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Improved Mixing System for Aquatic Mesocosm Facility

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Improved Mixing System for Aquatic Mesocosm Facility

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Background

- The VCU Environmental Science Department maintains 24 3' by 6' tanks at the Rice Center facility in Charles City, VA.
- Each tank holds 500 gal of water pumped from the neighboring James River.
- Water can then be examined and tested over long periods of time. Growth rates and populations of cyanobacteria and plankton within the tanks were analyzed to better understand their role within the James River ecosystem.

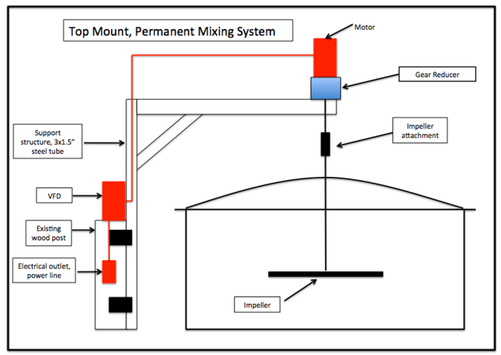
Problem Statement

Overtime it was found that inorganic sediments within the water samples would settle out and plankton populations would exceed that of what occurred naturally.

Objectives

To ensure plankton levels were maintained within the natural range of the James River the following objectives were attempted.

- Maintain colloidal particles in suspension
- Ensure tanks are well mixed
- Simulate river conditions



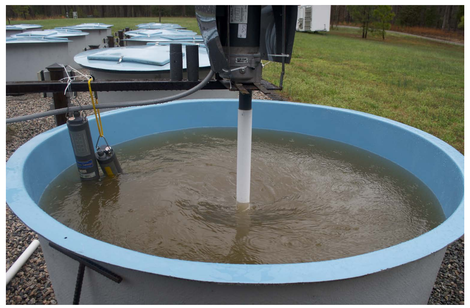
Design

Original design constraints were as follows:

- No addition or alterations to mesocosm tanks
- No exposed metal in contact with the water
- System must operate for time periods greater than seven days
- System must operate in outdoor weather and temperature ranges common to Virginia

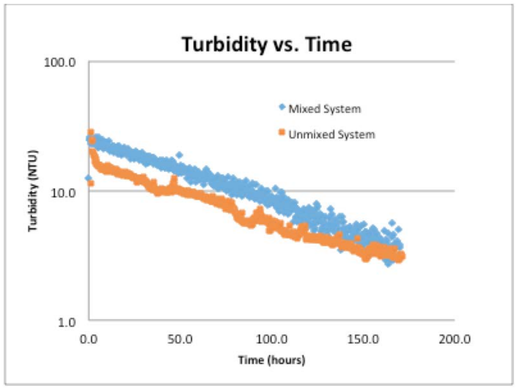
Current Design:

With the above constraints it was determined that the best design would be a pitch-blade impeller that would extend into the tank from above. Both the impeller and drive shaft were constructed from PVC. The impeller would be suspended from a steel frame fixed to a post already present next to the tanks. A variable frequency drive was also implemented to test the effectiveness of different rotation speeds.



Testing

To best simulate river conditions turbidity was chosen as the best testing parameter. Turbidity could be continuously monitored and compared to live readings from the Rice Center's river monitoring station.



Conclusion

Preliminary results show that turbidity in the mixed tank is held at a higher level than the non-mixed. system. However, after a week, the turbidity of both tanks converge to similar values.

Future Work

More work must be done in the future in order to maintain turbidity at the highest levels possible. Experimentation with impeller shape and size will be done. Additionally, impeller RPM will be evaluated.

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