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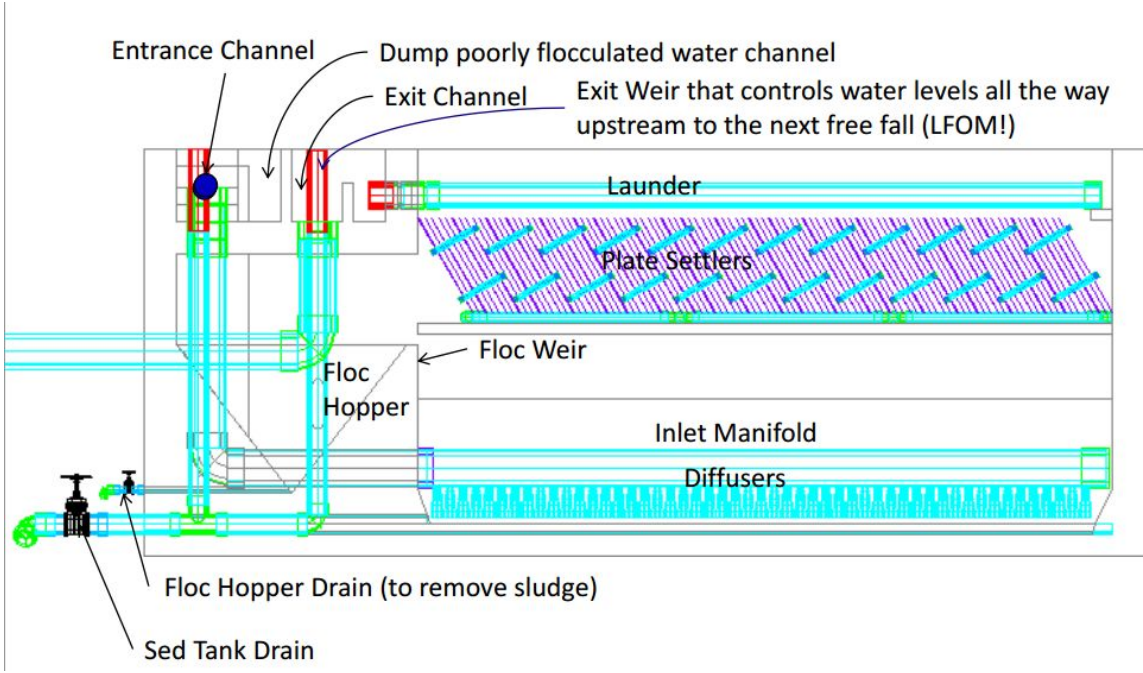
High Rate Sedimentation Floc Blanket

This semester the HRS- Floc Blanket team built a sedimentation tank with two goals: increasing the upflow velocity and decreasing the plan view area without decreasing the plan view area. Over the course of the semester, different experiments were performed to test the strength of the floc blanket under various conditions.
More information can be found in the HRS-Floc Blanket Spring 2016 report.

Floc blankets increase efficiency

- Sedimentation is the slowest step in the water treatment process
- Floc blankets in the current AguaClara sedimentation tanks are primarily stable under 1 mm/s upflow velocity
- A stable floc blanket decreases the effluent turbidity of the tank



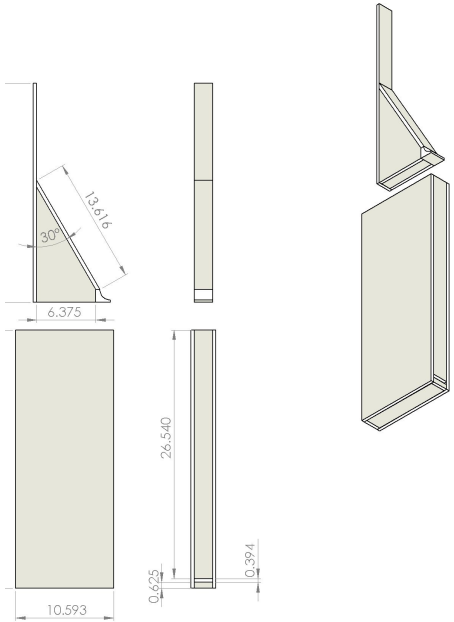
A higher upflow velocity with a stable, concentrated floc blanket is desired.

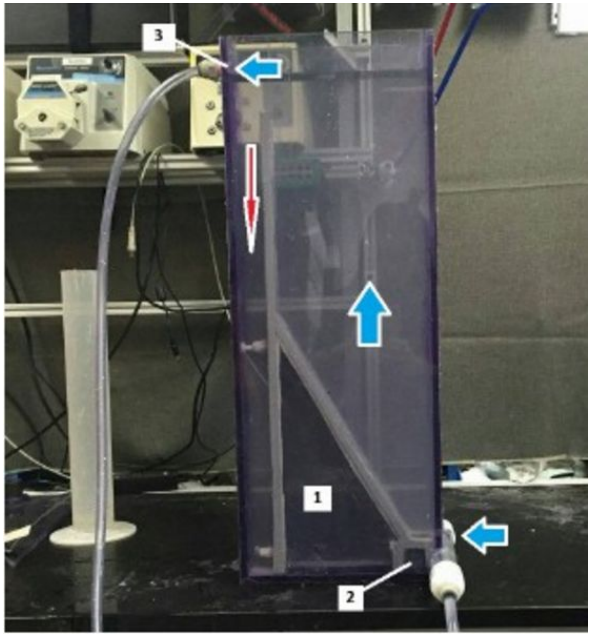
Faster sedimentation saves time and money

- A higher upflow velocity will result in a decrease in plan view area and construction costs and expedite the sedimentation process
- Improve upon the work that was done by the High Rate Sedimentation Team last semester

Further research efforts in providing more people with clean drinking water!

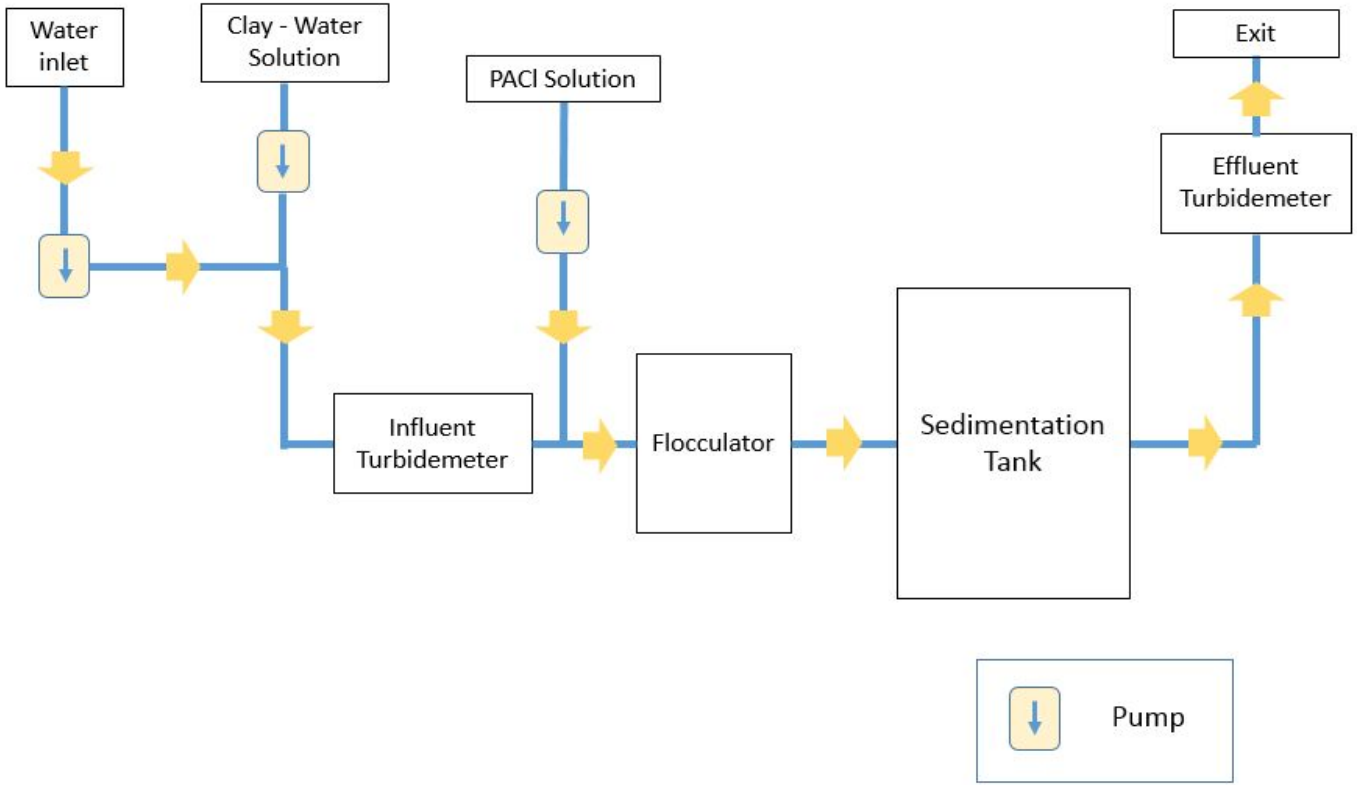
We constructed a bench scale model

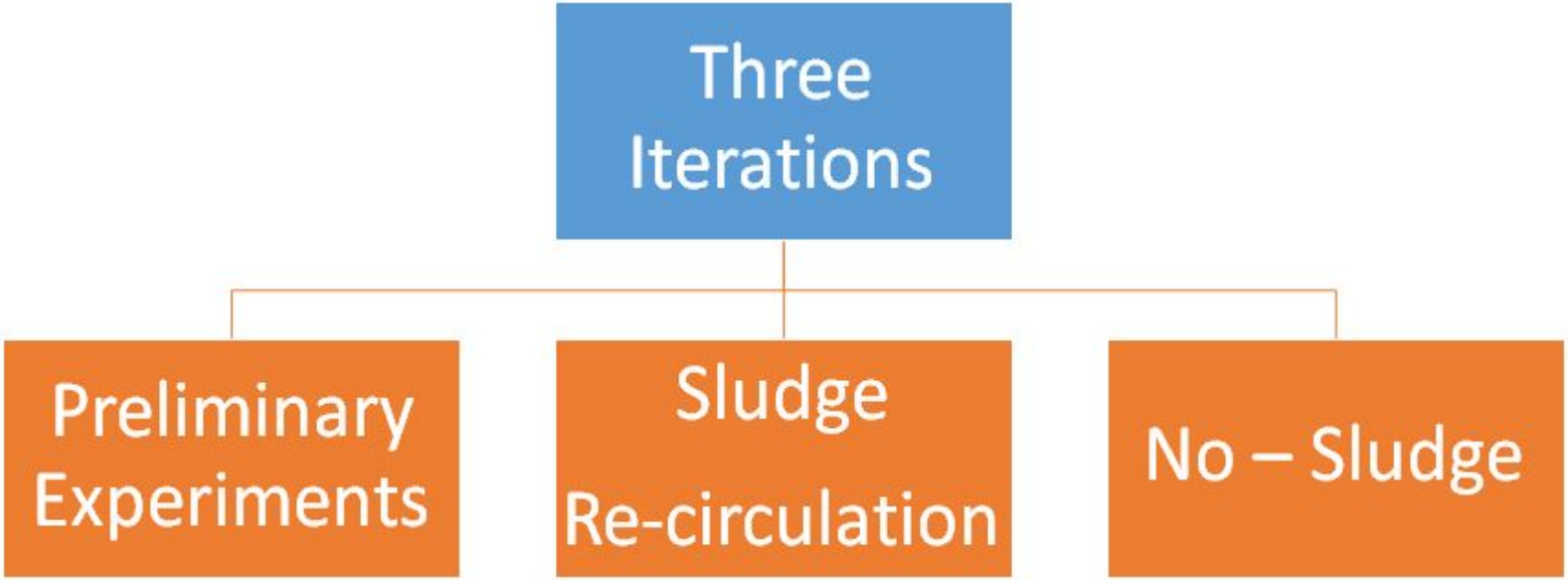




Tank with the insert (1) and jet reverser (2) and outlet (3). Blue arrows show water entering, rising through the tank and exiting, the red arrow points into the sludge hopper where flocs will fall and consolidate.

This design is an improvement upon the work done last semester. It is a bench scale model that is a fairly accurate representation of the current AguaClara sedimentation tank model


Water inlet
Clay - Water Solution
PACl Solution
Exit
Effluent Turbidemeter
Influent Turbidemeter
Flocculator
Sedimentation Tank
Pump


Three Iterations
Preliminary Experiments
Sludge Re-circulation
No – Sludge

In-blanket settlers changed floc blanket behavior

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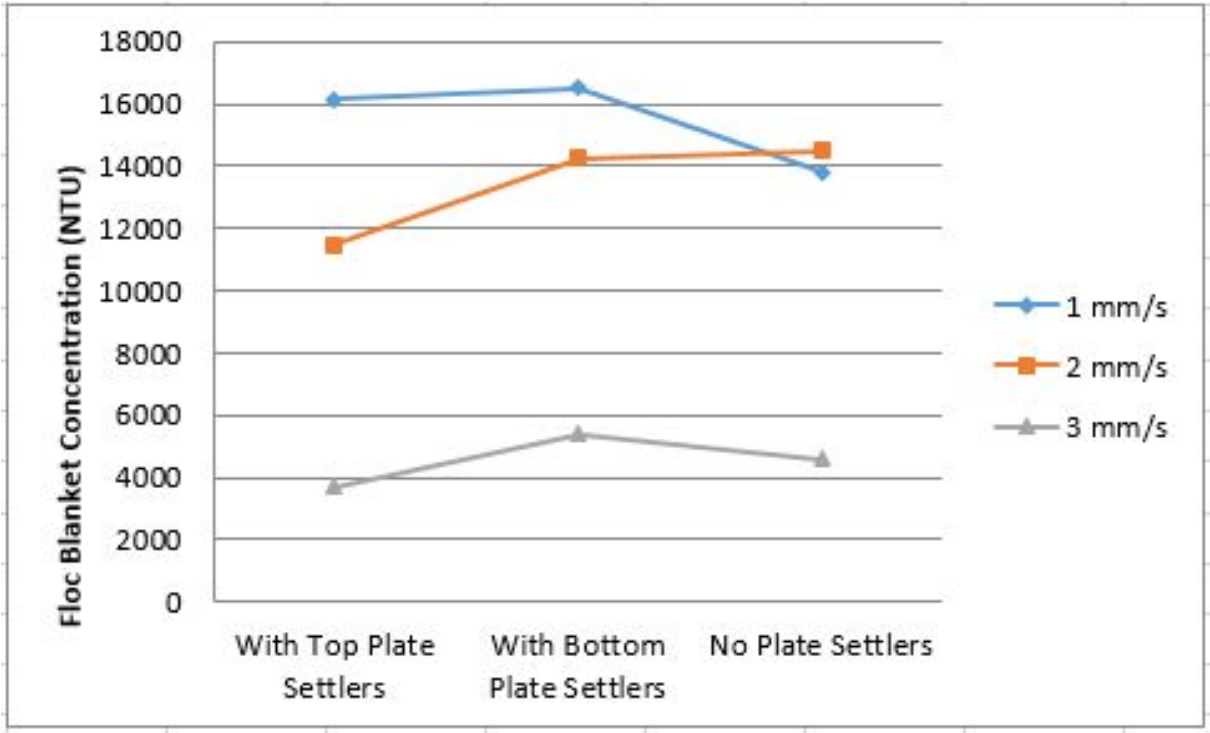
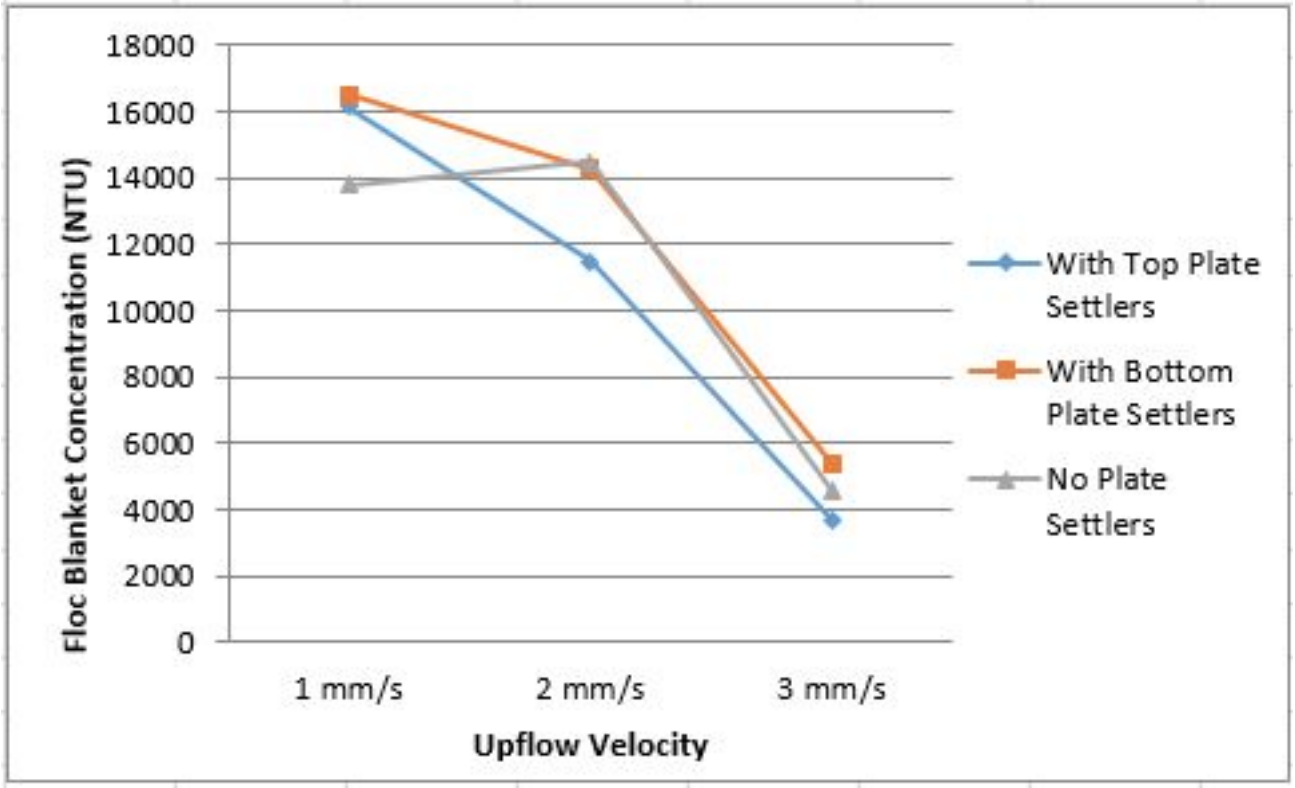
Sludge Re-Circulation

https://drive.google.com/file/d/0BxBRJ1mr_EDUNTdORk1iR3Bjb2c/view?usp=drivesdk

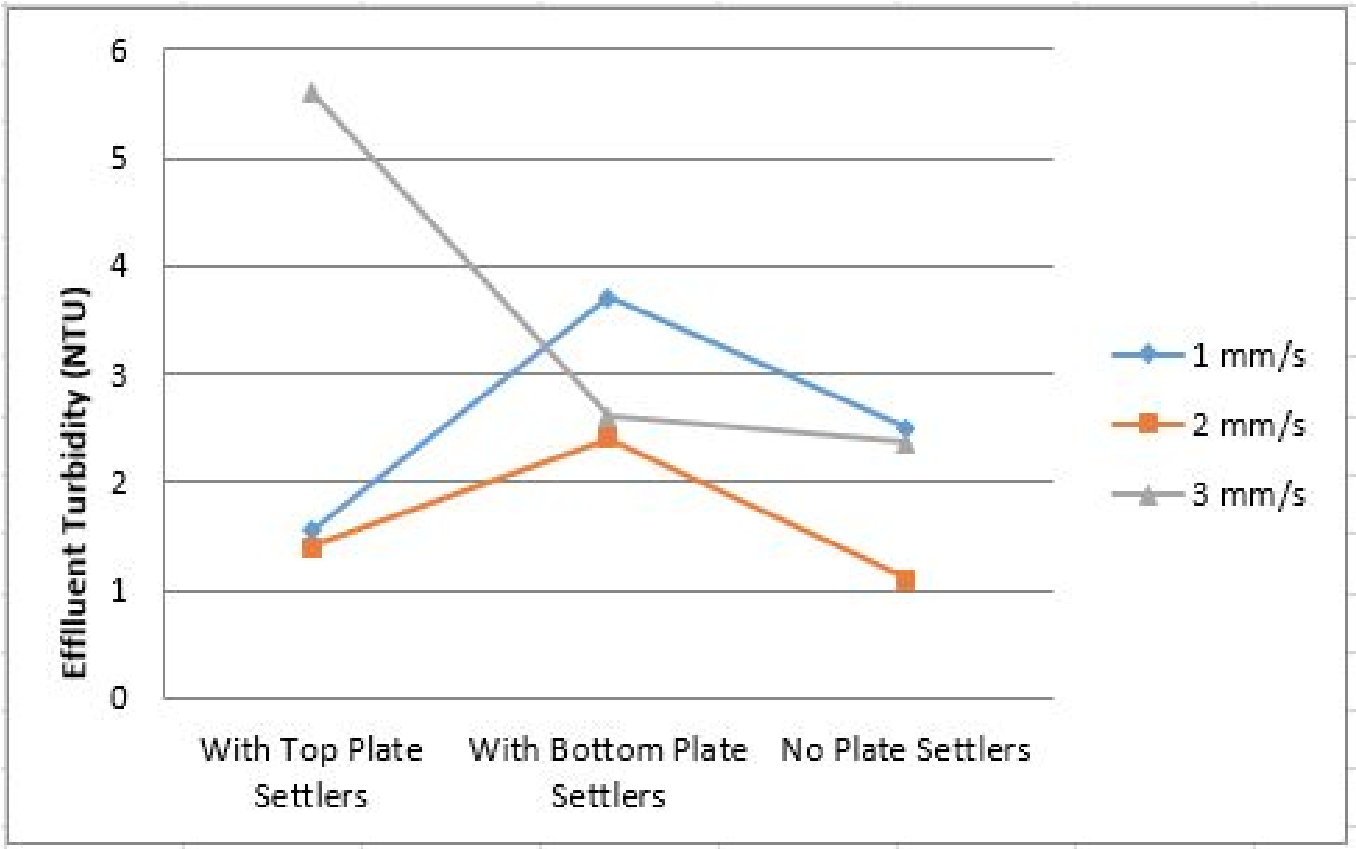
Bottom settlers can marginally increase floc blanket concentration



Floc blankets thin as upflow velocity increases



Bottom settlers provided worst performance



In-blanket settlers changed floc blanket behavior

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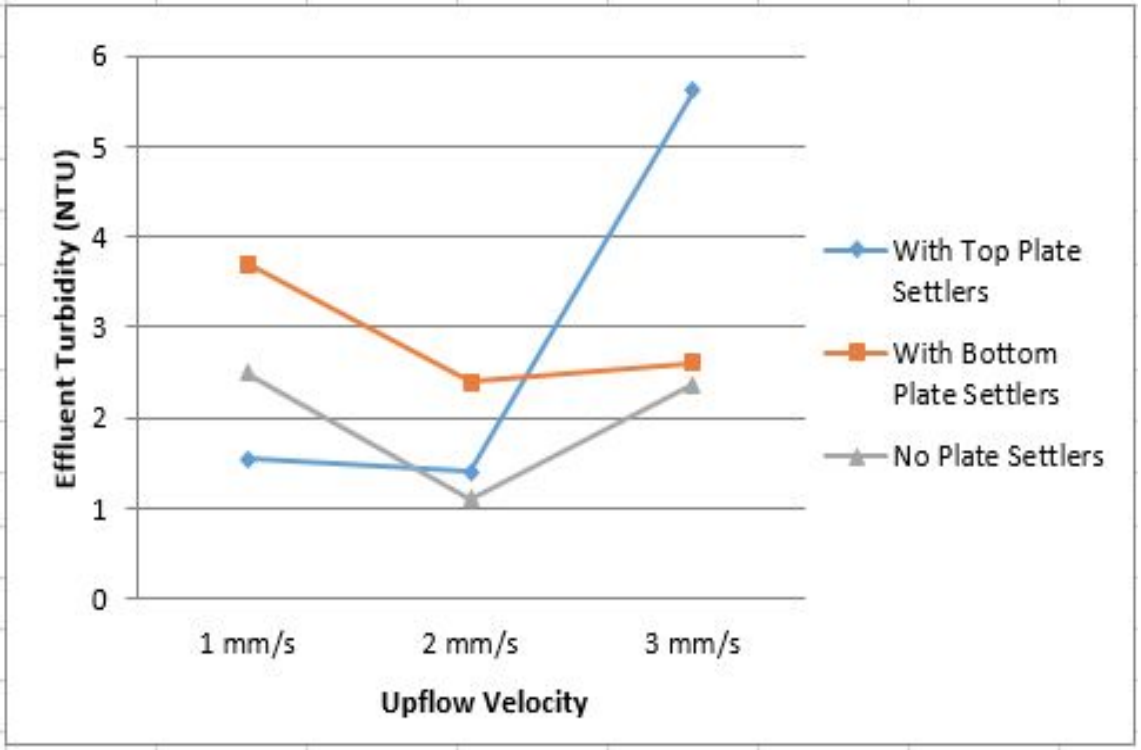
Higher upflow velocity decreases efficiency



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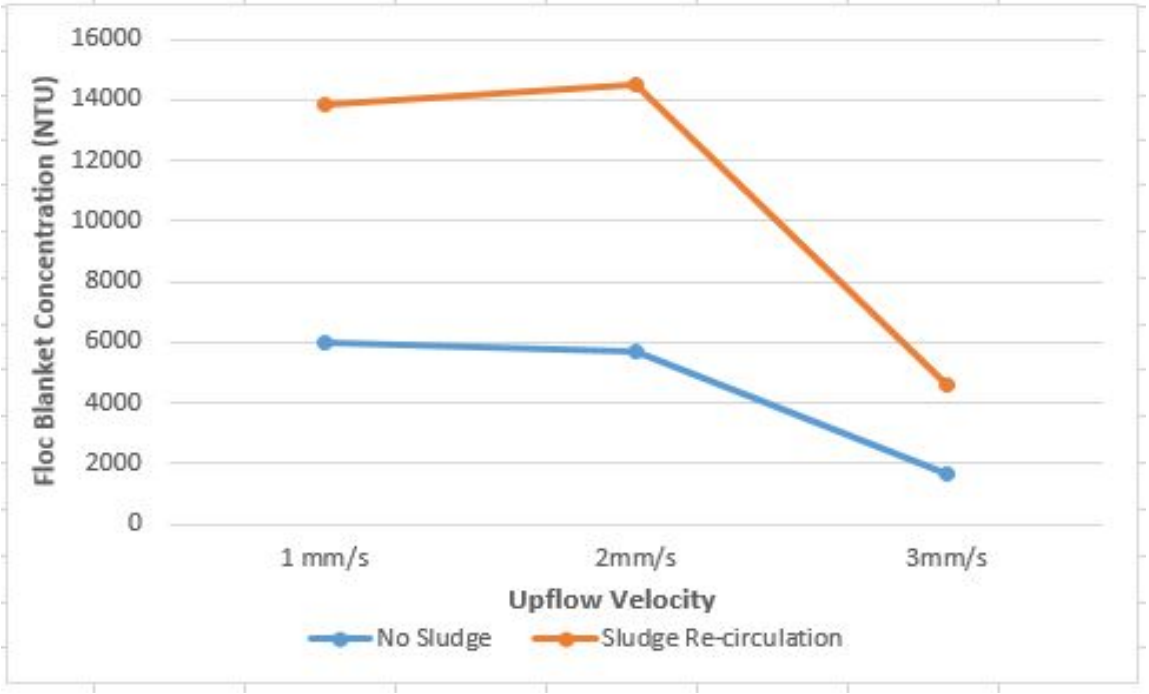
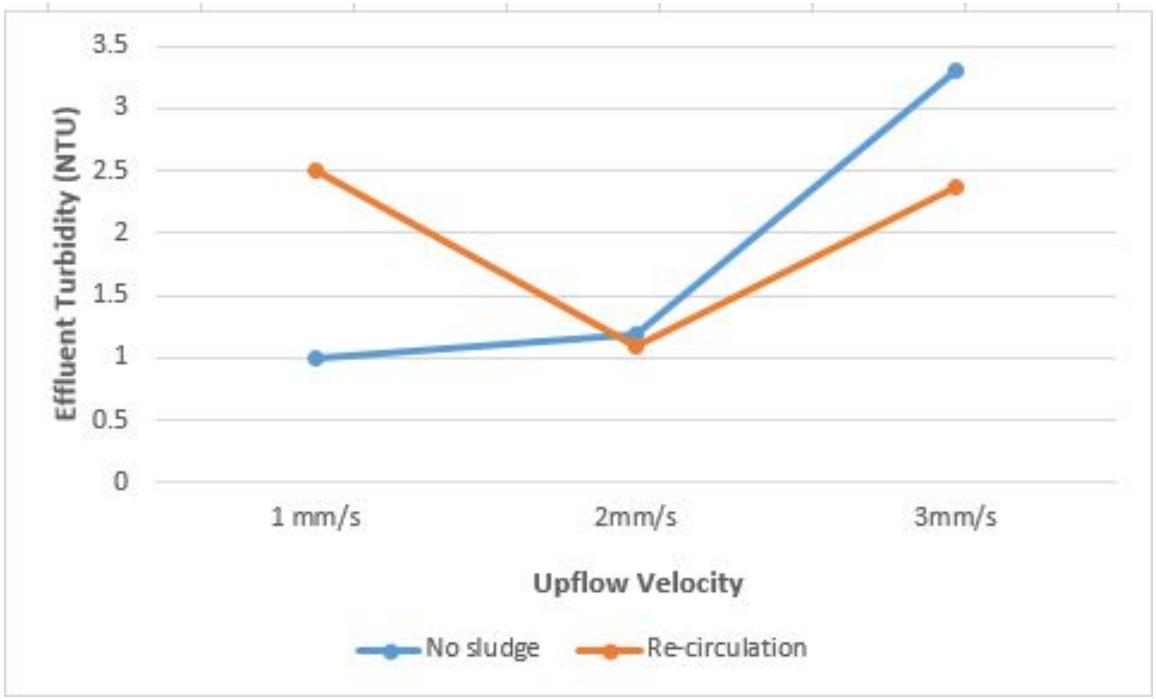
Without
Sludge Re-Circulation

Floc Blankets thinned without sludge re-circulation



- Without plate settlers

Effluent was similar to results with sludge re-circulation



- Without plate settlers

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Floc Breakup

4mm/s results were dependent on floc breakup

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20 | 5.5 | 2.8

NTU

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Conclusion

- The relationship between effluent turbidity and floc blanket concentration is strong, but cannot be compared across different setups.
- Optimum position for plate settlers at the top of the tank is unclear
- Floc size is important for high rate sedimentation

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Future Work

- Tolerance to dissolved organic materials
- Low turbidity test with tube settlers
- Further investigation for super dense floc blanket generation

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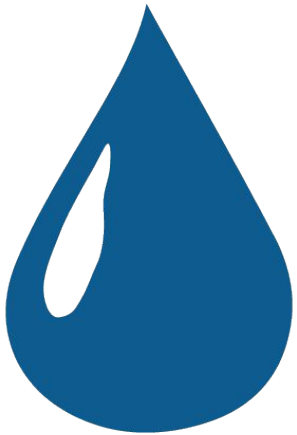
Questions and Recommendations



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Appendix Slides

Experimental Conditions for Iteration 2:

-	1mm/s	2mm/s	3mm/s
Influent Water Flow Rate (mL/s)	11.36	17.88	28.4
Influent Turbidity (NTU)	100	100	100
Influent Coagulant Dose (mL/s)	0.0101	0.0158	0.0291