PASSIVE FLOCCULANT DOSING SYSTEM FOR CONSTRUCTION SITE IMPLEMENTATION

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AGENDA

1. Current Flocculation Methods
2. Project Objectives
3. Apparatus Description
4. Experimental Testing
5. Results and Conclusion

TRADITIONAL SEDIMENT CAPTURE STRATEGIES

Traditional Strategies

- Rely on gravity settling
- Require large volumes for sufficient retention time
- Can be ineffective

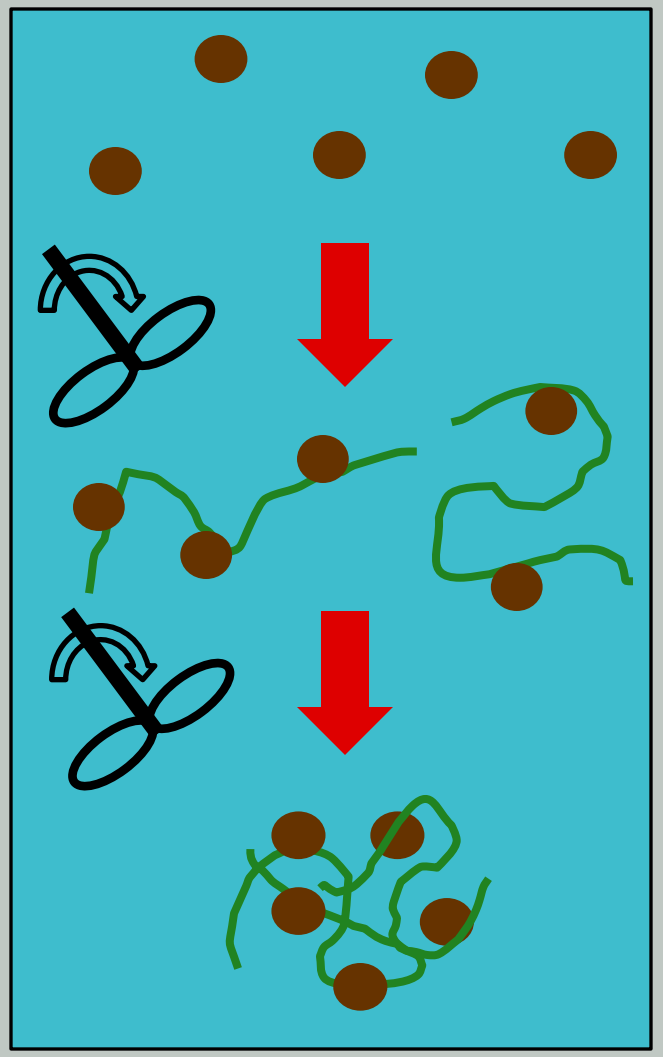
Improved Strategies

- Incorporate waste water treatment technologies to enhance sediment capture

ENHANCED SEDIMENT CAPTURE VIA FLOCCULATION

Flocculation

- Bridges multiple particles together to form flocs
- Polymers used as bridging agents
- Polymers sold as powders, solids, or liquid
- Flocculant concentration and mixing intensity essential for optimum flocculation



CURRENT PASSIVE FLOCCULATION TECHNIQUES

Pros

- Easy installation
- Low cost
- Proven effective

Challenges

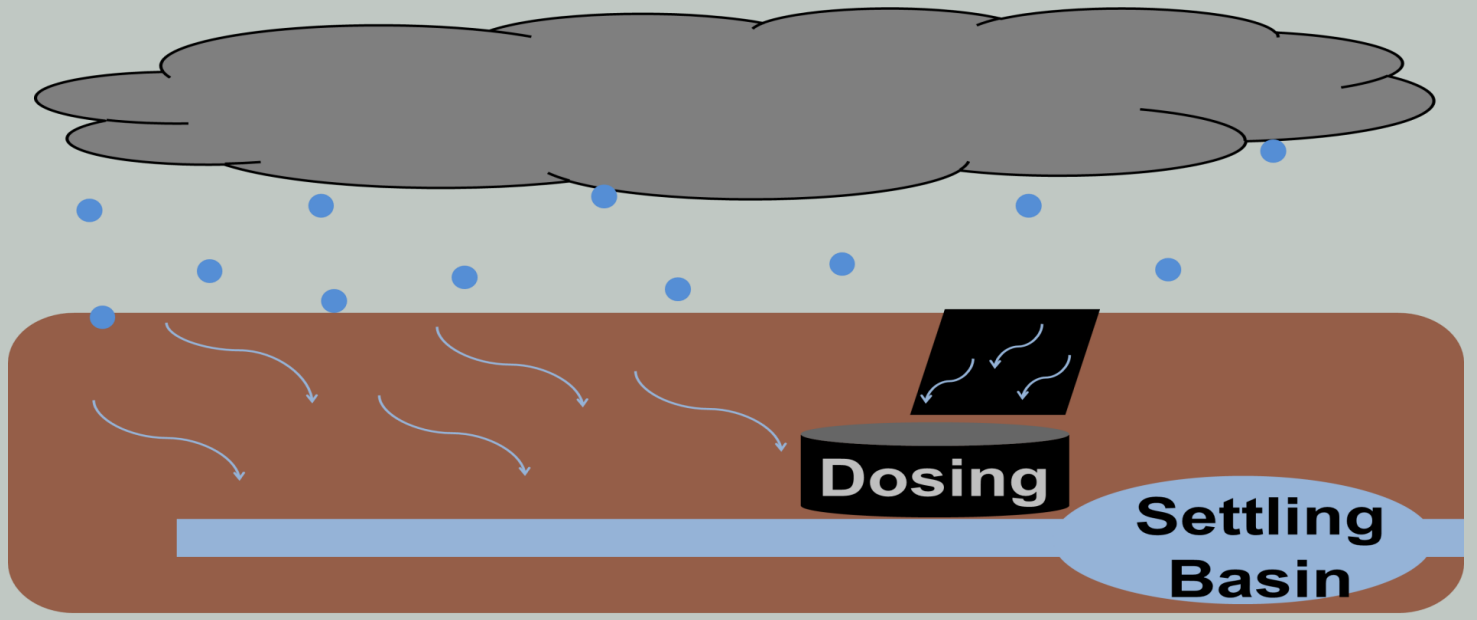
- Limited data on dosing concentrations
- Potential to become sediment laden

PROJECT OBJECTIVES

Develop a flocculant injection system for construction site implementation which must be:

1) Automated
2) Standalone/passive
3) Capable of maintaining optimum dosing concentrations

ALTERNATIVE 1:
NEW ZEALAND SYSTEM

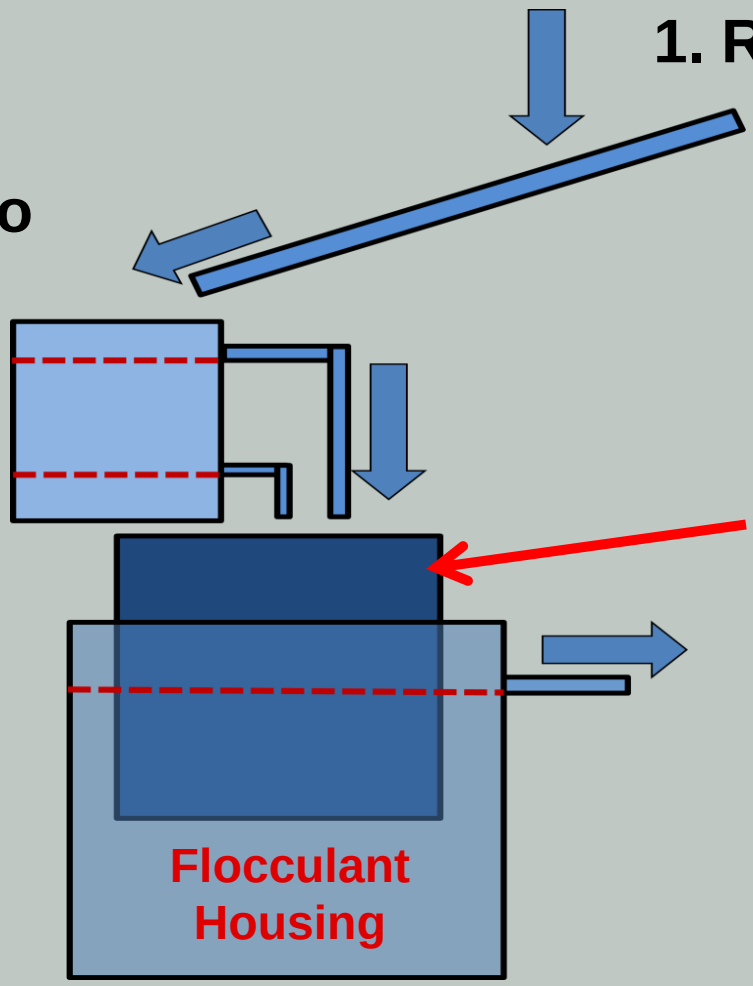


Rain is collected and routed into a bucket which displaces liquid flocculant into runoff

ALTERNATIVE 1:
NEW ZEALAND SYSTEM

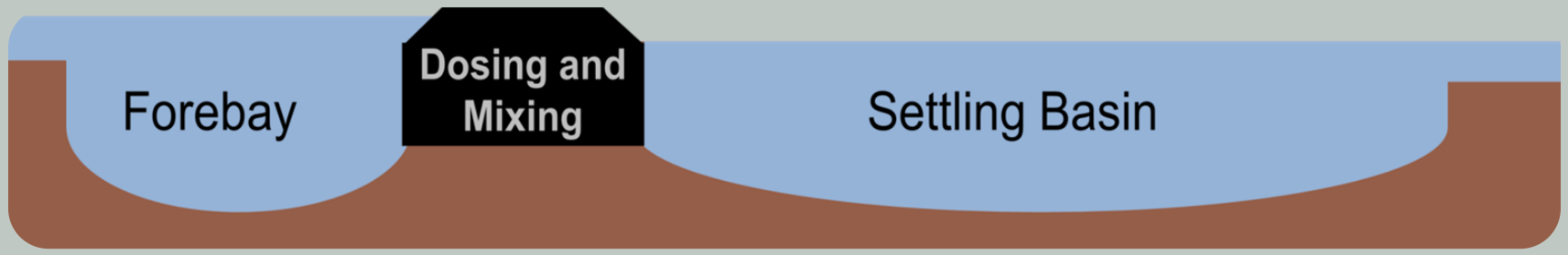
1. Rain Collection

2. Flows through detention bucket to compensate for rainfall/runoff lag

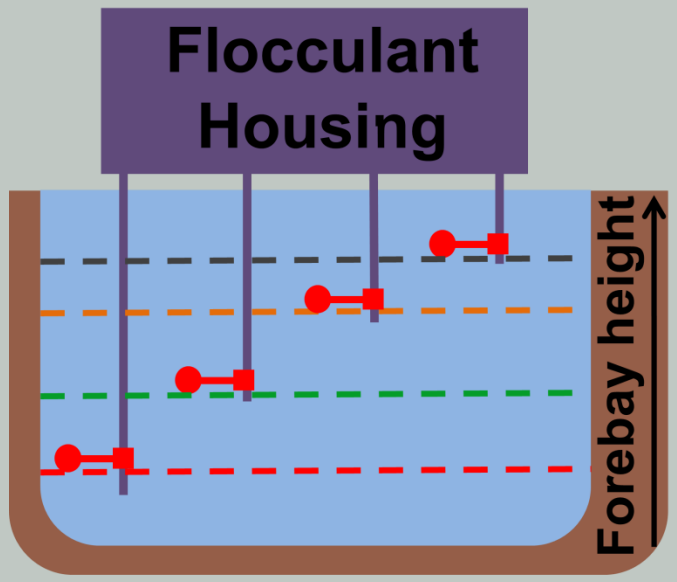


3. Rain water fills floating bucket and displaces flocculant

ALTERNATIVE 2: OSU SYSTEM



Dosing Apparatus



As forebay stage increases additional floats are actuated which correspond to increasing flow through flow control structure

COMPARISON

Similarities

- Automated
- Standalone and passive
- Maintain dosing concentrations
- Portable

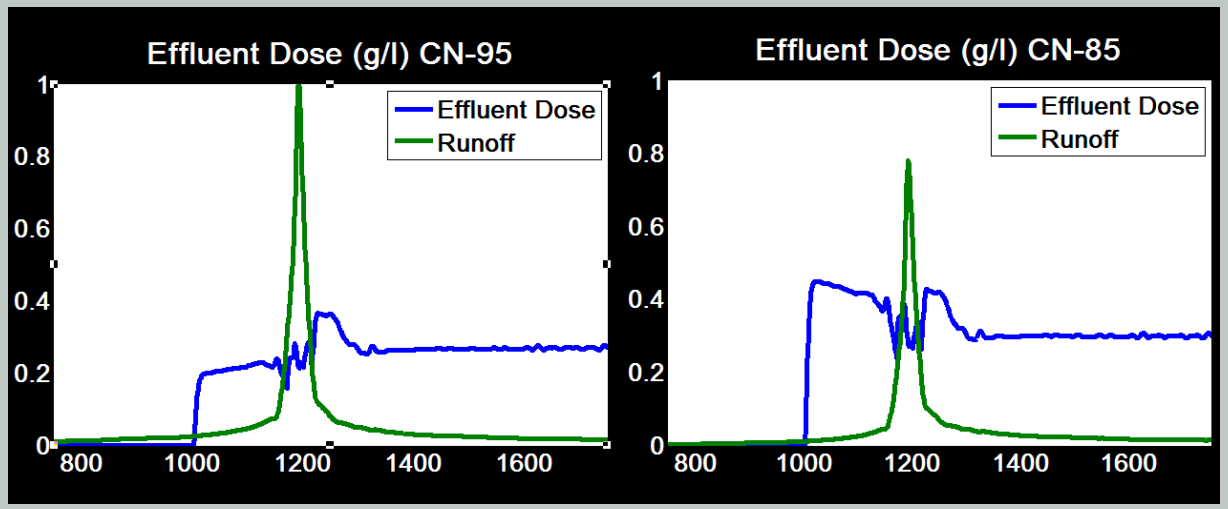
N.Z. System vs. OSU System

- Rainfall Controlled vs. Runoff Controlled
- Site specific design vs. General design
- No Moving Parts vs. Float Valves

MODELING COMPARISON

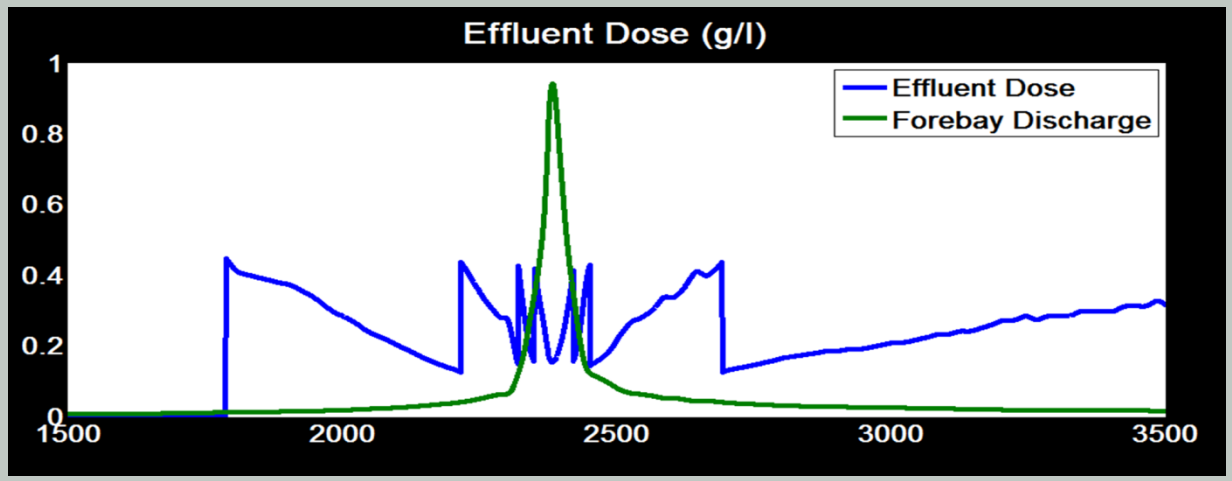
N.Z. System

Sensitive to rainfall runoff relationship



OSU System

Number of floats determine dosing range

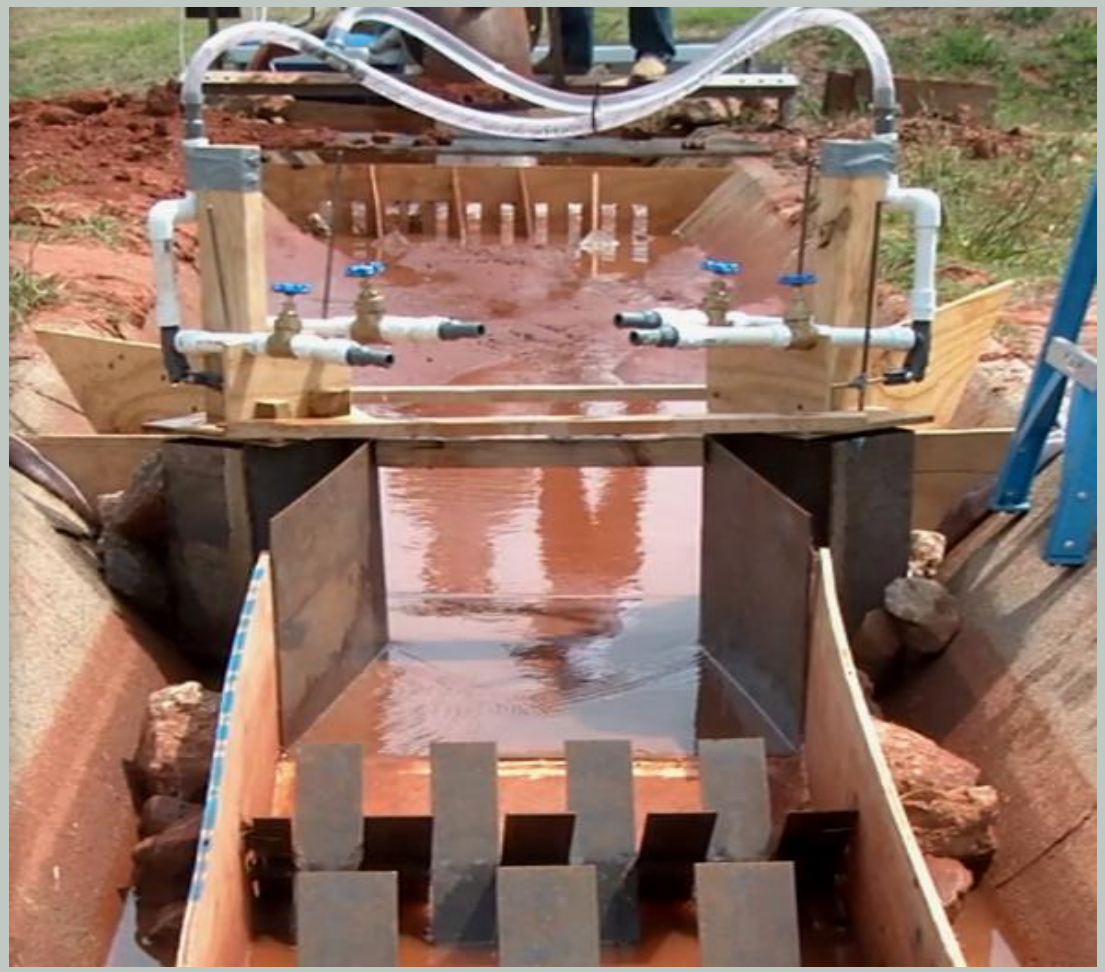


MODELING CONCLUSION

The OSU Experimental System

- Maintains optimum dosing concentrations
- Does not rely on unique rainfall/runoff modeling for dosing
  - Dynamic site characteristic do not influence performance
  - Structure can be reused without alteration for sites with similar runoff rates
  - Rapid calibration

OSU SYSTEM



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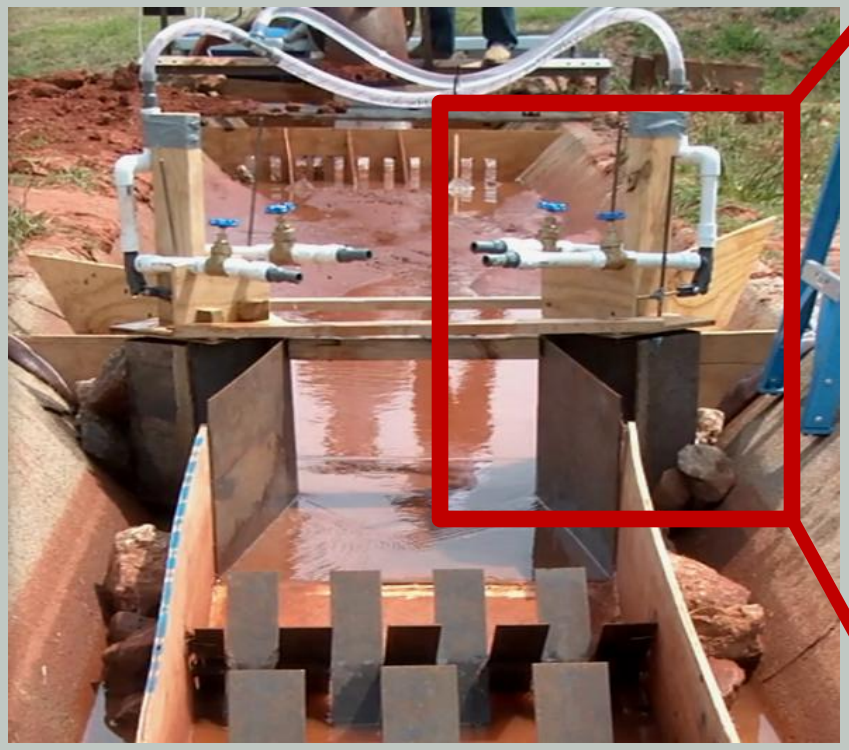
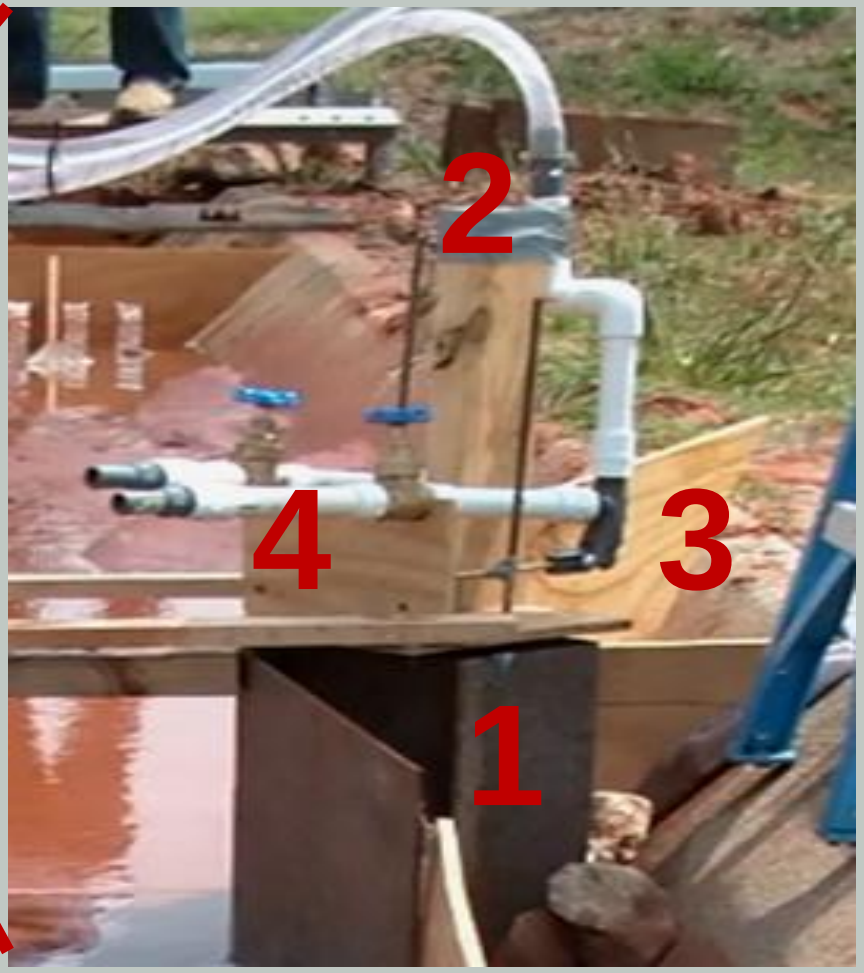
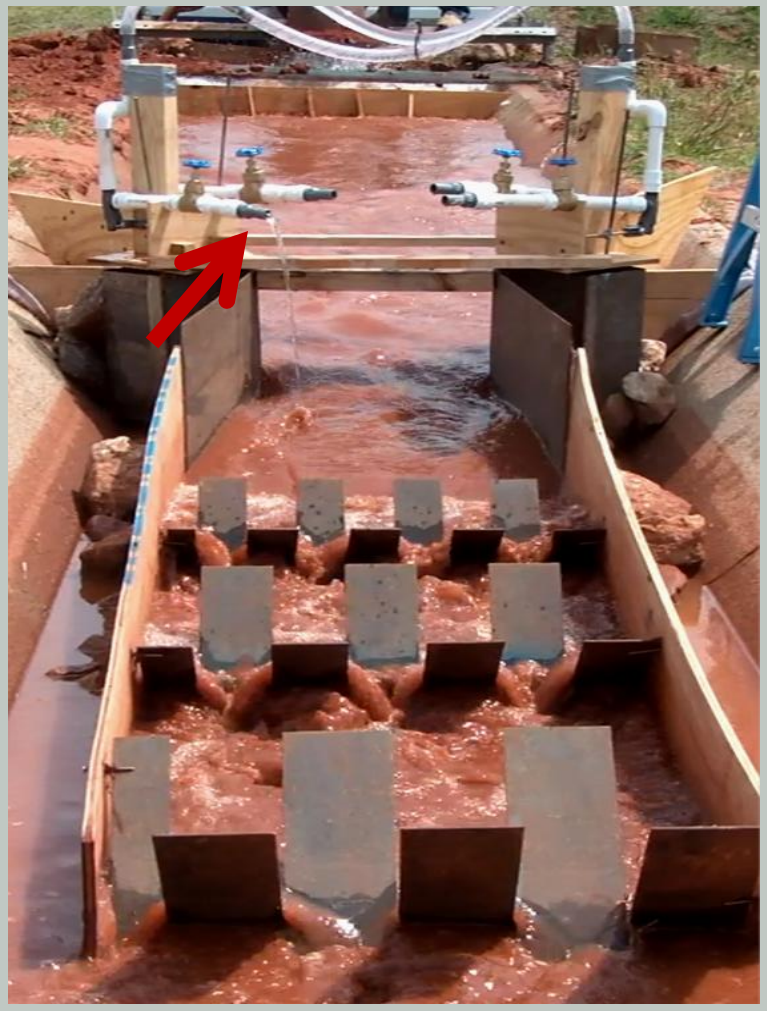
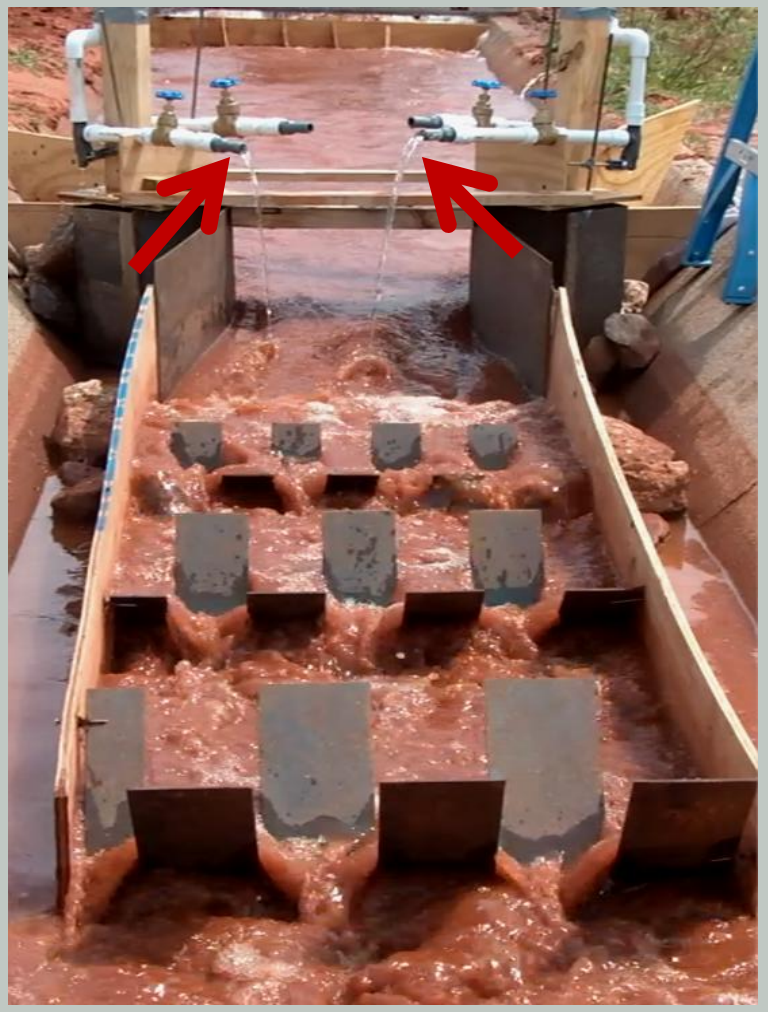




OSU SYSTEM





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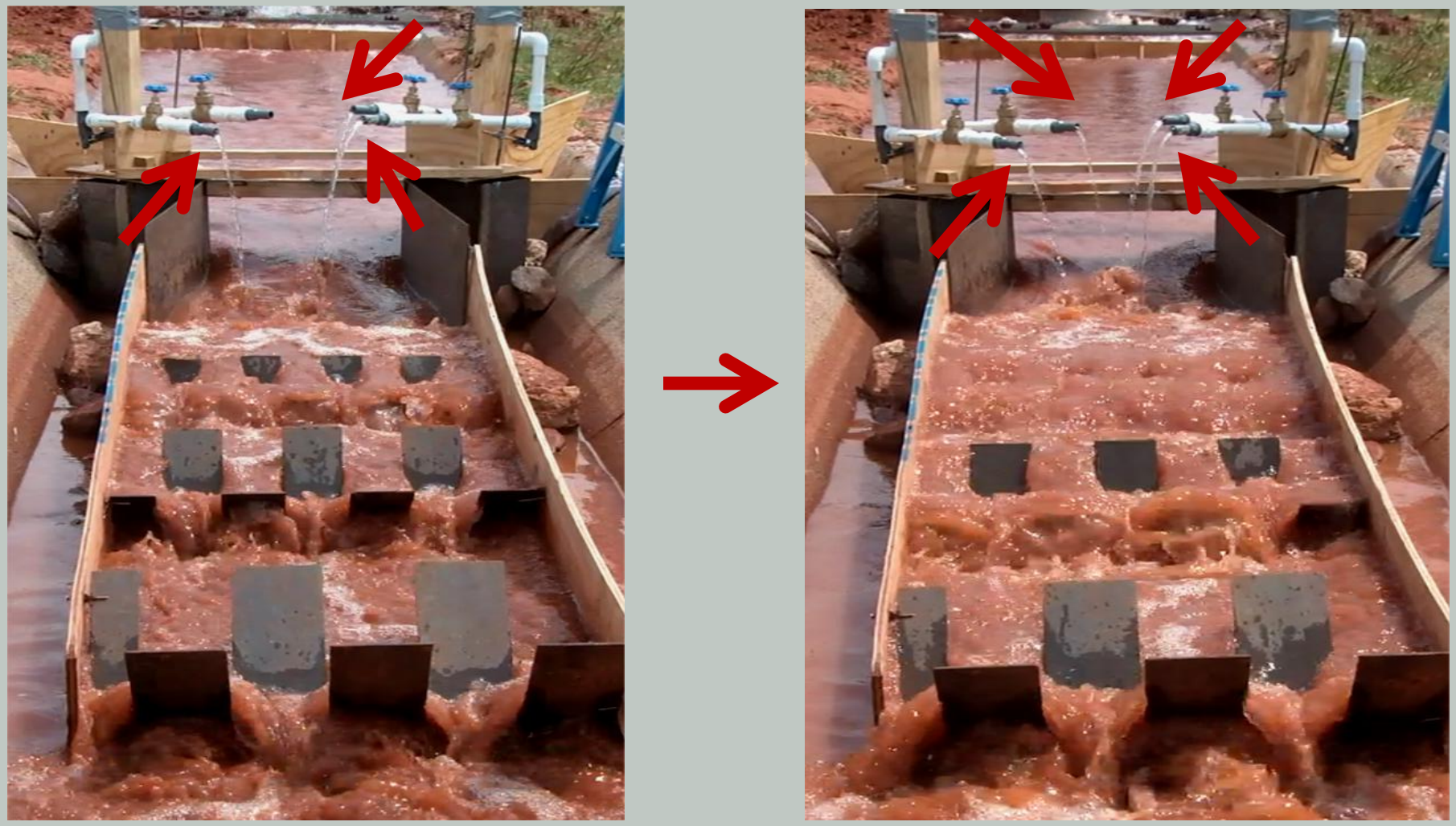
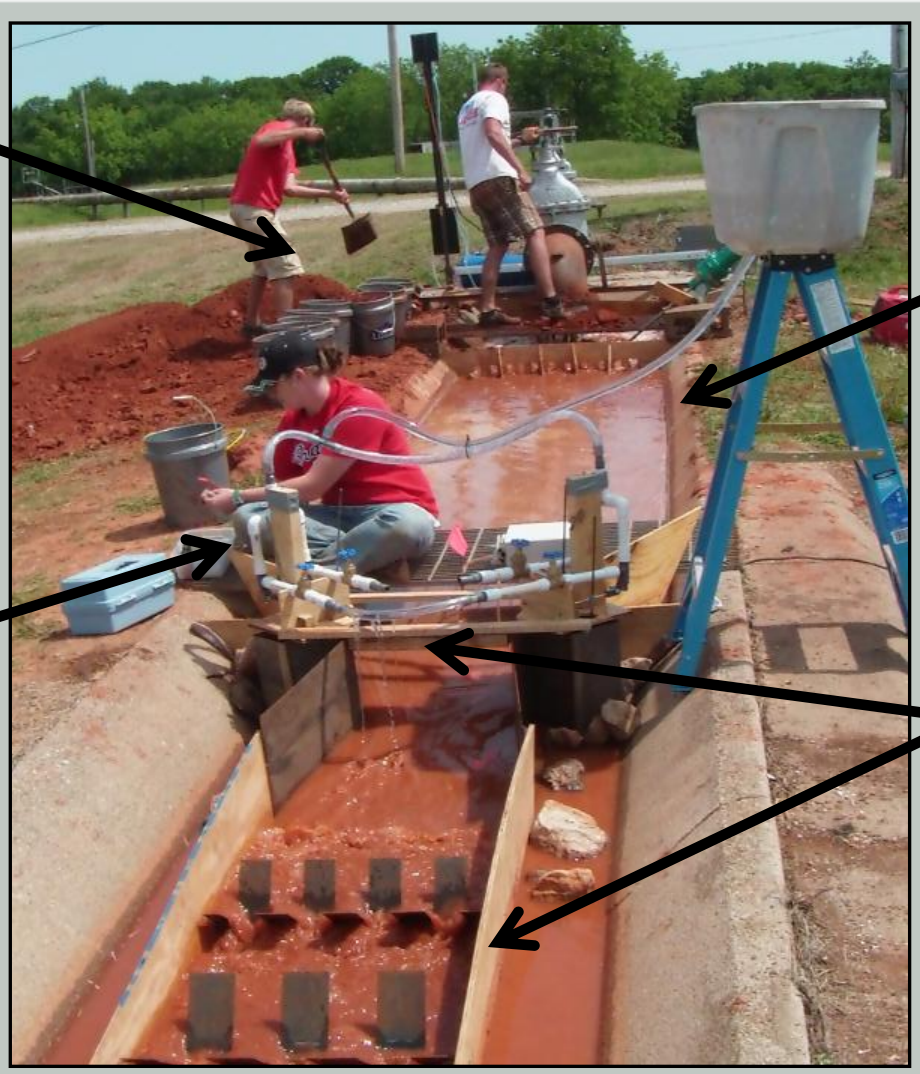


EXPERIMENTAL SET-UP

Sediment Introduction

Initial turbidity samples



Forebay

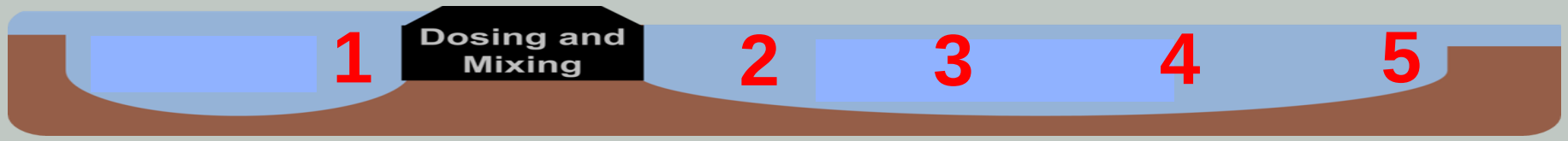
Flocculant Dosing and Mixing

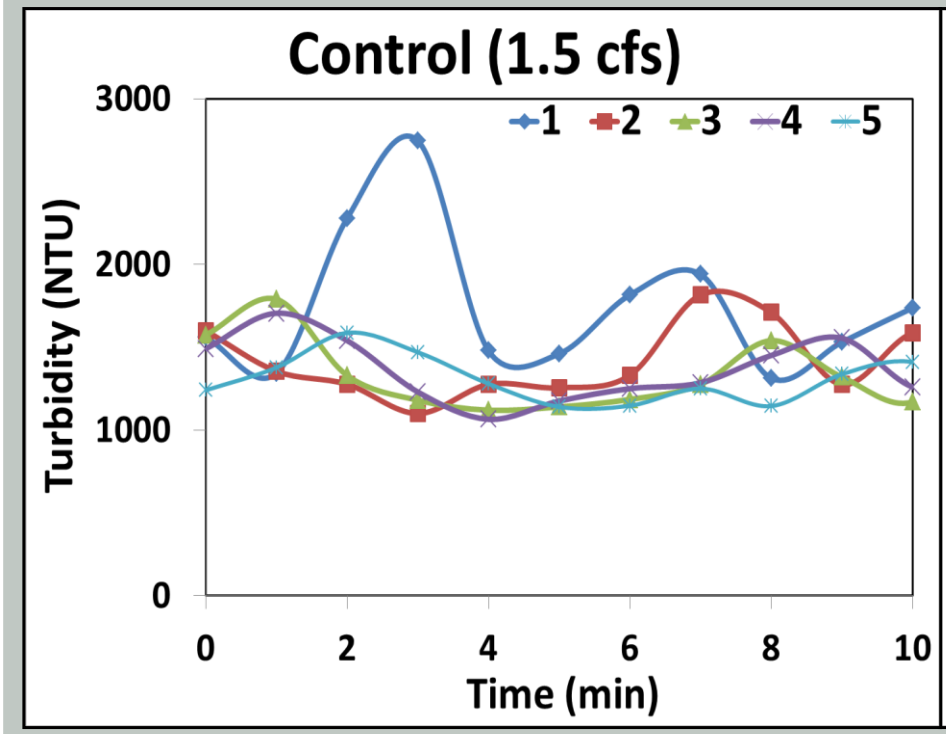
EXPERIMENTAL SET-UP

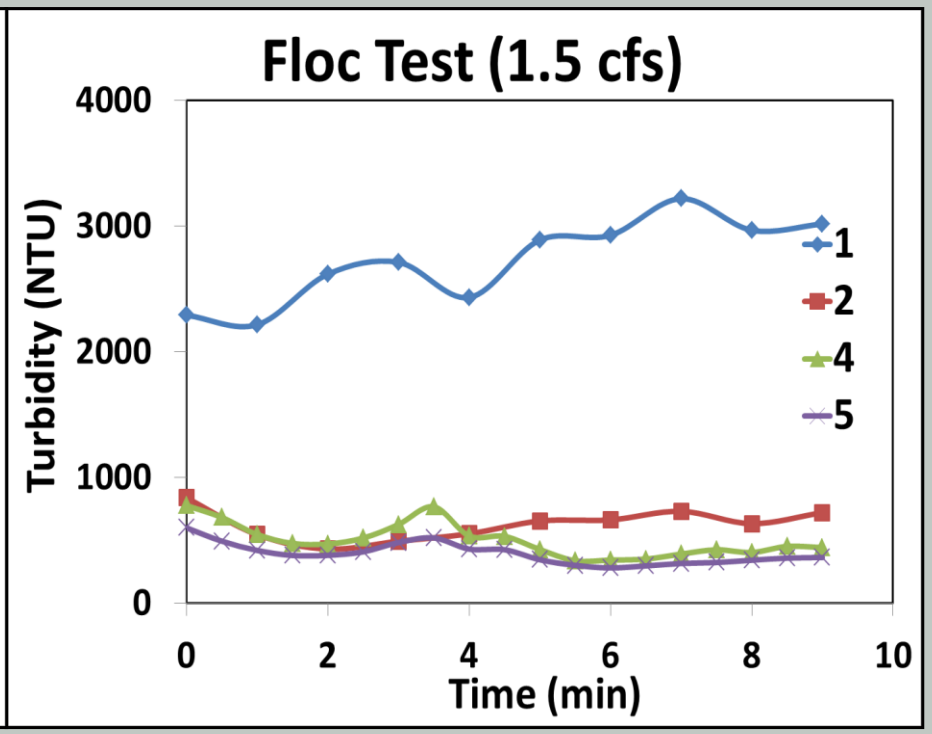
4 Turbidity measurements 25 ft. apart

RESULTS

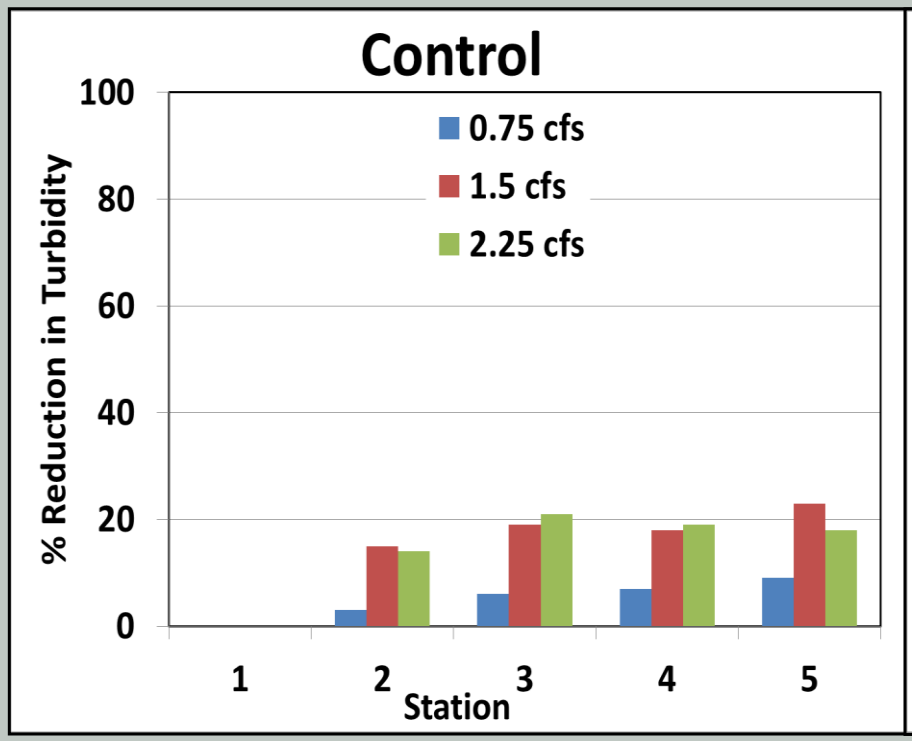
Sample Locations

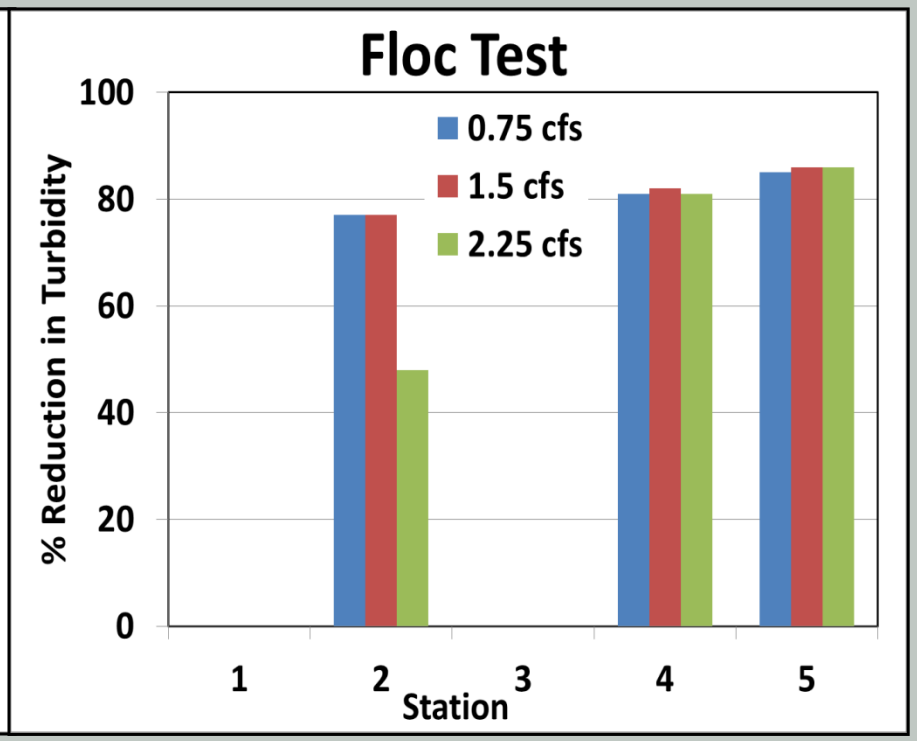






RESULTS


Control
100
80
60
40
20
0
% Reduction in Turbidity
0.75 cfs
1.5 cfs
2.25 cfs
1
2
3
4
5
Station


Floc Test
100
80
60
40
20
0
% Reduction in Turbidity
0.75 cfs
1.5 cfs
2.25 cfs
1
2
3
4
5
Station

RESULTS

Inflow Turbidity

2400

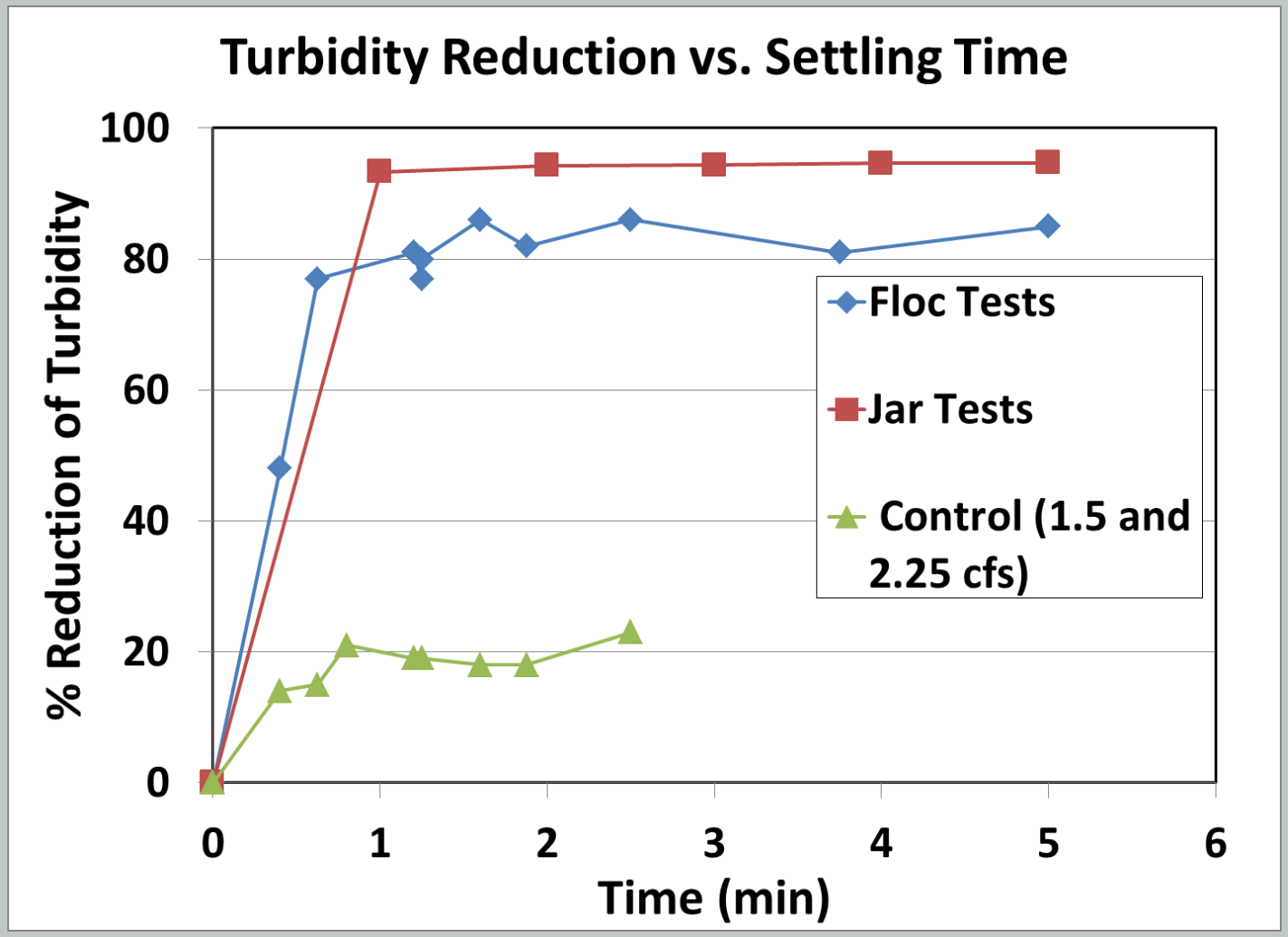
No Flocculant

1920

Flocculant

480

RESULTS


Turbidity Reduction vs. Settling Time
% Reduction of Turbidity
100
80
60
40
20
0
0
1
2
3
4
5
6
Time (min)
Floc Tests
Jar Tests
Control (1.5 and 2.25 cfs)

SUMMARY

Conclusions

- Demonstrated successful operation
- Apparatus achieved 4 x turbidity reduction compared to control
- Majority of turbidity reduction took place within 1 minute of settling time for all experiments

Future Work

- Modularize components
- Refine system and implement on construction site for performance monitoring

Patent Pending

ACKNOWLEDGMENTS

Research Team

Aaron Mittelstet
Grant Graves
Alex Tobergte
Neha Bhadbhade
Hayatt Azawi
Erin Daly

ARS Hydraulics Lab

Tyler
Bob
Greg Hanson
Kem Kadavy

Project Sponsors

Woolpert, Inc.

Greenville Co., SC