

Nishikigoi Pond Filtration

It is all about the water.



Nishikigoi

Nishikigoi ("brocaded carp"), are ornamental domesticated varieties of the common carp *Cyprinus carpio*. **Koi** is the common term used in English for Nishikigoi. Nishikigoi are related to goldfish, but they are not goldfish. Nishikigoi varieties are distinguished by coloration, patterning, and scalation.

	Nishikigoi	Goldfish
Kingdom:	Animalia	Animalia
Phylum:	Chordata	Chordata
Class:	Actinopterygii	Actinopterygii
Order:	Cypriniformes	Cypriniformes
Family:	Cyprinidae	Cyprinidae
Genus:	Cyprinus	Carassius
Species:	Carpio	Auratus
Potential Maximum Size	Over 36"	6"-12"
Native Climate	Temperate	Subtropical

Why Filter a Nishikigoi Pond?

- Nishikigoi release feces, urine, and ammonia into the surrounding water
- Organic materials such as leaves and algae can be in the water and start to decay
- Levels of nitrogen compounds (ammonia, nitrite, nitrate) rise to toxic levels
- Detritus forms in the bottom and becomes the home for pathogenic bacteria, parasites, and toxic hydrogen sulphide
- Oxygen levels decrease
- As water quality declines, the Nishikigoi become stressed and more vulnerable to parasites & pathogens

Filtration Improves Water Quality

- Matching stocking levels, pond size, and filter
 - Gently capture and remove solids
 - Convert ammonia to nitrite to nitrate
 - Maintain or improve oxygen levels
 - Improve water clarity
 - Maintain water quality
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Koi Pond Stocking Levels

Conservative Approach

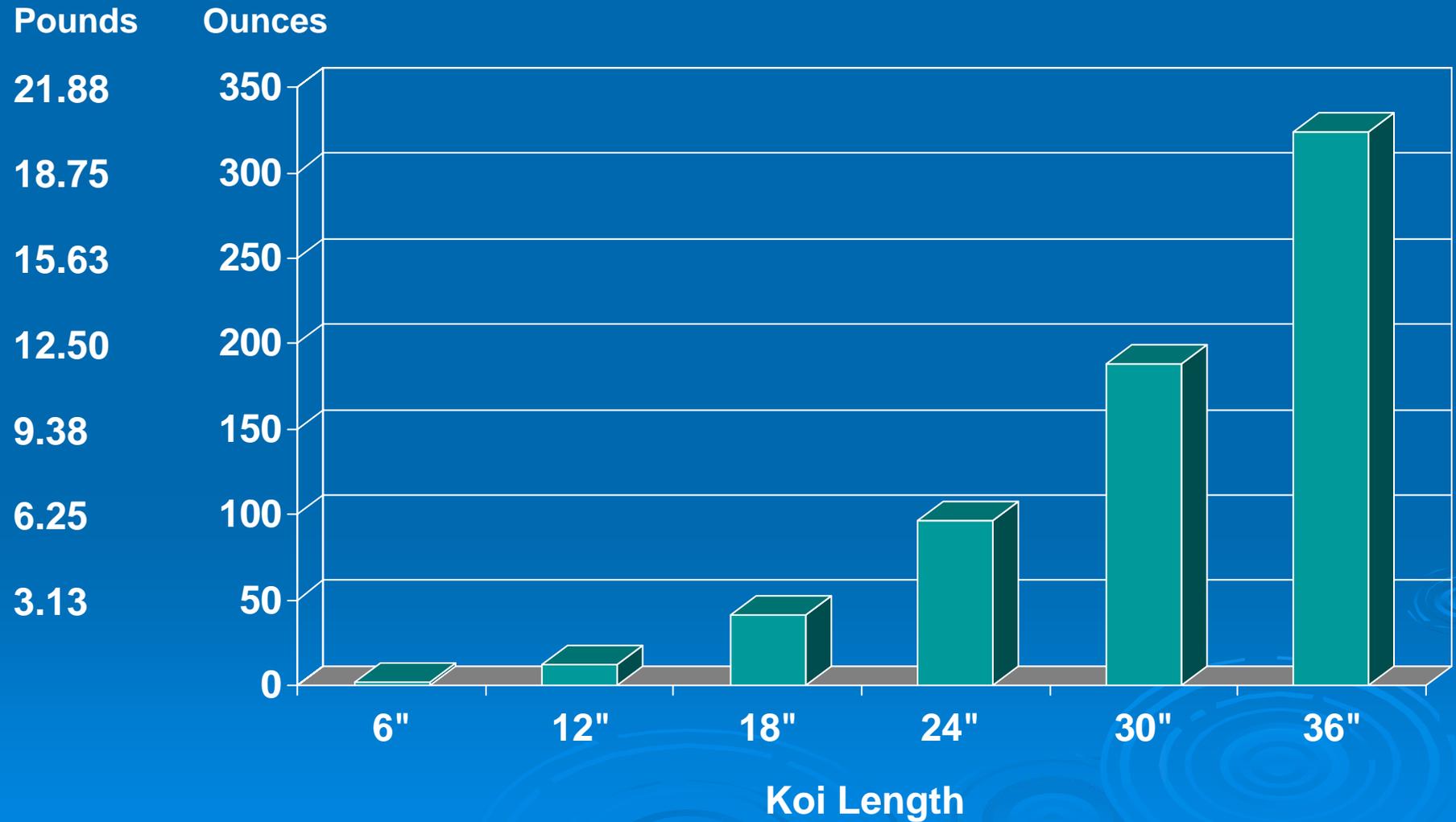
- Low : >100 gallons per lb of koi
- Medium ~50 gallons per lb of koi
- High: <25 or less gallons per lb of koi



Assumptions:

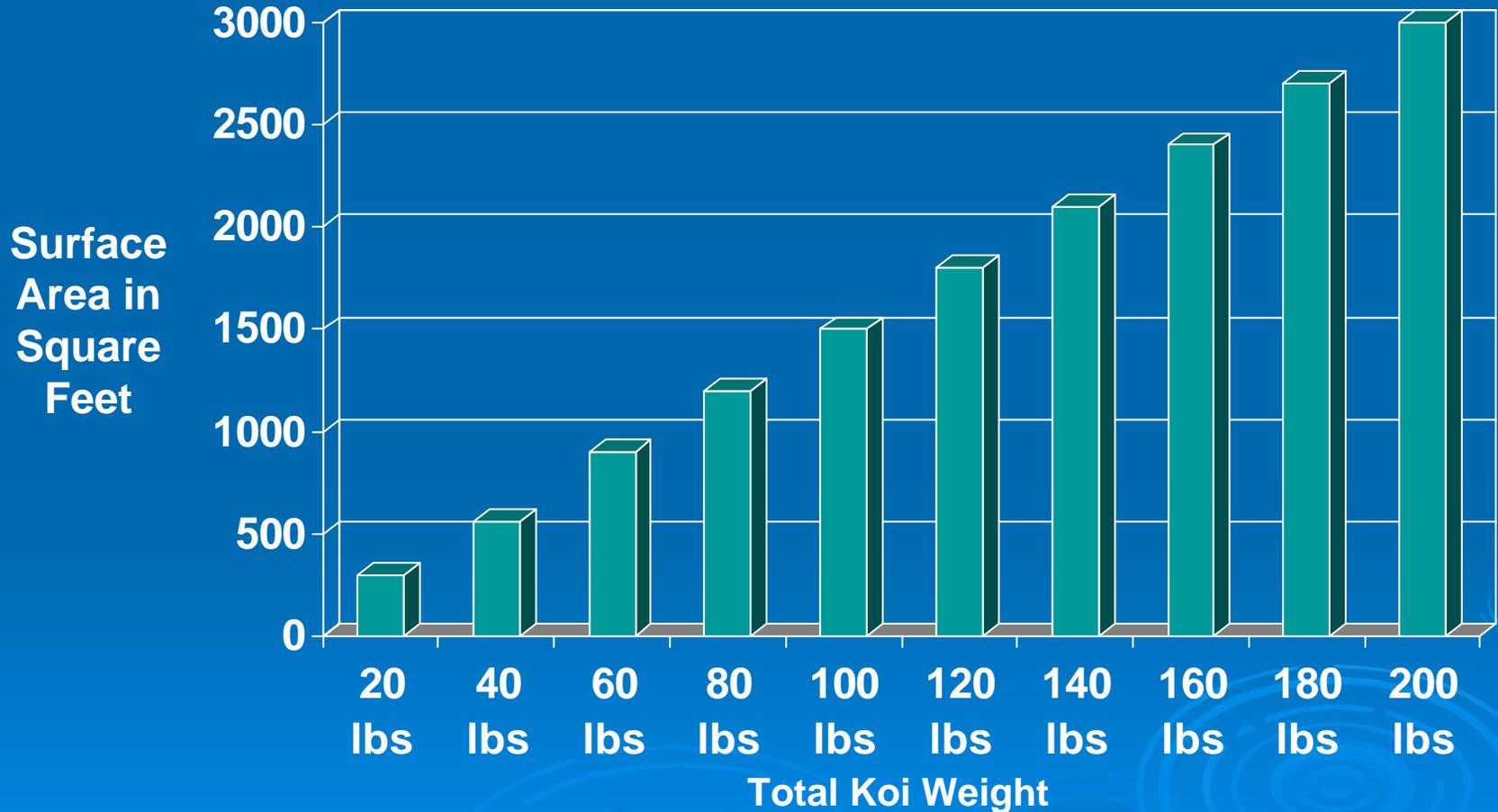
1. The pond will have a properly sized and maintained filter system
2. The owner will perform weekly water changes (at least 10%)
3. The owner will correct any problems with the water supply
4. The owner will not over feed the koi

Estimating Koi Weight



Media per Pound of Koi

Conservative Approach



Rule of Thumb: Each pound of koi needs ~15 square feet of media.

Some of the Many Media Choices



Bee Cell

Specific Surface Area: 198 ft²/ft³



Kaldnes

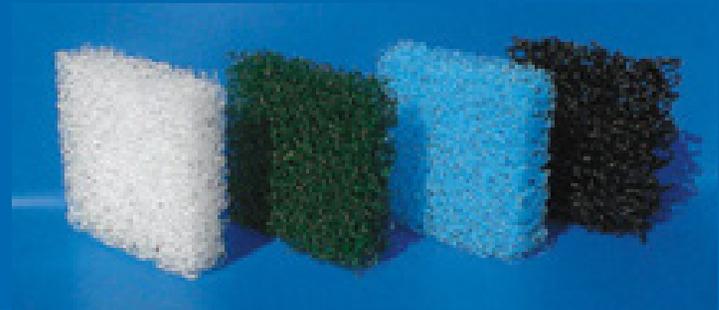
Specific Surface Area: 260 ft²/ft³



Pellets/beads

Specific Surface Area: 400 ft²/ft³

Matala Matting



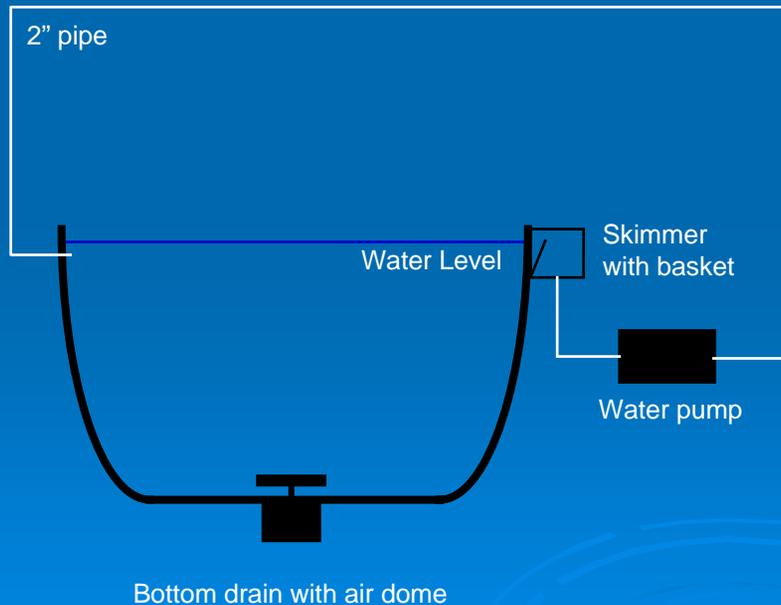
	Biological surface area for microbial growth	Free volume % open space
Black	62 sq.ft. per cu.ft.	92%
Green	96 sq.ft. Per cu.ft.	93%
Blue	124 sq.ft. Per cu.ft.	94%
Gray	171 sq.ft. Per cu.ft.	94%

5000 Gallon Pond Assumptions

- 5000 gallons / 50 gallons per pound = 100 pounds of koi
- 100 pounds of koi X 15 square feet of media per pound of koi = 1,500 square feet of media surface area needed
- Minimal volume of media:
 - Bee cell: 7.58 ft³
 - Kaldnes K1: 5.78 ft³
 - Beads: 3.75 ft³
 - Matala (gray): 8.78 ft³

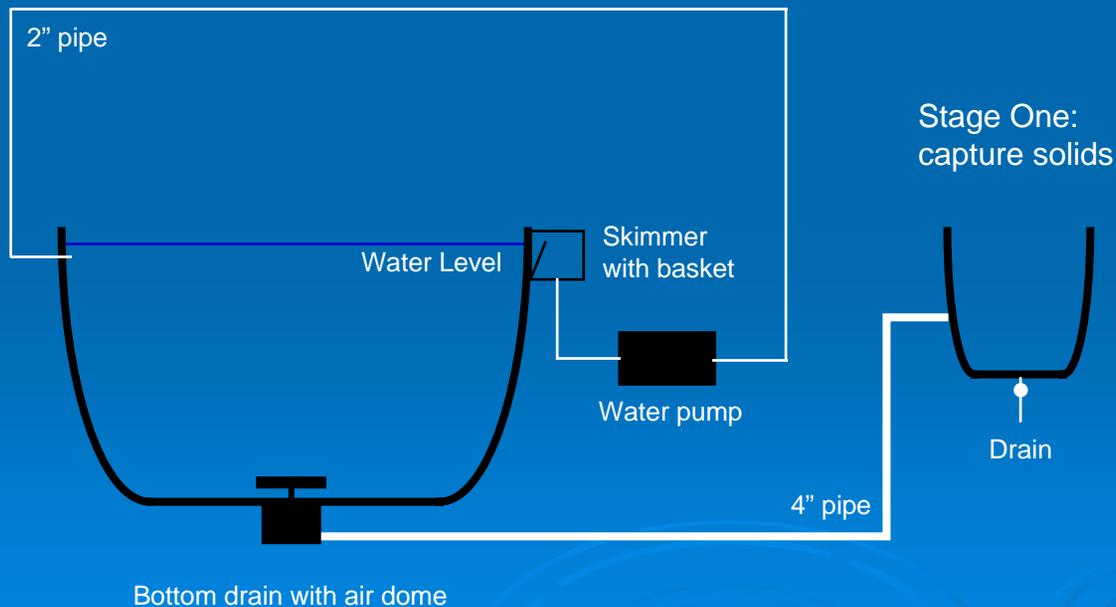
Gently Capture & Remove Solids

- Use a skimmer to capture floating and suspended debris



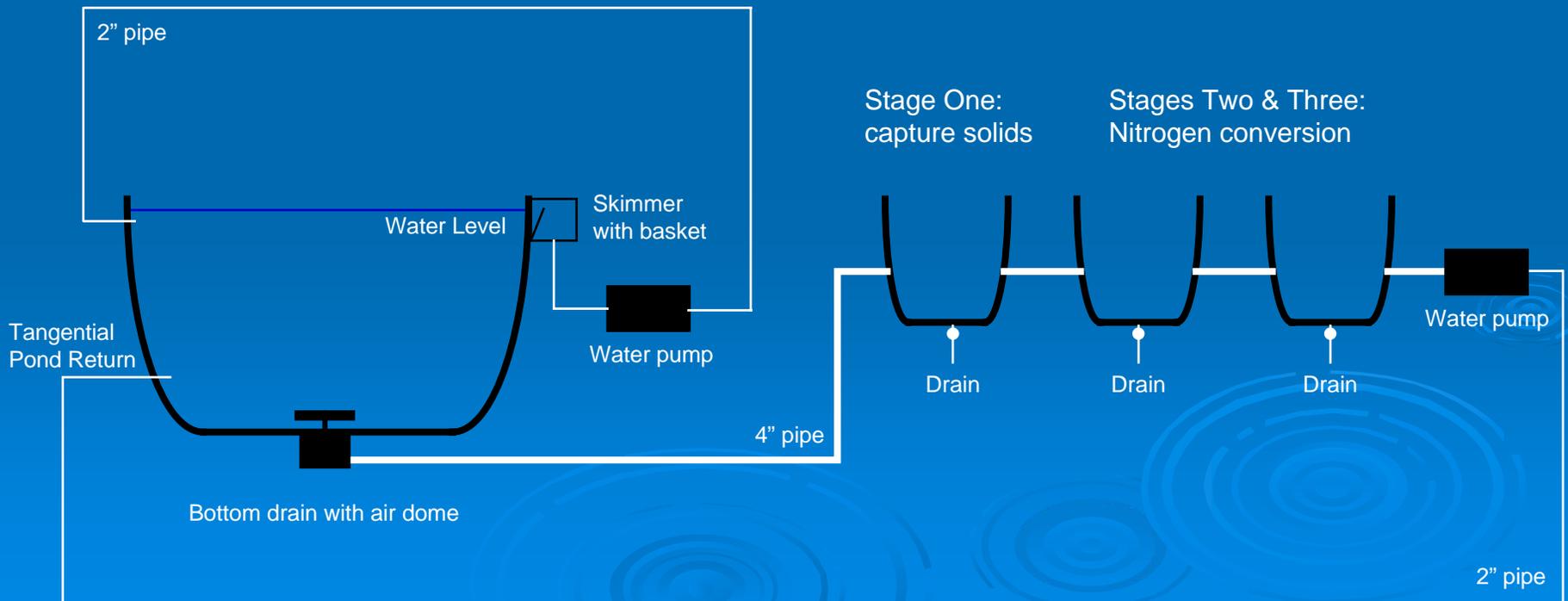
Gently Capture & Remove Solids

- Use Stage One of the filter system to capture sinking and suspended solids
- Stage one can be implemented with: simple vortex, added brushes, matting, foam, vortex micro screen (VMS), Answer,,static K1, sieve...etc.
- The more debris removed the better
- Don't forget it has to be easy to clean!!!



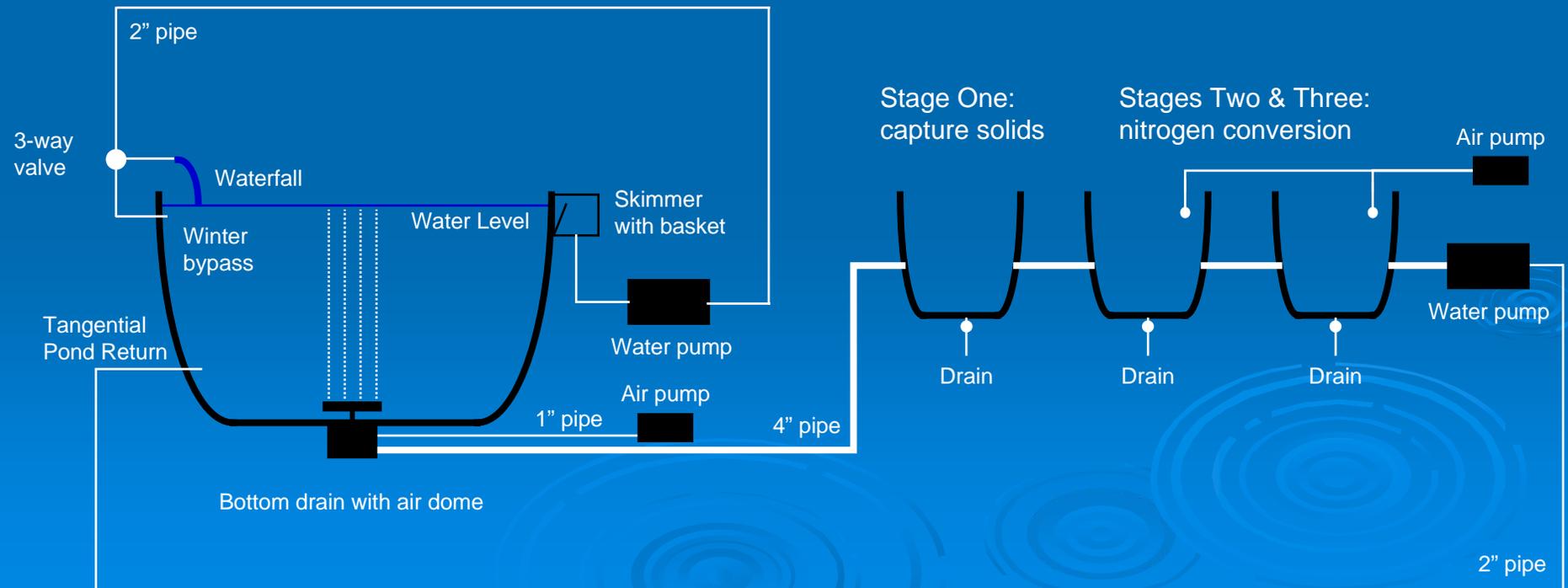
Convert Ammonia to Nitrite to Nitrate

- Stage Two and Stage Three (if present) to house media that provides a more for bacteria
- Media can be matting, foam, K1, lava rock...etc.
- Make sure the Stages are easy to clean!!!
- Note that the various types of bacteria needed to do the conversions consume O₂
- O₂ levels leaving Stages Two & Three will be lower than when entering



Maintain or Improve O₂ Levels

- Put in a waterfall or weir (use a bypass in the winter)
- Use air domes on bottom drains in spring, summer, and fall
- Use air stones in filter chambers or air-driven fluid beds



Pumping Air to Achieve O2 Levels

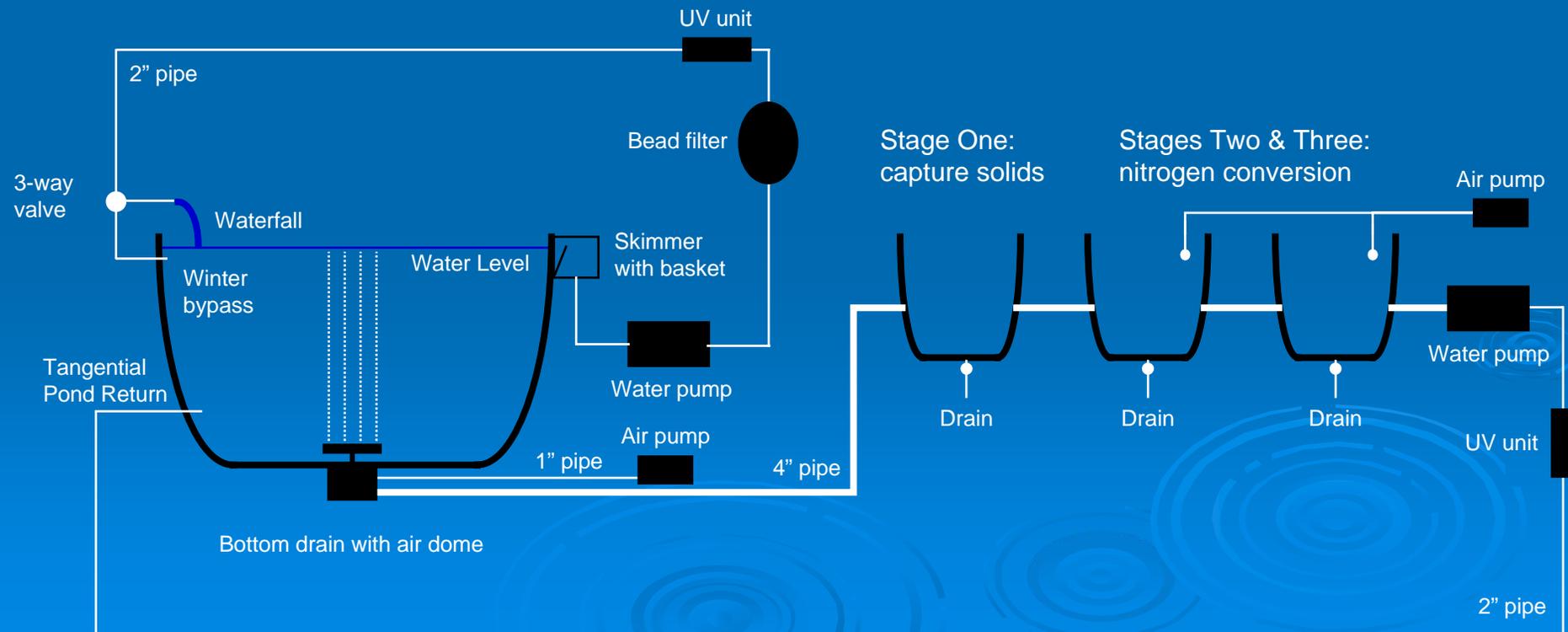
Pond Size in US Gallons	Liters of Air per Minute
1200	40
2400	80
3600	120
4800	180
6000	200
7200	240
8400	280
9600	300
10,800	340
12,000	400

Dissolved Oxygen Levels

Water Temperature	O2 Saturation mg/L	Koi Safe Min O2 Levels mg/L
32F	14.6	10.9
41F	12.8	9.5
50F	11.3	8.5
53F	10.7	8.0
59F	10.1	7.6
64F	9.4	7.0
68F	9.1	6.8
73F	8.6	6.5
77F	8.3	6.2
82F	7.8	5.9
86F	7.6	5.7

Improve Water Clarity

- Put a bead filter on the skimmer circuit
- Put UV units on the skimmer or bottom drain circuits



Oxygen Reduction Potential

- ORP is the measurement of the organic pollution in a pond system expressed in millivolts
- $<115\text{mV}$: filter system is probably not working and anaerobic bacteria are probably present
- 120 to 200mV : the filter system is barely able to handle the load
- 210 to 290mV : indicative of good pond and filter health
- 300 to 475mV : excellent conditions for health and growth
- $>500\text{mV}$: killing living organisms (such as a PP treatment)
- $>650\text{mv}$: sterile water

Measure Water Quality

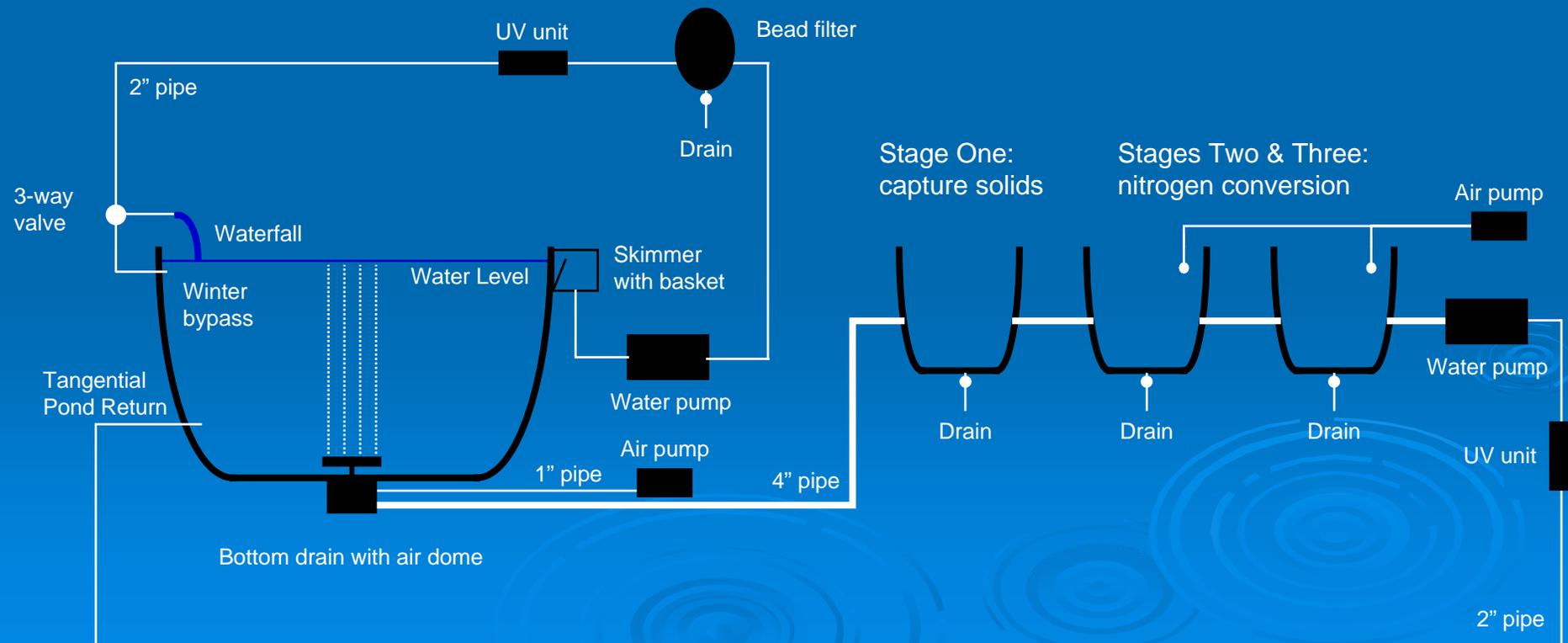
At least once a week

	Target Values	Comments
Ammonia	<0.01 mg/L	Smaller is better
Nitrite	<0.01 mg/L	Smaller is better
Nitrate	<40 mg/L	Smaller is better
pH (acid or base)	7.5 to 7.7	Stability is the key
kH (carbonate level)	100 to 150 mg/L	
gH (general hardness)	100 mg/L	Higher levels may cause shimmies
Oxygen level	6 to 9 mg/L	Temperature dependent
ORP level	>300 mV	Higher is better

Note: 1mg/L = 1ppm

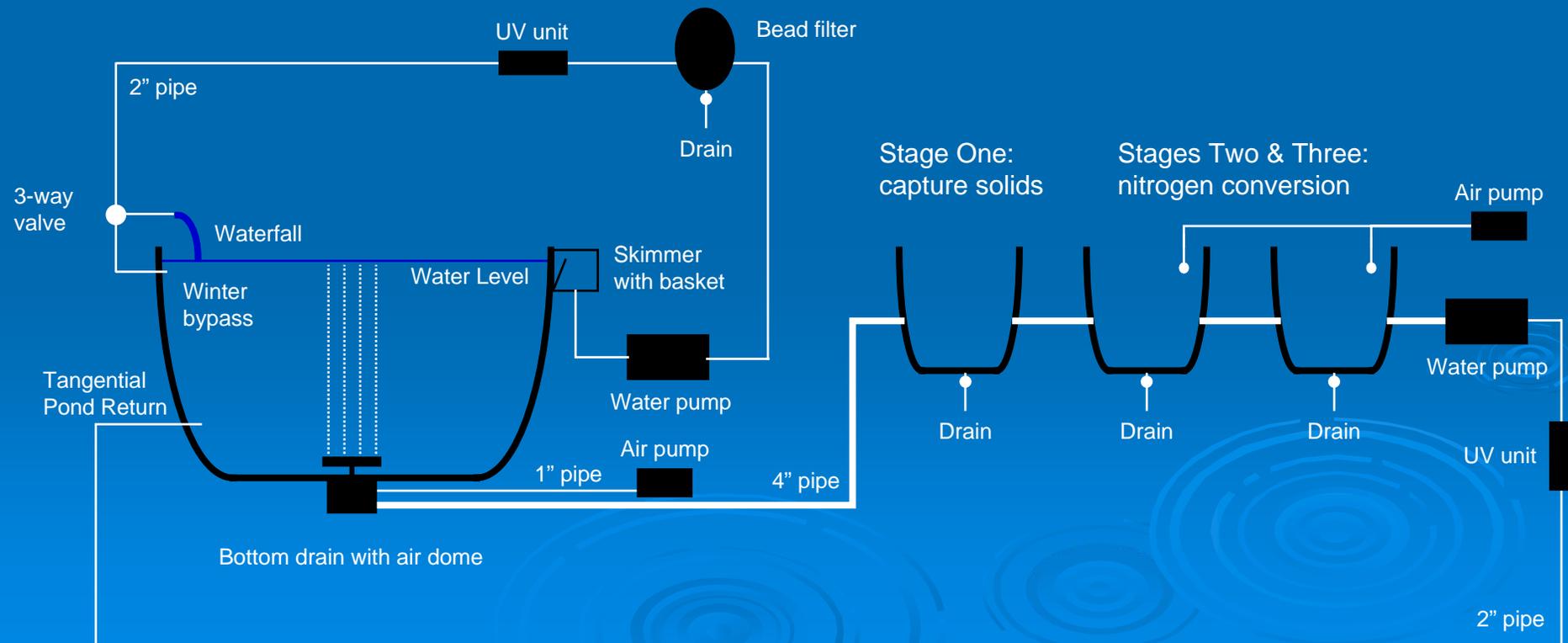
Maintain Water Quality

- Dump filters, skimmer basket and pump baskets at least once a week
- Do at least a 10% water change every week
- Replace UV lamps every spring



Other Tools

- Trickle tower can reduce nitrogen and increase O₂
- Protein skimmer or foam fractionator can remove organic compounds
- O₃ unit can burn off organic compounds



5000 Gallon Pond Filtration Budget Estimates

	Entry	Medium	High
2 Water pumps	\$500	\$750	\$1000
2 UVs	\$500	\$750	\$1200
2 air pumps	\$400	\$600	\$1000
Stage One (mechanical)	\$300	\$500	\$1500
Stage Two (bio)	\$300	\$500	\$1000
Stage Three (bio)	\$300	\$500	\$1000
Bead filter for polishing water	\$0	\$0	\$1200
Pipes and valves	\$300	\$400	\$500
	\$2,600	\$4,000	\$8,400

Enjoy Your Nishikigoi!

Thank you for your time and attention!

