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TRANSACTIONS

Paper No. 2544

UTILIZATION OF UNDERGROUND STORAGE RESERVOIRS

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Synopsis

The scope of this paper is limited to the consideration of planned utilization of the water storage capacity available in the unconsolidated tertiary and quaternary alluviums of stream valleys, interior valleys, and coastal plains, with particular reference to conditions in Southern California. The objective of such utilization is to achieve maximum salvage at minimum cost of that portion of the water supply that now wastes to the ocean or is lost through evaporation and consumptive use by natural vegetation. To accomplish this salvage, it will often be necessary during dry periods deliberately to draw down the water table in the ground-water basin much farther than it would otherwise fall, in order to create storage capacity.

The development of commercial supplies from ground water for irrigation, municipal, and other uses has caused a certain degree of involuntary utilization of underground storage, and the extent of such utilization, with consequent salvage, will increase as further development of ground-water supplies proceeds. Numerous artificial recharge, or spreading, projects have been initiated, but the net effect of many of these has been limited to keeping the water table slightly higher in dry years than it would have been otherwise. The ground-water basins would have filled during wet periods from natural percolation without spreading. No deliberate attempt has been made during drought periods to create additional underground capacity to be filled by water salvaged during later wet periods. Carefully planned utilization of the immense potential storage capacity available in the alluviums with ground-water basins operated in a manner somewhat analogous to surface reservoirs can frequently achieve a much greater salvage.

In some instances, only planned operation of the ground-water basin is required to produce ample conservation to meet the need for additional water. In other cases, the construction of relatively small surface reservoirs to act as regulatory storage that increases stream-bed percolation and artificial recharge thus will be operated in conjunction with underground storage to achieve maximum conservation necessary. In general, costs for underground storage should be far less than for the equivalent amount of salvage obtained by construction and operation of surface reservoirs alone. Few surface reservoir sites of large capacity, high yield, and low cost are still unused. Properly operated, there are no evaporation losses from most underground reservoirs, but, generally speaking, water must be pumped from them for use, thus adding to the final cost. However, this is not often a major item in the economic comparison of underground storage versus surface storage alone.

To obtain the full conservation of available water supplies at a reasonable cost will require the extensive utilization of underground storage, as will the large scale reclamation of sewage. Thorough investigation of the hydrology of the ground-water basins must precede development and utilization. To create storage capacity and to supply adjacent areas of deficiency, the exportation of pumped water from ground-water basins of large potential capacity and with ample tributary inflow may be required. A change in the location and pattern of pumping may be indicated.

Owners of overlying land and others having prior rights in the ground-water basins often object to the utilization of underground storage when an additional lowering of water table during dry periods, causing increased pumping costs, is necessary. Complex physical, engineering, financial, and legal problems are involved.

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Introduction

There is a regrettable tendency during drought periods to regard any drop in the water table of ground-water basins as a danger sign, without pausing to consider that the supply of water to the water table at such times is below average and that such a drop, in some instances, may be actually beneficial in salvaging wasteful consumptive use and in providing space for storage of later surplus waters. The ideal situation in the minds of many is to keep ground-water basins as nearly full as possible at all times, and large expenditures have sometimes been made for that purpose. The net result has frequently been a slight saving of pumping costs and a large waste of water that could have been used to good advantage elsewhere in areas of deficiency.

Hydrology

An excellent treatise on the hydrology of ground-water basins has been given by Harold Conkling,[2] M. ASCE. The subject will be treated here only in sufficient detail to serve as a background for the discussion of utilization of underground storage.

General Hydrologic Equation.—The various elements involving supply to, and disposal from, a ground-water unit, including the overlying surface,

[2] "Utilization of Ground-Water Storage in Stream System Development," by Harold Conkling, *Transactions*, ASCE, Vol. 111, 1946, p. 275.

are related in accordance with the following equation:

$$Q_i + P + U_i + I_i = Q_o + U_o + C + I_o + \Delta S \ldots\ldots\ldots (1)$$

in which Q_i is the surface inflow; P is the precipitation on the surface; U_i is the amount of underflow entering the unit; I_i is the artificial importation of water or sewage; Q_o is the surface outflow; U_o is the amount of underflow leaving the unit; C is the consumptive use (evapo-transpiration loss); I_o is the artificial exportation of water or sewage; and ΔS is the change in storage.

The change in storage as used in this equation includes not only that occurring beneath the water table (surface of the saturated alluvium), but also that within the root zone and between the root zone and the water table, over the period of time considered.

All the elements of supply and disposal (with the possible exception of precipitation) are, or can be, affected to some degree by man's activities.

Supply to the Water Table.—The sum of the following items, corrected for any change in storage as previously defined is the aggregate amount of water reaching the water table: percolation from precipitation; stream-bed percolation; artificial recharge through spreading grounds and diffusion wells; underflow into the ground-water unit; return flow from irrigation; return flow from cesspools and septic tanks; and leakage from water mains. In many ground-water basins, the opportunity for stream-bed percolation is limited by a high ground-water table.

As previously stated, each of these items is affected by artificial development and culture. To illustrate: In a natural state the average percolation of precipitation is comparatively small because the type and density of natural vegetation that becomes established consume nearly all of the average rainfall. When irrigated culture is substituted for natural vegetation, the percolation of precipitation tends to increase because the initial soil moisture deficiency at the onset of the rainy season is decreased. The regulation of runoff may increase stream-bed percolation and allow greater artificial recharge. The regulation from a portion of the watershed allows a greater proportion of the runoff from other areas to percolate or be spread. Stream-bed percolation may be entirely or partially cut off by the construction of lined flood control channels.

If the ground-water basin has a large capacity, enabling it to be drawn down without any danger of deficiency and, as is sometimes the case, if it will fill from natural percolation during wet periods, there is little benefit to be obtained from artificial recharging, other than that of keeping the water table slightly higher during dry periods. Very little over-all conservation is achieved. It must also be emphasized that if spreading is beneficial, the true salvage obtained is the difference between the amount of water spread and the amount that would have percolated naturally if allowed to remain in the stream channel.

Disposal from the Water Table.—Water reaching the water table is disposed of by means of the following items: Artificial extractions; underflow out of the ground-water unit; effluent seepage (or rising water); consumptive use by natural or artificial vegetation, deriving its water supply directly from the water table; artificial drainage; and change in storage beneath the water table.

The elevation of the water table affects the magnitude of underflow, effluent seepage, drainage, and consumptive use. In cases in which underflow, drainage, and effluent seepage serve as sources of supply to lower basins, no over-all salvage can be attained by decreasing these items through a lowering of the water table in a basin. However, if there are areas of natural water-consuming vegetation that feed directly on the water table, considerable salvage sometimes can be achieved by such lowering. Increasing artificial extractions and exporting the water to other areas of deficiency may accomplish the desired result.

Some ground water must be allowed to escape from the basin in order to prevent a gradual build-up of dissolved salts to undesirable concentrations. Disposal from the water table must equal the supply to it. If the net change in storage over a complete cycle of dry and wet periods is negative, then the basin is overdrawn with respect to the historic conditions of supply.

Safe Yields.—Safe yield may be defined as the average annual rate of artificial extraction from a ground-water basin which will not:

a. Exceed the difference between the average annual supply to the waste water table as defined previously and the average annual disposal from the water table by underflow, effluent seepage, drainage, and direct consumptive use;

b. Lower the water table sufficiently to permit intrusion of sea water or other water of undesirable quality or to prevent sufficient flow through the basin to maintain proper balance of dissolved salts;

c. Lower the water table beyond the economic limit for cost of pumping; or

d. Interfere with prior rights of others in adjacent ground-water basins.

It is apparent from this line of reasoning that safe yield is not a unique nor a fixed value. It is also obvious that the water table must be lowered somewhat below that for natural conditions in order that there may be a safe yield, since safe yield represents, in part, salvage from natural processes of disposal by underflow, effluent seepage, and direct consumptive use. This salvage can be achieved only be lowering the water table. A lowering of the water table may increase the stream-bed percolation and provide more space for storage of surplus water in wet years. The value of safe yield is dependent, then, other factors remaining the same, upon the assumption that is made as to the average elevation of the water table to be maintained. With extractions limited to safe yield, the water table will fluctuate around this average more or less in accordance with the sequence of wet and dry years. Safe yield changes in magnitude as cultural activities and developments alter the supply to the water table and disposal therefrom. Methods of determining safe yield have been adequately treated.[2,3]

[3] "Report of Referee," by Harold Conkling, George B. Gleason, and Elmer C. Marliave, *Raymond Basin Area Reference*, Vol. 1, Div. of Water Resources, Dept. of Public Works, State of California, 1943 (City of Pasadena vs City of Alhambra, et al, No. Pasadena C-1323).

Storage Capacity.—For the utilization of underground storage, the storage capacity available must be estimated from average specific yield, area, and the depth to which the basin may be dewatered below the highest allowable water table. The limitations on maximum depth to which a basin can be unwatered have been discussed previously.

In confined (or pressure) aquifers there is some small change in storage in the aquifer itself and some leakage from the confining strata as pressure is decreased. Storage capacity in such aquifers is not available for utilization unless it is possible to draw the piezometric level down below the top of the aquifer so that a free water table results.

Project for Ventura County, California

General Description of the Area and its Hydrology.—Three river systems (Ventura River, Santa Clara River, and Calleguas Creek) drain most of Ventura County, plus a considerable area in Los Angeles County (in California) lying to the east, as shown by Fig. 1. For purposes of this paper, only those

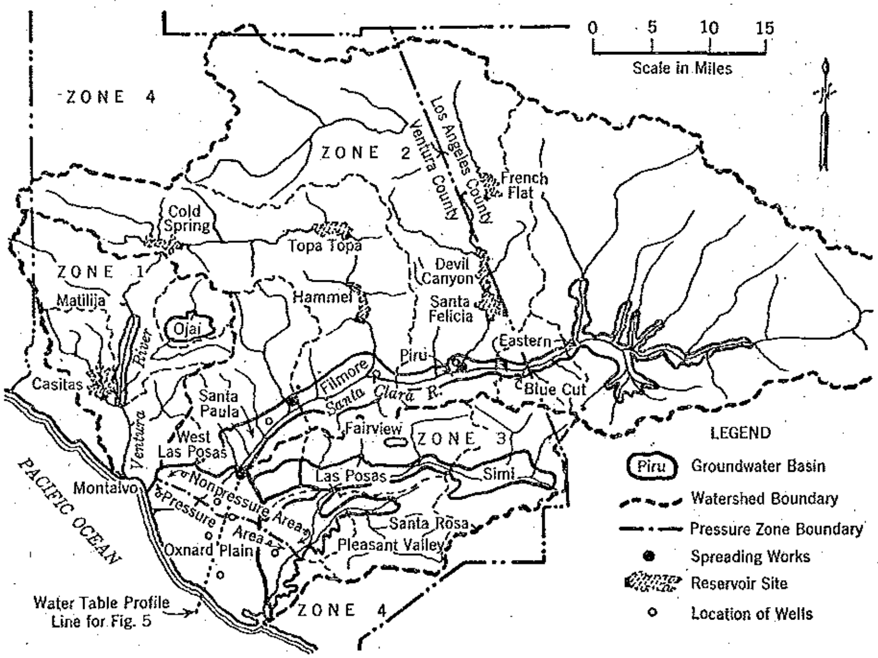

Fig. 1.—Ground-Water Basins in Ventura County, California

portions of Ventura County drained by or supplied by the Santa Clara River will be considered. The river and its tributaries, Sespe Creek and Piru Creek, are the only sources from which significant amounts of new water may be made available by conservation measures to supply the coastal plain and areas to the south of the Santa Clara River Valley.

Ground water is extensively produced from alluvial deposits that range in thickness from 100 ft or less up to several thousand feet. Lateral constrictions and other natural impediments to the movement of ground water divide the area into hydrologic units, or ground-water basins. These basins are delineated in Fig. 1. Eastern Basin, lying mostly in Los Angeles County, will not be further considered in this paper.

South and southwest of the pressure line that runs east and southeast from Ventura to the mountains on the south side of Pleasant Valley, in California (as shown in Fig. 1), the ground-water aquifers are overlain and confined by a relatively impermeable cap of clay and fine-grained silty deposits having considerable thickness. The bottom of this confining member is some distance below sea level in all parts of the plain. Water in these aquifers is under pressure and has produced numerous artesian or flowing wells.

Inland from the pressure line, there are no extensive confining members, and free water-table conditions exist. Montalvo Basin acts as the forebay area, or storage reservoir, from which ground water moves into the pressure aquifers of the coastal plain. The Santa Clara River System thus supplies not only its own valley but all of the coastal plain including the western portion of Pleasant Valley. If the severe overdraft existing in the nonpressure portion of Pleasant Valley were supplied, and if sufficient additional water could be imported and spread, it is possible that this area could also act as a forebay area to partly supply the pressure aquifers of the southerly portion of the coastal plain.

The total average annual surface inflow to Santa Clara River in Ventura County is estimated at about 230,000 acre-ft, of which nearly 40% is contrib-

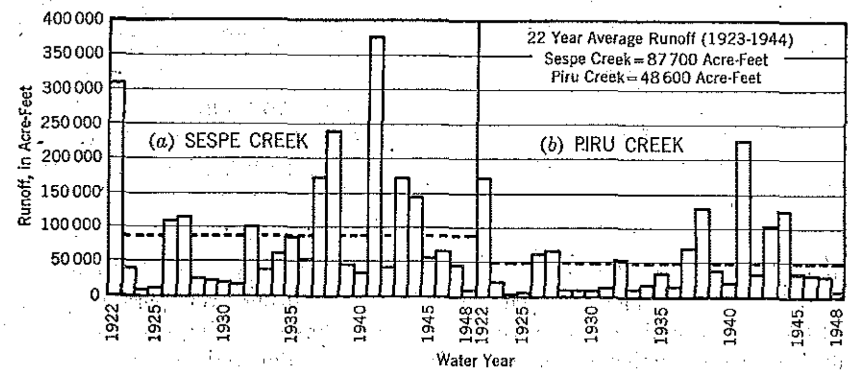

Fig. 2.—Annual Runoff in Sespe and Piru Creeks

uted by Sespe Creek and about 20% by Piru Creek. The extreme variation in annual runoff and the more or less cyclic character of the supply is shown by the hydrograph (Fig. 2). Annual runoff in Sespe Creek has varied from a minimum of 9% of average flow to a maximum of 430% of average. Inflow during wet periods is much more than sufficient to fill all ground-water basins along the river.

Two spreading areas are in use at the present time (December, 1951)—one near Piru, Calif., with a capacity of 75 cu ft per sec and the other near Saticoy, Calif., with a capacity of 145 cu ft per sec.

A drought similar to the one that occurred from 1923 to 1936, inclusive, has been used as the critical period in studies for the project. Combined average annual runoff in Sespe and Piry Creeks during this period was 54% of the long-term mean.

It is estimated that the average annual waste to the ocean in the Santa Clara River, with present culture and existing conservation works, would be 36,000 acre-ft for a drought period similar to that of 1923–1936. Of this total, 24,000 acre-ft would be from Sespe Creek and 3,000 acre ft from Piru Creek.

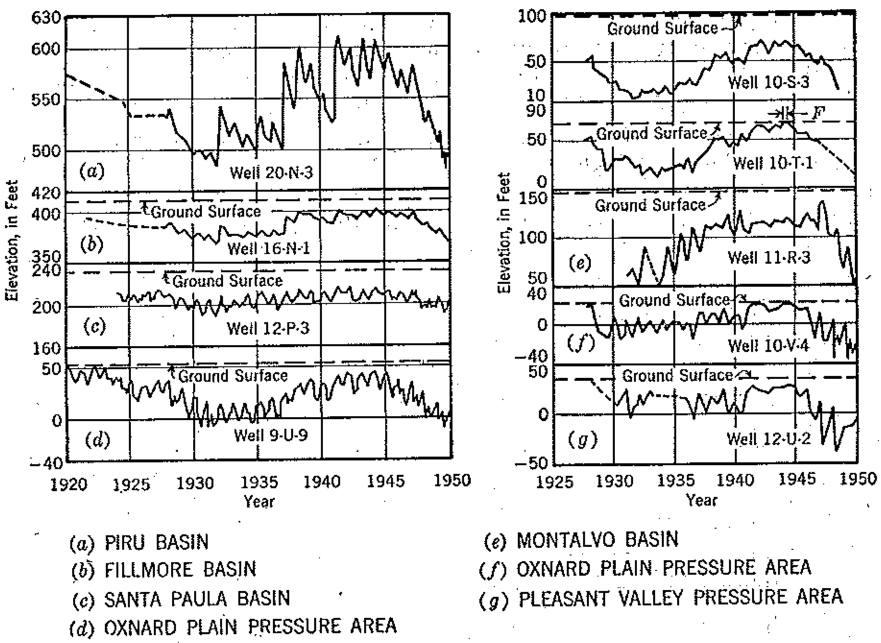

FIG. 3.—FLUCTUATION OF WATER TABLE

This is the water that could be salvaged during droughts by additional conservation works. The average annual waste during wet periods similar to 1937–1944 would be 7 to 8 times greater. Waste during drought periods will decrease as further development increases the demand for ground water, thereby causing a greater lowering of the water table in the Fillmore and Santa Paula Basins (in California). This lowering will give greater opportunity for stream-bed percolation, and the net conservation efficiency of any surface reservoirs that may be built will tend to decrease. Fluctuations of water table at wells in basins supplied by Santa Clara River are shown in Fig. 3. Although wide fluctuations are shown for Piru Basin, it is believed that there can be no overdraft there because of the ample depth of saturated alluvium remaining below the low point that has been, or may be, reached by the water table and the fact that the basin will always fill during wet periods. Fluctuations of the water table in all basins above Saticoy, will tend to increase because of increased demand, but there is no danger of overdraft. The con-

struction and operation of surface reservoirs on tributary streams will keep these basins full, unless they are utilized as underground storage reservoirs.

Over much of the coastal plain, the water (or piezometric level) is now below sea level, as shown by Figs. 4 and 5, and evidence indicates that sea

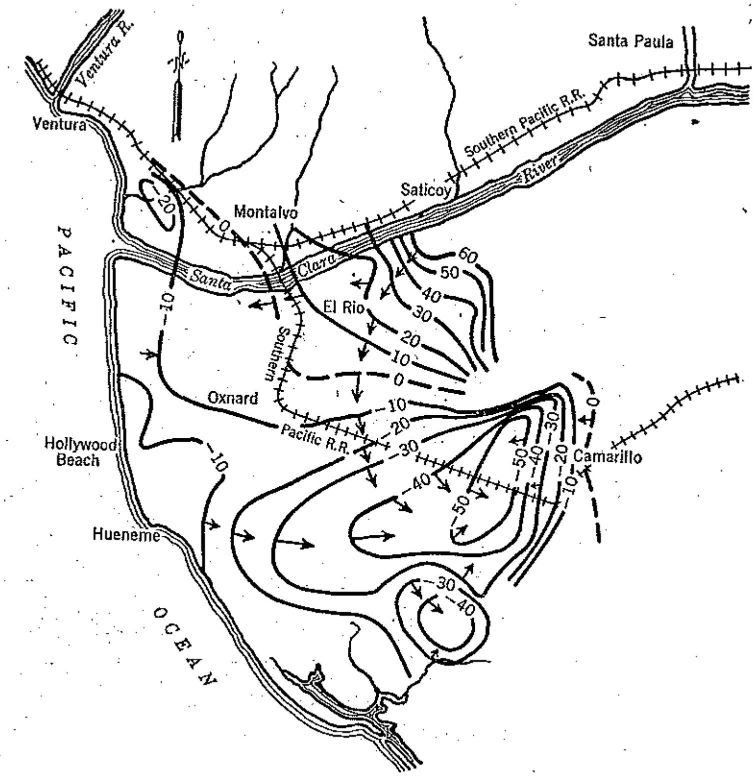

FIG. 4.—GROUND-WATER CONDITIONS ON OXNARD PLAIN IN APRIL, 1949

water intrusion has already advanced inland to some extent. The ground-water conditions on the Oxnard Plain in April, 1949, are indicated by the following table:

Elevation in feet below sea level	Area, in acres
0	55,500
−10	38,900
−20	21,600
−30	15,900
−40	7,000
−50	1,500

As indicated by the profile across the plain for spring, 1947 (Fig. 5), the transmissibility of the pressure aquifers is insufficient to meet the demand even with the Montalvo Basin (the forebay area) nearly full, unless a steep hydraulic gradient is produced by drawing the piezometric level below sea level in distant portions on the plain.

Available storage capacity in the Montalvo Basin is about 80,000 acre-ft above the record low point reached in 1931. It is believed that the basin should not be drawn below this point as the average water table elevation at that time was only about 25 ft above sea level. The supply to the Mon-

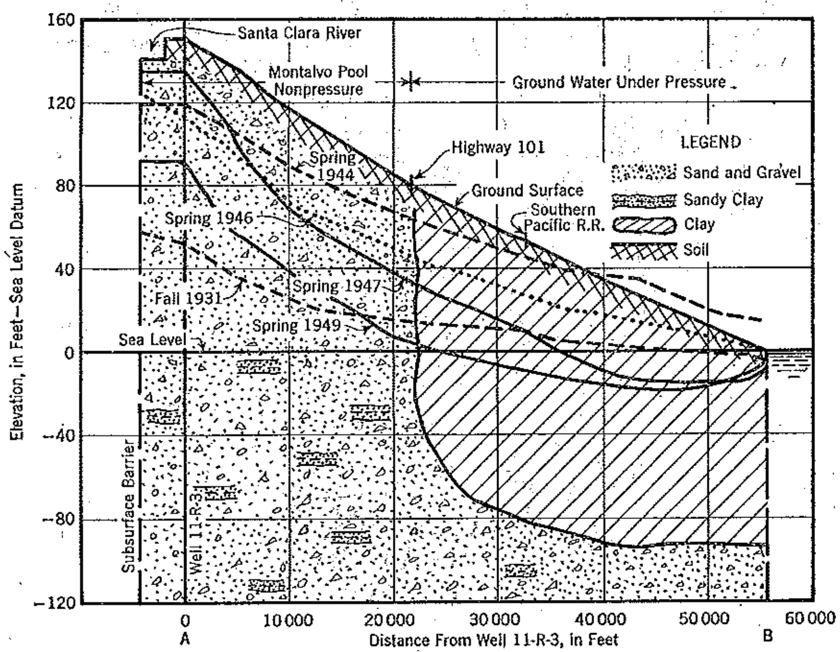

FIG. 5.—GROUND-WATER ELEVATION PROFILES

talvo Basin from the Santa Clara River during drought periods, without upstream regulation, is about 34,000 acre-ft per yr, whereas total demand on the basin is 61,000 acre-ft per yr (1950). As cultural development proceeds, the supply to the Montalvo Basin will decrease, and the demand on it will increase, thus aggravating the situation unless remedial measures are undertaken.

The problem, then, is to supply sufficient supplemental water to the coastal plain to maintain the piezometric surface above sea level at all times, or to maintain a ground-water ridge along the coast. Studies indicate that an average of 27,000 acre-ft should be provided annually by the initial project during drought periods, and that the need for new water may rise to an ultimate of 53,000 acre-ft per year.

Yield and Cost of Surface Reservoirs.—Feasible reservoir sites capable of salvaging significant amounts of water exist only on Sespe and Piru Creeks. The three most likely sites—Cold Spring and Topa Topa on Sespe Creek and Devil Canyon on Piru Creek—will be described in this paper. The capacity of Cold Spring Reservoir is limited to about 40,000 acre-ft unless several

miles of highway on extremely mountainous terrain are relocated. This is usually a very expensive undertaking.

Curves of annual yield for these reservoirs are given in Fig. 6. Curve A in each case represents yield that might be obtained from the reservoirs if all present downstream rights, other than gravity rights diverting directly from the stream, could be disregarded; that is, if there were no utilization of the ground water that is now supplied by the stream. Curve B represents new water added annually to the existing supply of the Santa Clara River system during the critical period, from runoff available at the dam site. This

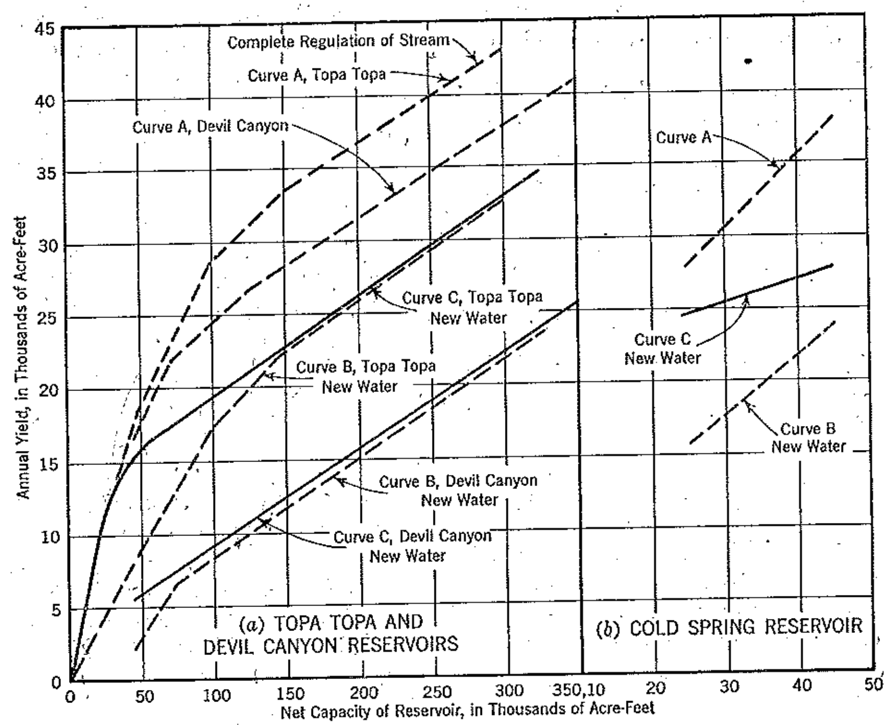

FIG. 6.—CAPACITY-YIELD CURVES FOR SURFACE RESERVOIRS

presumes the reservoir to be operated in a conventional manner with more or less uniform annual release in the regimen of demand, without regard to any planned utilization of ground water. Some of this new water for smaller capacities would be from the percolation of spill. Curve C represents new water that would be added with the reservoir operated in conjunction with underground storage. Water stored in the reservoir would be released as soon and as fast as it could be stored underground. Diversion from the release for immediate use would be made whenever possible, but the regimen of release would not be related to such use but rather to the capacity of the stream bed and spreading grounds to absorb the water. Other water would be spread first, when available, in order to achieve maximum salvage. Wells would be installed and water pumped as needed from the underground to supply areas of deficiency distant from the underground reservoir. Under this latter plan of operation, surface reservoirs act merely as regulatory storage to enable the runoff to percolate naturally or artificially, but the true storage reservoir is underground.

As previously stated, as cultural development proceeds, the amount of new water that will be added by reservoirs to the supply that would otherwise exist will progressively decrease. Evaporation and prior gravity rights were deducted in calculations for all curves of Fig. 6. Curves B and C are based on the critical period from May, 1923, to November, 1936, inclusive.

All of the new water added by Devil Canyon Reservoir on Piru Creek would not reach the Coastal plain, where the true shortage is, in time to be of benefit. A considerable proportion of water released from the reservoir during drought periods would percolate within Piru Basin and remain there, keeping the water table somewhat higher than otherwise.

With runoff on Sespe Creek controlled at Topa Topa, it is estimated that natural percolation and spreading of runoff from other portions of the watershed would contribute an average of 4,000 acre-ft per yr additional water to the supply. This reduces the amount of new water that must be added directly by surface or underground reservoirs to 23,000 acre-ft per yr. Preliminary estimates of capital costs for these three reservoirs are presented in Fig. 7. These curves are based on the critical period from May, 1923, to November, 1936, inclusive, and include an allowance for silt storage capacity for 25 years.

Proposed Solution for the Coastal Plain

To provide 23,000 acre-ft of new water annually by the construction and operation of surface reservoirs only would require 40,000 acre-ft of capacity at Cold Spring (including 4,000 acre-ft for sediment storage) and 125,000 acre-ft at Topa Topa (including 6,000 acre-ft for sediment storage). The cost for this program would be approximately $14,300,000 for the construction of the dams and reservoirs alone (1950). By building Cold Spring Reservoir to a capacity of 40,000 acre-ft and Topa Topa to 34,000 acre-ft (with the same allowances for sediment) and operating these reservoirs in conjunction with the 80,000 acre-ft of underground storage capacity available in the Montalvo Basin (assumed to be full at beginning if the critical period), the cost of construction of surface reservoirs could be reduced to $7,600,000 (1950). This is the project that is proposed for construction.

To this latter cost should be added the cost of drilling and equipping the 6 or 8 wells necessary and the cost of pumping water from Montalvo Basin. These wells need not be more than 250 to 300 ft deep, and the pumping lift would not be more than 150 ft. While these additional costs have not been definitely estimated, it is apparent that they would be far less than the $6,700,000 saving over the cost of construction of the surface reservoirs. Not all of the water put into Montalvo Basin would need to be pumped, since some would be distributed through the underground aquifers leading out from the basin.

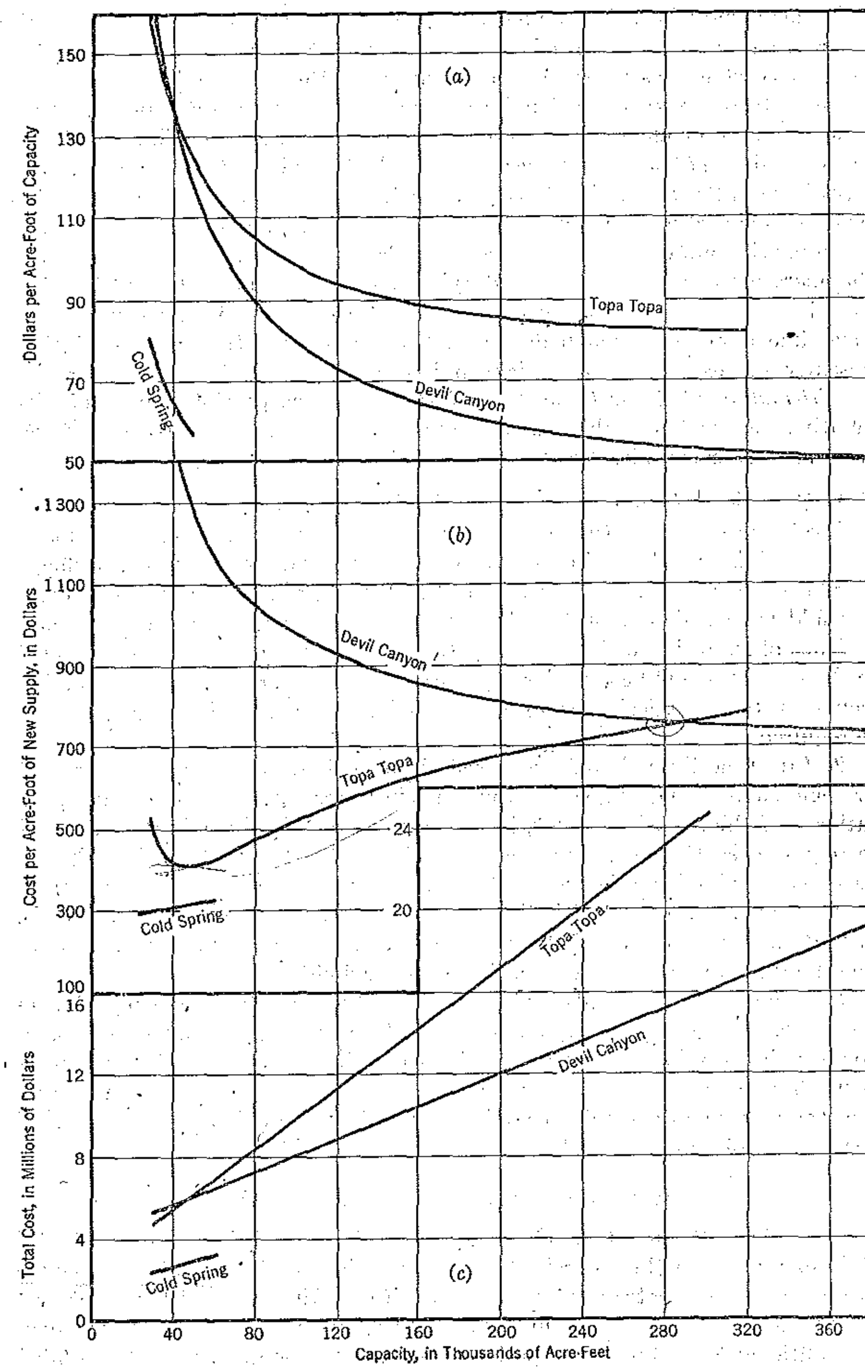

Fig. 7.—Cost of Surface Reservoirs (1950)

No plans have been formulated to provide the 26,000 acre-ft of additional new water that will be required each year eventually. An examination of the yield and cost curves (Figs. 6 and 7) will show that it would be extremely expensive to secure this additional water by the construction and operation of surface reservoirs alone. Underground storage capacity in Fillmore Basin is estimated at 170,000 acre-ft per 100 ft of depth and 125,000 acre-ft storage is available in Santa Paula. It is possible that these underground reservoirs could be operated in conjunction with some additional regulatory surface storage to provide more water for the coastal plain at considerably reduced cost. The operation of these basins would reduce some of the present wasteful consumptive use by natural water-loving vegetation along the river, but at the same time remove the small degree of flood protection that this vegetation presently affords to adjacent agricultural lands.

Distribution of Water to the Coastal Plain.—Three possible means of distributing new water to the coastal plain to prevent further intrusion of sea water are under consideration:

1. Cessation of pumping where and when the piezometric level falls to sea level, and supply to the affected areas by means of a surface distribution system. This would require very careful control and would present difficult distribution problems, and the cost of the distribution system would be high. It would meet serious objection from irrigators who prefer the ease and convenience of irrigating with pumped water. A direct charge for water applied on the surface would be considerably greater than the present cost of pumping ground water, and legal means of compelling cessation of pumping would be required.
2. Injection through diffusion wells into aquifers of the pressure area at strategic points. This injection would not interfere with the present pumping pattern. A high quality water, free of suspended and colloidal matter, would be required, so that water pumped from Montalvo Basin would be suitable. Careful control to keep the piezometric level above sea level at all points would be necessary. However, the distribution system need not be so extensive as that necessary for the first alternative, although the plan would require considerable preliminary investigation as to feasibility.
3. Building up a ground-water ridge along the coast by means of diffusion wells. This might be the simplest and least costly method, but considerable investigation would be necessary to determine its feasibility and the amount of water needed. Full advantage could be taken of the transmissibility and the storage capacity of inland aquifers since there would be no necessity of keeping the piezometric level there above sea level.

Central Coastal Plain Pressure Area

Montebello Basin acts as the forebay area for much of the central coastal plain pressure area (Los Angeles County, in California) in which there is severe overdraft and sea water intrusion. It has been estimated that, with cultural conditions as of 1945, by pulling the water table in Montebello Basin down an additional 50 ft during dry periods (thus creating storage space to be filled during subsequent wet periods), an average of about 15,000 acre-ft of water per year could be salvaged from the waste, using existing storage and spreading facilities. To accomplish this, a change in the pattern of pumping would be required, with a partial cessation of pumping from pressure aquifers near the coast and an increase in pumping from Montebello Basin. Water thus pumped from the forebay area would be supplied to the coastal areas by a surface distribution system. Further sea water intrusion would be at least partially halted.

Reclamation of Sewage

To achieve the maximum possible benefit from the reclamation of water from sewage, the utilization of underground reservoirs will be necessary for both storage and dilution. In the west basin, lying along the coast between Venice and Long Beach in Los Angeles County, extensive sea water intrusion has occurred, and pumping greatly exceeds recharge. It is proposed to add reclaimed water to the basin in this area, using spreading grounds and diffusion wells. This appears to be cheaper than possible alternative sources of supply. There seems to be little justification, however, for adding reclaimed water to an underground basin that is not overdrawn, unless the basin is to be operated as an underground reservoir with water pumped therefrom and exported to adjacent areas of deficiency. Otherwise, as stated before, the only result is to maintain the water table somewhat higher than it would be were no water added. A careful analysis of the hydrology in each case must precede development.

Financial and Legal Problems

Among the many problems involved, the following five are considered to be of primary importance:

(1) How can control be retained over the sale and distribution of water that has been salvaged by operation of an underground reservoir?

(2) Who will receive the benefit of such a conservation program and to what extent?

(3) Who is to pay the costs for conservation? How are such costs to be allocated and in what amounts?

(4) How can a legal right be attained to operate an underground reservoir, particularly if exportation is to be increased? Owners of overlying land and others having land rights would probably seek to enjoin such increase through court action

(5) Where it is necessary to lower the water table to achieve salvage, are present users from the basin to be recompensed for the additional cost of pumping, and, if so, by what amount? The incremental cost of pumping an acre-foot of water an additional 100 ft is about $1.70 for power only, assuming a plant efficiency of 60% and energy at one cent per KWH.

These similar problems are perplexing, and no simple solution is apparent. Present rights in the ground water can be determined by the adjudication procedure and these rights used as a basis for the determination of benefits and damages. This is rather lengthy and expensive, but has been used with success in ground-water problems in Southern California.

SUMMARY

The planned utilization and operation of underground storage offer the most economic means of conservation of waste waters in many areas. In Ventura County many millions of dollars can be saved by such utilization combined with regulatory surface storage, as compared to the use of surface storage only. For sewage reclamation, underground reservoirs must be used for dilution and storage in most instances.

Utilization of underground storage is by no means a simple matter, and a thorough hydrologic investigation is necessary.

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TRANSACTIONS

Paper No. 2545

THE ALLEGHENY CONFERENCE—PLANNING IN ACTION

BY PARK H. MARTIN,[1] M. ASCE

WITH DISCUSSION BY MESSRS. LOUIS P. BLUM AND PARK H. MARTIN

SYNOPSIS

Since 1943, the Allegheny Conference on Community Development has been developing and backing a plan of municipal improvement for the greater Pittsburgh (Pa.) area. This paper outlines the aims of the organization and its method of cooperation with existing planning bodies.

Among the many civic improvements credited to the Conference are a successful smoke abatement program, highway and bridge development, planning for stream pollution abatement, and alleviation of parking congestion in the city. In addition, the Conference has been active in the redevelopment of Pittsburgh's Golden Triangle district.

INTRODUCTION

Purpose.—The Allegheny Conference on Community Development (hereafter called the Conference) is an incorporated civic agency, privately financed, designed to do a job of research and planning in Allegheny County, Pennsylvania, to the end that an over-all community development program might be created, and by educational means to secure public support for such a program. Formed in the spring of 1943, the Conference first produced tangible results in the early part of 1945. Citizen committees, composed of persons qualified to deal with the particular phase of the program under study, were appointed. In some instances in which local, qualified agencies existed, they were asked to undertake specific studies; in other instances, studies have been carried on by the Conference staff. Consultants have been called in as needed.

Scope of Program.—As a result of the studies, the Conference developed a community development program that included recommendations on the following major items: smoke control; flood control; highways and bridges;

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