



Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

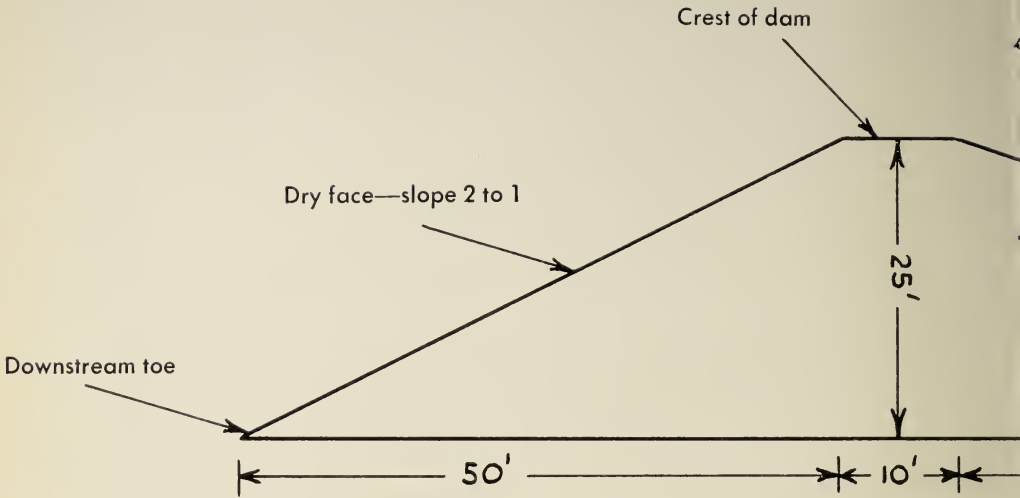
SMALL EARTH DAMS

LLOYD N. BROWN



CALIFORNIA AGRICULTURAL
Experiment Station
Extension Service

CIRCULAR 467



About 10,000 small earth dams have been built on California farms in the last 20 years and more are being built all the time. While many of the early dams were built primarily as stock-watering ponds, farmers are also deriving benefits from their reservoirs in the way of irrigation water and even recreational purposes.

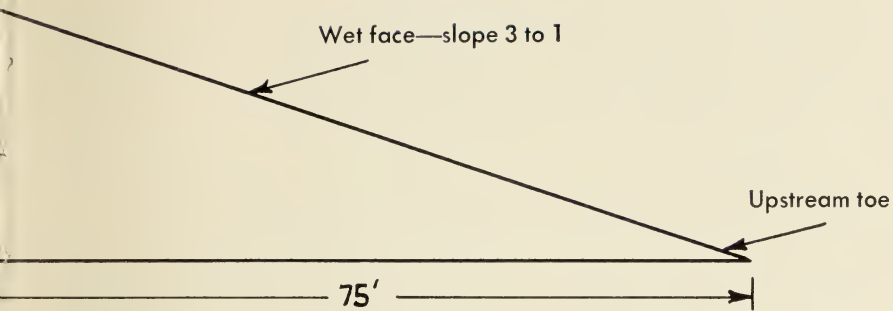
But dams have disadvantages too. They are expensive to build; they require labor and more expense to maintain properly; they may increase the nearby mosquito population.

So perhaps a dam would be a good investment for you; perhaps not. This circular discusses:

The laws involved— some are restrictive, some are beneficial, but you should know them.

Selection of a site— for the dam, the reservoir, the spillway. You'll undoubtedly have to compromise—you might want to give up the idea of building a dam.

Here is a cross section of a typical small earth dam showing the recommended ratios of width to height and naming the main parts.



Construction details— there are a lot of things to watch if your dam is to be a good one.

Maintenance practices— for the dam, the spillway, the reservoir, the watershed.

Management practices— for both practical and recreational uses of the reservoir.

Dam building is a very involved undertaking. This circular endeavors to supply you with practical suggestions which may be of assistance to you. It is up to you to fit them together as they apply to your situation.

THE AUTHOR:

Lloyd N. Brown is Extension Soils Specialist in the Agricultural Extension Service, Berkeley.

FEBRUARY 1958

Before you start

you should know the law

When you build a dam to impound water for your own use, in California, you should be familiar with the regulations of a number of public agencies. They are:

The State Water Rights Board

To legally impound and use water, a water right must be secured from this board and anyone proposing to build a dam would do well to write to this agency for information. The address is 1401 21st Street, Sacramento.

The Department of Water Resources

By California statutes, the State Director of Water Resources must approve all dams over a certain size and/or storage capacity. The reason for this is to assure that sound design is used for larger dams, to minimize failures. This procedure not only protects the public from floods due to dam failure, but makes available to builders of large dams valuable technical advice.

This publication, however, is concerned primarily with small dams that are exempt from supervision by the Department of Water Resources. Such dams are described as follows:

1. All dams 6 feet or less in height, regardless of storage capacity.
2. All dams storing 15 acre-feet of water or less, regardless of height.
3. All dams less than 25 feet high which have a storage capacity of less than 50 acre-feet of water.

(See pages 7 and 8 for directions on measuring the height of a dam and storage capacity of a reservoir.)

Dams exceeding the above limitations **MUST** be built under state supervision or severe penalties are involved. The department's address is 401 Public Works Building, Sacramento.

Enlarging small dams. Occasionally small dams are built with the idea of later enlarging them to a size that will bring them under the supervision of the Department of Water Resources. The builder of such a dam would be wise to consult the department in the beginning and use specifications for the larger dam to save expensive alterations later.

For instance—the department usually requires that the outlet pipe in large dams be laid in a trench and backfilled with concrete, rather than using concrete collars (which are allowed in smaller dams). If specifications for the larger dam were used from the start a considerable saving could be effected.

Agricultural Conservation Program—USDA

If you comply with the regulations of this agency when you build a dam, you may be entitled to financial help toward the cost of construction. The agency has offices in most California counties.

It is not anticipated that there will be any material differences between the technical recommendations in this publication and the requirements of the ACP.

lations which contain 4 pounds of actual 2,4-D per gallon. The addition of one gallon of diesel oil per 100 gallons of mixture will increase the kill on older vegetation. The best time to apply this solution is in early summer, when the plants are in full leaf. Apply enough to thoroughly wet all vegetation to be killed. Old, established plants may require a second spraying the following year.

Cattails and tules can be killed in late summer or early fall (but before frost), with a spray made up of 2 pounds of actual amino triazole per 100 gallons of water. Be sure to wet the vegetation thoroughly.

Reservoir scum

When algae or scum appears in reservoirs, it can be controlled with bluestone (copper sulfate) at the rate of $2\frac{1}{2}$ pounds per acre-foot of water. This treatment is only temporarily effective and it must be repeated as the need arises. The bluestone can be used in either the powder or crystalline form. Put the material in a sack and tow behind a boat

until it is dissolved. Row around the reservoir so as to get the application as uniform as practical.

Caution. This treatment will not injure bluegill or bass, but it may injure trout, carp or catfish. Use only $\frac{1}{10}$ of the above amount in ponds containing trout, and $\frac{1}{4}$ for ponds with carp or catfish.

Submerged weeds

Several types may develop in the shallow parts of the reservoir and many of them can be controlled with sodium arsenite. Use $2\frac{1}{2}$ - $3\frac{3}{4}$ gallons of a commercial sodium arsenite (which contains 4 pounds of arsenic trioxide per gallon) for each acre-foot of water. Dilute each gallon of the above concentrate in about 20 gallons of water. Spray over the surface of the water from a boat.

Caution. This material is highly poisonous. Do not get it on your skin. Avoid spraying vegetation on the shore which might be eaten by livestock. Treated water should not be used for swimming, watering livestock, or for irrigation for at least three days after treatment.

This dam shows the results of little or no maintenance. Large trees have been allowed to grow on the dam. If these trees should die or blow over the dam might be seriously weakened, due to rotting roots or large holes.



Management

of the reservoir

Trout ponds

These can be established in reservoirs where the temperature of the water does not rise above 70° F for any length of time. If the owner permits the public to fish in his trout pond, the Fish and Game Department will provide fish for stocking the pond (trout will not spawn in reservoirs so have to be replaced continually).

If the owner of a trout pond does not open it to public fishing, the state will not provide fish but will furnish a list of trout dealers and a transportation permit at no charge.

In any case, fishing is allowed only during trout season.

Warm water ponds

Theoretically, the most productive planting of warm-water fish is a mixture of bass and bluegills—both species reproduce rapidly and both make good eating. One of the main sources of bass food is young bluegills; carp and catfish tend to eliminate other species and take over the reservoir.

After an initial stocking, allow warm-water fish to spawn once before doing any fishing—spawning will be evidenced

The payoff for a dam can't be counted in money.





Water for sprinkler irrigation of otherwise poor pastureland can often be taken from a dam but pumping is usually required.

by the presence of small fish. Most reservoirs are underfished—when large numbers of fish are present they do not attain the size they would if fewer were left in the pond.

Food for fish is quite often produced in abundance by plankton-like material in the reservoir. It is evidenced by brownish coloring in the water.

While opinions differ on whether reservoirs need fertilizer to help produce fish food, local experience indicates that it is seldom necessary. It should be avoided, if possible, because addition of fertilizer to the reservoir will encourage undesirable marginal growth which will have to be destroyed.

Muddy water in the reservoir may be due to the presence of a large number

of carp or catfish which feed on the bottom and stir up the mud. This can only be avoided by eliminating the carp or catfish.

If the muddy condition is not due to carp or catfish, but winter runoff, it can be alleviated by adding finely ground, agricultural gypsum to the water—a rather expensive process. The gypsum costs about \$15 per ton and it may take as much as half a ton per acre-foot of water to clear up muddiness. However, much smaller amounts may do the job so it is suggested that the gypsum be applied at the rate of about 200 pounds per acre-foot, allowing a few days to observe results before adding more.

Spread the gypsum uniformly over the surface by shoveling from a boat.

