

Irrigation: structure 42  
Morton W. Billington

# Sealing Sandy Ditches

ENGINEERING RESEARCH

APR 19 74

FOOTHILLS READING ROOM

with the

*Bentonite Dispersion Method*

The material in this booklet is extracted from "An Evaluation Report on Recent Bentonite Sealing Work in Wyoming Canals" (March 1959) by R. D. Dirmeyer, Jr., project leader of canal sealing investigations at Colorado State University and consulting geological engineer. The report was prepared for the Wyoming Natural Resource Board in cooperation with M. A. McNamee, Agricultural Engineer, Wyoming Agricultural Extension Service.

Much of the background information is based on results of research in the field of low-cost canal sealing with clay sediments obtained since 1953. This research is sponsored by the Colorado Agricultural Experiment Station and Colorado State University Research Foundation in cooperation with other organizations including the U. S. Agricultural Research Service and many irrigation districts and private companies.

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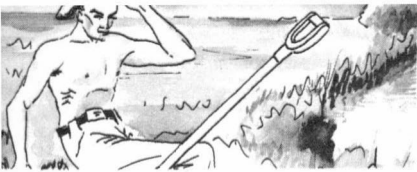
FORT COLLINS, COLORADO

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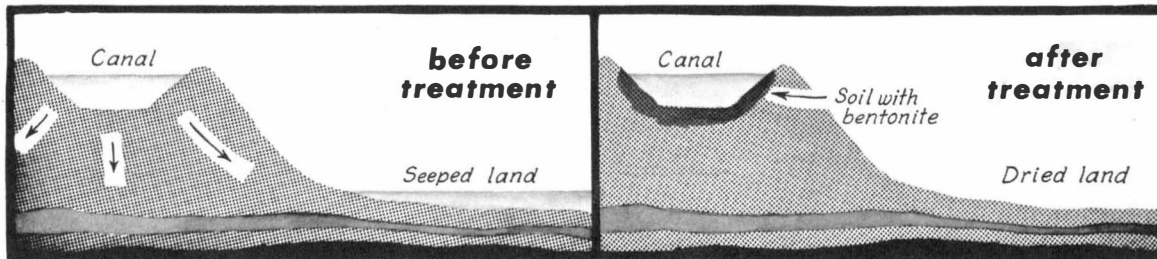
**Written and illustrated by R. T. Shen, Assistant Engineer, Civil Engineering Department,  
Colorado State University, Fort Collins.**



# What's Your Problem?

- ★ Are you looking for a way to stop seepage and save water or reclaim water-logged land?
- ★ The bentonite dispersion method may be your answer. It seals the leaks in a sandy ditch and dries up seeped areas.

Here's how bentonite works:



- Simple
- Economical
- Effective

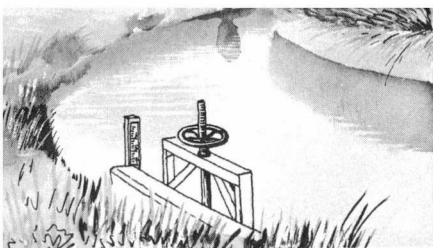
What's more, it interferes very little with your delivery operations.

- ★ But it also has limitations. It is a sealer, not a lining. If your problem is weeds, erosion, or animal boring, the bentonite dispersion method cannot help you.

Here's a way to save water and land!  
A way you can afford!



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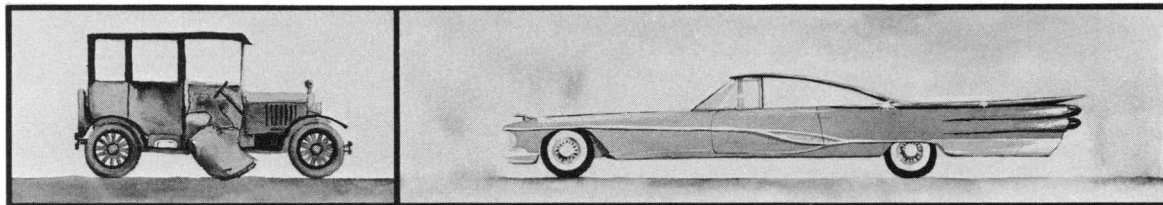
# What are Your Conditions ?

★ You have a leaky canal or ditch:

- its soil is sandy
- its banks can be harrowed
- its grade is flat enough for ponding

You can use the **bentonite dispersion method** to seal it.

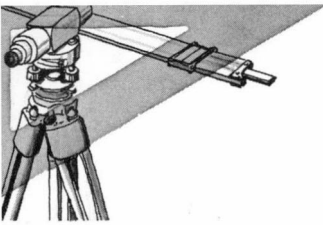
★ This method works if your channel is in good shape. If your ditch needs work, do it before you seal it with bentonite.



★ Just as you should mend the door before painting the car, you should:

- Remove weeds and trees
- Clean canal and control erosion
- Add and repair drop structures
- Maintain good bank road

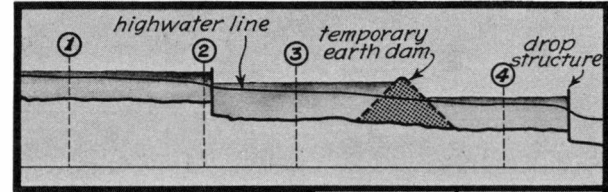
**Now is the time to put your system in shape—Start the repairs it so badly needs, even if only a little is accomplished at a time!**



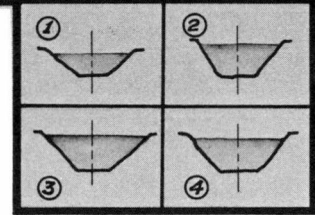
# How to Plan the Job....

★ Success will turn out the way you plan it. Be sure you plan your sealing work so it is a success.

★ Survey your canal section as accurately as possible.



★ Waterproof your check structures and build temporary dams so that water can be ponded above the highwater line throughout the section. Build temporary earth dams for trouble-free operation.



★ Calculate the amount of bentonite needed for ponding

- About  $\frac{3}{4}$  pound for one cubic foot of ponded water.
- Shrinkage (loss of volume during the filling of the pond) should be estimated according to ditch bed materials.

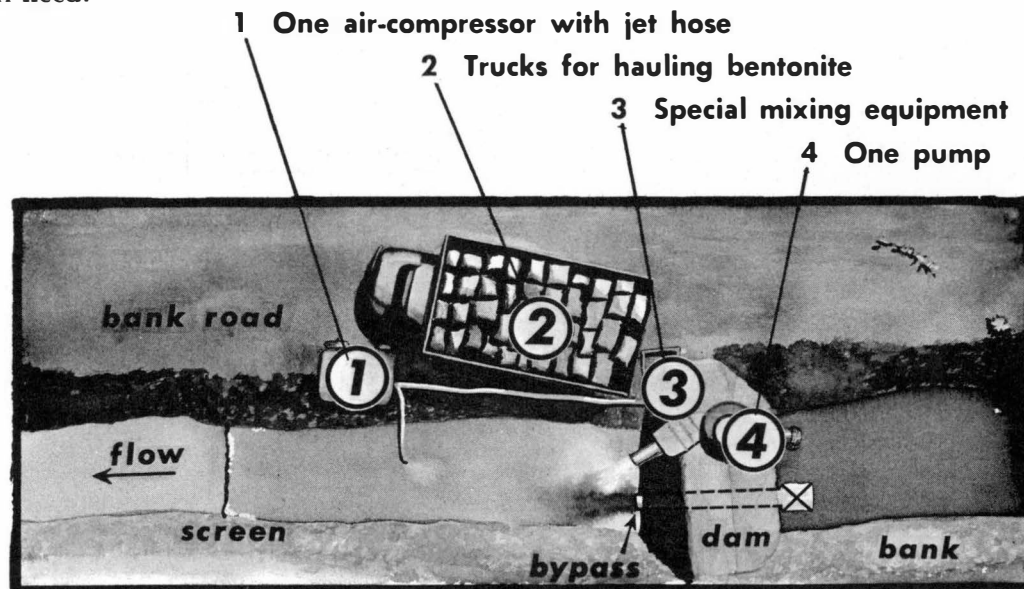
★ You know some obvious high loss zones? Pack them with local clay soil or a blanket of bentonite-soil mixture.

**Be sure to reserve extra granular bentonite on hand for additional needs in case of unexpected high loss or flocculation**

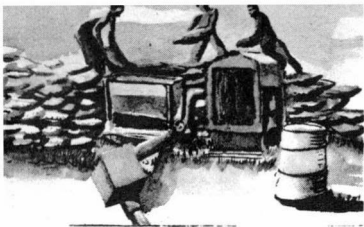
# Here's What You Need!

★ For your mix-point at the upstream end, you need a check structure or a dam with a controlled by-pass and a screen to catch the lumps.

★ You will need:



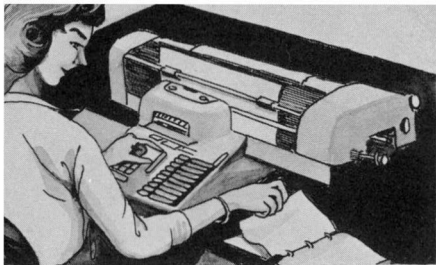
Various mixing devices have been developed. You may build your own mixing equipment, but it pays to get a contractor who specializes in this work



## *Here's What You Do !*

- ★ Mix the bentonite into the pumped water. Adjust the bentonite-feeding rate until it gives the best smooth, lump-free slurry.
  
- ★ Let in clear water through the by-pass to dilute the slurry mixture. Undispersed lumps may collect below the mix-point. Break them up with a jet of bubbling air.
  
- ★ Adjust the control gate at the by-pass to produce a 1.2% concentration at the test point. This will keep the concentration of the whole pond at 1% or higher.
  
- ★ Harrow the banks first several times, then the bottom. Be careful to avoid bank slumping.

**Harrow after the pond is full, otherwise you cannot seal the upper-bank area in the high-water zone**



## *How Much Does it Cost ?*

- ★ The bentonite dispersion treatment is inexpensive because you let the water do the work for you.
  
- ★ The cost varies with individual jobs. Generally, commercial bentonite sells for about \$14 per ton at the plant, and the mixing costs \$12 to \$20 per ton.
  
- ★ The total cost depends on:
  - How much bentonite you need.
  - How far you are located from the bentonite mill.
  - What preliminary repair work your ditch needs:
  
- ★ In work previously done in Wyoming, the cost has been 5 cents to 36 cents per square yard of wetted surface.

**The bentonite dispersion method is eligible for ACP (USDA) cost-sharing support in Wyoming**





## *Any Questions ?*

Q 1. How good is the bentonite seal?

Ans. As good as you make it. An 80 percent or better seal can be attained by careful planning, competent installation, and adequate maintenance.

Q 2. How long will the sealing last?

Ans. Given proper maintenance, a good installation will probably last ten years or more. Since the latest technique was developed only recently, present information on the life of the seal is not complete.

Q 3. Can success be assured for every installation?

Ans. Only if the canal or ditch is suitable for application of this method. If your canal slopes are steep and rocky, perhaps the multiple-dam method will work better. Get some professional help in your planning.

Q 4. What proof of success can I anticipate?

Ans. You can find more flow at the lower end of the treated section. If you want to be sure of this, you must set up accurate recording stations and get enough loss information beforehand for later comparison. Your measuring devices must be good in order to obtain reliable evaluation. The drying up of seeped land may be a good qualitative proof of success. A water-logged area often has several sources of intake, however, so before deciding to treat your ditch you should analyze the seep problem thoroughly. Otherwise you may treat the wrong ditch section.

Q 5. What is a good bentonite to use?

Ans. Commercial, high-swell bentonite is the best. There are standard tests available to determine the suitability of a bentonite.

Q 6. Can I use a natural bentonite from a nearby deposit?

Ans. It depends on the quality of the deposit and the condition of the channel bed. Sometimes a coarse unprocessed bentonite is needed to plug big holes. Technical advice should be obtained on this subject.

Q 7. How can the mixing be best accomplished?

Ans. Different devices have been developed for different conditions. An experienced contractor will do a good job. If you wish to do the mixing yourself, however, you may write for additional information.

Q 8. How do I control the bentonite concentration during the mixing?

Ans. You can sample the mixture at a test point just below the screen. Find out the percentage of suspended bentonite with a hydrometer and standard hydrometer jar. Adjust the clear water intake so the concentration stays at about 1.2%.

Q 9. How long should the ponding last?

Ans. At least two days. After ponding, the canal should be kept full of water so drying cracks will not develop.

Q 10. How often should the ditch be harrowed?

Ans. About twice a day for two days, or until all the bentonite is used up. The banks should be harrowed before the bottom, and no harrowing should begin before the maximum ponded depth is reached. Otherwise you cannot seal the upper bank area in the highwater zone.

Q 11. What shall I do if my ditch water is hard and causes the bentonite to flocculate and settle to the bottom of the ditch?

Ans. In this case, the upper bank areas will be left untreated. You can remedy this by shovelling granular bentonite ( $\frac{1}{2}$  to 1 pound per square foot) on the bank areas just ahead of the harrowing.

Q 12. What maintenance is needed for a treated section?

Ans. The usual maintenance practices. Keep the canal full of water for as long as possible, perhaps several months. Take precautions against bank erosion. Keep clear of weeds and trees. Control puncturing and burrowing animals and marine life.

Q 13. Can this method be used in a rocky canal?

Ans. This method, no. But bentonite can be used. The multiple dam method has been developed for canals having a fractured rock bed. This method is described in a separate booklet.

Q 14. Can bentonite be used to seal farm ponds and reservoirs?

Ans. Yes. The method is described in a separate booklet.

Q 15. Can bentonite take the place of other types of canal lining such as concrete?

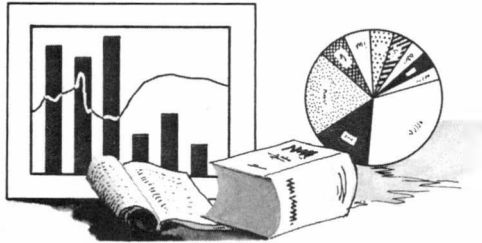
Ans. Bentonite can only seal. Other types of lining may bring other benefits in addition to sealing, such as erosion control, weed control, reduced cross-sectional area, and decreased maintenance costs. If you can afford an expensive lining like concrete, you need not consider using bentonite.

Q 16. Does bentonite affect field crops?

Ans. In a good installation with the bentonite dispersion method, the bentonite will be placed in the canal bed and bank soils. Wastage will be kept to a minimum. If some bentonitic water should reach the field by accident, the small amount of bentonite would normally be harmless.

Q 17. Will cattle be harmed by drinking water containing bentonite?

Ans. No. Bentonite is commonly used in products intended for stock and poultry consumption, such as in wet-mash poultry and stock feeds as a gelatinizing agent.



## *Want to Know More ?*

★ Other publications on the use of bentonite for sealing purposes:

- Sealing Rocky Ditches With the Bentonite Multiple-Dam Method—Circular 203-A
- Mixing Bentonite for Sealing Purposes—Circular 204-A
- Testing Bentonite for Sealing Purposes—Circular 205-A
- Sealing Farm Ponds and Reservoirs With Bentonite—Circular 206-A

★ For additional information, get in touch with your county agricultural agent or write to:

**Project Leader**  
**Canal Sealing Investigations**  
**Colorado State University Research Foundation**  
**Fort Collins, Colorado**

**or**

**Irrigation Specialist**  
**Colorado State University Extension Service**  
**Fort Collins, Colorado**



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