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***Pellet Softening:
Hardness, Iron and
Manganese Removal***

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Discussion Outline



- ▼ Set the Stage...
 - | Tuolumne, CA – Water Quality and Pre-design Analysis.
- ▼ Traditional Softening Processes Evaluated
- ▼ What is Pellet Softening?
 - | Advantages
 - | Possible Applications
- ▼ Tuolumne, CA Water Treatment Facility
 - | Pilot Study Results
 - | Design and Construction
 - | Facilities in Operation

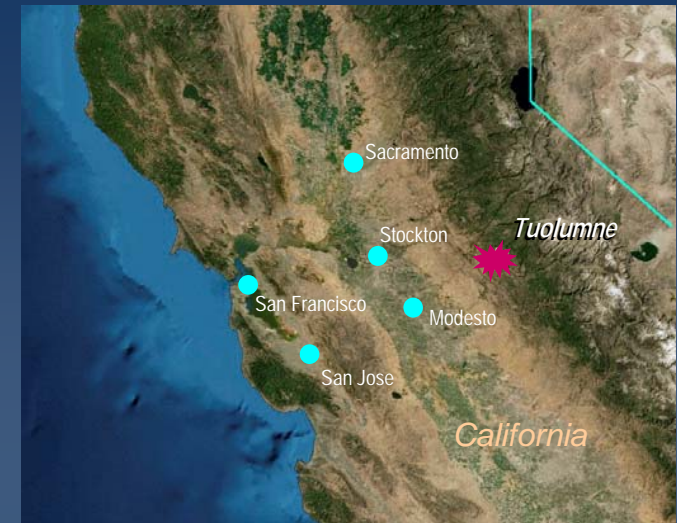


Tuolumne, CA



Background

- ▼ Client: Tuolumne Economic Development Authority (TEDA)
- ▼ Source: Groundwater Wells
- ▼ Problem: Hardness and Iron/Manganese Concentrations above SMCL's.
 - | Hardness: 97 to 238 mg/L (moderately hard to very hard)
 - | Iron: ND to 0.9 mg/L (SMCL = 0.3 mg/L)
 - | Manganese: ND to 0.35 mg/L (SMCL = 0.05 mg/L)



Tuolumne, CA - Predesign



▼ Pre-design Evaluation:

- | Space considerations, quantity and type of waste stream, ease of operation, operational & maintenance considerations
- | Evaluate Softening Processes
 - Pellet Softening
 - Ion Exchange
 - Membrane
- | Evaluate Fe/Mn Removal Processes
 - Greensand
 - Pyrolusite



Traditional Softening Processes



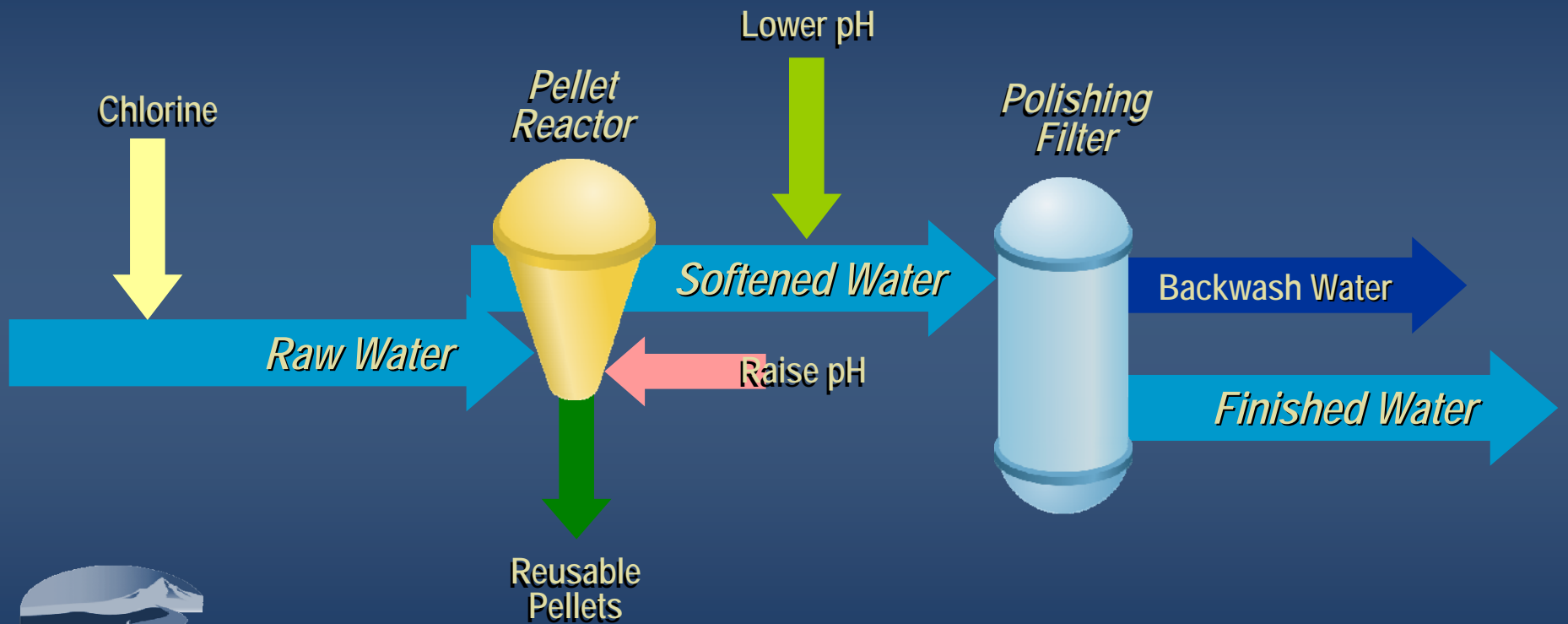
- ▼ Chemical Softening:
 - | Precipitation created through chemical addition (lime, soda ash or caustic soda)
 - | Large quantities of sludge produced
 - | Land intensive

- ▼ Ion Exchange:
 - | Generally used in industry and small home units
 - | Smaller footprint
 - | High strength liquid waste stream (acid & brine)

- ▼ Membrane:
 - | Smaller footprint
 - | High strength liquid waste stream (acid & brine)



Process Flow Diagram



What is Pellet Softening?



▼ Fluidized Bed, Up-Flow Reactor

- | Catalyst material (sand)
- | Raise pH using NaOH or CaOH₂ to promote crystallization of calcium on to the catalyst.
- | Treated water from top of reactor, enlarged catalyst removed from bottom of reactor
- | Softened water pH adjusted using CO₂ or acid



Advantages of Pellet Softening



- ▼ Continuous Water Treatment
- ▼ Operator Effort Minimized
- ▼ Easily Managed Waste Stream: Water and Sand
- ▼ Minimal Environmental Impacts
 - | No high strength liquid waste stream
 - | Environmentally benign solids – essentially damp sand
 - | Potential solids reuse opportunities
 - Lime in process, agricultural lime, acid wastewater neutralizer, animal feed additive, road building or cement making.



Applications



- ▼ Water Softening
 - | Reduced TDS and Chlorides
- ▼ Iron/Manganese Removal
- ▼ Phosphorus Removal
- ▼ Process Water Treatment
- ▼ Sulfate Removal
- ▼ Heavy Metals



Pellet Softening Pilot Study



▼ Pilot Study Objectives

- | Reduce hardness range to 60 – 75 mg/L
- | Reduce iron and manganese concentrations below SMCL, 0.3 mg/L and 0.05 mg/L, respectively.
- | Assess overall system performance
- | Determine operational considerations for full scale process



Water Quality – Before & After



- ▼ Two of five wells piloted – Well 6 and Well 3

Parameter	Well 6		Well 3	
	Raw	Finished	Raw	Finished
pH	7.1-7.8	8.2-8.9	7.3	8.0-8.4
Hardness (mg/L)	188-210	60 - 72	212-253	53-81
Iron (mg/L)	0.51-0.96	0.03-0.10	0.07	0.00
Manganese (mg/L)	0.28-0.36	0.015-0.019	0.28	0.018



Pilot Study Results



Results:

- ▼ Optimum pH for softening: 9.5 to 9.6
- ▼ Optimum stabilized pH 8.2 to 8.4
- ▼ Hardness within target range of 60-75 mg/L
- ▼ Iron and manganese removed to below SCML.

Conclusion:

- ▼ Process met pilot test objectives of softening water and removing iron/manganese.



Tuolumne Plant Design



- ▼ Capacity: 120 GPM (initial), 240 GPM (future)
- ▼ Major Components:
 - | Equalization Tank
 - | Softening Reactor (Pressure Vessel)
 - | Polishing Filter (Pressure Vessel)
 - | Infiltration Basin for backwash disposal
 - | Chemical Feed and Storage



Tuolumne Water Treatment Facility



Tuolumne Water Treatment Facility



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Softening Facilities in Operation



Hollywood, Florida



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Softening Facilities in Operation



- ▼ Hollywood, Florida
 - | Startup – 1960's through 1970's
 - | Capacity – 10 MGD

- ▼ Valencia Water Company, Santa Clarita, CA
 - | Startup – May 2008
 - | Capacity – 800 GPM (1.2 MGD)

- ▼ Tuolumne Water Treatment Facility, Tuolumne, CA
 - | Startup – May 2008
 - | Capacity 120 GPM Initial, 240 GPM Build-Out (0.18-0.36 MGD)





Questions?



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