



# Water Quality Considerations for Non-Hazardous Disposal Wells Injecting Under Pressure

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# Background Information

- Coal Mine in Southern Illinois
- Native Groundwater Infiltrating Mine
- Treatment and Disposal System to Handle Groundwater
  - Pretreatment: Coagulation and Sedimentation
  - Reverse Osmosis Treatment System
  - Post-RO Treatment and Disposal
    - Class I Non-Hazardous Well
    - Injected Under Pressure

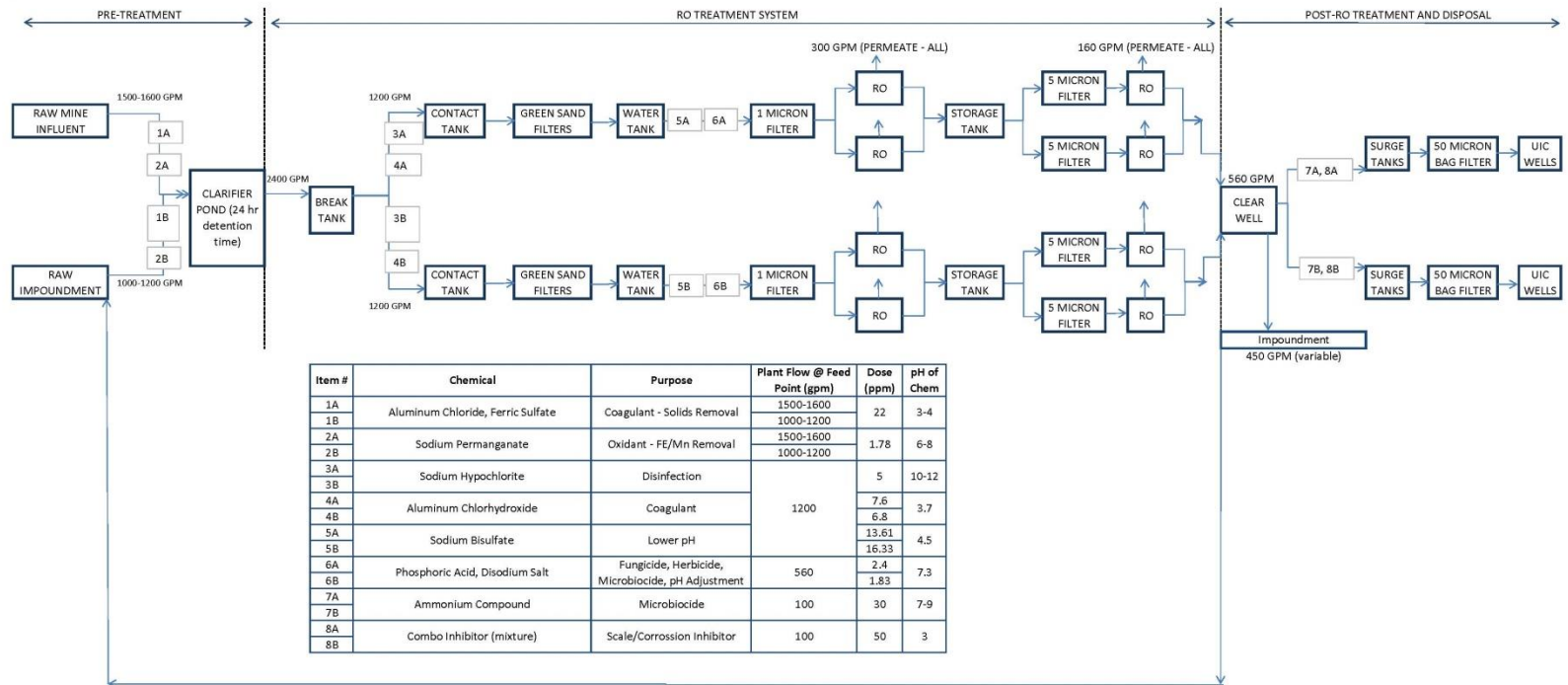
# The Problem

**Primary Problem:** Diminishing Disposal Volumes at Increased Pressures

**Other Concerns:** Frequency of Filters Clogging, Variation in Water Quality

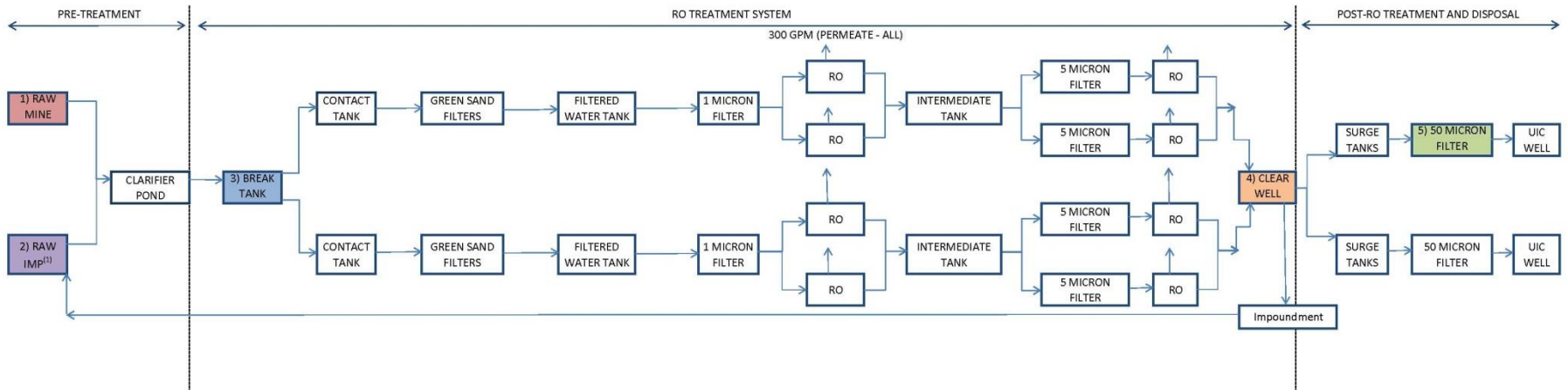
# The Investigation

## System Overview: Process Flow Diagram



# The Investigation

## System Overview: Process Flow Diagram



Location	TH <sup>(2)</sup> (mg/L)	Alk <sup>(3)</sup> (mg/L)	CH <sup>(4)</sup> (mg/L)	NCH <sup>(5)</sup> (mg/L)	TDS <sup>(6)</sup> (mg/L)	TSS <sup>(7)</sup> (mg/L)	Temp (°C)	Turbidity (NTU)	Ca <sup>(8)</sup> (mg/L)	Mg <sup>(9)</sup> (mg/L)	Fe <sup>(10)</sup> (mg/L)	Calculated TH (mg/L)	pH	SO <sub>4</sub> <sup>2-(11)</sup> (mg/L)	Cl <sup>(12)</sup> (mg/L)	NO <sub>3</sub> <sup>(13)</sup> (mg/L)	K <sup>(14)</sup> (mg/L)	Na <sup>(15)</sup> (mg/L)
1	2080	228	228	1852	20975	12	18.4	7.18	561	180	0.67	2142	7.7	650	10100	16.9	131	9720
2	1860	160	160	1700	16260	52	16.2	31.3	91.7	133	0.379	775	8.5	740	9120	15.5	64	5580
3	1780	208	208	1572	16260	7	16.8	2.06	508	111	0.038	1725	7.4	1080	7800	16	41.7	7250
4	8050	616	616	7434	41660	19	18.9	0.64	2407	419	0	7735.4	7.6	1200	35000	45.2	141	21850
5 <sup>(16)</sup>	6900	644	644	6256	58275	29	19.5	3.26	2109	403	0.159	6925.08461	7.7	1180	31900	45.9	132	21010

# The Investigation

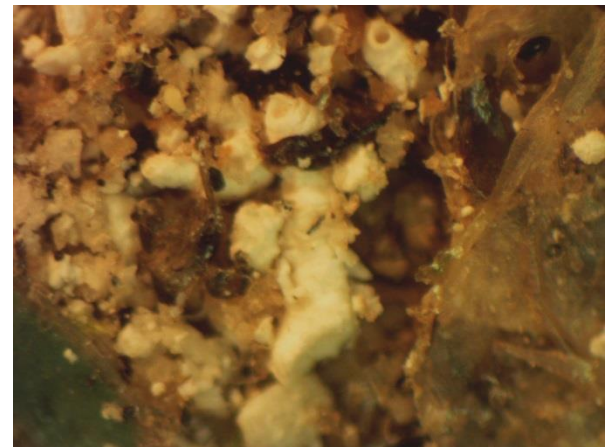
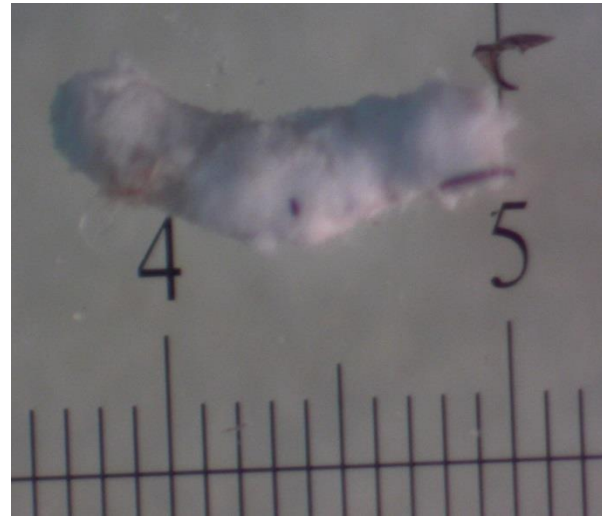
- Water Quality
  - Physical Characteristics
    - Temperature, Solids, Color/Odor
  - Chemical Characteristics
    - pH/Alkalinity, Hardness, Major Ions
- Water Quantity
  - Pre-Treatment Quantity
  - Post-RO Treatment and Disposal Quantity

# The Investigation



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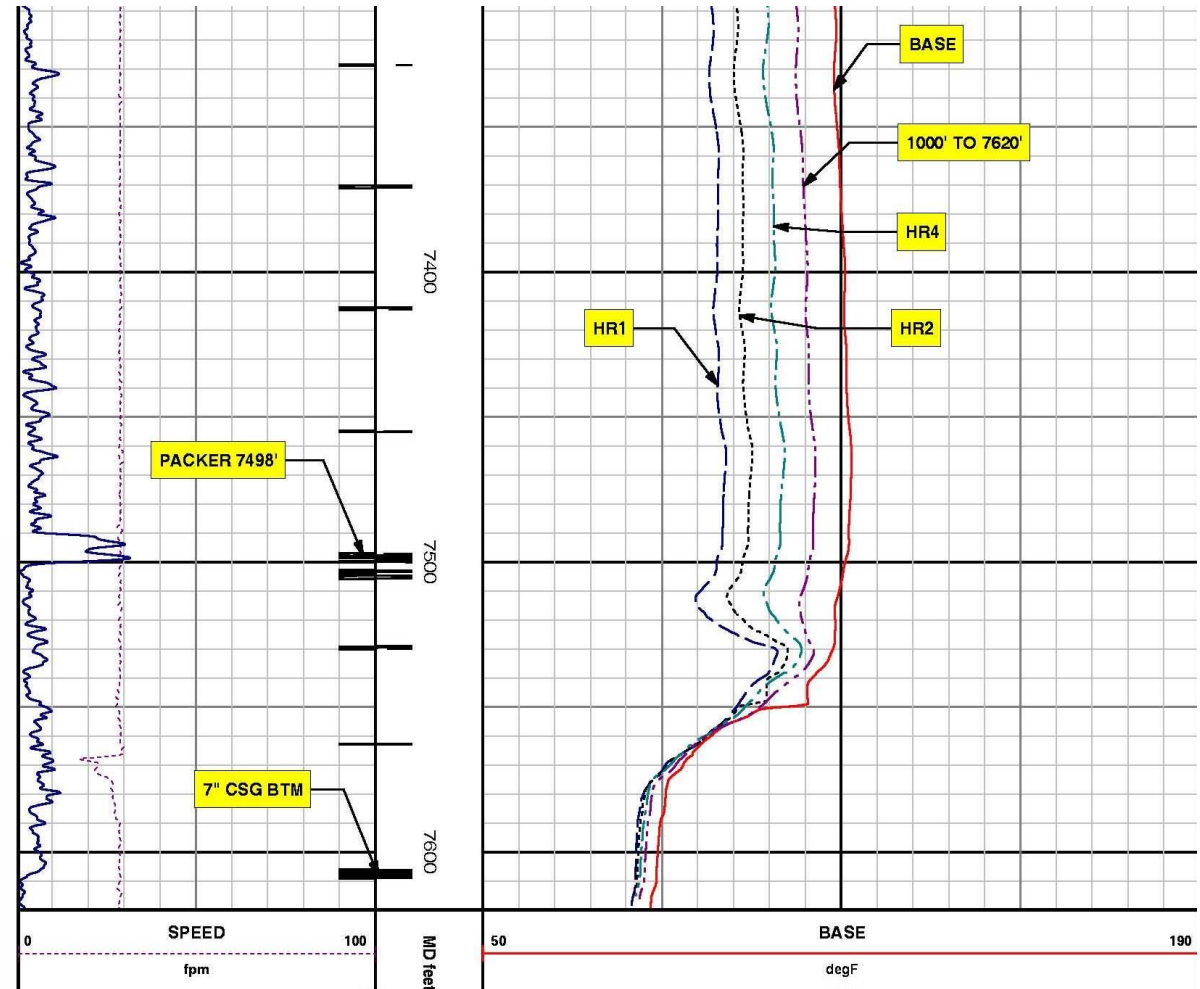
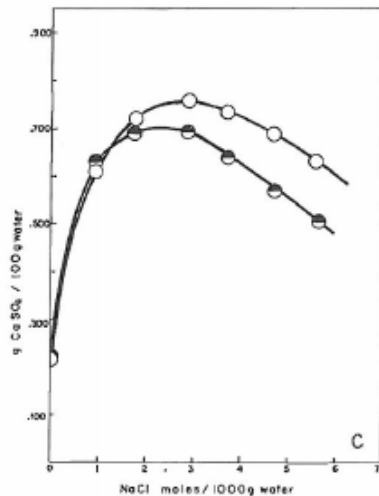
- GeoChemistry
  - Solubility Products
  - Visual Inspection
  - XRD/XRF Analyses





# The Investigation

- Gamma Ray/CCL Logs
- Scale Formation Reaction



# Conclusions

- Substantial Temperature/Pressure Changes Observed Downhole (Especially Near Packer Throat)
- Visual Inspections, Solubility Product Analysis, XRD/XRF Analyses Indicated Mineral Formation of Gypsum, Quartz, Magnesite, and Calcite

# Conclusions

- Recirculation of Concentrate Reducing Treatment Effectiveness
- Water Quality Investigation Indicated Ineffective Pre-Treatment
- Scaling Likely Causing Reduction in Disposal Capacity