Gravel Bog Filter Construction

I have always been intrigued by the idea of turning waste into a resource and that is exactly what a bog gravel filter does for you. It turns fish and plant waste into fertilizer (plant food). This plant food is then consumed the plants growing in the filter. The happy byproduct of this process is clear water and low maintenance. If a gravel bog filter had a mission statement this is what it would be:

To create an environment that maximizes organic decomposition and nutrient absorption thus starving the (always present) algae in the pond while looking gorgeous!

Here at Nelson's we are so sold on Bog Gravel Filtration, we will not build a pond without one and for one solid reason; there are virtually NO call backs from unhappy clients. They don't call back because with fewer pieces of equipment needed there is less chance for breakdown, secondly a properly constructed bog gravel filter only requires seasonal maintenance. More enjoyment of the water garden and less work for your client.

The only drawback to a gravel bog filter is there is no fancy filtration system (or as Cla Allgood of Allgood Outdoors calls them "The Big Uglies") to sell to a client, the bog gravel filter is designed and constructed on site. If a client insists on a "big ugly" filtration system, we install one in addition to the gravel bog filter. In my opinion the loss of monies from selling a fancy filtration system are more than made up by the elimination of call backs, the peace of mind from that and a happy customer, not just after the pond is constructed but in the years to come. We have too many fly-by-night contractor in this industry than can build a pond that looks great for a month.

Let's be clear about (pun intended) why ponds turn green. The green water is comprised of billions of tiny one celled plants called algae. Like all plants, algae needs sunlight, carbon dioxide, water and nutrients to grow, eliminate any one of these elements and it will not grow. Bog filters are extremely efficient at removing nutrients from the pond water.

This mission is accomplished by pumping pond water evenly though a gravel bed via a grid of perforated pipework. The gravel provides the surface area for nitrifying bacteria to colonize. The bacteria reduce fish and plant waste into plant food. Growing in the gravel are bog plants that take up the plant food. The water is returned to the pond stripped of all nutrients thereby "starving" the algae which cannot grow.

Bog gravel filtration is not new, Mother Nature has been using this technique for eons, we call it an aquifer, swamp or marsh. NASA has experimented with the technique for waste treatment on space stations. Some Sanitation Facilities use it in waste water treatment. In the pond industry, Dick Schuck presented this idea back in early 1990's. Years ago I met a fish farmer who used this technique and ended up making more money from the plants he grew in the filter than the fish! Nelson Water Gardens has been building bog gravel filters for the past 18 years. Before I get started here is a famous quote:

"Learn from the mistakes of others,
you can't live long enough to make them all yourself"
–Eleanor Roosevelt

Over the last 18 years of constructing Bog Gravel Filters, we've made plenty of mistakes and have also refined the process. We've given countless lectures and workshops and have learned from the feedback of audience. In a backward kind of way I'm going to start with the mistakes we made, to remove immediately any pre-conceived notions. In some instances the right way to do it seems wrong. For example, if a little bit of gravel does the job then a lot of gravel should be even better right? Well…not when it comes to depth of the filter bed, build deeper than 12" and the system can fail. Surface is key, the greater the surface area the more filtration! So here are the top 9 mistakes made construction bog gravel filters:

1. Too deep a bed of gravel – this is the most common mistake made, you need no more than 12" of gravel substrate. If you are adding a Gravel Bog to an existing deep pond area; construct a false bottom using grating.
2. The bog is too small: For water gardens 10 – 15% of surface area should be bog, and for koi ponds there should be 25 – 30%.
3. Wrong size gravel – use 3/8" pea gravel. Period. End of story.
4. Not capping the pipes, water follows the path of least resistance and will simply shoot out the ends instead of through the slots.
5. Not enough plants- initially you should plant one plant per square foot.
6. Wrong plants – there are many aggressive species which can clog the pipes and grow out of the filter.
7. Washing the soil off the roots of the plants before planting in the gravel. Don't do this! There is not enough nutrition in a new bog to sustain new transplants. Just knock the pot off the plant and plant it soil, roots and all directly into the gravel. We promise the soil will not "contaminate" the bog.

1502 Katy Fort Bend Rd Katy Texas 77493
281-391-4769
www.nelsonwatergardens.com email: info@nelsonwatergardens.com

8. Not taking the plants out of their pots; this severely limits the plants ability to absorb nutrients and defeats the purpose of the gravel bog filter.
9. Starving the bog; this happens when a pre-filter* is placed on the intake of the pump, this not only stresses the pump but defeats the entire purpose of the bog [i]by starving the plants of the nutrients that are being caught in the pre-filter.

*We are speaking of a true mechanical pre-filter (usually made from foam pads which need frequent cleanings) and not the pump protector or intake screen we recommend using.

Even a gravel bog filter constructed all wrong works to a certain degree. Near our shop, our local county park had a Koi pond that you couldn't even see an inch into the water. When they constructed the filter they used with 3-5" rock instead of 3/8" gravel (Why? I don't know!) and they left the plants in their pots. Despite these drawbacks, the pond did clear to a 12" depth! It has since been redone properly.

A Gravel Bog Filter can be constructed in any number of ways, examples of the most common configurations we have used in constructing water gardens.

1. **Partition:** The filter is within the pond separated by a porous retaining wall.
2. **Raised:** The filter is built next to and higher than the pond; water flows back via a stream or waterfall.
3. **Border:** A ledge 12" deep and as wide as it needs to be is constructed around the perimeter of the pond. At the edge of the ledge a porous wall is built to retain the gravel.
4. **Island:** Created by building a porous retaining wall on all sides in the middle of the pond.

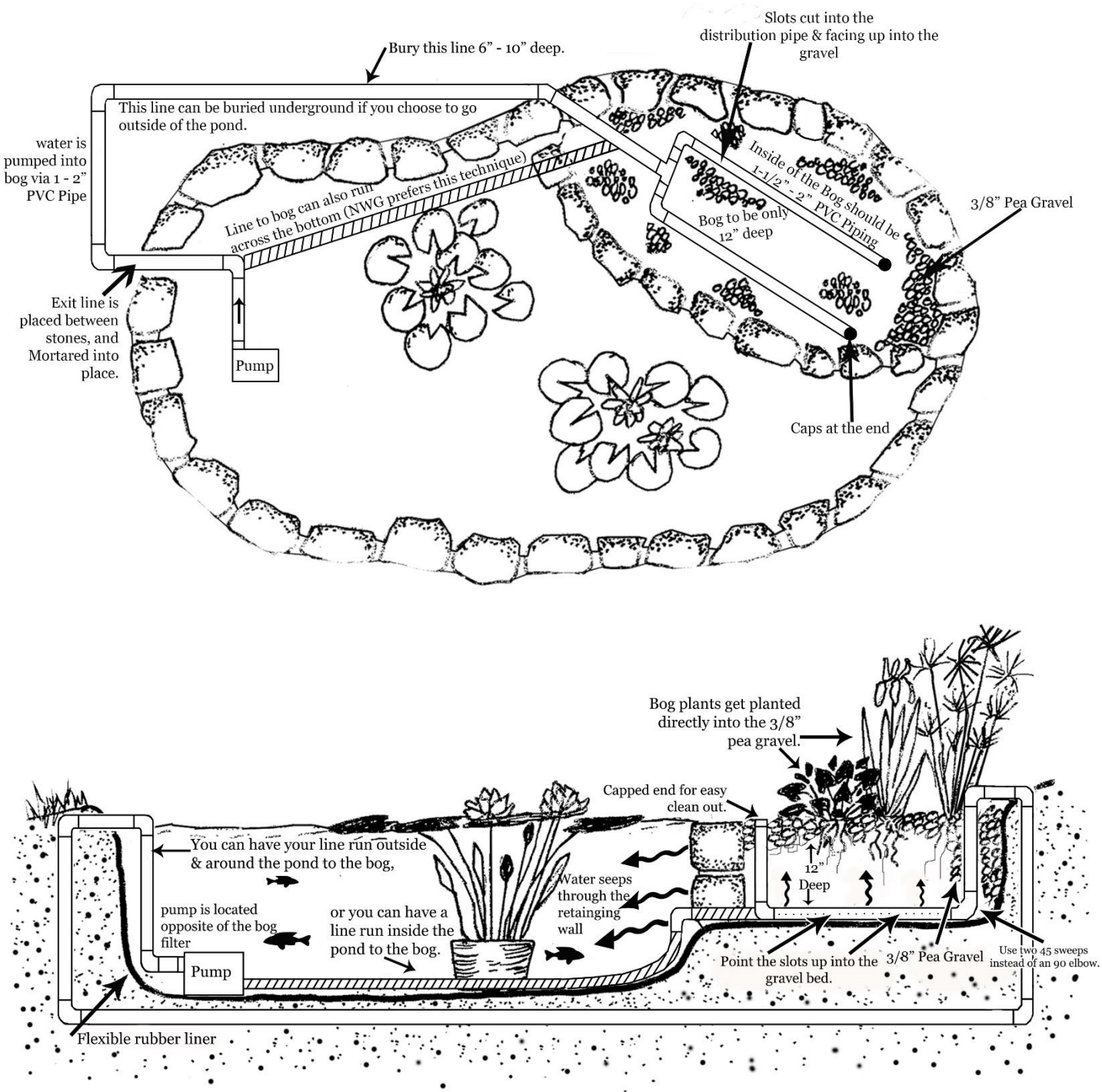
Directions

1. Follow the usual directions for building a liner pond, but be sure to leave room for the bog. Size the bog based on the surface area of the pond. If you will have just a water garden with plants and a few goldfish, the bog should be equivalent to 10-15% of the surface area. If you want to keep a lot of fish or a koi pond then size the bog to be 25-30% of the surface area.
2. If you want a raised bog (80% of the bogs we build are raised) build the retaining walls for the bog area out of a combination of full sized cinder blocks (8x8x16" and 4" cinder blocks (4x8x16") mortared together, making a 12" deep pit for the filter. Be sure to allow for the spillway(s) (a nice piece of flagstone works well) for the water to spill over and return to the pond, and a space on the side or the back side of the bog for the piping to go over the wall and down into the bog. Use a grinder and bevel the top inside edges of the cinder blocks or cover the edges with underlayment to soften the edges. Then line the bog with 45 mil EPDM pond liner allowing it to overlap the top of the walls.
3. Install the pump on the opposite side of the pond from where the bog filter is located. This is to facilitate good circulation of water throughout the pond. Select a pump that will turn the volume of the pond over every 1-2 hours. (You can go with a higher flow rate if you wish.) Run the flexible tubing[1] along the bottom of the pond, then up, and out of the pond, then along and over the bog wall, connecting with the PVC piping via a hose barb fitting threaded into a female PVC adaptor.
4. Next cut slots into the distribution pipe. The outlet of the pump determines the size of the pipes. Always bump up the pipes for efficient use of the pump. For example use 1" pipe on pumps with ¾" outlet. Minimum pipe size is 1" diameter for small bogs, though 1½-2" piping is recommended for most other bogs to avoid the possibility of clogging. The pipe is cut with slots a third of the way into the PVC pipe approximately 1" apart.
5. Attach a vertical capped stand pipe to the distribution pipe under the gravel[2]. Cut this pipe (now referred to as the "clean out pipe") to discreetly rise just above the gravel bed. Spray paint the cap black or brown and it will "disappear" from view.
6. Next lay the distribution pipe on top of the pond liner in the area partitioned off for the bog filter. Be sure to point the slots up into the gravel bed. Gravel bogs that are 2-3 feet in width can be fed by a single line of pipe. Wider areas require additional lines spaced 2'-3' apart. This layout is similar to setting up a septic drain field.
7. Be sure that each distribution line in larger bogs has its own clean out pipe[3]. (see mistake #4).
8. Once you are satisfied with your piping layout and location of the clean out pipe(s), glue all parts together. Turn on the pump and see if water is evenly distributed.
9. Mortar Rocks, flagstones, bricks, or whatever you wish on the outside and top of the bog filter retaining walls to give it a finished look.
10. Shovel 3/8" pea gravel into the Bog Filter area but only fill halfway (the rest of the gravel will be added during the planting). Most gravel is not very clean, wash it as best you can before adding to the filter but be aware it will muddy up the pond, do not to worry, it will clear up. After all, that's what the filter is designed to do! The construction process is finished, now it's time to plant your bog.

1 Using tubing within the pond means less leakage, easier repairs, and less likely to be damaged.
2 Use two 45° sweeps instead of 90° elbows to facilitate better water flow.
3 The under gravel pipes can be cleaned out by simply removing the cap from the stand pipe; water pressure from the pump will help dislodge any debris that has collected in the pipes. A reverse flow can be achieved by turning off the pump and putting a pressure washer down the stand pipe.

1502 Katy Fort Bend Rd Katy Texas 77493
281-391-4769
www.nelsonwatergardens.com email: info@nelsonwatergardens.com

Fig 1. Layout of Partition Bog Filter



Gravel Bogs can be designed in many different ways to suit your waterscaping style. Here at Nelson's you can see numerous styles;
Formal Raised Bog
Semi-Formal Raised Bog
Island Bog, Perimeter Bog
Head of Stream Bog
For very small ponds - Pottery Bog or Spillway Bog

1502 Katy Fort Bend Rd Katy Texas 77493
281-391-4769
www.nelsonwatergardens.com email: info@nelsonwatergardens.com

Planting the Bog Filter

1. Select your bog plants and arrange them in the bog area that is half filled with gravel. Be sure you stay away from the plants in the middle list. It's best to plant the tall plants towards the back of the filter, and lower growing plants in front. Create interest by contrasting plants with different foliage colors or textures.
2. After you have arranged the plants to your satisfaction knock the pots off the plants and place the plant with the root ball intact with soil. **Do not remove the soil**—there is not enough nutrition in a brand new bog to sustain the plants. (Trust us the soil will not wash into your pond.)
3. After the plants have been placed, gently shovel in the remaining gravel. Your goal is to place the plants at the appropriate level so that when the rest of the gravel is added the gravel level will be above the water level. In other words, no standing water in the gravel filter area.
4. Turn on your pump and your bog filter is now off and running with years of clear water enjoyment to come.

Suggested Plants
Arrowhead
Assorted Taros
Blue Carex
Blue Rush
Bog Lily
Canna
Chinese Water Chestnut
Corkscrew Rush
Creeping Jenny
Dwarf Horsetail
Dwarf Papyrus
Dwarf Sweetflag
Japanese Iris
Lizards Tail
Louisiana Iris
Melon Sword
Red Stemmed Sagittaria
Ribbon Grass
Ruby Creeper
Ruby Eye Arrowheand
Sensitive Plant
Siberian Iris
Spider Lily
Star Grass
Variegated Spider Lily
Variegated Water Celery

Plants that are invasive in a bog
All Cattails
Aquatic Mint
Chameleon Plant
Chocolate Mint
Gold Rush Reed
Horsetail
Mediterranean Reed
Parrot's Feather
Pennywort
Red Stemmed Thalia
Umbrella Palm
Yellow Iris

Non-Bog Plants that have worked for us
Leopard Plant
Butterfly Gingers
Day Lilies
Caladiums
Hibiscus
Calla Lily
Joe Pye Weed
Hosta's

1502 Katy Fort Bend Rd Katy Texas 77493
281-391-4769
www.nelsonwatergardens.com email: info@nelsonwatergardens.com