

How are they doing?

Check-up on the Enaville and Glenns Ferry Microfiltration WTPs

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Introduction

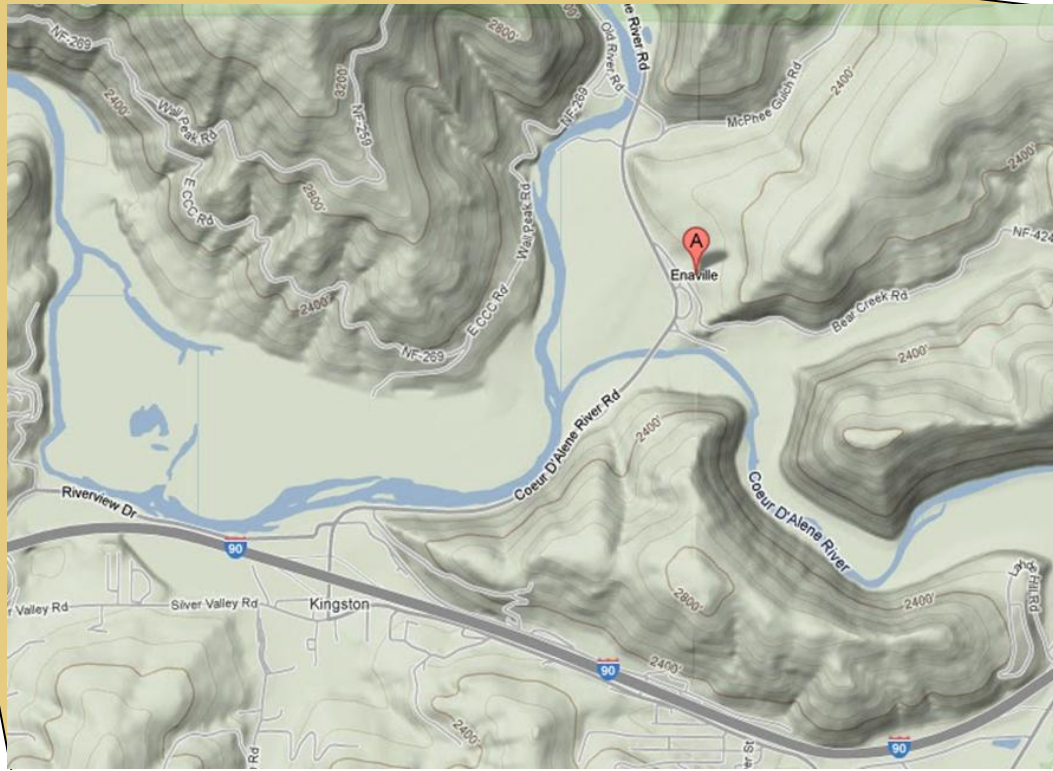
- Outline
 - PART 1 - General Information and History
 - PART 2 – Operations History and Track Record
 - PART 3 – Cost Evaluation and Take-Away Information

PART 1 – GENERAL INFORMATION AND HISTORY



Facility Descriptions

Enaville WTP (northern Idaho)



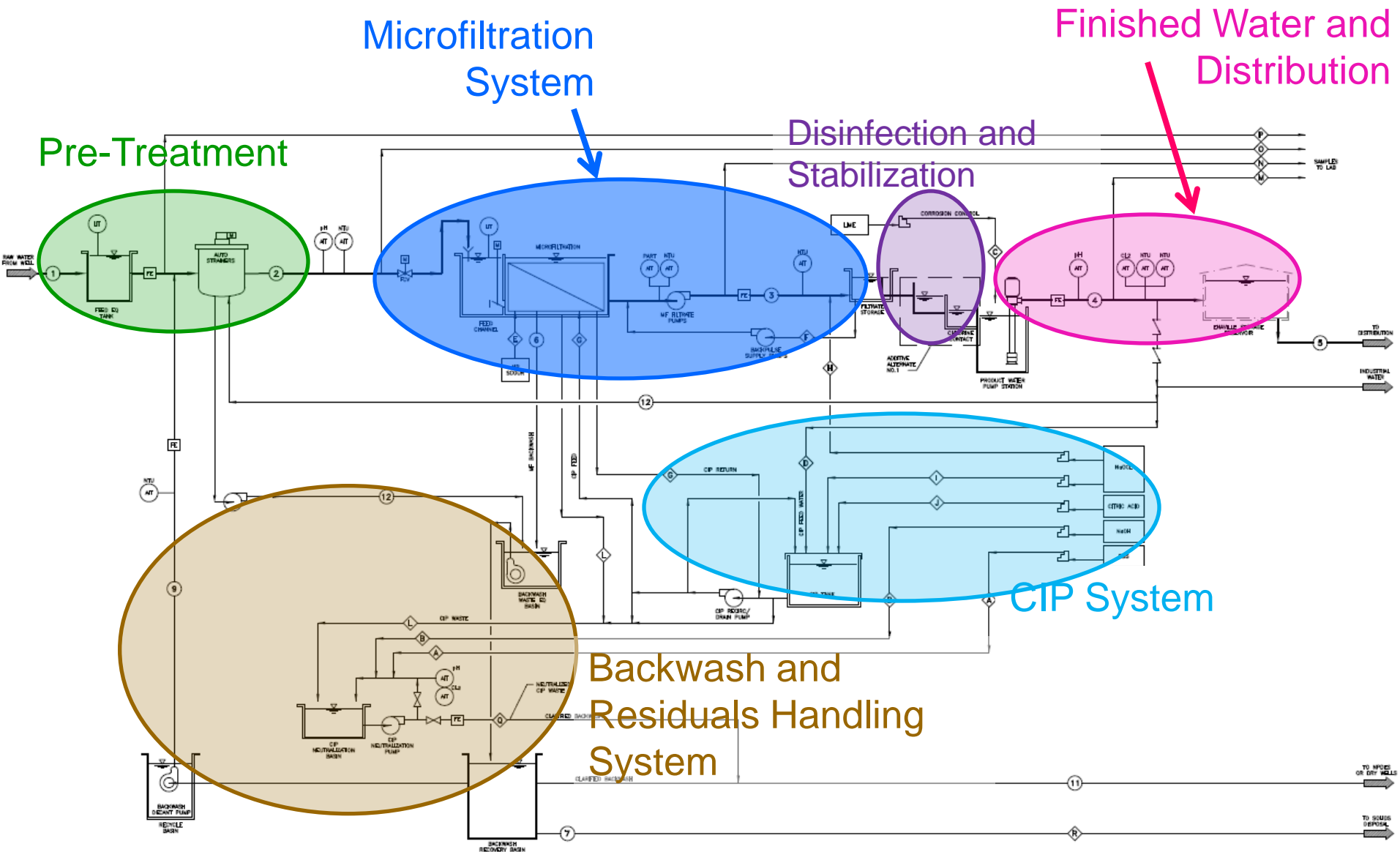
Facility Descriptions

Enaville WTP

- **Supply:** Groundwater Well (under the influence of surface water)
- **Constructed:** 2009-2011
- **Capacity:** 5.6 MGD (infrastructure to 6.8 mgd)
- **Service Area:** 5500 people
- **Filtration System:** GE-Zenon ZW1000 ultrafiltration membranes (submerged)
- **Additional Systems:**
 - Lime Addition for Corrosion
 - Sodium Hypochlorite for Disinfection
 - Backwash settling and recycling
 - Chemical CIP waste neutralization

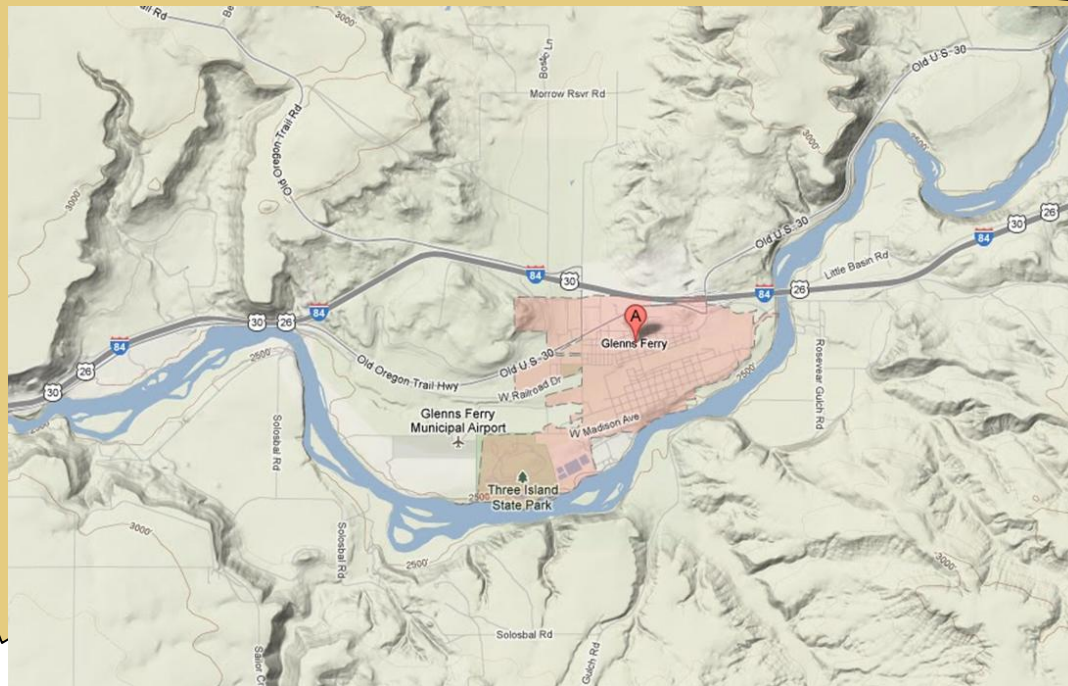
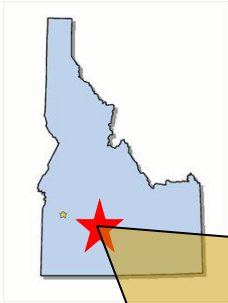


Enaville WTP Process Schematic



Facility Descriptions

Glenns Ferry WTP (southern Idaho)



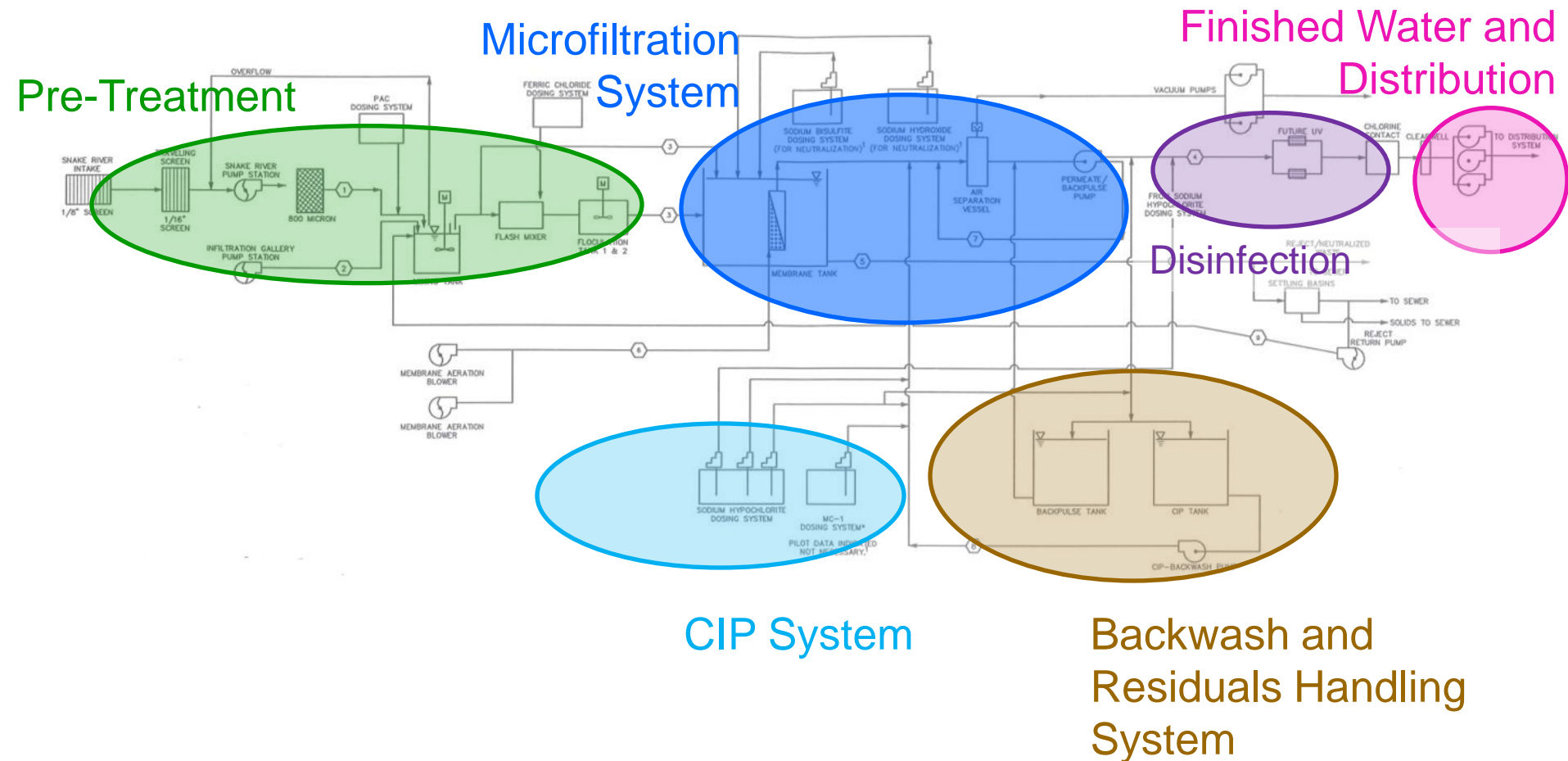
Facility Descriptions

Glenns Ferry WTP

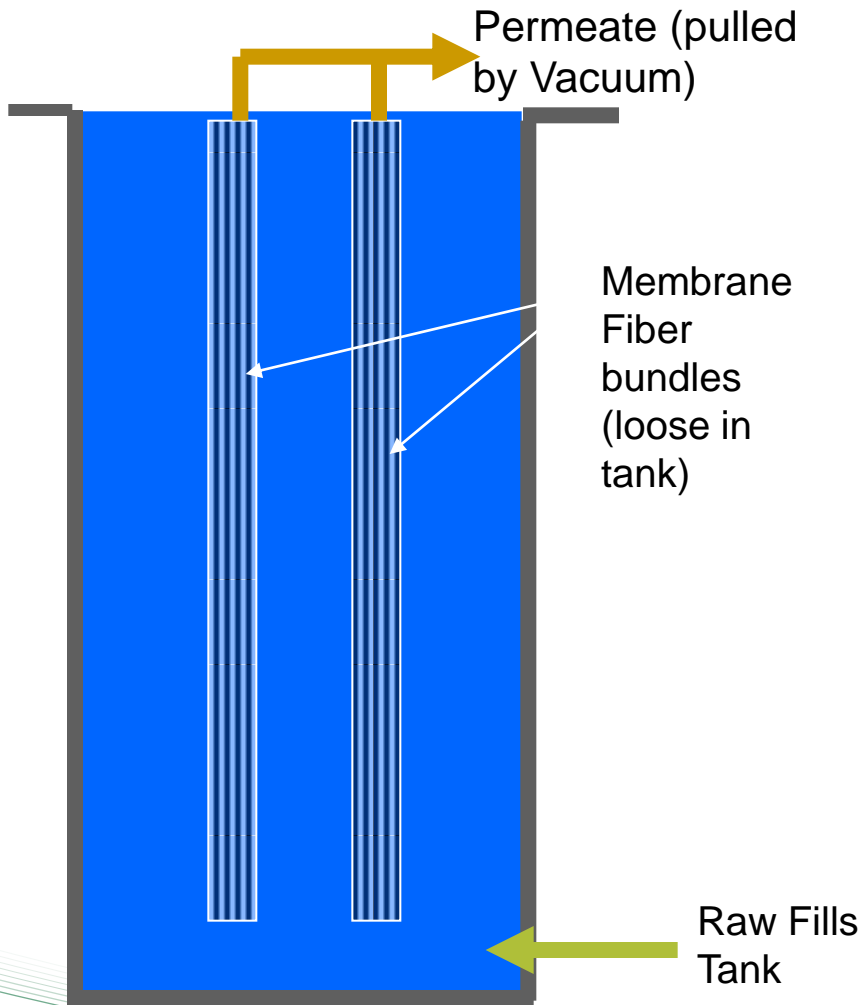
- **Supply:** Snake River (surface water)
- **Constructed:** 2002-2004
- **Capacity:** 1.08 MGD
- **Service Area:** 1500 people
- **Filtration System:** GE-Zenon ZW500c ultrafiltration membranes (submerged)
- **Additional Systems:**
 - Ferric addition for pre-flocculation
 - On-Site Generated Sodium Hypochlorite for Disinfection
 - Backwash settling and recycling
 - Optional PAC addition for TOC reduction and color



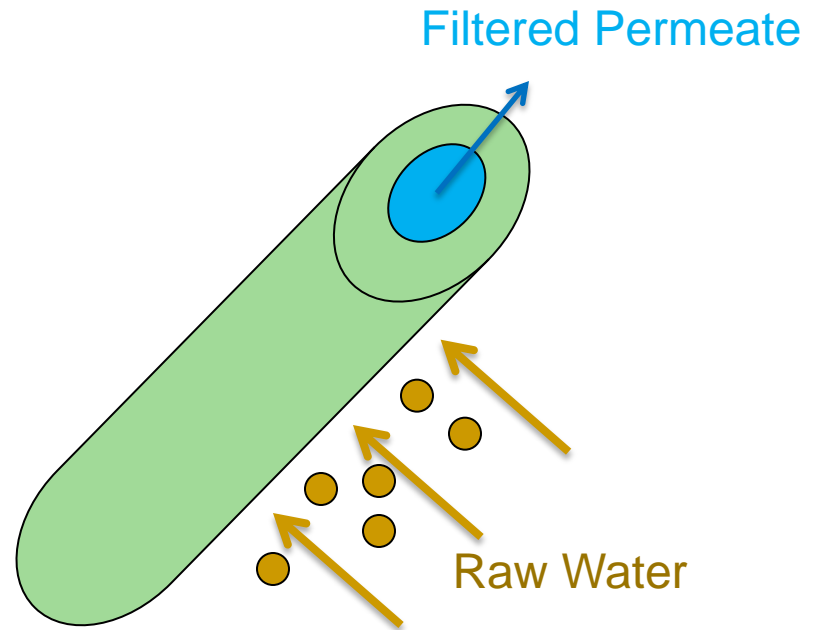
Glenns Ferry WTP Schematic



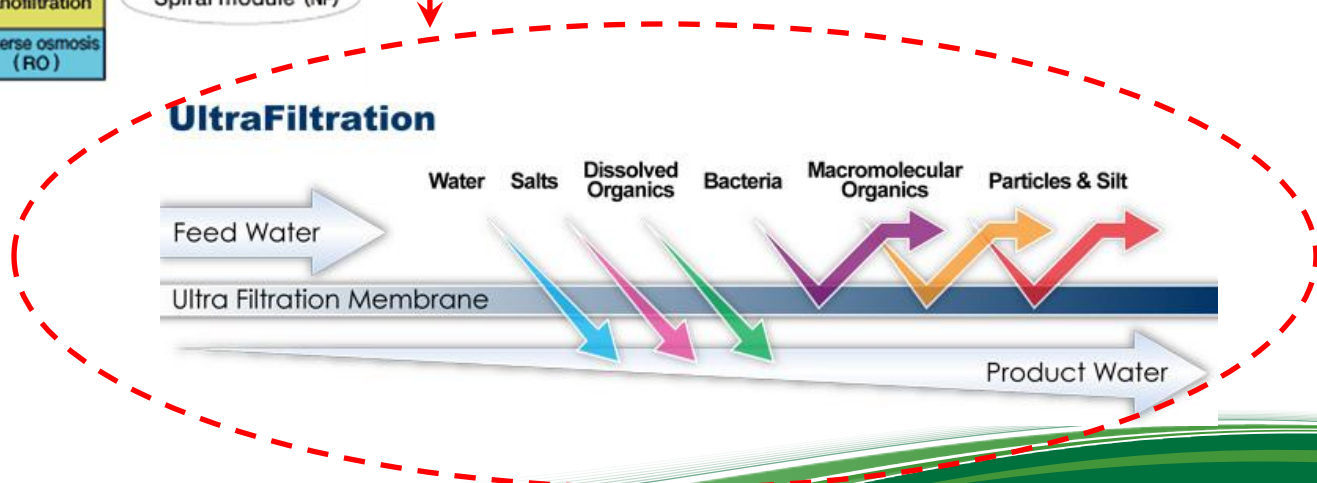
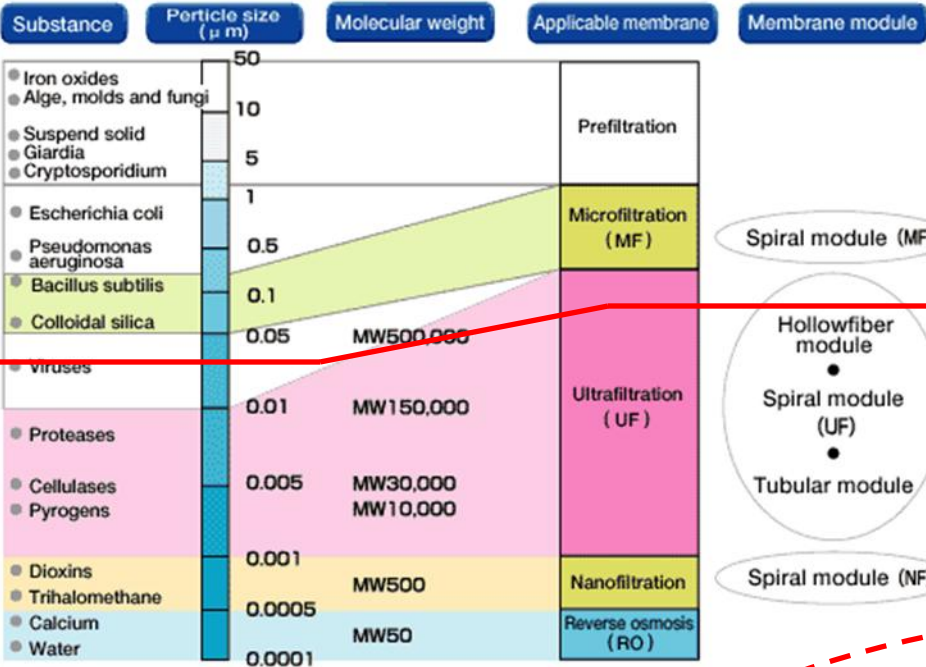
Submerged Hollow Fiber Membrane



Dead-End Filtration



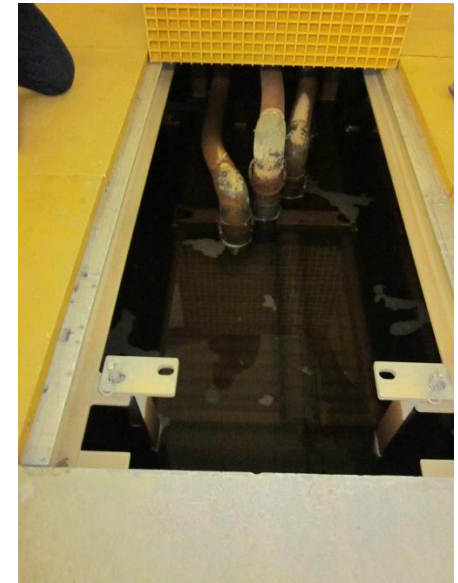
FILTRATION RANGE



Major Equipment Differences

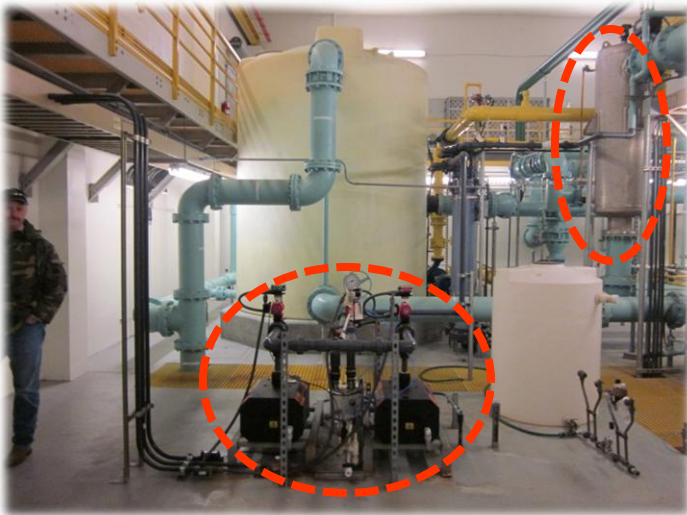


ENAVILLE - GE-Zenon Zeeweed ZW1000



GLENN'S FERRY- GE-Zenon Zeeweed ZW500

Major Equipment Differences



Glenns Ferry – Air Removal System
(*Vacuum Pump, and Air Accumulators*)



Enaville– Air Removal System
(*Pressure Venturi Ejectors*)

PART 2 – OPERATIONS HISTORY AND TRACK RECORD



WATER PRODUCTION/DESIGN CRITERIA

	Glenns Ferry	Enaville
Average Annual Production (current)	0.293 mgd	3.0 mgd
Peak Day Production (observed)	0.65 mgd	4.6 mgd
Peak Plant Firm Capacity	1.08 mgd	5.6 mgd
Average flow as % of peak capacity	28%	54%
Design Flux (peak)	30 gfd/SF @ 20C	50 gfd/SF @ 20C
Membrane Design Recovery	90-92%	95-98% +

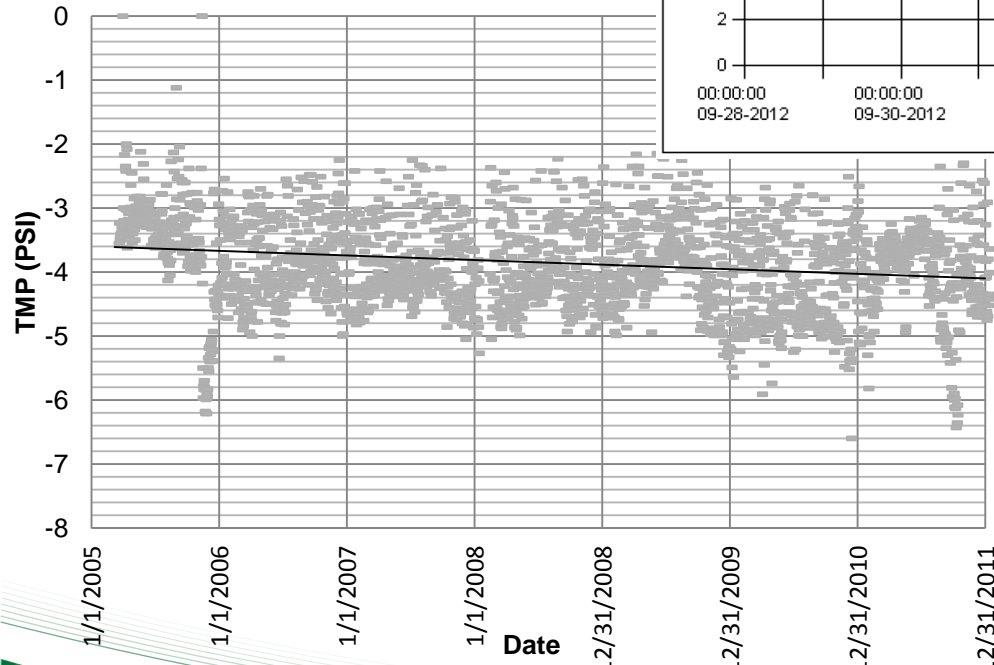
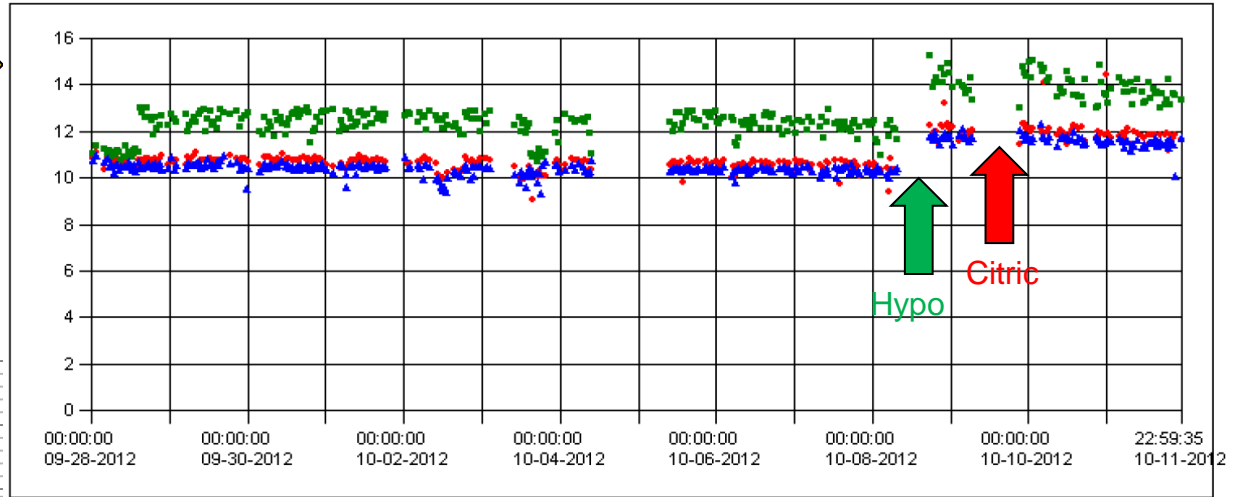
WATER QUALITY

<u>RAW WATER</u>	Glenns Ferry	Enaville
Turbidity	4.5 NTU average (peaks to 27 NTU)	0.2 NTU average (peaks to 1.2 NTU)
Alkalinity	125 to 160	10 to 30 mg/L
pH	7.3 to 7.9	6.3 to 6.7
TOC	1.3 to 4.5	<1 mg/L
Temp	6 to 17.4	5 to 15 C

<u>FINISHED WATER</u>	Glenns Ferry	Enaville
Turbidity	0.02 to 0.05 NTU	0.015 to 0.03 NTU
Alkalinity	Same as Raw	30 to 90 mg/L
pH	Same as Raw	7.1 to 7.3

TMP AND PERMEABILITY TRENDS

Enaville
(Permeability)



Glens Ferry (TMP)

MEMBRANE FIBER REPAIRS

	Glenns Ferry (Z500 reinforced fiber)	Enaville (Z1000 unreinforced fiber)
# of Breaks (annually)	Perform Repairs Annually with 10 to 20 repairs annually.	Perform repairs every couple months, 5 to 10 fibers per repair (20 to 40 repairs annually)
Repair Trigger	MIT Tests	MIT Tests and LRV Calc's
Time Required to Repair a "Train"	One Train, 8 hour day	Can do all 5 trains in an 8 hr shift
# Persons in Repair Crew	3	2
Estimate of Man-Hours Spent Annually	48	96
Normalized Man-Hours (per MGal of water produced)	0.45	0.088

PART 3 – COSTS AND TAKE-AWAY INFORMATION



OPERATIONS LABOR

<u>Labor</u>	Glenns Ferry	Enaville
Operations Staff	Lead Operator with Backup	Lead Operator with Backup
<i>Hours per day at the facility</i>	<4 hrs/day	<4 hrs/day
<i>% of Time on Tasks</i>		
Equipment Maintenance	30%	35% ***
Record keeping / Ordering Supplies	40-50%	35-45%
Membrane Repairs	<5%	<5%
Troubleshooting/Alarms	<5%	10-15% **

** High level of automation creates more alarms

*** Operator spends considerable time maintaining compressed air and automated valve systems.

CHEMICAL USAGE (ANNUAL)

	Glenns Ferry (Z500 reinforced fiber)	Enaville (Z1000 unreinforced fiber)
Cleaning Regimen	2 ppm hypo backpulse (regularly), annual hypo and Citric Acid CIP soak	Per Train: MC @ 200 ppm hypo weekly. CIP (500 ppm heated Hypo and Citric pH 3) every 5 weeks.
Citric Acid	<20 gallons – manual addition	127 gallons
Salt (for onsite hypo)	23,040 lbs	NA
Sodium Hypochlorite	--	7772 gallons
Caustic (for neutralization)	--	88 gallons
Sodium Bisulfite (for dechlorination)	--	128 gallons
Lime (pH adjustment)	--	42732 lbs
Ferric or Alum	3729 gallons (Ferric)	195 gallons (ACH)
Annual Chemical Costs \$	\$29,100	\$38,520

COSTS – O&M

<u>ANNUAL COSTS</u>	Glenns Ferry (Z500 reinforced fiber)	Enaville (Z1000 unreinforced fiber)
Power	\$22,000*	\$110,400
Chemicals	\$29,100	\$38,500
Membrane Replacement (every 10 years)	\$7,000	\$26,000
ANNUAL O&M \$	\$79,200	\$174,900
ANNUAL O&M (\$ per MGD at average conditions)	\$198,300**	\$58,300**

* Estimated based on several meters

**Operator labor costs excluded and assumed fixed costs.

COSTS - CAPITAL

	Glenns Ferry (Z500 reinforced fiber)	Enaville (Z1000 unreinforced fiber)
Membrane Eqpt Cost	\$1.19M (2003) CCI to 2009 = \$1.54 M	2.1M (2009)
Membrane Eqpt Cost \$/gal (at peak capacity)	\$1.42 (at 1.08 mgd)	\$0.375 (at 5.6 mgd)
Warranty	1- year	1-year cliff, 9 year pro-rated
TOTAL Construction Cost	\$5.15M (2003) excluding river intake costs and adjusting with CCI to 2009 = \$5.93 M	\$11.6 M (2009)
Construction Cost \$/gal (at peak capacity)	\$5.49 (at 1.08 mgd)	\$2.08 (at 5.6 mgd)

CAPITAL COSTS - ADJUSTMENTS

	Glenns Ferry (Z500 reinforced fiber)	Enaville (Z1000 unreinforced fiber)
<u>EQUIPMENT</u>		
Membrane Eqpt Cost \$/gal (at peak capacity)	\$1.42 (at 1.08 mgd)	\$0.375 (at 5.6 mgd)
<i>Adjusted for Flux and Recovery</i>	<i>\$0.80 (per gallon)*</i>	<i>\$0.375 (per gallon)</i>
<u>CONSTRUCTION</u>		
Construction Cost \$/gal (at peak capacity)	\$5.49 (at 1.08 mgd)	\$2.08 (at 5.6 mgd)
<i>Adjusted for Flux and Recovery</i>	<i>\$3.09 (per gallon)*</i>	<i>\$2.08 (per gallon)</i>
*(30 gfd at 90%, adjusted to 50 gfd and 95%)		

COSTS – *NOT ALL MEMBRANE PLANTS ARE THE SAME*

- ***So what is the reason for \$3.09 per gallon vs \$2.08 per gallon***
 - Improvement in technology – reduced footprint
 - Different equipment, better efficiency
 - Reinforced vs Unreinforced
 - Better understanding of Risk by the vendors
 - Ability to handle peak flows,
 - better cleaning regimens
 - better predictability and permeability maintenance
 - Economy of scale?
 - ie cost curves...
 - Design Flux and long-term warranty implications

QUESTION AND ANSWER

- *Thanks for your participation!*

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