



Department of Civil Engineering
American Society of Civil Engineering
Student Chapter

2019 Ohio Valley Student Conference

Thursday, April 11-Friday, April 12, 2019

2019 Environmental Competition

Overview

Lake Rockwell Reservoir was constructed in 1915 and is the primary source of Akron's drinking water supply. To ensure the protection of this water source, the land surrounding the lake is restricted and there is no trespassing. Lake Rockwell tends to experience algae blooms and the growth of cyanobacteria. Cyanobacteria creates toxins in the water that are hard to filter through the water plant. The concentration of phosphorus plays a role in the thriving population of these cyanobacteria.

Objective

The goal of the 2019 OVSC Environmental Competition is to design a small-scale treatment system that will reduce the concentrations of phosphorus, iron, achieving as close to a neutral pH, and cleaning out any sediments in the water. The practical objective is to develop a treatment design that is not only effective and innovative but also sustainable.

Water Source

The water for the competition will come from the Lake Rockwell supplied by the Akron watershed. This will be from Kent, Ohio which is where Lake Rockwell is located. Short term fluctuations are common based on the amount of rainfall in the immediate region that impact the water levels in the lake. It is reasonable to expect that the water source might have the qualities outlined on the following page.

pH	7.15-8.8
Specific Conductivity ($\mu\text{s}/\text{cm}$)	254 – 455
Raw Turbidity (NTU)	1.63-31.5
Raw Potassium Permanganate (KMNO_4)	0-0.381
Total Suspended Solids (mg/L)	0-164.8
Raw Nitrate (mg/L-N)	0.005-0.503
Raw Manganese (Mn)	0.055-0.553
Total Iron (mg/L)	0.29-0.41
Total Aluminum (mg/L)	12 – 15



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Hardness (mg/L)	62-142
Raw Turbidity	1.63-31.5
Raw Alkalinity (mg/L-CaCO ₃)	49-115
Raw Fluoride (mg/L)	0.057-0.154
Raw Bromide (mg/L)	0.019-0.042

Deliverables

With in the first five minutes of the start of the competition, each team must pour enough water into their system so that two liters of treated water can be recovered. Each team must recover two liters of lake Rockwell water within 45 minutes of the start of treatment time from the two-gallon bucket provided. The treated water will be scored on the pH, **turbidity**, ~~iron concentration~~, **alkalinity**, and phosphorus level. OVSC judges will extract samples from the treated water to analyze.

Materials

All materials that are used to treat the water, both mechanical or substances added to the Akron water, must be purchased from a retail store such as Lowe's, Home Depot, Walmart, garden center, sand/gravel operations, etc. Pre-manufactured treatment or screening systems such as chemical cartridges or water filters are not permitted. All receipts from the purchase of materials, and equipment must be included in the appendix of the Technical Review Paper (see below). All materials must be listed with a cost associated in the technical paper. Failure to account for all items will result in a technical paper penalty. Any electric, battery, or manually operated tool may be used in the construction and operation of the apparatus and may be obtained by any means, however an estimated cost must be included in total cost. The cost should be estimated based on rate of 6.50 cents kWh.

Construction and Treatment

- Pre-assembly of apparatus components is permitted; however, teams are advised that access is limited to standard entry doors. If transport is deemed unsafe the team will be asked to disassemble the apparatus and reassemble during the construction phase of the competition.
- Each school may enter one (1) team, consisting of up to but no more than five (5) ASCE undergraduate student chapter members. One (1) member should be designated as team captain.
- Each team will be provided with a two (2) foot deep by four (4) wide countertop area, with sources of electrical power. The treatment system must fit in the allotted space or floor area the same size.
- All team members must provide and be equipped with proper clothing (long pants, closed toed shoes), as well as protective eyewear, and latex gloves.
- Before time begins, all materials and tools must be in a designated area and not in contact with any team member.
- Teams will be given a maximum of 15 minutes to complete their set-up and teams will have a maximum of 45 minutes to complete the treatment of the water.



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- Each team member used during treatment time will be listed under cost as \$20.00 per person (any design that needs team member to operate apparatus during treatment must record the appropriate cost).
- All substances added to the Lake Rockwell water which will be presented in the final effluent must be measured to the nearest mL if liquid or nearest gram if dry and reported to the judges before addition.
- After judging is finalized each team is responsible for the cleanup and disassembling of their treatment system.

Technical Paper and Presentation Poster

Every participating team must submit one technical review paper, not to exceed 1,500 words (not including references and tools list) as well as a presentation display poster. The paper should describe the teams' preparation for the competition including design considerations, development, and proposed implementation of the treatment apparatus, and must be submitted at the beginning of the captain's meeting on the day of competition. The Technical Paper must be divided into the following labeled sections:

1. Abstract
2. Introduction
3. Materials/Methods
4. Discussion
5. References
6. Appendix (including receipts for materials and tools)

The poster must be 24" x 36" and present the final Lake Rockwell treatment system description, summary of cost, and environmental impact.

Judging

Teams will be judged by a panel of water quality professionals. Samples of the treated water will be tested for ~~total iron~~, alkalinity, turbidity, **phosphorus** and pH.

Scoring related to the creativity and sustainability of the treatment process will be evaluated by a panel of judges. Creativity refers to the uniqueness of the system. Sustainability refers to the total life-cycle cost and environmental impact:

- What resources are used, and what is the waste generated by the system? Are the materials used safe for humans and the environment?
- Could any materials used result in any harmful byproducts in the effluent?
- What is the potential for recycling the system components at the end of its functional lifetime?



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These will be ranked in order from greatest to least and awarded points accordingly. The decisions of the judges are final, and the team captain is the only team member that may interact with judges during the competition. There are a maximum of 100 points available for each team, with the judging criteria as follows:

Parameter	Subcategory	Scoring
Treated Water Quality	pH	The closest team to pH 6.5 will get 20 points, with 2 points subtracted per place thereafter
Treated Water Quality	Total Iron	The team with the lowest concentration will get 20 points, with 2 points subtracted per place thereafter
Treated Water Quality	Total Alkalinity	The team with the lowest concentration will get 15 points, with 2 points subtracted per place thereafter
Treated Water Quality	Turbidity	The team with the lowest concentration will get 15 points, with 2 points subtracted per place thereafter
Treated Water Quality	Phosphorous	The team with the lowest concentration will get 15 points, with 2 points subtracted per place thereafter
Time of Treatment	Minimum time to recover 2 L	The team with the shortest time will get 10 points, with 1 point subtracted per place thereafter
Sustainability	Life cycle cost and environmental impact	The team with the most sustainable design will get 10 points, with 1 point subtracted per place thereafter
Creativity	System uniqueness	The team with the most creative design will get 10 points, with 1 point subtracted per place thereafter

Penalties

Failure to pour Lake Rockwell water into the treatment system in the first minute	1 point per 10 seconds over the first minute
Failure to account for all materials & costs in the Technical Paper	5 points
Physical contact by any team member with the Lake Rockwell water intake, effluent, or intermediate water	25 points
Failure to provide presentation display poster	5 points
Failure to complete system construction in 15 minutes	2 points per minute after the first 15 minutes
Failure to recover two liters in 45 minutes	10 points



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All substances added to intake or process water must be for the purpose of treating the water. Any form of dilution is prohibited and will result in disqualification.

Awards

An overall total of 100 points are available to be awarded for treatment quality, time needed and creativity and sustainability; the team with the most points will be deemed the overall winner. Second and third place overall awards will also be given as well as awards for the sub-categories below. The sub-category awards have no impact on the overall awards and will include:

- Best Environmental Technical Paper - The team with the highest score for the Technical Review Paper will be awarded “Best Technical Review Paper”.
- Most Creative Apparatus - The team with most creative design will be awarded “Most Creative Apparatus”

**** Please submit any questions regarding these rules to ovsc2019@zips.uakron.edu with “Competition Name_RFI” in subject line ****