THAT DRAINAGE JOB

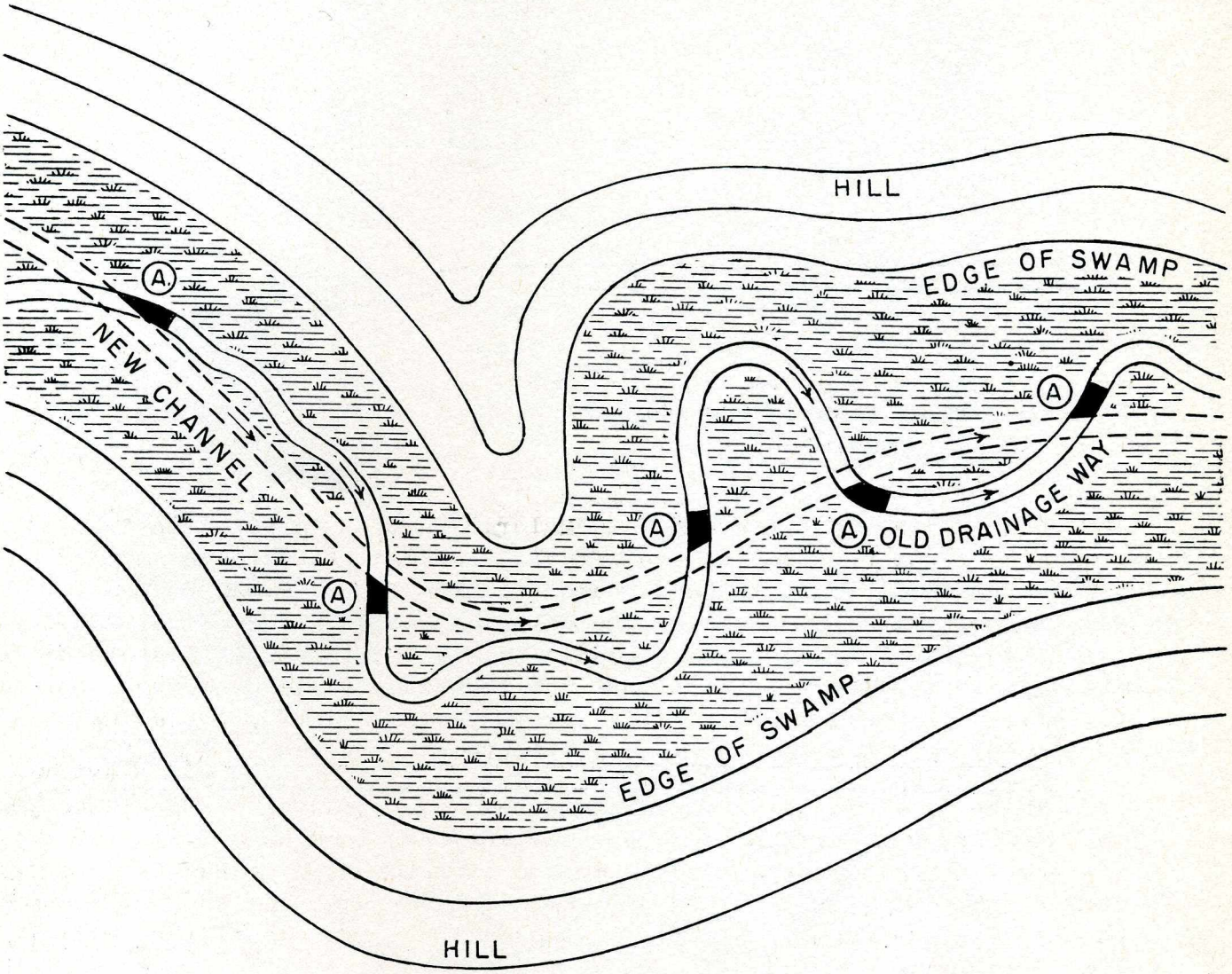
A FEW SUGGESTIONS FOR FOREMAN TO MAKE DRAINAGE EASIER AND BETTER

FEDERAL SECURITY AGENCY
UNITED STATES PUBLIC HEALTH SERVICE
OFFICE OF MALARIA CONTROL IN WAR AREAS
ATLANTA, GEORGIA

The letters "MCWA" stand for "Malaria Control in War Areas". It is a very important part of the war effort. Because it is important and because every bit of it is being paid for from Public Funds, those of us who are doing the work must do the best job we can and do it at the lowest cost. Every time we waste money by making a careless mistake or by digging a ditch that won't do the job it was built to do someone has to buy extra war bonds or pay extra taxes. Do a good job, a job that will work and a job that will cost just as little as possible.

There are many ways to drain water off a pond or swamp. Some you may have used before, others you may not have thought of. In the next few pages a few suggestions are made and a few common mistakes are pointed out. Look these over. They may aid YOU to do a better job for our country at lower cost. Study the suggestions and see if they will fit your problem.

DITCHES SHOULD BE AS STRAIGHT AS POSSIBLE



New ditches should be dug as straight as possible, but the ditch should follow the low land and not go through hills that would make a very deep ditch necessary. The best ditches are located in natural small valleys through which water would naturally drain if the valley floor were low enough.

When a new channel cuts across an old winding drainage way log and earth dams should be built (A) to keep water from flowing into the old channel. Below the dams the holes and low spots in the old channel must be filled so that water will drain out of it. The lower end should be left open to permit such drainage.

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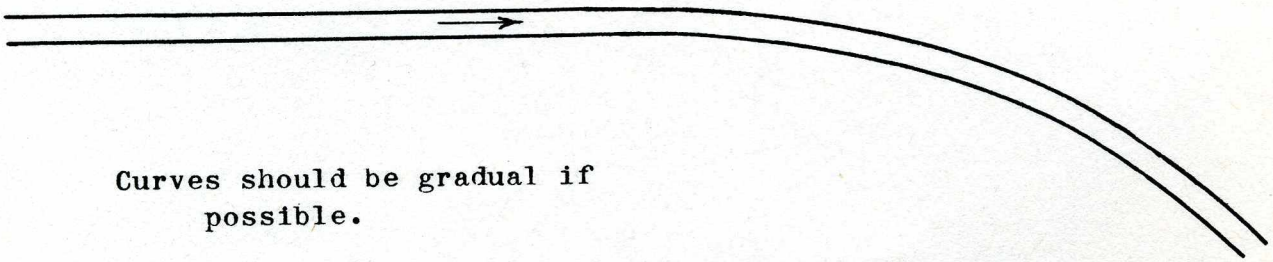
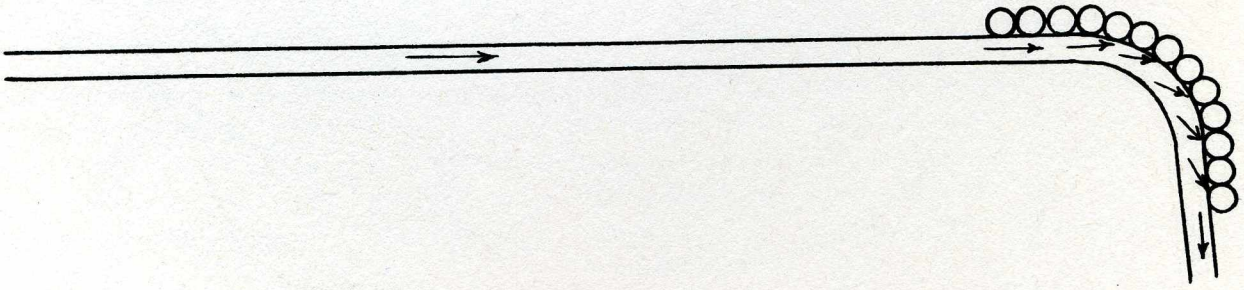
CURVES SHOULD BE GRADUAL OR ELSE PROTECTED



Curves should be gradual if possible.



When curves are sharp the fast flowing water hits the outside of the curve and wears the bank away. If a sharp curve must be used, protect the bank with hand placed stone, broken concrete or logs set into the ground on end.

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Ditches should be dug so that they will slope a tenth to a half a foot in every hundred feet of length. The engineer calls this "a grade of 0.1% to 0.5%". If the ditch is steeper than a half foot in a hundred the water will run too fast and will wash out the sides and bottom of the ditch.

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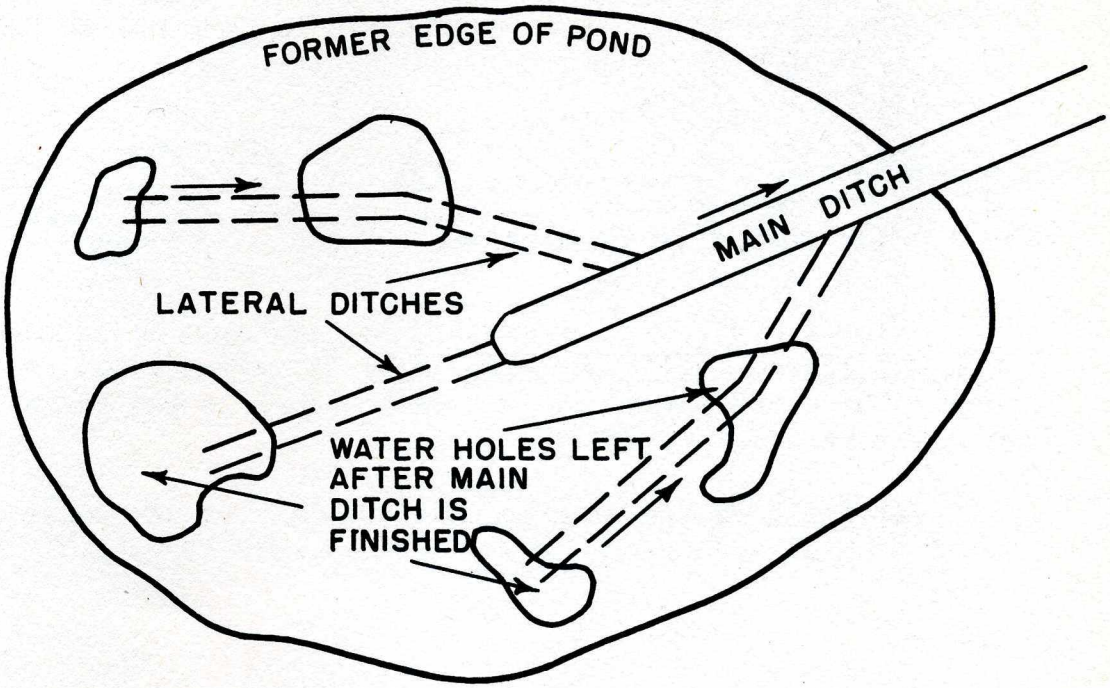
DON'T DIG LATERAL DITCHES UNTIL THE MAIN DITCH HAS A CHANCE TO DRAIN OFF THE GROUND WATER



When the water is drained from a pond or swamp several holes may be found in the bottom that will still hold water. Don't dig lateral ditches to these holes until some time passes. The water in the holes may run into the main ditch through the ground. If it does not, laterals can be dug later.

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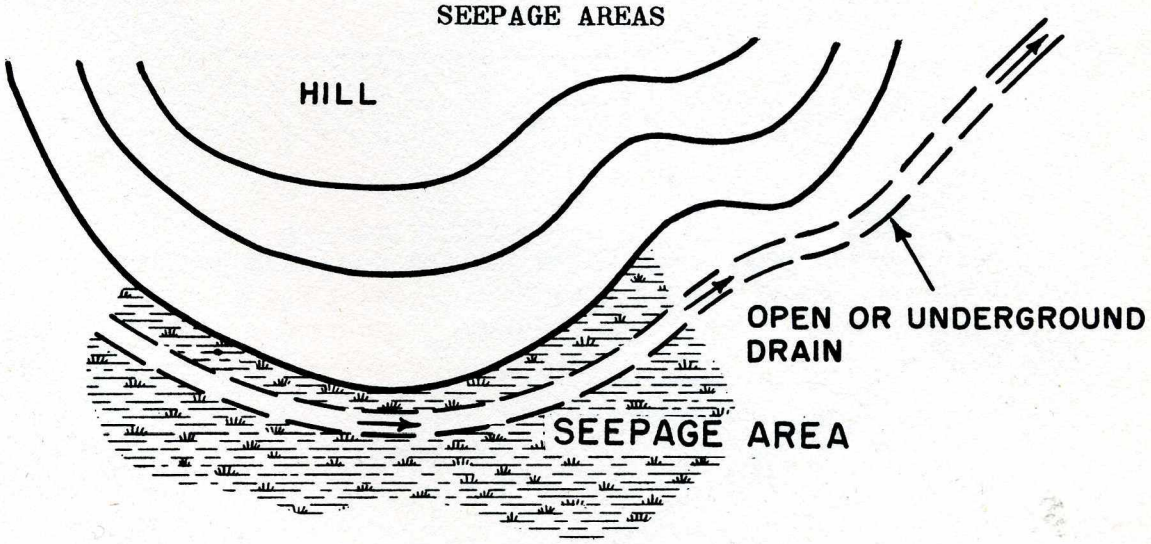
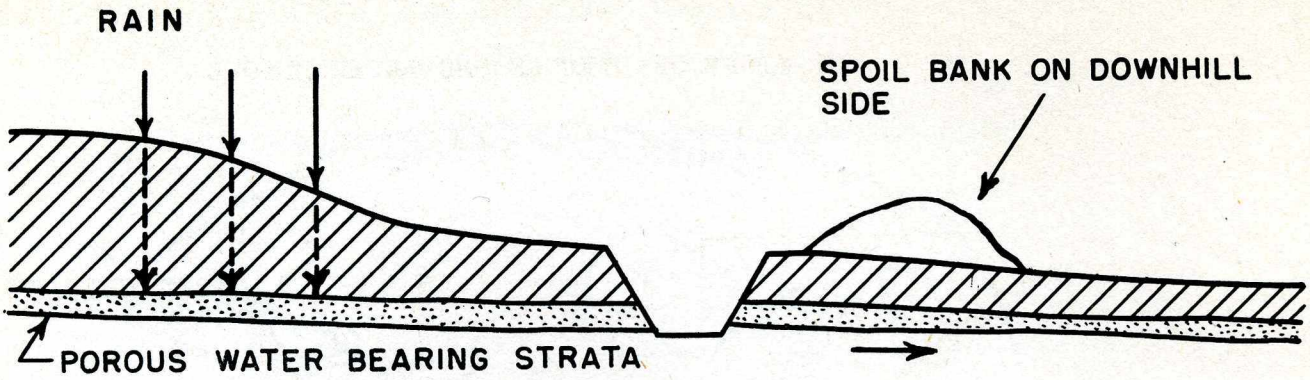
SEEPAGE AREAS



When water falls on a hillside some of it soaks into the ground and goes down until it gets to a vein of gravel and sand. If this vein comes to, or near, the surface of the ground at the bottom of the hill the water from the vein will pond on the surface. This is known as a "seepage area".



Seepage areas can be drained by digging a ditch around the base of the hill where it will catch the water as it comes out of the underground vein. The ditch should be just deep enough to get below the gravel vein where it can collect all the seepage water.

The depth of the vein and the location of the water can be found by digging holes with earth augers or post hole diggers.

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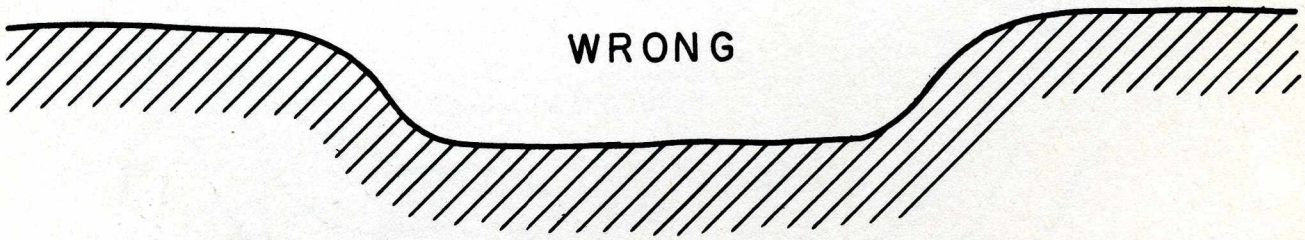
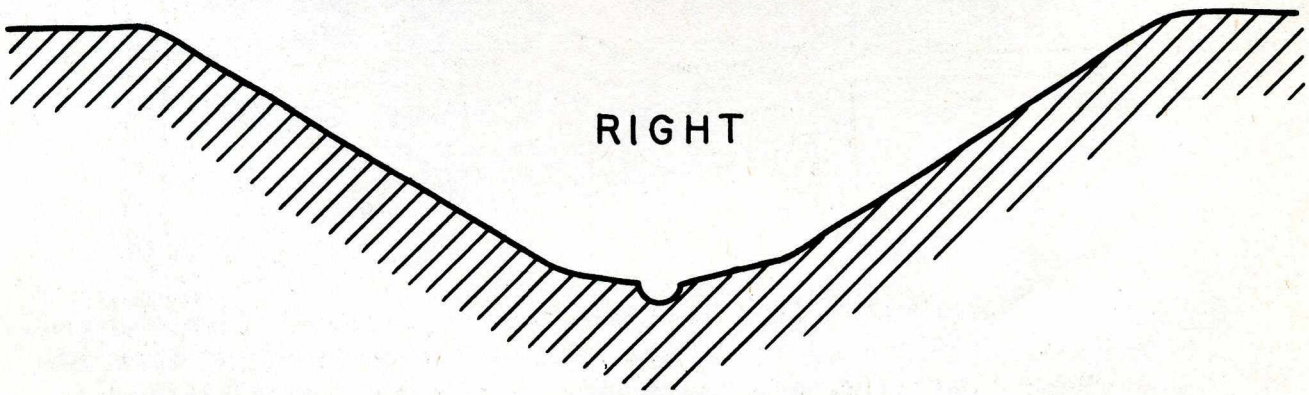
A DITCH SHOULD BE

JUST LARGE ENOUGH TO CARRY OFF THE SURFACE WATER RAPIDLY

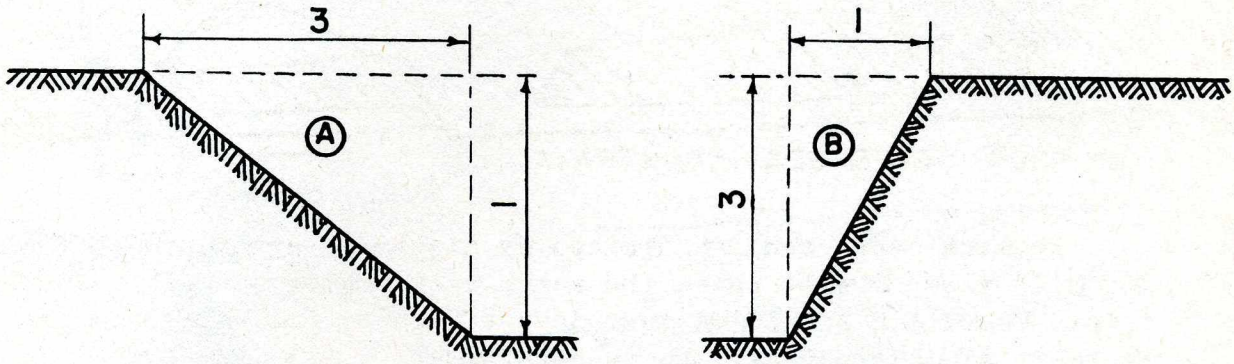


This ditch will have water spread over its bottom. Mosquitoes will breed in the ditch itself.



This ditch will carry as much water as the other, there will be few puddles in the bottom and the banks will not cave. During dry periods the water will run in the small channel in the bottom of the big ditch. There will be no water in which mosquitoes could breed.

THE SIDES OF DITCHES SHOULD BE SLOPED



The sides of a ditch should be sloped enough so that they will not cave off into the stream. (A) shows how a ditch should be sloped in soft, loose soil. (B) shows how it may be sloped in hard, rocky soil.

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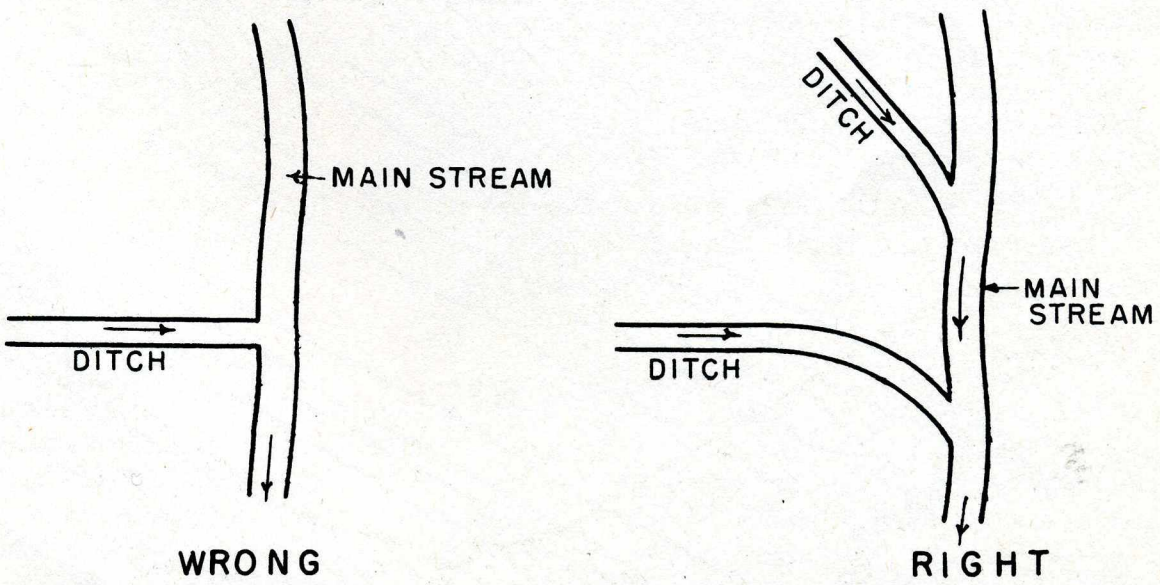
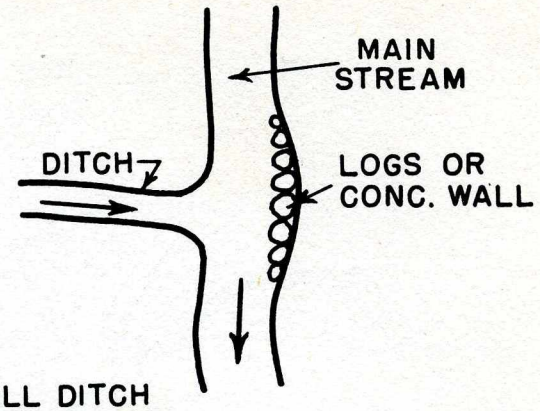
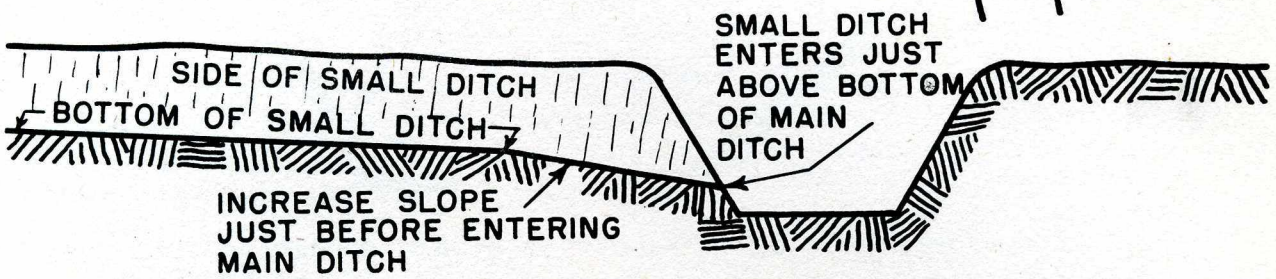
WHEN DITCHES JOIN



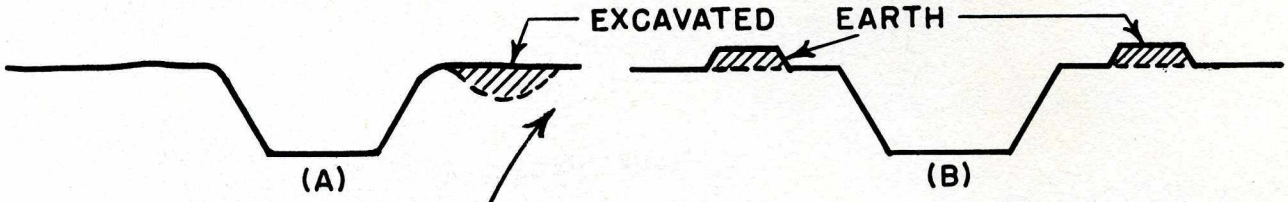
Where two ditches or a ditch and stream join, the smaller ditch should enter the main stream running in the direction of flow.

When a ditch must go straight into another, as shown, the main stream bank across from the small ditch entrance should be protected with logs, stone or broken concrete.

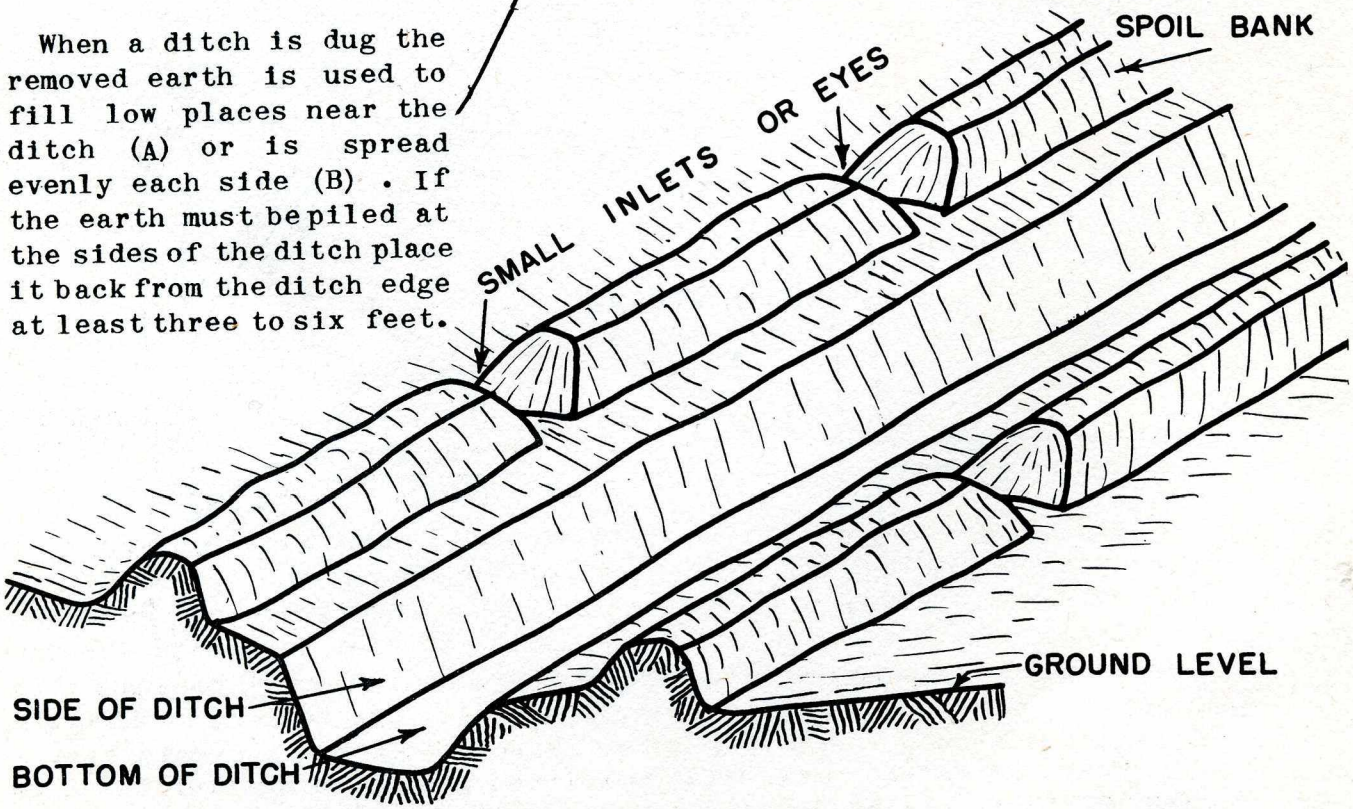




Where two ditches join, the slope of the smaller ditch should be increased just before it enters the main ditch and it should enter a little above the bottom of the main ditch.

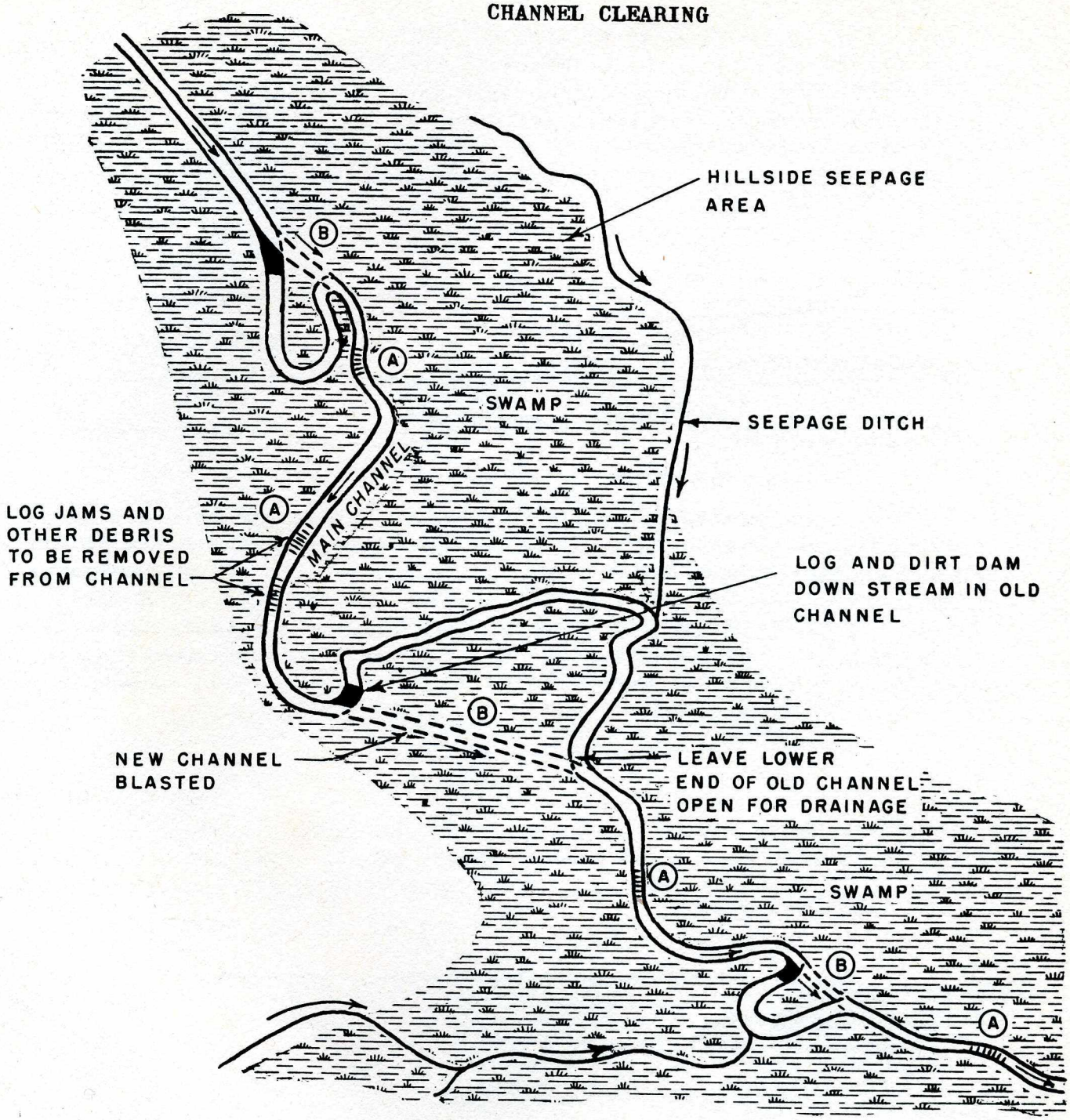


When a ditch is dug the removed earth is used to fill low places near the ditch (A) or is spread evenly each side (B) . If the earth must be piled at the sides of the ditch place it back from the ditch edge at least three to six feet.



When the earth, removed from a ditch, is spread on each side, small Inlets or "eyes" are cut through the bank to let the water run into the ditch from the sides.

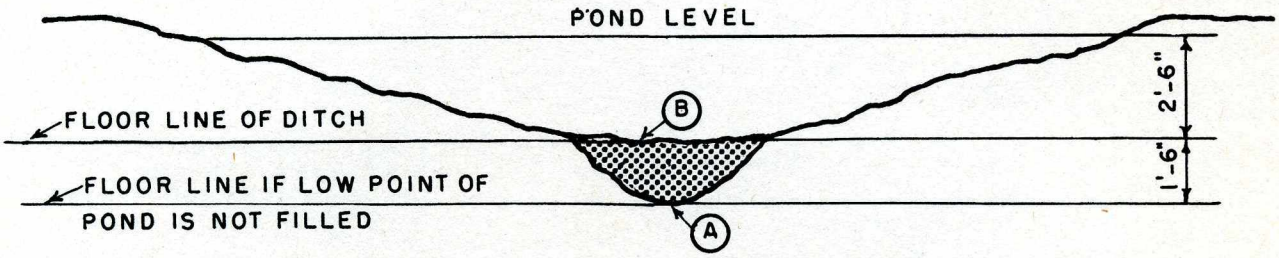
CHANNEL CLEARING



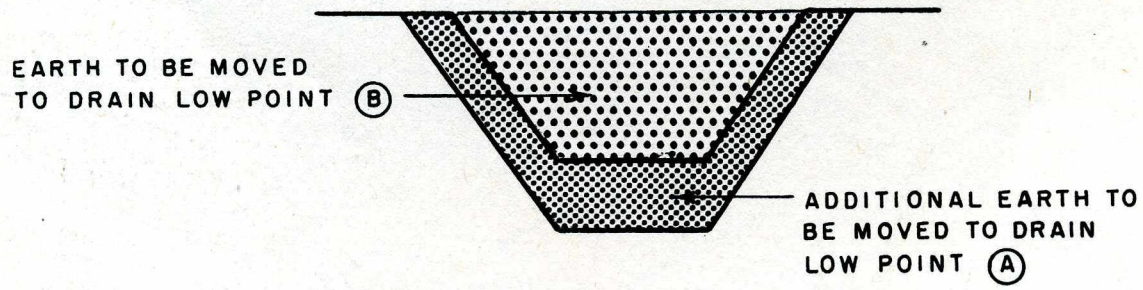
Wide flat swamps are often found on each side of slow winding streams. Usually there are logs in the channel of the stream and it has many sharp winding bends. This type of swamp can often be easily drained by improving the stream channel. This causes the water to flow faster in the channel thus drawing off the water from the side swamps. Channel clearance is low in cost and will often be satisfactory, however, before the work is attempted an engineer should run levels to be sure that enough slope is available.

To clear this kind of channel, remove logs (A) and other trash that slows the flow of water in any way. Short new sections of channel (B) should be blasted or dug across the necks of sharp bends.

DEPTH OF DITCHES



In most drainage jobs the ditch is cut low enough to drain the lowest point (A) in the pond to be drained. However, if the low point of the pond is in a small hole as shown in the sketch above it is often cheaper to fill the hole so that the elevation (B) becomes the low point. The elevation of (A) is 1.50 feet lower than (B). A ditch to drain the water from (A) would have to be 1.50 feet deeper than a ditch to drain the water from the elevation at (B). Notice below how much more dirt has to be moved to make a deeper ditch to drain the hole.



By filling small low points in ponds it is often possible to keep the ditch bottom higher and so make a shallower and smaller ditch which will need much less labor. An engineer should decide on the best and cheapest method to use.

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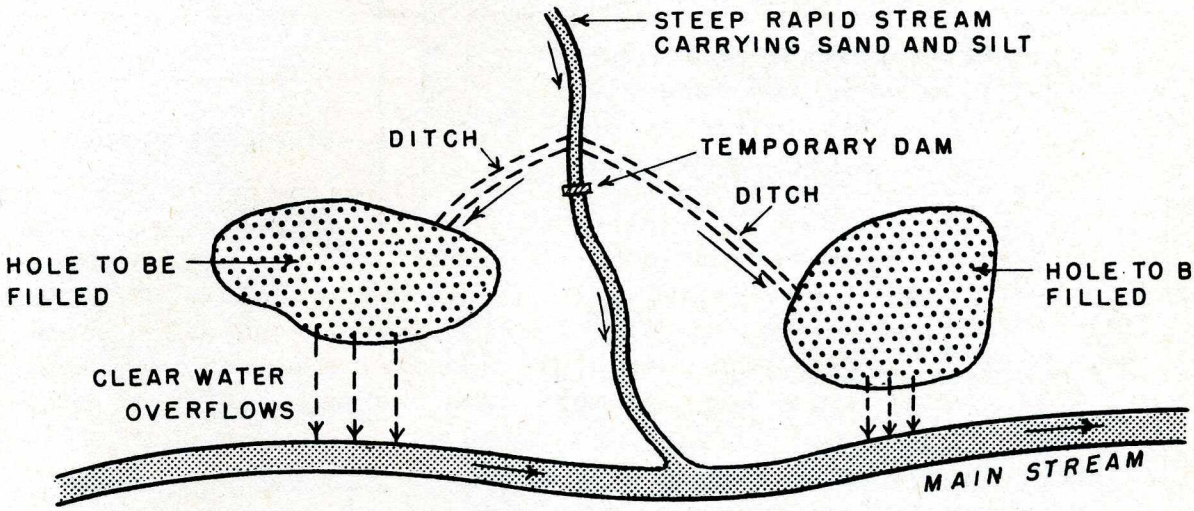
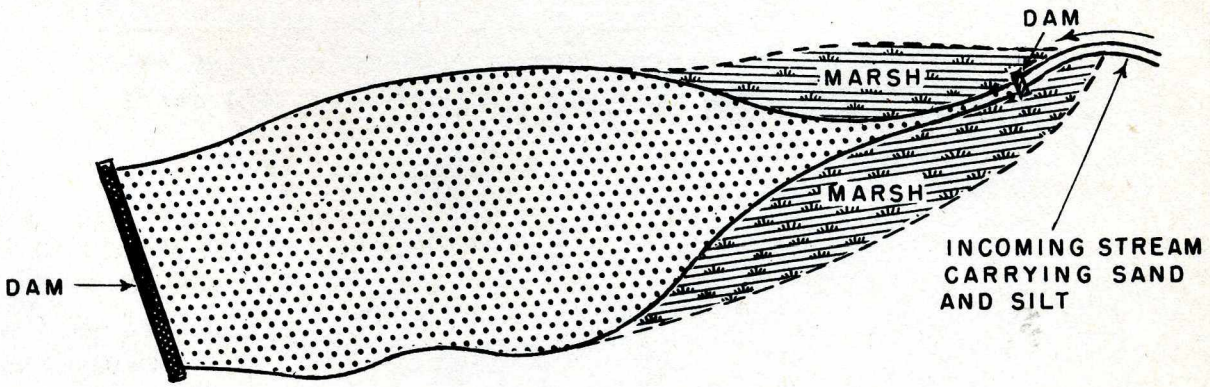
NATURAL FILLING METHODS

Filling can sometimes be done with very little cost and effort if a stream is available which carries a great deal of sand and silt. If a stream of this kind can be diverted into a pond or other area to be filled the sand and silt will settle to the bottom when the stream reaches the quiet water of the pond.



By putting a temporary dam across the stream that carries the sand and silt the water can be forced into ditches that will carry the water and silt into the pond or hole that is to be filled.



Filling of this type is often useful in filling the wide, shallow areas that occur many times in ponds made by putting a dam across a stream.

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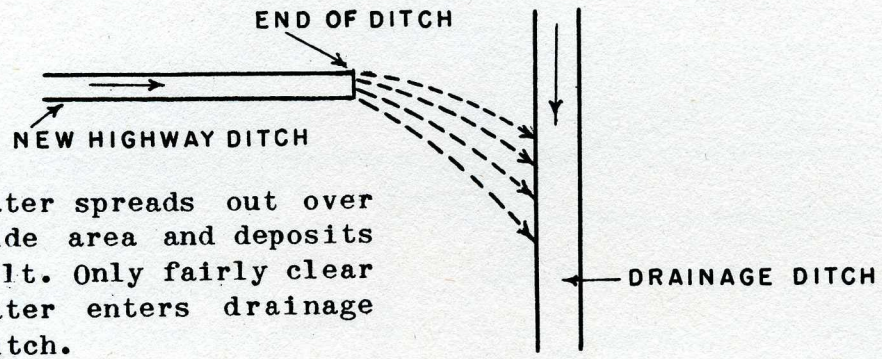
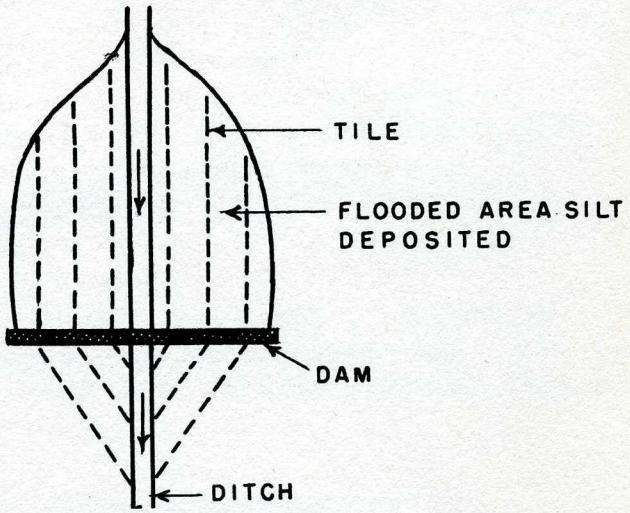
SILT IN DITCHES

Unstable highway side ditches and others in which the water picks up a heavy load of sand should never be connected directly with a drainage ditch. Some method must always be found to remove the sand from the water before it enters the main ditch. If this is not done the main ditch will soon be filled and ruined. The sand may be removed in several ways, all of which slow the rate of flow of the water and let the soil settle to the bottom in the areas where it is wanted.

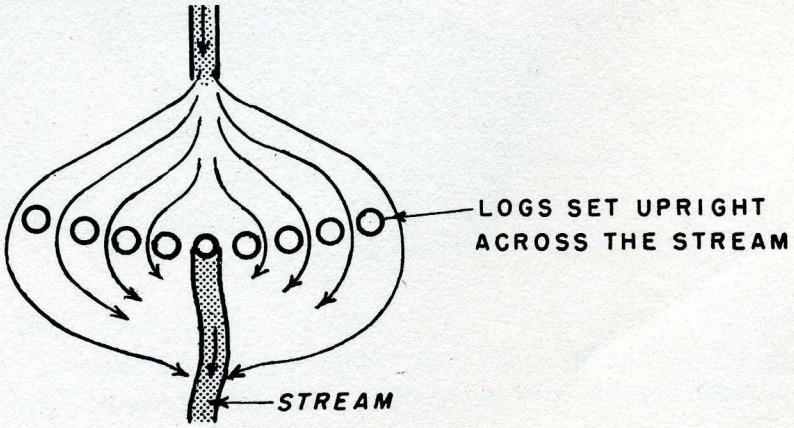


Water spreads out over wide area and deposits silt. Only fairly clear water enters drainage ditch.



Tile lines drain water which seeps down through the sand and carries it past dam

A dam can be placed across a ditch carrying water loaded with silt. Tile drains collect the clear seepage water and carry it through the dam.



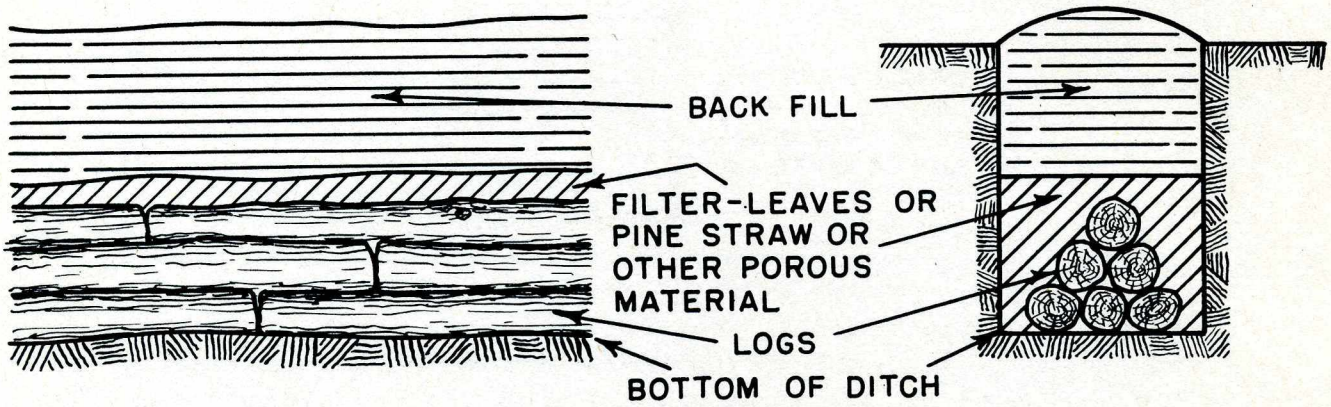
Logs set upright in the soil to form a dam across the stream will force the water to slow down as it passes through or around the dam, thus depositing the silt.

UNDERGROUND DRAINAGE

A drainage way placed underground has one great advantage over an open ditch: It puts the water where mosquitoes can't reach it.

Underground drains have many other good points. A pole type drain is cheap, if it is properly built it will last for many years without maintenance and it leaves the surface of the ground available for crops and pasturage. Tile underground drains have the same advantages and are more permanent.

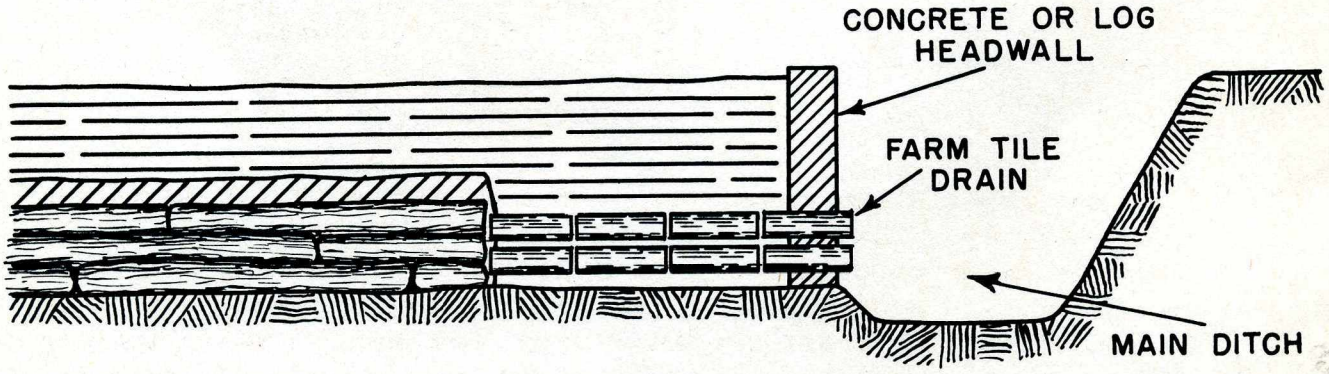
The most simple underground drain is made by placing logs in a ditch and covering with earth.



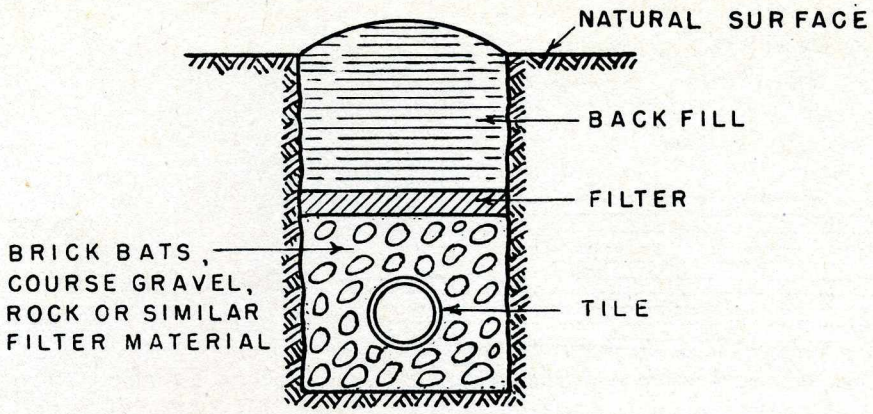
The logs should be 4 to 8 inches in diameter and should be piled in a pyramid in the ditch. The ends of the logs should not all come at one point but should be staggered, as bricks are layed.

The filter over the drainage way is very important for the filter must keep out the dirt which would work down between the logs and clog the drain. The filter should be made of straw, grass, leaves or brush piled on the logs until it is 6 to 12 inches deep. Earth is piled over the filter until it is heaped about a foot above the ground.

Log drains should slope from two tenths to a half a foot for every hundred feet of ditch length. As in other ditches the slope should be increased just before the drain reaches its outlet. Such drains usually should not be longer than a thousand feet.



The logs will not rot where they remain wet, but if air reaches them they may decay. For this reason a log drain should stop several feet from its outlet, the last few feet of the drain being through farm tile or other pipe, which should pass through a headwall and enter the main ditch at least six inches above its bottom. The headwall will also protect the bank of the main ditch from caving or being washed out. An open, free flowing outlet is absolutely necessary for an underground drain.



This type of drain will last longer than a pole drain but costs considerably more to install. However, it is well worth using where materials and labor are obtainable. Eventually such a drain may partially "silt up". Flow is stopped and the drain will have to be dug, cleaned and relaid, but if the drain is properly installed and protected from crushing from above silting will occur very slowly, if at all.

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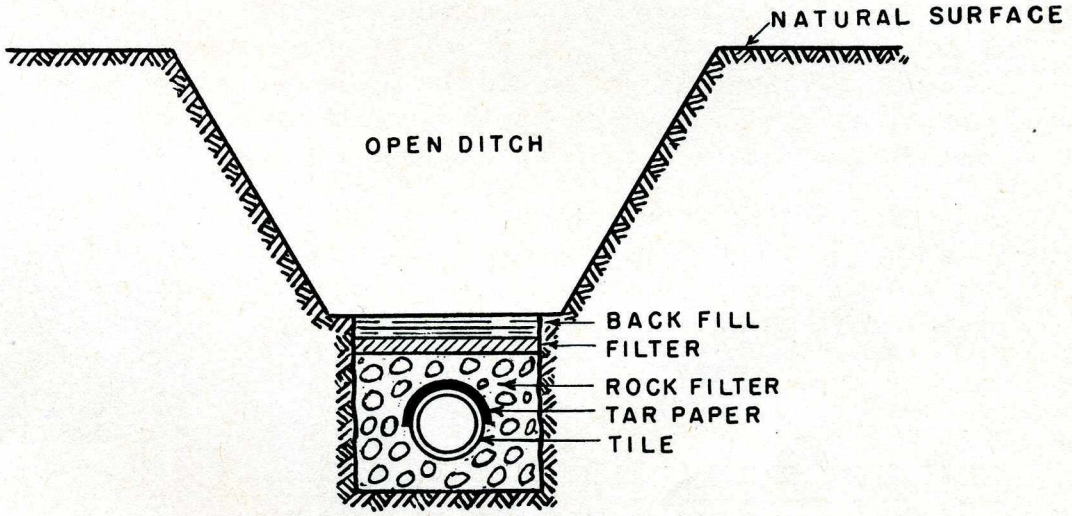

Many open ditches are designed to carry off large amounts of storm water quickly. During dry periods these ditches may contain only enough water to make puddles in the bottom. In this standing water mosquitoes may breed. An underground drain tile, installed underneath the ditch bottom, will drain off the water from such puddles while the big ditch, above, dry in normal weather, will carry large amounts of storm water when necessary.

Underground drains of one type or another should be considered in draining seepage areas, marshes, wet areas caused by springs and areas wet by overflowing drinking fountains and artesian wells.