



TREATING BRACKISH WATER IN SANDOVAL COUNTY FEBRUARY 19, 2010

CDM

Project Background

- ◆ Sandoval County drilled two exploratory wells in 2007 in Rio Puerco Basin/SE portion of San Juan Basin
- ◆ Penetrated brackish water aquifer 3500 below ground surface.
- ◆ Brackish water under artesian pressure (over 150 psi) and 150 degrees Fahrenheit
- ◆ Well 6 production capacity approximately 600 gpm.

Project Purpose

- ◆ **Sandoval County proposed to develop a wholesale water utility**
- ◆ **Provide water to the City of Rio Rancho (5 MGD)**
- ◆ **Provide water to sustain growth over next 40 years in the area**
- ◆ **No other sources of potable water in area**

Water Chemistry

- ◆ Brackish water defined by concentration of total dissolved solids
 - ❖ Fresh water <1000 mg/L
 - ❖ Brackish water : 1000-10,000 mg/L
 - ❖ Seawater: 30,000 mg/L
- ◆ Sandoval County TDS: 12,000 mg/L

Water Chemistry

◆ Constituents of Concern

- ❖ TDS -12,000 mg/L
- ❖ Hardness – 1500 mg/L (100 mg/L acceptable for drinking water systems)
- ❖ Calcium- 450 mg/L
- ❖ High Alkalinity -1800 mg/L
- ❖ Bicarbonate- 1800 mg/L

Water Chemistry

- ❖ Arsenic – 635 ppb (over sixty times MCL)
- ❖ Radium- 80 mg/L (sixteen times higher than MCL)
- ❖ Boron -9.7 mg/L (nearly twice as high as that found in seawater (5 mg/L))
- ❖ Carbon dioxide gas -1900 mg/L

Treatment Challenges

- ◆ CO_2 and H_2S
- ◆ Arsenic and radionuclides
- ◆ Hardness (calcium and magnesium)
- ◆ Alkalinity
- ◆ Boron
- ◆ High temperature

Treatment Processes

- ◆ Aeration to remove CO_2 and H_2S
- ◆ Coagulation/sedimentation to remove arsenic and radium
- ◆ Warm lime softening to reduce hardness and alkalinity
- ◆ Granular filtration to remove solids
- ◆ Ion exchange to remove remaining hardness
- ◆ Reverse osmosis to remove TDS and boron
- ◆ Cooling towers to reduce temperature

Treatment Goals

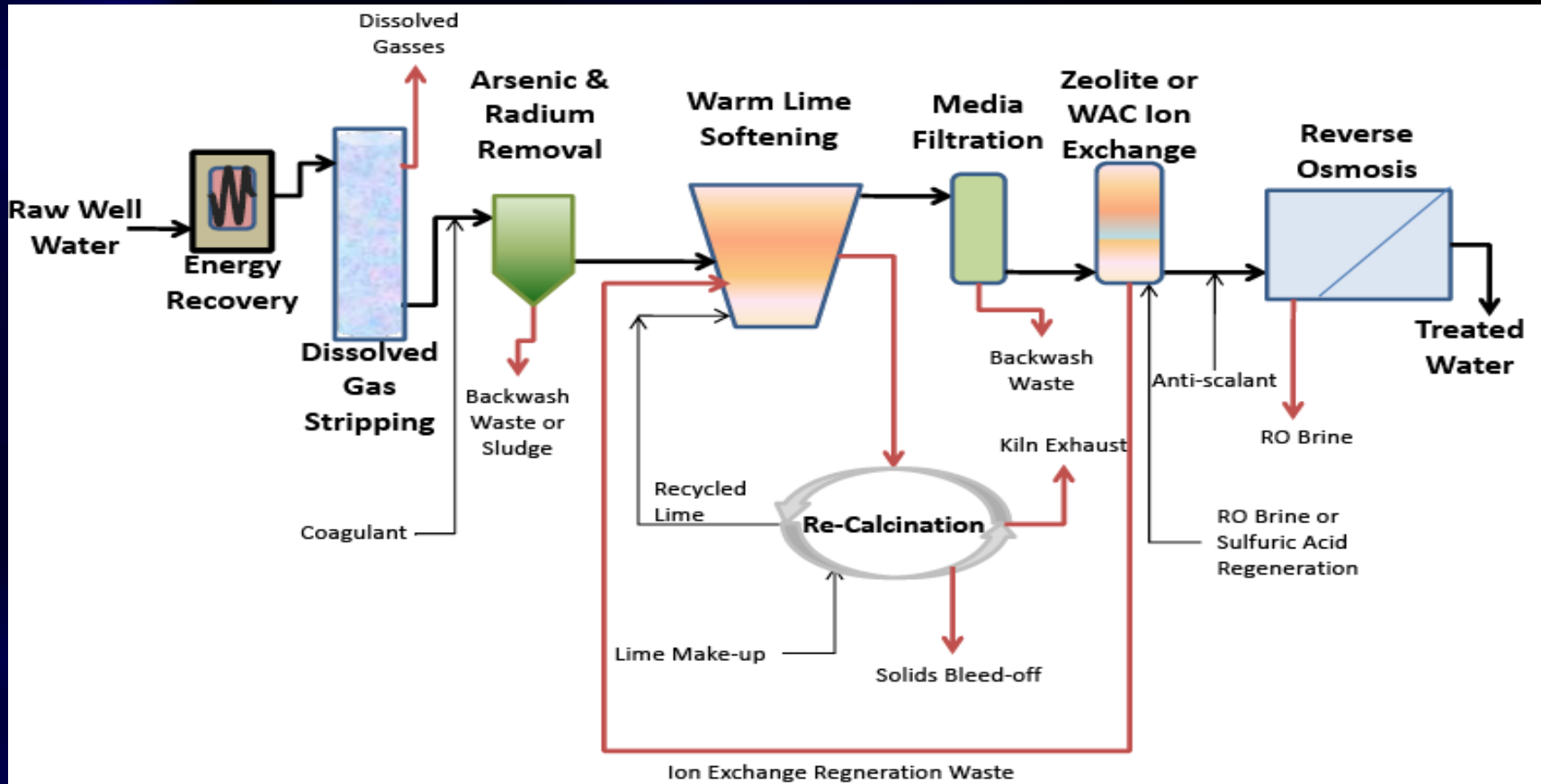
- ◆ Produce 5 MG of potable water meeting EPA Drinking Water Standards
 - ❖ Reduce TDS to $< 500 \text{ mg/L}$
 - ❖ Reduce arsenic to $< 8 \text{ ppb}$
 - ❖ Reduce hardness to 100 mg/L
 - ❖ Reduce radium to $< 16 \text{ pCi/L}$
- ◆ Selective recovery of treatment by-products
 - ❖ Sodium chloride (NaCl)

Bench Scale Testing

◆ Conducted in June 2009

- ❖ Determine pre-treatment processes
- ❖ Focus on hardness, alkalinity, TDS, and removal of arsenic and radium
- ❖ Determine dosages of pre-treatment chemicals
- ❖ Estimate chemical usage and volume of treatment system waste products

Pre-Treatment Process Train



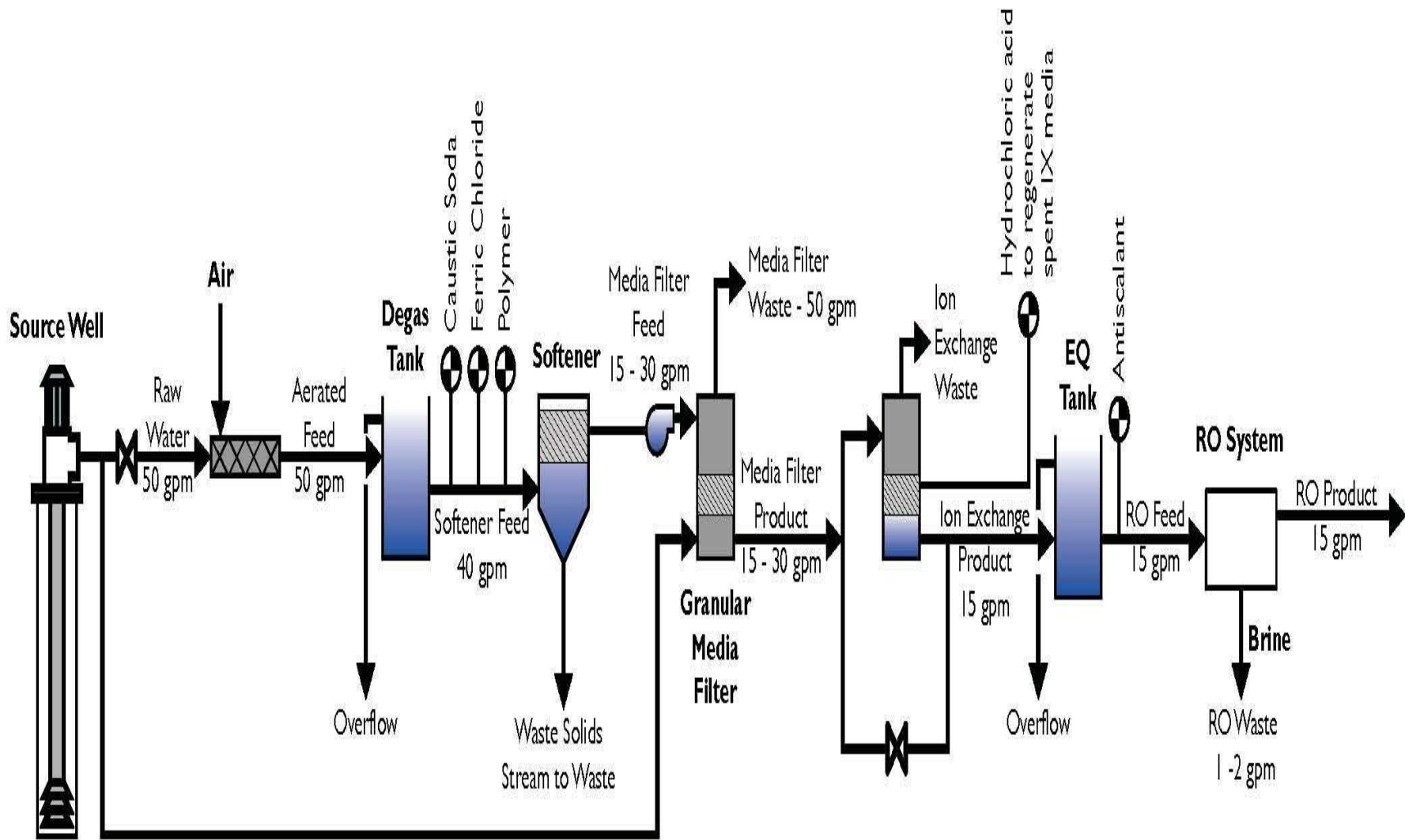
Pilot Testing

- ◆ **Conducted September – November 2009**
- ◆ **Evaluated pre-treatment processes and RO system**
- ◆ **Generate water quality projections for product and waste streams**
- ◆ **Establish design criteria and operating conditions for full-scale plant**

Pilot Testing Parameters

- ◆ Caustic soda used in softening process instead of lime
- ◆ Coagulation and softening occur in same contact clarifier
- ◆ WAC ion exchange to remove remaining hardness and divalent ions
- ◆ High Efficiency Reverse Osmosis process using both brackish water and seawater membranes (4 stage process)
- ◆ 80% recovery target for RO process

Pilot Testing Process Flow Diagram



Pilot Testing Trailer and Equipment



Pilot Testing Trailer and Equipment



Pilot Testing – RO Process



Pilot Testing – Clarifier/Softening Process



Pilot Testing – Clarifier/Softening Process



Pilot Testing –Holding Pond



Pilot Test Results – Pretreatment Processes

◆ Pretreatment processes successful

- ❖ Hydrogen sulfide and CO₂ reduced in aeration
- ❖ Arsenic and radionuclide reduced in coagulation/sedimentation
- ❖ Significant hardness removal in warm lime softening process
- ❖ Effective radionuclide removal in softening and granular filtration processes
- ❖ Ion exchange effective in reducing remaining hardness

Pilot Test Results – RO Process

◆ RO Process Successful

- ❖ Achieved 80 percent recovery
- ❖ TDS reduced to < 200 mg/L
- ❖ Boron removal from 9.7 mg/L to 3 mg/L
- ❖ Concentrate contained primarily sodium chlorides and sodium sulfates
- ❖ Permeate requires stabilization to reduce corrosiveness of water
- ❖ Cooling required before introduction into system

Conclusions

- ◆ **Brackish water supply can be treated to meet EPA Drinking Water Standards**
- ◆ **Significant pre-treatment required before RO process**
- ◆ **Significant challenges with disposal of waste products**
- ◆ **Possibility of beneficial recovery of by-products, namely sodium chloride**

Conclusions

- ◆ **Estimated construction cost of full scale 5 MGD plant -\$62.4 million**
- ◆ **Estimated annual O&M - \$15.2 million (\$6.75/100 gallons)**
- ◆ **Funding challenges**

Questions and Comments

