WHAT THE SALINE WATER CONVERSION PLANT MEANS TO THE CITY OF ROSWELL, NEW MEXICO

General C. M. Woodbury1/

The City of Roswell is a community of approximately 40,000 people located in the Pecos Valley in the southeastern part of New Mexico. The growth of the past ten years has been gradual, but it has generally increased at a rate of approximately 90% in ten years. It is increasing at a higher rate than the national increase, or for the Southwest, and this continual growth of the community results in an ever increasing problem, as it does nationally, a needed source of potable water.

The present water supply is obtained from the Pecos Valley Artesian Basin, one of the few remaining artesian basins left in the world. This basin is protected by the State. The water withdrawn is fully appropriated, in the amount of approximately 300,000 acre feet, annually. This, or a high percentage, supplies a highly agriculturally developed area, and the community.

The Artesian Basin is unique in that approximately forty miles west of Roswell, the basin, in good years, receives a recharge of approximately 275,000 acre feet per year, which, without any great amount of mathematics, it is immediate to see that the basin is over appropriated, approximately 12½%, and in many years this figure is exceeded.

However, a greater problem than the over appropriation is to the east and slightly north of the City of Roswell, and underlying the lower line of the easternmost extremity of this basin along the Pecos River, is a highly concentrated saline area, which, during the period of high pumping of fresh water from the basin, lowers the pressure of the fresh water and allows this saline water to encroach into the fresh water supply. This problem is becoming more acute yearly, as most of the agricultural wells in the area east have become too saline for use, and also the water in some of the supply wells in the City of Roswell.

This saline encroachment is becoming more noticeable each year, to the degree that if this serious encroachment continues, it will be necessary to abandon some of the easternmost supply wells.

When the Department of the Interior made inquiries relative to the location of the Brackish Water Conversion Plant, the City of Roswell immediately recognized the potential of what this process could do, first, to furnish between 250,000 to 1,000,000 gallons of demineralized water, and secondly, by the location of the supply wells for this plant in this area of saline encroachment, could reduce the pressure that the saline water is exerting on the fresh water basin and thus retard the encroachment and possibly allow the fresh water to reclaim some of the area already lost. The possibility of a demineralized supply aroused a great deal of local interest.

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In the early concept, it was felt that possibly the electro-dialysis method of conversion would be used. This process has been used commercially in several parts of the country. As this plant's source of energy is electrical, immediately we investigated the power rates, availability of electric power and the cost. As this type of plant reduces the saline content of the brackish water by ½ by each stage, it would have to be determined how many stages would be necessary to reduce the water to potability. We used, originally, 4,000 parts per million which approximately takes four stages to reduce to 250 parts per million. From the best information we had, approximately, each stage of this type of plant would approximate $1,000,000.00, therefore we had a plant of $4,000,000.00 investment and also took into consideration replacement of membranes, operation and general upkeep of the plant, and we came up with a price of 77 cents per thousand gallons. Into this price went amortization, operation and maintenance. It is my understanding at a later date, that some places in operation are producing potable water at a lesser amount. This type of plant being one that takes the salt out of the water, by-product of brine coming through this plant leaves a concentration of four times that of the raw water, and you have a disposal problem in the area.

The disposal problem, of course in many areas, if it is a sea water plant, the water could be returned to the ocean, but in an inland area the problems are more complex. If a large river were available you could run this brine into the river at high water. However, in the arid southwest, you have an alternative of either putting it back in the aquifier. However, a legal problem would result if anyone's well turns saline and they would of course, hold the city responsible. So, we investigated the possibility of evaporation.

First, we determined the heat intensity of the sun in this area and found it to be approximately 525 langlies. This, of course, not having a heliometer available, we interpolated between Albuquerque and El Paso, Texas, then checked the maximum sunshine available to the Roswell area and determined it was approximately 75%. Next the average humidity and the velocity of the wind. This established the fact that it would be possible to evaporate 10 feet of water annually. So it was determined actually, by making a series of tanks approximately 120 feet wide and 3/4 to 1 mile long, and some 300 acres of surface area, this could be accomplished. The City agreed in the original proposal with the Department of Saline Water, Department of the Interior that although we produce water for 8 cents a thousand gallons, we could pay 60 cent a thousand gallons for product water. However, after the possibility developed, whereby this quantity could be increased to 1,000,000 gallons, we determined that we could use 1,000,000 gallons at 40 cents a thousand gallons. Now, this of course, is paying a premium water price, however, if it accomplishes the purpose of aleviating the salt encroachment, we felt this could be charged to the source of supply as treatment.

After many months of anxiously awaiting the outcome, it was determined that Roswell would be selected for one of the experimental plants. However, not the electro-dialysis method, but a vapor-compression, forced circulation, distillation process.

Immediately the problem was attacked from the angle of finding water suitable for this type of plant and the co-operation of the Pecos Valley Conservancy District, who agreed to furnish the water to the plant, if it was possible to locate the wells in the high saline area. So far we have drilled

three wells.

In the area of approximately five miles east of Roswell, behind the interface of the highly saline water, we drilled the first well, approximately 720 feet deep and it flowed at a rate of 400 gallons per minute. However, this water was analysed and found to contain a good deal of free hydrogen-sulfide gas and a very high total of disolved solids. Upon the completion of this well, we moved a mile south in the same general area and drilled a second well. This well was drilled to the top of the water bearing strata and was determined to be the same water, less the hydrogen-sulfide gas.

The analysis of this well is as follows:

	No. 1	No. 2	No. 3
pH	7.1	7.1	7.3
Total Hardness	2,380 mg/1 as $CaCO_3$	3,066 mg/1 as $CaCO_3$	2,008 mg/1 as $CaCO_3$
Calcium	1,736 mg/1 as $CaCO_3$	2,252 mg/1 as $CaCO_3$	1,562 mg/1 as $CaCO_3$
Magnesium Hardness	644 mg/1 as $CaCO_3$	814 mg/1 as $CaCO_3$	446 mg/1 as $CaCO_3$
Alkalinity	154.6 mg/1 as $CaCO_3$	155.6 mg/1 as $CaCO_3$	139 mg/1 as $CaCO_3$
Chloride, CL	7,210 mg/1	1,190 mg/1	2,670 mg/1
Sulfate, SO_4	1,995 mg/1	2,700 mg/1	1,750 mg/1
Silica, SiO_2	14 mg/1	10 mg/1	14 mg/1
Iron, FE	3.3 mg/1	0.20 mg/1	0.10 mg/1
Turbidity	20 mg/1	None	None
Residue on Evap.	15,940 mg/1	24,280 mg/1	7,760 mg/1
Total Disolved Solids (Calculated)	14,728 mg/1	22,253 mg/1	6,930 mg/1

However, as it is in the upper brackets of brackish water, we moved a mile south and drilled the second well (No. 2, above). A seven inch casing was set and cemented in. This well flowed at a rate of approximately 150 gallons per minute. The total number of disolved solids, as you see from the analysis, was approximately 24,000 ppm, which is in the upper bracket of brackish water, three quarters that of sea water.

We moved a mile east, set a third well and set an eight inch casing of approximately 600 feet, and this was determined by analysis to be a different water, having a total amount of disolved solids of 7,760 ppm and a chloride count of 2,670 ppm.

At present the corps of Engineers is running tests on No. 2 well, with a vapor compression plant and are prepared for the experimentation, using forced circulation and treatment to take out the Calcium Sulfate.