Kennedy/Jenks Consultants

Engineers & Scientists

Treatment Process Selection for the 20 mgd Longview Regional Water Treatment Plant

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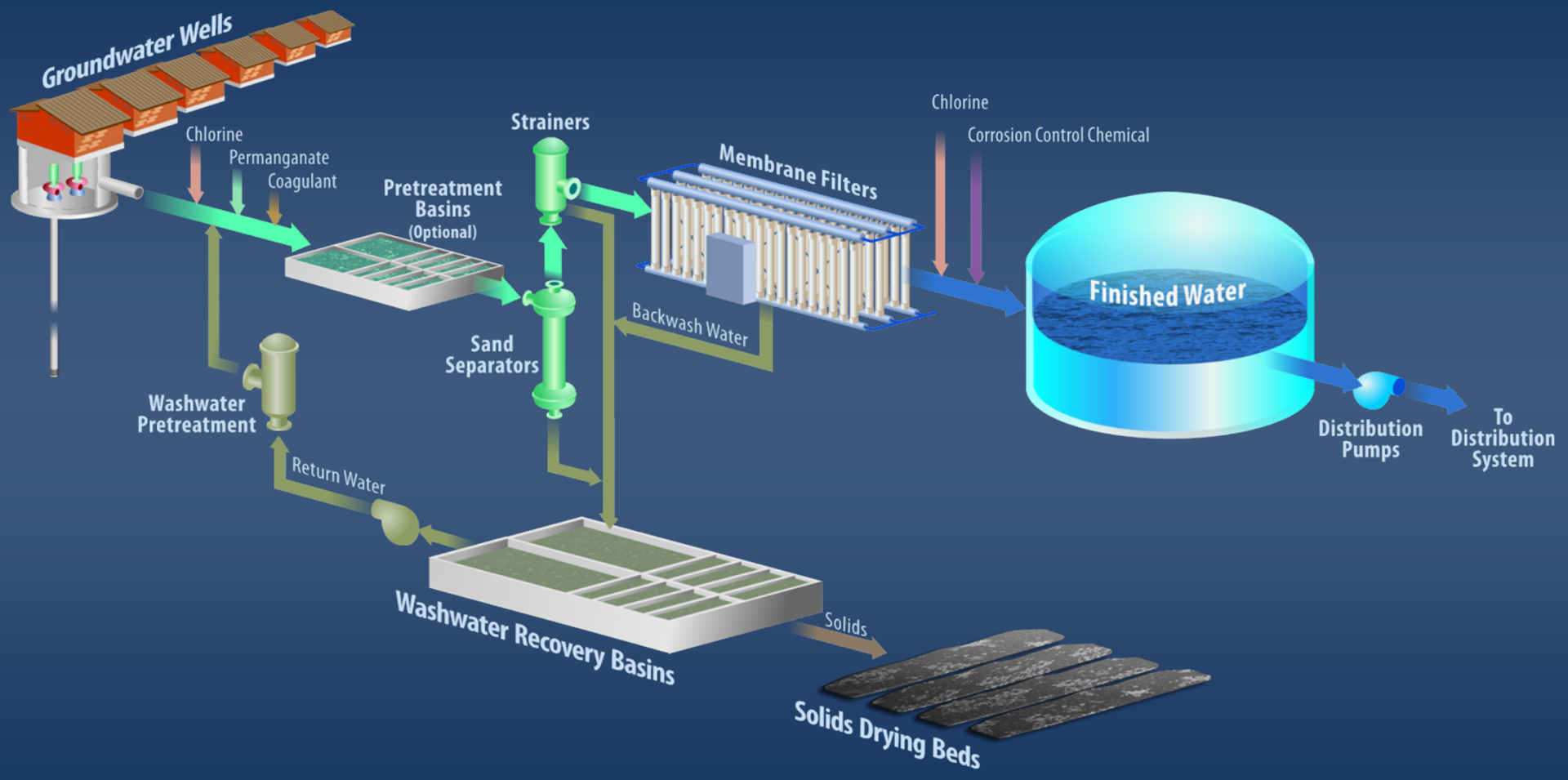
Well Water Quality

Parameter	Production Well 1	Prudential Boulevard Test Well
Target Contaminants		
Iron (mg/L), Total	0.93	1.2
Manganese (mg/L), Total	0.597	0.601
Arsenic (μg/L), Total	5.7	12.7
Other Water Quality		
pH	7.3	7.8
Alkalinity (mg/L as $CaCO_3$)	105	130
Temperature (°C)	11.7	12
Hardness (mg/L as $CaCO_3$)	99	112
Total Dissolved Solids (mg/L)	187	201
Conductivity (μMhos/cm)	240	307

Water Quality Goals

Parameter	Water Quality Goal	MCL	SMCL
Total Iron	≤ 0.05 mg/L	-	0.3 mg/L
Total Manganese	≤ 0.02 mg/L	-	0.05 mg/L
Total Arsenic	≤ 5 μg/L	10 μg/L	-

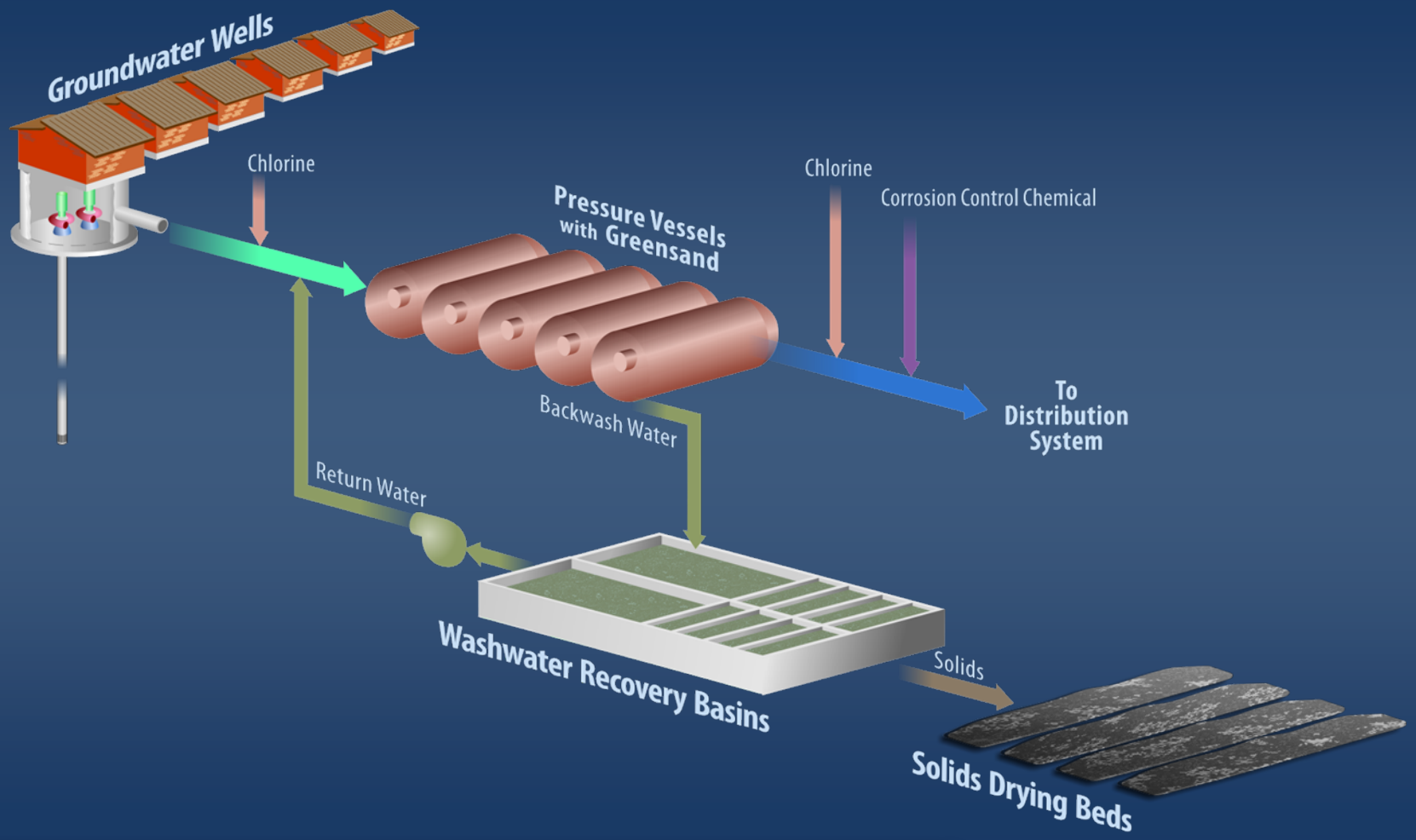
Membrane Treatment Process



Membrane Pilot Study

- Performed in 2007
- Good removal of iron
- Some manganese removal
  - Oxidation with permanganate required
  - Could not meet goal
- Ferric chloride recommended to improve Arsenic removal

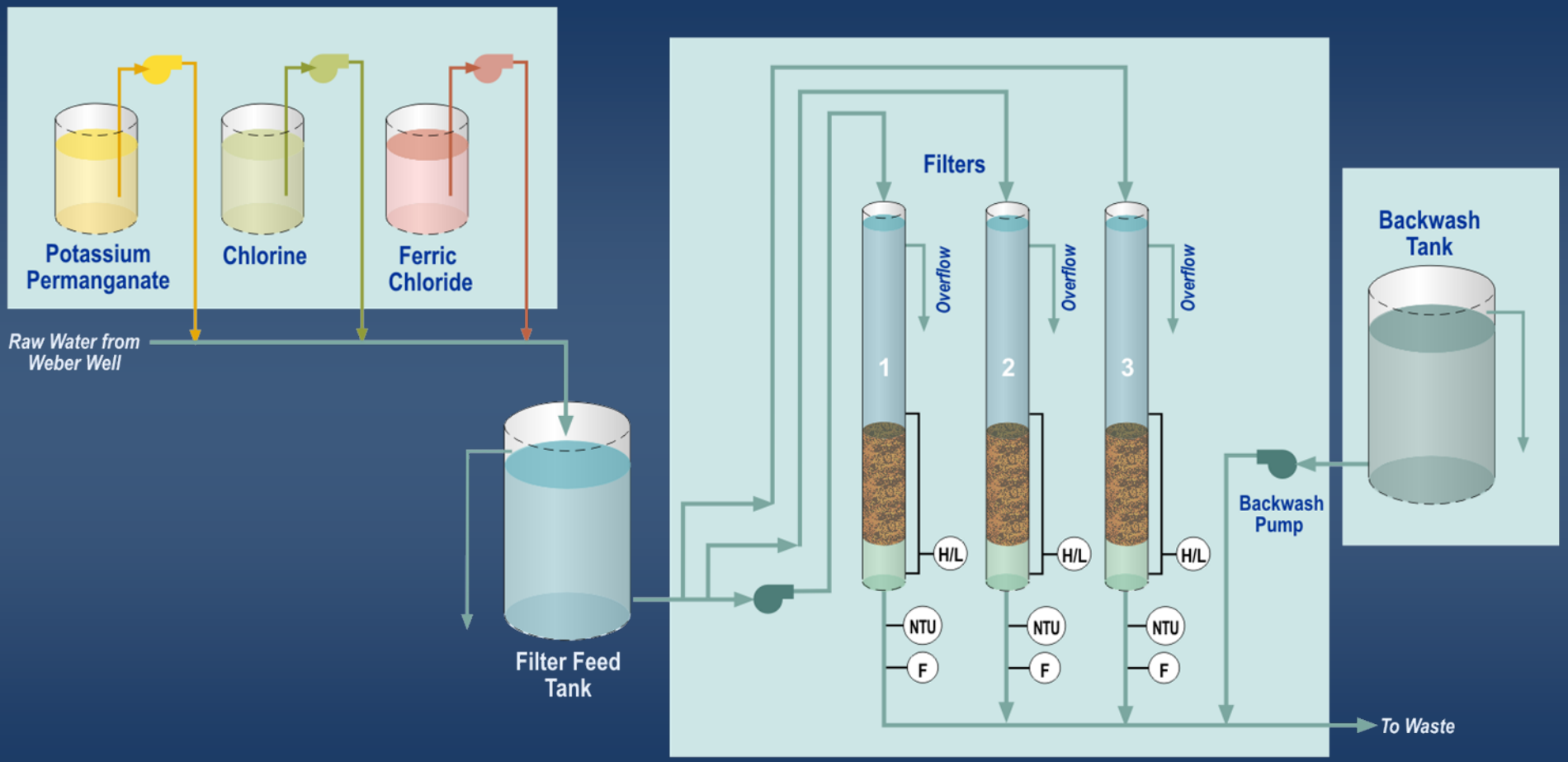
Granular Media Treatment Process



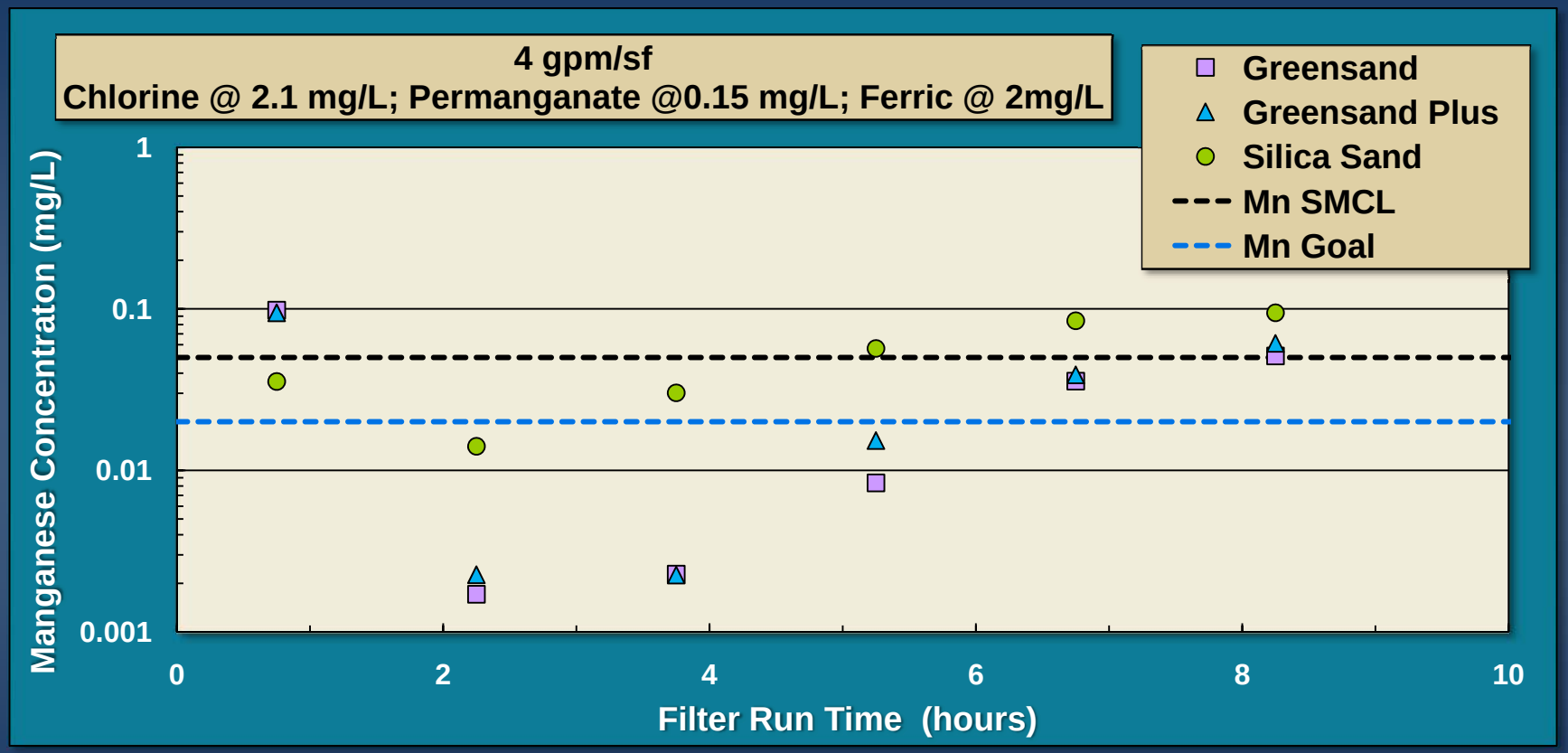
Granular Media Pilot Study: Pilot Filter Media Design

Parameter	Pilot Filter		
	Greensand	Greensand Plus	Silica Sand
Top Media	***Anthracite***	***Anthracite***	***Anthracite***
Depth (inches)	24	24	24
Effective size (mm)	0.95 - 1.05	0.95 - 1.05	0.95 - 1.05
Bottom Media	***Greensand***	***Greensand Plus***	***Silica Sand***
Depth (inch)	12	12	12
Effective size (mm)	0.30 - 0.35	0.30 - 0.35	0.52

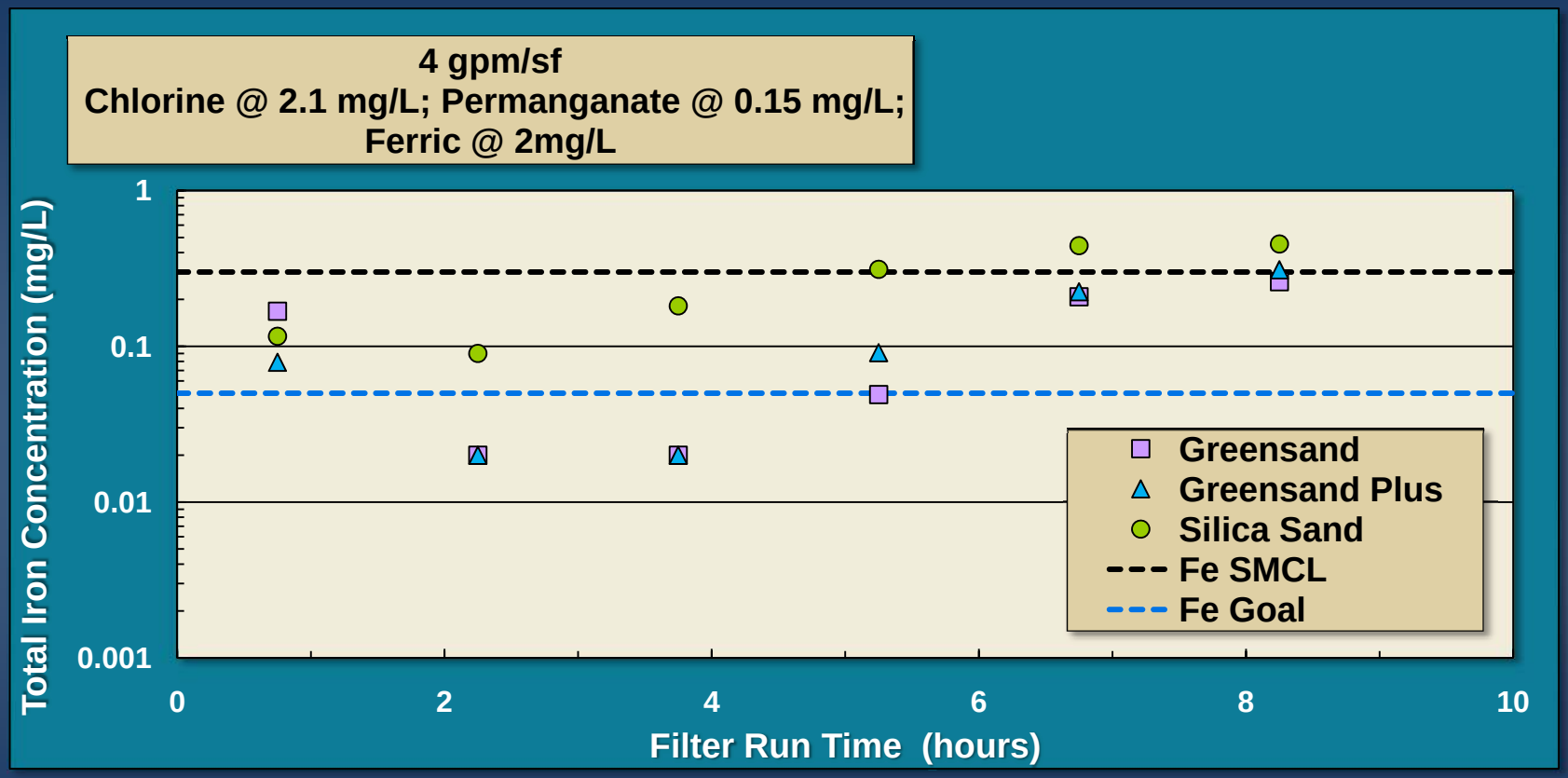
Pilot Equipment Schematic



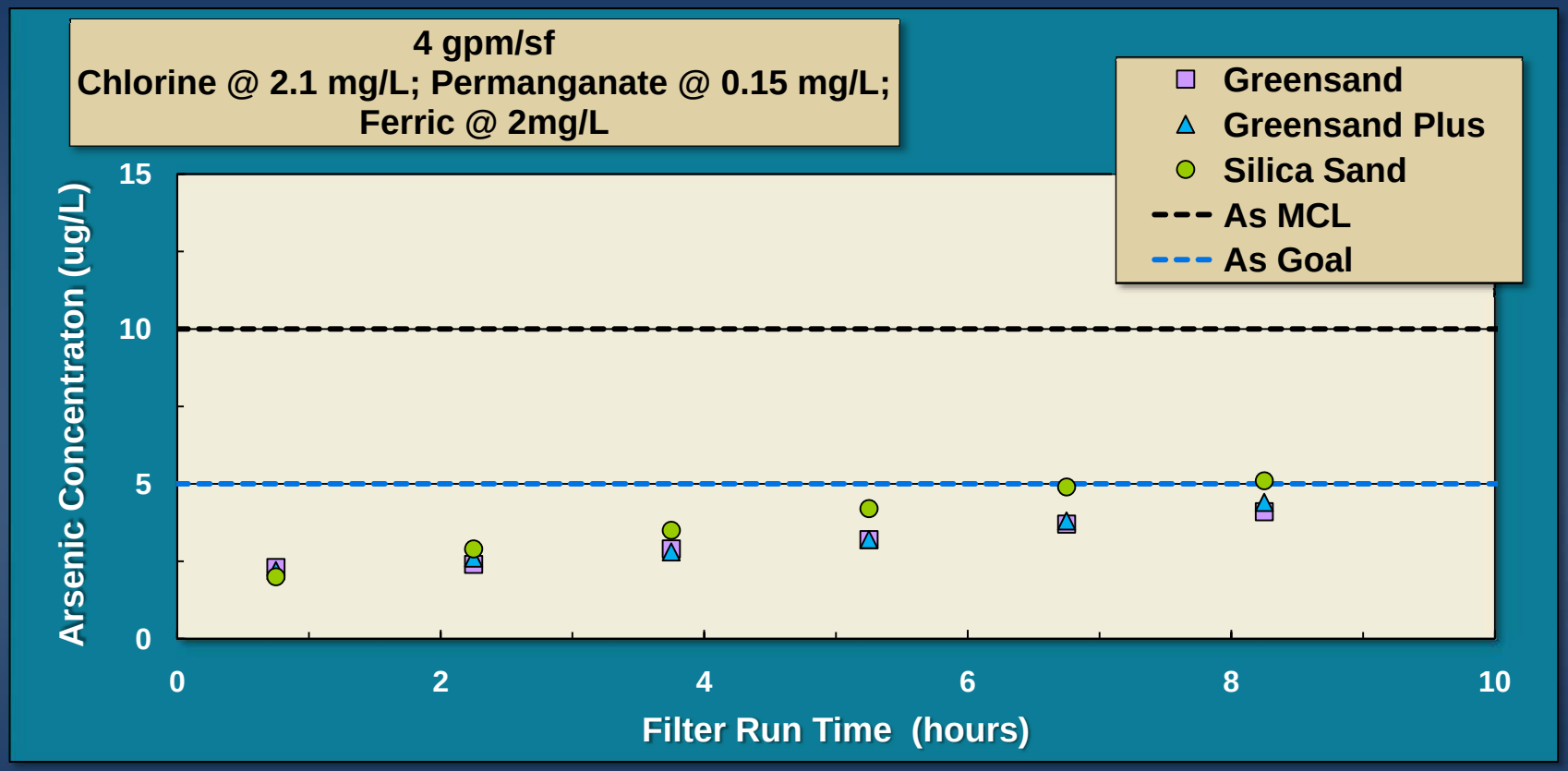
Manganese Removal: Existing Test Well



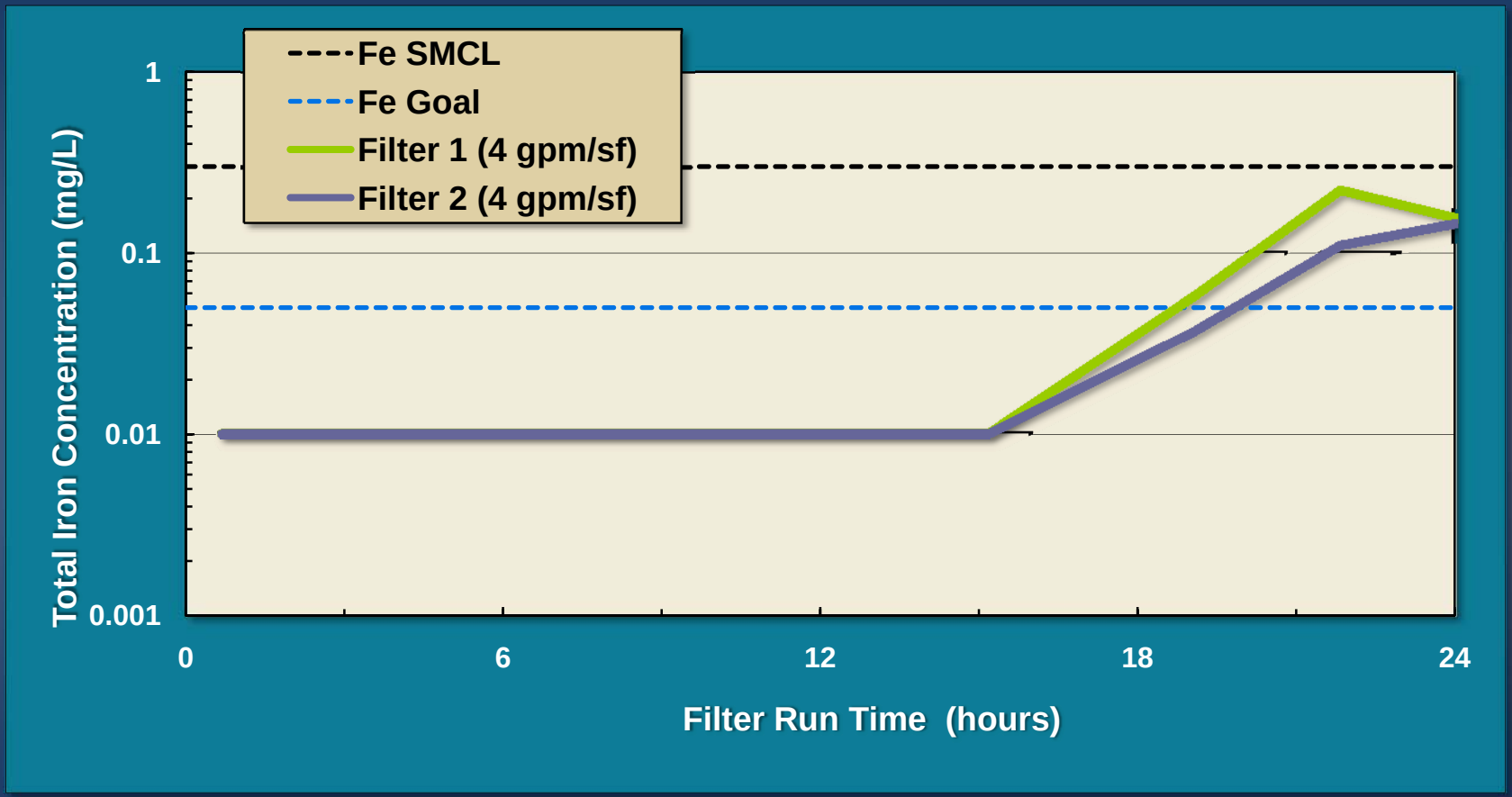
Iron Removal: Existing Test Well



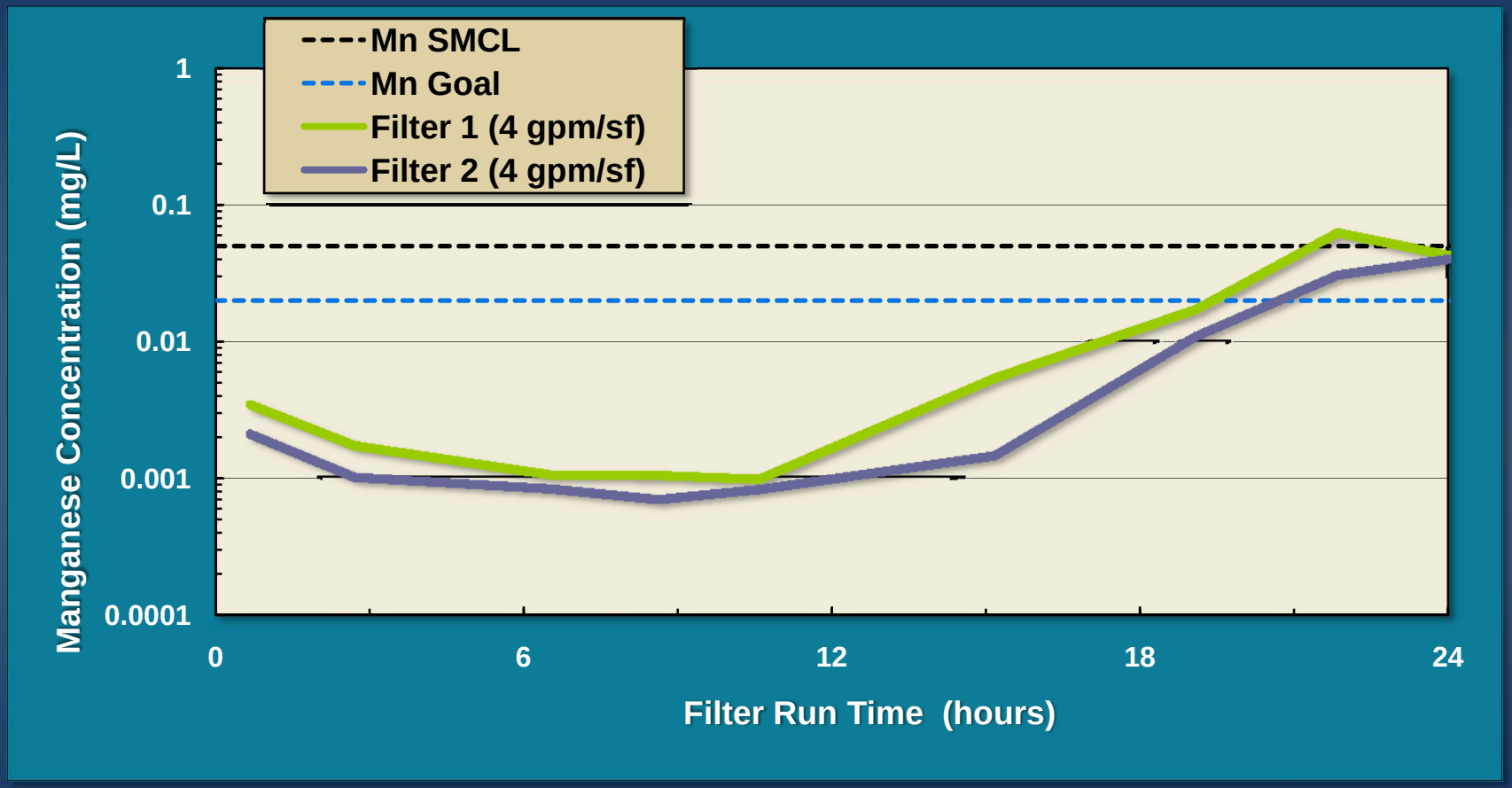
Arsenic Removal: Existing Test Well



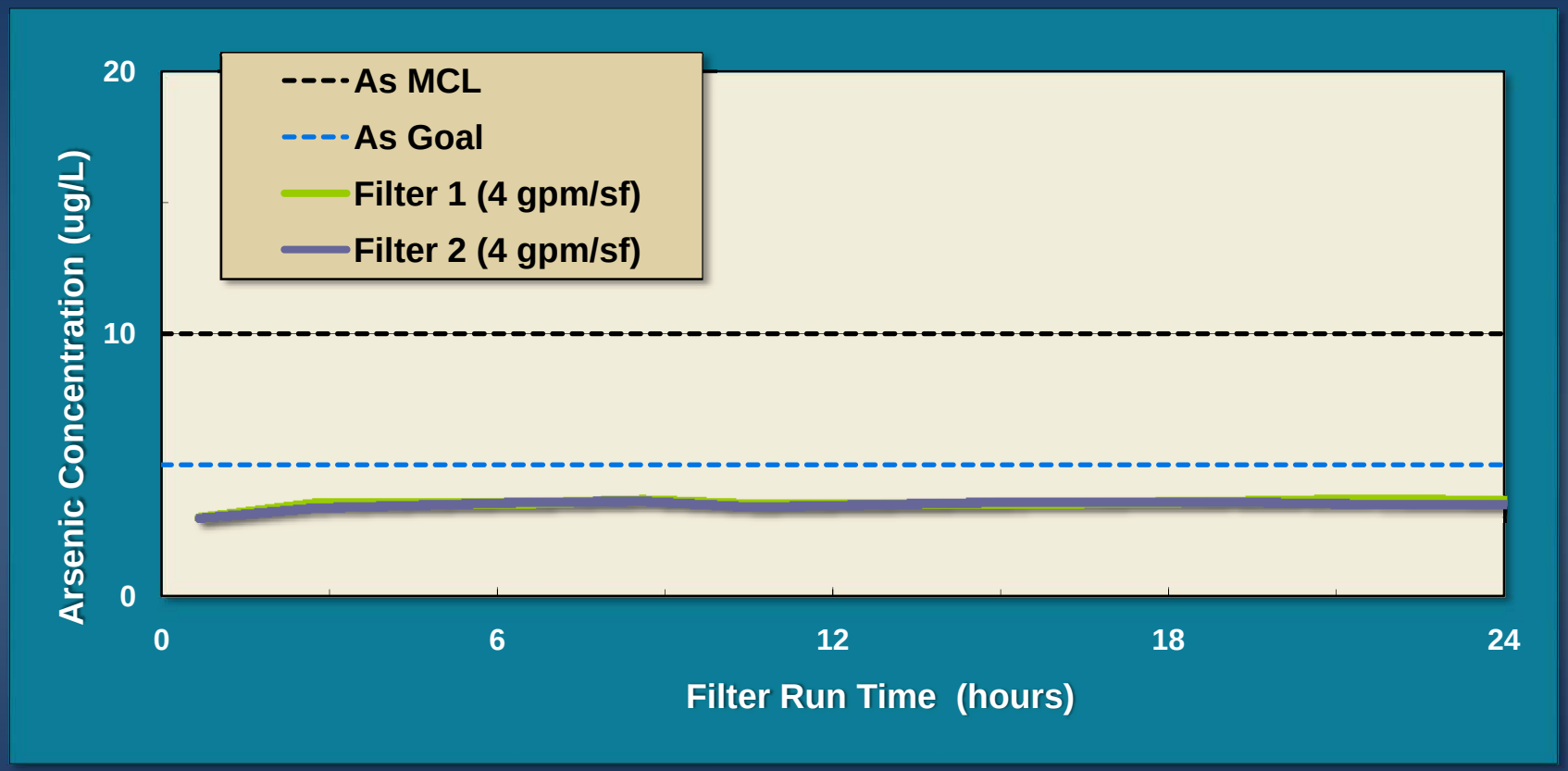
Iron Removal: At Selected Plant Site



Manganese Removal: At Selected Plant Site



Arsenic Removal: At Selected Plant Site



Greensand Filtration

Advantages

- Well-established, robust and proven process
- Distribution pumping not needed
- Major equipment, such as pressure vessels are provided by numerous vendors
- Media type can be changed in the future
- Lower capital cost than membranes
- Lower operations and maintenance cost than membranes
- Operations, maintenance and controls simpler than for membranes
- Fewer buildings required
- Operator skills required similar to those for existing plant

Disadvantages

- Footprint of process may be larger than required for membranes

Membrane Filtration

Advantages

- Modular process
- Footprint of filtration process will be smaller
- Positive barrier to particulate solids and most pathogens

Disadvantages

- Higher capital cost than greensand
- Higher operations and maintenance cost
- Finished water booster pumping required
- Complexity of mechanical, instrumentation and controls, and controls interface
- Proprietary vendor package
- Unproven in iron and manganese removal
- Unfamiliar operations requirements/operator skills
- Potassium permanganate is required

Comparative NPV Costs for Alternatives – 2009 Dollars

Cost Elements	Greensand Alternative	Membrane Alternative	Rehabilitate Existing Surface Water Plant
Comparative Construction Cost	$30,800,000	$38,800,000	$38,100,000
Comparative O&M NPV	$9,075,260	$22,316,212	$12,645,854
City Allied Costs	$687,000	$687,000	$1,840,000
Engineering Costs	$8,574,000	$8,574,000	$10,200,000
Property Acquisition	$2,000,000	$2,000,000	-
Other City Expenses	$235,000	$235,000	-
Total Comparative NPV	**$51,400,000**	**$72,600,000**	**$62,800,000**

Filtration Technology Evaluation Matrix

Evaluation Criteria	Weight	Greensand Media Weighted Score	Membrane Weighted Score
Capital Cost	10	50	40
Net Present Value	13	104	26
Operability	1	7	3
Performance	19	171	95
Flexibility	2	10	10
Complexity	3	24	15
Capacity	15	45	120
Regulatory Acceptance	16	128	80
Total Weighted Score		**539**	**389**

Recommendation

- Granular media filtration recommended
  - Lower cost
  - Proven performance
  - Simpler process