

A Guidebook for Montana Ponds



- What You Need to Know About Ponds and Alternatives •

Summary

This guide will help you make decisions about the potential benefits and negative impacts of creating an aquatic amenity. A comprehensive assessment of the natural resources on your Montana property and consideration of legal and management factors will help you determine whether a wetland or riparian enhancement, stream restoration, upland habitat improvement, or pond is best for you.

Anyone interested in ponds, including current pond owners, prospective pond owners, excavation operators, developers, realtors, and consultants will find this guide useful. It also provides information on alternatives to building a pond, references to other publications that provide more technical details on this and related subjects, and additional contact information.

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What Do You Want on Your Property?

Identifying your goals is the first step in making a plan for your property. When comparing your objectives to available resources, you may find that a pond is not the best option, but a wetland or riparian enhancement, stream restoration, or upland habitat improvement project may be more suitable. Here are some ideas to get you started.

Identify Your Goals

Figuring out what is most important to you is the first step for your project. Here are some questions to help you identify the aspects you would like to add or enhance on your property. Check those most important to you and keep them in mind as you read the rest of this guide.

Do You Want:

- To support a healthy native fishery?
- To provide habitat for amphibians, wildlife, and waterfowl?
- To watch ducks, deer, or turtles?
- To improve the aesthetics of your landscape?
- To provide your kids with skating or swimming?
- To support native aquatic and upland vegetation?
- To paddle around in a small boat?
- To enhance fire suppression?
- To irrigate crops or water stock?

Ways of Achieving Your Goals

Pond Development



Stream or Riparian Area Restoration



Wetland Restoration or Enhancement



Points to Ponder

Constructed ponds may cause management or natural resource problems if not responsibly planned, sited, constructed, and managed. Problems may include:

- The ability to obtain a water right.
- Extensive legal requirements.
- Liability for property damage from incorrectly constructed or improperly maintained ponds.
- Insurance rates for your property may change.
- Long-term maintenance obligations.
- Invasive or undesirable species, devastating diseases, genetic contamination, or predators that suppress amphibians, insects, or fish.
- Water pollution that contaminates surface and ground water
- Reduction of water supply to natural streams, irrigation, fisheries, or drinking water
- Disruption of natural hydrology or floodplain function.
- Landowner goals not being met most effectively.

What Is Feasible on Your Property?

Successful pond construction requires careful forethought and planning. Site feasibility, design, construction, and ongoing maintenance must be well thought out before the ground is broken. This section guides you through a series of questions that will help you determine if necessary elements are in place to build and maintain a healthy pond on your property. If a pond is not appropriate, you can use this chart to find alternative means of meeting your goals.

Start here!

Do you have options for a water source?

Water for filling a pond is supplied by surface water or ground water. Often ponds are filled by some combination of sources, depending on the time of year and the availability of water. Some ponds are seasonal and only fill during the wetter months, then are dry the rest of the year. See pages 9-11 in the Design Considerations section to learn more about the climate, water supply, and water sources in Montana.

YES

NO

If you do not have a water source that will maintain a perennial pond, turn to pages 5-6 to see if another alternative is right for your property.

Can you obtain a legal water right to use the water?

You may need to obtain the appropriate water rights for your water source before beginning construction on a pond. The water rights process for new rights varies between river basins, so it is important to contact your local DNRC Water Resources office. Turn to page 7 in the Legal Requirements section for more detailed information on water rights and for information on how to contact local Water Resources offices.

YES

NO

If you cannot obtain a right to use surface water or ground water, you will not be able to fill a pond. Turn to pages 5-6 to see if a wetland enhancement or other alternative is an option on your property.

CAUTION!

Careless design and improper construction of a pond can lead to time-consuming and costly repairs. The Design Considerations and Pond Construction sections on pages 9 - 12 outline several elements that should be considered before proceeding to the next question.

MAINTENANCE?

A pond can take substantial time and money to maintain. See page 13 to determine if you want to make this investment.

Can you obtain all of the proper permits?

Federal, state, and local permits may be required. As the pond owner, you are responsible for obtaining all required permits prior to any construction. Refer to the Table of Permits on page 8 to determine which permits apply to you and how to contact the permitting agency. Application processes vary, so make sure you allow adequate time to secure the required permits.

YES

NO

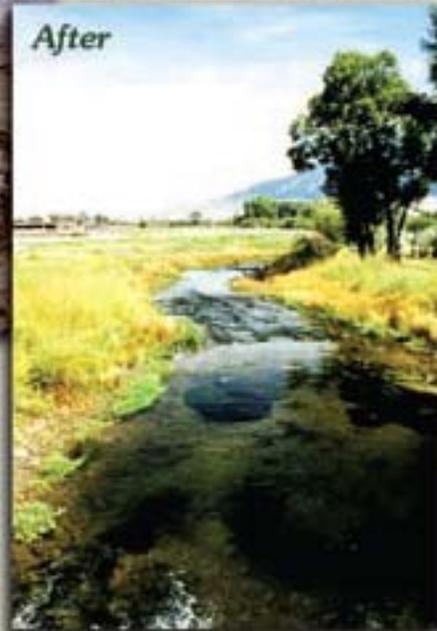
Finish here!

You have determined that it is feasible to build a pond. Pages 9-14 describe the entire process from design considerations through methods to enhance your pond to meet your goals.

Without proper permits, you will not be able to begin construction as planned. A modification of your pond design may change the types of permits needed, or you may want to consider other alternatives to a pond that are described on pages 5-6.

Alternatives to Building a Pond

You have determined that a pond is not feasible or does not best meet your needs. This section will help you explore some of the other options available that may still help you meet your original goals, such as fisheries and recreation, and be more appropriate for your property. Many federal, state, and private conservation programs exist to help landowners by providing technical assistance and funding for conservation projects. For more information on alternatives, see Additional Resources on page 15.



Stream restoration along the Ruby River stabilized eroding banks, reduced sediment in the streams, and improved trout spawning grounds.

Projects are likely to require several permits before construction. If your project requires water, you must check to ensure a proper water right exists. Refer to the Legal Requirements section on pages 7-8 to determine which permits apply and how to contact the appropriate agency.

These alternatives can be very complex projects. Consulting a professional is highly recommended.

Stream Restoration

If a stream or river flows through your property, a stream restoration project may be an excellent way to improve the overall health of the stream and meet your goals. Stream restoration projects can improve fisheries habitat, recreational opportunities, and aesthetics. These projects can also preserve other aquatic life, stabilize stream banks, enhance water quality, and reduce the risk of flooding. Technical and financial assistance is available through a variety of state and federal agencies as well as private conservation organizations. The table on page 6 shows several of the programs available in Montana.

Wetland Restoration or Enhancement

Restored wetlands can provide landowners with wildlife viewing opportunities, increased aesthetic value, a reduced risk of flooding, and a potential increase in property value. The shallow waters of a healthy wetland can offer habitat for more types of birds, mammals, reptiles, amphibians, and aquatic plants than a pond. If resources on your property exhibit wetland characteristics such as the presence of water at least part of the year, soils that drain poorly, or aquatic plants like willows or cottonwoods, a wetland restoration project may be the best option. Technical and financial assistance is often available for these projects. The table on page 6 and the Additional Resources Table on page 15 provide more information on technical and financial assistance for wetland restoration projects.



Seasonal Pond

Water rights should be obtained for a small pond or wetland even if the water will only be available for part of the year. A seasonal or temporary pond is supplied by water available from snow melt or other sources during the wetter months. Even a limited water source can provide habitat for an abundance of amphibians, waterfowl, and other aquatic life. The table to the right and the Additional Resources Table on page 15 provide more information on the assistance available for seasonal ponds.



Wildlife Protection and Habitat Improvement

Landowners interested in providing habitat, having viewing opportunities, or ensuring the protection of wildlife have several options for accomplishing these goals. Healthy streams, wetlands, riparian areas, and uplands provide critical habitat for a wide variety of wildlife and waterfowl. The natural resources available on your property will determine the range of species for which you are able to provide habitat. Several state and federal agencies provide technical and financial assistance to landowners. Information on programs that focus on wildlife habitat is listed in the table to the right.

Conservation Programs

Program	Agency	Contact
Future Fisheries Improvement Program	Montana Fish, Wildlife & Parks	(406) 444-2449 www.fwp.mt.gov/habitat/landowner.asp
Grassland Reserve Program	Natural Resources Conservation Service	(406) 587-6967 www.mt.nrcs.usda.gov/programs
Habitat Montana Program	Montana Fish, Wildlife & Parks	(406) 444-2612 www.fwp.mt.gov/habitat/landowner.asp
Montana's Forest Legacy Program	Montana Fish, Wildlife & Parks	(406) 444-2612 www.fwp.state.mt.us/habitat/forestlegacy.asp
Montana Wetlands Legacy Program	Montana Fish, Wildlife & Parks	(406) 994-7889 www.wetlandslegacy.org
Partners for Fish and Wildlife Program	U.S. Fish and Wildlife Service	(406) 727-7400 partners.fws.gov
Wetland Mitigation Program	Montana Department of Transportation	(406) 444-7228
Wetland Reserve Program and other Conservation Programs	Natural Resources Conservation Service	(406) 587-6967 www.mt.nrcs.usda.gov/programs
Wildlife Habitat Incentive Program	Natural Resources Conservation Service	(406) 587-6967 www.mt.nrcs.usda.gov/programs
Upland Game Bird Enhancement & Release Programs	Montana Fish, Wildlife & Parks	(406) 444-2612 www.fwp.mt.gov/habitat/landowner.asp

Legal Requirements

Water Rights

One of the first steps when thinking about building a pond should be to investigate your ability to use a water source. Water right processes differ for ground water and surface water. A new water right, or change in an existing right, must be obtained before surface water can be used. The use of ground water does not first require a permit for a water right before using the water if the use is 35 gallons per minute or less and does not exceed 10 acre-feet per year, but the use must thereafter be properly reported to obtain a water right. In some cases, a water right will not necessarily guarantee water. A recent priority date on a water right, drought, or other factors may reduce the amount of water available. In some areas of Montana, Controlled Ground Water Areas and Closed River Basins restrict certain types of new water rights due to shortages in water availability or other issues. Contact your regional DNRC Water Resources office to learn which type of water right is needed and the status of new water rights in your area.

TYPES OF WATER RIGHTS		APPROXIMATE LENGTH OF APPLICATION PROCESS	APPLICATION FEES
Provisional Permit	Grants the use of surface water or larger ground water appropriations for a specific amount and purpose.	Six months or more	\$400.00
Certificate of Water Right	Issued on ground water appropriations of 35 gallons per minute or less, but not to exceed 10 acre feet per year.	File within 60 days of water being put to use	\$50.00
Authorization to Change	Allows an appropriator with a recognized water right to change the place of use, point of diversion, purpose of use, or place of storage and still maintain the priority date and dates of use of the original water right. (Crop season irrigation rights may not be changed into a year-round pond water use.)	Six months or more	\$400.00

Department of Natural Resources and Conservation Water Resources Offices

If you do not know which regional office serves your county, call the office nearest you or call (406) 444-6601.

Billings Regional Office	(406) 247-4415
Bozeman Regional Office	(406) 586-3136
Glasgow Regional Office	(406) 228-2561
Havre Regional Office	(406) 265-5516
Helena Regional Office	(406) 444-6999
Kalispell Regional Office	(406) 752-2288
Lewistown Regional Office	(406) 538-7459
Missoula Regional Office	(406) 721-4284



Montana has seven Indian reservations and the regulations and permitting requirements for tribal land are different on each one. The following tribes currently do not have established permitting departments and you will need to contact the tribal government directly for more information. Rocky Boy's, (406) 395-4282, Fort Belknap, (406) 353-8429, Fort Peck, (406) 768-5155, Crow, (406) 638-3700, and Northern Cheyenne, (406) 477-6284.

Table of Permits

Regulated Activity	Regulation	Length of Application Process & Fees (Approx.)	Governing Agency Information
Any activity that will modify the bed or banks of a perennial stream. (Instream ponds may be difficult or even impossible to permit in some parts of the state.)	310 Permit	Up to 90 days	Contact local Conservation District or the Montana Association of Conservation Districts (406) 443-5711
Any activity (such as construction) that will cause unavoidable short-term violations of water quality standards.	318 Permit	30 - 60 days \$150 fee	MT Department of Environmental Quality (406) 444-3080
Any activity that might discharge into State or Tribal waters including wetlands.	401 Water Quality Certification	60 - 90 days Fee varies by project	MT Department of Environmental Quality (406) 444-3080
Any activity that will result in the excavation, discharge, placement of dredged or fill material into lakes, ponds, rivers, streams, and wetlands.	404 Permit	30 - 120 days \$0 - \$100 fee	U.S. Army Corps of Engineers (406) 441-1375
Ponds for rearing and selling live fish or fish processing.	Commercial Aquaculture License	At least 6-8 weeks	MT Fish, Wildlife & Parks (406) 452-6181
Ponds that charge a fee for fishing, but not the sale or transport of live fish.	Commercial Fish Pond License	At least 6-8 weeks	MT Fish, Wildlife & Parks (406) 452-6181
Private fish pond that does not sell fish or fish eggs.	Non-Commercial Private Fish Pond License	At least 6-8 weeks	MT Fish, Wildlife & Parks (406) 444-2449
Construction, repair, or removal of a dam that impounds 50 acre-feet or more at the normal operating pool.	Downstream Hazard Evaluation Permit	60 days \$125 fee	DNRC Dam Safety Program (406) 444-6613
Any new construction within a designated 100-year floodplain.	Floodplain Permit	Up to 60 days Fees vary by county	MT Association of Counties to find local Floodplain Offices (406) 444-6654
Any person intending to acquire new or additional water rights, or change an existing water right.	Water Right Permit and Authorization to Change	6 months or more \$400 fee	DNRC Water Rights Bureau (406) 444-6601
Ground water appropriation of 35 gallons per minute or less, but not exceeding 10 acre-feet per year.	Certificate of Water Right	File within 60 days of water being put to use \$50 fee.	DNRC Water Rights Bureau (406) 444-6601
Work in or near a lake within a county's jurisdiction.	Lakeshore Protection	Varies by county	MT Association of Counties to find local Planning Offices (406) 444-4380
Any discharges into surface water or ground water, including those related to construction, industry, mining, and gas activities.	Montana Pollutant Discharge Elimination System Permit (MPDES)	Varies by county	MT Department of Environmental Quality (406) 444-3080
Work in, over, or near any stream, river, lake, pond or wetland on the Flathead Reservation	Aquatic Land Conservation Ordinance (ALCO)	45 - 90 days	Shoreline Protection Office Confederated Salish & Kootenai (406) 883-2888
Any activity affecting the water quality of Flathead Reservation waters.	401 Water Quality Certification	Varies by project	Water Quality Program Confederated Salish & Kootenai (406) 883-2888
Any activity affecting the water quality of Blackfeet Reservation waters.	106 Water Program and Ordinance 98	Varies by project	Blackfeet Environmental Office (406) 338-7421
Use of water within subdivisions. (May be regulated.)	Subdivision Regulations	Varies by county	MT Association of Counties to find local Planning Offices (406) 444-4380

Design Considerations

Carefully planning the design of your pond and seeking the help of a professional whenever possible can eliminate common, costly, and time-consuming problems. The site design includes finding the appropriate location for your pond, developing a detailed design, and creating a construction plan. The information in this section will help ensure that your pond is well constructed, supports aquatic life, and meets your goals. Refer to the Pond Enhancements section on page 14 for ways to further improve wetland characteristics and biodiversity.

Water Sources

Your water source is a critical factor in determining where to build a pond and the type of pond that can be built. Potential water sources for a pond include streams, springs, irrigation ditches, wells, surface water runoff, and ground water. The amount of surface water runoff available depends on the size and nature of your watershed or drainage. Ground water resources are evaluated by observing nearby surface water features and wells, digging groundwater test holes, or establishing monitoring wells. The semiarid climate in Montana dramatically impacts the water supply and can make it difficult for pond owners to rely on a water source to keep their ponds filled to a desired level.

Water Quality

The quality of the water supplying your pond is important since it directly influences the overall health and productivity of the pond. Land uses within your watershed and on your property can influence water quality through contributions of sediment, pesticides, other chemicals, oils, and excessive nutrients from fertilizer and animal wastes.

Factors that Affect Water Quality:

Temperature: Most commonly influenced by the depth of the pond, temperature of the water sources, and the amount of shade available from vegetation or other sources.

Dissolved Oxygen: Low levels of dissolved oxygen can cause fish kills.

Nutrient Levels: Accelerated aquatic plant growth caused by high nutrient levels can lead to extreme day and night changes in dissolved oxygen which can cause summer or winter kill, as well as reducing the attractiveness of your pond.

The sensitive balance between these three components influences the health of fisheries and the growth of aquatic plants such as algae, and affects the viability of fish and aquatic life.

Soil Analysis

MEET THE JONES'

The Jones' have recently retired and moved to Montana. They decided a pond would be a wonderful addition to their property and hoped it would also benefit neighboring wildlife and waterfowl.

After obtaining the proper permits and water right to fill their pond, they found a consultant to help with the design and construction stages. Together, they created a design that incorporated the Jones' aesthetic and wildlife habitat goals.

The result is a shallow water pond that offers open water for waterfowl, a variety of plants that provide additional cover for birds and amphibians, and a generous vegetative buffer that adds to the beauty of the pond.

It took over one year to complete the project and annual upkeep is a continued necessity, but careful attention to the design, planning, and construction ensured their pond fulfilled their goals.

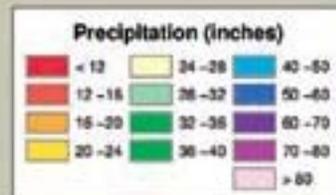
The Jones' are a composite of several pond owners and this is a fairly typical successful pond experience.

If the water source for your pond is surface water, make sure your pond will hold it. Identifying the soil types at the prospective pond site during the planning process is critical. Clayey soils, soils with low permeability rates, and soils that can be compacted to make a good seal are generally acceptable. Soils for an embankment pond must also be suitable for dam and spillway construction. A site with porous soils may be acceptable if the bottom of the pond can be sealed with a clay blanket, bentonite, chemical additives, or a flexible membrane.

Another factor to consider is soil salinity. Saline soils may corrode metal pipes, stunt plant growth, and kill fish.

It is a good idea to have a soil scientist, engineer, or biologist help you make the determination that the soil is suitable. Additionally, the Natural Resources Conservation Service (NRCS) can provide you with a soil report. See page 15 for NRCS and other contact information.

1971-2000 MONTANA
Average Annual Precipitation

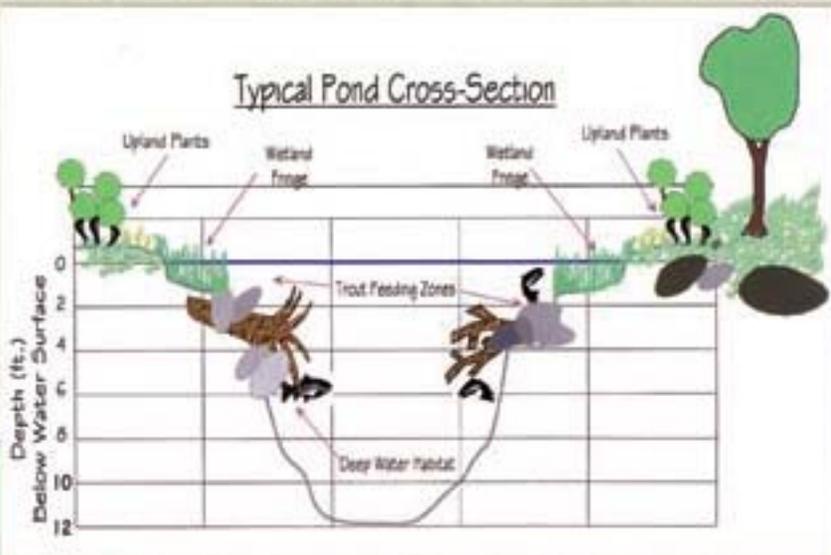


0 20 40 80 120 160 Miles

This map illustrates the semiarid nature of Montana's climate. Most of the central and eastern parts of the state receive less than 15 inches of precipitation a year. More moisture is found in the higher mountain peaks and in the northwestern part of the state.



Typical Pond Cross-Section

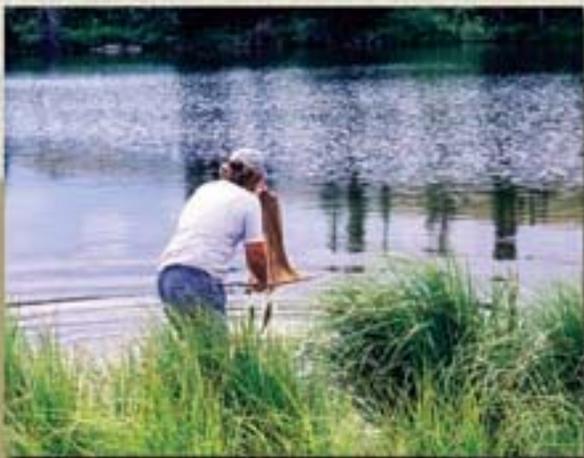


Depth

Calculating the depth and volume of your pond is an important step in the design process and is a necessary part of obtaining a water right. The depth of a pond is determined by factors including the amount of water you have to fill it, type of fish or other aquatic life desired, temperature, water quality necessary to maintain life, rate of siltation, maintenance commitment, and cost. For example, a trout pond should have cooler temperatures in the summer and limited shallow water to allow food production without overheating the pond. Wetlands function best with a combination of shallow, intermediate depth, and deepwater areas. A pond that mimics these qualities is likely to be more successful. Amphibians and aquatic insects need shallow water for reproduction and protection from fish. Aquatic plants also benefit from gradually sloped banks and shallow water, while fire suppression ponds require greater depths and steeper banks. It is helpful to make a list of the activities, plants, or animals you would like your pond to support, then work with an expert to determine how many of these are feasible, given the opportunities and limitations of your site. See page 15 for more in-depth sources of information.

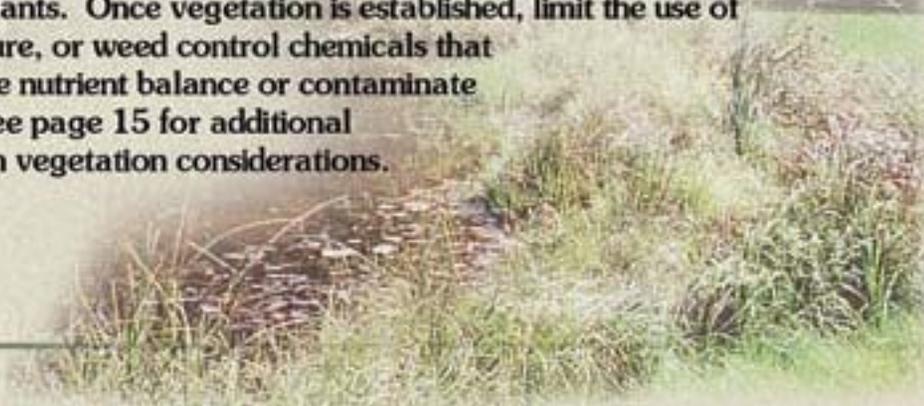
Fish Stocking

Fish stocking in Montana is carefully regulated by state law and enforced by the Montana Fish, Wildlife & Parks (MFWP). A permit must be obtained from MFWP in order to stock fish in a pond. The type of fish you may stock in your pond is determined by a local MFWP fisheries biologist. Biologists will restrict stocking to fish species most likely to thrive in your pond without harming natural aquatic communities. Contact MFWP at (406) 444-2612 for information on how to contact your local fisheries biologist.



Revegetation

Vegetation shades a pond, adds habitat, helps maintain water quality, and enhances aesthetic beauty. Reestablishing vegetation around a pond soon after construction will reduce bank erosion and limit establishment of noxious weeds. A gradual transition from aquatic vegetation to upland vegetation, with a generous buffer around the perimeter of the pond will provide habitat that fosters fish, birds, and aquatic communities. Native plant species should be used when seeding or transplanting vegetation. A local nursery or the Natural Resources Conservation Service should be able to help determine the appropriate plants. Once vegetation is established, limit the use of fertilizer, manure, or weed control chemicals that might upset the nutrient balance or contaminate your pond. See page 15 for additional information on vegetation considerations.



Pond Construction

When the design for your pond is completed, the next step is construction. This section will help you to understand some important construction considerations and to find additional technical assistance and other resources on pond construction. See page 15 for technical references on pond construction, fish stocking, and other related subjects.

Technical Assistance

Seeking professional assistance for the design and construction of your pond is highly recommended. A professional can ensure that your pond is compatible with the resources available, is constructed safely, does not violate laws, and best meets your intended uses. Improperly constructed ponds can require costly repairs, jeopardize the overall health of your pond and downstream waterways, and may pose a liability risk.

A number of private consultants specialize in developing ponds, and assistance is available from several state and federal agencies. It is important to keep in mind that Montana does not currently have a certification or licensing process for pond construction. Be sure to hire licensed, insured, and bonded contractors, and ask questions about previous pond construction.

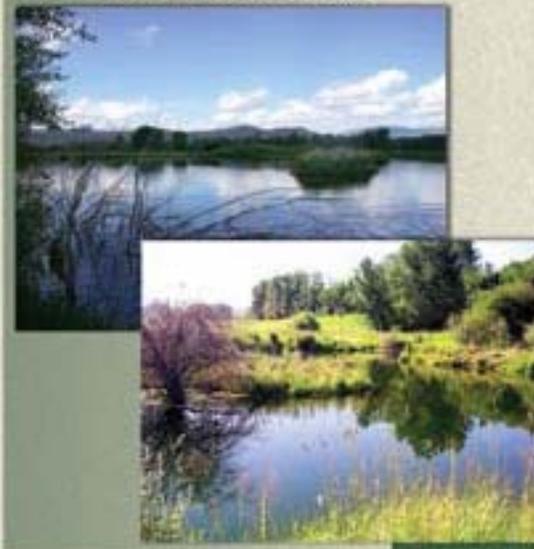
Construction Considerations

- Make sure you have all the proper permits and have obtained a water right prior to construction.
- Building a pond can be expensive. Decide how much money you are willing to put into a pond for both the construction and long-term maintenance.
- Instream ponds are often discouraged and rarely permitted because the return flow is often warmer, of lesser quality due to nutrient loading, and fish migration is prevented.
- Wetlands are protected by federal law and should not be converted to other uses.
- Call One-Call Locators (800) 424-5555 to find out where underground utilities are buried before digging.
- Excavating a pond creates large amounts of soil and rock that must be disposed of properly. Typically, they can be disposed of in upland areas and used for landscaping or roads.
- Dams and flow structures should be installed with the assistance of a professional.
- Make sure you have fish screens, if necessary, for blocking fish passage.
- Fish stocking requires licensing through Montana Fish, Wildlife & Parks. Only species appropriate for your area can be used.
- Gradually sloped banks with healthy native vegetation will minimize erosion.
- Quickly reestablishing vegetation after construction will reduce the onset of weeds and protect water quality.
- Safety should be a concern during construction. If possible, avoid steep embankments and fence the area.
- Small ponds may not be suitable for winter recreation due to thin ice caused by ground water, recirculation, or aeration.

Poorly Constructed Pond



Well Constructed Ponds



Pond Maintenance

A properly constructed pond should require little maintenance, but problems can emerge that are costly and time-consuming to fix. Regular monitoring can catch problems early. Consider developing a long-term maintenance plan before building your pond. This section provides some guidelines to help you develop such a plan. For more information, see **Additional Resources** on page 15.

Monitoring

A monitoring plan that tracks the health of your pond can help you gain a better understanding of how the ecosystems within your pond function while helping to pinpoint problems early. Use the checklist below as a guide for monitoring your pond at least once a year. Simple testing kits can be purchased at most local pet stores. The **Additional Resources** on page 15 can guide you to more detailed information.

Pond Monitoring Checklist

- Pond depth is adequate.
- Embankments are stable.
- Inflow and outflow structures and fish screens are passing the appropriate amount of water and are clear of debris.
- Pond basin is retaining water.
- Water supply is clean.
- Water temperature is appropriate for selected fisheries.
- Dissolved oxygen, pH, and nutrient levels are in balance.
- Banks support diverse plant communities.
- Fish, amphibians, and other aquatic life are healthy and in balance.

Consequences of poor maintenance



Identifying aquatic insects



Testing dissolved oxygen content



Maintenance Tips

- Develop an alternative plan in case drought, dewatering, a junior water right, or other circumstances affect your water supply.
- Stock fish only according to the recommendations of the Montana Fish, Wildlife & Parks. Permitted species are the only fish that can be stocked.
- Maintain inflow and outflow structures to prevent fish passage.
- Manage weeds around the perimeter of the pond with biological control or chemicals intended for use near water.
- Use aeration to manage the growth of algae and other aquatic plants.
- Minimize mosquito populations by establishing a healthy fish population, building and maintaining a good flow-through, or installing a recirculation system to prevent stagnation.
- Inspect embankments, dams, and other structures on a regular basis. A failed pond can cause costly and extensive damage to your property and adjoining properties.
- Avoid nutrient sources such as manure, fertilizer, and fish food.
- Limit livestock access to reduce nutrient loading, loss of surrounding vegetation, and to protect aesthetic values.
- Monitor and thin cattails regularly since they can take over a small pond and emergent vegetation around larger ponds.

Pond Enhancements

Pond enhancements are an excellent way of increasing the benefits to the ecosystems surrounding your pond and the value you can derive from the pond. This section offers an overview of options pond owners can use to achieve their goals by enhancing their ponds. See Additional Resources on page 15 for further information.

Adding Diversity & Value

Enhancing a pond with wetland characteristics will foster biological diversity and increase aesthetic appeal. A wetland is characterized by three components: hydric soils, aquatic vegetation, and the availability of water at least part of the year. The shallow open water of a wetland supports frogs, turtles, and salamanders; provides habitat for ducks and other waterfowl; and supports diverse aquatic plants such as willows, alders, and cottonwoods. A pond that supports cold-water fisheries will need to be deep, but adding a shallow section will support a greater variety of aquatic animals, plants, and birds.

Establishing a Conservation Buffer

Enhancing your pond with a conservation buffer is an easy way to improve the appearance of your aquatic amenity, reduce maintenance, and protect your pond. The appropriate buffer width is determined by the space available around your pond and the desired benefits such as water quality, flood control, or wildlife habitat. Below is a list of benefits conservation buffers can provide.

- *Increase water quality by filtering out nutrients and other pollutants.*
- *Provide erosion control by stabilizing embankments and dams.*
- *Serve as a food source, nesting area, and shelter for wildlife.*
- *Reduce stress on fish by keeping water temperatures cool.*
- *Limit impacts of flooding by slowing and absorbing excess water.*
- *Increase aesthetic value with lush vegetation.*
- *Reduce the risk of children or livestock falling into pond.*



Buffer

Yellow-headed Blackbird



Western Toad



Additional Resources

Resource Type	To Receive a Copy:
Permitting	
<i>Water Rights in Montana</i> , Department of Natural Resources and Conservation, Helena, 2004	(406) 444-6610 www.dnrc.mt.gov/wrd/home.htm
<i>A Guide to Stream Permitting in Montana</i> , Montana Association of Conservation Districts, Helena, 2000	(406) 444-6667 www.dnrc.mt.gov/cardd/cardd.html
Pond Design, Construction, Fish Stocking, and Maintenance	
<i>Soil Survey Information</i> , Natural Resources Conservation Service, Bozeman, MT	(406) 587-6813 http://www.mt.nrcs.usda.gov/soils/
<i>A Guide for Building and Managing Private Fish Ponds in Montana</i> , Montana Fish, Wildlife & Parks, Helena, 1994	(406) 444-2449 www.fwp.mt.gov
<i>Ponds – Planning, Design, Construction</i> , Natural Resources Conservation Service, 1997	1-888-526-3227 www.mt.nrcs.usda.gov/news/pubs.html
<i>Small Earthen Dam Construction: A Guidebook for Planning and Construction of Small Earthen Embankments</i> , Department of Natural Resources and Conservation, Helena, 2004	(406) 444-0860 www.dnrc.mt.gov/wrd/home.htm
<i>Pond Guideline, Opencut Mining Program</i> , Department of Environmental Quality, Helena, 2004	(406) 444-4970 www.deq.mt.gov/opencut/
Stream Management	
<i>Montana Stream Management Guide</i> , Montana Department of Environmental Quality, Helena, 1998	(406) 444-6697
Wetlands	
<i>Landowner's Guide to Montana Wetlands</i> , Montana Watercourse, Bozeman, 2001	(406) 994-6671 www.mtwatercourse.org
<i>An Introduction to Wetland Restoration, Creation, and Enhancement</i> , Environmental Protection Agency, Washington, D.C.	1-800-832-7828 www.epa.gov/owow/wetlands/restore/finalinfo.html
Water Monitoring	
Web site: <i>Monitoring and Assessing Water Quality</i> , Environmental Protection Agency	www.epa.gov/owow/monitoring/volunteer
<i>Volunteer Wetland Monitoring: An Introduction and Resource Guide</i> (EPA 843-B-00-001), Environmental Protection Agency	1-800-832-7828 www.epa.gov/owow/wetlands/monitor/volmonitor.html
Aquatic Plants	
<i>Field Guide to Montana's Wetland Vascular Plants</i> , Montana Wetlands Trust, Helena, 2001	(406) 444-6652 http://nris.state.mt.us/wis/wetlands/metadata.html

Glossary

A

Acre-foot (acre-feet) - The volume of water needed to cover an acre of land to a depth of one foot; equivalent to 43,560 cubic feet or 325,851 gallons.

Adjudication - A judicial procedure decreeing the quantity and priority date of all existing water rights in a basin.

Aerate - To supply air to water, soil, or other media.

Algae - Chlorophyll-bearing nonvascular primarily aquatic species that have no true roots, stems, or leaves; most algae are microscopic, but some species can be as large as vascular plants.

Algal bloom - The rapid proliferation of passively floating, simple plant life, such as blue-green algae, in and on a body of water.

Aquaculture - The science of farming organisms that live in water, such as fish, shellfish, and algae.

Aquifer - A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to springs and wells.

B

Basin - The area drained by a river and its tributaries; a watershed.

Beneficial Use - The use of water for the benefit of the appropriator, other persons, or the public, defined more specifically within each state's water law. It may include (but is not limited to) water use for stock water, domestic, fish, wildlife, industrial, mining, municipal, power, or recreational uses.

C

Compactibility - How well a soil can be made to resist liquid passing through it.

Consumptive use - A beneficial use of water that reduces supply, such as irrigation or municipal use.

Cubic foot per second (cfs) - A rate of water flow that will supply 1 cubic foot of water in one second; 1 cfs = 448.8 gallons/minute.

D

Dam - A concrete or earthen barrier constructed across a river and designed to control water flow or create a reservoir.

Dewatering - Elimination of water from a lake, pond, river, stream, reservoir, aquifer, or containment system.

Dissolved oxygen - Oxygen dissolved in water; one of the most important indicators of the condition of a water body. Dissolved oxygen is necessary for the life of fish and most other aquatic organisms.

Diversion - An open, physical alteration of a stream's flow away from its natural course.

Dredge - To remove or scrape up sand, gravel, or other surface deposits that are covered with water.

Drought - A prolonged period of less-than-normal precipitation such that the lack of water causes a serious hydrologic imbalance.

E

Erosion - The wearing away of the land surface by wind, water, ice, or other geologic agents.

Eutrophication - A process by which aquatic ecosystems receive high nutrient levels that stimulate plant growth.

Evaporation - The process by which water is changed to gas or vapor; occurs directly from water surfaces and from the soil.

Evapotranspiration - The process by which water is discharged to the atmosphere as a result of evaporation from soil, surface water bodies, and transpiration by plants.

Exotic species - Undesirable non-native plant or animal species often referred to as nuisance species.

F

Floodplain - Any land area susceptible to being inundated by flood water from any source.

Flow Rate - The volume of water that flows past a given cross sectional area per a given unit of time, which is usually described in gallons per minute (gpm) or cubic feet per second (cfs).

G

Ground water - Underground water that is found in the spaces and cracks of soil and rock. It may be connected to surface water or confined to an area underground.

H

Hydric soil - Soil that is wet long enough to periodically produce anaerobic conditions, thereby influencing the growth of plants.

Hydrologic cycle - The circulation of water from the sea, through the atmosphere, to the land, and thence back to the sea by overland and subterranean routes.

I

Impermeability - The incapacity of a soil type to transmit a fluid.

Impoundment - A body of water formed behind a dam.



I

Infiltration - The downward entry of water into soil.

Instream flow - Water left in a stream for non-consumptive uses such as preservation of fish or wildlife habitat.

L

Lacustrine - Pertaining to, produced by, or formed in a lake.

Leaching - The removal of materials in solution from soil or rock; also refers to movement of pesticides or nutrients from land surface to ground water.

M

Mitigation - Actions taken to avoid, reduce, or compensate for the effects of human-induced environmental damage.

Monitoring - Repeated observation, measurement, or sampling at a site, on a scheduled or event basis, for a particular purpose.

N

Native species - A plant or animal species indigenous to a specific area.

Nitrate - A chemical used in fertilizer which can cause water pollution and excessive aquatic plant growth.

Nitrogen - A substance required by all living things to make protein.

Non-point source - A source (of any water-carried material) from a broad area, rather than from discrete points.

Nutrient - Any inorganic or organic compound needed to sustain life.

O

Offstream use - Water withdrawn or diverted from a ground water or surface water source for use.

Oxbow - A bow-shaped lake formed in an abandoned meander of a river.

P

Percolation - The movement of water through soil.

Perennial stream - A stream that normally has water in its channel at all times.

Periphyton - Microorganisms

Permeability - The capacity of a rock for transmitting a fluid; a measure of the relative ease with which a porous medium can transmit a liquid.

pH - A measure of the acidity (less than 7) or alkalinity (greater than 7) of a solution; a pH of 7 is considered neutral.

Point-source contaminant - Any substance that degrades water quality and originates from discrete locations.

Pollutant - Any substance that, when present in a hydrologic system at sufficient concentration, degrades water quality in ways that are potentially or actually harmful.

Pond [artificial or constructed] - A man-made water body.

Priority date - The official date of a water right, used in determining seniority among water users.

R

Recharge - The resupply of water to rivers or aquifers.

Return flow - That part of a diverted flow that is not consumed and returns to its original source or another water body.

Riparian area - The green zone adjacent to springs, streams, rivers, wetlands, ponds, and lakes where plant communities are shaped by the presence of water.

Rush - A family of grass-like herbs, often found in wet places and in colder regions. Can be identified by the presence of rounded stems.

S

Sediment - Mineral or organic particles that can be transported by water and which eventually settle and accumulate on the bottom of a water body or waterway.

Sedges - A family of grass-like herbs, often found in wet places and in colder regions. Can be identified by the presence of edges on the stems.

Surface water - Water above the surface of the land, including lakes, rivers, streams, wetlands, wastewater, flood water, and ponds.

T

Tributary - A river or stream flowing into a larger river, stream, or lake.

Turbidity - The state, condition, or quality of opaqueness or reduced clarity of a fluid due to the presence of suspended matter.

U

Upland - A general term for non-wetland; elevated land above low areas along streams or between hills; any elevated region from which rivers gather drainage.

W

Water right - Legal right to the use of water.

Water table - The top of the water surface in the saturated part of an aquifer.

Water quality - Chemical, physical, and biological characteristics of water that determine its suitability for a particular use.

Waterfowl - Aquatic birds such as ducks, swans, and geese.

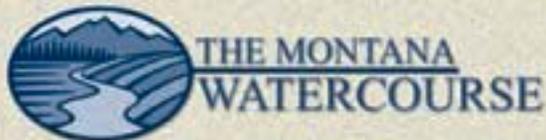
Watershed - The entire drainage area of a river or stream and its tributaries.

Wetland - An area that is regularly saturated by surface water or groundwater and is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions.

Wild fish - Populations or communities of fish species that sustain themselves through natural reproduction.

About the Montana Watercourse

The Montana Watercourse is a statewide water education program housed on the Montana State University campus in Bozeman. Our mission is to foster lifelong stewardship of Montana's water by providing educational programs and materials for all water users. The Montana Watercourse provides tools and unbiased information for making wise water resource decisions through presentations, workshops, trainings, tours, and publications.



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