

**Water and Environmental Programs
Engineering Success Stories**

State: North Dakota

Borrower Name: Grand Forks Trill Water Users, Inc

Engineering Firm: Advanced Engineering & Environmental Services, Inc.

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County: Grand Forks

Keywords: Softening

Membrane Softening

Problem Description/Issue:

Grand Forks Trill Water Users, Inc. (GFTWU) is a rural water system located in eastern North Dakota with approximately 2100 rural members, five (5) communities and the Grand Forks Air Force Base as their customers. The water treatment system is designed to produce on average 2,500,000 gallons per day with peak capacity at 3,500,000 gallons per day. Raw water is taken from the Elk River Aquifer. The aquifer is a shallow water supply with depth to water table as high as two feet from surface. Maximum permitted yield capacity of any one well in the aquifer is 200 acre feet per year. GFTWU has used the aquifer as their water supply for the past 25 years.

In the last 15 years the State of North Dakota has allocated numerous water appropriations permits to irrigators, some within several hundred feet of GFTWU wells. Monitoring of the water supply has shown that the quality of the water in the aquifer is deteriorating. Hydrocarbons, nitrates and hardness are a few of the elements that have increased in the water supply. The hardness of the water has increased from approximately 12 grains to 25 grains and nitrates will show spikes as high as 6-7 PPM in wells which several years ago had no traces of nitrates. During this period GFTWU water treatment consisted of iron removal by pressure filters and disinfection.

Because of customer demands for softer water and the System Managers concern that water quality will continue to deteriorate, the Board of Directors looked at several options to protect their water supply and provide a better quality water. They initiated a wellhead protection program and are currently buying large buffer areas and irrigation permits near the Systems well field. The Board of Directors evaluated several water treatment methods to improve the quality of water delivered to the system's users. Membrane softening was chosen as the preferred alternative. Membrane softening allowed GFTWU continual use of the existing iron removal plant as a pre-treatment unit. This affords the flexibility to bypass

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the membrane system and supply water to customers should the membrane system need to be taken out of service. The membrane system assures GFTWU will stay in compliance with primary drinking water standards should elements within the raw water continue to approach maximum contaminant levels (MCL). A life cycle analysis of several treatment alternatives indicated the membrane softening alternative was more cost effective than abandoning the existing plant and building a new lime softening plant or other softening system. Also, other softening systems would not assure drinking water standard compliance in the future should undesirable elements continue to rise in the raw water supply.

Once the treatment process was chosen, the Board of Directors, at the recommendation of their Engineer, developed a pre-qualification process to evaluate Membrane Filter System Suppliers. Specifications were developed based on a set space requirement, maximum O&M cost and given performance standards. Bids were received and a membrane equipment supplier selected. Plans and Specifications were then developed and bids requested for general construction. The General Contractor was responsible for all phases of construction including project coordination, delivery and installation of the membrane filters.

The treatment process has been in operation for approximately five months. The Board of Directors and System Manager are well pleased with the water produced and the plant's operation. All elements found in the raw water are being reduced to background levels, or less, and hardness is reduced to approximately 3.5 PPM. Operational power costs are above anticipated levels, however, the System Manager has conducted some in-house modifications and the power cost is coming in line with the Engineers estimates.
