



Optimization of Treatment To Conserve Water At The US Naval Academy

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US Naval Academy:

- **Established 1845**
- **1,160 Acres**
- **3.46 MGD Iron Removal WTP:**
 - **Constructed 1971**
 - **Modifications in 1998 & 2004**

5/6/2009



Source Water:

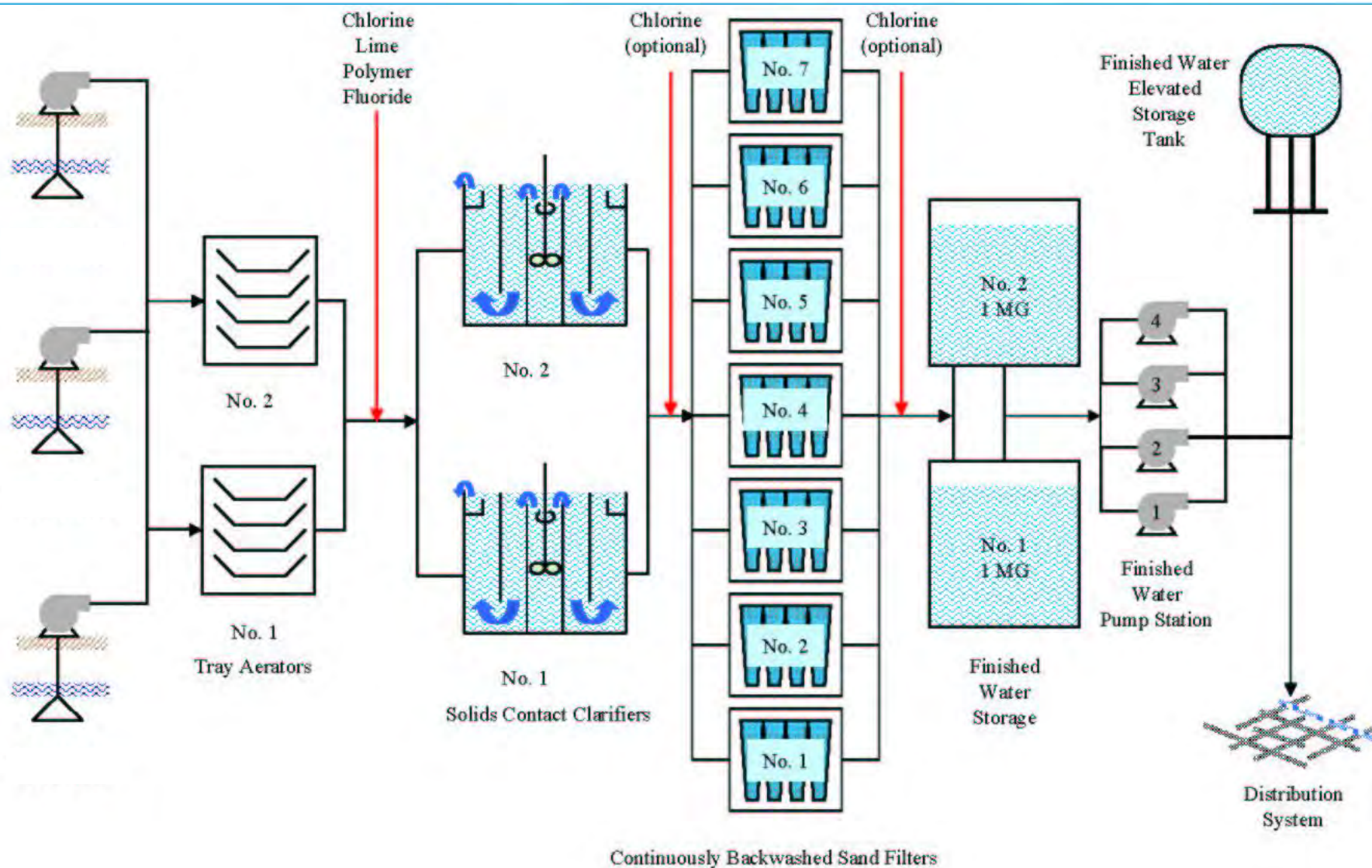
- **3 wells**
- **600' to 700" Deep**
- **Upper Patapsco Aquifer**
- **1200 – 1300 gpm capacity**
- **20 mg/L Iron**

Objectives:

- **Reduce volume of sludge being generated**
- **Reduce amount of backwash water being discharged**
- **ID alternative sludge disposal methods**

Approach:

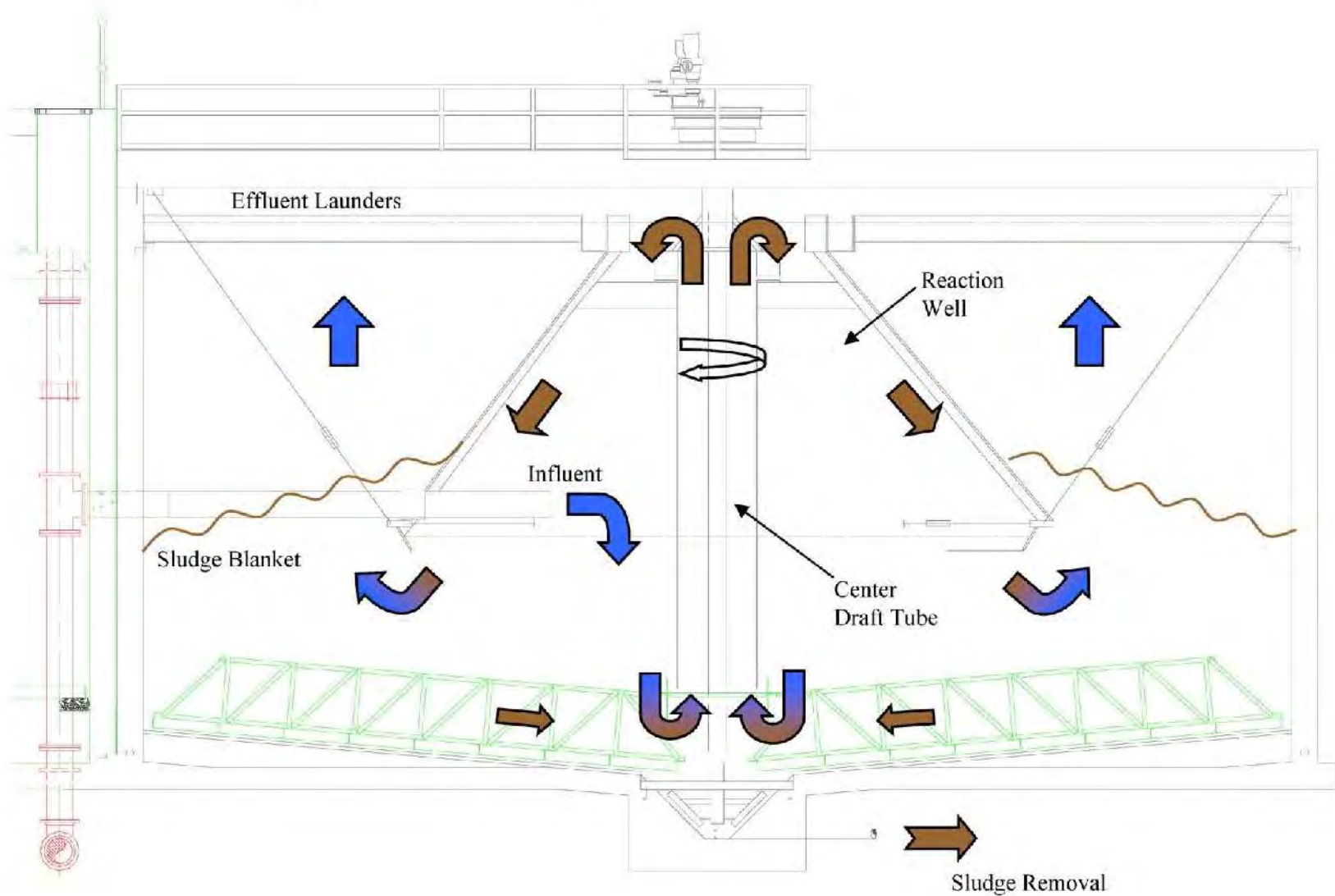
- **Review existing design & operating information**
- **ID where water is being lost & quantity**
- **Evaluate processes**
- **ID alternatives to reduce volume of waste & costs**



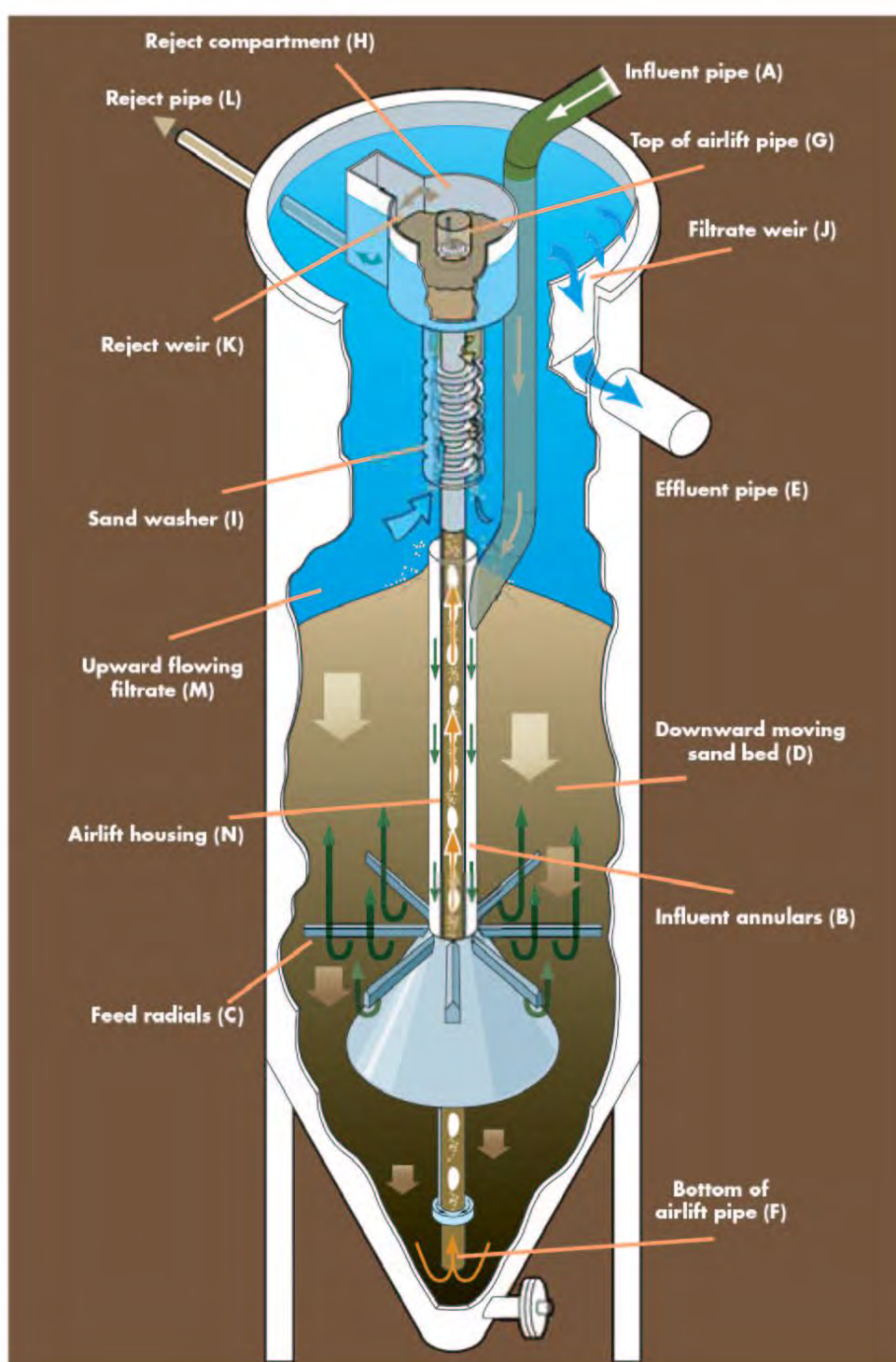
WTP Operations:

- **Manned 24/7 but operated 14 hrs/day**
- **1.8 MGD average production**
- **50,000 g/hr blow-down from clarifiers:**
 - **Frequency = 1/day to 1 every 4 days**
- **13,000 g/hr filter backwash water being generated**
- **Total filter backwash = 160,000 gal/day (14 hrs ops)**

Upflow Solids-Contact Clarifier (2)



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Dynasand Filter (7)

- Continuous backwash
- Water flows up
- Sand moves down
- Backwash rate ea. filter is fixed

Water Losses:

- **19,000 gal/clarifier drains to filters**
- **Drained water conveyed to waste**
- **38,000 gal total lost ea. Shut-down**



Process Issues:

- **Lime & Polymer dosage = $\frac{1}{2}$ of targeted amounts**
- **Metering:**
 - **Raw water flow meter disabled by lightening strike**
 - **No metering of sludge blow-down**

Summary of Waste Streams:

- **Reject water from filters**
- **Clarifier blow-downs:**
 - **Supernatant**
 - **Settled solids**
- **Clarifier drainage following shutdowns**

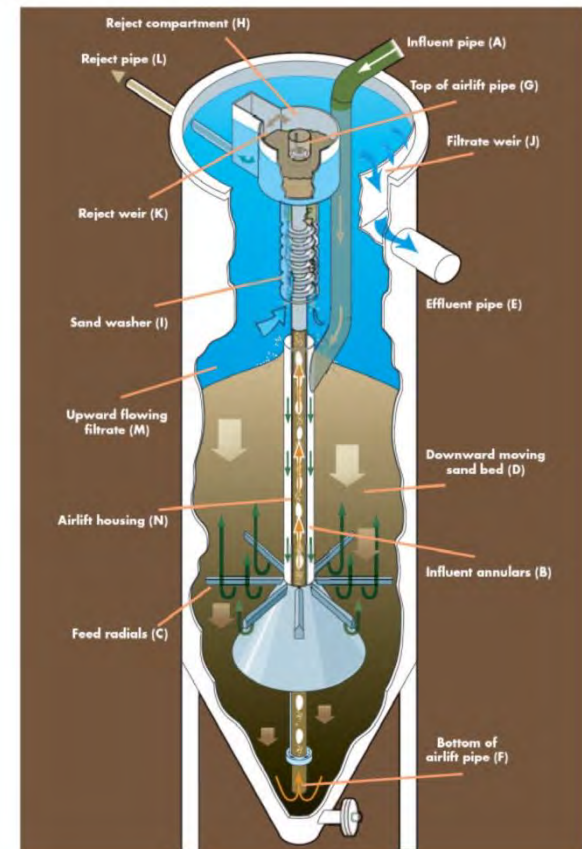
Waste Reduction Strategies:

- **Minimize filter reject water**
- **Optimize blow-downs from clarifiers**
- **Minimize plant shut-downs**

Minimize Filter Reject Water:

- Operate 4 filters at avg flow
- Within design surface loading rates
- 40% reduction in waste water
- \$150,000/yr savings

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Optimize Blow-downs:

- **Currently not process driven**
- **Currently controlled by limited sludge tank volume**
- **Interim solution:**
 - **Contract dewatering**
 - **Less \$ than current waste hauler**
 - **Provide additional functional volume in tank**
 - **Provide operational experience for future on-site facility**

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Minimize Plant Shutdowns:

- Most WTPs operate best 24/7
- Ea. shut-down:
 - Wastes water from drainage
 - 2 to 3 turnovers required to achieve steady-state
 - Results in water quality deterioration at ea. start up



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Minimize Plant Shutdowns:

- Current Avg & Max Daily Rates = 25% & 50% of Design
- 24 hr operation would:
 - Maintain steady state conditions
 - Eliminate losses due to drainage of clarifiers
 - Require use of only 1 clarifier
 - Result in > \$60,000/yr savings

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Long Term:

- **Eliminate filter reject water discharge [recycle]**
- **Optimize chemical dosages**
- **Optimize clarifier blow-downs**
- **Eliminate clarifier blown-down supernatant discharge [recycle]**
- **Construct dewatering facility**
- **Continue 24/7 operation of WTP**
- **Note: Recycle alternatives should be pilot tested**

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SUMMARY

	Reject Water From Filters	Sludge From Blow-Downs		Clarifier Draining After Shutdown
		Supernatant	Settled Solids	
Current Practice	Discharge to Sewer	Discharge to Sewer	Evacuation, Hauling	Discharge to Sewer
Interim Strategy	<u>Operate filters at proper design loading rate of 4–5 gpm/ft²</u> <ul style="list-style-type: none"> Requires full-scale study Requires operator training 	<u>Optimize chemical doses</u> <ul style="list-style-type: none"> Requires bench-testing Requires operator training <u>Optimize blow-down intervals and volume</u> <ul style="list-style-type: none"> Requires on-time evacuation of holding tank 		<u>Reduce plant shutdowns by operating the plant 24/7 through throttling plant flow</u> <ul style="list-style-type: none"> Requires plant repairs Requires VFDs at well pumps
Long-Term Strategy to Eliminate Waste Stream	<u>Recycle to head of plant</u> <ul style="list-style-type: none"> Requires full-scale study Requires construction 	<u>Recycle to head of plant</u> <ul style="list-style-type: none"> Requires full-scale study Requires construction 	<u>Construct dewatering facility</u> <ul style="list-style-type: none"> Requires optimization of chemical doses and blow-downs Requires construction 	

Questions?

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