4th & Carey Groundwater Remediation Project

and

Reverse Osmosis Water Treatment System
Contaminated City Well

Groundwater contamination from industry was discovered in the Southeast region of Hutchinson in 1982 and has since progressed over the eastern part of the City.

Well #8 - 4th and Carey
PWS Well #8
Located at
4th Ave. & Carey St.

4th and Carey Site
consists of 1,240 acres
including many of
Hutchinson’s Industries
## Groundwater Contamination

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>POTENTIAL SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon tetrachloride</td>
<td>Grain fumigant</td>
</tr>
<tr>
<td>Chloroform</td>
<td>Degradation product of carbon tetrachloride</td>
</tr>
<tr>
<td>Tetrachloroethene (PCE)</td>
<td>Dry cleaning fluid</td>
</tr>
<tr>
<td>Trichloroethene (TCE)</td>
<td>Industrial cleaning solvent</td>
</tr>
<tr>
<td>Cis-1, 2-dichloroethene</td>
<td>Degradation product of TCE</td>
</tr>
<tr>
<td>Trans-1, 2-dichloroethene</td>
<td>Degradation product of TCE</td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td>Petroleum</td>
</tr>
</tbody>
</table>
Groundwater Contamination Plumes

- Chlorides (1000 mg/L)
- Trichlorethene (TCE)
- Tetrachloroethene (PCE)
- Carbon Tetrachloride
- Vinyl Chloride
4th & Carey Groundwater Remediation Project History

- KDHE mandate to address source areas and cleanup the contaminated groundwater
- Cooperative effort with industry
- Tax Increment Finance (TIF) District
- Disconnect private water wells in the contaminated areas
Concerns of Standard Remediation Alternatives

- Typical Pump, Treat and Discharge Systems Waste a Significant Amount of Water
- Water Permitting Issues
- High Chloride Levels in Effluent are Highly Regulated and Complicate Cleanup Efforts
Sources of Salt Contamination

*Slide Courtesy of the Kansas Department of Health and Environment (KDHE)*
## Chloride Levels in Remedial Wells & Treated Effluent

<table>
<thead>
<tr>
<th></th>
<th>Chloride Concentrations (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RW-1</td>
<td>722</td>
</tr>
<tr>
<td>RW-2</td>
<td>402</td>
</tr>
<tr>
<td>RW-3</td>
<td>502</td>
</tr>
<tr>
<td>Effluent*</td>
<td>642</td>
</tr>
</tbody>
</table>

*Suggested TMDL MCL <300 mg/L

**CESSNA Site**
Objectives

• Prevent migration of groundwater contaminants to unimpacted areas.

• Remove Groundwater Contaminants in the Southeast Region

• Reclaim Water for Beneficial Use in the Potable Water Supply

• Comply with Federal and State Regulations
Solutions

• Pump Contaminated Groundwater

• Reverse Osmosis Membrane Filtration - Remove Chloride & Minerals

• Air Strippers – Remove VOC

• Treated Water Blended with the City’s Well Water Resulting in Very High Quality Water
4th & Carey Project Components

1. **Source Area Remediation** (AS/SVE Treatment Systems for Shallow Source Area Groundwater Contamination – Approx. 30’ deep)

2. **Downgradient Remediation and Containment** (Extraction Wells for Deep Groundwater Contamination – Approx. 60’ deep)

3. **Reverse Osmosis and Air Stripping Treatment** (Hutchinson Water Treatment Center for RO Treated Water and Untreated Municipal Water Blending)

4. **Deep Well Disposal** (Class I UIC Non-hazardous Deep Disposal Wells)
Catcher’s Mitt Concept

Source Area Remediation

Source Area Remediation

Farmland

Bunge

Garvey

EW1

EW2

EW3

RW2

RW3

11th Avenue

Airport Road

4th Avenue

Avenue G

Halstead Street

Lorraine Street

Obee Road

DDW1

DDW2
Carbon Tetrachloride Source Area Remediation

Non-domestic Water Well

4th & Carey

Site

Airport

Earmland

Bunge

Farmland
• 3 AS/SVE Treatment Systems at Farmland Elevator

• 1 AS/SVE Treatment System at Bunge Elevator
Catcher’s Mitt Concept

Source Area Remediation

Source Area Remediation

Farmland

Bunge

Garvey

Lorraine Street

Halstead Street

11th Avenue

4th Avenue

Airport Road

Avenue G

Obee Road

Lorraine Street

Halstead Street

Source Area Remediation

Source Area Remediation

RW2

RW3

EW1

EW2

EW3

DDW1

DDW2
• EW-1 (4th & Carey Extraction Well @ 200 gpm)
• EW-2 (4th & Carey Extraction Well @ 400 gpm)
• EW-3 (4th & Carey Extraction Well @ 400 gpm)
• RW-2 (Textron Remediation Well @ 400 gpm)
• RW-3 (Textron Remediation Well @ 1200 gpm)

Total 2600 gpm; 3.74 MGD
Monitoring Network

Approximately 110 Wells Monitored throughout the course of the year
Remediation System
Performance/Observations

• Significant reduction in VOCs observed at source areas.
• Plume migration towards extraction wells as planned.
• Results to date are very encouraging.
Catcher’s Mitt Concept
Class I Non-hazardous Deep Disposal Well

- **DDW-1**
  (Deep Disposal Well #1 @ 1250 gpm)
- **DDW-2**
  (Deep Disposal Well #2 @ 1250 gpm)
- **DDW-3**
  (Future Disposal Well #3 @ 1250 gpm)

Current Capacity 2500 gpm; 3.6 MGD
Future Capacity 3750 gpm; 5.4 MGD
City of Hutchinson
Class I UIC
Well #1
Construction

Arbuckle Formation
4,000 to 4,800 feet deep
Deep Disposal Well System
RO Water Treatment Facility

Deep Disposal Wells
Hutchinson Water Treatment System Schematic

- **Remediation Wells**
- **Contaminated City Wells (future)**
- **City Northwest Wells**

**6 MGD Water Treatment Facility**

**Reverse Osmosis Plant**

**Air Stripper**

**Water Blending at New Clear Well**

**Water Distribution System**
- 10 MGD (ADF)
- 23.4 MGD (PDF)

**Deep Well Disposal**

**Flow Rates:**
- 8 MGD
- 4 MGD
- 2 MGD
- 6 MGD (CONCENTRATE)
- 6 MGD (PERMEATE)
City of Hutchinson
Reverse Osmosis Water Treatment Facility

North Process Building Elevation
City of Hutchinson
Reverse Osmosis Water Treatment Center
Water Treatment System

- 3 Dual Chamber Pressure Sand Filters (2 filters per vessel – 1.61 MGD treatment capacity per filter)
- 6 Cartridge Filter Units (5 micron) (1.68 MGD per filter unit)
- 4 RO Feed Pumps (1400 gpm, 250 HP each)
- 4 RO Treatment Module Skids (2 MGD input/1.5 MGD output treatment capacity each)
- 1 Air Stripper/Degasifier Tower (7.56 MGD treatment capacity)
<table>
<thead>
<tr>
<th>RELATIVE SIZE OF COMMON MATERIAL</th>
<th>MOLECULAR WEIGHT</th>
<th>FILTRATION TECHNOLOGY</th>
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</thead>
<tbody>
<tr>
<td>Aqueous Salts</td>
<td>200</td>
<td>RO, NF</td>
</tr>
<tr>
<td>Metal Ions</td>
<td>5,000</td>
<td>NF, Microfiltration</td>
</tr>
<tr>
<td>A</td>
<td>20,000</td>
<td>Ultrafiltration</td>
</tr>
<tr>
<td>A</td>
<td>100,000</td>
<td>RO, NF, Microfiltration</td>
</tr>
<tr>
<td>A</td>
<td>500,000</td>
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</tr>
<tr>
<td>Aqueous Salts</td>
<td>10</td>
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</tr>
<tr>
<td>Metal Ions</td>
<td>100</td>
<td>NF, Microfiltration</td>
</tr>
<tr>
<td>Metal Ions</td>
<td>1000</td>
<td>Ultrafiltration</td>
</tr>
<tr>
<td>Metal Ions</td>
<td>10^4</td>
<td>RO, NF, Microfiltration</td>
</tr>
<tr>
<td>Metal Ions</td>
<td>10^5</td>
<td>RO, NF, Microfiltration</td>
</tr>
<tr>
<td>Metal Ions</td>
<td>10^6</td>
<td>RO, NF, Microfiltration</td>
</tr>
<tr>
<td>Metal Ions</td>
<td>10^7</td>
<td>RO, NF, Microfiltration</td>
</tr>
</tbody>
</table>

- **Aqueous Salts**
- **Metal Ions**
- **Pyrogens**
- **Carbon Black**
- **Virus**
- **Colloidal Silica**
- **Sugars**
- **Albumin Protein**
- **Yeast Cells**
- **Bacteria**
- **Beach Sand**
- **Paint Pigment**
- **Pollens**
- **Milled Flour**

### MF (Microfiltration)
- **Ultrafiltration**
- **Particle filtration**
Water Treatment Pumping Systems

- 4 Low Service Raw Water Pumps to Treatment (1900 gpm, 75 HP each)
- 3 Waste Transfer Pumps to Disposal Wells (1050 gpm, 30 HP each)
- 2 Pressure Filter Backwash Pumps (3500 gpm, 75 HP each)
- 6 High Service Pumps to Distribution System (3300 gpm, 250 HP each)
## Water Quality Results

<table>
<thead>
<tr>
<th></th>
<th>Total Hardness (mg/L)</th>
<th>Chloride (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre RO Treatment</strong></td>
<td>300</td>
<td>138</td>
</tr>
<tr>
<td><strong>Current</strong></td>
<td>120</td>
<td>55</td>
</tr>
<tr>
<td><strong>Drinking Water Standard</strong></td>
<td>400</td>
<td>250</td>
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</tbody>
</table>
## Projected Water Demand

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Daily Flow (MGD)</th>
<th>Peak Daily Flow (MGD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXISTING (2000)</td>
<td>6.5</td>
<td>15.0</td>
</tr>
<tr>
<td>PROJECTED (2010)</td>
<td>8.1</td>
<td>19.1</td>
</tr>
<tr>
<td>PROJECTED (2030)</td>
<td>10.0</td>
<td>23.4</td>
</tr>
</tbody>
</table>
Benefits for the City of Hutchinson

- Higher quality of water for the community
- Extends life of household plumbing and appliances
- Provides comprehensive solution to industrial community
- Modular and easily expandable water treatment center to accommodate future capacity needs
- Meets existing and future water supply regulations (insurance policy for future generations)
Benefits for the Environment

• Cleans up the Equus Beds Aquifer
• Prevents migration of contamination to protect the groundwater
• Eliminates discharge of high chloride water into surface waterways
• Beneficial use of remediated water
• Reduces use of current groundwater supply, by replacing it with remediated water
### PROJECT COST:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Groundwater Contamination Source Remediation</td>
<td>$ 740,000</td>
</tr>
<tr>
<td>RO Concentrate and Wastewater Deep Disposal Wells (DDW's)</td>
<td>$ 4,095,000</td>
</tr>
<tr>
<td>Groundwater Remediation Wells and Pipelines</td>
<td>$ 2,610,000</td>
</tr>
<tr>
<td>RO Water Treatment Plant</td>
<td>$17,660,000</td>
</tr>
<tr>
<td>RO Raw Water, Concentrate and Distribution System Pipelines</td>
<td>$ 9,340,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$34,445,000</strong></td>
</tr>
</tbody>
</table>

### PROJECT FUNDING:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payments from Companies Responsible for Contamination</td>
<td>$12,222,000</td>
</tr>
<tr>
<td>TIF District Tax Proceeds and Interest Earned</td>
<td>$ 1,086,000</td>
</tr>
<tr>
<td>Federal Grants ($3.5 million less grant admin. costs)</td>
<td>$ 3,372,000</td>
</tr>
<tr>
<td>KDHE Low Interest Loans – City Funds</td>
<td>$16,650,000</td>
</tr>
<tr>
<td>Water Utility Capital Improvement (CIP) Funds – City Funds</td>
<td>$ 1,350,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$34,680,000</strong></td>
</tr>
</tbody>
</table>
Cooperative Effort

- City of Hutchinson
- Potential Responsible Parties (PRPs)
- State Agencies
- Federal Assistance
Questions?