

# CRUMB RUBBER PRE-FILTER FOR USE WITH UV WATER TREATMENT SYSTEM



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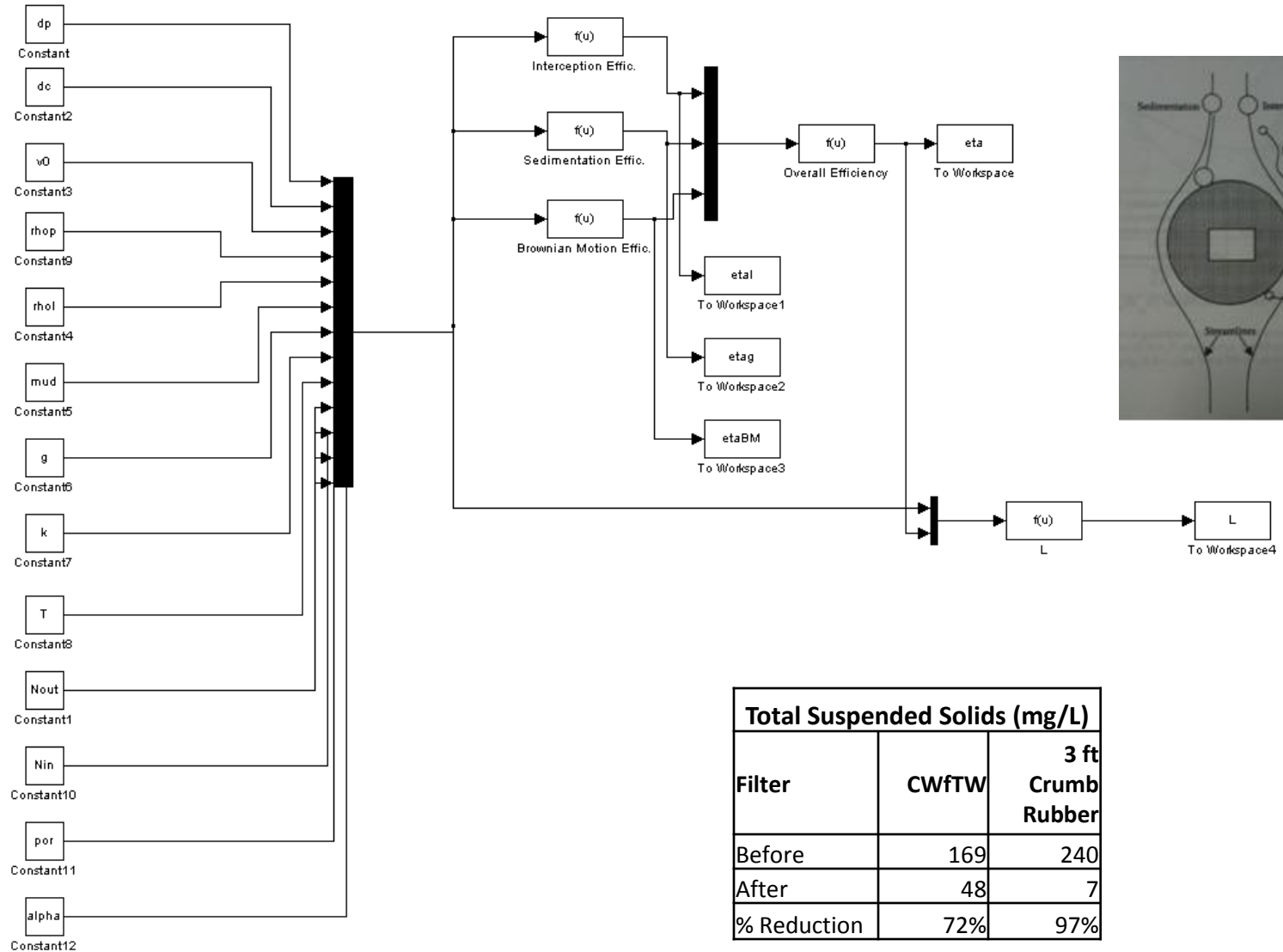
# Project Description

- The goal of this project is to create both a test stand to test a water filter, and to use crumb rubber to pre- filter drinking water to meet EPA requirements and NSF standards in regards to turbidity, solids, and leached chemicals. The pre-filter is intended for use with a UV water treatment system
- High Level Customer Needs and Engineering Specs – Test stand
  - Flow Rate and pressure drop across filter is to be measured
  - Tests will be sent out for metals and VOC leeching, Turbidity removal, and Total Suspended Solids removal
- High Level Customer Needs and Engineering Specs – Filter
  - Minimum flow rate of 5 liters per minute
  - Remove large particles from water
  - Does not leech hazardous materials into water
  - Does not negatively impact taste or smell of water

# State of Design

- Schedule
  - Test stand and filter constructed
  - Preliminary testing completed
- Budget
  - Total Cost for Bill of Materials = \$2091
  - Actual Cost for Bill of Materials = \$881
  - Amounts for test stand, simple filter, and variable compression filter

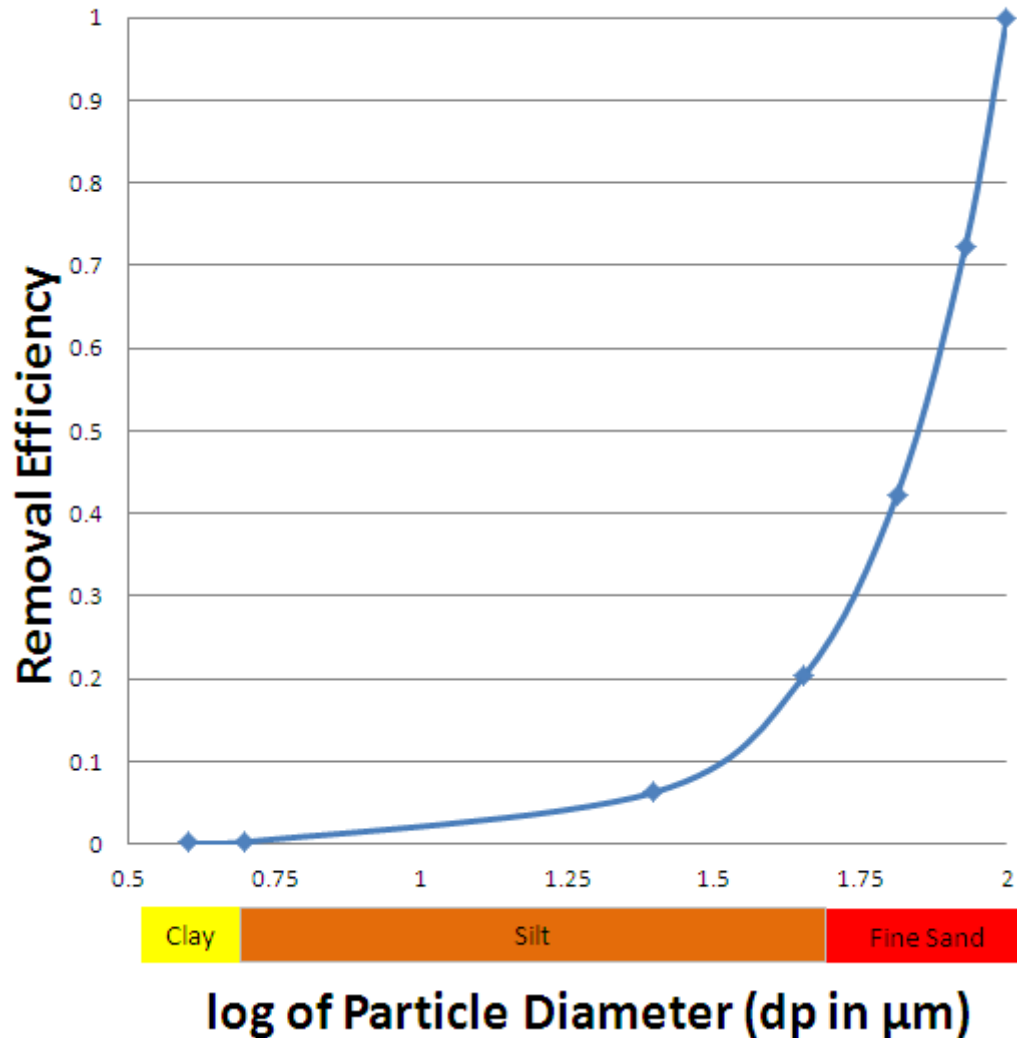
# Concept Summary



Total Suspended Solids (mg/L)		
Filter	CWfTW	3 ft Crumb Rubber
Before	169	240
After	48	7
% Reduction	72%	97%

# Concept Summary

## Crumb Rubber Filter - >30 Mesh Media

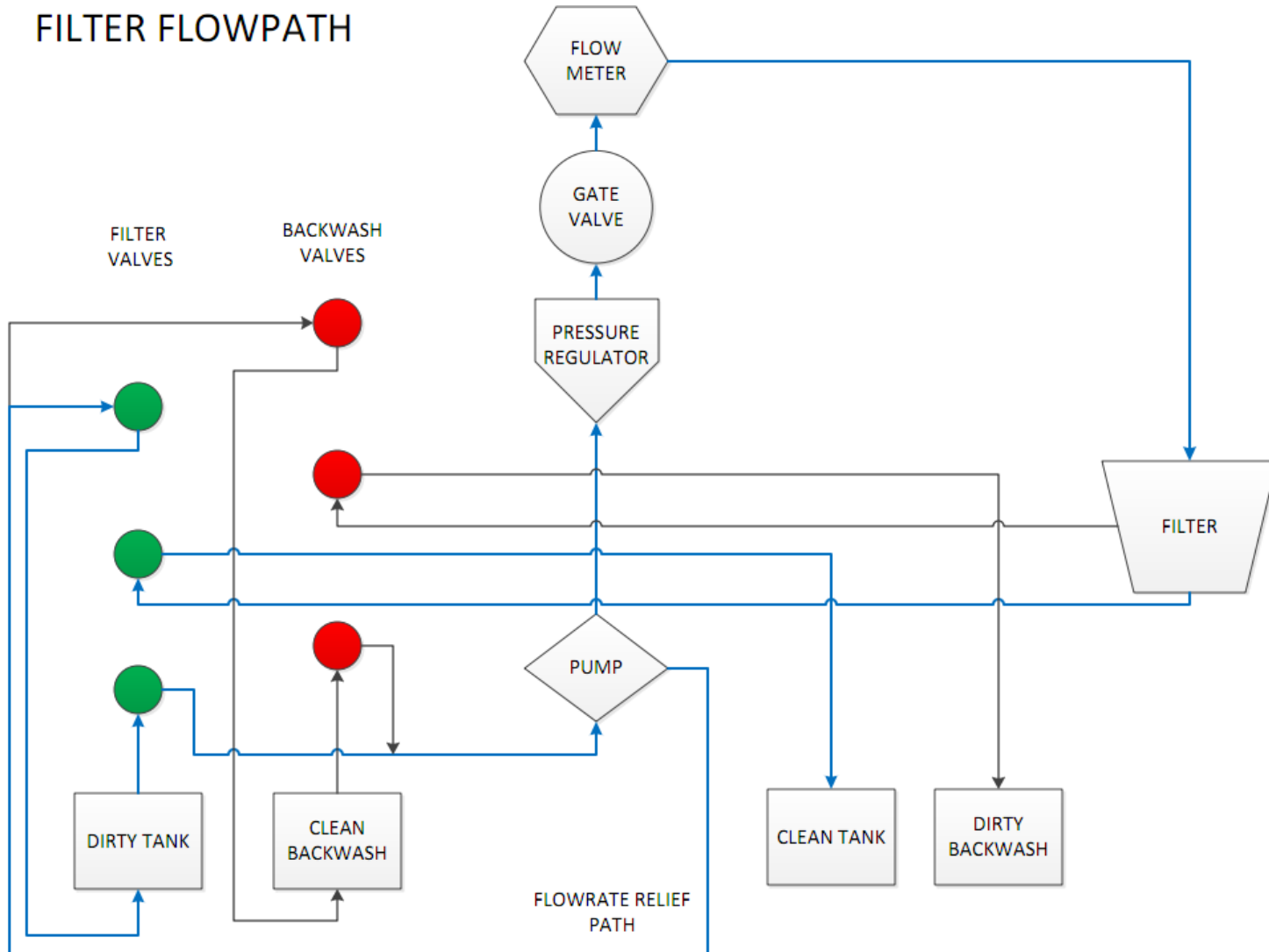


# Concept Summary

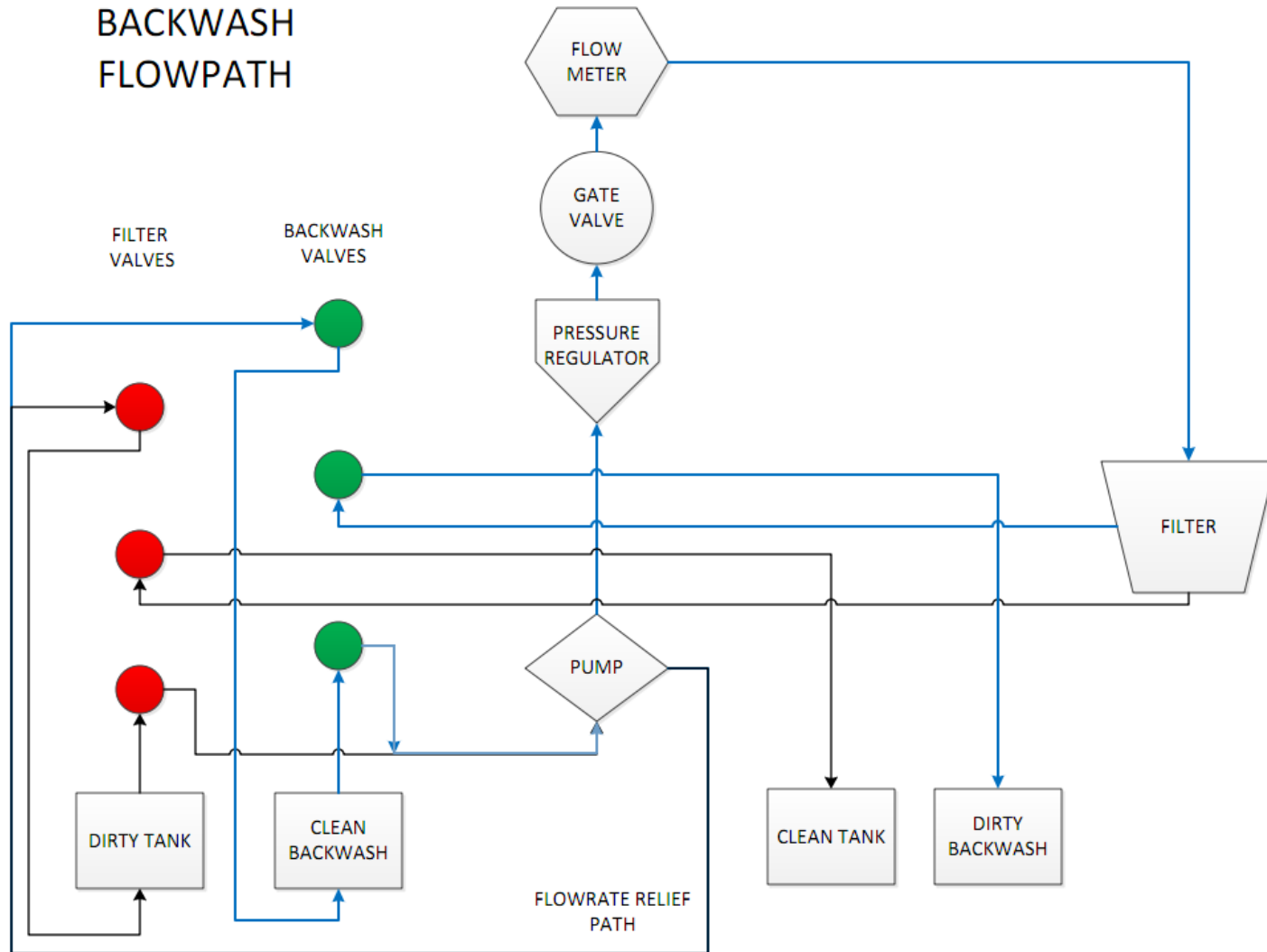
Particle Size ( $\mu\text{m}$ )	Efficiency	Length (m)	Sediment Type
4	0.0016	407.2	Clay
5	0.0025	263.4	Silt
25	0.0626	10.7	Silt
45	0.2028	3.3	Silt
65	0.4232	1.6	Very Fine Sand
85	0.7237	0.9	Very Fine Sand

# System Architecture

## FILTER FLOWPATH



# System Architecture





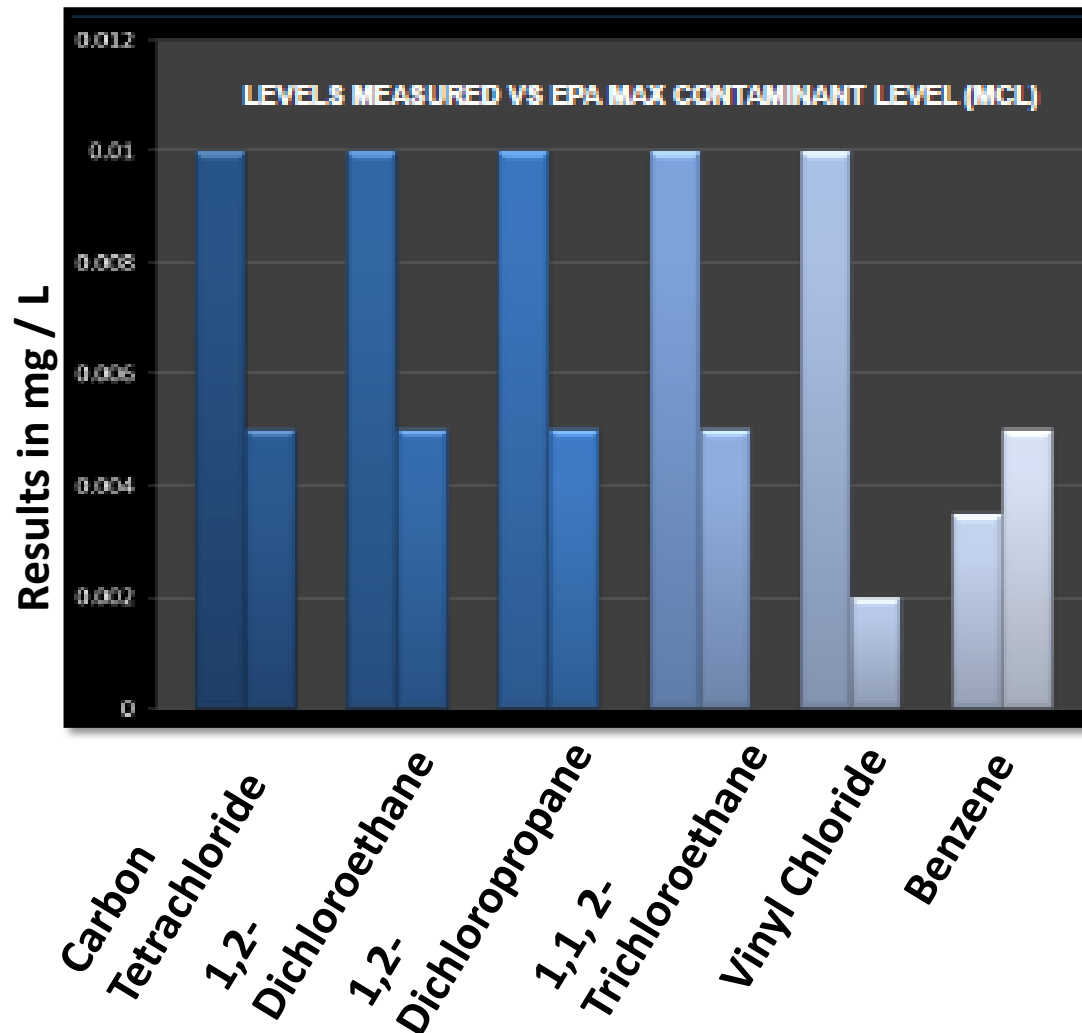
# Design Summary

- Filter test stand constructed
  - Runs desired testing water through filter
  - Measures flow rate and pressure differences across filter
  - Adaptable for use with multiple water filter interfaces
- Crumb Rubber (recycled tires)
  - Used as filter media
  - Tested for flow, pressure drop, metals leaching, VOC's leaching



# SYSTEM TESTING RESULTS

Paradigm Environmental Services volatile analysis report for DI water soaked in <30 mesh crumb rubber for 10 weeks



# SYSTEM TESTING RESULTS

**DEPARTMENT OF ENVIRONMENTAL SERVICES  
HEAVY METAL TEST RESULTS  
FOR WATER SOAKED IN CRUMB RUBBER FOR 102 HOURS  
METHOD SM 18-19, 3113 B**

		<b>EPA MCL</b>
<b>Arsenic</b>	<b>0.00100 mg / L</b>	<b>0.01000 mg / L</b>
<b>Cadmium</b>	<b>0.00100 mg / L</b>	<b>0.00500 mg / L</b>
<b>Chromium</b>	<b>0.00100 mg / L</b>	<b>0.10000 mg / L</b>
<b>Copper</b>	<b>0.00500 mg / L</b>	<b>1.30000 mg / L</b>
<b>Lead</b>	<b>0.00100 mg / L</b>	<b>0.01500 mg / L*</b>
<b>Manganese</b>	<b>0.17400 mg / L</b>	<b>0.05000 mg / L</b>
<b>Nickel</b>	<b>0.00260 mg / L</b>	<b>***</b>

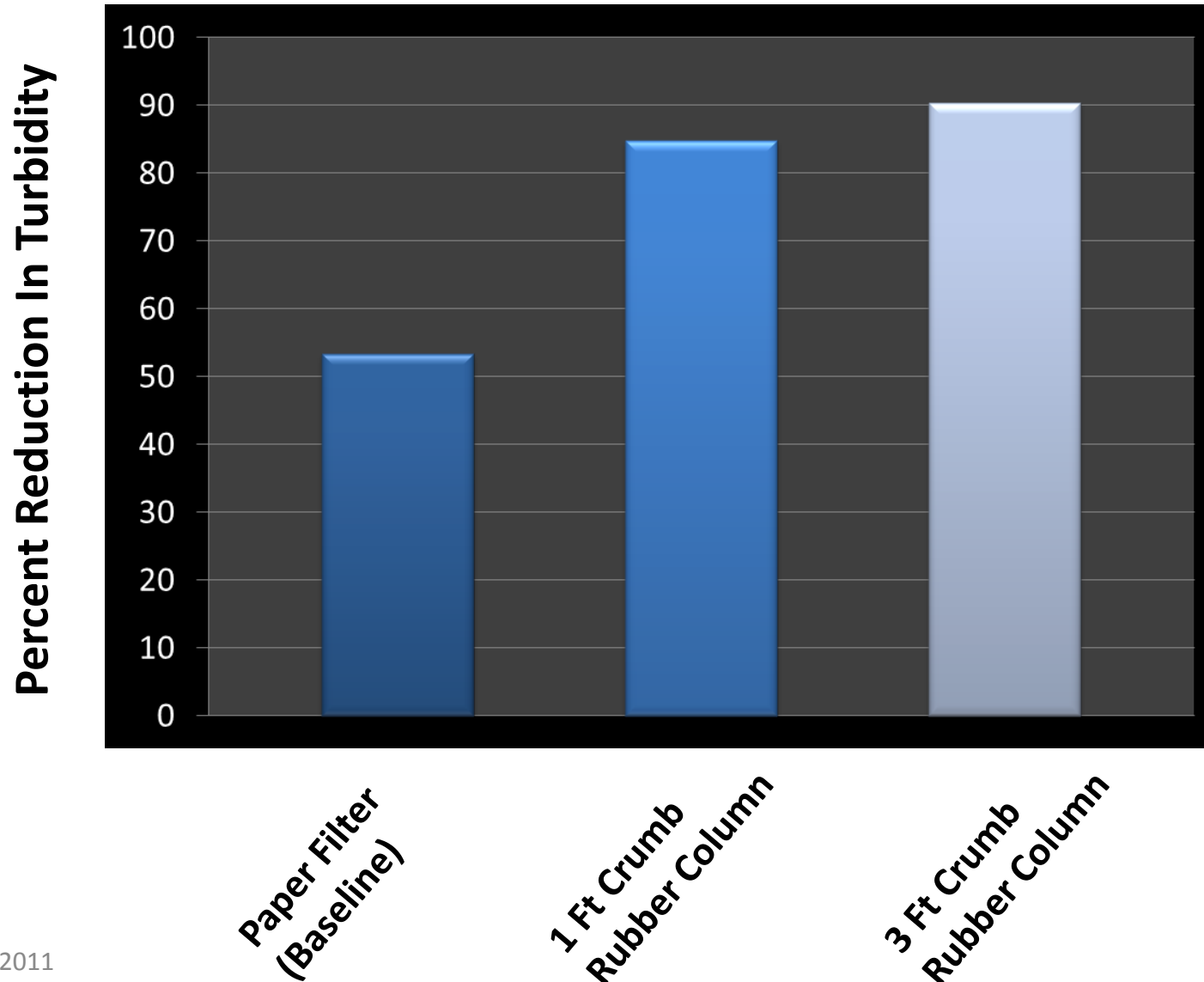
**METHOD SM 18-121311 B (99)**

<b>Zinc</b>	<b>4.23000 mg / L</b>	<b>5.00000 mg / L*</b>
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**\*Secondary standard (not enforced)**

**\*\*Not regulated by EPA**

# SYSTEM TESTING RESULTS



# OBJECTIVE PROJECT EVALUATION

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## SUCCESS

- Test stand is capable of measuring and metering flow characteristics
- Test stand provides convenient filter path and backwash path crossover
- Test stand accommodates a wide range of tests
- Percent reduction in turbidity surpasses paper filter baseline
- TSS reduction surpasses paper filter baseline

## FAILURE

- Detected levels of priority pollutants that exceed EPA standards
- Pump was unable to achieve desired flow rates
- Turbidity of 5 NTU's was unable to be achieved
- Time constraints could not allow for optimized filter design

# Suggestions for Future Work

- The > 30 mesh Crumb rubber has proven to be effective in removing particles and turbidity from the water, but does add harmful chemicals the filtered water. If this filter media is treated by cleaning or chemically changing it somehow (heating), it may not leech the harmful chemicals into the water.