

YOUR FREE READER'S COMPANION

The Pond Build Pack

A companion to The Backyard Koi Pond & Water Garden Building Bible · by Russ Coleman

Thanks for picking up the book. This is the companion you tape inside the garage once the water's in, and the one you carry to the dig before it is: the style-and-depth chooser that matches your yard to the right pond, a filtration and pump sizing table so you buy the right equipment the first time, the liner and excavation numbers you'll reach for with a shovel in your hand, a fish-stocking chart that keeps you from overcrowding, a water-quality cheat sheet for the tests that actually keep fish alive, and a build-and-first-season checklist. Print it, fold it, keep it where the wet boots go.

Ponds that fail almost never fail from the plants down. They failed from the water up — too shallow, under-filtered, stocked too heavy, swinging chemistry that cooked or poisoned the fish. Get the volume and the filter right and the rest is just landscaping. Build the ecosystem, not just the hole. — Russ

1. The Style & Depth Chooser

A backyard water feature is one of four things. Match it to your yard, your budget, and whether you actually want fish, and you've made the decision that drives every other number in the build. Every one of these is a small living system of water, oxygen, and circulation — even the one with no fish in it.

Style	Typical depth	Typical volume	DIY cost (2026)	Pick it when	Think twice when
Koi pond	3–4 ft (900–1200 mm)	1,500–6,000+ gal	\$3,500–\$12,000+	You want koi to watch for decades; fish are the whole point	Tight budget, small kids, or you won't run real filtration
Water garden	18–24 in (450–600 mm)	300–1,500 gal	\$1,200–\$4,000	You want lilies and a few small fish; the forgiving first build	You want to overwinter big koi in a hard freeze
Pondless waterfall	No pool; buried reservoir	~150–500 gal circulating	\$1,500–\$5,000	You want the sound of water, no fish chores, no drowning risk; a slope is a gift	You want open water reflection or fish
Hybrid	Pool 18–30 in (450–760 mm)	400–1,500 gal	\$2,500–\$6,500	You want sound and a few fish, with a low entry point	You want a serious koi collection

Read your yard first

- Koi need real depth — 3 to 4 feet, no exceptions. Depth buys thermal mass: it stays cooler in summer heat and won't freeze solid in winter, so fish have a safe layer to retreat to. A shallow pond cooks past 84°F and suffocates fish.
- Don't build a koi pond under ~1,500 gallons. Volume is what keeps water chemistry stable under a heavy fish load. Small water swings fast and hard; bigger water forgives.
- A slope is a gift, not a problem — work with gravity for a pondless waterfall or stream instead of fighting it.
- Small kids push hard toward pondless or a fenced setup. You can convert a pondless waterfall into a hybrid pool later when they're older.
- Heavy tree cover means more skimmer cleaning and a UV clarifier you'll lean on. Site away from the worst of the leaf drop and runoff if you can.

The honest trade-off: a water garden is cheaper, shallower, and forgiving, but it can't safely hold big koi through a freeze. A koi pond is deeper, costlier, and more demanding, but it's the only one that satisfies if fish are your goal. Build a smaller pond properly — real depth, real EPDM liner, real filtration — before you build a big one with corners cut.

2. Pump & Filtration Quick-Reference

This is the part beginners get wrong most, and it's the part that keeps fish alive. The filter is the organ that processes fish waste; the pump is the heart that moves the water through it. Size both for the fish you'll grow into, not the little ones you bring home on day one — koi keep growing, and a pond stocked light today is stocked heavy in three years.

Turnover — circulate the whole pond at least once an hour

Pond volume	Minimum pump (1x/hr)	Comfortable target	Biofilter rating (koi)	UV clarifier
500 gal	500 GPH	750 GPH	500–1,000 gal	9–13 watt
1,000 gal	1,000 GPH	1,500 GPH	1,000–2,000 gal	13–18 watt
2,000 gal	2,000 GPH	3,000 GPH	2,000–4,000 gal	25–40 watt
3,000 gal	3,000 GPH	4,000 GPH	3,000–6,000 gal	40–55 watt
5,000 gal	5,000 GPH	6,500 GPH	5,000–10,000 gal	55–110 watt

Three sizing rules that keep fish alive

1. Read the pump's flow chart at YOUR head height, not the box rating. Head is the vertical lift from the water surface to the top of the falls, plus friction loss — figure roughly 1 ft of head for every 10 ft of horizontal pipe run. Output drops as head rises, so a "3,000 GPH" pump may only push 2,000 at your real lift. Buy to the chart, not the headline.
2. Size the biofilter for koi, not goldfish. Koi are heavy waste producers. When a filter lists two ratings, always use the smaller koi number, and go up a size if you stock heavily. An undersized biofilter is the quiet cause of green water and dead fish.
3. Match UV flow to the lamp. A clarifier only kills algae if the water passes slowly enough for the light to work. Check the maker's max GPH for that wattage and don't overshoot it, or the green water stays green.

3. Liner, Volume & Dig Basics

Everything downstream starts with gallons. Get your volume right and the pump, filter, and liner all fall into place. Get it wrong and you buy the wrong everything.

Volume — do this math before you dig

Length (ft) × Width (ft) × Average depth (ft) × 7.48 = gallons. Use average depth, not maximum — a pond running from a 12-inch shelf to a 36-inch bottom averages about 24 inches (2.0 ft), not 3. For an irregular kidney shape, multiply by about 0.85 to account for the curves.

Surface (L × W)	Avg depth 1.5 ft	Avg depth 2 ft	Avg depth 2.5 ft
6 × 8 ft	539 gal	718 gal	898 gal
8 × 10 ft	898 gal	1,197 gal	1,496 gal
10 × 15 ft	1,683 gal	2,244 gal	2,805 gal
12 × 16 ft	2,154 gal	2,872 gal	3,590 gal
15 × 20 ft	3,366 gal	4,488 gal	5,610 gal

Liner — buy it once, never splice

Liner length = max length + (2 × max depth) + 2 ft overlap. Same formula for width. The 2-foot overlap leaves a 1-foot flap on each side to anchor under rock and soil. Buy matching underlayment at the same size — it's what saves the liner from the root or stone that would otherwise puncture it years down the road.

Pond max L × W	Max depth	Liner needed (L × W)
6 × 8 ft	2 ft	12 × 14 ft
8 × 10 ft	2 ft	14 × 16 ft
10 × 15 ft	2.5 ft	17 × 22 ft
12 × 16 ft	3 ft	20 × 24 ft
15 × 20 ft	3 ft	23 × 28 ft

Five dig rules

- Use 45-mil EPDM rubber liner (about \$0.90–\$1.25/sq ft in 2026). Order one size class up rather than splice — there's no good field splice for a fish pond.
- Cut planting shelves as you dig. A marginal shelf around 9–12 inches deep holds lilies, iris, and marginals; the deep zone is where the koi overwinter.
- Level the top edge all the way around. An uneven rim is the most common rookie mistake — water finds the low spot and runs out one corner while the rest of the liner shows. Set a level on a straight board across the hole and shave until it reads true everywhere.

- Pull every rock and root out of the hole before the underlayment goes in. What you leave behind is the puncture you'll be patching later.
- Run power on a GFCI circuit and call 811 before you dig. Electricity beside water without a ground-fault breaker is a real hazard, and the free utility-locate call beats hitting a gas line.

4. Fish Stocking & Water-Quality Cheat Sheet

Overstocking is the root of most pond problems I get called out for. Go light — you can always add fish, but you can't easily un-pollute an overcrowded pond. And remember a mature koi reaches 18 to 24 inches and can hit 36; stock for that grown fish, not the 4-inch one in the bag.

Stocking — 1 inch of adult koi per 10 gallons

Pond volume	Conservative adult koi	Maximum (heavy filtration)
1,000 gal	2–3 koi	4 koi
2,000 gal	4–6 koi	8 koi
3,000 gal	6–9 koi	12 koi
5,000 gal	10–15 koi	20 koi

A single grown koi effectively wants 200-plus gallons to itself for stable water. Stock slowly over weeks, not all at once — a brand-new pond has no established bacteria yet, and dumping in a full load on day one poisons them in their own ammonia.

Water-test targets — test, don't guess (liquid drop kit, not strips)

Parameter	Target	Notes
Ammonia (NH ₃)	0 ppm	Anything above 0 is a problem; act on it
Nitrite (NO ₂)	0 ppm	Toxic; signals an immature or crashed biofilter
Nitrate (NO ₃)	under 40 ppm	Lower with water changes and plants
pH	7.0–8.5	Stable matters more than perfect; avoid swings
KH (carbonate hardness)	100–200 ppm	The buffer that keeps pH stable; below 80 is dangerous
Dissolved oxygen	6–8 ppm	Add aeration on hot nights and during treatment
Temperature	under 75°F ideal	Warm water holds less oxygen

When something's off, work this top to bottom

Problem	Likely cause	Fix
Green water (pea soup)	Nutrient overload + sun; no/undersized UV	Add or upsize UV; cut feeding; add plants and shade; reduce stocking
Water level dropping	Splashing falls, evaporation, or a leak	Pump-off test — if level holds with pump off, the leak's in the falls/plumbing
Fish gasping at surface	Low oxygen; high heat; rotting debris	Aerate now; remove debris; partial water change; stop feeding until stable

Sick fish, water tests bad	Ammonia/nitrite spike; crashed biofilter	25–50% dechlorinated water change now; stop feeding; add bacteria; aerate
Sick fish, water tests fine	Disease, parasites, temperature stress	Quarantine; identify before medicating; salt bath for many parasites
pH swinging	Low KH buffer	Raise KH to 100–200 ppm with crushed coral or buffer; recheck

5. Build & First-Season Checklist

A pond is a living system, so the work doesn't end when the water goes in — the first season is when it comes alive or crashes. Work this list in order.

Before you dig

- [] Pick the style off the chooser in Section 1 — koi pond, water garden, pondless, or hybrid — and don't undersize it.
- [] Run the volume math so you know your gallons before you buy a single piece of equipment.
- [] Check codes, permits, and any fence/safety rules for open water, especially with kids around.
- [] Call 811 and plan a GFCI-protected circuit for the pump.

Build day

- [] Dig the deep zone to full koi depth (3–4 ft) and cut the planting shelves as you go.
- [] Level the entire top edge with a board and level — pull every rock and root from the hole.
- [] Lay underlayment, then 45-mil EPDM liner; fit the folds, fill slowly, and trim the overlap, anchoring the flap under rock and soil.
- [] Set the pump, plumbing, skimmer, biofilter, and UV sized off Section 2; prime and run it.

First season — cycle before you stock

- [] Dechlorinate the water before any fish go near it.
- [] Let the pond cycle — run the filter and let beneficial bacteria establish over several weeks (this is "new pond syndrome"). Add bottled bacteria to speed it.
- [] Stock slowly, a few small fish at a time, testing water between additions. Watch ammonia and nitrite climb and then fall to zero before adding more.
- [] Test weekly the first season — ammonia, nitrite, nitrate, pH, and KH. Feed lightly; a hungry pond is healthier than an overfed one.
- [] Plant for balance — lilies and marginals shade the water and eat nitrate, starving the algae that turns it green.
- [] Plan for fall and winter now — a net before leaf drop, and a de-icer or aerator to keep a gas hole open in the ice (never smash the ice; the shock can kill fish).

That's the pack. The one habit worth more than any tool in the shed: size the filter and the depth for the fish you'll grow into, not the little ones you buy — because koi grow, and a pond that's right for ten 4-inch fish is a death trap for ten 20-inch ones. Build the water garden first if you're new to learn the moves, then the full koi pond when you're ready; both are drawn up complete with material lists and step plans in the back of the book. When you've got clear water and healthy fish on your own dig, I'd love to hear about it, and in a couple of emails I'll tell you how a quick word from you helps this book reach the next person standing in their backyard with a shovel and an idea.

Build the ecosystem, not just the hole,
Russ Coleman