Pilot-Scale Testing of Filamentous Algae Cultivation for Pollution Recovery from Fresh Surface Waters in the Great Lakes

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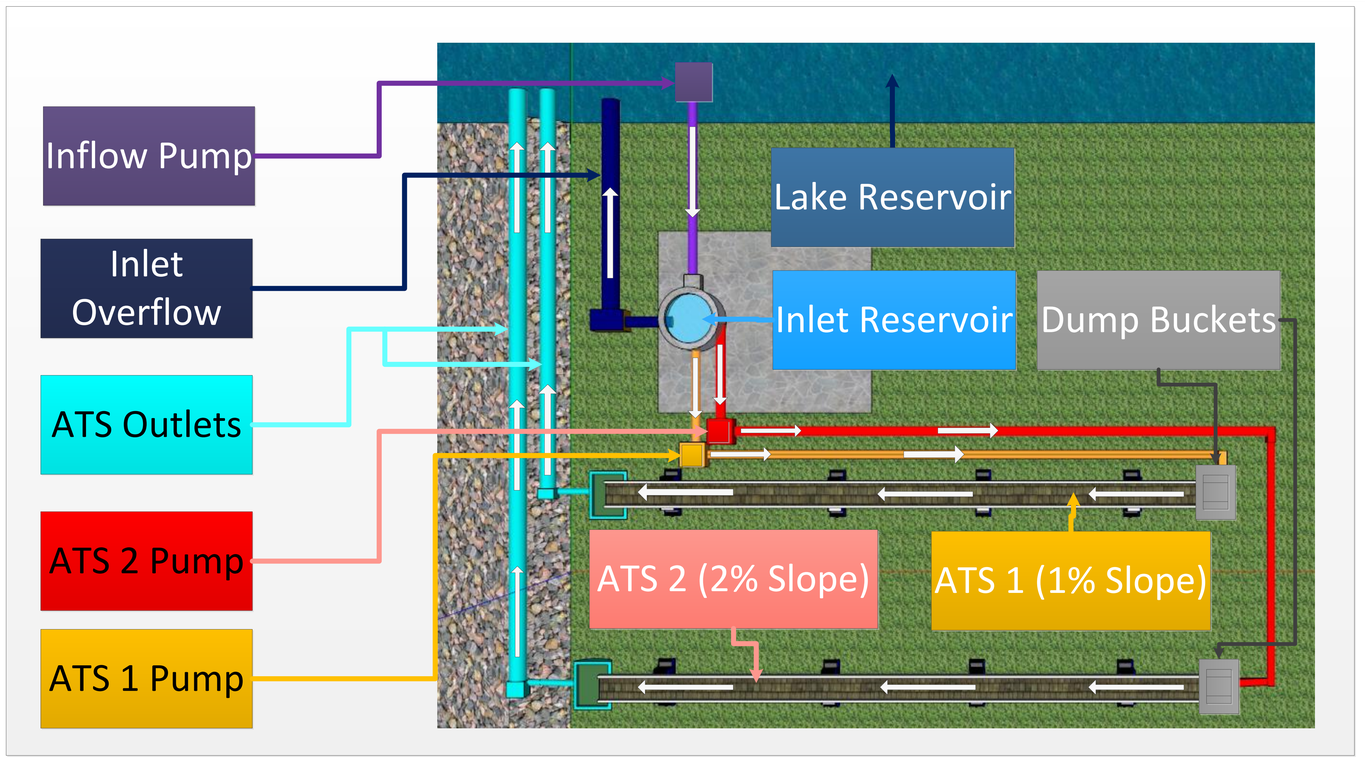
ABSTRACT SUMMARY

One of the largest hurdles in the production of algal biodiesel is overcoming the issues of scaling up. In order to scale up operation, a number of preliminary studies should first be addressed to ensure the best viable productivity from an industrial scale project. A research study was undertaken to investigate the feasibility of large scale cultivation of filamentous benthic algae for both phytoremediation purposes as well the value of the produced biomass content. The use of filamentous algae has the potential to become a valued option due to the low cost methods of harvesting.

BACKGROUND

Two pilot scale algal turf scrubber (ATS) flumes are were designed and installed on the U.S. Buffalo, NY, waterfront and diverted water would pass through the plant and promote the growth of filamentous algae for nutrient uptake. Periodic harvesting of the algae would remove the pollutant nutrients and produce potentially valuable biomass. The benthic algal cultivation system will be analyzed on its remedial efforts on the local high nutrient concentration from agricultural runoff and industrial loading in the United States New York Buffalo City region. The results of this pilot scale experiment will help to address design issues in question for larger scaled projects, such as the optimal length for nutrient assimilation rate and effect of hydraulic slope on productivity.

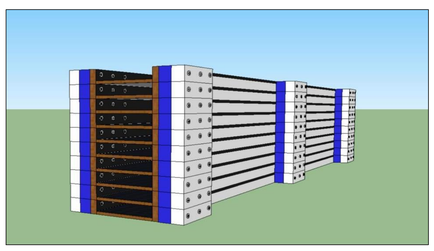
PILOT-SCALE ALGAL TURF SCRUBBER SITE PLAN SCHEMATIC



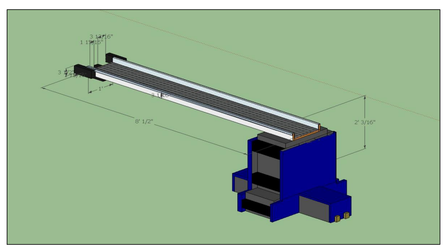
On site schematic of the pilot-scale algal turf scrubber experiment which took place on the Great Lakes Research Center facility in downtown Buffalo NY

SMARTPHONE ACCESS TO ADDITIONAL PICTURES

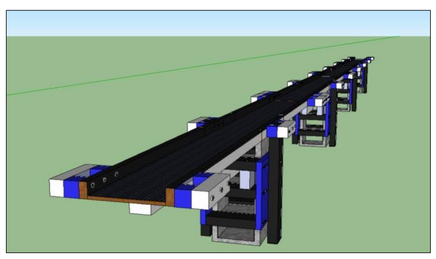
ALGAL TURF SCRUBBER DESIGN



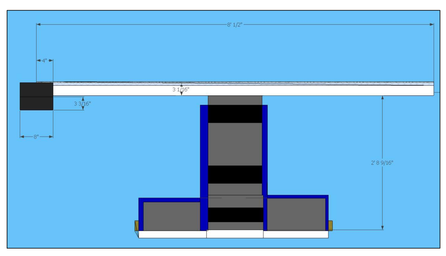
Modular design provided easy transport and easy mass manufacturing of individual components



Measurements were calculated to minimize waste produced from standardized materials

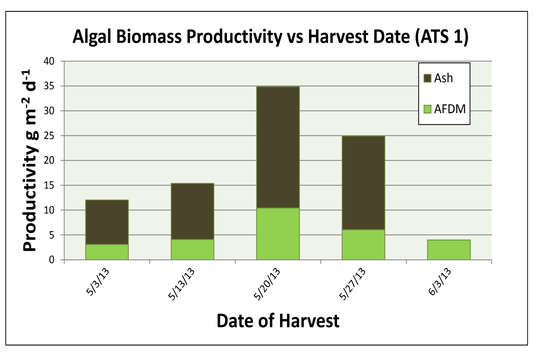


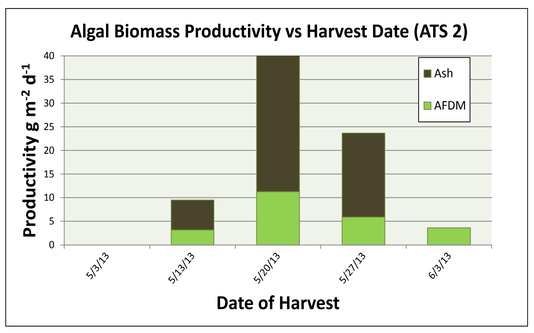
Modular design provided opportunity to construct individual pieces offsite minimizing on-site construction time.



Apparatus was engineered to withstand forces experienced on site, as well as handling during construction

RESULTS





MATERIALS AND METHODS

Two identical algal turf scrubber apparatuses were built with the hydraulic slope as the sole variable. Each ATS was twelve meters long and a third of a meter wide. Water was diverted from the lake waterfront into a local reservoir. From the local reservoir, two pumps were used to bring water to the head of each ATS where water was cascaded down periodically through the use of a dump bucket apparatus. The entire experiment was run in a circular loop using the lake as the primary reservoir. The algal biomass was harvested through the use of a wet/dry vacuum on a weekly basis. The algal biomass was air dried, oven dried, and weighed before and after each transition.

CONCLUSION

The final biomass production rate was relatively low in comparison to other methods which use the free-floating algae variety. However, further analysis will be made to compare the economic impact of the low cost method of dewatering the biomass through the use of filamentous algae. Further investigations will also be made as to the elemental composition of the biomass and financial stimulus of providing a service of remediation of contaminated surface waters.

REFERENCES

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Adey, W. H. and K. Loveland (2007). Dynamic aquaria : building and restoring living ecosystems. Amsterdam ; Boston, Academic Press.

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