Water Conservation at Aqseptence Group

Ryan Pauly

MnTAP Advisor: Jane Paulson

On-site Supervisor: Paul Johnson

UNIVERSITY OF MINNESOTA

Driven to Discover℠

MnTAP

UNIVERSITY OF MINNESOTA

Company Overview

- **Headquartered in Germany**
- **Collection of water technology companies**
- **Johnson Screens**
  - New Brighton
  - 1904 by Edward Johnson
  - Continuous slot wire wrapped screen
  - Industrial filters and water wells

Aqseptence Group

Products

- **Continuous wire wrapped screens**
  - Water intake
  - Wells
  - Decoration

Motivations For Change

- **Current situation**
  - 10 million gallons of water per year
  - High levels of chromium
  - Water recycling systems need improvement
- **Goals**
  - Reduce water usage by 30%
  - Recycled water for NSF products

Reasons for MnTAP Assistance

- **Audit water usage**
  - Evaluate largest sources of consumption
  - Evaluate current recycling systems
- **Evaluate strategies to:**
  - Improve recycling systems
  - Reduce source water
  - Remove chromium from recycled water
- **Determine savings for final recommendations**

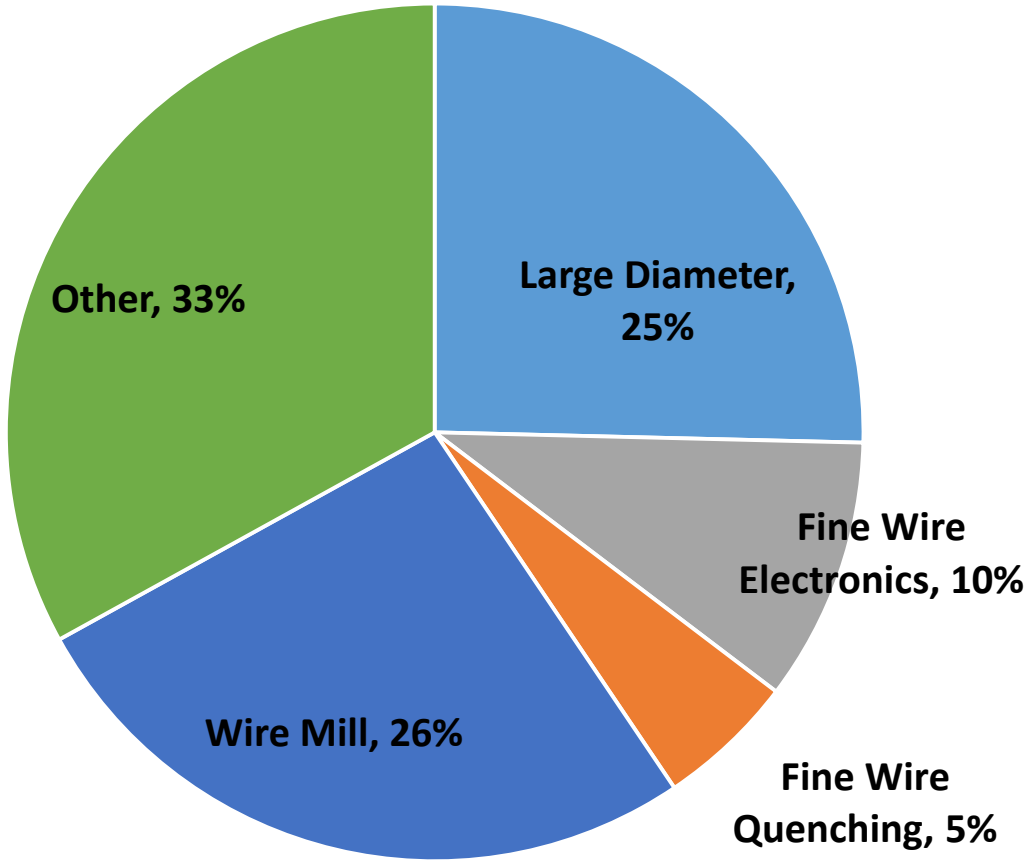
Approach

- **Investigate water consumption processes**
  - Map water flow
  - Quantify water usage
- **Evaluate current recycling systems**
  - Identify successes and shortcomings
  - Understand shortcomings
- **Identify material flow**

Approach

- Identify top water usage areas
  - Screen Machines > Wire Mill
- Blueprint for recycling system
- Chromium removal
- Address remaining areas

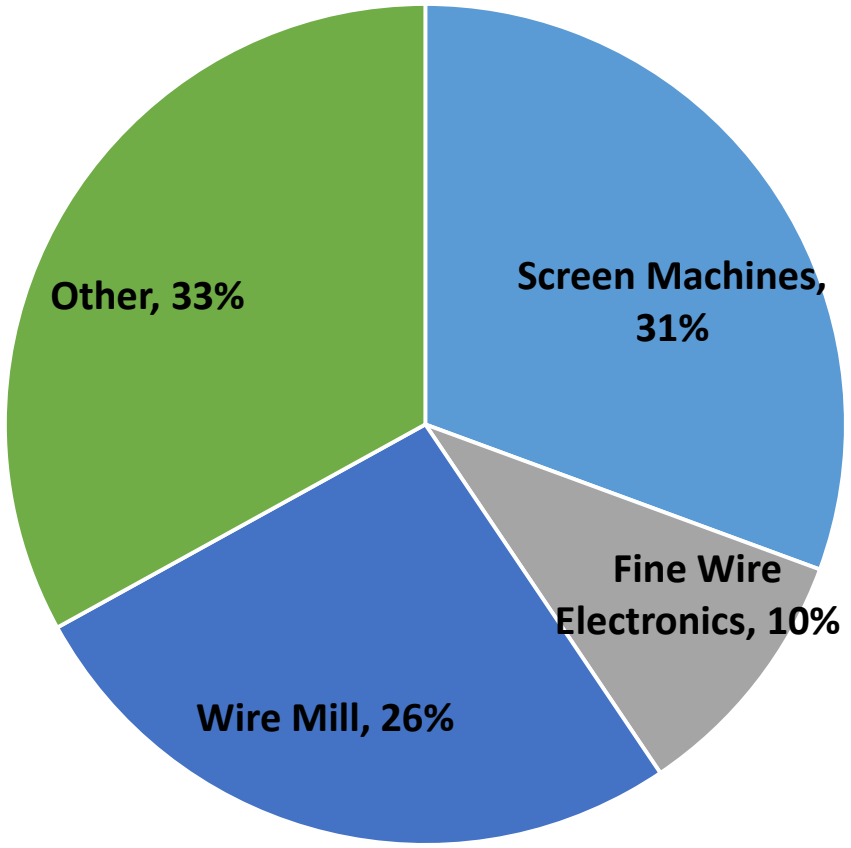
Water Usage



Approach

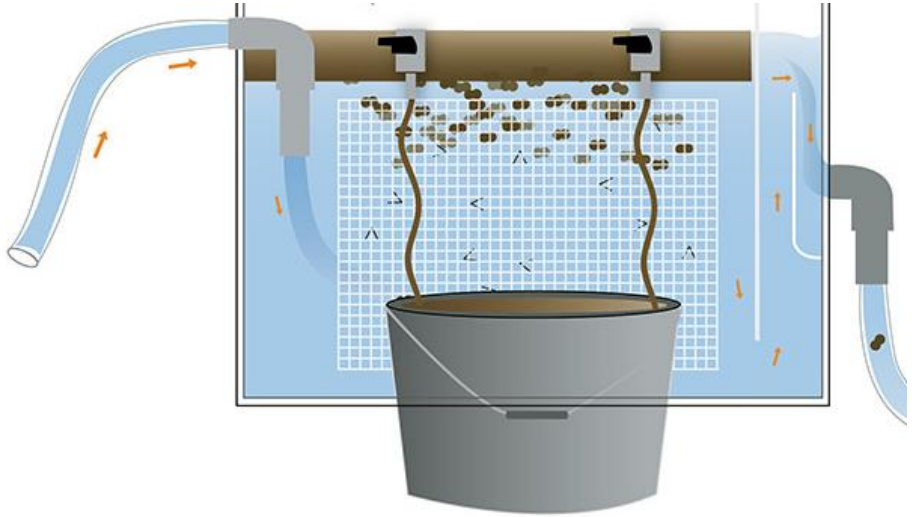
- Identify top water usage areas
  - Screen Machines > Wire Mill
- Blueprint for recycling system
- Chromium removal
- Address remaining areas

Water Usage



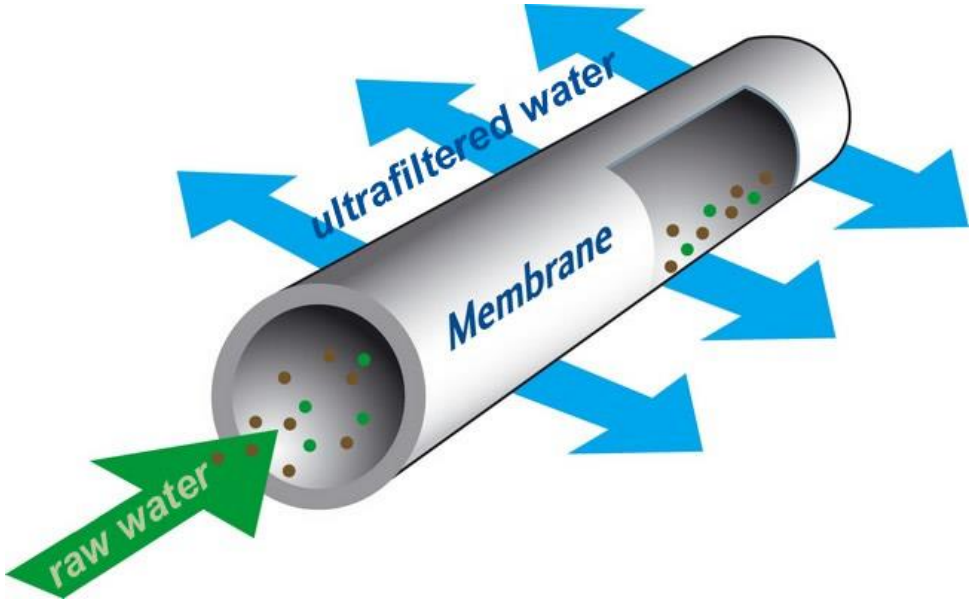
Contaminated Water

- **Small particulates and burnt oil**
- **Oil-water emulsion**
- **Current recycling system**
  - Oil-water coalescing separator
  - Flow pattern in reservoir
  - Centrifuge



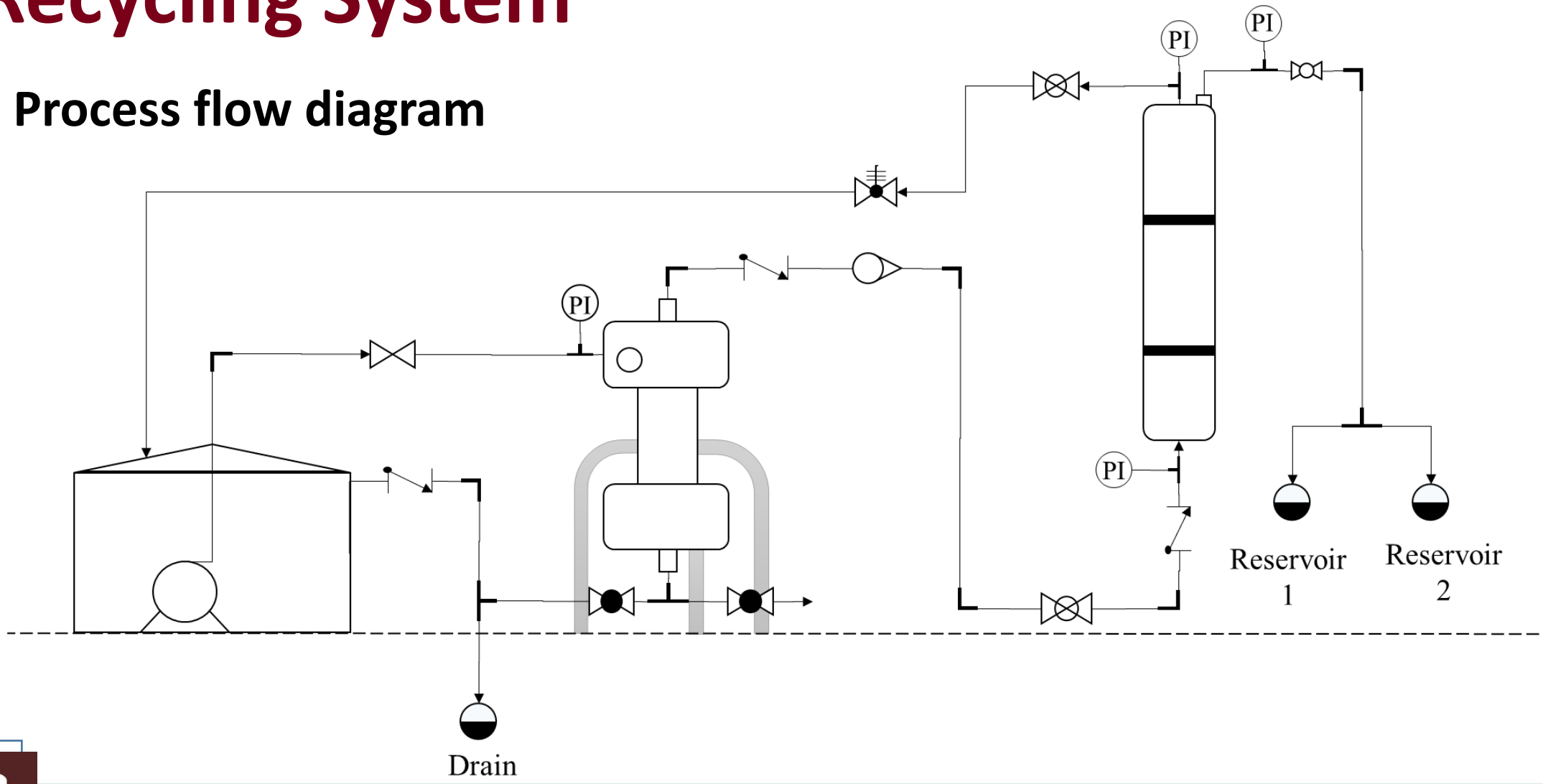
Recycling System

- **Proposed system: centrifuge and ultrafiltration**
  - Centrifuge: particles > 74 microns
  - Ultrafiltration: oil-water emulsion
- **Pilot system**
  - 4 machines



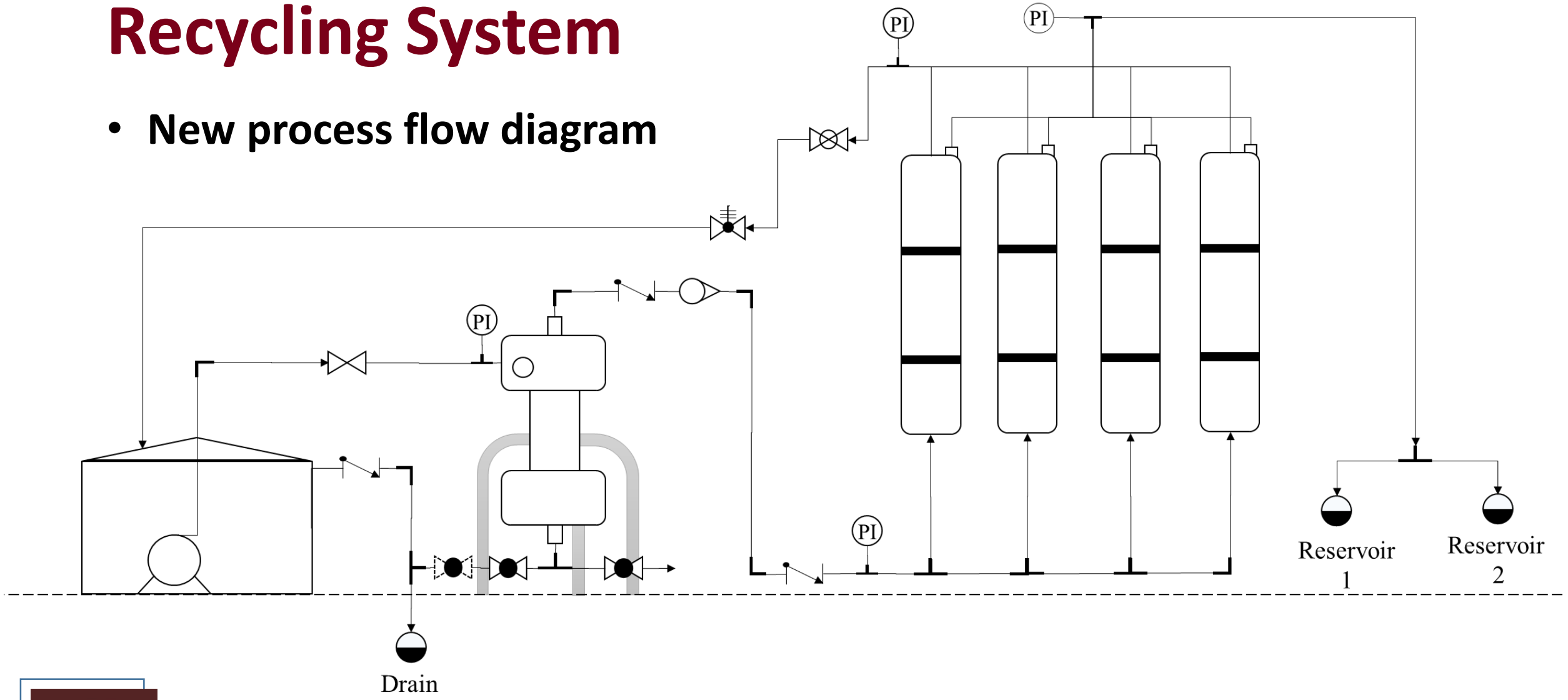
Recycling System

- **Process flow diagram**



Recycling System

- New process flow diagram



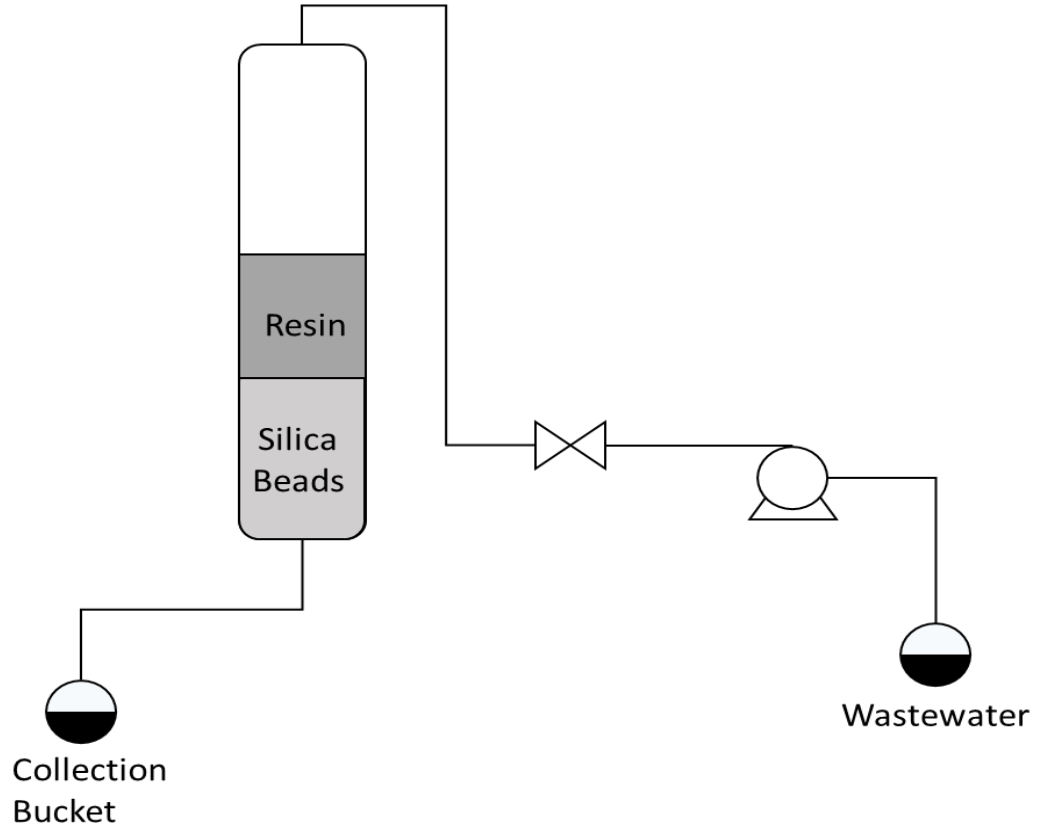
Recommendations: Recycling System

Recycling System	Water Reduced (gallons per year)	Implementation Cost	Cost Savings (per year)	Payback Period	Status
Large Diameter Implemented	940,000	$4,000	$7,000	6.9 months	Implemented*
Large Diameter Recommended	1,170,000	$6,000	$8,600	8.4 months	Recommended
Small Diameter	4,000	$4,000	$30	130 years	Recommended
Total	**2,100,000**	**$14,000**	**$15,600**	**10.8 months**	**--**

*Additional ultrafiltration columns need to be added

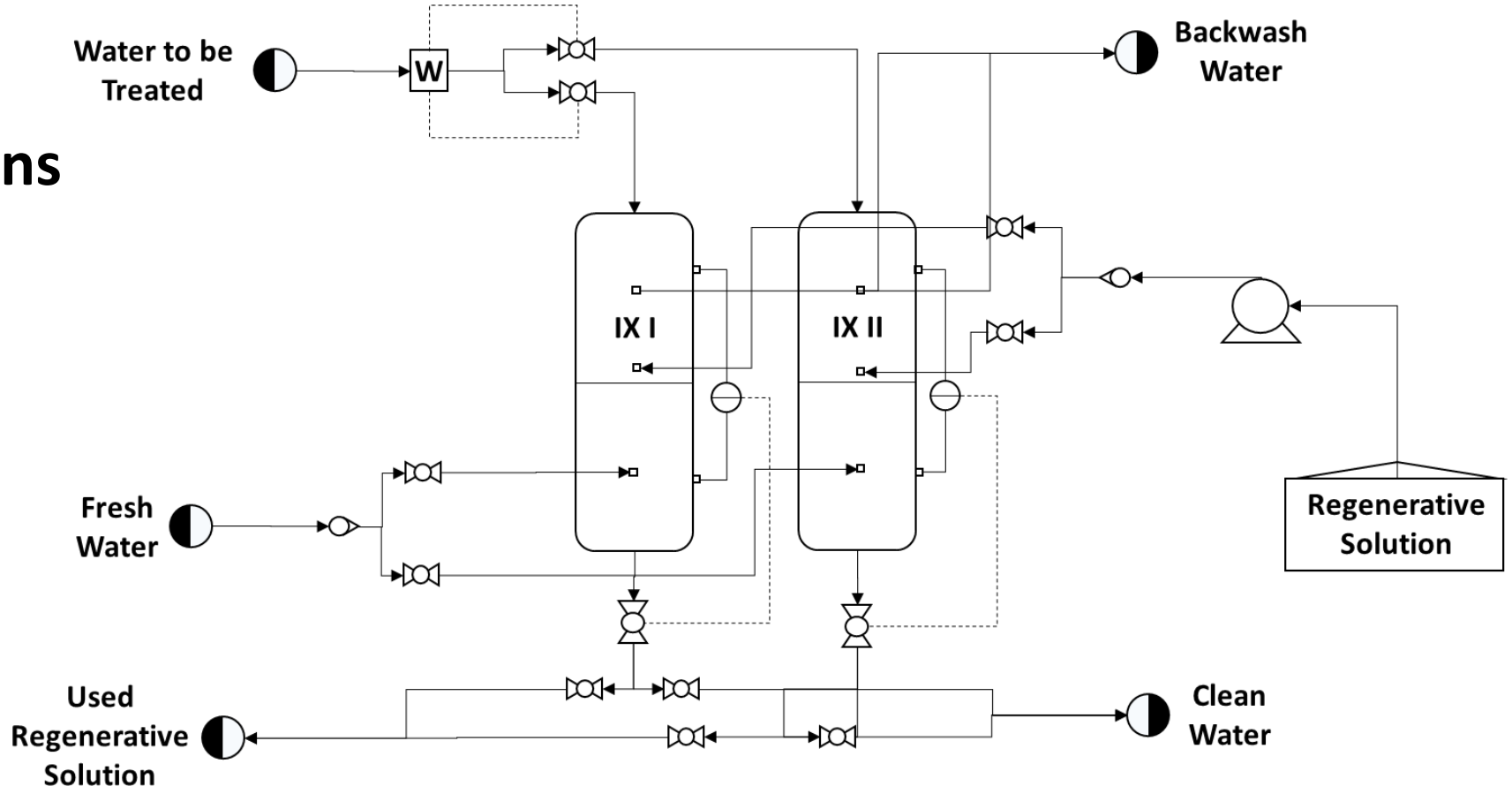
Chromium Removal

- **NSF certification**
- **Proposed solution: ion exchange**
  - Regenerable resin
  - Pilot scale system
  - Colorimeter



Chromium Removal

- **Process flow diagram**
- **Multiple location options**
  - Following ultrafiltration
  - Next to reservoir
- **Additional cost for automation**
- **No downtime**



Recommendations: Chromium Removal

Ion Exchange Location	Water Reduced (gallons per year)	Implementation Cost	Cost Savings (per year)	Payback Period	Status
Next to Reservoir	120,000	$4,500	$870	5.2 years	Recommended
Following Ultrafiltration	120,000	$2,700	$870	3.1 years	--

Fine Wire Screen Machines

- **Electronics cooling water**
- **Quenching water**
- **Solution**
  - Closed loop system with chiller
  - Recycling system

Recommendations: Fine Wire

Waste Reduction Option	Water Reduced (gallons per year)	Percent Reduction	Implementation Cost	Cost Savings (per year)	Payback Period	Status
Closed Loop Cooling Water	780,000	100%	$4,500	$4,700	11.5 months	Recommended
Recycling System	390,000	95%	$3,700	$2,900	15.3 months	Recommended
Total	**1,170,000**	**--**	**$8,200**	**$7,600**	**13 months**	**--**

Quenching Water

- **Excess water applied to weld**
- **Limited control**
- **Solution**
  - Globe valves and flow meters

Recommendations: Quenching Water

Quenching Water Reduction	Water Reduced (gallons per year)	Percent Reduction	Implementation Cost	Cost Savings (per year)	Payback Period	Status
With Recycling Systems	82,000	29%	$3,300	$600	5.5 years	Recommended
Without Recycling Systems	175,000	29%	$3,300	$1,700	2 years	--

Wire Mill

- **Wire washing stage**
- **Minimal contaminants in samples**
- **Air wipe in Use**
- **Suggestion**
  - Shutoff water
  - Further testing necessary

Recommendations: Wire Mill

Waste Reduction Option	Water Reduced (gallons per year)	Implementation Cost	Cost Savings (per year)	Payback Period	Status
Cleaning Water in Wire Mill	2,070,000	--	$15,400	--	Testing Required

Summary

Waste Reduction Option	Water Reduced (gallons per year)	Percent Reduction	Implementation Cost	Cost Savings (per year)	Payback Period	Status
Large Diameter Implemented	940,000	95%	$4,000	$7,000	6.9 months	Implemented*
Large Diameter Recommended	1,170,000	95%	$6,000	$8,600	8.4 months	Recommended
Small Diameter	4,000	95%	$4,000	$30	130 years	Recommended
Ion Exchange from Reservoir	120,000	100%	$4,500	$870	5.2 years	Recommended
Fine Wire Screen Machines	1,170,000	> 95%	$8,200	$7,600	13 months	Recommended
Cleaning Water in Wire Mill	2,070,000	--	--	$15,400	--	Testing Required
Quenching Water	82,000	29%	$3,300	$600	5.5 years	Recommended
Total (Excluding Wire Mill)	**3,500,000**	**37%**	**$30,000**	**$25,000**	**14.4 months**	**--**

*Additional ultrafiltration columns need to be added

Personal Benefits

- Interaction with wide variety of people
- Application of principles learned in school
- Design and construction of recycling system

Questions?