

**Water and Environmental Programs  
Engineering Success Stories**

**State:** Colorado

**Borrower Name:** City of Las Animas

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**Congressional Information:** Dan Schaefer

**Counties:** Bent

**Keywords:** Reverse osmosis

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## Reverse Osmosis Treatment Plant

### Description of the problem:

Las Animas, Colorado, a rural community with a marginal economy and difficult water problems, recently put its new reverse osmosis plant on line.

Las Animas (population approximately 2,660) lies over the alluvial aquifer of the Arkansas River on the plains of southeastern Colorado. Water quality data in this basin has been evaluated and documented through several US Geological Survey studies. The quality of the water is affected by the extensive use and reuse of the Arkansas River water for irrigation. Evapotranspiration of the irrigation water concentrates the dissolved solids. The degradation of the water is illustrated below, starting at Pueblo.

<b>Town</b>	<b>Miles from Pueblo</b>	<b>Sodium Mg/L</b>	<b>Sulfate Mg/L</b>	<b>Hardness Mg/L</b>	<b>Dissolved Solids Mg/L</b>
Pueblo	0	24	145	219	326
Avondale	11	47	224	307	535
Fowler	36	57	320	368	651
Las Animas	85	201	938	848	1748

Water pumped from the city's seven wells has even higher concentrations of many of the contaminants listed. Water quality data collected from well samples have indicated sulfate ranging from 1,600 to 3,000 Mg/L. Pinhole leaks in the City's water lines could actually close themselves in the span of a few days through the water's disposition of dissolved solids. The problem had become so severe that many people who work in Las Animas refused to live there due to the hardness of the water. Fifty percent of the city's homeowners used some form of in-home water treatment process. The costs associated with the hard water were extensive, e.g. the life span of household water

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heaters was shortened from 16 years to about 4 years. Estimated monthly costs for operating the systems ranged from \$12 to \$31 with an average cost of \$23.30. Amortized over 20 years for the entire community, these costs were estimated at \$2.17 million.

**Solution:**

Gil Morrill, the city's consulting engineer studied alternative solutions for the problem including alternative water supplies. The most cost effective and environmentally sound was the reverse osmosis system. While funding was being secured for the project, Las Animas was planning for the design of the plant with a model system. A pilot filter run over several weeks in early 1994 indicated that the dissolved solids (ranging from the high end from 3,600 to 4,700 Mg/L) would be reduced to below 750 Mg/L; hardness, ranging from 1,600 to 1,988 Mg/L would be reduced to below 150 Mg/L; and sulfate, ranging from 2,100 to 2,800 Mg/L would also be reduced to below 150 Mg/L. The somewhat high iron and manganese content of the water was anticipated to cause scaling of the RO membranes if it was allowed to oxidize. Consequently, the city's wells were modified with foot valves so a full water column could be maintained.

To keep sulfates in solution and prevent membrane fouling from this source, the system will add a scale inhibitor. To recondition the permeate, the city will blend 80-100 percent raw water back into the system. Corrosion control will be further enhanced with the addition of sodium hydroxide and zinc orthophosphate. Fluoride levels will be restored through the addition of hydrofluorosilicic acid. Disinfection will be accomplished through chlorination. Concentrate from the RO units will be discharged back into the river through an industrially permitted discharge point. The ratio of finished water to wastewater produced in the process is expected to be 50:50.

Construction bids were opened August 26, 1995. The low bid was \$3.7 million. Average monthly water bills will be about \$35, roughly the same as what the average customer pays now, given existing monthly bills and home treatment system expense. This compares with the Colorado average monthly municipal water bill of \$26.19. As of the writing of this report, the residents of Las Animas are extremely happy with the water produced by the RO plant. One lady reports how nice it is to be able to "boil beans" again.

This report was extracted from an article written by Barry Cress, a specialist with the Colorado Division of Local Governments.

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