

Aquaculture Ponds (Acre) 397

DEFINITION

A water impoundment constructed and managed for commercial aquaculture production.

PURPOSES

To provide a favorable *aquatic* environment for producing, growing, harvesting, and marketing commercial aquaculture crops.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to:

1. *All impoundments that store water and are managed for commercial aquaculture purposes.*
2. *Embankment impoundments that do not exceed the requirements for low hazard dams having a product of storage times effective height of dam less than 3,000 acre-feet and effective height of dam less than 35 feet, as defined in conservation practice standard 378, Pond.*

CRITERIA

General Criteria

A thorough aquaculture resource assessment shall be made to determine the feasibility of the project prior to design.

Soil conditions, climate, water resources, and topography shall be suitable for constructing a pond or reservoir.

All measures implemented under this practice shall comply with all applicable federal, state, local and tribal laws, rules and regulations.

All measures implemented under this practice shall comply with Michigan's Generally Accepted Agricultural and Management Practices for Fish. *Aquaculture Facilities must be registered with the Michigan Department of Agriculture.*

Federal and state threatened, endangered, candidate, rare, and other sensitive species shall be carefully considered in aquatic habitat improvement and included in the management plan. No plan shall have adverse effects on threatened or endangered species or species of concern. *All ponds shall be designed to minimize the escape of harmful fishery species to downstream waters.*

The site will be protected from flooding, sedimentation, and contamination. The soils within the pond area, as well as those in the contributing drainage area, must be checked for residues of pesticides and other harmful chemicals if there is a possibility of contamination.

Acid soils shall be limed to achieve a neutral condition or the desired pH level for best production.

When multiple ponds are installed, each pond shall be arranged so that it can be managed independently of the others to facilitate harvesting and the control of parasites and disease.

Aquaculture ponds may be: (1) embankment ponds that intercept and store surface runoff water, or (2) off-channel impoundments or excavated ponds that are filled by pumping ground water, or diverting spring or stream flows.

Water Supply. *Any available water source may be used if the quality and quantity are adequate. If water is pumped from rivers and streams or other sources where undesirable fish, pesticide residue, fish disease, and parasites may be introduced, filters must be installed in the pumping station.*

Evaporation rates, fish-stocking densities, and species requirements shall be used in establishing specific flow rates.

The minimum incoming water supply for trout is 200 gal/min/surface acre and 100 gal/min/surface acre for other species. However, evaporation rates, fish loading densities, and species requirements will be used in establishing specific rates. Flow shall be measured during periods of lowest flow. The pumping and pipeline facilities shall be located to best serve the pond, taking into account accessibility for maintenance and repair; protection from overflow and flood hazards; connections to power lines or fuel sources; and future expansion. Also, incoming water shall be as far away from outlet drain as possible so that rapid removal of fresh water will be avoided.

Water Quality. Water entering the pond shall be aerated to increase dissolved oxygen and dissipate harmful gases if needed.

Provisions must be made for any needed treatment of water released downstream from the pond and be in compliance with any federal or state regulations.

The proposed water supply should meet the chemical criteria in Table 1.

Dissolved Oxygen	Desirable Minimum	8ppm 5ppm
pH	Desirable Min/Max	6.5-8.5 6.0/9.5
Carbon Dioxide	Desirable Min/Max	2ppm or less 0/3ppm
Iron	Maximum	1ppm
Alkalinity	Desirable Min/Max	100-120ppm 20/200ppm

Orientation. Rectangular ponds shall be positioned with the long axis perpendicular to the prevailing wind where possible or shall be protected from wave action if needed.

Pumps and Conduits. Pump discharge through levees shall be installed above expected high water, and provisions shall be made to prevent pump and motor vibrations from being transmitted to discharge conduits.

Water Depths. The water depths required for various species are as shown in Table 2. Aerators or circulators will allow ponds to support fish at shallower (8-10 foot) depths.

Species	Minimum Depth
Bass, Bluegill	12 ft (4m)
Minnows	10 ft (3.3m)
Trout	10 ft (3.3m)

Drains. The pond must have facilities for complete as well as partial drawdown. Turn-down pipes, quick-release valves, bottom-water release sleeves, or other devices for water level control and pond management are to be included in the construction of the drain facility as appropriate.

Pond Bottom. Where fish are harvested by seining, the pond bottom shall be smooth and free of all stumps, trees, roots, and other debris. Existing channels and depressions in the pond area shall be filled and smoothed.

Access and Safety. Provisions shall be made for access to the site as well as access for operation and maintenance. Gravel on the levees will permit vehicle travel for feeding or harvesting during wet weather. Ramps shall be located as necessary to accommodate aeration and harvesting equipment. The maximum grade for equipment access shall be 20 percent or 5:1 slope. Generally, level areas or restraining barriers shall be provided to protect pumps, motor, fuel tanks, and utility poles from vehicular traffic. Appropriate safety features and devices shall be installed or made available close by to aid people who fall into the pond and to prevent such accidents.

Protection. A protective cover of vegetation shall be established on all exposed soil surfaces that have been disturbed. If soil or climatic conditions preclude the use of vegetation, other protection methods may be used. Adequate provisions must be made to protect earth surfaces from wave erosion and turbulent water at pipe inlets and outlets. Fences shall be installed as necessary to exclude livestock and unwanted traffic. Road surfaces shall be treated if necessary to prevent vehicles from cutting deep ruts or sliding into the pond. Dams and levees shall be crowned to provide drainage.

Embankment Ponds - Design Criteria

Embankment type ponds shall meet or exceed the requirements specified for conservation practice standard 378, Pond with the following additional requirements:

1. The minimum elevation of the top of the settled embankment shall be increased to allow for wave action. This increased allowance shall be as specified in Table 3.

Table 3 – Wave Height			
Maximum fetch length		Wave height	
(Ft)	(m)	(Ft)	(m)
600-1,320	(200-400)	0.5	(0.15)
>1,320	(>400)	1.0	(0.31)

Fetch is defined as the longest uninterrupted distance traveled by wind or wave.

2. The minimum top width of the embankment shall be 14 feet and 20 feet, respectively, where it is to be used as a one-lane or two-lane road for harvesting, feeding, and management purposes and is nonpublic. Minimum side slopes shall be *3 feet horizontal to 1 foot vertical or flatter*.
3. Interior embankment constructed for division of water or to direct water flow for circulation shall have adequate cross section to provide for stability and function for its intended purpose.

Excavated Ponds - Design Criteria

Excavated type ponds shall meet or exceed the requirements specified for conservation practice standard 378, Pond with the following additional requirements:

Ponds, established by excavating or constructing an embankment around their outer perimeter, shall have either an emergency spillway with a bottom width of at least 10 feet or have an overflow pipe installed with sufficient capacity to remove a 10-year/24-hour direct rainfall event in 48 hours. The pond bottom shall be sloped to the outlet at a gradient of at least 0.2 feet per 100 feet.

CONSIDERATIONS

General

The owner/operator's objectives *should* dictate the level of development and management to be planned. The plan should be based on the limitations and potentials of available natural resources. *Information on adapted commercial aquatic species is available from Michigan State University, Cooperative Extensive Service.*

Ponds from 2 to 20 acres are desirable for commercial production and 1/2 to 10 acres for hatchery and fingerling ponds.

Consider the potential effects of installation and operation of this practice on the cultural, archeological, historic, and economic resources.

Other planning considerations include the following:

- Application of practical pond management techniques should achieve the desired level of production.
- Easy access to the site is available or can be constructed and maintained for the public if fee fishing is planned.
- The visual design should be carefully considered in areas of high public visibility and those associated with recreation.
- Only purchase fish from a source free of disease and parasites. *Many fish diseases are extremely contagious and extreme care is required to limit disease transmission.*
- *Measures to avoid depredation by birds or other animals should be included in the design.*

Additional Considerations for Ponds Used for Fee-Fishing

Management for Fish

1. Species Selection and Stocking Rates

a. Cold Water Ponds

Normal water temperature is cooler than 65°F (18°C) and surface water temperature rarely exceed 72°F (22°C). Rainbow trout are most suitable. Brook trout are suitable but often have a lower survival rate than rainbow. Brown trout are suitable and are tolerant to higher temperatures than either rainbow or brook but are more difficult to catch.

Table 4 provides guidance in determining initial stocking rates for ponds of medium fertility. Use lower stocking rates for less fertile waters and higher rates for fertile waters. A simple test for alkalinity will give an indication of fertility. Consider the medium fertility range of 40-120 mg/l of CaCO₃ alkalinity. Trout normally do not reproduce in ponds, so restocking should be planned at 2-3 year intervals, depending upon growth and harvest rates. If adult trout are present, do not restock with small fingerlings.

Commercial fish production, hatcheries, or raceways require more detailed analysis to determine stocking rates and a fisheries biologist should be consulted.

b. Warm Water Ponds

Historically, largemouth bass and bluegill have been the most popular fish to stock in warm water ponds. In light of management problems, bluegills should only be stocked when population controls are planned. Hybrid sunfish are being used with success and are available commercially. Forage fish such as golden shiners or fathead minnows, when stocked with largemouth bass or channel catfish, will result in earlier development of catchable-size fish. Other warm water species including channel catfish, yellow perch and redear sunfish may be stocked. Northern pike, muskellunge, walleye, crappies, and bullhead are not recommended in ponds less than 2 acres in size. It is illegal to stock grass carp or White Amur in Michigan.

Table 4 provides guidance in determining initial stocking rates according to pond size.

Largemouth bass and bluegill, if properly managed, should not require restocking since reproduction will replenish harvest. Channel catfish may successfully reproduce if provided secure nesting sites such as nail kegs, drain tiles, milk cans, or hollow logs. Hybrid sunfish require restocking but do not restock with small fingerlings if adult bass or channel catfish are present.

2. Supplement Feeding

Natural food supplies in the pond will sustain the fishery stocked at the rates shown in Table 4. With intensive management and supplemental feeding, higher fish populations and harvestable yields can be produced. Feed should be provided at the same time and from the same place every day during the growing season. The optimum growing season for trout can be considered to be the period when water temperatures range from 50°-65°F (10°-18°)C while for channel catfish and sunfish the optimum growing season can be considered that period when water temperatures are above 60°F (15°C). Hybrid sunfish respond well to supplemental feeding. Only offer the amount of food that can be consumed in 15 minutes. Excess food will be harmful to water quality.

3. Fish Population Control

Maintenance of a “balanced” fish population requires careful management. Managing the harvest is most important in warm water ponds stocked with several species of fish. Aquatic plant control described in another section is a prerequisite to fish population control.

a. Cold Water Ponds

In trout ponds harvest 25 to 50 fish/ac/yr. Records must be kept of fish removed. Natural mortality should be accounted for in that 20 to 50 percent of the fish may die annually after reaching 8 inches in length.

b. Warm Water Ponds

Maintaining a “balanced” population of largemouth bass and bluegill is difficult but possible. Overharvest of bass is a leading cause of stunted panfish populations. Bass must not be fished until they have had a successful spawn, generally occurring the second or third year after stocking. Then in fertile pond, harvest no more than 35 lbs/ac/yr. of bass and in less fertile ponds no more than 25 lbs/ac/yr.

Manage the bass harvest to sustain a “balanced” population consisting of individuals in all year classes. It takes 4 to 5 pounds of forage fish to produce 1 pound of bass. A “balanced” bass

population will serve as a check on the panfish or forage fish.

Bluegill and channel catfish may be harvested as soon as they are considered big enough to eat. A good pond should yield 200-300 fish/ac/yr. Channel catfish and hybrid sunfish will require periodic restocking, depending upon the rate of harvest. In some ponds, particularly neglected ponds, total fish eradication and restocking may be necessary. Completely draining the pond for two weeks is recommended. Fish toxicants are approved for use in Michigan but a permit for their use is required for ponds with multi-owners or with outlets in Michigan from the Michigan Department of Environmental Quality.

Table 4 – Fish Stocking			
Species	Size-inches	No./Ac	Dates
COLD-WATER PONDS			
Trout	2 - 4	125 - 200	April - May
Trout	4 - 6	90 - 150	September - October
Trout	6 - 10	80 - 130	April - June
WARM-WATER PONDS			
Largemouth or Smallmouth Bass alone	2 - 4	100	July - August
	6 - 10	25 - 50	April - October
	12	6 - 8	October or May
Bass with minnows	2 - 3	500 adult minnows, then after minnows spawn, stock bass as above	April - May
			July - August
Largemouth Bass with bluegills-sunfish hybrid	1 - 2	Stock bass as above and 500 fingerling hybrids	July - August
Channel Catfish with minnows	2 - 3	500 adult minnows, then, after minnows spawn,	April - May
	2 - 4	100 fingerling catfish	July - August
Largemouth Bass	5 - 6	100	July - August
Bluegill	1 - 2	500	
Channel Catfish (Pond >0.75 acre)	2 - 4	100	

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specification sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

Support data documentation requirements are as follows:

- Inventory and Evaluation records
 - Assistance notes or special reports
- Survey notes, where applicable
 - Design survey
 - Construction layout survey
 - Construction check survey

- Design records
 - Physical data, functional requirements, and site constraints, where applicable
 - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
 - Location map
 - “Designed by” and “Checked by” names or initials
 - Approval signature
 - Job Class designation
 - Initials from preconstruction conference
 - As-built notes
- Construction inspection records
 - Assistance notes or separate inspection records
 - Construction approval signature
- Record of any variances approved, where applicable

OPERATION AND MAINTENANCE

A plan for operation and maintenance should be prepared for use by those responsible for the system. This plan should provide for inspection, operation, and maintenance of vegetation, pipes, valves, spillways, roads, and other parts of the system. Renovation of older ponds for commercial production shall meet the above requirements.

Any use of fertilizers, pesticides, and other chemicals to assure riparian management shall not compromise the intended purpose.

This practice will be inspected periodically and restored as needed, to maintain the stated purpose. Additional operation and maintenance requirements will be developed on a site-specific basis to assure performance of the practice as intended.

REFERENCES

1. Managing Michigan Ponds for Sport Fishing, Extension Bulletin E-1554.
2. Generally Accepted Agricultural and Management Practices for Fish, Care of Farm Animals, Michigan Department of Agriculture.
3. Wisconsin Commercial Fish Pond Standard, Wisconsin Field Office Technical Guide.
4. Fish Stocking Combinations for Farm Ponds. SIU Fisheries Bulletin No 4, Fisheries Research Laboratory, Southern Illinois University, Carbondale, Illinois.