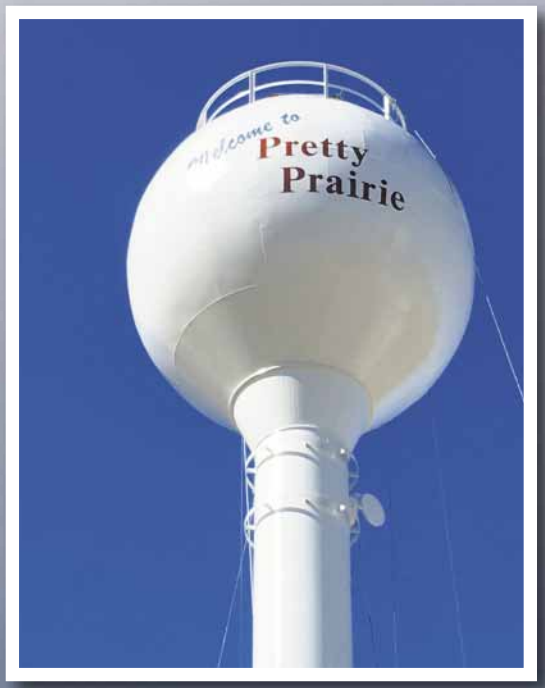
By Delbert Zerr, KRWA Consultant

Pretty Prairie – Most Improved Water System Announced at the 2022 KRWA Conference



A new 50,000-gallon elevated tank was constructed as part of the Pretty Prairie project.

The city of Pretty Prairie was officially recognized by the Kansas Rural Water Association during the 2022 Annual Conference & Exhibition.

Pretty Prairie has a population of approximately 650 and is located in south-central Kansas about 15 miles south on Kansas Highway 14 and five miles west of the city of Hutchinson in Reno County. Pretty Prairie was platted in 1889 and incorporated in 1907. It was named after its scenic setting of the prairie.

The city's water source is wells, the most recent of which was constructed in 1994. This well was drilled to nearly 100 feet and has a static water level of 27 feet. In addition to a very adequate quantity of water, the overall water quality was also very good. Unlike much of the groundwater in Kansas which has elevated hardness levels, the hardness concentration of the water in this well is less

than 200 milligrams per liter (mg/L). Sulfate, iron and manganese levels are very low also. The one exception though is that the water is high in nitrate and exceeded the maximum contaminant level (MCL) of 10 mg/L established by the Environmental Protection Agency (EPA).

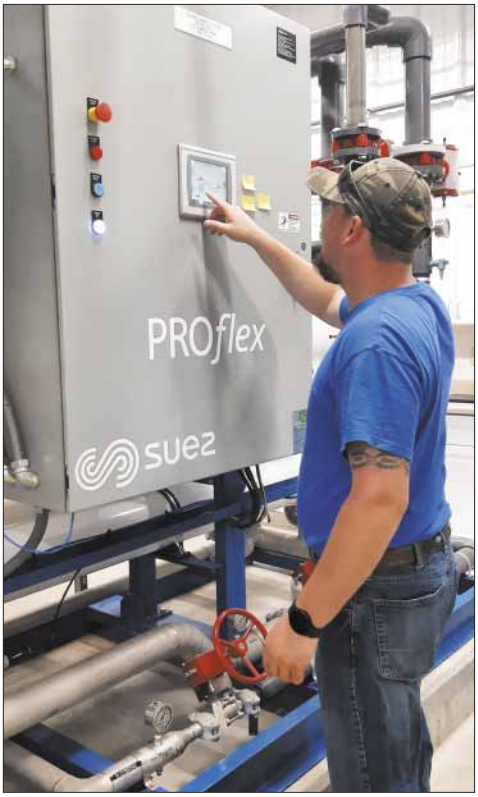
Health effects of elevated nitrate

Nitrates are very soluble and tend to move through soils, eventually ending up in groundwater. In water, nitrate has no color, no odor, no taste, and can only be detected by testing. The EPA standard for nitrate is to protect public health, especially in infants. Water containing high nitrate can cause methemoglobinemia, also known as infant cyanosis or blue baby poisoning in infants less than six months of age. This occurs because the conversion of nitrate to nitrite by bacteria in the stomach interferes with the oxygen-carrying capacity of the child's blood. Usually, at around six months of age, a child's digestive system should be fully developed and should no longer suffer from the effects of nitrate poisoning.

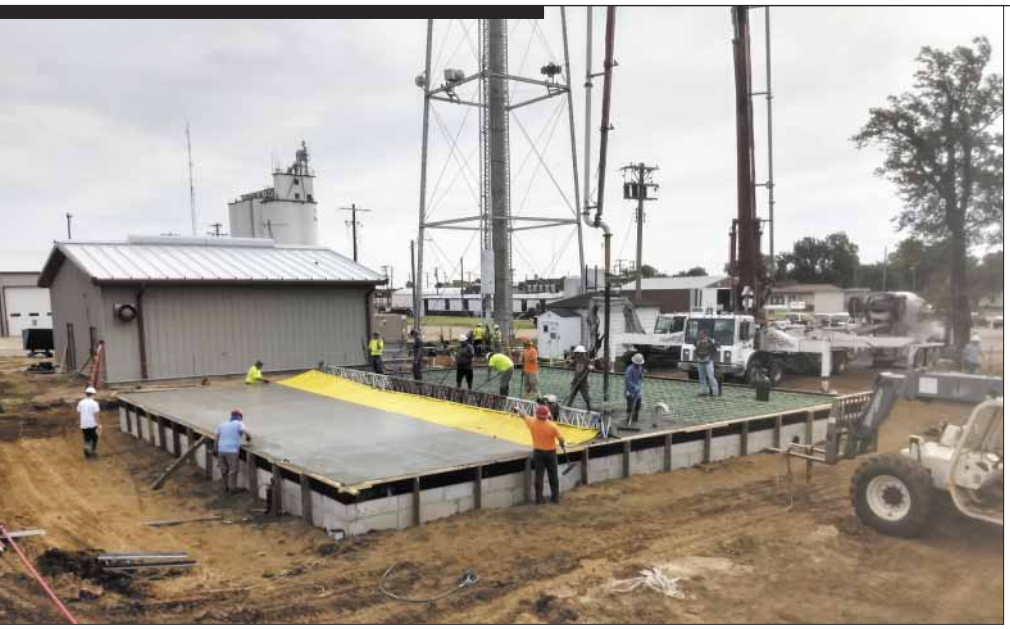
Nitrate Source

Nitrate is a compound that occurs naturally. Natural nitrate levels in groundwater though are generally low and only show an increase in concentration due to human activities. Human activities such as agriculture, industry, and domestic effluents are sources that can eventually reach groundwater. The movement of nitrates through the soil is typically slow and actually may take years for it to eventually reach groundwater. The fact that the source of the nitrate may have been from activity years in the past, maybe as long as 20 years ago, the problem of elevated nitrate levels in groundwater may continue for years into the future.

High nitrate in the wells has been an ongoing issue for the city for many years going back to at least the early to mid-1990s and especially when the Maximum Contaminant Level was reduced from 20 mg/L to 10 mg/L. Nitrate levels have increased over the years ranging from 10 mg/L to just above 20 mg/L more recently. During these years the city provided bottled water to at-risk families. Then in 2017,



Dustin Jesseph, Water Operator, points to the Human Machine Interface (HMI) touch screen on the control panel. Comm-Tronix, Wichita, Kan, installed the system controls.



This photo shows the new 150,000-gallon clearwell under construction.

Each skid can treat 150 GPM. The skids are used individually, alternating operation on a 24-hour basis.

the city council agreed to a consent decree with the Kansas Department of Health and Environment (KDHE) and the EPA. As a result, the city secured the services of the engineering firm Schwab and Eaton, P. A., Manhattan, Kan., to evaluate options to bring the system into compliance.

This photo shows the completed clearwell with the two submersible pumps in the lower right corner. The old 50,000-gallon elevated tank in the background was removed later.

Treatment options

Treatment options available to remove nitrate from drinking water include ion exchange, reverse osmosis, and electrodialysis. Ion exchange systems operate much the same as home softeners where an exchange of ions occurs with the use of special resins. Reverse osmosis (RO) utilizes a semi-permeable membrane that does not allow nitrate to pass through. Electrodialysis uses an electric current process to trap nitrate on a membrane. Of these three treatment options, ion exchange and RO are the most common options used in Kansas and the city chose to go with RO.

The bid opening for this project was held on July 18, 2018, and APAC Construction, Hutchinson, KS, was awarded the contract. The plant began operation in June of 2019. The overall project included two Pentair RO skids to treat well water, a new 150,000-gallon clearwell, and a new 50,000-gallon elevated storage tank to replace the old tank which was removed. Each skid can treat 150 GPM. The skids are used individually, alternating operation on a 24-hour basis. The flow into the clearwell includes 85 GPM from the wells that does not flow through the RO membranes for a total flow of 235 GPM. The blending process produces water that meets the EPA standard for nitrate. Two submersible pumps deliver treated water from the clearwell to the distribution system. Each pump is capable of delivering 625 GPM and only one pump will operate at any one time. Only in an emergency would both pumps operate together.

Project cost

As is always the case, cost was a serious concern. Jenifer Albright, City Clerk noted that the city tried to obtain a Community Development Block Grant (CDBG) but was unsuccessful on three occasions. The city was

The new treatment plant building houses the RO membranes and a standby generator.

This photo shows a close-up view of the RO tubes.

able to obtain a 30 percent forgiveness loan through the KDHE State Revolving Fund (SRF), to fund the $2.224 million project. Jennifer stated that the city had a water rate analysis done in 2016 and the results showed that an adjustment (increase) was needed. Rates were increased from $24.00 to $32.50 base rate and the usage rate increased from $1.75 to $2.50 for 100 cubic feet (748 gallons). She noted also that the plant has been in use now for about three years and the city is preparing for another rate increase. She stated that with additional costs including electric, chemical, and additional training for operators due to the larger responsibility of operating a reverse osmosis plant, the city is currently losing about $50,000 per year, or about $15.00 per household.

These improvements should provide the city with a very dependable supply of water, not only with a very adequate quantity standpoint but also with a very good water quality.

Shown here are the two Pentair RO skids. The skids are operated individually, alternating every 24 hours.

These improvements should provide the city with a very dependable supply of water, not only with a very adequate quantity standpoint but also with a very good water quality.

Bert Zerr is currently a consultant with KRWA. He has been with KRWA since 2005. Prior to that, Bert was a District Engineer with the KDHE in the Salina District Office for 32 years.