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MINERAL RESOURCES AND GROUND-WATER SUPPLIES IN THE ARKANSAS BASIN IN KANSAS

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General

The Arkansas Basin includes nearly half the area of Kansas and produces slightly more than half the total value of Kansas raw mineral products. A larger percentage of the total ground water pumped in the State comes from the Arkansas Basin. In 1949 the total value of raw mineral materials from this area was $178,400,000; incomplete figures for 1950 indicate that the total for the year will be at least 10 percent greater. In the western half of this area there are 150,000 to 175,000 acres of land under well-water irrigation, and more than 100,000 acre-feet of water is pumped annually for irrigation purposes. As much if not more water is pumped annually in the Arkansas Basin for municipal and industrial uses as is pumped for irrigation use. Estimated total average daily pumpage is well in excess of 200,000 gallons.

When we add to these impressive figures the fact that a sizable part of the industry and business of this area is derived from the processing and use of these raw mineral materials and underground water supplies, it becomes readily apparent that the underground resources of the Arkansas Basin in Kansas play a vital and perhaps dominant role in the total economy of this region. These underground resources must be given careful consideration at all stages of planning and execution of basin-wide development of the Arkansas River watershed.

In a brief review of the mineral resources and ground-water supplies of the basin it will be impossible for me to present many details and I will attempt merely to outline the occurrence of these resources in the Kansas

part of the basin. However, I wish to call your attention to the many published reports of the state Geological Survey of Kansas that may serve as source material for detailed investigations. A map showing the extent of the petroleum industry in the State and a nontechnical summary of ground-water supplies in the southwestern area are particularly usable for regional studies. Also, a map showing graphically the many mineral resources of the State is now in preparation.

Mineral Resources

The mineral resources of southern Kansas display a distinct geographic pattern which is controlled by the geology of the area. In general older rocks that dip slightly to the west crop out in the eastern area and as one proceeds westward the rocks observed at the surface become younger. Traversing this area from east to west for mineral resources we find zinc and lead mining in the southeastern corner; coal and shale adjacent to the west and north; gas and oil still farther west in an area that also contains limestone, sand and gravel, and ceramic raw materials; the vast salt deposits start just west of Arkansas City and Wichita and continue westward; and gypsum is mined in Barber County. The State's principal gas reserve occurs in the Hugoton field in the southwestern area.

Oil and gas. -- The petroleum industry accounts for a larger dollar value annually than all other mineral industries combined. Of the 60 counties that lie wholly or partly within the basin in Kansas, 52 produce oil or gas. Annual production is approximately 41 million barrels of oil valued at 100 million dollars. Proved oil reserves exceed 300 million barrels (at current prices worth approximately 800 million dollars). Annual gas production is approximately 360 billion cubic feet valued at 26 million dollars; estimated gas reserves are 15, ~~000 billion~~ trillion cubic feet (at current prices worth approximately 1,200 billion million dollars).

Coal. -- Ninety-nine percent of Kansas coal production comes from the Arkansas Basin area. The value of current coal production exceeds 8 million dollars per year, and reserves are adequate for the foreseeable future at present production rates.

Zinc and lead. -- All Kansas production of zinc and lead comes from Cherokee County, although some lead deposits are known to occur in Linn County. Annual value of present production exceeds 10 million dollars.

Cement. -- Portland cement is made in Allen, Montgomery, Neosho, and Wilson Counties. The value of the annual output from these counties is about $17,500,000. Reserves of raw materials occur throughout much of the eastern part of the basin area. Natural cement is produced in Bourbon County.

Sand and gravel. -- Sand and gravel deposits occur in much of the basin area, and "chat" as a by-product of mining activities occurs in Cherokee County. Annual production is valued at more than 6 million dollars and reserves are extensive.

Salt. -- Most of the Kansas salt mines are in the Arkansas Basin area in Rice and Reno Counties. The 1949 production amounted to 595,641 tons valued at $4,407,397. Reserves of salt in the area are estimated at 5,000 billion tons.

Building stone. -- Dimension stone for building purposes has for many years been produced at several quarries in Cowley and Chase Counties, and smaller or intermittent operations have gone on at a number of other places.

Crushed rock and agricultural limestones. -- Very large reserves of limestone suitable for crushed rock and agricultural limestone occur in nearly half of the counties in the basin. It is produced in numerous quarries in counties east of McPherson, Sedgwick, and Sumner. Output is valued at approximately 5½ million dollars annually.

Ceramic clays and shales. -- Clay and shale suitable for ceramic use occur in the majority of the counties in the basin. Brick and tile plants

are operating in Allen, Cowley, Crawford, Montgomery, and Wilson Counties. Clays suitable for the manufacture of lightweight aggregates are known to occur in several of the counties as do rock wool raw materials. Several potteries are now in operation and additional clay deposits have been tested. The annual value of ceramic products from the basin area exceeds 3 million dollars annually and is growing rapidly.

Volcanic ash. -- Scouring powders, abrasive soaps, ceramic glazes, sweeping compounds, and other products utilize volcanic ash produced in this area. At least 11 counties contain workable deposits and the reserves are large.

Gypsum. -- One mine and plant for the production of gypsum and gypsum products is in operation in Barber County. The reserves of the area are large.

Potential mineral products. -- In addition to the many mineral materials now being produced in this region many other potential mineral resources have been studied by the State Geological Survey. These include asphalt rock in the east-central area; oil shale, also in the east-central area and essentially coextensive with phosphatic shales; glass sand which is also a general silica sand and high-duty casting sand in Barber, Comanche, and Kiowa Counties; dolomite in small quantities in a few counties;chalk in Finney, Ness, and Lane Counties; and small deposits of diatomaceous marl, bentonite, and refractory clay. Pyrite was produced formerly in Cherokee and Crawford Counties, and processing plants for tripoli and helium have operated in the basin. The possibilities for producing feldspar and potash as by-product materials are now being investigated.

It is obvious from the foregoing that the mineral industries of the Arkansas Basin in Kansas are many and varied, and that there exist many potential opportunities for future expansion and still further diversification.

Ground-Water Resources

The abundance, quality, and occurrence of ground water, as in the case of mineral resources, are controlled largely by the details of local geology and change markedly from east to west. The pumpage of well water for irrigation, municipal, and industrial purposes in the Arkansas Basin in Kansas substantially exceeds 200,000,000 gallons per day on the average. Most of this water is obtained from the central and western parts of the area and irrigation usage is restricted largely to the western one-third. There are an estimated 1,500 well-irrigation plants in that part of the State.

In the southeastern corner of the State potable waters are obtained from the Ordovician rocks at depths exceeding 1,000 feet. These aquifers are used only a short distance westward in Kansas as the water farther west becomes too highly mineralized. These deep-rock sources of water are being drawn upon extensively in the Pittsburg to Baxter Springs area and are of great importance to the industries of that area. Although supplies are meeting present demands, the quantity of water obtainable in the future from these rocks is limited and therefore greatly expanded future developments from the deep aquifers should not be anticipated. Shallow aquifers of limited capacity exist in this area and also continue westward to the position of the Arkansas River. Throughout the region west of Crawford and Cherokee Counties and east of McPherson and Sedgwick Counties ground water occurs in limitied quantities in bedrock formations at relatively shallow depths and in moderate to limited amounts in thin alluvial fills of major valleys. This region is generally poorly supplied with ground water.

The south-central Kansas region contains more abundant quantities of ground water in discontinuous aquifers. Sand and gravel deposits occur as relatively thick fills in abandoned Pleistocene valleyways and along the existing major and some minor valleys. Such areas are abundantly supplied

with ground water of variable quality but are separated by areas lacking such deposits and their contained water. The alluvial plain of the Arkansas Valley, the filled valley across McPherson and Harvey Counties, and others in Rice and adjacent counties are particularly productive of water. Except at only a few localities aggregating not more than a few townships in total extent these ground-water resources are essentially undeveloped and constitute an important future source.

Southwestern Kansas, in spite of its relatively low rainfall, contains the most prolific aquifers and abundant supplies of ground water in the State. This is because of the extensive near-surface deposits of sand and gravel and the several sand-dune tracts that afford excellent recharge conditions. It is within this southwestern area that nearly all the irrigation development is located, and where there is to be found the greatest reserve of ground water in Kansas. It is estimated that 175,000,000 acre-feet, or 57 trillion gallons, of water are in storage in the southwestern 15 counties, and that the annual increment of recharge or replenishment of water to these aquifers, exclusive of seepage from the major stream channels, is approximately 160,000 acre-feet or 52 billion gallons. Within southwestern Kansas there are only a few small areas where maximum potential development of ground water has been approached, and the "safe yield" is judged not to have been exceeded anywhere within the region. In much of the region large additional supplies of ground water can be developed if it is economically feasible.

Since 1937 ground-water investigations in Kansas have been conducted on a completely coordinated and unified basis. In that year a cooperative program of work was instituted by the State and Federal Geological Surveys with cooperation from the Division of Water Resources of the State Board of Agriculture and the Division of Sanitation of the State Board of Health. The cooperative program has greatly increased the efficiency of ground-water work in Kansas

and field investigations of more than two-thirds of the south-central and southwestern areas have been completed; however, the data available for southeastern Kansas are less adequate.

Conclusions

In the Arkansas Basin in Kansas, mineral resources exert an important influence on the economy of the area, and ground-water resources in the western two-thirds of the area are of great importance. These underground substances should be given careful consideration along with the many other factors, in basin development planning.