GROUND-WATER RESOURCES IN NORTHEASTERN COLORADO

by

Robert A. Longenbaugh

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Northeastern Colorado encompasses several prin-al ground-water aquifers. A brief description of aquifers, their location, and characteristics fol-s. Figure 1 depicts the total area and has been sub-ided into five areas coinciding with ground-water ifers having like characteristics. The areas rep-ented are: (I) the artesian aquifers of the Denver in; (II) the alluvial aquifers of the South Platte er and its tributaries; (III) the Ogallala and Arikaree aquifers on the High Plains; (IV) the Ogallala, Arikaree and White River aquifers of northern Colorado; and (V) the area of shale and impermeable sandstones yielding less than 50 gallons per minute.

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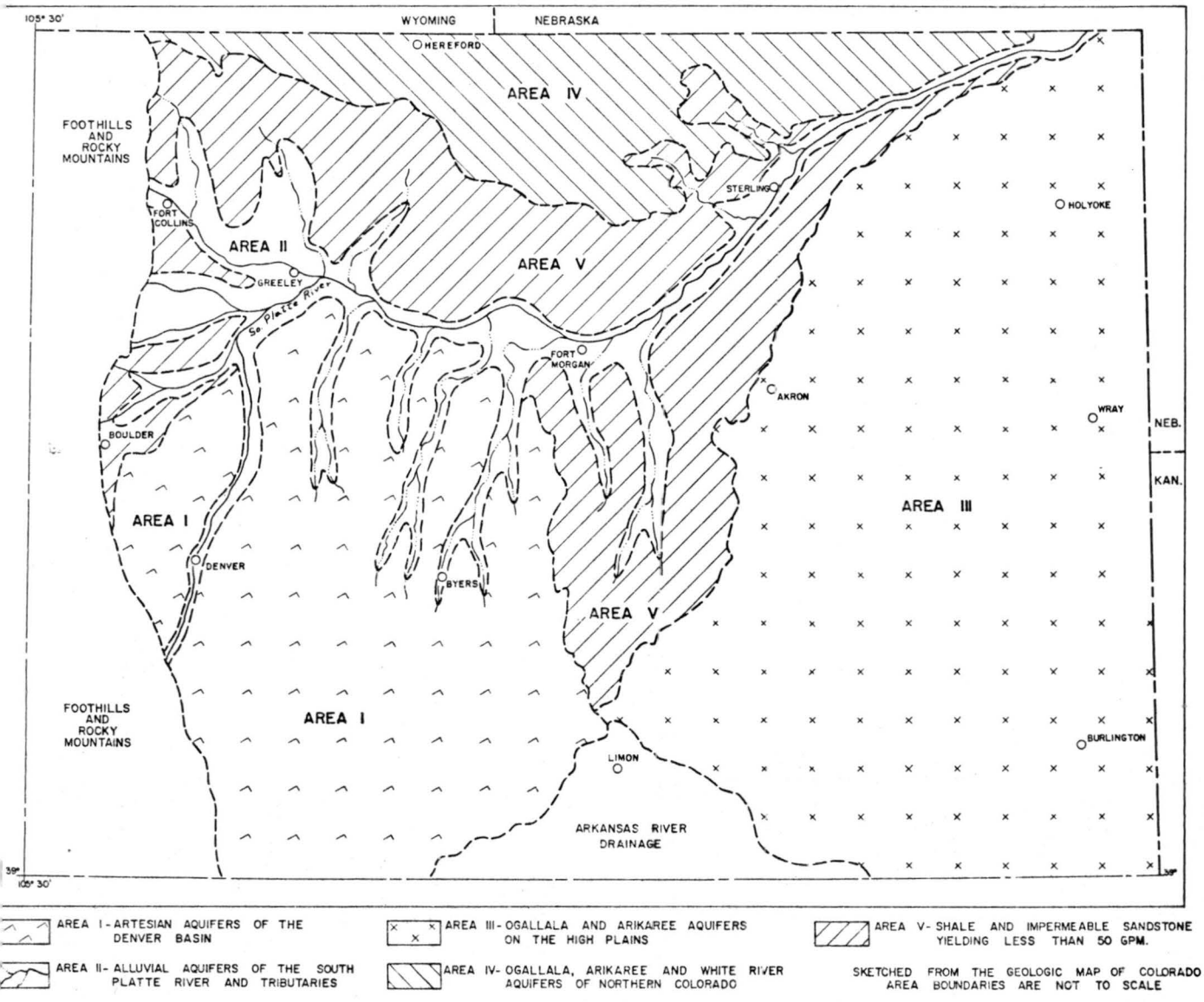
Artesian Aquifers of the Denver Basin

The Fox Hills Sandstone, the Dawson Arkose, the Arapahoe Formation, and the Denver Formation comprise the artesian aquifers of the Denver basin. These aquifers range in age from Late Cretaceous through Tertiary. The lowermost aquifer, Fox Hills,

FIGURE 1. SKETCH OF PRINCIPAL GROUND-WATER AQUIFERS IN NORTHEASTERN COLORADO



ds over some 6,000 square miles and reaches
s of more than 2,500 feet. The Fox Hills Sand-
is primarily a marine deposit, but the other
ers are of continental origin. Outcrops of the
ian aquifers occur south and west of Denver,
he principal recharge site is believed to be in
Black Forest area near Castle Rock, Colorado.
ne first successful artesian well was drilled in
Rapid development followed and by 1896 there
400 artesian wells in the Denver basin. Today
6,000 wells tap the artesian aquifers of this
and in addition, numerous shallow wells have
completed in the alluvium and in the crystalline
tions west of Denver. Originally, water flowed
e surface, but by 1890 only a few wells were
lowing. A continuous decline of the artesian
ure has occurred through the years and in
places today it is necessary to lift water about
eet. In 1962 there were about 900 new wells
l in the Denver metropolitan area, 350 tapping
rtesian aquifers. No significant dewatering of
quifers has yet occurred. It is estimated that
resent annual withdrawal is about 50,000 acre-
Estimates indicate that between one-half and a
n acre-feet of water could be withdrawn from
rtesian aquifers before serious dewatering oc-
This assumes no recharge, but since there is
recharge the amount of withdrawal could be
. Water from these aquifers is of desirable
y for municipal, industrial and domestic use.
a small amount is pumped for irrigation.

al Aquifers of the South Platte River

ea II of figure 1 shows the distribution of the
al aquifers of the South Platte River and its
aries. The alluvium consists of Pleistocene and
t terrace and flood-plain deposits (Bjorklund
Brown, 1957). The principal ground-water
e is the alluvium of the South Platte River Val-
d the tributary valleys of Lost, Kiowa, Bijou,
Arroyo, Badger, Beaver, Wildcat, Pawnee, Lone
Crow, and Boxelder Creeks and the Poudre,
hompson, Little Thompson and Saint Vrain
s.

e alluvial deposits are composed of poorly
sands and gravels with occasional clay lenses.
lluvium varies from zero to about 300 feet in
ess with the greater thickness occurring in
uth Platte Valley. Saturated thicknesses also
nd are generally greater in the Platte Valley.
that yield from 500 to 1,000 gpm can be de-
d in most of the alluvium; and where the satu-
alluvium is very thick, it is possible to obtain
that produce 2,000 gpm. It is estimated that
luvium of the South Platte basin contains at
least 25,000,000 acre-feet of ground water.

Wells for municipal, domestic, stock, industrial and irrigation water supplies tap the aquifer. Today there are more than 5,200 irrigation wells in the South Platte Basin that pump as much as 1,000,000 acre-feet annually. Water levels in the South Platte River Valley have not declined significantly yet, but the water levels of tributary valleys such as the Bijou, Kiowa, Beaver and Badger are declining. Withdrawals have exceeded the recharge. Recharge in these tributaries is from precipitation and flood runoff, while the South Platte River and irrigation canals tend to recharge the alluvium in the Platte Valley.

Municipal and industrial demands are increasing and may require additional ground-water supplies. A water management plan is needed in the Platte Basin to coordinate surface and ground-water supplies. The Platte Valley itself will probably have sufficient water if used properly, but some of the tributaries are already over-developed and a few wells were abandoned in Kiowa and Bijou Creeks last year.

The Ogallala and Arikaree Aquifers on the High Plains

The Arikaree and Ogallala Formations, together, cover an area of about 9,500 square miles in eastern Colorado. Both formations are composed of poorly bedded sands and gravels that are heterogeneous and contain deposits of silts and clays. Varying degrees of cementation are present in the sands and gravels. The Arikaree Formation, present in the northern one-fourth of the area, yields moderate amounts of water for irrigation purposes in the vicinity of Holyoke.

The Ogallala Formation covers an area of about 9,000 square miles and varies in thickness from a few feet on the west edge to 400 feet on the Kansas-Nebraska line. Accordingly, the saturated thickness varies from zero to about 350 feet on the east side. Well yields of 1,500 to 2,000 gpm have been reported for some of the better wells near Burlington, but the average for the entire area is about 800 gpm. The general ground-water movement in this area is to the northeast. The volume of water pumped in the area during 1960 was estimated to be 60,000 acre-feet (McGovern & Coffin, 1961). Pumping lifts are generally over 120 feet. Shallow wells tapping the alluvium adjacent to the Arikaree and Republican Rivers also exist in the area, but generally this water supply is limited. Present storage in the Ogallala is estimated to be 80,000,000 acre-feet.

Irrigation wells constitute the principal draft on the aquifers although municipal, domestic and stock-water supplies are also withdrawn. There were about

irrigation wells in the area in 1950; the number eased to 400 in 1960, and is now estimated to ed 500. Further development is expected along eastern portion of the area in the zone of greatest rated thickness.

fers of Northern Colorado

Area IV (fig. 1) includes the Arikaree and Ogal- Formations and the White River Group. The llala and Arikaree Formations are the same as ne High Plains, but the aquifers and saturated s are both thinner. The maximum thickness of Arikaree is 80 feet and the Ogallala is about 200

The White River Group (Babcock and Bjork-, 1956), can be further subdivided into the Chad- and Brule Formations. The Chadron is generally lt and clay deposit that locally may be sandy. e domestic and stock water supplies are from aquifer. The Brule is a jointed and fractured onitic siltstone that yields water for irrigation for municipal, domestic and stock consumption. amount of fracturing controls the well yields.

Deeper aquifers include the Fox Hills and Lara- Formations which produce water for some do- tic and stock water supplies. Alluvial terrace and am deposits also occur and provide sufficient r for irrigation wells in some localities.

Municipal, domestic and stock water supplies can lly be obtained in Area IV, but water for irri- on has been developed only near Hereford and hwest of Sterling. Ground-water supplies for re development of stock, domestic and municipal is adequate, but additional water for irrigation his area will be limited.

e and Unsaturated Sandstone Aquifers

Area V (fig. 1) is dominated geologically by the re Shale and the Laramie Formation. These for- ions contain large amounts of gray to blue shale, some sandstone and coal layers present in the amie. Wells in this area generally yield less than 50 gpm, but are used for domestic and stock water-supplies. Water from these wells is often high in dissolved solids. Sufficient ground water is available in this area to satisfy future domestic and stock water needs. North of the South Platte River, a few wells tap the Fox Hills Sandstone which underlies the Laramie Formation.

Summary

Generally speaking, the ground-water supplies of the South Platte River Valley and the High Plains area are large enough to support the present demand and some future development. Excessive development of ground-water supplies in the artesian aquifers of the Denver basin and the alluvial aquifers of tributary streams to the South Platte River has resulted in the lowering of the water table. Water-quality studies and water-management plans, including both surface and ground-water supplies, are needed now to help us use our water resources efficiently.

ACKNOWLEDGMENTS

The author wishes to acknowledge the oral and written communications of Mr. George Chase of the Ground-Water Branch of the U. S. Geological Survey. Data provided by Mr. Chase was mainly used in the discussion of the artesian aquifers of the Denver basin.

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