United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

AQUACULTURE POND

CODE 397

(ac)

DEFINITION

A water impoundment for farming of freshwater and saltwater organisms including fish, mollusks, crustaceans, and aquatic plants.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- To provide a favorable aquatic environment for aquaculture crops.
- To reduce or manage nutrient-enriched and pathogen-laden discharges.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all impoundments created by excavation or earthen embankmentsthat store water and are managed for aquaculture purposes. This practice does not address other types of aquaculture containers addressed by NRCS Conservation Practice Standard (CPS) Fish Raceway or Tank (Code 398).

CRITERIA

General Criteria Applicable to All Purposes

Aquaculture ponds may be embankment ponds that intercept and store surface runoff water, or off-channel impoundments or excavated ponds that are filled by pumping ground water, or diverting spring or stream flows. Ponds may be constructed with a bare-earth bottom, or may be lined with a less-pervious (compacted earth) or impervious liner material (geomembrane, geosynthetic clay, concrete).

Protect the site from flooding, sedimentation, and nonsediment contamination.

Check the soils in the pond area and contributing drainage area for harmful chemicals and remediate if necessary.

If pH is unsuitable for desired aquaculture crops and where the water will be in contact with earth, apply lime to acid soils to achieve a neutral condition or the desired pH level for best production.

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

Design all ponds to prevent the escape of nonnative or otherwise harmful species to adjacent surface water bodies.

Establish vegetation on all exposed soil surfaces that have been disturbed. Use other protective methods if soil or climatic conditions preclude the use of vegetation.

Where the embankment of the pond is used as a road for harvesting, feeding, and management, and is nonpublic, the minimum top width of the embankment is 14 feet. Design the road according to NRCS CPS Access Road (Code 560).

Water supply
Any available water source may be used if the quality and quantity are adequate. Open water sources can introduce biosecurity risks such as aquatic pathogens. Runoff from upstream drainage basins, especially basins including agricultural or industrial sites, can also introduce contaminants. If water is pumped from rivers and streams or other sources where fish, invasive mollusks, pesticide residue, fish disease, and parasites may be introduced, include filters, screens, disinfection by ultraviolet or other means, or a combination thereof as needed in the pumping system. Design intake screens for fish protection at the point of withdrawal in accordance with all applicable Federal and State requirements.

Establish incoming flow rates using evaporation rates, stocking densities, and cultured species requirements.

Water quality
Aerate water entering the pond to increase dissolved oxygen and dissipate harmful gases, if needed. The minimum needed dissolved oxygen level in ponds is typically 3 to 5 parts per million, but varies by species. Include supplemental aeration within the aquaculture ponds, as necessary to maintain desired dissolved oxygen. Aeration guidance is found in NRCS Agricultural Engineering Technical Note (Title 210), Agricultural and Biological Engineering, No. AEN-3, “Aeration of Ponds Used in Aquaculture.”

Evaluate the water temperature and water chemistry for the species requirements and the planned production level.

Introduce incoming water as far away from outlet drain as practicable to prevent the rapid removal of fresh water from the pond.

Provide for the collection, harvest, and utilization of wastes from the cultured organisms.

Make provisions for any needed treatment of water released downstream to ensure that the State-designated use of the receiving waters is not degraded from the aquaculture impoundment structure. Discharge of aquaculture effluent to surface waters is regulated under the National Pollutant Discharge Elimination System (NPDES). The applicable criteria differ depending on what species will be grown, existing conditions of the receiving water body, and the size of the operation. Early consultation with the regulating agency is advised.

Land application of nutrient enriched discharge water must meet the criteria in NRCS CPS Nutrient Management (Code 590).

Pond size and depth
Construct the pond to the recommended size and depth for the species to be grown.

Pipes and conduits
Install pump discharge through embankments and levees above expected high water level. Make provisions to prevent pump and motor vibrations from being transmitted to discharge conduits.

Provide adequate cross section of interior embankments constructed for division of water or to direct water flow for circulation to ensure stability and function for their intended purpose.

Make adequate provisions to protect earth surfaces from turbulent water at pipe inlets and outlets.

Drains
All ponds must have facilities for complete as well as partial drawdown. Turn-down pipes, quick-release valves, bottom-water release sleeves, pumps, or other devices for water level control and pond

management are to be included in the design and construction of the impoundment. For conduit design and seepage control meet the requirements in NRCS CPS Pond (Code 378).

Pond bottom
Where organisms are harvested by seining, smooth the pond bottom and remove all stumps, trees, roots, and other debris. Fill and smooth existing channels and depressions in the pond area. Deepen the edges of the pond 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.

Slope the pond bottom to the outlet at a gradient of at least 0.2 foot per 100 feet.

Liners
Where necessary to prevent excessive seepage and to limit nutrient transport to ground water, install a liner compatible with the environmental needs of the desired aquatic organisms. Utilize the criteria in NRCS CPS Pond Sealing or Lining - Compacted Soil Treatment (Code 520), CPS Pond Sealing or Lining - Concrete (Code 522), or Pond Sealing or Lining - Geomembrane or Geosynthetic Clay Liner (Code 521).

Facility access, safety, and security
Make provisions for access to the site as well as access for operation and maintenance. Ramps for equipment access must have a grade of 4 horizontal to 1 vertical or flatter.

Include appropriate safety features to aid people who may fall into the pond and install devices to prevent such accidents.

Install fences as necessary to exclude livestock and unwanted traffic and to protect crops from predators that can deplete production and transfer pathogens. Netting over the production area can also help prevent predation.

Additional Criteria for Watershed Ponds
Watershed ponds are filled by runoff from surrounding land and usually consist of an embankment across a drainageway.

Design earthfill dams and embankments meet the requirements in NRCS CPS Pond (Code 378).

Additional Criteria for Levee Ponds
Levee ponds are established by excavating and constructing an embankment around their outer perimeter that excludes outside runoff. Levee ponds are usually filled by pumped water. Levee ponds require 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 or less. Use a minimum of an 8-inch diameter pipe. The levee around the excavated pond must meet the requirements for embankments in NRCS CPS Pond (Code 378).

Provide for embankment settlement in levee construction to meet the minimum freeboard requirements. All levees or berms should be convex to allow rain runoff. Provide a minimum berm width of 10 feet between the outside toe of levee and top of bank of outlet drainage ditch.

Additional Criteria for Modification of Existing Aquaculture Ponds
Existing aquaculture impoundments must be evaluated to determine improvements necessary to ensure structural stability and safety, adequacy for the intended aquatic organisms, and potential discharge or seepage issues impacting water quality. Evaluate according to the NRCS National Engineering Manual (Title 210), Part 501, Subpart B, “Repair and Rehabilitation.”

CONSIDERATIONS

Contact the State fishery agency or appropriate State university or research institution for recommendation on pond size, water depths, and adapted commercial aquatic species. General guidance for pond size, water depths, and other aspects of aquaculture pond design and operation may be found in the References section at the end of this document. Literature addressing the state of aquaculture science for specific species can be found in professional association journals, including the “Aquacultural Engineering Journal,” the “North American Journal of Fisheries Management,” and the “North American Journal of Aquaculture.”

Consider lining the pond bottom and interior side slopes for improved disease control (earthen surfaces can harbor disease organisms), easier harvesting, waste removal, seepage control, and limiting nutrient transport to ground water.

Much of the nitrogen and phosphorous added to the aquaculture pond as feed or fertilizer remains after harvest. Consider methods to lessen the nutrient loading of discharges by—

- Using high quality feed and good feeding practices to limit waste production.
- Minimizing water exchange to limit effluent volume.
- Capturing rainfall by maintaining storage volume to reduce pond overflow.
- Treating effluents by using constructed wetlands, sedimentation lagoons, or detention in drainage canals or ditches.

For ponds where water will be in contact with earthen material, liming can enhance the effect of fertilization, prevent swings in pH, and add calcium and magnesium which are important in animal physiology.

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 and other animals should be included in the design.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing aquaculture ponds describe the site-specific requirements for applying the practice to achieve its intended purpose.

As a minimum the plans and specifications include—

- A site location map with topographic information.
- Site plans drawn to scale showing existing and proposed site features, including the pond(s), water supply and effluent piping and associated components, predator control system, and access roads.
- Typical cross sections of the pond(s) showing the elevations and dimensions.
- Structure size, location, material type, and elevations.
- Liner type, thickness, and installation method, if required.
- Disposal of any excess excavated material.
- Location and type of fence, if required.
- Areas to be vegetated and vegetative specification.

OPERATION AND MAINTENANCE

Prepare a written site-specific operation and maintenance plan for the system. As a minimum provide for inspection, operation, and maintenance of—

- Vegetation.
- Pipes.
- Valves.
- Spillways.
- Roads.
- Liner.
- Other structural parts of the system.

REFERENCES

Tucker, C.S. 1999. Characterization and Management of Effluents from Aquaculture Ponds in the Southeastern United States. Southern Regional Aquaculture Center publication No. 470. Stoneville, MS.

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Wurts, W.A. and M.P. Masser. 2013. Liming Ponds for Aquaculture. Southern Regional Aquaculture Center publication No. 4100. Stoneville, MS.