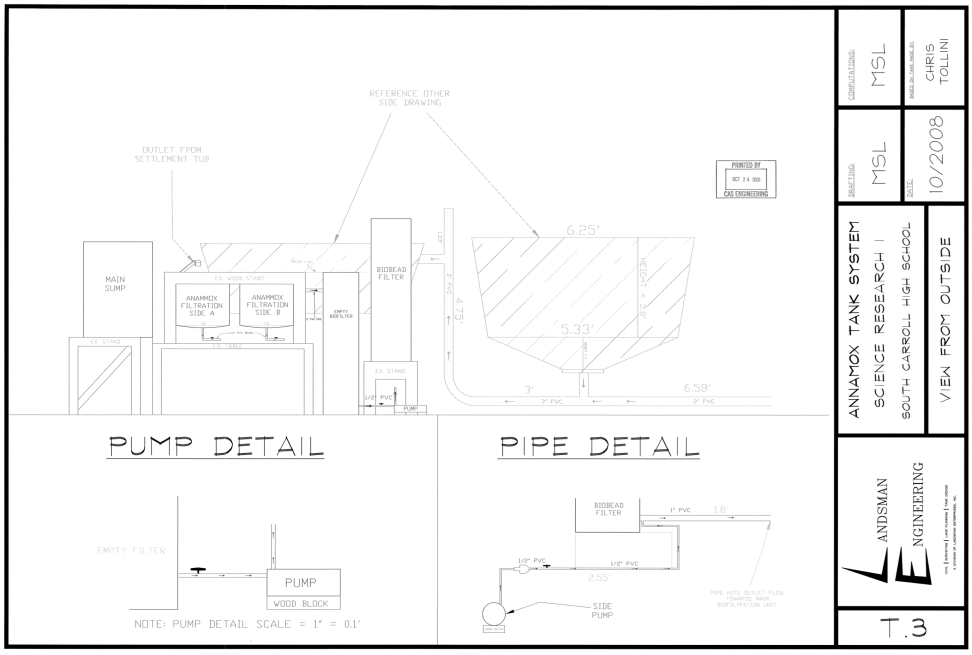
New Recirculating Aquaculture Technology comes To Carroll County

The Carroll County Public School (CCPS) system continues to be a leader in Science, Technology, Engineering, and Mathematics (STEM) Education Maryland in innovation and technology through their unique Science Research courses I & II curriculum. Our partnership with CCPS gives Maryland Sea Grant a venue to implement various projects to test their efficacy in the public school setting and track results with students and teachers. Successful projects in the past have lead to changes in the Science Research curriculum and a spread to other school systems interested in emulating the STEM model set forth at CCPS high schools.

Aquaculture has been at the forefront of these projects in the Science Research courses for more than 10 years and another recent expansion in 2008 of a new recirculating system promises greater opportunities for the future and places CCPS as a potential centerpiece for not only high school education engaging students and teachers but the potential of educating citizens concerned with the health of Chesapeake Bay.

In the summer of 2008, with the generous support of the Maryland Sea Grant Extension Program, CCPS, and the Center of Marine Biotechnology (COMB), the vision of designing and building a *true recirculating* system based upon COMB research became reality. The new technology of this system is in the biological filtration of the waste products of the fish. Instead of just the traditional aerobic biological filtration a new anaerobic biological filtration loop was designed into the recirculating system. The anaerobic loop takes advantage of naturally occurring bacteria that use the Anammox process. The Anammox process has been known for approximately 12 years from it's original discovery in the Netherlands in a waste treatment facility. In the last 4 years COMB has taken this process and applied it to recirculating aquaculture in the hopes that it would reduce or eliminate the need for water changes thus reducing the costs of operating these intensive systems. These costs can be significant when considering the replacement of salts and preparation of water for marine systems in particular. In addition, it was projected that this would also be a healthier less stressful environment for fish. Success has been achieved with these systems at COMB so it was time to try it within the Aquaculture in Action network.

A recirculating Anammox system was constructed at South Carroll HS in July-September 2008 by Mr. J. Adam Frederick and Mr.Chris Tollini a technician at the COMB Aquaculture Research Center. The system was tested by SCHS Science Research students and teachers and is now fully functional and operating housing striped bass from the Horn Point Laboratory and sturgeon from the Maryland Department of Natural Resources Cedarville Hatchery. The system consists of 2- 450 gallon tanks, aerobic biological filtration, and an Anammox filtration loop. The system will reduce or eliminate the need for water changes and hopefully reduce the mortality of the fish in the system.



The drawing above was rendered by Martin S. Landsman a student at SCHS enrolled in Science Research and using this project to help complete a drafting internship.

The costs to CCPS were significantly reduced through contributions from COMB, MD Sea Grant, and the guidance and skill of Mr.Tollini in construction of the system. Costs will further be reduced if the system successfully reduces the need for water changes, cuts the costs of replacing salts in the system, and reduces mortality of the fish. The Science Research students at South Carroll HS lead by teacher Judy Plaskowitz now maintain the system and enter data on the Aquaculture in Action website so we can monitor the progress of the system. The goal through monitoring is to illustrate two key points:
How long does it take for nitrogen levels (ammonia, nitrite, and nitrate) to drop near zero?
Will nitrogen levels be significantly less than those systems running without Anammox technology?
So far the data indicates that the system is working well and levels of ammonia and nitrite are both less than when compared to other systems not using Anammox technology.

The Anammox systems are expanding to three other high schools- Westminster HS, Century HS and Winters Mill HS in CCPS. This illustrates a real investment from the school system and their satisfaction with the system and how it can be used as an effective STEM teaching model. The impact of having 3 systems running in these schools will involve the participation of hundreds of students.

For more information regarding this project please contact:

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Mr. Brad Yohe, Carroll County Public Schools Science Supervisor, BEYOHE@carrollk12.org

VOLUMES

TANK SIDE A:	61.36 CUBIC FEET
TANK SIDE B:	61.36 CUBIC FEET
MAIN BIOFILTER:	12.50 CUBIC FEET
SETTLEMENT TUB:	25.45 CUBIC FEET
MAIN SUMP:	8.48 CUBIC FEET
ANAMMOX TUBS:	1.39 CUBIC FEET
EMPTY FILTER:	3.14 CUBIC FEET
BIOBEAD FILTER:	3.94 CUBIC FEET
TOTAL PIPING VOLUME:	5.45 CUBIC FEET
TOTAL SYSTEM VOLUME:	183.07 CUBIC FEET

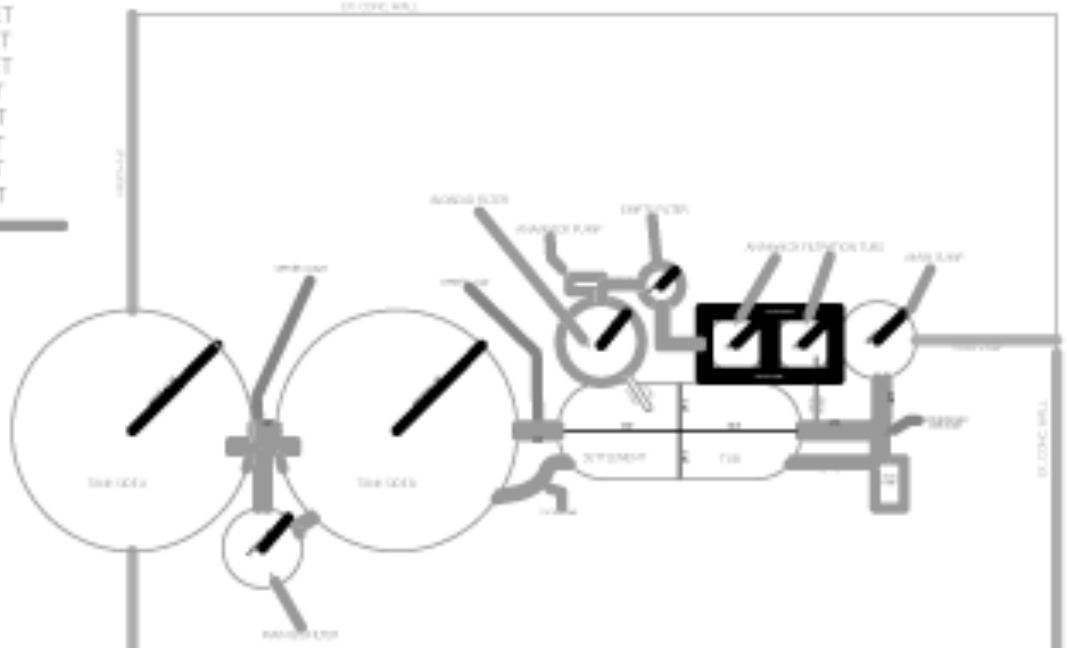
INDEX OF TANK DRAWINGS

FLOW RATE ANALYSIS

FLOW RATE TRIALS BELOW DISPLAY THE LITERS OF WATER BEING PUMPED OUT IN LITERS PER SECOND. TRIALS 1-5 WERE DONE BY PULLING WATER FROM TANK SIDE A, WHEREAS TRIALS 6-10 WERE DONE FROM TANK SIDE B.

TRIAL	FLOW RATE
1 :	0.083 LITERS / SEC
2 :	0.080 LITERS / SEC
3 :	0.074 LITERS / SEC
4 :	0.074 LITERS / SEC
5 :	0.081 LITERS / SEC
6 :	0.103 LITERS / SEC
7 :	0.103 LITERS / SEC
8 :	0.105 LITERS / SEC
9 :	0.099 LITERS / SEC
10 :	0.104 LITERS / SEC
AVERAGE FLOW RATE:	0.091 LITERS / SEC
STANDARD DEVIATION:	0.013 LITERS / SEC

OUTSIDE



CLASSROOM

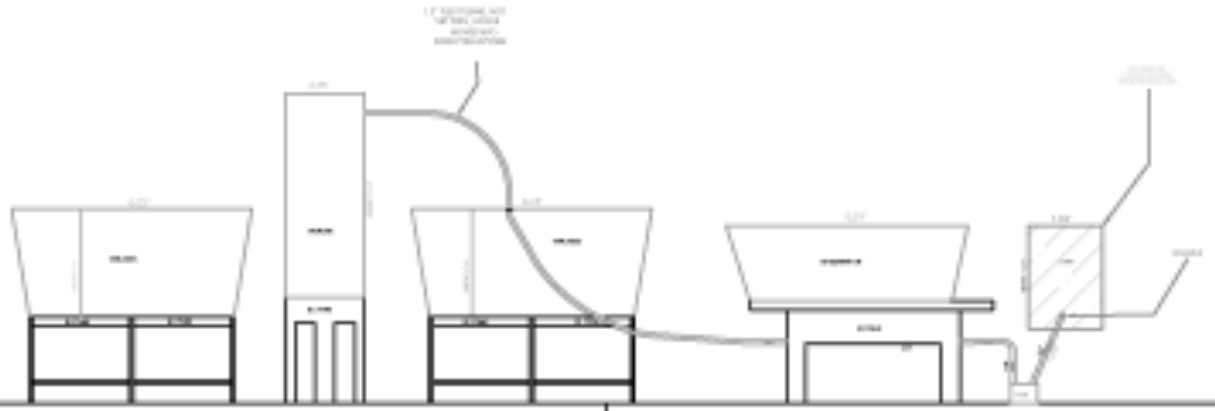
DRAWN: MSL
CHECKED: CHRIS TOLLINI
EDITED: MSL
DATE: 10/2008

ANNAMOX TANK SYSTEM
SCIENCE RESEARCH I
SOUTH CARROLL HIGH SCHOOL

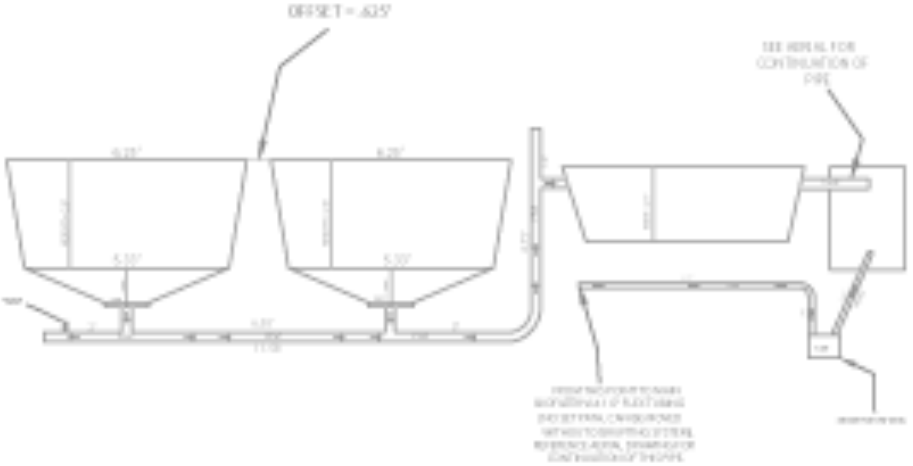
AERIAL VIEW

ANDSMAN ENGINEERING

T.1



PIPE DETAIL



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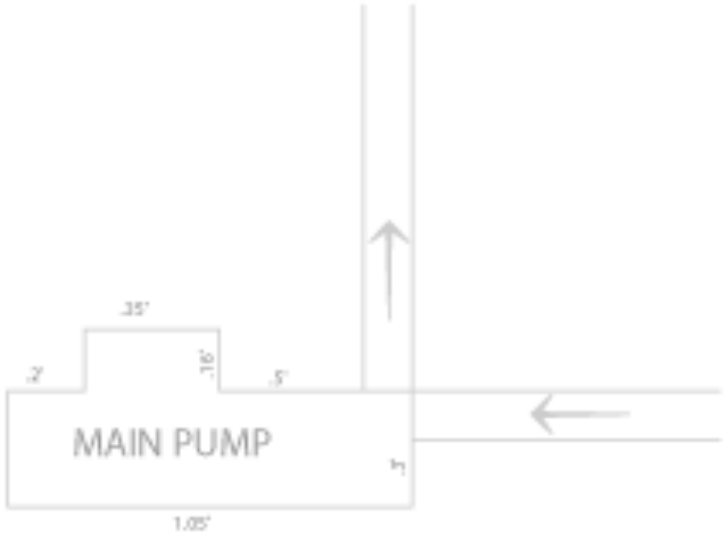


NOTE: PUMP DETAIL SCALE = 1" = 0.1'

DRAWN	MSL
CHECKED	MSL
DATE	10/2008
DESIGNED	CHRIS TOLLINI

ANNAMOX TANK SYSTEM

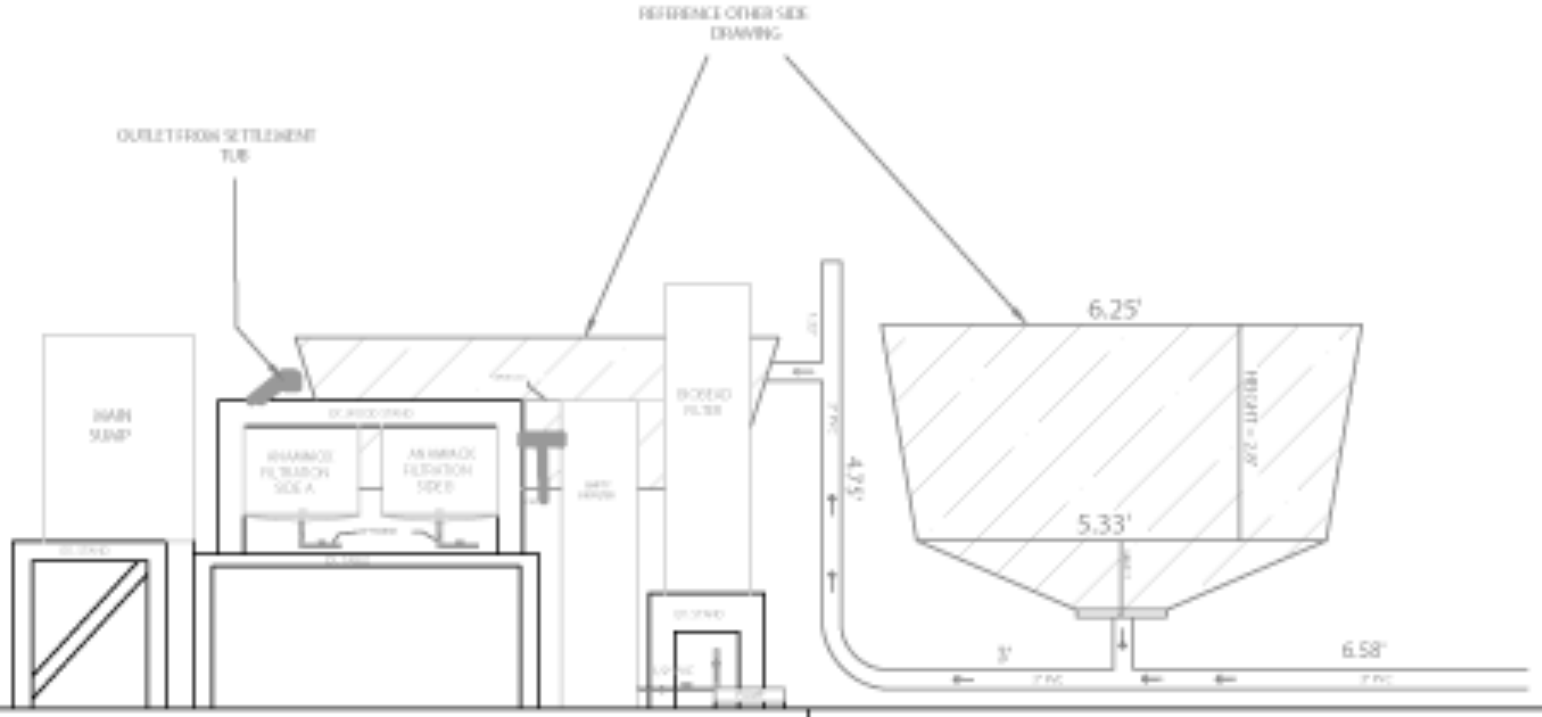
SCIENCE RESEARCH I

SOUTH CARROLL HIGH SCHOOL

VIEW FROM THE CLASSROOM

ANDSMAN ENGINEERING

T.2



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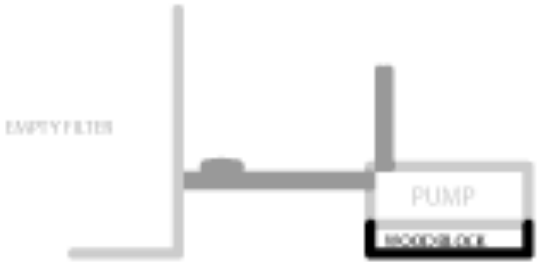

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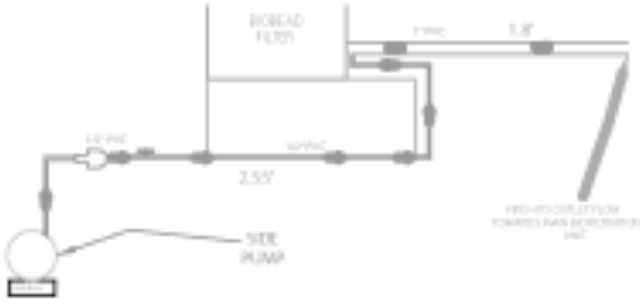
PIPE DETAIL



DESIGNED	MSL
DRAWN	MSL
CHECKED	CHRIS TOLLINI
DATE	10/2008

ANNAMOX TANK SYSTEM
SCIENCE RESEARCH I
SOUTH CARROLL HIGH SCHOOL

VIEW FROM OUTSIDE

ANDSMAN NGINEERING

T.3