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Corrosion Evaluation at Young Life's Washington Family Ranch

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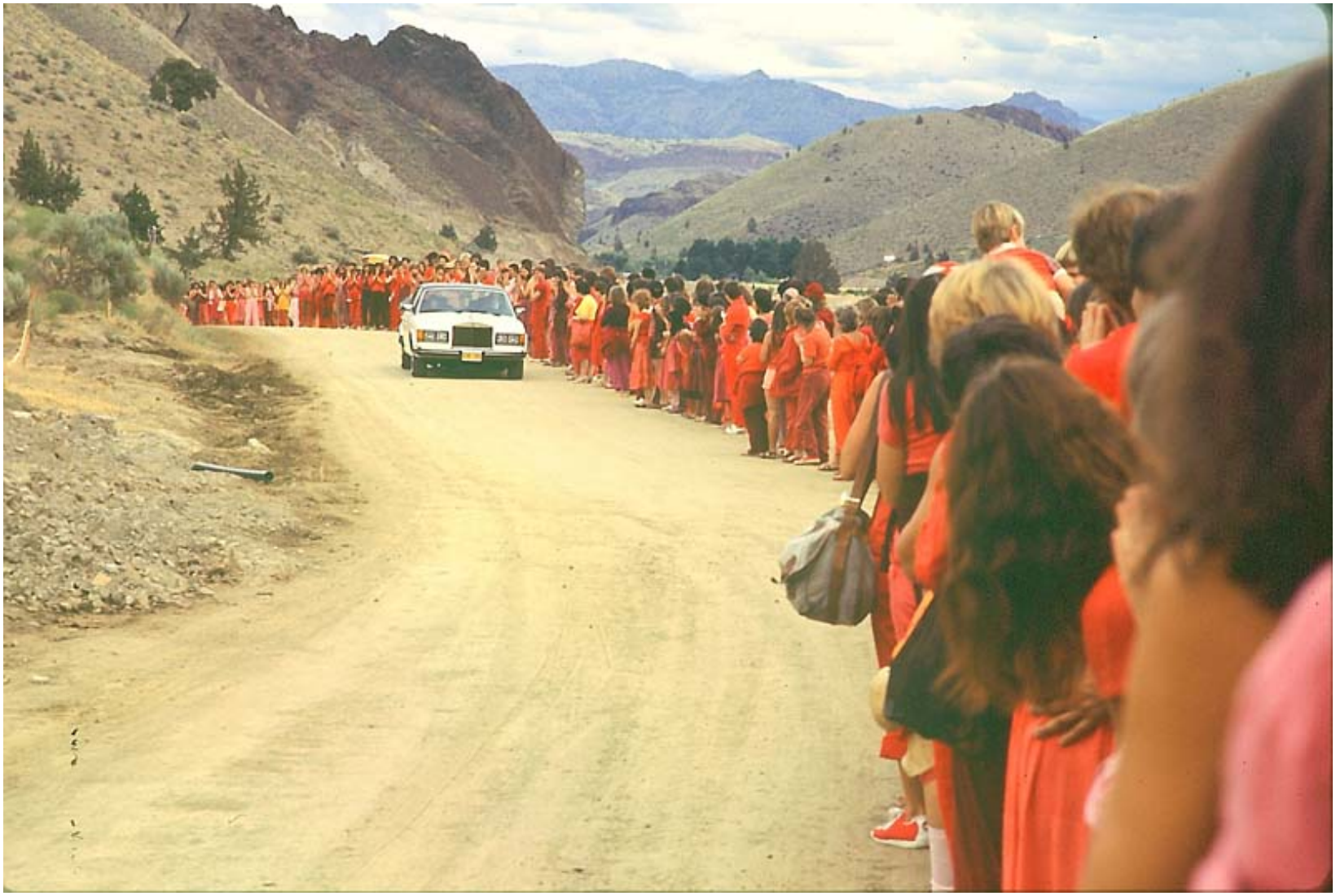
CASCADE to COAST
AWWA SHORT SCHOOL



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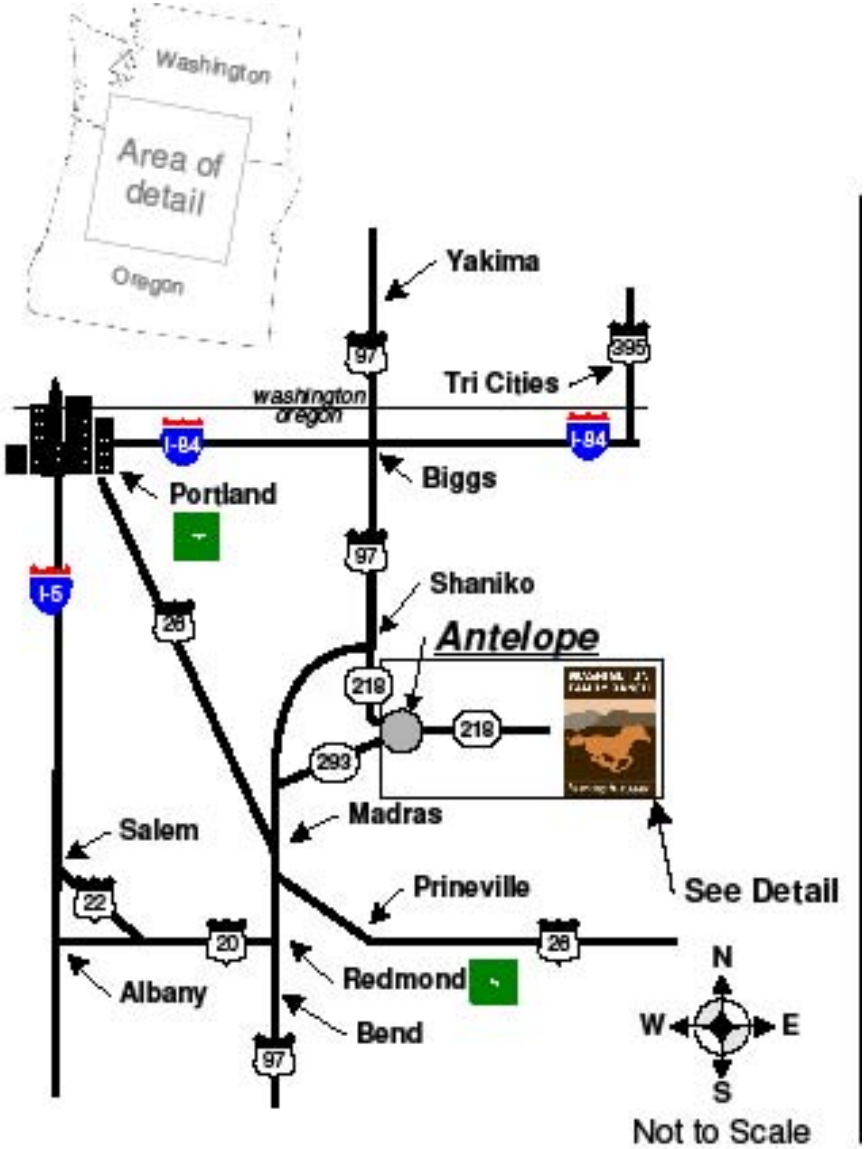
History of Young Life's Washington Family Ranch

- Location: Big Muddy Ranch near Antelope, OR
  - 50 miles NE of Bend, OR
- 1980s – Bagwhan Shree Rajneesh established intentional community at Big Muddy Ranch
- 1985 – The Bagwhan was deported
- 1999 – Young Life opens Washington Family Ranch

Location of Washington Family Ranch



Background

- Christian Youth Camp near Antelope, OR
- Approximately 40 permanent residents
- Summer camps with 300 – 500 campers per week
- Water supply:
  - Single well – 100 gpm
  - Disinfection – sodium hypochlorite
- Peak Season Average – 70,000 gpd

Water Quality Issues - Timeline

- Exceeded action level for Copper in 2006
  - sample collected from new copper pipe
- Scaling in swamp coolers and shower heads – maintenance issue
- Installed water softener in March 2007
  - sodium chloride regenerant
- Pitting of new copper piping observed
- Exceeded action level for Copper in 2009

Historical Lead and Copper Data

Lead and Copper 90th Percentile Results			
Date	**Lead (mg/L)**	**Copper (mg/L)**	**Sample Frequency**
9 / 1999	0.0089	**1.50**	6 months
11 / 2000	0.0015	0.55	6 months
4 / 2001	0.0022	0.95	1 year
9 / 2002	0.0023	0.33	1 year
9 / 2003	0.0011	0.22	1 year
8 / 2006	0.0040	**1.36***	3 years
9 / 2009	0.0025	**1.78**	6 months
Action levels: Lead = 0.0155 mg/L Copper = 1.35 mg/L *sample collected from new copper pipe			

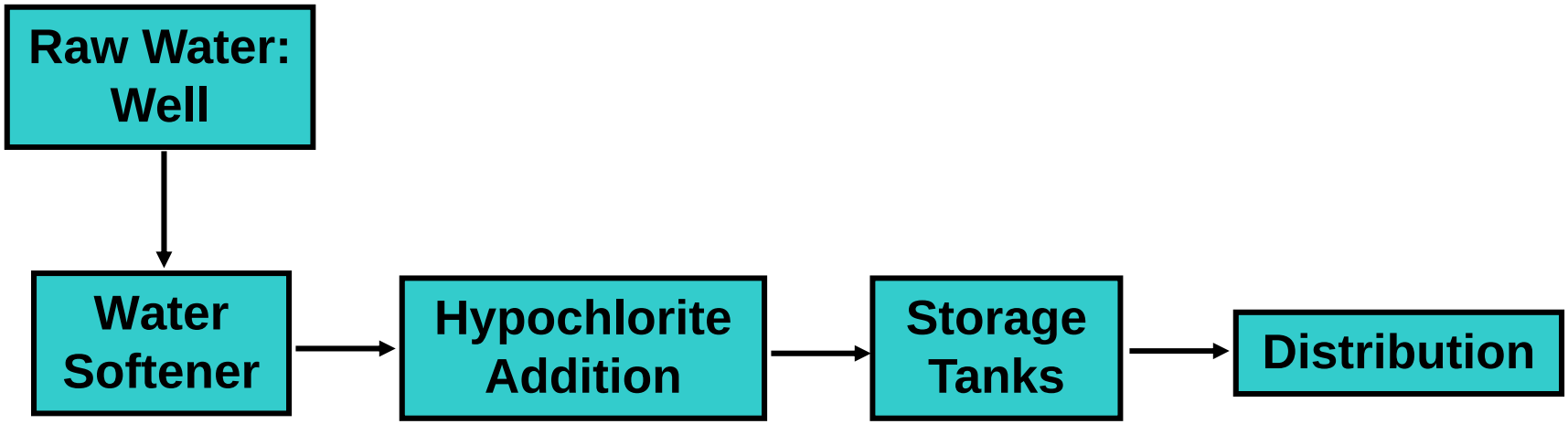
Copper Chemistry

- Usually originates in the pipe materials rather than water source
- New copper tends to “leach” more copper than older pipe
- Strong oxidants can accelerate copper corrosion
- Chlorides have been implicated in copper pitting corrosion

Cause of Young Life's LCR Violation and Copper Pipe Corrosion?

- Very little historical water quality available
- Additional sampling and testing required to determine cause of corrosion
- Collected and tested samples in July 2009
  - Raw water
  - Downstream from water softener
  - Distribution system

Water Treatment Process Train



Water Quality Sampling Results

Raw, Softener, and Distributed Water Quality				
		Sampling Location		
Parameter	**Unit**	**Raw**	**Softened**	**Distribution**
Temp	°F	16.4	19.3	22.7
Chloride	mg/L	29.1	-	92.3
Sulfate	mg/L	38.6	-	36.2
Alkalinity	mg/L	361	-	374
TDS	mg/L	420	548	536
pH	Units	7.7	7.8	7.7
Copper	mg/L	ND	ND	0.367
Manganese	mg/L	ND	ND	ND
Iron	mg/L	ND	ND	ND
Magnesium	mg/L as Mg	15.5	8.39	7.77
Sodium	mg/L	112	208	218
Calcium	mg/L as Ca	56.2	32.2	29.7

Calculated Water Quality Indices

Parameter	Unit	Sampling Location	
		Raw	Distribution
Chloride-to-sulfate mass ratio (CSMR)	--	0.8	2.5
Hardness	mg/L as $CaCO^3$	204	106

Water Quality Observations

- All copper is coming from pipe in distribution system – no copper in raw water
- Water softener is not functioning properly
  - softener is only removing 50% of the hardness
  - softener is contributing 63 mg/L of chloride to the water
- Inspection revealed water softener is undersized

Recommendations

- Optimize operation of existing water softener
- Install larger water softener or expand existing
- Replace copper piping with nonmetallic piping
- Add orthophosphate

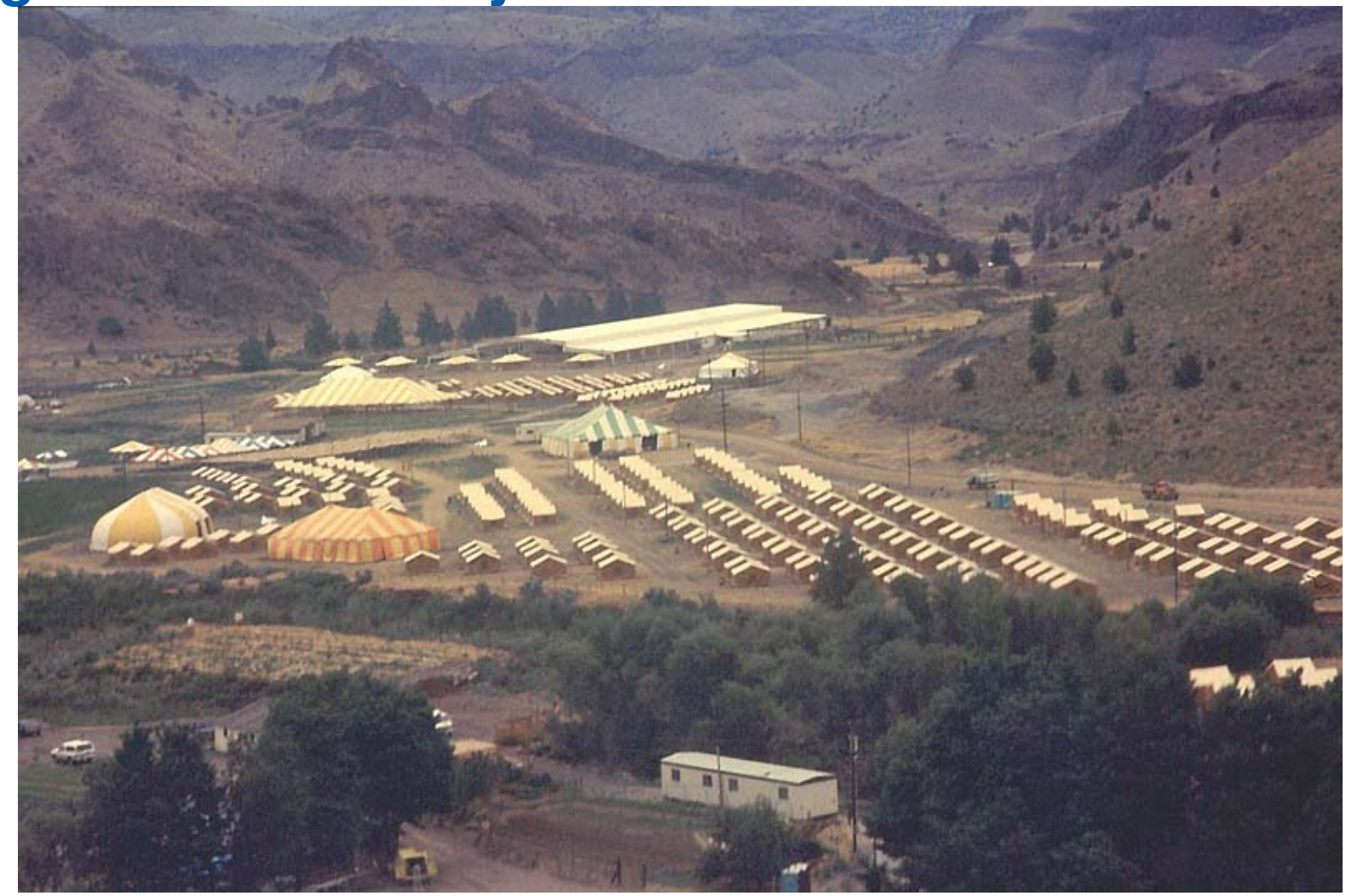
Recent Developments

- Water softener was taken off-line until improvements could be made
- Scaling occurred
- Copper concentrations still high after softener was taken off-line

Recent Developments

- New water park to be constructed
- Additional well required
- Drilled new well and no water
- Considering abandoning wells and changing to surface water
- Decision on water softener improvement / replacement pending decision on source water

Bagwhan Shree Rajneesh Intentional Community



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Washington Family Ranch

Photo courtesy of Young Life

Washington Family Ranch

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Questions?

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