





# filtering through pond filtration

## tales from the FIELD

A couple years ago, we received a call from an upscale, high-profile customer – a CEO of a huge, multi-million dollar corporation whose pond we’d installed just a couple weeks before. This really was a big, beautiful pond that included a long, meandering, 150’ stream. The main waterfall was facing the office in his home.

He called in frantically and said, “There’s something wrong with my pond. It isn’t working right. There are bubbles coming out of the waterfalls, and I need you to come out immediately and have a look.”

I told him that something must be blocking his pump. But he said, “No, I had my maintenance man check the pump and there’s nothing blocking it. It’s totally free and clear.” So I said I’d send Ed over to check it out.

When Ed arrived, he saw just what the guy had described. There were bubbles coming out of the falls, so Ed opened the skimmer lid to discover that there was no water in the skimmer ... but

the pond was completely full. Knowing there had to be something stopping the water flow, he reached in front of the skimmer opening and found a piece of wood. The customer said, “Oh, don’t pull that out. I put it there myself so debris wouldn’t go into the skimmer and clog the net.”

Ed thought he was joking. He even looked around for a Candid Camera lurking somewhere in the background. The customer was serious and Ed didn’t know exactly what to say, so he removed the wood and watched as the water rushed into the skimmer, and the waterfall started working perfectly. At that point it clicked in the customer’s head that the debris is supposed to go into the skimmer ... we haven’t heard from him since.

*Ellen Beaulieu*  
*NAWGS President*





## Sorting Through All the Filter Options

There are dozens of manufacturers producing hundreds of filters. Each month a new filter gets thrown onto the market. Which one is best? What's the difference between them? What do you need to know if someone else asks you about the differences? In this chapter we will try to untangle the tangled mess of filters on the market, and make you an expert in the field of pond filtration.

### The Three Types

The three main types of pond filters include biological, mechanical, and chemical/sterilizer. Biological filters work by using bacteria to break down pond wastes, converting them into less

harmful compounds that can be used as aquatic plant fertilizers. Mechanical filters work by trapping and removing debris and sediment, thus cleaning the pond water. Skimmers and pre-filters for pumps are two examples of mechanical filters.

Water sterilizers pass water through a tube that houses an ultraviolet bulb, killing living microscopic particles in the water.

Many filters overlap into more than one category. For example, our BIO-FALLS® filter has large amounts of surface area for biological filtration, while the filter mats help with the removal of fine to medium sized particles, which is a mechanical variety of filtration.

## Biological Filters

There are many types of nutrients found in a water garden system—fish

waste, uneaten fish food, leaves, and runoff from lawns to name a few. High levels of ammonia (a form of nitrogen) are highly toxic to fish and are a major contributor to prolific algae growth. In water gardening, the primary nutrient that biological filtration utilizes and renders usable is nitrogen.

### How It Works

In biological filtration, nitrifying and facultative bacteria, known as facultative bacteria, absorb ammonia, and turn nitrites into nitrates, which are less dangerous. These bacteria require oxygen to live, so it's important for the pump to run 24 hours a day, 7 days a week. If the pump shuts down, the bacteria can quickly use up all of the oxygen and die.

Nitrates are removed from the pond by another biological filtration method known as de-nitrification. This process occurs only in anaerobic (without oxygen) areas of the pond. That's why it's not necessarily bad for some areas of your pond to experience minimal water flow (such as on the bottom of your pond, under an inch or so of gravel). The bacteria that live in this area of the pond turns nitrates into nitrogen gas, which is released into the atmosphere. Nitrates are also absorbed by aquatic plants and algae during their growth processes.

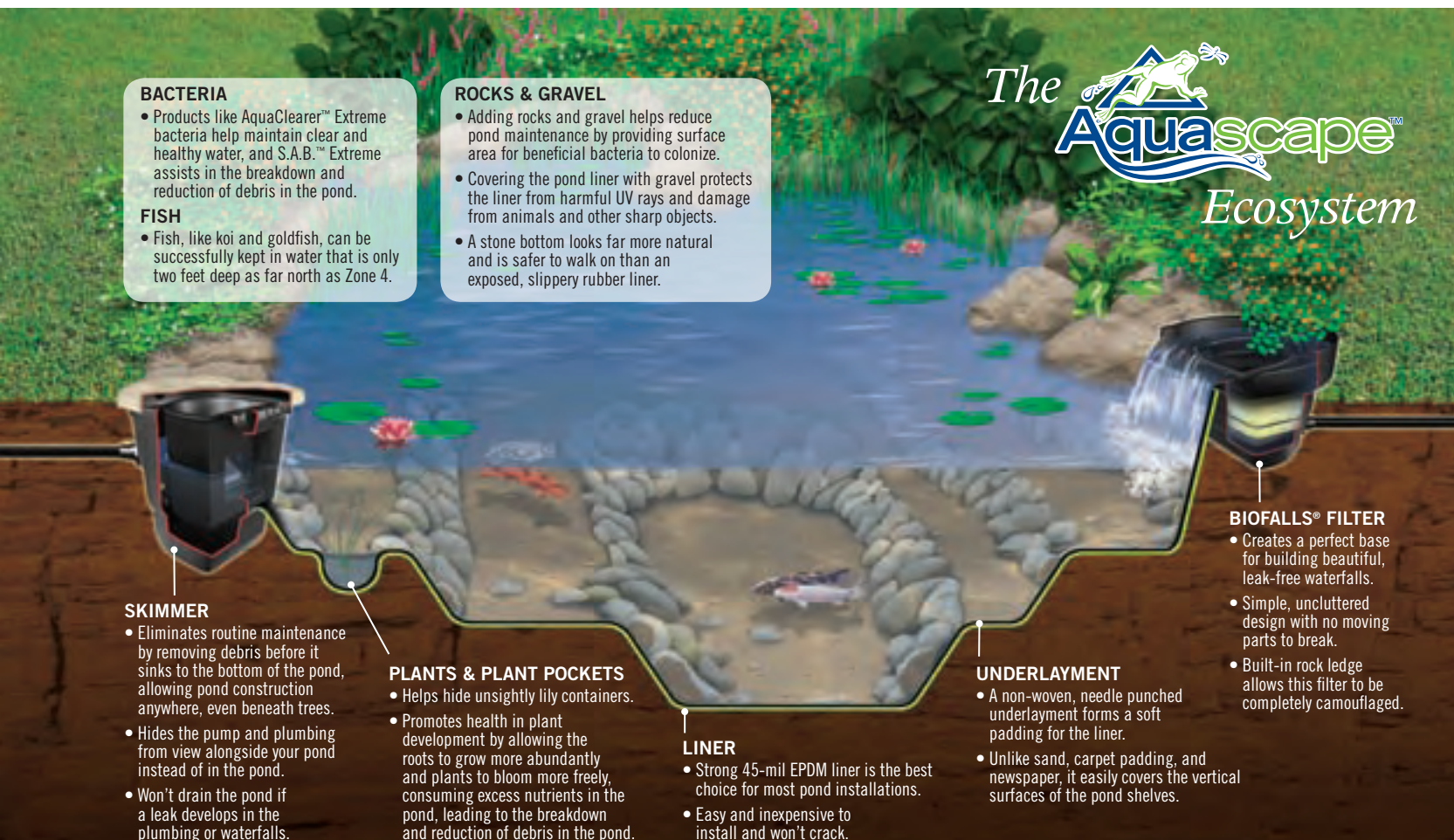
For any biological filtration to work, there literally needs to be billions and

billions of bacteria working to purify the water. They prefer to anchor onto things, which is why surface area is so important. More surface area means more bacteria, and more bacteria means better biological filtration. *(Aquatic plants are great biological filters and we have more information on them in Chapters 3 and 16.)*

### A Complete System

A good biological filtration system, teamed up with a mechanical filter (such as a skimmer) to remove solids before the water enters the biological filtration unit, is the most effective way to filter water. As the water enters the biological filter, there should also be a swirl chamber designed to avoid channeling, and to allow more solids to settle.

Next, the water should evenly flow up evenly through the filter media. Any number of materials could be used as long as they have a high amount of surface area. We've found lava rock or BioBalls™ to be a very effective material. The final factor in a good biological filtration unit is that the water is well oxygenated on its return to the pond. This happens most naturally and most easily through a waterfall or stream.







*Quite simply, our filter is designed to work in the field. We are currently generations removed from our original garbage can design. Each generation fixed a problem we experienced in the field.*

## Mechanical Filters

Mechanical filters rid ponds of larger particles, waste, and sediment. There are many types of commercial filters designed to perform this task. Because they remove larger waste particles in the pond, and because they work so effectively, some need to be cleaned quite frequently.

### Sedimentation Filters

Sedimentation filters allow particles that are heavier than water to drop to the bottom of the pond, where they are removed through a filter that is hooked up to a bottom drain. They only remove the larger particles, and have to be installed where they can be fed by gravity.

### Skimmer Filters

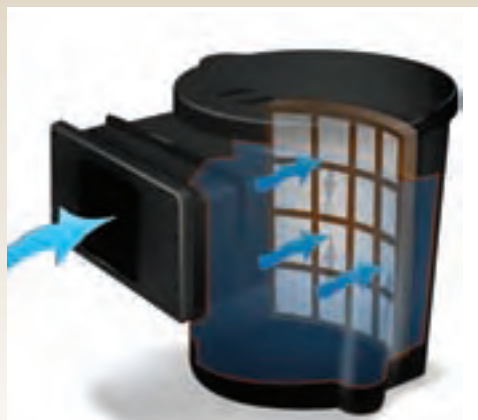
There are two main types of skimmers—box skimmers and floating skimmers. Both types filter the water by removing floating debris and waste before it's had a chance to fall to the bottom of the pond. The box skimmer is the predominant type of skimmer on the market today because it's easy to maintain.

Box-style skimmers come with either vertical or horizontal filter mats. Aquascape pioneered the horizontal filter mats, which prove to be the most effective, while providing the least amount of maintenance. In order to test the differences between them, we installed both types and gathered all our field experience. We also considered comments from our customers who installed the two styles, and have listed them on the next page.

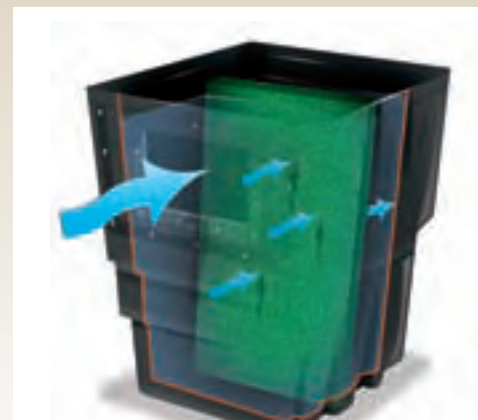
## Vertical Filter Mats



The vertical filter mat creates two chambers in the skimmer – one for the net and filter mat and the other for the pump.



After the mat has collected smaller particles, it gets heavy and loses its durability/shape.



The open weave plastic mat reduces the frequency of cleaning and the water flow issue.

### 1) Vertical Filter Mat

The vertical filter mat was the hottest new design on the market in 1997. This mat was designed after the horizontal mat had established itself on the market, to signal the pond owner when the mat needed to be cleaned, and to provide easy access to the mat, by putting it in a pull out tray.

#### Design Liabilities of the Vertical Filter Mat

- The tray that supports the filter mat becomes distorted and very difficult to push in or pull out, especially once the ground around the skimmer has settled, and the walls of the skimmer box have bowed inward.
- After the mat has collected smaller particles, it gets heavy and loses its durability/shape.
- The vertical filter mat creates two chambers in the skimmer—one for the net and filter mat

and the other for the pump. Once the mat accumulates some waste material, the water flows through it so slowly that it creates a false low water level in the pump chamber, exposing the submersible pump to air.

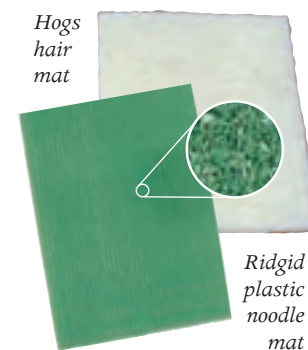
- The vertical mat design disallows an automatic water fill valve to be used effectively. Because the water level of the pump chamber fluctuates constantly, it's possible that the automatic fill valve will run continuously, flooding the pond's edges, unless you put it in front of the net and mat.

#### Maintenance of the Vertical Filter Mat

Maintenance requirements have been one of the huge Achilles of the vertical filter mat skimmer. Several manufactures, since the vertical filter mat debut years ago, have designed and developed their own versions. Many have made modifications and changes to improve

the performance and reduce the amount of maintenance required of this style of filter. Some versions work better than others, but all have the same design liabilities to one degree or another. One successful improvement to the vertical filter mat has been to change the traditional "hogs hair" filter mat over to an open weave, noodle-like plastic mat that is more rigid. This improvement reduces the frequency of cleaning and the water flow issue with the two-

chamber design by allowing the debris that normally clogs the surface of the hogs hair mat to be trapped in the open weave of the noodle-like mat and settle down into the mat.





*The horizontal mat has breezed through the test of time, showing why it's still the #1 selling skimmer on the market today.*

#### **Shortcomings of Vertical Filter Mats**

- Frequent cleaning of the mat.
- Constant monitoring of the filter mat to make sure there is enough water in the pump chamber for the pump to operate properly.
- If an automatic water fill valve is installed, make sure it's not running continuously.

#### **2) Horizontal Filter Mat**

The horizontal mat design was created in the field as the first professional pond skimmer. It's breezed through the test of time, showing why it's still the #1 selling skimmer on the market today. Now entering its 8th generation, the horizontal design is still standing at the top of the mountain, and here's why.

#### **Design Benefits of the Horizontal Filter Mat:**

- Allows water to pass evenly through the mat.
- Made of sturdy materials and evenly balanced on the support rack.
- Traps all smaller debris that passes through the net.
- Lays flat so there is no sagging or early wear and tear.
- Never clogs to the point of preventing water from passing through, so the pump chamber does not run dry.
- An automatic water fill valve can be used without the worry of excess water being introduced into the system.

#### **Maintenance of the Horizontal Filter Mat:**

- Cleaning once a month, if needed.
- Possible replacements every three years.

#### **Field Testing**

There are an abundance of skimmers being advertised, they all look great on paper, but how will they perform in the field? That's the question.

When considering skimmers, always try to find out if and how they've been field tested. Realistically speaking, what insurance does the homeowner, and therefore you, the installer, have that this skimmer is going to stand the test of time, and be as maintenance free as the manufacturer claims? Keep in mind, Aquascape is still the only manufacturer that installs their filters on a daily basis. Field tested... field proven.



### **What's the purpose of the PondSweep "Bellows" in these skimmer models?**

**Dry Cleaning:** The bellows door seals shut so the pond owner can easily remove the mat, net and optional brushes without plunging their arms into cold, dark water. When the pump drains the skimmer it can be more thoroughly cleaned and the inside is easier to inspect for unwanted debris. We recommend adding a low-water pump shutoff when using PondSweep skimmers so the pump shuts down automatically every time the bellows is closed.

**Skimmer Efficiency:** Since our bellows is sealed at the sides and bottom ALL the water entering the skimmer is taken from the pond's surface. This creates a more powerful skimming action, a useful feature when building larger ponds or in heavily wooded yards. This same efficiency also facilitates the addition of an optional bottom sweep, which pulls debris from the bottom of the pond without sacrificing effective skimming from the pond's surface. Skimmer efficiency is perhaps most valued when using dual pumps as the larger waterfall pump can be shutdown to save power while the remaining pump can still skim the pond effectively.



## Filter Construction Methods & Materials

The major difference between filters has mostly to do with the way they're constructed. There are four common filter manufacturing techniques, including rotational molded plastic, fiberglass, blow molded plastic, and vacuum forming. All of Aquascape's filters are designed and manufactured with years of construction and plastic manufacturing experience, ensuring the best functioning product in the field.

### Rotational Molding

- Uniform distribution of plastic throughout the mold insures that the product will be extremely durable and not contain any weak points.
- Has a certain degree of flexibility which allows the filter to expand and contract in the ground without cracking from the freeze/thaw cycles of the earth.

### Fiberglass

- Extreme rigidity increases the risk of the filter cracking through the freeze and thaw cycle.
- Installers run the risk of getting fiberglass splinters.
- Fiberglass is considerably heavier than other filter material.

The latest generation of Grande BIOFALLS® filter gives the most flow and natural construction options available anywhere.



### Blow Molded Plastic

- Weaker points in the corners of the filter.
- Strength and structural stability can be absent if the product is not properly designed for the molding method.

### Vacuum Forming

- Minimizes the wall thickness of the filter.
- Uses a flat sheet of plastic that is stretched into the desired shape. This process allows the corners to be stretched, making them weak.
- Extremely flexible, causing performance problems in the field.



Whether a pond needs a filter mat or not is completely contingent on where the pond is constructed, and the owner's maintenance desires. Ponds that have high fish loads or excess falling debris, benefit from a filter pad. Conversely, ponds with low fish and debris probably won't even require a filter pad in the skimmer.





*Bags of filter media increase filter capacity and can easily be removed for cleaning on an annual basis.*

## Biological Filter Media

Every conventional water gardening, koi, or pond magazine that you read will advertise a dozen different kinds of filter media. The main purpose of filter media is to provide surface area where bacteria can grow and serve as your biological filter. While all will basically do the job, some do it better and simpler than others.

### BioBalls™

BioBalls™ are small plastic balls with different ridges and shapes that are purely used as bacterial surface area.

The more sides and protrusions the BioBalls™ have, the more surface area they provide. The big advantage to BioBalls™ is that they are lightweight,

making them easier to move around and to clean. They also seem to last forever because they are made from very durable plastics.

### Brushes

Brushes usually hang down from a bracket or stem somewhere in the filter. They have large amounts of surface area to encourage bacterial growth, but they can only be used in a small percentage of filters. To adequately filter a pond of any size with only brush filters, the amount of brushes required may be unfeasible. While they're mainly intended to provide surface area for bacteria, they do an adequate job of removing medium to large-sized particles as well.



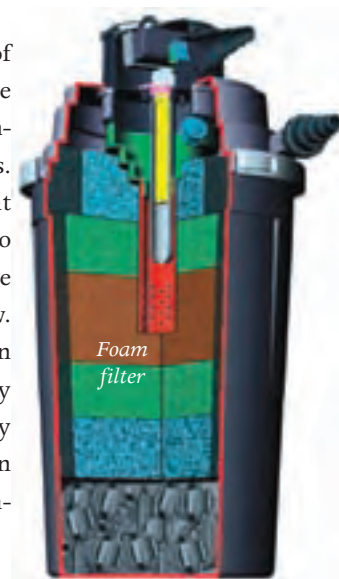
### Ribbon

Ribbon types of media have been around for a while and their popularity is starting to increase. Typically, ribbon media consist of long, thin pieces of plastic. The nice feature of ribbon is that because of its design, it rarely gets clogged, so you always have a good flow rate through your filter. It is also easily compressed so you can fit a lot of it into a small place making it very useful in smaller filters. The only downside is that most ribbon is very smooth and doesn't contain a whole lot of area for bacteria to colonize, which means that you have to use a lot of it.



### Foam

The main goal of foam is to remove small and medium-sized waste particles. The vast amount of surface area also creates a good place for bacteria to grow. Because the pores in foam are small, they clog fairly quickly and are less than conducive to catching large particles.



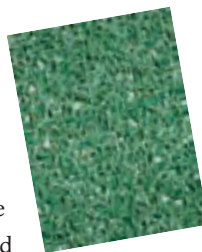


### Lava Rock

Lava rock has been an old standby for years. Lava rock not only has numerous pores that provide excellent breeding areas for bacteria, but it also acts as a mechanical filter by removing medium to large-sized waste particles. It's, by far, the least expensive (and most cost effective) of all filter media. However, lava rock does have a few downsides as well. Because it's so porous, lava rock tends to clog fairly easily and it can be difficult to clean. It is also very heavy to move around. Last but not least, lava rock tends to wear away and erode after time so it will have to be replaced every few years.

### Matala Mats

Matala mats are quickly growing in popularity. Matala mats are made of extruded plastic and resemble a large brick of "ramen noodle." The mats generally have quite a bit of surface area for bacteria to colonize, but the real benefit of Matala mats is how they handle sediments. Because of their unique design, water flows through the mat, slows down, and causes any sediment to settle out and sink to the bottom. Its open design also allows the mat to be fairly clog resistant and easy to clean.



sites. In order for the sterilizer to be effective in clearing parasites in ponds, multiple units are often required and therefore becomes expensive real quick, let alone a hassle to plumb everything up. Not to mention that the bulbs have to be replaced every 6-8 months because they lose their effectiveness. You see a lot of sterilizers used in fish quarantine setups because it is on a smaller scale.

However, in the water garden industry, UV sterilizers combined with some sort of mechanical filtration are mostly used to get rid of algae blooms that create green water. Yes, they are effective at clearing green water, but they are considered "band-aids." The big misconception is that they get rid of all types of algae, but they are only effective at clearing single-celled algae blooms (green water) and not string or blanket algae. They kill good bacteria too!

Most of the time sterilizers are found in poorly filtered ponds that are suffering from water quality issues. Adding a sterilizer seems like a quick fix, but does not go after the root of the problem. The truth is, in a balanced, well-filtered ecosystem, algae blooms like this are rarely a problem. Instead of just throwing a sterilizer in a pond, work at making the pond a better ecosystem. A lot of times, this means upgrading the filtration, reducing the fish population, or simply adding some more plants. This has been Aquascape's philosophy for years.

## Sterilizing Filters

### UV Sterilizers

UV sterilizers are one of the most debated topics in pond building. There is a lot of confusion as to what they do and what they won't do and where they fit into the hobby. UV sterilizers work by passing water over a high output, ultraviolet lamp. When single-celled organisms such as algae, parasites, and bacteria come in contact with this UV light, their DNA is altered, ultimately causing harm and death to the organism.

UV sterilizers are used in two ways; to clear up algae blooms that cause green water, and the control of para-



### TIP from TEAM AQUASCAPE

**Green Water... what green water? If you have a pond that's properly built using the five-part recipe—rocks & gravel, plants, fish, mechanical & biological filtration, and re-circulating system—you will not have a green pond. We see ultraviolet devices as pills, or band-aids that attack the symptoms, not the causes, of algae. In turn, they only mask the problem...temporarily.**







*Koi aficionados are as proud of their plumbing and filter designs as they are of their fish—if not more.*

## External Filters

External filters are probably the most talked about filter in the pond industry. They have a popular past, mostly because there were so few options at the time. Let's take a look at the mechanical and biological workings of the external filters available in our industry today.

External filters evolved from the swimming pool industry, where noise and camouflaged filters are inconsequential (people aren't expecting a natural look), and where maintenance is required because the water is CHEMICALLY CONTROLLED and filtered. The external filter was designed for swimming pools where chemicals are required for swimming safety.

Whether it was a sand filter, or a diatomaceous earth filter, the word filter in the name encouraged pond hobbyists to retrofit pool filters for ponds, thinking they'd solved their daily maintenance problem. The fact of the matter is, a chemically controlled filter works poorly with a biological environment. Think about it for a minute... is the chemical filter designed to filter fish poop... is it designed to eliminate dead, decomposing water lily leaves? Probably not. Instead, it's designed to work with chlorine and other chemicals, right?

The bottom line is... pool installers don't use our biological filters to keep their pools clean, and we suggest you avoid using their chemical filters to clean your pond. Here are some other types of filters derived from the pool industry that you can still easily find on the market.

### Bubble Bead Filter

This external biological filter is a molded PVC canister that contains plastic beads. The water



flows up through the beads, and is then flushed back into the pond. A UV clarifier is sometimes used with this system. This has to be regularly back-flushed for it to function properly. These filters can be very large, expensive, and a big challenge to hide outside of a natural pond. These can be disguised with landscaping, such as shrubs or other strategic plantings, for example.



*This is some dude's garage—  
hopefully he has flood insurance  
in case there's ever a leak.*

### Sand Filter

This mechanical filtration system is used primarily in the pool industry. The filter acts like a net or filter cloth that allows the liquid to pass, but not the solids. It needs to be backwashed regularly for it to function properly, because of fish waste and solid organics that build up in the sand. If it's not backwashed, then the waste will cure inside the sand, causing it to turn anaerobic and harden.



*Note the external tubing.*

### Vortex Filter

In this external filter, the water flows by gravity or forced pressure into a sump that's shaped like a cone. After reaching this cavity, the water is directed into a rotational spin. This forces solids to fall to the bottom of the filter, while suspended particles get caught in a strainer-like filter that must be periodically washed. The filtered water passes through a spray bar that leads back into the pond.



*The U.S. government almost went to war over things that looked like this!*

### Inline Filters

These non-professional types of filters come in all sizes, shapes, and styles. Generally, this type of filter is targeted toward do-it-yourselfers with a very limited budget. Ponds that have this filter are generally the smallest of backyard ponds (around 200 to 1000 gallons). These filters clog easily and frequently and, quite frankly, are ugly to look at sitting next to the pond.



*It's painted black so you won't notice it.*



# Filtration Problems to Avoid

## Floating Skimmers

A few manufacturers are currently producing floating skimmers. They float on the pond's surface and are connected to the pump by a section of pipe. The pump recirculates the water and draws any debris floating on the water surface. Debris is then caught in a sieve-type container, which is only meant to handle small pieces of floating material. Floating skimmers are only effective in very small ponds, and because of their size, and the sieve through which the water enters the pipe or pump, they must be emptied frequently. It's not easy, and it's certainly not leisurely or relaxing...it's work! Is that what your customers want?



*It's so nice when a filter works and you can see the bottom.*



*Mr. Jones, you should be happy that you clean your screen off daily—your pump only costs you \$6 a month to run!*

## Pump Pre-filters

Pump pre-filters are made of foam that traps small particles of debris. They are usually attached directly to the pump, and can be connected to a fountain pipe that leads to a waterfall. As the foam filter becomes saturated with debris, there will be a constant noticeable decrease in the water volume, which will require frequent cleaning of the filter. Remember the previous problems? Well, in this case you're looking at the same problem with a different style of filter.

## Submersible Filters

This is a pre-filter for the pump, where the water is drawn down through the filter foam and pumped up to a fountain or other water feature. It mechanically clears the water by removing small particles of algae and organic debris. Biologically, it cleans the water by removing ammonia caused by fish waste. Beneficial bacteria live in the filter and convert ammonia to harmless nitrates. These filters also require lots of attention to maintain the water flow to the waterfall or fountain.

## Magnets

Magnets are a new item in the pond industry. What they claim to do is alter the magnetic field of minerals in the water. The manufacturers claim that these minerals, if left unchecked, cause string algae in ponds and lime scale in an ultraviolet filter. Our team has tested the magnets and their presence has shown no noticeable changes in the water quality or algae levels. None!

## Bottom Drains

For those who still prefer to install a bottom drain, there are two types to choose from. With the traditional type, a hole needs to be cut in the liner at the lowest part of the water garden. If the seal around the bottom drain fails, all the water will drain out of the pond, leaving your fish high and dry. The risks involved in this bottom drain installation outweigh any potential benefits that it may have.

The other type of bottom drain still needs to be located at the lowest part of the pond, but instead of cutting a hole in the liner, the drain will be set on top of the liner. When excavating the pond, dig a trench from the lowest part of the pond to the skimmer. After you lay out the underlayment and liner, the bottom drain and pipe is placed in the trench. The pipe can now be disguised



with gravel. If you decide to use a bottom drain, this type will set the fish's and your mind at ease.

## And in the End...

After learning about all the different filter types and techniques, it still all boils down to one thing... what's best for you to install? The greatest attribute that Aquascape brings to the table is that the filters you receive from us have been thoroughly tested in the field. They are currently being installed by our very own construction crew, as well as thousands of other crews across North America every single day of the week. They're tested and we know they work before you ever get your hands on them.

