Farm ponds for Iowa

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FARM PONDS FOR IOWA

WATER SUPPLY

FISHING

RECREATION

AGRICULTURAL EXPERIMENT STATION—AGRICULTURAL EXTENSION SERVICE, cooperating

IOWA STATE COLLEGE

AMES, IOWA

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Recreation picture on cover courtesy of Daily Iowan; fishing picture by Jim Sherman.
Farm Ponds for Iowa

BY D. O. HULL, R. A. WILCOX AND E. B. SPEAKER

Every farm must have an adequate water supply which can be depended upon for livestock during periods of extended drouth. Many farmers in southern Iowa depend upon their farm ponds as a principal source of water or to supplement their wells. A well planned and constructed farm pond may be what you need to insure an adequate supply of water on your farm at all times if your present water supply is not dependable.

A farm pond will be a ready source of water for many years if properly planned, constructed and maintained. Before investing money in a farm pond, however, consider a number of important problems. Then decide what is best for you and your farm. Your county extension director or technician of your local soil conservation district may be able to help plan the pond.

A farm pond, in addition to its usefulness in providing water for livestock, can serve other important needs on the farm. The pond can supply water for fire protection, limited irrigation, orchard and crop spraying, fish production, recreation and waterfowl. A pond properly planned and maintained can be stocked with fish and thereby be a source of food as well as provide sport for the family or neighbors.

COST OF CONSTRUCTION

The largest item of cost in constructing a farm pond is that of building the dam. Cost of moving earth is greatly affected by the workability of the soil and the efficiency of the equipment used.

Many good farm contractors in Iowa are now prepared to construct earth dams for farm ponds according to plans and specifications given in this bulletin. Private engineers may

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1Original materials for this publication were assembled by C. R. Johnson, formerly assistant extension agricultural engineer at Iowa State College.
be hired to draw up plans for ponds and supervise construction. Your Soil Conservation Service technician will, with the consent of the Soil Conservation District commissioners, do the survey work, and draw up plans and specifications.

Farm ponds are being built in Iowa by contractors at the present time at a flat rate per cubic yard of earth moved or on an hourly basis. The number of cubic yards of earth in any dam may be estimated by dividing the dam into sections and then estimating the volume of each section separately. Get an estimate of cost from your contractor before beginning construction.

**ESSENTIAL REQUIREMENTS**

Not all ponds have been satisfactory. Many of the early ponds were located in too large a watershed; dams and spillways were not designed properly.
Experience indicates that the following are essentials of good farm pond construction and maintenance:

1. A convenient suitable location
2. Adequate storage capacity
3. Watershed of proper size
4. Permanent dam and spillway
5. Outlet to stock drinking tank
6. Fencing from livestock
7. Timely maintenance
8. Adequate life saving facilities

LOCATION OF POND

Select the farm pond site with utmost care. Locate your pond in a small depression or ravine that receives runoff water from pasture land, meadow or woodlot. But, if you are building your pond to serve entirely as a source of water supply, don’t locate it in a deep, active gully which can’t be stabilized. Direct runoff from a cultivated field will rapidly fill the pond with silt. You won’t want water from barn lots or other sources of contamination to enter your pond. You may be able to use diversion ditches or terraces to keep contaminated water from entering the pond.

To be sure that the pond will hold water you need, it is essential to have an impervious subsoil for the dam to rest upon and plenty of impervious soil conveniently available for building the dam.

It is also important to locate your pond where the water may be used conveniently.

ADEQUATE STORAGE CAPACITY

Ponds should not go dry during periods of drought. Design the pond large enough to provide an adequate supply of water for livestock or irrigation during dry summer months, taking into consideration evaporation and seepage losses. A pond should be 8 feet deep in the deepest area below the spillway.

In estimating required storage capacity, assume for aver-
TABLE 1. DRAINAGE AREAS AND POND CAPACITIES FOR SUPPLYING LIVESTOCK WITH WATER.*

<table>
<thead>
<tr>
<th>Drainage area (acres)</th>
<th>Water stored 2&quot; runoff (gallons)</th>
<th>Water available for livestock 46% of storage</th>
<th>Number of cows that can be watered for 125 days or equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54,300</td>
<td>25,000</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>108,600</td>
<td>50,000</td>
<td>33</td>
</tr>
<tr>
<td>4</td>
<td>217,200</td>
<td>100,000</td>
<td>66</td>
</tr>
<tr>
<td>8</td>
<td>434,000</td>
<td>200,000</td>
<td>132</td>
</tr>
<tr>
<td>12</td>
<td>651,600</td>
<td>300,000</td>
<td>198</td>
</tr>
</tbody>
</table>

*Daily water consumption may be estimated by assuming 12 gallons for each cow, 3 gallons for each head of hogs or sheep, 4 gallons for a flock of 50 hens and 30 gallons for each person. Twenty-eight thousand gallons of water will supply 1-acre-inch of irrigation water.

...age conditions of soil and depth of pond that the amount of water lost through evaporation and seepage is equal to or slightly greater than water retained in storage. For example, a pond should hold 125,000 gallons of water to take care of a seasonal requirement of 50,000 gallons.

Iowa’s dry season requires that a pond be large enough to hold sufficient water supply to last 4 months or 125 days. During the drouth years of 1934 and 1936 some ponds failed because they didn’t have enough water to last over the dry period when little or no water flowed into the ponds.

One can determine the capacity of a pond by a careful survey with an engineer’s or farm level. Rough estimates may be made from the area and the average depth. Since ponds are most frequently saucer-shaped, the capacity of a round pond of this shape may be conveniently used to estimate the capacity of the pond under consideration. From table 2 you

TABLE 2. CAPACITY OF ROUND PONDS HAVING BANKS WITH SIDE SLOPES OF 3 TO 1.

<table>
<thead>
<tr>
<th>Depth at spillway level (feet)</th>
<th>Diameter at spillway level (feet)</th>
<th>Diameter at bottom (feet)</th>
<th>Capacity of pond (gallons)</th>
<th>Water available for use (54% loss) in gallons</th>
<th>Drainage area (25,000 gal. per A.) in approximate no. of acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>50</td>
<td>2</td>
<td>40,700</td>
<td>17,750</td>
<td>0.75</td>
</tr>
<tr>
<td>8</td>
<td>75</td>
<td>3</td>
<td>131,000</td>
<td>60,300</td>
<td>2.5</td>
</tr>
<tr>
<td>12</td>
<td>75</td>
<td>3</td>
<td>137,700</td>
<td>63,400</td>
<td>2.5</td>
</tr>
<tr>
<td>8</td>
<td>100</td>
<td>52</td>
<td>281,000</td>
<td>129,200</td>
<td>5.0</td>
</tr>
<tr>
<td>12</td>
<td>100</td>
<td>28</td>
<td>319,000</td>
<td>146,900</td>
<td>6.0</td>
</tr>
<tr>
<td>16</td>
<td>100</td>
<td>4</td>
<td>326,000</td>
<td>150,000</td>
<td>6.0</td>
</tr>
<tr>
<td>12</td>
<td>150</td>
<td>78</td>
<td>946,000</td>
<td>435,000</td>
<td>17.5</td>
</tr>
<tr>
<td>16</td>
<td>150</td>
<td>54</td>
<td>1,049,000</td>
<td>482,500</td>
<td>19.2</td>
</tr>
<tr>
<td>20</td>
<td>150</td>
<td>30</td>
<td>1,092,000</td>
<td>502,500</td>
<td>20.0</td>
</tr>
</tbody>
</table>
can estimate the capacity of ponds, circular in shape, and having sides with slopes 3 feet horizontal to 1 foot vertical.

**SIZE OF THE WATERSHED**

To determine the size of watershed needed to provide an adequate supply of water for a particular farm, estimate the amount of water which will run off the pasture or meadow land under consideration. Use data for drought years to insure an adequate supply of water during such years.

You can expect a 2-inch runoff annually from watersheds that are gently rolling (slopes 5 to 10 percent), have normal infiltration rates of typical prairie soils and have fair to good coverage over the surface. Runoff from an acre under those conditions will amount to about 54,000 gallons of water annually. Deducting 56 percent for seepage and evaporation losses, each acre in the watershed will contribute 25,000 gallons of water for livestock and domestic use.

A watershed of from 3 to 5 acres will provide enough water for livestock on the average farm. If the size of watershed is kept under 10 acres, a vegetated spillway channel will safely discharge runoff from the area during heavy rainstorms. (See tables 1, 3 and 5).

**MANAGEMENT OF THE WATERSHED**

It has been pointed out previously that the watershed should remain in meadow, permanent pasture or trees. A pond site should be fenced away from the watershed to keep

![Fig. 2. This stock water pond is protected with a good fence and well vegetated watershed.](image)
Fig. 3. Earth dams for gully control do not provide for permanent water supply. Runoff from large cultivated watersheds will rapidly fill the pond with silt. Note the good vegetative cover on the dam and good spillway in the foreground.

livestock from getting into the pond. If the pond water is to be used for domestic purposes, keep livestock out of the watershed. Grazing should be controlled to keep the sod from being torn up.

THE EARTH DAM

In Iowa, farm ponds are made by building earth fills across natural waterways. Many ponds fail because earth dams are not adequate. Most common mistake is to make the dam too narrow with side slopes too steep.

It is desirable that the water side of the dam have a slope of 3 feet horizontal to 1 foot vertical, and the lower side of the dam have a slope of 2 to 1. The top of the dam should be 8 to 10 feet wide and at least 1½ to 3 feet higher than the bottom of the spillway.

Several things should be done before work is started on the fill. Remove all the top soil and debris such as roots, brush, etc., from the dam site. Cut back all over-hanging
banks to a 1 to 1 slope. Plow the area which will support the dam in the same direction as the fill will lie. This will form a good bond between the new fill and its support.

Stockpile the top soil removed from the dam site. Then when the dam is completed, spread this top soil over the fill in a layer 2 to 6 inches, except below the water line on the front side of the dam. Vegetative cover to protect the dam from rilling will become established quicker if seeded in fertile top soil.

Prepare the base of the fill so it is wide enough to provide for the desired side slopes and top width of the fill. Any drain tile lines under the pond site should be removed or plugged.

Engineers consider that best fill material consists of \( \frac{2}{3} \) sand and \( \frac{1}{3} \) clay. Such material is stable even when it undergoes moisture changes. Soils with higher clay content are likely to open large dangerous cracks when they dry out. Soils containing too much sand are pervious and unstable.

Satisfactory earth fills have been made from soils whose textures vary from \( \frac{2}{3} \) sand and \( \frac{1}{3} \) clay but precautions should be observed and adjustments made in design. Where

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Fig. 4. Using a bulldozer to cut core trench when preparing site for earth dam. The area has been cleared of debris and well scarified to provide water seal at base of fill.
the sand content of the soil to be used for the fill is higher, side slopes should be made flatter than 3 to 1.

Figure 6 shows areas in Iowa where ponds are most likely to be successful. In these areas, the clay subsoils from Shelby, Lindley, Seymour, Lagonda and Clarinda soils are satisfactory for pond fills.

If construction of a pond is considered in areas other than those where ponds are likely to be successful as indicated in fig. 6, special methods of construction will be necessary to seal the pond against seepage. Experience in construction of irrigation canals indicates that clay blankets, or small amounts of bentonite and similar materials mixed with the soil used in pond construction may prove practical in controlling seepage. In some parts of the country where stock watering reservoirs are constructed, it is generally common practice to spread 6 to 12 inches of impermeable clay over the bottom of the pond. The clay is spread on in a thin layer at a time and packed with a tractor or sheepfoot roller.

In some instances where it is not necessary to seal the entire pond area against seepage, it is desirable to place a core
wall of impervious material in the center of the dam. Impervious clays, or bentonite and similar materials mixed with soil will serve for this purpose. This calls for careful placing of the earth in the embankment.
The best practice in building the fill is to borrow material from the area to be flooded. At least a 10-foot berm should be left between the edge of the borrow pit and the toe of the dam. If there is not an adequate depth of impervious material covering the area to be flooded, the borrow pit should be located elsewhere.

When constructing the fill, spread the soil in 5- to 10-inch layers over the entire dam. Pack each layer with the tractor used in construction or by rolling with a sheepfoot roller. Dry material is difficult to pack. Therefore, the soil should be moist at the time of construction.

There are several advantages in using the larger earth-moving equipment that can either be hired by the hour or contracted for by the job. Generally the earth dam can be built more economically with this type of equipment. Also, the construction period is shortened resulting in less chance of heavy rainstorms damaging the dam while it is under construction.

**SPILLWAY**

The dam must be protected by a spillway of sufficient size and cross section. A spillway is a sod-covered overflow trough around one end of the dam. It serves as the safety valve of the pond by preventing excess water from over-
Cross section along center of water supply line.

topping the dam and resulting in damage to the fill. Runoff from the watershed in excess of that which the pond will hold is discharged by the spillway. It must be located far enough below the top of the dam so that no water will flow over the dam even during periods when runoff is greatest. The bottom of the spillway should be 1½ to 3 feet below the top of the dam.

Protect the spillway with vegetation or masonry material to prevent erosion. Wide crest, or sometimes called wide bottom, spillways carefully sodded are the best for most farm ponds.

Reed canarygrass, bluegrass and bromegrass have given excellent results as a vegetative cover for pond spillways. When it is not possible to get a satisfactory sodded spillway, it may be necessary to line the spillway with concrete or rubble masonry. To be successful such a spillway must be constructed with aprons, cutoff walls, and adequate wing walls to prevent the flood water from washing around or undermining the fill. Spillways of this type should be built only on the advice of a qualified technician or engineer.

Determine the size of a spillway required by estimating the rate of runoff from the area draining into the pond. The
following table indicates the runoff from areas up to 10 acres in size which are covered with various kinds of vegetation.

TABLE 3. RUNOFF FROM DRAINAGE AREAS IN CUBIC FEET PER SECOND.*

<table>
<thead>
<tr>
<th>Rolling land 5 - 10% slope</th>
<th>Hilly land 10 - 30% slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres</td>
<td>Cultivated fields</td>
</tr>
<tr>
<td></td>
<td>C = .60</td>
</tr>
<tr>
<td>1</td>
<td>3.6</td>
</tr>
<tr>
<td>2</td>
<td>7.2</td>
</tr>
<tr>
<td>3</td>
<td>10.8</td>
</tr>
<tr>
<td>4</td>
<td>14.4</td>
</tr>
<tr>
<td>5</td>
<td>18.0</td>
</tr>
<tr>
<td>7.5</td>
<td>22.5</td>
</tr>
<tr>
<td>10</td>
<td>30.0</td>
</tr>
</tbody>
</table>

*Computed from equation Q = CIA, where the value of I is 6 for areas of 5 acres or less, and 5 for larger areas, and C is as indicated.
Fig. 9. The earth fill failed on this farm pond because of inadequate protection of the spillway.

For a drainage area of 5 acres of rolling pasture land, the spillway should be designed to carry 10.8 cubic feet of runoff per second after the pond is filled. The size of the spillway necessary to meet the discharge requirement can be found in the following table 4 of discharge capacities of broad crested spillways of various widths under various heads of water above the crest.

Some spillways have eroded even after a good sod was established. Sustained small flows which loosen the sod have caused this damage. A trickle tube which will lower the water level of the pond below the crest of the spillway

<table>
<thead>
<tr>
<th>Head on crest (feet)</th>
<th>Width of spillway (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>0.5</td>
<td>2.3</td>
</tr>
<tr>
<td>1.0</td>
<td>6.4</td>
</tr>
<tr>
<td>1.5</td>
<td>11.8</td>
</tr>
<tr>
<td>2.0</td>
<td>18.1</td>
</tr>
</tbody>
</table>
Fig. 10. This heavily grassed watershed makes a silt-free pond. This is important whether the pond is used for water supply, fish production, swimming or irrigation.

will protect the spillway from damage caused by such sustained small flows.

PIPE OUTLET TO TANK

Water may be piped from the pond to a stock watering tank located below the dam. If livestock is allowed free access to the pond, there's a good chance for the fill to be damaged.

A water pipe, usually no smaller than $1\frac{1}{4}$ inches in diameter and laid in a narrow trench under the dam, is satisfactory for supplying the tank. Lay the pipe before beginning construction on the dam. Moist clay should be packed tightly around the pipe to prevent seepage.

A screen or a section of a perforated pipe should be fitted to the upper end of the discharge pipe to keep solid materials out of the stock tank. The screened or perforated end of the outlet pipe may be placed in a concrete or clay tile, or metal barrel filled with cobble stones to serve as an additional filter.

The water level in the tank is generally controlled by a float valve. A cutoff valve also should be provided. The water tank should be set on a concrete or masonry platform and should be equipped with an overflow pipe.
Fig. 11. Proper installation of a good stock watering tank is important if the pond is used for stock water supply. Note tank set on a good concrete platform. It is located to provide access to livestock in three fields. The back slope of the pond is well protected with good vegetative cover.

DOMESTIC USE OF POND WATER

If a pond is to be used as a source of domestic water supply, special care must be taken to protect the water from contamination. The drainage area should be in meadow land and any drainage whatsoever from the farmstead should be excluded from the watershed. Great care must be taken in installing the pipe inlet. A gravel and sand filter with a strainer is desirable. Special equipment now is available to chlorinate and filter pond water for domestic uses.

MAINTENANCE OF PONDS

A pond must have constant maintenance if it is to furnish an adequate supply of water for a long period of years. When erosion starts on either the dam or in the spillway, repairs must be made immediately to prevent serious damage. There must be constant vigilance so that small animals are not allowed to burrow into the dam, causing a washout. Any damage to the earth embankment due to wave action should be checked by establishing a good vegetative cover over the dam.
LIFE SAVING PRECAUTIONS

The farm pond is and should be a place for the farm family to enjoy swimming. However, in the past several years there have been numerous deaths due to drowning in farm ponds. To eliminate the danger of tragedy, life saving equipment should become a part of every pond. Signs indicating the depth along the sides of the pond will guide the non-swimmers to that portion of the pond where they can learn to swim safely. Commercial life buoys, rope and logs placed along the pond will help rescue attempts if swimmers get in trouble. Life-saving schools under the direction of trained instructors are a great benefit to a community.

FISH FOR FARM PONDS

Valuable food fishes can be produced in farm ponds if the ponds are properly constructed and managed. Fish should be handled as farm crops, and harvested intelligently if maximum yields are to be expected. A single acre of water is capable of producing from 100 to 400 pounds of fish each year. Therefore, a pond of this size is ample for the average family from the standpoint of fish production.

Only a few simple requirements are necessary to produce fish. These practices are compatible with other uses of the pond, except that ponds intended for maximum fish production should not be used for household water supply. Addition of commercial fertilizers to stimulate algae growth will impart an objectionable taste to the water.

Recommendations for the location and construction of the pond are the same for fish production as for stock-water purposes. However, a pond for fish production should be constructed with a drain. Fish populations occasionally become unbalanced, making it necessary to drain the pond and remove a part or all of the fish.

Deep water is important. If the pond is to be stocked with fish, it should be at least 8 feet deep at the deepest point. Deep water provides cool water for fish in the hot summer months, lessens the chance of fish losses by asphyx-
iation under the ice in winter, prevents an over-abundance of aquatic plants, and assures a more permanent water supply for livestock.

**SIZE OF THE POND**

Ponds to be stocked with fish should be at least one-half acre in size. Ponds from 1 to 2 acres in size are even more desirable. They are large enough to support a sizeable crop of fish, yet small enough to manage without excessive expense or time. Ponds larger than 2 acres should not be constructed without skilled engineering advice.

**FERTILIZING THE POND**

Many authorities are in agreement that the fish crop can be increased if fertilizer is added to the pond. However, the use of fertilizer probably won’t pay unless the pond is fished intensively. Also, fertilizers have little or no effect in waters which are turbid over extended periods of time.

Primary purpose of the fertilizer is to increase the microscopic food for fish and to control submerged plant growth in the pond. Fertilizers are particularly important in ponds located on poor soils and less important in ponds constructed in soils of high fertility.

The amount of nitrogen, phosphorus, potash and other essential materials available determines the abundance of microscopic plants. Well fertilized ponds contain algae and minute aquatic animals in sufficient numbers to give the water a green or light brown color.

Commercial fertilizers are generally more satisfactory than organic fertilizers. A fertilizer such as 8-8-4 containing 8 percent nitrogen, 8 percent phosphorus and 4 percent potash appears to add the proper amount of these elements to most Iowa ponds. Commercial fertilizers which approximate this analysis can be obtained locally.

The fertilizer may be applied by broadcasting by hand around the edge of the pond in water up to 5 feet in depth. The 8-8-4 fertilizer should be applied at the rate of 100
pounds per surface acre. In ponds located on moderately rich soil, one treatment may suffice, but three or four applications may be required for ponds located on poor soils.

For maximum fish production, treatments should begin about the middle of May and continue at 10 or 15 day intervals until the bottom is barely visible in water 12 inches deep. At this time, treatment should be discontinued until the water clears to the above mentioned point.

Algae, the microscopic plants produced by the added fertilizer, may appear as a “bloom” of minute individual plants or in the form of a slimy green scum over the pond surface. If this growth becomes objectionable to livestock, the pond can be treated with copper sulfate at the rate of not more than 1 pound of copper sulfate to 1,000,000 gallons of water. Exercise extreme care in this treatment because excessive dosages of copper sulfate will kill fish and even livestock. However, recommended dosages are unharmful.

STOCKING THE FARM POND WITH FISH

A rather large variety of fish can be raised in a farm pond. However, it is usually more satisfactory to confine stocking to 2 or 3 kinds.

One of the most successful combinations is largemouth bass and bluegill. A balance between the two species can be easily maintained through management. Fertilizer can be added to produce large quantities of plankton algae; the bluegills feed upon plankton; the bass feed upon the bluegills.

Success has been obtained in Iowa by using from 200 to 600 young-of-the-year bluegills to 100 largemouth bass of the same age per acre of water surface in fertilized ponds, and about half that number in unfertilized ponds.

A few channel catfish may be added if desired. However, bullheads should be excluded because they compete with other fishes for food and space.

If bullheads are added to the pond, there’s a tendency for them to take over the pond at the expense of other fishes. If they nest successfully, bullheads build up their population
rapidly. The result often is a pond full of stunted bullheads and few fish of edible size.

Bullheads in the pond also tend to upset the balance between the species. Bass feed by sight while bullheads feed by feel and smell. Since the bullheads keep the pond stirred up and the bottom muddy, bass have difficulty in seeing and catching the young bluegills and bullheads. The result is a decrease in bass numbers and an increase in bluegill and bullhead numbers.

Minnows should not be stocked in a farm pond in the bass-bluegill program. Bluegills not only furnish an ample amount of food for the bass but also supply a large surplus for the anglers. Contrary to popular belief, it is not necessary to add food of any kind to the farm pond once it has been properly fertilized and stocked with fish.

Fish management in small farm ponds varies greatly from that practiced in large lakes and reservoirs. In the farm pond only two or three kinds of fishes are stocked, and it is essential that the forage species be readily available for the bass. Unless the bluegill population can be kept under control by the bass, the pond will become over-populated with bluegills.

**CONTROL OF WATER PLANTS**

The advantages of aquatic plants in farm ponds seem to be outweighed by the disadvantages. Some aquatic plants tend to purify the water, furnish shade to keep the water cool, harbor insects and add to the general attractiveness of the pond. On the other hand aquatic plants furnish a hiding place for the bluegills and prevent the bass from keeping them in proper control. Nutrients provided by fertilizer are used by these plants instead of being transformed into fish food. Vegetation is not used as a food by bass nor by bluegills to any degree.

Aquatic plants are almost certain to appear in clear-water ponds of their own accord. Therefore, it is advisable to add sufficient fertilizer to keep the water darkened enough to
control them. Broadleaf plants can be controlled by spraying with 2,4-D.

However, use 2,4-D with caution around ponds containing fish. The chemical 2,4-D itself is not toxic to fish. But, oily solvents and carriers sometimes used for 2,4-D sprays may kill fish if applied in large quantities. To protect the fish, apply 2,4-D materials only to plants above water and not to the water surface.

Although it is necessary to control or even eliminate the aquatic plants in the deeper parts of the pond itself, marginal and submarginal plants are highly desirable. Wave action may cause serious damage to the pond banks and to the dam unless they are riprapped with rock or covered with vegetation. Reed canarygrass, spike rush, waterprimrose, wild millet and others are exceptionally good for this protection.

Inlets and waterways leading to the pond also should be well protected to prevent silt from entering the pond. Blue-
Fig. 13. Good vegetative growth on the pond fill and inlet waterway prevents erosion on backslope and holds silt in waterways.

grass, redtop, clovers, perennial and annual lespeadeza and bromegrass are excellent for this purpose.

HARVESTING THE FISH CROP

Assuming that the pond has been properly stocked with fish and a sufficient amount of plankton or minute fish foods have been supplied, the owner need only wait until fish are of suitable size for the table. Iowa law prescribes a bass must be 10 inches in length. Bluegills may be harvested at any size during the open season.

After the first successful reproduction, fishing should be very intensive, especially upon the bluegills, to avoid over-population and subsequent starvation.

OBTAINING FISH FOR STOCKING THE POND

Fish may be obtained from several sources: By application to the U. S. Fish and Wildlife Service, U. S. Department of the Interior, Washington 25, D. C.; by application
Fig. 14. You can raise these beauties on your own farm in Iowa. Photo courtesy of Jim Sherman.

to the Fish and Wildlife Service through the U. S. Soil Conservation Service if the pond is located on a farm cooperating with this Service; or by application to the State Conservation Commission, Des Moines, Iowa. Fish may also be purchased from commercial hatcheries. A list will be supplied by the State Conservation Commission.

Applications should be made at only one of the above sources. If a source is unable to supply the fish, the applicant will be advised so he can apply elsewhere. Fish usually are available in the fall of the year, but applications should be filed early in the spring to insure fall delivery.