JULY 1989

Oklahoma Water News

MONTHLY NEWSLETTER OF THE OKLAHOMA WATER RESOURCES BOARD

Groundwater? Stream Water? Are Springs Neither or Both?

When assessing Oklahoma's native water resources, one might initially consider vast and ancient underground sources lying nearly motionless hundreds or thousands of feet beneath the earth; or fertile rivers and streams winding through prairie canyons in the west and around lush, green hills in the east.

But geologic forces which created these precious natural formations also spawned other, more mysterious sources which are both ground and surface waters—yet neither. Undoubtedly, they are the most conspicuous forms of natural return of groundwater to the surface. Infiltrating the ground through porous soils, fractures and sinkholes, these waters journey through the earth's circulatory system—sometimes at depths of hundreds of feet—only to reemerge as springs, clean and clear, through openings in rocky bluffs or the soil. Their existence depends on many factors—among them geology, hydrology, topography and climate.

Often, springs discharge below the water table in oceans and freshwater lakes, making them hard to measure. Very small springs don't really "spring" from the earth at all; they merely seep onto the ground. Others emerge forcefully from majestic cliffs or as geysers, shooting scalding jets of steam and water high into the air. Many are intermittent, flowing only during or after a rainfall. Springs may issue from a single or many openings.

Spring waters are typically very clear—especially those which issue from limestone and soft gypsum aquifers. The clarity, as well as the quality, of groundwater reflects the chemical composition of the rocks with which it comes in contact. As water seeps down through soil and rock, it takes minerals into solution, so its quality is determined by the type, concentration and solubility of minerals it encounters. Little particulate matter is added to spring water from highly soluble limestone formations, while springs emerging from unconsolidated sandstone aquifers are usually less pure. Unfortunately, spring water from limestone aquifers often takes into solution calcium and magnesium, resulting in "hard" water, often undesirable for human consumption as well as some industrial uses.

Some springs appear "blue" when the water collects in pools. Experts attribute the bluish hue to the reflectance properties of tiny particles held in suspension. But the relative ease with which contaminants can enter a spring system makes them highly vulnerable to pollution, so untreated spring water normally should not be used for drinking.

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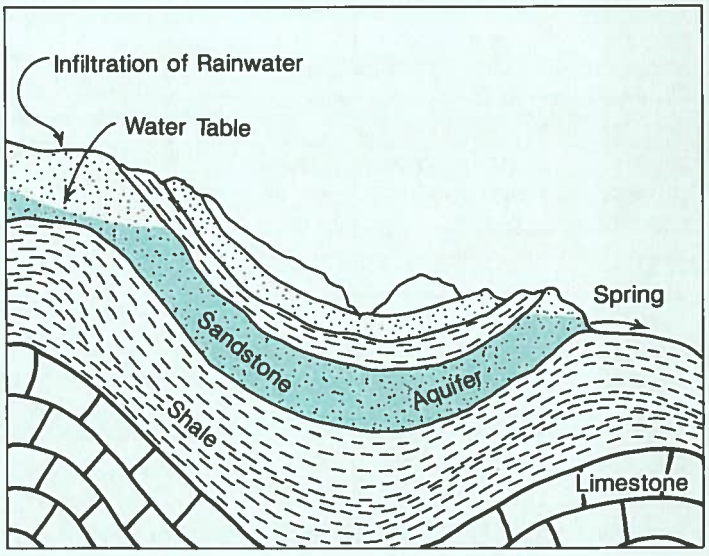

Cross-section of a typical spring, formed when the water table intersects the land surface.

There's a mystique about spring waters. Tonics? Cure-alls?

Medicinal properties of springs have long been thought to revive strength and vigor and cure debilitative illnesses. While little scientific evidence exists to confirm it, the soothing waters of "hot" springs are widely considered therapeutic for aching muscles or minor cases of arthritis. Bottled spring water, targeted at health-conscious consumers, has recently become a booming industry.

Although some springs flow constantly, but at uneven rates, it is difficult to determine their relative size or rate of discharge. As a result, long-term records are required to accurately determine flows.

In the U.S., most large springs (having a discharge of 100 cubic feet per second) exist in Florida, Missouri, Idaho, Oregon and northern California. Silver Spring, in Florida, may be the largest limestone spring in the U.S., discharging some 531 million gallons per day. Widely known for its clarity, the spring issues forth from several openings in a subtropical forest and gives rise to a navigable stream.

Oklahoma's divergent topography and climate have had a pronounced effect on springs and the state has its share of attractive springs.

As elsewhere, Oklahoma springs issue from aquifers in limestone and/or sandstone formations such as those in the Arbuckle Mountains, the Ozark region of the northeast, and the Black Mesa region of the Panhandle. Several years ago, the U.S. Geological Survey and the Oklahoma Geological Survey began an inventory of state springs. Although funding problems cut short the study, the two agencies assembled substantial quantity and quality data.

According to Bob Burchett, USGS district chief, field staff measured discharges in several regions where springs are prevalent. USGS computers now have on file rough data on springs in 28 counties and partial data on an additional 10 counties.

In the Panhandle and northwest Oklahoma, the nearly perennial flow of the Cimarron River is augmented by numerous small springs and seeps which issue from the Dakota Sandstone Formation in northwest Cimarron County. During the 1956 drought, many of the state's rivers were dry while the Cimarron's lowest daily flow, near the eastern edge of the High Plains, was approximately 4,300 gallons per minute (gpm), or almost 9.6 cfs. Sandstone red beds along the Cimarron River in Harper, Woodward and Major Counties are interspersed with massive gypsum layers. Groundwater has dissolved the gypsum and left behind solution channels and huge caves such as Alabaster Caverns in Woodward County. At Roman Nose State Park and elsewhere near the river, large springs of highly mineralized water flow from these cavities.

Not all springs in eastern Oklahoma emit fresh water. Shallow seas which covered much of western Oklahoma millions of years ago left behind vast salt deposits. Now, salt springs supply much of the flow and tons of chlorides daily to the Elm Fork and other tributaries of the Red River, as well as Lake Texoma.

Many clear spring-fed streams lace the Ozark Region of northeastern Oklahoma, where limestone beds have fractured or dissolved, creating interconnected passageways for the free flow of underground water. Where streams have cut valleys below the water-bearing section of the limestone, bountiful springs flow out of rocky openings at rates sometimes exceeding 1,000 gpm, and many seeps dot the region.

Today, these waters are used for livestock, domestic purposes and recreation. More importantly, they provide the headwaters and base flow of many streams. Spavinaw Creek (on which Tulsa has developed two major water supply reservoirs—Spavinaw and Eucha) derives much of its flow from springs issuing from the Boone Formation, an important limestone aquifer. Water from this source is one of the best quality municipal supplies in Oklahoma.

Spring-fed Honey Creek provides the beauty for scenic Turner Falls.

A 1968 USGS study of the Ozark Region estimated that the collective discharge of 25 selected springs along with small seeps in the area was enough to furnish the domestic water supply to a population of 200,000. Spring flow in Ottawa County alone came to more than 14 million gallons of water per day. The largest spring measured, in Delaware County, discharged 3,600 gpm.

Nowhere else in Oklahoma, and probably not in North America, is such a large span of geologic time evident in such a compact area as in southern Oklahoma's Arbuckle Mountains. Part of the region is underlain by one of the most prolific aquifers in the country, the Arbuckle-Simpson. Thick dolomite and limestone beds were raised, tilted and broken by forces that created the mountains. Over millions of years, water has entered fractures in the limestone, dissolving cavities and channels and allowing water to circulate at great depths. Such activity makes this area a prolific source of springs, especially in Johnston County, which probably is home to the greatest density of measurable springs in Oklahoma.

Information has been obtained for more than 100 springs issuing from the Arbuckle-Simpson Aquifer in its outcrop area. USGS officials confirm that many of these are short-lived "wet weather seeps" which discharge only during or after rainfalls. Such springs probably occur where the water table is "perched" and cease flowing when the perched water recedes below the discharge point.

Arbuckle springs contribute substantially to the flows of Blue, Honey, Pennington and Mill Creeks and other streams that drain the mountains. The rather high perennial flow in the uppermost reaches of Blue River supplies water for downstream irrigators, residents of Durant and a state fish hatchery. And as the home for scenic Turner Falls, Honey Creek provides recreation for thousands of visitors each year.

One of the largest springs in the region is Byrds Mill Spring, 12 miles south of Ada, which has supplied water to that city since 1911. Although it, too, is subject to rapid fluctuations, USGS gages on the spring have annually registered discharges from 3,600 to 18,000 gpm.

The Arbuckle-Simpson Aquifer also generates springs in and around the Chickasaw National Recreation Area, near Sulphur. Springs in eastern areas of the park produce good quality water, thought to originate in the Arbuckle Formation. However, those in the western sector contain highly mineralized poor quality water, the source of which may be the overlying Simpson Formation. The strange taste and odor of the water have led to the belief that the springs have medicinal value.

The same forces which created the Arbuckles also lifted the Wichita Mountains. Here, also, the Arbuckle Group outcrops and emits springs. A bountiful spring near Meers eventually flows into Lake Lawtonka, providing the reservoir and the City of Lawton with as much as one million gallons per day.

mainstream

FIA Videocourse August 23

The Federal Insurance Administration (FIA) will sponsor a live, interactive, nationwide video course on August 23, via the Federal Emergency Management Agency's (FEMA) Emergency Education Network. Titled "Community Floodplain Management," the broadcast will begin at 10 a.m. at three Oklahoma locations.

According to Engineering Division Chief Harold Springer of the OWRB, which coordinates the federal flood insurance program in Oklahoma, the 4½-hour videocourse is designed especially for local officials. Springer said it will focus on the "nuts and bolts" of floodplain management and will cover information on flood maps, administrative procedures and community assistance. Presenters will be local and state floodplain administrators and regional FEMA representatives.

The telecast can be viewed in Tulsa at the Red Cross Center, 10151 East 11th Street. For information, call Randy Jones at (918) 831-1100.

In Oklahoma City, Oklahoma Civil Defense will host the videocourse at their offices at 2915 North Lincoln. For information, contact Lou Miller at (405) 521-2481.

In Lawton, the presentation will be at the Great Plains Area Vo-Tech, 4500 West Lee Blvd., Building 300, Room 301. For further information, call the Civil Defense office in Lawton at (405) 355-1483.

Further information on the videocourse is also available by calling Ken Morris at the OWRB in Oklahoma City at (405) 271-2555.

Well Sampling Underway

On July 10, OWRB staff from the Oklahoma City headquarters and all branch offices began an extensive sampling program that will yield water quality information on 182 wells in 21 major groundwater basins.

According to Groundwater Division Chief Duane Smith, samplers will collect three samples from each well—one to check metals, one to analyze for common ions, and another to measure nutrients. Smith said it is important to sample during the irrigation season when heavy use flushes wells of stagnant water and presents a more representative sample of the water's quality.

The State Water Quality Lab, operated by the State Department of Health, will analyze the water samples. Information from the program will be incorporated into Oklahoma's Water Quality Standards which, for the first time in 1985, included specific organic parameters for groundwater.

Gary Glover, OWRB hydrologist who oversees the field work, said all sampling should be finished by August 31. He pointed out that 1989 is the seventh consecutive year that OWRB staff members have collected samples on these wells.

Use a Leak Detector Free

If you've ever lived in a rural water district, you know that every drop of water saved is money in your pocket. That's why the OWRB and the Oklahoma Rural Water Association cooperate in a very successful program to save every precious drop of water rural residents pay for. Walid Maher, who oversees the OWRB program, points out that nationally, it is estimated that water system losses average 15 percent.

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The Water Resources Board owns the leak detector and provides it and a small operating fund, according to an annual contract with the ORWA. ORWA, in turn, makes the detector and its operator available without charge to any rural water district in the state that suspects its system has costly leaks. The Association maintains and operates the equipment and requires only that the water district provide an assistant to their technician.

Rural water district officials who suspect water losses in their system's lines can make an appointment for the leak detector and an ORWA technician by calling Association offices in Oklahoma City at (405) 672-8925.

ACTIVE CONSERVATION STORAGE IN SELECTED OKLAHOMA LAKES AND RESERVOIRS AS OF JUNE 28, 1989

PLANNING REGION LAKE/RESERVOIR	CONSERVATION STORAGE (AF)	PERCENT OF CAPACITY
SOUTHEAST		
Atoka	123,475	100.0
Broken Bow	918,100	100.0
Pine Creek	77,274	99.5[2]
Hugo	157,600	100.0[2]
McGee Creek	109,800	100.0
CENTRAL		
Thunderbird	105,925	100.0
Hefner	75,355	100.0
Overholser	15,935	100.0
Draper	88,715	88.7
Arcadia	27,390	100.0
SOUTH CENTRAL		
Arbuckle	62,548	100.0
Texoma	2,637,700	100.0
Waurika	203,100	100.0
SOUTHWEST		
Altus	132,886	100.0
Fort Cobb	78,423	100.0
Foss	243,810	100.0[1]
Tom Steed	88,971	100.0
EAST CENTRAL		
Eufaula	2,329,700	100.0
Tenkiller	627,500	100.0
Wister	63,250	100.0[2]
Sardis	302,500	100.0
NORTHEAST		
Eucha	79,567	100.0
Grand	1,448,100	97.1
Oologah	544,240	100.0
Hulah	30,594	100.0
Fort Gibson	365,200	100.0
Heyburn	6,600	100.0
Birch	19,200	100.0
Hudson	200,300	100.0
Spavinaw	30,000	100.0
Copan	43,400	100.0
Skiatook	311,770	97.6
NORTH CENTRAL		
Kaw	428,600	100.0
Keystone	616,000	100.0
NORTHWEST		
Canton	97,500	100.0
Fort Supply	13,900	100.0
Great Salt Plains	31,400	100.0
STATE TOTALS	**12,736,328**	**99.5**

1. Conservation storage lowered for project modification
2. Seasonal pool operation

Data courtesy of U.S. Army Corps of Engineers, Bureau of Reclamation, Oklahoma City Water Resources Department, and City of Tulsa Water Superintendent's Office.

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