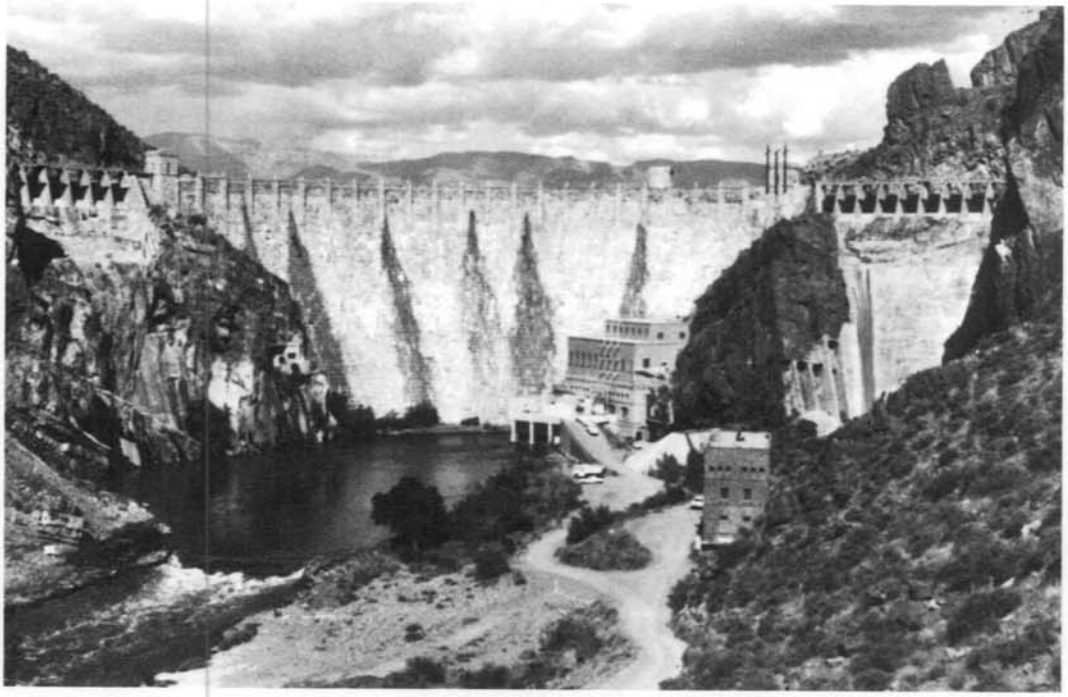
# WATER OPERATION AND MAINTENANCE

## BULLETIN NO. 120

JUNE 1982







**UNITED STATES DEPARTMENT OF THE INTERIOR**
**Bureau of Reclamation**

The Water Operation and Maintenance Bulletin is published quarterly for the benefit of those operating water supply systems. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning laborsaving devices and less costly equipment and procedures will result in improved efficiency and reduced costs of the systems for those operators adapting these ideas to their needs.

To assure proper recognition of those individuals whose suggestions are published in the bulletins, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

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Division of Operation
and Maintenance Technical Services
Engineering and Research Center
P O Box 25007
Denver CO 80225

Cover photograph

Theodore Roosevelt Dam, the first major structure constructed by the Bureau of Reclamation on the Salt River Project, is located 122 kilometers (76 mi) northeast of Phoenix, Arizona. The 85.3-meter (280-ft) high cyclopean-masonry, thick-arch structure spans the Salt River to form a reservoir of 1.7 by $10^9 m^3$ (1,382,000 acre-ft). The reservoir provides irrigation water to the Salt River Valley and offers year around boating and fishing for the residents of Arizona.



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WATER OPERATION AND MAINTENANCE
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## INTRODUCTION

The first Bureau workshop on the review of operation and maintenance program proves to be a success. See page 1.

Safe access ladders are shown on pages 3 and 4. They were designed for use on trucks with high "beds."

On page 5 is a short article on how well drillers can benefit from the earth's radiation.

The article beginning on page 6 gives very informative and comprehensive details on the pesky pocket gophers.

Recycling pieces of discarded pipe and landing mats into usable catwalks is illustrated on page 14.

Can you imagine a portable pumping unit for $300? Read article on page 15.

The color of that gas tank can save you money—see page 16.

Do you have an ear for danger? The article on page 17 alerts you to listen for safety.

## REVIEW OF OPERATION AND MAINTENANCE PROGRAM[1]

Have you ever wondered why representatives of the Bureau of Reclamation conduct formal onsite examinations, at least every 3 years, of structures and facilities where operation and maintenance responsibilities have been transferred to your organization? The examinations are required under the Bureau's RO&M (Review of Operation and Maintenance) program which was established over 30 years ago by an administrative directive to insure that Bureau constructed (or Federally funded) water projects are operated and maintained properly.

The RO&M program is an essential Bureau-wide administrative function which enables the Bureau to fulfill its obligation to protect the Federal investment and provide some assistance to our water user organizations. To meet this obligation, Reclamation policy requires that a representative portion of all water project facilities be examined at least every 3 years by regional office personnel, with E&R (Engineering and Research) Center personnel performing the examination of major structures every sixth year. Reports of all examinations are prepared to verify that RO&M program requirements have been met and for documenting the condition of the facilities.

There has been a need to obtain more Bureau-wide uniformity and consistency in accomplishing objectives of the RO&M program. As a result, a portion of the Bureau's personnel from its seven regional offices and the E&R Center in Denver, who are assigned primary RO&M responsibilities, met in Sacramento, California, on March 9-11, 1982, for the first RO&M Workshop. The participants discussed requirements of the program, responsibilities, preparation for onsite examinations, interpreting field conditions and situations, report contents and format, and followup procedures on items needing attention from past examinations with water users' organizations and project offices. Classroom sessions were held for 2 days, with a limited RO&M examination of Folsom and Nimbus Dams and Folsom South Canal on the third day.

As a result of the Workshop, general guidelines for developing uniformity of RO&M recommendations and reports including field examinations will be prepared. It was the consensus of the Workshop participants that it was a valuable experience and should be held annually or on an as-needed basis for other Bureau personnel involved in the RO&M program.

Participants of the first RO&M Workshop are shown in fig. 1 on the following page.

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[1] This article was especially written for this publication by the Water O&M Branch, Bureau of Reclamation, E&R Center, Denver, Colorado.

Figure 1.–First RO&M Workshop participants.

Back row, left to right, standing: Bill Nelson, SW Region; Sue Vonich, MP Region; Herb Fowler, MP Region; Van Morgan, PN Region; Dan Evans, UM Region; Ron Effertz, LC Region; David Allen, SW Region. Middle row, left to right: Gary Egan, MP Region; Virgil Temple, PN Region; Richard Allen, PN Region; Bob Karrh, SW Region; Liz Partridge, MP Region; Cliff Boyce, UC Region. Front row, left to right: Del Seely, LC Region; Jill Davidson, E&R Center; Ron Johnston, UC Region; Jerry Schaack, E&R Center; Phil Roth, E&R Center. Not pictured: Will Rusk and Vern Yocom, E&R Center.

## SAFE ACCESS LADDERS FOR TRUCK BEDS[2]

Employees of the Upper Missouri Region's Canyon Ferry Project Office, Helena, Montana, have designed and fabricated truck bed ladders that provide unusually safe access. The ladders can be secured in the travel position and lowered for use. Because the ladders were designed with step through "guardrails," employees can get on and off the ladders in a fully erect position.

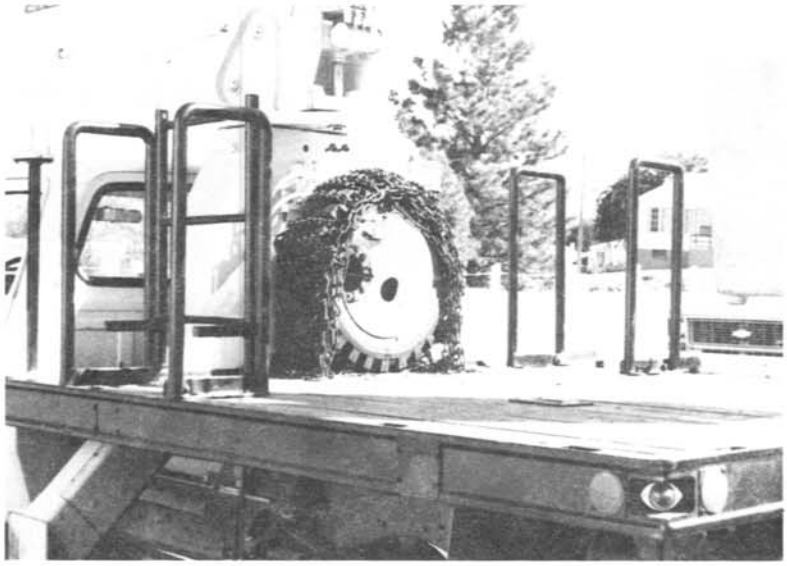

Figure 2.–A project boom truck equipped with the ladders. The near ladder is secured in the travel position and the far ladder is in the lowered position.

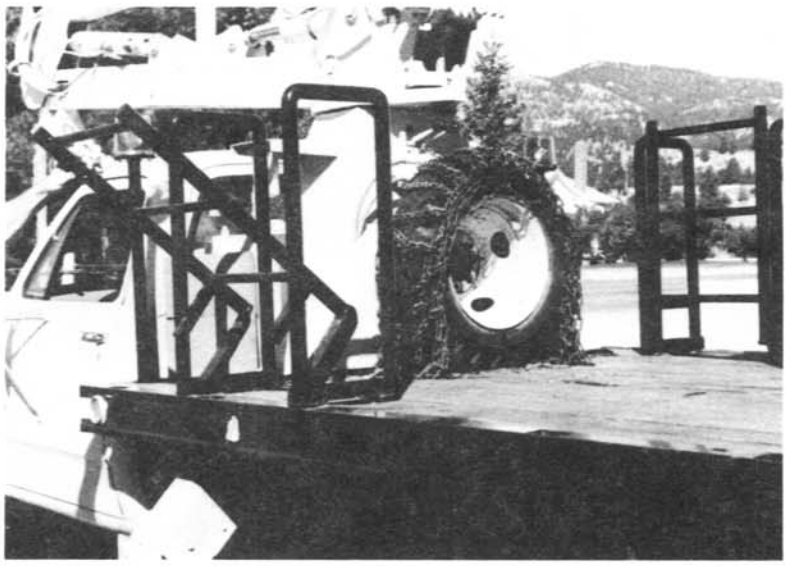

Figure 3.–Ladder being lowered into place.

[2] Reprinted from Safety News, First Quarter, 1982, Bureau of Reclamation.

Figure 4.–Ladder in the lowered position. The distance between the top rung and the truck bed allows ample room for safe footing.

Figure 5.–Ladder in use.

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## DRILLERS CAN BENEFIT FROM EARTH'S RADIATION, ELECTRICITY[3]

The gamma radiation and electrical potential that occur naturally just beneath the surface of the earth can be a valuable aid to water well drillers.

A St. Paul, Minnesota engineer, David Hanson, made that point last month at the annual Nebraska Well Drillers Conference in Lincoln.

Hanson explained that electrical potentials exist between different earth materials and they can be used to identify boundaries between the clay and water-bearing sand and gravel layers.

Hanson said that a device called an electric logger is needed to measure the potentials. The probe of this instrument is inserted into a driller's test hole and potentials are read at several depths.

The logger is precise enough to locate traces of silt in aquifers, according to Hanson. Silt, which can reduce the yield of a well, is often difficult to detect in a driller's core samples.

Hanson told the conference that electrical potentials in the earth are also helpful for properly positioning screens in wells. Screens prevent water from mixing between aquifers. They guard the well against encrustation and electrolysis, which can occur if the chemical composition of each water source differs.

Hanson also told the well drillers that the earth naturally emits small amounts of gamma radiation, with the amount varying with the type of earth material.

A gamma logger measures this type of radiation and can be used instead of an electric logger to distinguish between clay, sand, and gravel layers.

The engineer stressed that electric and gamma loggers will not replace the well driller's log or core samples for determining the best locations for wells.

"The instruments only offer a driller a second opinion on problem sites," he said.

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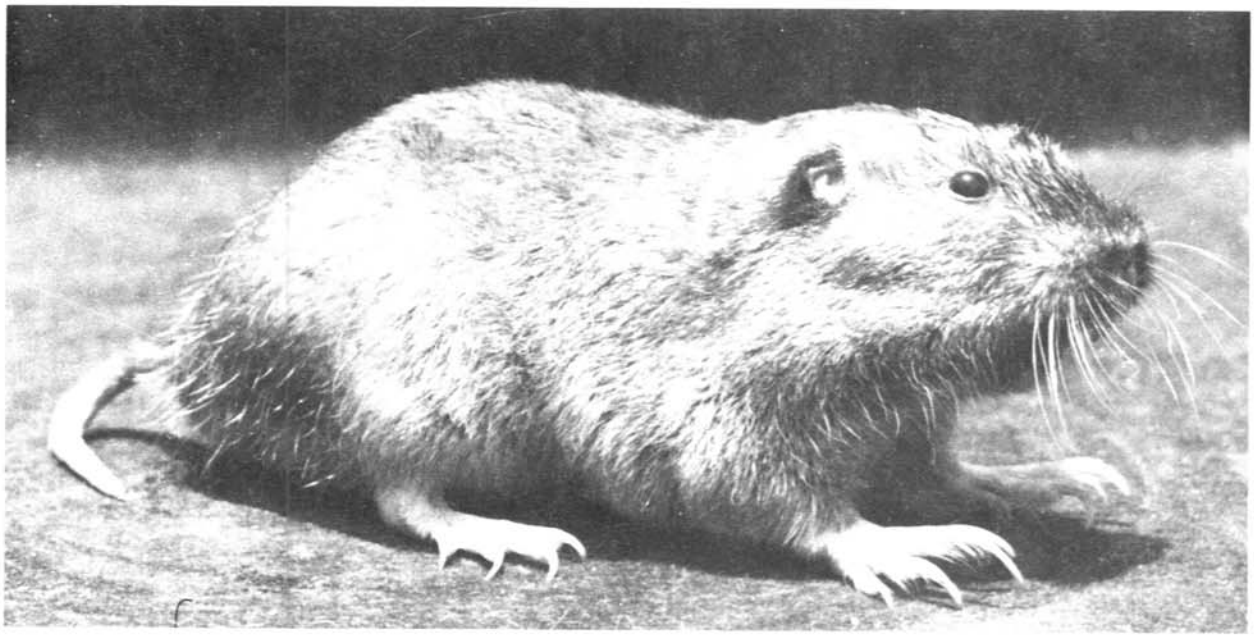
[3] Reprinted by permission of the Editor, from the March 6, 1982 issue of the Nebraska Farmer; copyright Harcourt Brace Jovanovich Publications.

## CONTROLLING POCKET GOPHERS[4]

By Donald W. Willis



rigure 6.–The Western pocket gopher (*Thomomys bottae*) is well adapted for constructing underground burrows which may be 244 m (800 ft) long.

One of the most harmful and annoying rodent pests is the pocket gopher, a medium-sized burrowing animal, which gets its name from the fur-lined external cheek pouches in which it carries its food. The pocket gopher causes damage both by what it eats and by the above-ground mounds created when burrowing and foraging.

On the positive side, gophers do cultivate wild grasslands. But they also accelerate erosion of mountain soils and are an aggravating and expensive nuisance to users of irrigation water by causing breaks in irrigation checks and ditch banks. Burrows in home gardens often divert the relatively expensive metered water. And the unsightly mounds smother vegetation and damage machinery.

The gopher digs with its long foreclaws, using the incisor teeth to cut roots or dislodge small stones. Loosened earth gathers under its body, then is kicked backward by the hind feet. When a "load" is accumulated, the animal turns about, brings the forefeet together under

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[4] Reprinted by permission of Harcourt Brace Jovanovich Publications, copyright, from Pest Control Magazine, September 1981.

its chin, and pushes the loose soil out onto the surface through a short lateral off the main tunnel.

Figure 7 –Foreclaws of gopher.

Successive loads produce a low-rounded mound somewhat crescent-shaped. (At times, soil also is packed into abandoned tunnels.) After the lateral has been closed, a central depression in the mound usually indicates where the lateral tunnel opens. The surface placement of successive mounds frequently affords a clue to the position of the main tunnel. New mounds often are dark because of moisture in the freshly removed soil.

The burrow system of a single gopher will have several mounds, for one gopher may displace as much as 2722 kg (3 tons) of soil before completing its burrow, which could total 244 m (800 ft). Because of this, an infested area may give the impression of having many more pocket gophers than are actually present.

There are few plants which gophers will not eat but they exhibit preferences.

Juicy-stemmed or bulbous-rooted plants are relished more than fibrous species such as grasses.

Legumes are high on the gopher's preferred foods list. For this reason, alfalfa fields and pastures or lawns containing clover may attract and support high populations of gophers.

Root girdling, especially on young stock, causes loss to orchard vineyard and ornamental trees.

The chief damage caused by gophers is their cutting of roots and stems, either for food or merely because these are in the way as burrows are dug. They sometimes cut off roots, then pull the entire plant beneath the surface where they can chew off lengths to be transported in their cheek pouches to underground storage chambers.

## Three Genera

There are more than 100 varieties of pocket gophers in the United States. Most of them fall into three main genera: *Geomys*, *Thomomys*, and *Cratogeomys*. The genus, *Thomomys bottae* (the western pocket gopher), includes all species west of the Rocky Mountains. The eastern pocket gopher, genus *Geomys*, occurs in the Eastern Gulf States and all over East and North Central America. A third genus (*Cratogeomys*) occurs in parts of the Southwestern United States and Mexico.

All pocket gophers have many characteristics in common. They average about 125 to 175 mm (5 to 7 in) in length, with some growing as long as 330 mm (13 in). Adult males are a little larger than adult females. Their front limbs are strong and carry long claws which are used for digging and, occasionally, fighting. They have relatively large incisors (front teeth) which are used for the same purposes. The muscular lips close around and behind the teeth, so that the gopher can use its teeth for digging without "eating dirt." Certain species often run backwards through their burrows with great ease, using their short hairless tails as a guide. Coloring varies from light to dark brown. Chins and bellies may be almost white, reddish-brown or nearly black in color.

The pocket gopher is active year round and lives alone, except during the spring mating season. A population of 50 gophers per acre (125 gophers per hectare) is quite high, while meadow mice may reach 20 times this number during population eruptions. Diseases which can exert sudden and severe reduction in more crowded rodent populations are not as readily transmitted among gophers. Therefore, gopher population trends are not as markedly cyclic as those of some other species.

## Effective Control

This characteristic of underground solitude makes control methods difficult and expensive. However, persistent effort will reduce and even eliminate gophers over a considerable area.

Prompt attention to the first evidence–"new mounds"–in a garden or field will often save valuable plants, and prevent other damage.

Control is most effective when green surface vegetation starts to grow early in the fall or spring. Gophers are most active when the ground is soft and before young are born.

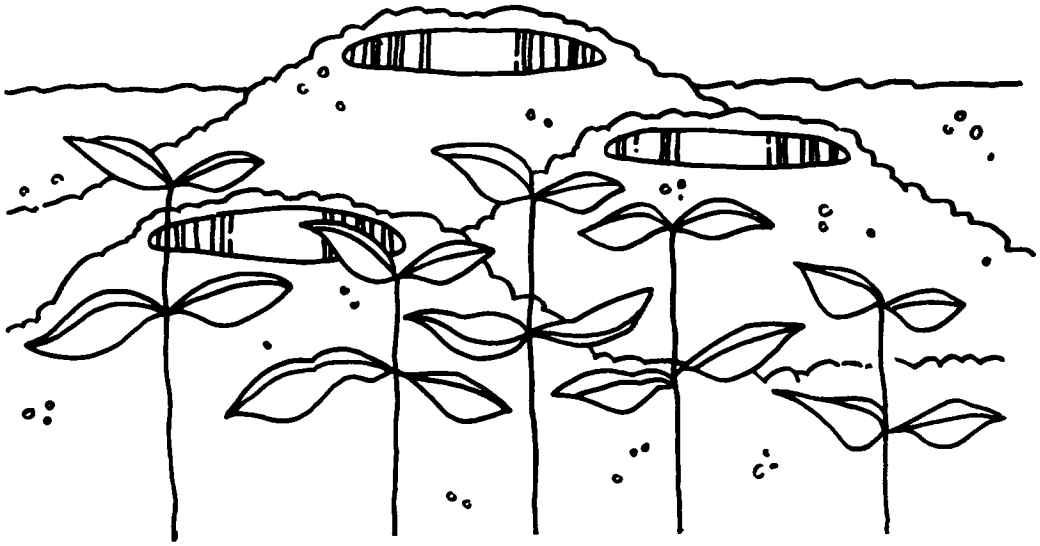

Figure 8.–Prompt attention to the first evidence–"new mounds"–in a garden or field will often save valuable plants.

Methods of control include: (1) trapping; (2) gassing; (3) flooding; (4) exclusion; (5) encouraging natural enemies; and (6) poisoning. Control of pocket gophers is best accomplished by trapping and poisoning. As previously stated, gopher control is difficult and expensive. This is because the bait or trap cannot be placed on top of the ground near a gopher mound but must be carefully located in the underground burrow.

## Trapping

Because pocket gophers live in small underground burrows, special types of traps are required (ordinary mouse or rat traps are useless). The most successful trap is the Macabee–about 140 mm (5-1/2 in) long and made of wire except for the trigger. It springs when a gopher pushes against the flat trigger pan. Next most popular is a box type with a choker loop, which releases when the gopher seizes special bait on a trigger.

Traps are quick and positive when properly set. They are inexpensive to buy, last indefinitely, and are simple to use. But the labor of setting traps makes them costly to use. With a catch of one gopher per day per trap, the cost per gopher killed could run as much as $3 to $5 each.

In setting a trap, dig down to the main run, which is always kept open by the gopher. A lightweight shovel serves for digging. And a 300-mm (12-in) stout iron spoon or narrow trowel is useful for exposing the main run and placing the trap properly. The freshest mound should be selected and the probable location of the main run determined by following the angle of the dirt-plugged hole. Mounds are usually 150 to 375 mm (6 to 15 in) distant from the main run, and the laterals nearly at right angles to it.

With the shovel, clear a place so that a trap can be set in each direction. Clean out the main run with the spoon, disturbing it no more than necessary. A little loose dirt may be left in the bottom of the tunnel to cover the prongs and front end of the trap when the latter is pushed into place.

Many people cover the burrow with a clod or handful of grass of alfalfa so that a little light reaches the trap. A gopher instinctively closes all open burrows tightly to keep out natural enemies. A trap placed in an uncovered hole may be sprung by the dirt which the gopher pushes ahead in plugging the hole.

Each trap should have a light wire or cord attached so it can be fastened to a marker stake. This plan also prevents the trap from being dragged far back into the tunnel by a wounded gopher, or being removed by a dog or cat when it contains a gopher.

After having put out the traps, tramp down or kick the tops off all mounds nearby so that the next visit will show any new mounds where gophers remain and where further effort is needed. For most efficient use of traps and best results, each setting should be visited morning and evening, or more often.

### Gassing

Fumigation, a successful method for controlling some rodents, is of limited effectiveness against pocket gophers. The extent of the burrow system; the chance for leakage through the softer earth of laterals; the closeness of the main runs to the surface of the ground; and the fact that gophers may quickly plug off their burrows when a poisonous gas is detected and so escape destruction; make use of gas unsatisfactory.

### Flooding

This method may be used to drive gophers from their runways, but few actually drown. Individual gophers in lawns and gardens can be forced out by turning the stream from a hose down the burrow so the gopher can be clubbed as he emerges.

### Exclusion

Where small gardens or ornamental plantings of high value need protection, this can be accomplished by fencing. To protect against both underground and overland invasion, the

fence of small-mesh wire, sheet metal, or concrete should extend 0.3 m (1 ft) above the ground and 0.6 m (2 ft) below. Young trees or grapevines can be given protection by enclosing them in a wire-mesh basket or cylinder. This should also be of 0.6 m (2 ft) depth but need only come up to the surface.

In cases of unusually heavy and persistent burrowing in canal and ditch banks, the underground fence of wire mesh or concrete can be used also. This is an expensive procedure and is warranted only when gopher damage is quite costly.

## Natural Enemies

The barn owl and gopher snake are useful aids in gopher control. The owl nests in barns, steeples, palm trees, and holes in cliffs or earth banks. Its diet is almost entirely rodents, often mainly pocket gophers. A pair of owls may take three to six gophers daily when feeding their young; they rarely eat birds and never kill poultry. The gopher snake commonly eats gophers in fields and orchards, but sometimes takes eggs from wild birds or from henhouses. Some house cats become expert at catching gophers.

## Poisoning

Control of pocket gophers is best accomplished by poisoning. Over large areas heavily infested with gophers, the least expensive control is poison bait. The probe method is used to locate an open burrow. Poison bait is dropped through the probe hole after this has been enlarged by digging. Care should be taken not to drop dirt into the tunnel nor cover the bait with dirt.

Pocket gophers' external cheek pouches are lined with fur. No poison can be absorbed there, so dependence must be placed on stomach poisons. Strychnine is effective for this purpose. Baits should be tinted with green food coloring so they do not attract other animals or birds, wild or domestic. These baits are commonly available in packages at garden supply stores and hardware stores.

Strychnine alkaloid-coated grain is a relatively safe poison. It is extremely distasteful to humans and it has no secondary effect. An animal eating only the flesh of a poisoned gopher will not be affected.

However, it is possible for a nontarget animal to obtain a lethal dose of strychnine by eating entire gophers. The rodent may have some of the bait in its cheek pouches or undigested in its stomach. This type of poisoning is unlikely, but it must be recognized as possible.

Poison grain should not be left lying around. Neither should bait be left in the dispensing machine. Some machines have built-in safety devices so that the bait cannot be dispensed accidentally. If bait is spilled, it must be picked up or buried.

Grains coated with 0.1 percent, 0.25 percent, 0.31 percent, and 1 percent strychnine alkaloid were field tested. Excellent control was obtained with all except the 0.1 percent bait, which was too weak. The 1 percent bait, although giving excellent control, was too strong for safe usage. Strychnine dust on this bait was excessive and caused some discomfort to the operator. Although the bait currently in use is 0.5 percent strychnine, a bait of 0.3 percent strychnine has been found to give consistently excellent results, and is recommended for future use. The less toxic a bait, the more required for a lethal dose.

Strychnine is a fast-acting poison and many gophers are killed within an hour after feeding on the bait. (If feeding is slow or sporadic, one gopher may consume a large amount of bait before being killed.) Most gophers were killed when given 50 seeds of 0.5 percent strychnine. Gophers will build up resistance to strychnine if repeatedly given sublethal quantities.


Figure 9.–Gopher gun.

Using Bait Machines*

1. To poison pocket gophers, the natural runway must be located by probing 300 to 450 mm (12 to 18 in) from the mound on the side of the horseshoe-shaped depression.

2. When the runway is found, press the button on top of the handle, letting the inside valve shaft telescope.

3. Pull the unit out of the gound, holding down the button. The bait automatically drops into the gopher's runway.

4. This hand machine then automatically reloads itself for the next probe.

* Several hand machine, dispenser-type probes are available. And the United States Fish Wildlife Service at Denver, Colorado Wildlife Research Center has developed a tractor-drawn "Burrow-builder" for use on large acreages. It creates an artificial burrow system intersecting natural burrows, and also deposits poison bait in one operation.

Bait Acceptability

Laboratory tests were conducted with six different grains (barley, cracked corn, milo, oats, beans, and wheat) in order to determine preference. It was found that given a choice, gophers

preferred milo and barley over the others. Cracked corn and beans were least preferred. However, all baits were eaten.

Taste does not appear to be a critical factor in the selection of a good bait. The extremely bitter taste of strychnine does not seem to bother the gophers, either. When gophers are given a sublethal dose with sufficient strength to almost kill them, no bait shyness occurs; after recovery the gophers will eat more of the poison bait. (This was repeated many times on the same gopher.) Tests were also conducted using 0.5 percent strychnine-coated milo which was moldy. This bait was also readily accepted by the gophers.

Many gophers apparently store a considerable amount of bait before eating a lethal dose. And the lethal dose varies. Out of 25 gophers given 50 milo seeds of 0.5 percent strychnine, only three survived. Two of the survivors ate 50 seeds and one ate 48 seeds. Those killed at 15 to 50 seeds, with an average of 34 seeds.

## Bait Durability

The durability of bait in the ground was found to be very important in obtaining good control. During early spring, both milo and barley were found to be very toxic after 13 days in an artificial burrow, even though many seeds had sprouted up to 150 mm (6 in). The same bait was found to be only slightly toxic after 26 to 29 days. Durability depends to a large extent on the germination conditions in the soil. During the warmer months, the seeds sprout and mold faster than in early spring or late fall. The effective life of the milo and barley bait was 2 to 3 weeks.

Beans were found to germinate so rapidly during the warmer months that poor control resulted. Seeds examined 1 week after placement in the ground had sprouted up to 100 mm (4 in). The cotyledons had swelled and the poison-containing seeds were shed.

During the spring and fall, a bait lasting 2 weeks is sufficient for good control. Most of the pocket gophers are killed during the first week after poisoning. During July and August, the gophers' habits change sufficiently so that many are not killed during the first week. Some of the gophers do not find the poison bait while it is effective, and poorer control results. For these reasons, it would be desirable to have a bait which would last a month or more. This would insure all gophers in a field coming into contact with the bait and make good control possible in all seasons.

## Reinfestation

For longer-lasting control, it is advisable to poison large blocks of land. The surface movement of young gophers in early fall is the major cause of repopulation of an area where good control was achieved. The severity of repopulation depends on the proximity of other gopher-infested areas, as well as the number of original gophers which survived. Strive for total elimination in the target area.

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## CATWALKS[5]

The ditchriders at the Solano Irrigation District are recycling discarded pieces of pipe and landing mats into simple catwalks to cross over small ditches and drains. These catwalks are particularly useful in areas where ditches are burned to control weed growth because they do not burn like those made of wood.

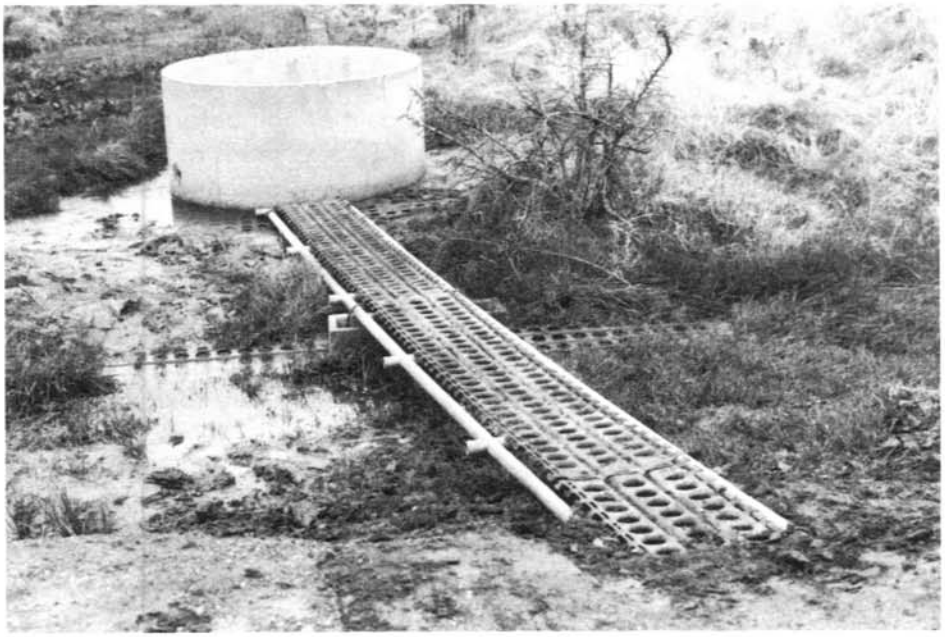

Figure 10.–Catwalk made from discarded pieces of pipe and landing mats.

[5] Information provided by Gordon Johnston, Retired, Solano Irrigation District, California.

## A HOME-BUILT PORTABLE PUMP[6]

If you need to move water fairly often from one place to another–for instance, from a pond to a field–here's an idea you might use. It's a home-built, easily transported pumping unit built with a few odds and ends and powered from the PTO shaft of a tractor.

This one was built by Bob Hodge, a Fannin county grain, peanut, cattle, and catfish farmer. He uses it to pump water out of one of his 33 ponds used to raise the catfish and moves it either to another pond or onto a cultivated field.

Hodge built it with the help of his son, Craig, and Danny Skidmore, who works in the catfish operation. The prime components are a couple of old truck wheels, standard 200-mm (8-in) irrigation pipe, a junked 5-speed transmission from an International truck, the rear end of an old Ford auto, a home-assembled drive shaft, and an impeller to actually get the water moving up out of the pond.

All together it cost him about $300 to build a couple of years ago. A comparable commercially-constructed rig cost somewhere around $3,000 at that time. Hodge got the idea for it after seeing a similar unit in Arkansas.

Construction is relatively simple if you have a few basic shop skills. A U-joint connects the drive shaft directly to the PTO. That shaft leads to what was once the back end of the old transmission. (The transmission is reversed from its original position in the truck.) A shaft coming out the other side of the transmission takes a slight upward slant in order to clear the wheels and ease the rig over humps on the sides of ponds. Another U-joint makes another slight turn from that point down to the rear end out of an old LTD Ford. The rear end drives the impellers. Hodge built the impellers in his shop according to a standard design.

In use, the rig is backed over a levee so that wheels and impellers drop down below the water surface. After that the PTO is engaged and water comes pouring up out of the pipe. Hodge's twin-rig will pump as much as 316 L/s (5000 gal/m) by a conservative estimate.

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[6] Reprinted from The Texas Farmer-Stockman, April 1981, Copyright 1981, by The Farmer-Stockman.

## WHAT COLOR IS YOUR GAS TANK ? [7]

Want to know how to lose a fast $200 each year? Paint your 1136-L (300-gal) gasoline storage tank bright red, leave it in full sunlight, and do not fix that dripping from the hose fitting.

Extension Ag Engineer Bob Durland at South Dakota State University says a red tank in full sunlight will lose about 38 L (10 gal) each month from evaporation. A leak of one drop of gasoline every 2 minutes will lose 132 L (35 gal) of the high-priced fuel each year.

Add the two and you have lost 587 L (155 gal) of gasoline from your 1136-L (300-gal) tank in just 12 months. Multiply this by $1.30 per gallon ($0.34 per liter) and there goes your $200.

The engineer says that if possible, gasoline tanks should be buried. Evaporation losses decrease to less than a gallon per month. By painting the tank white, losses decrease to about 23 L (6 gal) per month even if the tank still is in full sunlight.

If the white tank is equipped with a pressure-vacuum relief cap, the 23-L (6-gal) loss is cut in half. This small item alone will save from 151 to 189 L (40 to 50 gal) of gasoline that would evaporate annually from a red, unshaded tank.

If the white tank with pressure-vacuum cap is shaded, losses are just over a gallon (4 liters) per month—almost as good as a buried tank, Durland said. Shade alone will cut losses by 75 percent.

Another savings tip is in buying fuel for the season. Gasoline additives are changed so fuel will be compatible with climate. Durland says winter-grade gasoline evaporates easier than summer-grade, although it does help with winter starting and rapid warmups. Winter-grade gasoline used in summer can cause vapor locks. Summer-grade gasoline used in winter could cause hard starting.

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[7] Reprinted by permission of the Editor, Kansas Farmer, from August 15, 1981 issue.

## AN EAR FOR DANGER[8]

Do you listen for safety? Have you fine tuned your ears to hear all instructions, to hear danger signals, and to hear things when they are going right? Like musicians who train their ears for music and mechanics who train their ears to detect the rhythm and sounds of motors, we must all train our ears to listen for safety.

For example, long before the critical point is reached and things blow up, equipment often signals that something is wrong. These warnings may be subtle like a slight vibration in a motor or a creak in a support timber, or they may resemble the proverbial bull in the china shop as when a brake screeches or a bearing becomes dry and grinds.

Before discussing how to train our ears to hear these special signals and warnings, let us examine how we hear. Hearing can be divided into two operations that normally occur so closely that they appear to be simultaneous.

The first is the physical experience of receiving a sound through the ear. Sound waves strike the ear drum and set them vibrating. The nerve connections then carry the message to the brain where the second part of the hearing operation takes place.

Here is where you must train yourself to recognize and interpret the danger signals. Here is where alertness and being fined tuned to listening for safety pays off.

Many things affect alertness. Sometimes we concentrate on our work with such intensity that although a sound strikes our ears and reaches our brains, we really do not "hear" it and thus do not respond.

Other factors that keep us from being attuned to danger signals are lack of sleep, improper or too much food, the use of alcohol or drugs, poor ventilation or anything that induces sleepiness and natural indifference.

While most people would recognize a fire siren or a shout by a coworker, unless trained to listen for safety, many might ignore or not recognize the warnings given by motors, tires, support timbers, etc., and failure to recognize these warnings could result in an accident and injury or even a fatality.

There is seldom any mention in literature of the "sound" of imminent failure. Most often you must learn from experience. Fortunately, you do not need to wait for experience to teach you about every machine, vehicle, or piece of equipment. You can transfer your knowledge to new machines and experiences.

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[8] Reprinted from the Industrial Supervisor, November 1981, published by National Safety Council.

Before we can recognize danger signals, we must know what the everyday sounds of our environment are. By first concentrating on listening to the sounds of things going right, we can later ascertain when something sounds "amiss."

Listening for safety also includes listening to instructions whether at work or during leisure time. Train yourself to concentrate on what others are saying to you. If directions are unclear, ask questions. You may also want to repeat instructions for a double check.

And remember, although it may be somewhat easier to see danger than to hear it, your ears are able to receive warning signals from all directions while your eyes can only checkout the direction you are looking. So fine tune your ears to provide all around protection.

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## LEARN TO DO THINGS RIGHT[9]

By May Kidney

Don't mess around with makeshift methods!
  Learn to do things right!
Yes, I'll admit you might get by;
  Remember, I said, "might."

But you don't have to take that chance,
  So why be just plain dumb?
You didn't hurt yourself today,
  But that day's bound to come.

You're very careful playing golf,
  About the club you choose,
So why get careless in the shop?
  You know which tool to use!

Some dumbheads learn by accident;
  That method can be rough.
The knowledge that you learn that way
  Might not come soon enough.

The time to learn is here and now—
  Today! Right now! This minute!
There must be something in your head!
  Why don't you USE what's in it?

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[9] Reprinted from Industrial Supervisor published by National Safety Council.

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