

Constructing a Pond

Tips for Small Acreages in Oregon

"Never fry a fish until it's caught."

- English proverb



Ahhhhh...waterfront property. Who wouldn't want a backyard pond for sparkling water, dockside fishing, or enhanced property values? Before you move the heavy equipment in, take time to review your goals, determine whether you have a pond site, and apply for the appropriate permits. It could save you from digging a very expensive, dry hole in the ground.

The Dream Pond: What's Your Goal?

Ponds can be a place to relax, provide a water source, or enhance wildlife habitat. It stands to reason, not all uses can be expected from one pond. Your first step in planning a pond is to sort out what your priorities are and what uses can coexist:

Use	Features
Fish Production	<ul style="list-style-type: none"> 1 acre or more in size, 10-foot minimum depth. Screened inlets and outlets to retain fish. Cold-water fish, like trout and salmon, require cool, clean, and oxygenated water. These fish may require a cool water source in the summer when water temperature is high and dissolved oxygen is low.
Stockwater Supply	<ul style="list-style-type: none"> Pond is sized according to the number and type of animals. A beef cow or horse needs 15 gallons, a hog 4 gallons, and a sheep 2 gallons per day for drinking water. Fence around the pond maintains clean drinking water. Pipe through the dam supplies water to a tank or nose pump outside of the fence.
Irrigation Water	<ul style="list-style-type: none"> Pond is sized according to crop needs and evaporation. High water demand of irrigation limits use to small acreages and high value crops. Drip irrigation and irrigation management may stretch out water supply.
Fire Protection	<ul style="list-style-type: none"> Pond is sized according to fire-fighting needs. A typical firehose uses 1/4 acre-foot of water over five hours. Location is near house and buildings. A pump and hose or an all-weather access point for fire trucks may be needed to provide access to water.
Recreation Area	<ul style="list-style-type: none"> Pond depth is more than 3 feet to discourage aquatic weeds from growing on the bottom. Pond slopes are less than a 3:1 ratio (3 feet horizontal for every 1-foot vertical) to allow swimmers to climb up banks. Swimming areas may have an installation of geotextile fabric and sand to discourage plant growth.
Wildlife Habitat	<ul style="list-style-type: none"> Pond depth is less than 3 feet over two-thirds of the water area to encourage plants that provide food and cover for wildlife. Pond slopes are 6:1 or flatter to encourage plant growth. Pond bottom is uneven to encourage plant diversity. Land surrounding pond is important for food and cover. A nearby field can provide nesting and a shrub clump may connect the pond to an upland forest.

What Type of Pond Can I Build?

Your next step is to determine if you have a proper pond site. Site conditions will ultimately determine whether your particular goal or goals are practical. A resource professional can give you an in-depth evaluation of your pond site. This fact sheet will give you general information on building a pond. There are two basic pond types:

An excavated pond is a pit dug into the high water table in low-lying areas. The surrounding area should be flat and have less than a 4 percent slope. Water volume is determined by the amount of earth excavated, the water table level, soil porosity, or the amount of water pumped from another water source. These ponds are usually small because of high excavation costs.

An embankment pond is a pool of surface water that collects behind a dam. The surrounding area is usually a sloping valley. Embankment ponds are more complex and may require an engineer to design and oversee pond construction. Consider what is above and below the dam. Above the dam, make sure you will not back water onto your neighbor's property. Below the dam, make sure that a dam failure will avoid losses of people, buildings, or roads.



The Right Site: Water Source

A proper pond site has a good water source. The water source can be the natural water table, surface runoff, or a combination of both. Read on to determine what water source may be on your property:

- **Water table.**

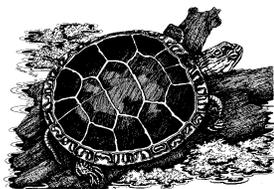
Excavated ponds depend on the prevailing level of the water table in the area. The level should be within 2 feet from the top of the ground.

- **Surface water.**

Embankment ponds can be located in broad drainage swales, to the side of a stream, or in streams. *However, avoid building a dam that blocks fish passage in a stream.* The drainage area supplying surface water to the pond should not produce runoff that's full of sediment, fertilizers, manure, or pesticides. Avoid building ponds in drainage areas with overgrazed pastures, eroding cropland, over-fertilized lawns, barnyard runoff, or a high density of septic systems. A small drainage area may result in a dry pond during the summer and an overflowing pond during storm events.

- **Springs and wells.**

Groundwater is ideal for aquatic life because it is cool, clean, and controllable. However, groundwater may contain high levels of minerals and dissolved gasses such as hydrogen sulfide and carbon dioxide. Test the water before constructing a pond. Pumping groundwater to supplement a pond can be expensive and should be weighed carefully in the overall project cost.



US Fish and Wildlife Service

The Right Site: Soils

A proper pond site has somewhat porous soils if the water source for your pond is solely groundwater or clayey soils if the source is surface water. Check the soils on your site by reviewing a soil survey at your local soil and water conservation district and USDA- Natural Resources Conservation Service office. Once you have pinpointed a potential site, dig several holes 2 feet deeper than the proposed pond depth with a soil auger or backhoe. An engineer or soil scientist can help identify the soils at your specific site. A soil investigation will reveal:

- **Soil type.**

Clays, silty clays, sandy clays, and other soils that leak less than 0.6 inches per hour make a good pond site. Some soils that have sand, gravel, and at least 20 percent clay can be compacted for a good seal. However, most sand and gravel soils are porous and not suited for pond sites, unless a watertight liner is installed. Peat soils, pure silts, or fine sands are not suitable for dams because these soils compact poorly or flow when saturated.

- **Excess sodium or salt.**

In eastern Oregon, saline soils may corrode metal pipes, stunt plant growth, and kill fish. Pond soils should have a salt content less than 8 millimhos (mmhos/cm) for good water quality.

- **Cemented pan or bedrock.**

If a cemented pan or bedrock is present, it should be more than 5 feet below the surface for an adequate pond site. Equipment may have trouble working through shallow layers. During construction, broken layers can fracture into a material that is difficult to seal. Bedrock is often already cracked and will create a leaky bottom. A 2-foot layer of compacted clay may be needed to seal pond bottoms.

Building the Perfect Pond

Once you have determined your goals and have found a proper pond site, you will need to apply for permits. (See the next page for details.) Once your permits are approved, you can begin pond construction. A pond has several components that protect your pond and the watershed downstream. Here are some tips in designing and constructing your pond:

Use a profile and size that fit the pond use.

Fishponds are usually more than 1 acre in size, 10 feet to 12 feet deep, and have 3:1 or steeper bank slopes. Shallow wildlife ponds vary in size, are less than 3 feet deep over two-thirds of the pond area, and have 6:1 or shallower bank slopes. Pond sizes for livestock watering, irrigation, and fire protection will vary according to the situation.

Create a natural shape.

A rectangular shape is the easiest to build. However, a pond with rounded corners and peninsulas has more eye appeal, more fishing access, and increased wildlife habitat.

Stake the pond area.

Mark the outline of the pond with stakes. Clear trees, brush, and vegetation at least 30 feet from the planned embankment and spillway. Flag trees and brush you wish to save for landscaping and wildlife habitat.

Set aside topsoil.

Remove and stockpile topsoil during excavation. Place reserved topsoil on dam, bank slopes, and other areas where good plant growth is needed.

Install a "water-tight" dam on embankment ponds.

In the dam location, excavate a trench to a solid-clay soil layer to stop water leaks between the dam and natural ground. Properly compact dam soils to limit the amount of water that can saturate the dam. Compact the dam in thin layers using equipment such as a sheepsfoot roller. A well-built dam will have a 3:1 slope on the inner and outer slopes for stability, mowing, and maintenance. An 8-foot to 12-foot-wide top will provide room for construction equipment, allow vehicle traffic, and decrease the potential for washouts from animal burrows.

Install a water control structure on embankment ponds.

A pipe inlet in the dam controls the pond level, provides drainage for pond repairs, and allows water to escape without erosion. Oregon regulations require water control structures on embankment ponds.

Install an emergency spillway.

During a rainstorm, the water control structure may run full. An emergency spillway reroutes the water around the dam to avoid a dam breach. Oregon regulations require spillways on excavated ponds that handle runoff and embankment ponds.

Include livestock watering.

A 2-inch pipe through the dam can gravity feed a water tank below. A float valve will maintain adequate levels in the tank. A fence should be placed 60 to 100 feet from the pond edge and enclose the entire pond and dam. The fence will provide a buffer, prevent livestock from ruining the bank slopes, and lengthen the life of the pond.

Install a diversion or buffer strip.

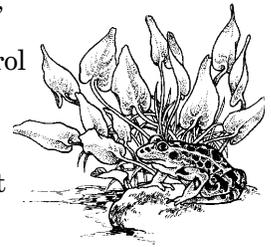
A diversion or grassed buffer strip above the pond can divert or absorb sediments and nutrients before they reach the pond. This can reduce muddy water and fish kills.

Add a safety station.

Pond owners are responsible for pond safety. Slopes that are steeper than 3:1 are hazardous for swimmers. Install a safety station with ring buoys, ropes, and long poles. Limit the amount of access to young children. Establish rules for recreational use.

Maintain the pond.

Immediately after construction, seed the dam and pond slopes with grass. Avoid planting legumes, such as clovers and crownvetch, which attract moles, mice, and other burrowing animals. Control muskrats and nutria that may tunnel in the dam. Repair gullies, reseed bare spots, and remove any shrubs or trees that could reduce dam integrity.



UW- Extension Service





- Private engineers inventory pond locations, design projects, obtain permits, and supervise construction for all types of ponds. Check the yellow pages in the phone book for engineers.
- The USDA-Natural Resources Conservation Service, local soil and water conservation districts, US Fish and Wildlife Service, and Oregon Department of Fish and Wildlife may provide on-site advice on pond location, design, construction, and cost-share funding of shallow wildlife ponds. Contact your local offices.
- The OSU Extension Service offers information on aquatic weed control. Contact your local office.

Don't Forget Pond Permits

You will need certain permits and approvals before you begin excavating a pond, regardless of the situation. Although the process may be challenging, it is designed to avoid problems that have occurred in the past. Do not begin construction until you have received the proper permits. See *Filling out a Permit* in this fact sheet series for more information. Here's a list of the permits and approvals that may be needed:

- **Permit for floodplain alteration.**
Contact your local planning department.
- **Permit to use water (water right) and to construct a reservoir.**
Contact your local watermaster or the Oregon Water Resources Department at (503) 378-8455.
- **Permit to fill or remove over 50 cubic yards in wetlands, streams, or other state waters.**
Contact the Oregon Department of State Lands at (503) 378-3805 and U.S. Army Corps of Engineers at (503) 808-4373.
- **Dam safety review.**
A registered engineer is required to design reservoirs with a dam over 10 feet tall (from natural ground to top of dam) *and* storage over 9.2 acre-feet. Contact the Oregon Water Resources Department at (503) 378-8455.
- **Water Quality Certification.**
Projects that require Removal-Fill Permits will need to be certified by the Oregon Department of Environmental Quality at (503) 229-5279.
- **Coastal Zone Management Compliance.**
Projects west of the crest of the Oregon coastal range may need review by the Oregon Department of Land Conservation at (503) 373-0096.
- **Federal, state, and local agencies may require other permits.**
This is especially true if there are sensitive fish, wildlife, or plants that may be affected.

Algae and Other Plant Problems

Aquatic plants are an important link in a pond ecosystem. Algae are the foundation of the food chain for fish. Free-floating and rooted aquatic plants provide escape cover and shelter for fish and wildlife. However, too many aquatic plants can kill fish. How much is too much? Healthy ponds normally have a faint, green color from algae (you should be able to see an object 2 feet below the surface). But water with a bright pea-soup color indicates an algae bloom and imminent fish kill. Thick aquatic vegetation may also hamper swimming, boating, and fishing.

Prevention is often the best protection against too many aquatic plants. Algae and other aquatic plants thrive on nutrients. Check out the watershed above your pond and correct excessive fertilizing, septic tank failures, and barnyard runoff. However, ponds without fresh water flows often have aquatic plant problems and little can be done to solve them. Contact your local Extension Service office or consult the Pacific Northwest Weed Control Handbook for herbicide solutions. Raking, cutting, and barrier practices can be found at the Washington State Department of Ecology website (if any conflict of information occurs, follow Oregon regulations): <http://www.wa.gov/ecology/wq/plants/management/index.html>.

