

BB2SJ Aquaponics Pilot Plant

Phase 1 Part 2.

Grow Bed & Tank

Item	Scope of Work
2.0	<p>To produce accurate design for Solid separator, bio filter, media grow bed, DWC (Deep Water Cultured) & sump tanks layout drawing for actual construction.</p> <p>Your design shall include followings:</p> <ul style="list-style-type: none">• General layout of the system• Detail dimension of the system• Detail explanation and illustration of overall system• Functionality of each component• Operating parameters of the system• Material Inventory.
2.1	To present & obtain approval from officers on overall design
2.2	Procurement & Construction
2.3	To interact and liaising with other project team members to monitor & to propose improvement or modifications.

- *Please refer to Master Program for timing of execution for each phase.*
- *Refer next page for reference.*

For Reference:

Types of Aquaponics Systems

There are several different types of aquaponic systems that have developed over the past 30 years or so, and each can be used in different ways depending on your situation. A commercial system will be very different from a home or backyard system - but nevertheless, there are several common components and 3 widely accepted and used systems.

Media Filled Growbeds are the simplest form of aquaponics. They use containers filled with a suitable growing media such as expanded clay balls, pumice stone, gravel or something similar. Water from a fish tank is pumped over the media filled beds and plants grow in the rock media. [Click here for our DIY - Growbed Media guide.](#)

This style of system can be run two different ways, with a continuous flow of water over the rocks, or by flooding and draining the grow bed in a 'flood and drain' or 'ebb and flow' cycle.

Nutrient Film Technique is a commonly used hydroponic method, but is not as common in aquaponic systems. In NFT systems, nutrient rich water is pumped down small enclosed gutters, the water flowing down the gutter is only a very thin film. Plants sit in small plastic cups allowing their roots to access the water and absorb the nutrients.

NFT is only really suitable for certain types of plants such as leafy greens and herbs because larger plants will have root systems that are too big and invasive, or they become too heavy for the lightweight growing gutters.

Deep Water Culture works on the idea of floating plants on top of the water allowing the roots to hang down into the nutrient-rich water. This can be done in a number of ways and this method is one of the more commonly practised commercial methods.

DWC can be done by floating a foam raft on top of the fish tank, however a more common method is to grow the fish in a fish tank and pump the water through a filtration system and then into long channels where floating rafts filled with plants float on the water surface and extract the nutrients.

The growbeds should be about 12" in depth as this has been proven to be the most effective depth for plant growth and the cultivation of a beneficial ecosystem in the beds. [Click here for our DIY - Growbed Guide.](#)

Once the water reaches the appropriate level then it will be drained from the growbed (usually quickly) which will draw oxygen back down into the growbed for the benefit of the plants and microbes. This cycle then continues regularly and provides the plants with all of the nutrients that they need to grow extremely abundantly and naturally without any added pesticides, herbicides or fertilisers.

NFT is more commonly used in commercial aquaponic systems but can be successfully used in a hobby system provided that the water is filtered before it is used in the NFT channels.

Unfiltered water from the fish tanks will contain many particulates which will attach to the plant roots and will ultimately stop their ability to take up nutrients and oxygen.

The water must be filtered before it reaches the channels as particulates and solids in the water will clog up the root systems of the plants and will inhibit their ability to take up oxygen and nutrients.

DWC is the most commonly used method in commercial aquaponic systems as it provides the versatility to grow a relatively wide variety of leafy plants and herbs and can be set up relatively inexpensively.

source: <http://www.japan-aquaponics.com/aquaponics-systems.html>

DIY Aquaponics Guide for Growbed Media

The growbed media is an important part of your aquaponics system as it is effectively the home for your bacteria. We discuss what can be used as media and the benefits of each.



Aquaponics systems use several common components, the growbed (the hydroponic part of the system); the fish tank (the aquaculture part of the system); the plumbing; and the growbed media are some of the main ones.

There are three main types of aquaponics systems that are generally used and it is perhaps worth noting this in advance:

- NFT channels (Nutrient Film Technique) - usually found in hydroponics set-ups.
- DWC or Deep Water Culture (or Channel), which are long, deep troughs
- Media filled growbeds.

An aquaponics media filled growbed is simply a suitable container that is filled with a growing media such as gravel, hydroton or lava rock, and this article will specifically concentrate on the growbed media, its function in an aquaponics system and the types and pros and cons of each type of media.

What does the growbed media do?

- The growbed media provides the plants with a foundation in which to grow and anchor their roots.
- The growbed media also serves to moderate the temperature around the plant roots.
- The growbed media provides a surface area for the nitrifying bacteria to colonise.
- The growbed media facilitates the mechanical filtration for the solid waste in aquaponics systems.
- The growbed media provides a home for beneficial worms in aquaponics systems.

What are some key considerations?

- The growbed media must be pH neutral as it must not affect the water chemistry in aquaponics systems.
- The growbed media must not contain any other types of contaminants that could affect the water chemistry.
- The growbed media needs to be able drain water well so that roots don't get waterlogged.
- The growbed media needs to be well-sized to allow oxygen to be drawn down into the growbed.
- The growbed media with a high surface area will be best for the beneficial bacteria in your system.

So what can you use?

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Expanded Clay Pebbles - a type of Lightweight Expanded Clay Aggregate (LECA)



LECA is a porous clay pellet that expands when wet and forms a dense soil-like layer that roots can easily grow into. Additionally, the pebbles are relatively smooth, making them easy on hands and sensitive roots. Clay Pebbles also have a very high surface area, which gives the beneficial bacteria somewhere to live, enabling it to be a very effective biological filter. It is pH neutral, meaning that it will not affect the water chemistry, thus adversely affecting plant growth. It will also drain freely, aiding in the oxygenation of roots.

Hydroton is the most famous brand name for expanded clay pebbles, but recently this company has stopped all production - but alternatives like Canna Aqua Pebbles are almost exactly the same in composition. Clay Pebbles can be bought in various sizes and the larger diameter is normally recommended to avoid clogging.

Lava Rock - (Pumice Stone)



Lava rock is widely used in many areas due to its availability and cost. In many ways it is natural version of hydroton as it is a lightweight, porous material that exhibits all of the characteristics of hydroton. It is not quite as easy to work with as hydroton as it is usually irregular in shape, and you also have to be careful to ensure that there are no impurities or chemicals present. Lava rock can be up to 90% porous and so initially it may float in your aquaponics system. This is common, but if you let the lava rock soak in the water it should eventually stop floating.

River gravel or Pea gravel



While not as easy to work with as other alternatives, river gravel (gravel from rivers is generally more rounded and friendly on the hands) is a cheap and readily available growbed media. In addition, its higher density enables allows gravel to support taller plants than clay pebbles would be able to. Aquaponics gardeners who cultivate corn and other stalked plants tend to prefer the density of gravel, as well as backyard aquaponics enthusiasts who are on a budget. Gravel does not hold water well, is very heavy, and has a much lower surface area than hydroton so it is not able to support bacterial colonies to the same degree - thus lowering its bio-filtration capacity. Gravel should be tested before you put it into your aquaponics system to make sure that it does not contain things like lime. You can take several random samples (different types of stones) and add vinegar to see if it reacts with the stone (It must not).

Perlite / Vermiculite / Sand / Coir / Glass beads

These have all been used as either a complete growbed media - or in addition to one the main ones noted above. In each case you need to be confident that none of these media types will leach anything into your system and so sold pay close attention to where the media comes from. You may find that perlite, vermiculite and sand are relatively small in size and so could cause clogging in your system and may also impede the free flow of water in your growbed. Coir can also cause discolouration of your water and as an organic media will break down over time and may introduce unwanted organisms into your system. You also need to be sure that any of these media is pH neutral and that it will not affect your water chemistry.

Washing the growbed media

There are different schools of thought about whether you should wash your growbed media or not. On the negative side, it is a time-consuming, labour intensive activity that generally uses a significant amount of water. On the positive side it improves the quality of the water in your system from the very beginning and it ensures that any bugs or detritus is washed away before it gets in your system. I think that ultimately the choice of whether to wash or not will depend on your personal circumstances. If water is scarce or expensive then there is no real need to wash the media as the water will clear up on its own in a few days or so. If you are buying from a reputable source then you should not need to worry about foreign objects in your media. The truth is that some people wash their media, and some don't but there seems to be no adverse affect on an aquaponic system either way.

So which growbed media is best?

This will depend on your personal circumstances, your location and what you want to grow. LECA (Expanded Clay Pellets) are a popular, if slightly expensive choice, and where possible we prefer to use lava rock to get the same benefits for a fraction of the cost. River gravel is also commonly used due to its availability worldwide and its cost-effectiveness. Look in your local homestores and builder's merchants and find out what is available locally - if you join a forum you may find fellow aquaponicists near you who would be happy to point you in the right direction.

by Aragon St-Charles