NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

AQUACULTURE PONDS

(Ac.)
CODE 397

DEFINITION

A water impoundment constructed and managed for commercial aquaculture production.

PURPOSE

Provide a favorable aquatic environment for producing, growing, harvesting, and marketing commercial aquaculture crops.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to:

- All impoundments that store water and are managed for commercial aquaculture purposes.
- Embankment impoundments that do not exceed the requirements for Class (a) dams having a product of storage times effective height of dam less than 3,000 acre-ft^2 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.

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.

The site must be protected from flooding, sedimentation, and non-sediment 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 any 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.

All ponds shall be designed with measures to assure containment of exotic species.

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 shall be used.

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 system.

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

Pond area, The topography and geology of the site shall permit storage of water at a depth and volume that will ensure a dependable supply, considering beneficial use, sedimentation, season of use, and evaporation and seepage losses. If surface runoff is the primary source of water for a pond, the soils shall be impervious enough to prevent excessive seepage losses or shall be of a type that sealing is practicable.

Water Quality. Water entering the pond shall be aerated to increase dissolved oxygen and dissipate harmful gases if needed. The minimum dissolved oxygen level in ponds is 3 to 5 parts per million.

Water temperature and water chemistry shall be suitable for use for fish-stocking density and species requirements in the planned aquaculture production.

Incoming water shall be added as far away from outlet drain as possible to prevent the rapid removal of fresh water from the pond.

Provisions shall be made for any needed treatment of water released downstream from the aquaculture impoundment structure.

All federal, state and local regulations will be followed and necessary permits will be obtained prior to construction and stocking.

Design Criteria – Embankment Ponds. Earthfill dams and embankments around excavated ponds shall meet or exceed the requirements for embankments specified for Pond (378).

The minimum top width of the embankment shall be 14 ft and 20 ft, respectively, where it is to be used as a one-lane or two-lane road for management purposes and is nonpublic.

Design Criteria – Excavated Ponds. Ponds established by excavating and constructing an embankment around their outer perimeter that excludes outside runoff shall have either an auxiliary spillway or a principal spillway pipe installed with sufficient capacity to remove a 10-year/24-hour direct rainfall amount in 48 hours. A minimum 8-inch diameter pipe shall be used.

Levee construction shall add the required embankment settlement to the minimum freeboard requirements. A minimum berm width of 10 feet shall be provided between the outside toe of levee and top of bank of outlet drainage ditch.

Orientation

Rectangular ponds shall be positioned as nearly as possible as follows:

> 10 acres or less-long axis in the direction of prevailing wind. More than 10 acres long axis perpendicular to the direction of prevailing wind.

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

Interior embankments constructed for division of water or to direct water flow for circulation shall have adequate cross section to ensure stability and function for its intended purpose.

Adequate provisions must be made to protect earth surfaces from turbulent water at pipe inlets and outlets.

Pond size and depth. The pond shall be constructed to the recommended size and depth for the species to be grown.

Drains. All ponds shall 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 drawdown facility as appropriate. Conduit design and seepage control shall meet or exceed the requirements specified for Pond (378).

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. The edges of the pond should be deepened to provide at least 3 feet of water.

Where crawfish are harvested by trapping, complete clearing and removal of trees, stumps, and other vegetation is not required.

The pond bottom shall be sloped to the outlet at a gradient of at least 0.2 foot per 100 feet.

Access and safety. Provisions shall be made for access to the site as well as access for operation and maintenance. The access ramps, if provided, shall have a grade for equipment access of 4 horizontal to 1 vertical or flatter.

Appropriate safety features shall be made available nearby to aid people who may fall into the pond and devices installed to prevent such accidents.

Fences shall be installed as necessary to exclude livestock and unwanted traffic.

CONSIDERATIONS

The owner/operator's objectives will dictate the level of development and management to be planned. The plan must be based on the limitations and potentials of available natural resources. A thorough aquaculture resource assessment must be made to determine the feasibility of the project. The planning is complete when all practice components essential to reaching the cooperator's management objectives have been identified.

The State fishery agency or appropriate State University or research institution should be contacted for recommendation on pond size, water depths, and adapted commercial aquatic species.

Consider any adverse impact to cultural resources when planning for aquaculture ponds.

Other planning considerations include the following:

- The visual design of ponds should be carefully considered in areas of high public visibility and those associated with recreational fishing.
- Consider the effects on the volume of downstream flow or aquifers that might cause undesirable environmental, social, or economic effects and contribute to water table decline from heavy pumping.
- Measures to avoid depredation by birds or other animals should be included in the design.
- Measures to assure containment of exotic species shall be included in the design.

Cultural Resources Considerations

NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Endangered Species Considerations

Determine if installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern, or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates that the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Catfish Ponds

a. Site Selection

1) Level topography is desirable, preferably with a slope of less than 5 percent.

2) Pond site should be located out of a hazardous flood zone.

3) Suitable soils are those that are fairly impervious, on which water can be impounded.

4) The pond area should be accessible to trucks and tractors for management and harvesting activities.

b. Water Supply

1) A dependable water supply that is free of disease or parasitic organisms, and pollutants is essential. As a general rule, a flow of at least 25 gallons per minute per surface acre is necessary.

2) Water from wells and springs should provide a flow sufficient to fill the pond, replace evaporation loss, and to provide an emergency flow for use in case of oxygen deficiency.

3) Water from streams, canals, or sloughs should be filtered to remove undesirable fish, fish eggs, and debris.

c. Water Quality

1) pH range of 6.5 to 8.5 is desirable.

2) Total hardness between 20 and 200 ppm is desirable.

3) Salinity - Catfish can tolerate brackfish water in production ponds - up to 9000 ppm, however, the water source for ponds should probably not exceed 5000 ppm (spawning ponds require fresh water - less than 2000 ppm for good results).

d. Water Temperature

Catfish require warm water for good growth (85^{o}F is optimum). For commercial production, the water temperature in the ponds should remain above 70^{o}F for at least 120 days during the year.

e. Pond Construction

1) Depth - Ponds should be 3 to 5 feet deep.

2) Size - 1 to 40 acres or more.

3) Bottom - The entire bottom should be graded and sloped (0.2 feet per 100 feet) toward harvest basin or outlet to keep fish from becoming stranded in pools when the pond is being drained. In large ponds slope from the center to the edges.

4) Harvest Basin (optional) - This is a sump at the low end of the pond into which the fish are concentrated for harvesting by draining the pond. It should be 18 inches deeper than the pond bottom, with smooth sloping sides and bottom. The area required will vary with pond size from 1/4 acre to 1 acre depending on the size of the pond.

5) Levees

a) Slope - Water Side (Small Ponds) 3:1, Large Ponds (More than 2 Acres), 4:1.

b) Freeboard - 1 foot on ponds with fetch length less than 660 ft; and 2 feet on ponds with fetch length greater than 660 ft.

c) Erosion Control - Seeded or planted to adapted grasses.

7) Water Control Structures - These should be located in the harvest basin or low end of the pond. They should be:

a) Capable of draining the pond in 48 hours or less.

b) Designed so that the water level can be readily adjusted (flashboards, etc.).

c) Provide for bottom water overflow.

d) Equipped with a removable screen.

8) Dams - Where dams are used to create catfish ponds a bottom water discharge feature should be included in the outlet structure and the bottom should be smoothly graded and shaped as in item e.(3) above.

Trout Ponds

Trout can be reared commercially in ponds or reservoirs in the cooler parts of California, i.e. the north coast and at elevations above 5000 feet. However, most commercially produced trout in California are reared in raceways or modified raceway ponds where large volumes of cold water can be used to keep the oxygen levels high and the temperature low.

a. Site Selection - Important characteristics are:

1) Have a suitable source of water.

2) Level topography.

3) Be out of the high flood hazard zone.

4) Soil suitable for the impoundment of water.

5) Suitable access for vehicles.

b. Water Quality

1) Temperature - water between 50^{o}F and 65^{o}F is ideal; 70oF is about maximum. Trout growth is slow below 50^{o}F.

2) Dissolved oxygen content - trout water should have a minimum of 5 ppm; 7 ppm or higher is preferable.

3) Trout water should have pH value within the range of 6.5 and 9.0 for good production.

4) Hardness - for trout production it is desirable for water of at least 50 ppm in hardness.

5) The water supply shall be free of pollutants. Also, it must not contain lethal amounts of gases such as carbon dioxide, hydrogen sulphide or nitrogen and heavy metals such as copper and zinc.

6) Salinity - trout will tolerate brackish water along the coast.

c. Water Quantity

There should be a large enough inflow to fill the ponds and replace daily evaporation and percolation loss. An inflow of at least 25 gallons per minute per surface acre of water is desirable to maintain good water quality.

d. Pond Construction

1) Depth - Trout ponds should be 3 to 5 feet deep. Where ice cover persists for long periods, a depth of 15 feet or more may be necessary.

2) Size of trout ponds is usually 1/4 acre to 5 acres.

3) The bottom should be graded and sloped toward the outlet or harvest basin. It should be smooth and free of stumps, roots, and rocks that would snag fish seines.

4) A harvest basin can be installed in front of the outlet where the fish can be collected when the pond is drained (see previous section on catfish), or it can be installed below the outlet. In the latter case it usually consists of a concrete wire with plots for flashboards and a screen.

5) Water control structures for trout ponds should be designed to allow for bottom water discharge and be equipped with removable screens.

Minnow Ponds

a. Site Selection

1) Have a suitable source of water.

2) Level topography is desirable - less than 5 percent slope.

3) Ponds should be out of a flood zone.

4) Soil should be suitable for impoundment of water.

5) There should be good access for vehicles.

b. Water Supply

A dependable water supply is needed that is free of pollutants such as insecticides or silt. The pH of the water should be within the range of 6.5 and 8.5, not excessively hard, and free of excessive amounts of carbon dioxide, hydrogen sulphide, etc. Water temperature is not as critical as it is with catfish or trout, however, the growth rate is slow in cooler water (below 65^{o}F).

The water supply should be sufficient to maintain the ponds at a stable level -- equal to evaporation and percolation.

c. Pond Construction

2) Depth - 3 to 5 feet

3) Size - 1/4 to 1 acre, but can be larger.

4) Pond bottom should be graded and sloped toward outlet (0.2 feet per 100 feet) and smoothed so that the pond can be seined readily.

5) A catch (harvest) basin should be installed at the outlet. Place either in front of the outlet or outside of the pond below the outlet (for details see page 19, U.S. Department of the Interior, Fish and Wildlife Service Circular 35).

6) A suitable water control device is necessary - i.e., a turn down standpipe, shear-gate valve, or regular gate valve-for each pond.

Water Quantity

This practice may change the amount of water available to other uses when water for filling the ponds is taken from a surface water source or pumped from wells. In humid areas this practice may have a negligible effect on the quantity of

water. In water short areas the impoundment of water may cause a shortage for other uses.

1. Effects on the water budget, with emphasis on effects on volumes and rates of runoff, infiltration, evaporation, tran-spiration, deep percolation and ground water recharge.

2. Effects on the volume of downstream flow or aquifers that might cause undesirable environmental, social, or economic effects.

Water Quality

Commercial fishponds disrupt the natural drainage system of the area on which they are constructed. They are a confined feeding area in which the fish are concentrated and the waste feed and fish feces are deposited. During the production cycle, the pond is managed to control water conditions by the addition or removal of water. Waste water is high in BOD, nutrients, organics, and other material. Waste water may have a temperature higher than ambient temperature and may be a potential pollutant of the surface water outside of the ponds. (Refer to Practice Specification 312, Waste Management System.)

Because the ponds are a concentrated feeding operation, pollutants are concentrated. Any seepage will carry dissolved pollutants into the ground water. Improperly managed runoff from around the ponds, from the feed storage, and from fish processing plant, may increase the opportunities for organics, BOD, pesticides, pathogens, and other chemicals to enter surface and ground water.

In locations where the ponds replace cropland, a new set of hydrologic conditions will be established. The effects of these conditions on water quality must be evaluated for each individual site. If the site was previously cropland determine if pesticide or other toxic residues may be a problem.

In locations where the impoundment of water reduces the flow further downstream, this practice may reduce the pollutant assimilative capacity of the stream.

When ponds are constructed above the water table, a ground-water mound of polluted water may be created beneath the pond.

Oxygen deficiency may become a problem at times. This is especially true early in the morning after hot days with little air movement. A system of aeration should be planned for in areas where this problem is common.

1. Effects on erosion and the movement of sediment, organics, and soluble and sediment-attached substances.

2. Effects on the visual quality of water resources.

3. Short-term and construction-related effects on the water resources.

4. Effects on the temperature of water discharged.

5. Effects on the movement of dissolved substances below the root zone and toward ground water.

6. Potential for redistributing toxic materials during earth moving.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing aquaculture ponds shall be in keeping with this standard and shall describe the site-specific requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

A plan for operation and maintenance shall be prepared for use by those responsible for the system. This plan shall provide for inspection, operation, and maintenance of vegetation, pipes, valves, spillways, roads, and other parts of the system.