REPLENISHING UNDERGROUND WATER SUPPLIES on the FARM

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Replenishing Underground Water Supplies on the Farm

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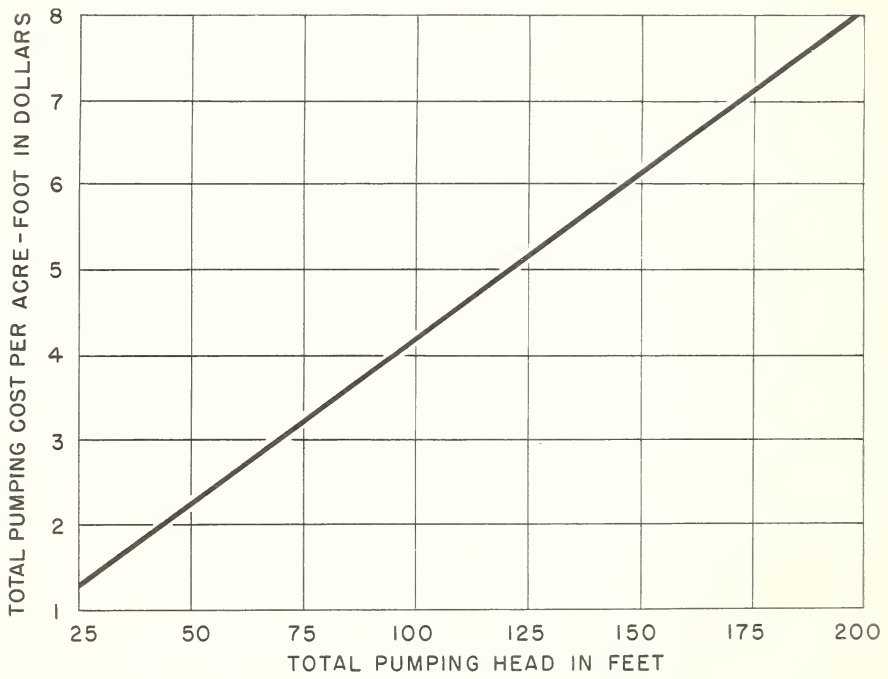
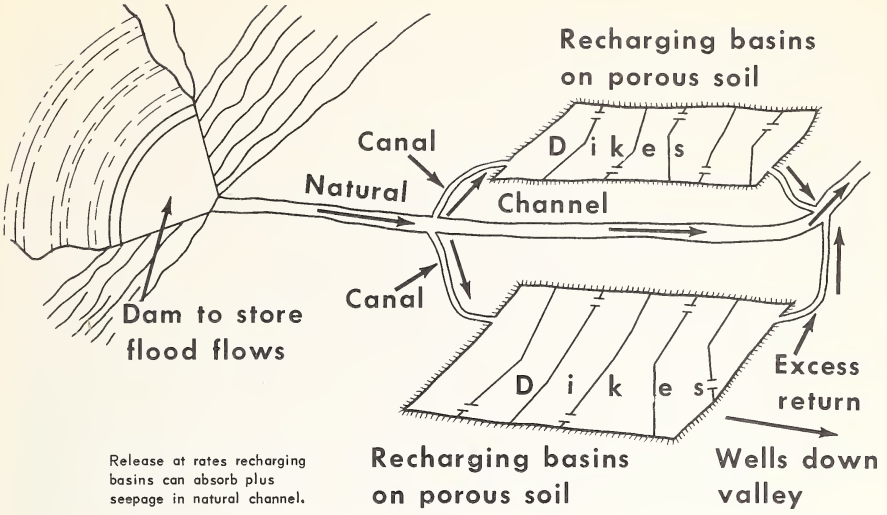
Beneath the surface of the ground are water basins with unused storage capacity far in excess of the largest surface reservoirs. In many localities, farmers who irrigate can use these underground reservoirs as supplements to ponds and other surface basins by storing water in them for later use.

The practice of depositing water in subsurface storage basins is called *artificial recharge*. It conserves water and raises water-table levels. The effectiveness of this practice can often be measured in dollars and cents; for example:

Assume that the water level in a well is 150 feet beneath the surface. Depositing additional water in the formation from which the well draws its water raises the water level by 50 feet. Pumping costs are then reduced at least $2 for each acre-foot of water pumped. If the farmer irrigates from this well, and applies 3 feet of water a season per acre, his irrigating costs are reduced by $6 an acre.



Graph showing how pumping costs and pumping distances are related.



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Ideal recharging system—a combination of surface reservoirs and good recharging sites.

Flood water, waste water, and water above that needed for irrigation are good sources for potential underground storage.

METHODS OF RECHARGE

Five methods are used. Each method lets the water infiltrate through the soil and seep down to the waterbearing formations. The best sites on which to conduct artificial recharge operations permit convenient control of the water and maximum penetration into the soil. Farmers should consider the geological structure of their land and the location of their wells before selecting a recharge method or a recharge site.

Irrigation systems may convey water to recharge sites. Special systems are sometimes needed. The ideal system is a combination of surface reservoirs and efficient recharge sites. The surface reservoirs impound flood flows and simultaneously remove silt and bedload. Releases from the surface reservoirs can be adjusted to suit the capacity of the recharge sites.

Basin Method

Impound the water in a series of small basins formed by dikes or banks. Arrange the basins so that the entire surface area can be submerged. The dikes may follow the contour. Provide dikes with overflow facilities so the excess water from the highest basin escapes into the next lower basin.

Use this method if gullies and ridges cut up your recharge site. The basins prevent the water from collecting in the gullies and running off before it has a chance to penetrate the soil.

Use the basin method even though the water contains silt. Hold the water in the uppermost basin until the silt settles. Let the

water flow into the lower basins when it becomes relatively clear. Remove the silt from the uppermost basin between intervals of recharging.

When the basin method is used, the net area wetted is usually greater than with other methods and the water is more easily controlled.

Furrow Method

Pass the water through a series of furrows or shallow, flat bottom ditches. Space them close together in order to utilize the greatest possible percolating area. Slope the ditches to make the water flow freely and to hold in suspension any silt and foreign material.

Use this system if water is plentiful and contains considerable silt. Make sure, however, that the water flows fast enough to carry the silt through the recharge system and back into the main stream channel.

Consult your county agent or a representative of the Soil Conservation Service, U.S. Department of Agriculture, before planning an artificial recharge program on your farm. You will probably need help in making the determinations discussed on pages 2, 7, and 8 of this leaflet, and on other technical aspects of artificially recharging underground water supplies.

Several variations of this system are used. Sometimes the ditches snake back and forth until they gradually reach the lowest limit of the recharge site.

Flooding Method

Pass the water slowly over the land in a thin sheet. Do not let it collect in small streams and run off the recharging site.

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Recharging basins formed by building dikes on the contour.

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Recharging basins constructed across a natural channel. The dikes are built of nonerodible material. Water passes over them without eroding them away.

Use this system if your site is level and uncut by large gullies and ridges. Small gullies and ridges may be tolerated. Neutralize their effects by ditches and embankments. Water diverted from shallow gullies to ridges runs in all directions and much of it is saved before it again returns to the gullies.

Preparing land for the flooding method of recharge is cheaper than preparing for any other method.

Shaft or Pit Method

Take advantage of abandoned gravel pits, old wells, or other pits or shafts. Divert the water into these places instead of letting it flow over the ground.

Use this method if you need a high rate of percolation in a confined area. With the exception of gravel pits, only small amounts of water can be sunk in this manner.

Do not use this method if the water contains much silt. It is extremely costly sometimes to rid wells or shafts of silt deposits. It may be necessary to chlorinate the water in order to maintain injection rates. This adds to the expense of using this method.

Injection-Wells Method

The use of injection wells is a variation of the shaft or pit method, except that the well is specially designed and adapted for depositing water.

Use this method if impermeable strata or layers exist between the surface of your land and the water-bearing formations. Use it also if your land is too valuable to set aside a large part of it for surface methods of recharge.

The precautions and limitations that apply to the use of abandoned pits and old wells apply also to the use of injection wells.

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Ditches for recharging purposes. The gravel and boulders increase the infiltration rate.

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Furrows dug on sandbar of riverbed create a greater wetted area and increase infiltration.

RECHARGING SITE SELECTION

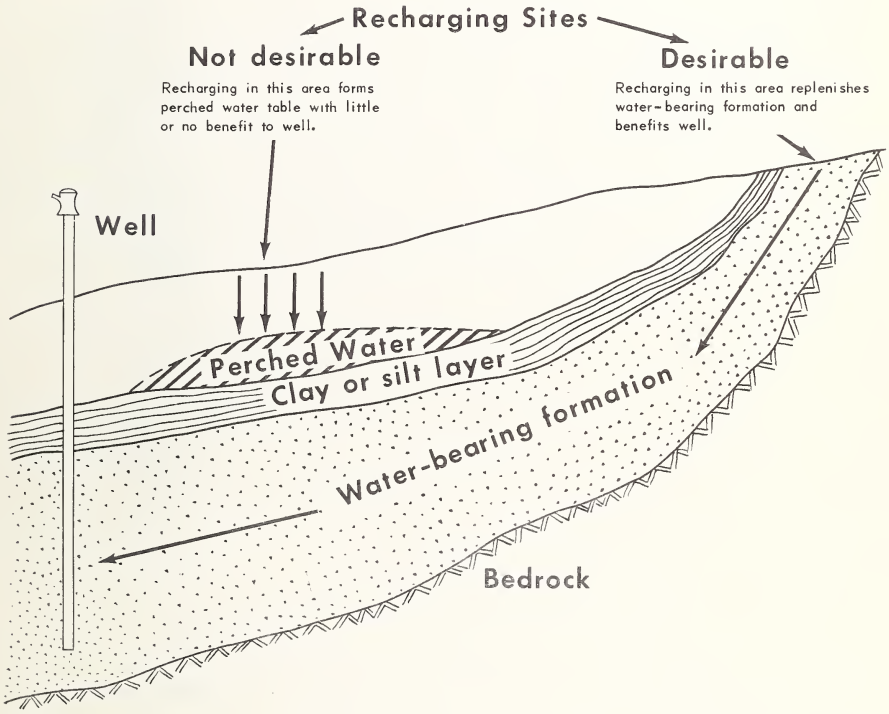
Find out where the water-bearing formations are. Draw contour maps to establish the direction in which the underground water moves. Locate your recharging site "upslope" from your wells. Orient it in such a way that the deposited water follows the underground channels and actually replenishes your wells.

Soils that contain sand and gravel offer the least resistance to the penetration of water. The poorest crop-producing soils often make the best recharging sites.

Formations beneath the soil that reduce the passage of water include hardpan layers, clay, silt, or cemented sand or gravel. To avoid recharging above such formations, examine well logs. If no well logs are available, drill exploratory holes.

Sometimes the exploratory holes or the well logs show that impervious strata slant between the surface and the water-bearing formations.

The formations can still be replenished if their natural intake can be located and recharging operations done there.



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Drawing showing how selection of a recharging site may be affected by impervious layers between the surface and the water-bearing formation.

DO'S AND DON'TS

Don't be misled by uneven percolation. Water-bearing formations may not be uniform in extent or depth. Some areas may therefore fill up faster than others and erroneously indicate that the entire formation is filled. Such filled areas are called "ground-water mounds." The mounds build up because water moves slower through the ground than it does into the ground.

Don't compact the soil. Don't use heavy machinery to construct a recharging site unless it is unavoidable.

Do regulate traffic over the recharging site. Travel over the site when the soil is wet or damp slows infiltration of water.

Don't plow, disk, or otherwise mechanically manipulate the soil unless it is necessary to control weeds and algae on the recharging site.

Don't use water that contains sodium. Too much sodium seals the soil. "Soft" water usually contains high percentages of sodium.

Do use water that contains calcium carbonate. This substance promotes infiltration. "Hard" water usually contains high percentages of calcium carbonate.

Do preserve grass and other vegetation on recharging sites. Such growths promote infiltration. Don't permit too much grazing, however, when the soil is wet.

Do be judicious when using waste water. Public health has to be protected. Some States prohibit the introduction of contaminated water underground unless the water is treated. Measures to control mosquitos may be necessary.

Do be careful when handling flood water. Uncontrolled floods may damage your recharging site. Flood water usually contains heavy deposits of silt and bedload. It is sometimes wise to bypass the initial flood flows and to start recharging operations after the water clears and the force of the flow abates.

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