November 17, 2010

IWEA SJWP

Arrangements Committee

Meeting

Handouts

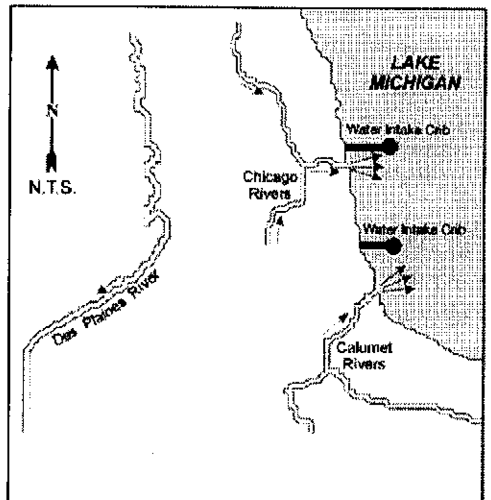
111 E Erie St.

Chicago

DB 1

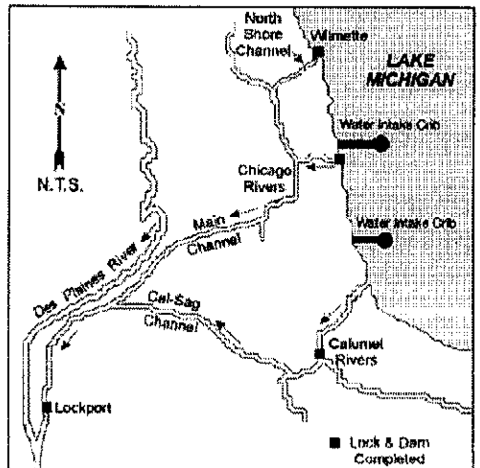
"Play-Doh River Reversal"

Students will be asked to model the natural flow of the Chicago and Calumet Rivers into Lake Michigan using a canvas comprised of play-doh. The play-doh surface geography can be predefined for the students to reflect the true slopes of the landscape within the watershed to aid in the natural flow of the rivers. Establishing the flow of water into the lake can be verified by adding a drop of dye (red or brown to indicate pollution). The colored "pollution" will flow into the lake illustrating the issues Chicago was facing with the sewage infiltrating the drinking water supply.



BEFORE CANAL SYSTEM CONSTRUCTION

Next the students will be asked to reverse the flow of the Chicago River. They will accomplish this by drawing and then carving out the "man-made channels" emulating the construction of the North Shore Channel, Sanitary and Ship Canal and the Cal-Sag Channel. Once they have finished carving out the channels their coach will verify that the channels slope down and away from the lake. They will get the "thumbs up" to open up the "gates" and take down the "dams". The reversal of the rivers can be verified by adding a drop of "Irish" green dye, as done on St. Patrick's Day, into the Chicago River which should be flowing away from the lake and towards the Des Plaines River.



CHICAGO SANITARY AND SHIP CANAL SYSTEM COMPLETED

The "Play-Doh River Reversal" is an activity that can be educational, fun and competitive. The exact scale of the canvas depends on the size of the work groups. There are several ways to facilitate the flow of water and collect any overflow. Also, the activity can be customized to increase or decrease the degree of complexity for the students depending on the amount of detail we want to incorporate. A more detailed description of the activity can be developed when key parameters such as allotted time for the activity, activity setting and the size of the work groups are established. Also, this activity will work well for an ice breaker but can be customized if decided for the design/build competition as well.

DB 2

Proposed idea for the Design/Build Competition

Background: Despite the reversal of the Chicago River, and even the construction of the largest wastewater treatment plant in the world, contaminants continued to accumulate in the rivers, canals, and Lake Michigan. The persistence of the problem was due mainly to the fact that Chicago and many of the older suburbs are served by combined sewers, in which both sanitary and storm flow are conveyed through the same pipes.

As the area developed and more land was paved, the amount of rain water entering the sewer system dramatically increased. During rain events, the sewer system and treatment plants could not accommodate the additional flow, and combined sewage would overflow to the local waterways. During particularly large storms, raw sewage has been released into the lake in the past. Beach closings were frequent along the Lake Michigan shoreline and the area waterways were polluted and devoid of aquatic life. In addition, combined sewage would back up into basements of homes and businesses.

The District adopted the Tunnel and Reservoir Plan (TARP) in 1972. TARP's main goals are to protect Lake Michigan from raw sewage pollution; improve water quality of area rivers and streams; and provide an outlet for floodwaters to reduce street and basement sewage backup flooding. (MWRD website)

"Tarp Construction and Water Filtration Relay"

DB 3

Location: Beach on Lake Michigan

Synopsis: Students will be formed into teams to build a combined sewer system in the sand on a Lake Michigan beach. The model system can consist of flexible clear tubing and a variety of simple connectors and adapters. On the surface, there will be a number of access points into the system that can be represented, for example, as clear model houses and street sewers. The tubing will converge to a single location that will represent a treatment plant. Once this drainage system is assembled and buried, a large storm event will be simulated by performing a controlled and localized flooding of the area sewers with water. The tubing will reach capacity and water will backflow into homes and out of the street sewers. A bypass can be simulated as well as combined sewer overflows into the waterway system. This will illustrate some of the challenges the area has faced in the past with managing flooding and pollution control in large storm events.

Once the flood has been established, each team will be asked to retrofit the system into a deep tunnel and reservoir system. Larger diameter tubing will be buried slightly deeper in the sand than the tubing used in the previous step. The retrofit can be easily and quickly accomplished by having attachment points on short downspouts from the tubing in the previous step. A discharge twist valve will be attached to the end of the large "deep tunnel" tubing which will lead to a large reservoir that the students will dig into the sand. Once the deep tunnel and reservoir system is successfully constructed and inspected, they will get the "green light" for a 100 year storm. This time a much larger amount of water will be introduced to the TARP system they have built. Once they sense the system has reached capacity they can twist the discharge valve leading to the reservoir preventing any flooding or other discharges. All the water will drain into the reservoir where it will await treatment instead of being bypassed into the lake or waterway system or backing up into peoples homes.

To take this a step further and simulate the treatment process being proposed by other members for consideration. The water can be manually pumped from the reservoir into a water filter that each team will construct. The water filter can be made out of a large funnel or container with a screen, course gravel and fine sand. The filtered water can be collected into a squirt gun, such as a super soaker. Once the squirt gun is full, a team member will run toward the lake and discharge the treated water into the lake! The first team to do so wins!

This activity would probably work best for a Saturday morning event. It will be educational, fun and competitive. I think the students would really enjoy the opportunity to get out of the hotel and engage in a constructive activity in the sun while playing in the sand on the lake front.

A contingency plan in the case of inclement weather would be to have a similar activity indoors. In this case the sewer and reservoir system would be constructed within a play-doh canvas at a much smaller scale.

U of I Filter:
https://engineering.illinois.edu/news/2010/09/23/ewb-biofilter-project-benefits-village-todaytomorrow-world (see attached) DB4

WEF WW Challenge:
Please visit the WEF Wastewater Challenge website for a brief idea on the basis for this competition:
http://www.wef.org/PublicInformation/page.aspx?id=136&ekmensel=c57dfa7b_52_0_136_1
and http://www.wef.org/PublicInformation/college.aspx?id=7591 DB5

My thought is to create a much simpler version of the "wastewater" and provide students with a number of household supplies. We can then give the students 45 minutes to an hour to build/design a simple treatment system. It would not be as complex as the actual WEF Wastewater Challenge. For example, we can create a wastewater with some large particle sand, grass, some flour, food coloring, and whatnot...then the students would be given household items such as t-shirts, strainers, a bucket, carbon fish tank filter, etc. to come up with a treatment system to treat this "wastewater."

This would fit within the 2 hour constraint, and a winner could be judged based on ingenuity of design, use of standard water/wastewater treatment design principles, water quality (turbidity, pH, etc.), and more.

DB 4

EWB biofilter project benefits one village today...tomorrow, the world!

September 23, 2010

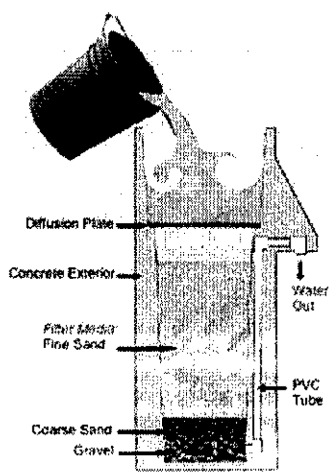
What if, in addition to earning a degree from a top-ranked engineering program, you could actually change the lives of several million people?

(l to r) Peter Maraccini, Ofelia Romero, Thomas Van Dam, Paulino, Alejandro, Ovidio, Rolando, Kim Parker, Emily Van Dam, Alyssa Sohn, and Anne Kreamer Diaz.

For several years, the Mayan community of Socorro, Guatemala was afflicted with acute and chronic gastrointestinal diseases stemming from poor drinking water quality, soil-transmitted helminthes (worm) infections, and malnutrition. During the beginning of the rainy season, diarrheal rates in children exceeded 75%, resulting in missed school, emotional and economical stress on their families, and occasionally death.

In an attempt to alleviate their drinking water crisis, the people of Socorro assembled a council and, with the help of Wuqu' Kawoq, a U.S.-based non-governmental organization, contacted the University of Illinois at Urbana-Champaign Chapter of Engineers Without Borders (EWB-UIUC) requesting assistance. As a result of a three-year partnership, relief has come in the form of a simple, effective, and ever-evolving water treatment system: the biosand filter.

"The biosand filter utilizes the purification phenomena of the natural environment to treat the raw river water in two distinct ways," explained former project leader Peter Maraccini, a recent graduate in civil and environmental engineering (CEE).
"Once water is poured into the filter and allowed to pass through the sand, microbial and algal colonies develop in the top portion of the sand column and form a biological film, or biofilm. The biofilm helps strain or inactivate helminthe (worm) eggs, protozoa (such as Giardia and Cryptosporidium), and infectious bacteria from the water. Secondly, because dissolved metals in the water oxidize and subsequently precipitate throughout the sand column, the negatively-charged bacteria and viruses may be attracted and adsorbed to the positively-charged metal oxides in the sand and removing them from water.



According to Maraccini, research is ongoing to better identify all routes of protozoa, bacteria, and virus removal; still, it is evident that the biosand filter harnesses to power of the natural environment to Socorro's benefit.

"While it was apparent biosand filter could significantly benefit Socorro, many outside factors had to be considered before this water treatment could be implemented there," Maraccini added. "Principally, the people of Socorro had to be the drivers of the project with EWB-UIUC and Wuqu' Kawoq supporting them. Our team members kept this in mind during a two-week trip to Socorro in December 2009/January 2010 when the implementation of the biosand filters began."

Guatemalan construction workers pouring concrete in biosand filter mold.

EWB-UIUC trained four members of the community on the construction of biosand filters using only locally available materials and simple building techniques. The construction workers were incredibly adept and quickly acquired the necessary construction techniques by late January.

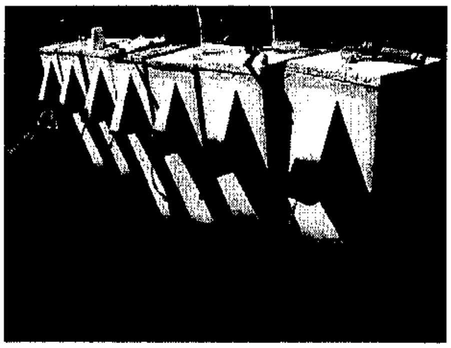
Ofelia Romero and Kim Parker teaching a family about the biosand filter and proper hygiene

Concurrently, team members trained two social workers and seven teachers at the local elementary school on biosand filter use and maintenance, along with lessons on the importance of proper water storage, healthy hygiene, and sanitary practices.

After the EWB team left in early January, the project continued spreading to serve all 150 houses in Socorro. Without any outside help, the construction workers built and installed the biosand filters throughout the community . The social workers and elementary teachers trained future users of each biosand filter before units were delivered, and returned to answer and lingering questions after installation.

COLLEGE OF ENGINEERING | UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN HOME CONTACT US SEARCH SITE MAP
306 ENGINEERING HALL, MC 266 | 1308 WEST GREEN STREET | URBANA, IL 61801
CONTACT WEBMASTER

"Best of all, the people of Socorro are spreading the word on the biosand filters' success and the construction workers have been asked to produce and deliver filters in the nearby towns of Pacaco, Las Guardianias, and another community in the Guatemalan highlands with whom Wuqu' Kawoq work," said team member and CEE graduate student Ofelia Romero. "This success came from within the community and now the benefits of the biosand filter will reach new and previously unaided regions of Guatemala."



Several completed filters at the end of the day.

After recognizing how a simple and effective water treatment technology can spread organically to help an exponentially greater number of people, EWB-UIUC refocused its efforts to improve the removal mechanism of the biosand filter.

"Within the filter, metals dissolved in water can precipitate to form positive metal oxides, to which negatively charged viruses in the environment attach and removed from the filtered water," explained Ian Bradley, a graduate student in civil and environmental engineering. "Knowing that, we asked the question: What if we enhanced this effect by placing magnitudes greater quantities of metal oxides in the biosand filter? Well, we did, and uncovered a way to help millions more outside of Socorro."

CEE graduate student Ian Bradley works on improving the biosand filter back in the lab

Current research at Illinois has shown that the incorporation of zero-valent iron in the form of steel wool, a product available commercially across the world, including Guatemala, can remove better than 99.999% of viruses in water, beating even United States Environmental Protection Agency standards. The iron oxidizes (rusts), forming positively charged oxides to which negatively charged viruses attach. Because of the water chemistry, the iron doesn't re-enter the water and the user never tastes the iron in the filtered water. The only end result is a cleaner, safer drinking water.

Earlier this year, EWB-UIUC won $76,000 in funding to continue this research and to begin the transition of bringing the iron-amended biosand filters from the lab to end-users.

"We will return to Socorro in December to evaluate the effects of the previously implemented biosand filters on the people's health and to begin initial onsite investigations of iron-amended biosand filters utilizing site-specific water," Maraccini said. "Bringing relief to Socorro has always been our main focus. We have already worked with them to make significant improvements, but more can be done.

"With the iron-amended biosand filter, EWB-UIUC can help more than the 450 people of Socorro; we can help the approximately three million current users of the biosand filter elsewhere, an impact started at the University of Illinois at Urbana-Champaign and reaching across the world."

Article editors/Contact: Kimberly Parker and Ofelia Romero, Engineers Without Borders.

Photos: Alyssa Sohn, Kimberly Parker, and Ofelia Romero.

2010

Water Environment Federation
the water quality people®

WEF Wastewater Challenge

wef | Wastewater Challenge

Table of Contents

A. Introduction

The 2010 WEF Wastewater Challenge is a new national competition that's both challenging and fun. This hands-on competition requires teams of students to a build wastewater treatment system from an assortment of household products in an effort to remediate a sanitary sewer overflow (SSO). This is your chance to compete and problem solve with fellow students from schools throughout the nation.

The competition will take place in Phoenix, Arizona, at the 2010 WEF Collection Systems Conference on June 13, 2010. To be eligible to compete, your team must submit a Design Report to the WEF Wastewater Challenge Committee, and the top 12 teams will be selected to compete. The deadline to submit reports for entry is May 1, 2010, at 5 PM PST.

All team members must be a WEF Student Member. For more information on how to join and participate please visit: http://www.e-wef.org/timssnet/memberships/tnt_membership.cfm (click on "Student Package"). There is a limit of one team per student chapter.

B. Case Scenario

A collection systems crew needs your help. There has been a sanitary sewer overflow due to a massive rain event. The treatment plant has reached its capacity, and the collection system is surcharged. The surcharge has caused numerous manhole covers to pop and wastewater is spilling into a neighborhood street, flooding the area and threatening human health. The weather forecast is predicting heavy rain for several days. The challenge is to contain the spill and provide an emergency treatment system to treat the SSO and surcharged flows on site immediately.

Because of the extreme urgency of the situation, the crew has turned to you and your team, the local wastewater treatment experts, for some help. Unfortunately, it's the evening of Thanksgiving Day, and all the stores are closed. The only resources you have are the odds and ends in your garage. You quickly gather all the materials you can use and come up with a way to protect the town's drinking water supply from getting contaminated by this sanitary sewer overflow. Let's hope that you and your team can save the day!

C. Materials

Your garage contains a large assortment of materials that can be used to create a treatment system, which are listed on a spreadsheet (Appendix A). In addition to the items listed in the spreadsheet, your team can select three additional items that one can find in a household garage, but these items cannot be pre-manufactured water treatment systems (i.e., Brita filters, pool filters, etc.). For the three additional items, teams must submit receipts and/or price quotes from a major hardware supply store. Access to electricity will be available, but due to intermittent lightning during the storm, only 25 minutes of electricity supply is guaranteed. Any additional power source (that does not utilize an electrical outlet) must be supplied by the team, and each source will count as one of the three "bonus" materials. In addition, any materials required to fuel the power source will also count as one of the three "bonus" materials and must be factored into the operational costs, as well. Solar energy sources cannot be used due to the lack of sunlight during the rainstorm event.

Please note: Many of the materials listed above can be recycled or obtained in a sustainable manner, and environmentally-friendly practices are encouraged and recommended.

D. Cost Analysis

Each team is required to prepare a cost analysis for their design. The cost analysis will be presented to the judges as part of the presentation given during the competition. The cost analysis will have two main components: material costs and operational costs, and a total cost will be calculated as the sum of the material costs and operational costs.

Material costs will be calculated based on the spreadsheet (Appendix A). The unit costs for each material are listed on the spreadsheet, and based on the items used; each team must calculate how much their system would cost to build from scratch. The material costs should not include the cost of tools used during pre-fabrication. Receipts and/or price quotes must be provided for the three "bonus" materials used in the construction of the treatment system.

Operational costs will be calculated based on the number of operators required to set up the treatment system (at the burdened hourly rate of $25.00 per operator; maximum of 4 operators; minimum set-up time of 1 minute; maximum set-up time of 1 hour); and the cost of the tools used to set up the treatment system (during the one-hour set-up period prior to the competition; minimum/maximum set-up time of 1 hour; refer to spreadsheet [Appendix B] for hourly rates).

Teams will be charged a minimum of 1 minute for one person for setup. System components will be inspected when teams arrive to the competition and the components will be noted by the judges. Teams will place their components in the competition area unassembled and build time will start when the team enters the box. There will be no assembly allowed prior to the start. Any team that is determined to have pre-assembled will be disqualified.

Please note: If the team chooses to select an item, such as a "chemical" that must be added during the treatment process as one of the bonus materials, the cost and quantity of the chemical to treat 10 gallons of influent must be included in the operational costs. This applies to any material item that is "consumed" during the course of the competition (i.e., batteries, chemicals, etc.).

Format of Cost Tables:

Material Costs

Item	Per Unit Price	Quantity Used	Item Price
1" Copper Pipe	$ 3.20 per Lin Ft	5	$ 16.00
1" High Pressure Washer Hose	$ 2.50 per Lin Ft	2	$ 5.00
1" PVC Pipe	$ 0.20 per Lin Ft	9	$ 1.80

Operational Costs (To Treat 10 Gallons of Wastewater)

Item	Per Unit Price	Quantity Used	Hours Used	Item Price
Adjustable wrenches	$ 3.00 per Unit-Hour	2	1	$ 6.00
Basic Socket Set	$ 5.00 per Unit-Hour	1	1	$ 5.00
Caulking Gun	$ 2.00 per Unit-Hour	2	1	$ 4.00

E. Influent Constituents

The following constituents will be mixed with ten gallons of local tap water the night before the competition to simulate the wastewater. The contaminated wastewater will be placed in two 5-gallon buckets, and the team will have 10 minutes to pour the wastewater into their system. To compare the untreated and treated wastewater, an untreated wastewater sample will be used as a control.

<u>**Contaminants (in 10 gallons of tap water):**</u>

10 oz. of Morton Iodized Table Salt

1 lb. of Folgers coffee grounds

8 oz. of Miracle Grow Potting Soil

1 oz. of grass

4 oz. of orange juice (Florida's Natural)

4 oz. of vegetable oil (Crisco)

7 oz. of plant leaves

½ roll of Charmin Double Ply toilet paper

4 oz. of Soft Soap hand soap

2 oz. of Safeway Corn Starch

4 oz. of Crest Whitening Toothpaste

4 oz. of Lucerne 4% Small Curd Cottage Cheese

F. Scoring

The winner of the competition will have the highest number of points based on the following criteria:

Criteria	**Maximum Points Possible**
Design	45
Cost	45
Amount of Water Recovered	25
Speed and Efficiency	15 (First to Recover 1 Gallon)
Electrical Conductivity	15 (Lowest)
pH	15 (Most neutral; pH=7)
Turbidity	15 (Lowest)
Dissolved Organic Carbon	15 (Lowest)
Presentation	50
Design Report	50
Interaction Deduction	-10
Safety	10
Total	**300**

a) Design

This component will evaluate the physical design of the treatment system. Each treatment system will be evaluated by a panel of judges experienced in the water/wastewater industry. Factors to be considered include: simplicity, sustainability, efficiency, relevance, creativity, safety, and structural and operational durability. Each team is required to display the full name of the college either on the design or on a separate banner or sign to be displayed next to the design (this is not considered in the cost analysis).

Simplicity (15%): Is the system easy to assemble and operate?

Sustainability (25%): 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?

Efficiency (25%): Are the minimum resources used to the maximum effect? Is the system designed to treat the wastewater in a manner that is time and resource-efficient?

Creativity/Theme (5%): Does the system make novel use of engineering principles? Does it show school spirit?

Structural and operational durability (20%): Can the system function more than just once? Is the system structurally sound?

Safety (10%): Was the treatment system constructed and operated safely using the proper tools and personnel protective equipment ?

b) Amount of Water Recovered

Each team will receive a percentage of the points based on the volume recovered. (Total volume recovered / 10 Gallons x 25 = # of points)

c) Speed and Efficiency

The team that recovers the first gallon of water in the shortest amount of time will receive the maximum number of points. Each team after that will be awarded fewer points, based on the relative speed compared to the first team. (First team's time to recover 1 gallon / Time to recover 1 gallon x 15 = # of points)

d) Water Quality Parameters

Electrical conductivity, pH, turbidity, and dissolved organic carbon will be measured using instruments provided onsite. Points will be awarded as listed in the scoring criteria table with the maximum number of points awarded to the team with the best measurements. For each parameter, remaining designs will receive a fraction of the maximum possible points.

e) Interaction Deduction

Your team will have ten minutes to load the treatment system with 10 gallons of influent, and then the system must run without any human interaction (i.e., no one may step foot inside the 100 square foot (10' x 10') treatment area. If any operators must step foot inside the 100 square foot treatment area for any reason, there will be a ten point deduction for each instance. Each interaction can be a maximum of one minute. Longer interactions will be counted as multiple interactions.

f) Presentation

Each team will give a 7-minute presentation on the team's design process with a 3-minute question and answer period afterward. The presentation should include a brief overview of the overall project description, design process, treatment principles utilized, environmental impacts, and cost analysis, at a minimum. Professionalism is encouraged and expected. The presentation scores will be determined by a panel of judges experienced in the water/wastewater industry.

The presentations will be given in front of the team's system. PowerPoint is not an option here as a computer will not be provided. Teams need to be prepared to speak over a loudspeaker system in front of a large group of their peers.

g) Design Report

A detailed Design Report is required for entry to this competition. The report can be a maximum of 10 pages. The report should include a detailed presentation of the overall project description, design process, treatment principles utilized, environmental impacts, and cost analysis. The Design Report should also include both the material cost and operational cost tables. This report will be used to evaluate which teams will be invited to participate in the national competition in Phoenix, AZ.

The Design Report shall be presented on 8 ½" by 11" pages in portrait orientation. All pages of the report shall maintain a minimum of 3/4" margins on all sides. Body text shall be in English and use 12-point, normal width character spacing, Times New Roman or Arial font. Section headings and subheadings shall be considered part of the body text, shall adhere to the margin requirements and may be of any font type or size. The report shall consist of a single-sided report cover, single-sided pages for the body and appendices, and a back cover. A protective plastic cover in front of the report cover is permitted and does not count towards the page limit. No additional pages separating the appendices are permitted. No blank pages shall be inserted into the report. Body pages, with the exception of the Table of Contents shall be numbered beginning with the number one (1). The Table of Contents shall be limited to a total of one (1) page, numbered with the lowercase Roman numeral *i*. Pages located in the appendices shall be numbered in such a way that the appendix and page number are clearly listed (e.g., A-1, A-2, B-1, B-2; A1, A2, B1, B2; etc.,) as appropriate. Photographs, tables, line drawings, graphs, headers, and footers shall be permitted and shall be counted as part of the page limit defined herein. Captions used for any photographs, tables, line drawings, graphs or other figures shall be no less than 10-point, normal width character spacing, Times New Roman or Arial font. These items shall be restricted to the margins described herein. Items such as page numbers, logos, section headings, etc. may be incorporated into the header and footer of the pages and are not subject to the font requirements of the body text. The header and footer may be located within the margin itself (i.e., outside of the body text limits). Material on the report cover may not be referred to in the body pages.

Reference citations of the papers should conform to the official *WEF Author Guidelines for References and Citations,* which can be found on the WEF Publications website: http://www.wef.org/Publications/page.aspx?id=2834

h) Safety

Each team shall construct and operate the system with the proper safety procedures and personal protective equipment. Teams that do not follow proper safety protocol will receive a deduction in points.

Format

The reports must adhere to the following format, and the following must be included at a minimum:

a. **Report Cover**: Inside of the cover shall be left blank. Protective plastic cover is optional.

b. **Table of Contents** (Page *i*)

c. **Content** (Pages 1-X)

d. **Appendices** (Pages A1-X)

e. **Back Cover**: This cover shall be left blank. Protective plastic cover is optional

Note: Number of total pages is based only off of Content and Appendices.

Submissions

All design reports must be submitted electronically via e-mail to WEFWastewaterChallenge@gmail.com by May 1, 2010, at 5 PM PST. Two hard copies of the report must be brought to the competition in Phoenix, Arizona, on June 13, 2010.

G. General Rules

1. Each team will receive 10 gallons of wastewater in two 5-gallon buckets at their source area (i.e., 100 square foot treatment area).
2. A maximum of 0.5 gallons of tap water will be allowed for use as a primer for the treatment system. This water will be added after the presentation period.
3. Teams must physically introduce all of the wastewater into the system within 10 minutes from the designated start time.
4. Each team will have exactly one hour to treat all 10 gallons of the wastewater.
5. The first gallon of effluent will be collected in a gallon jug and retained for water quality analysis.
6. Any design that violates the WEF Wastewater Challenge Guidelines will be disqualified.
7. Any design that is deemed dangerous or hazardous to the competitors, judges, or bystanders will be automatically disqualified.
8. Teams that interact with the system after the start of the hour allotted for the wastewater treatment process will be penalized 10 points of each interaction.

H. Time Constraints

Each team will have exactly one hour to set up the treatment systems. Judges will then begin to evaluate and inspect the treatment systems for the design component of the competition, in addition to ensuring that each team has followed the guidelines. Following the team presentations, each team will be allowed to prime their systems with 0.5 gallons of tap water. At a designated start time, each team will be allotted 10 minutes to pour the 10 gallons of effluent into the treatment system. Immediately at the conclusion of the 10 minute period, each team must vacate their respective treatment system areas and the one hour treatment period will begin. Any interactions with the treatment system after the start of the one hour treatment period will result in a deduction of points (see Interaction Deduction section for more details).

I. Site Constraints

Each team will be provided with a 10' x 10' treatment system area. During set-up, no team member physically setting up the system should step outside of this 10' x 10' area, and no part of the treatment system can exceed the limits of this 10' x 10' space. Two five-gallon buckets containing the influent wastewater will also be located within this 10' x 10' space.

J. Questions and Competition Location/Date

Questions regarding the rules will be addressed by the WEF Wastewater Challenge Committee (WEFWastewaterChallenge@gmail.com). The competition will take place on Sunday, June 13, 2010, as part of the WEF Collection Systems Conference. Please visit the conference website for more details (http://wef.org/CollectionSystems/).

Appendix A: Construction Materials

Item	Per Unit Price			
1" Copper Pipe	$	3.20	per	Lin Ft
1" High Pressure Washer Hose	$	2.50	per	Lin Ft
1" PVC Pipe	$	0.20	per	Lin Ft
1/2" Copper Pipe	$	1.20	per	Lin Ft
1/2" Hardware Cloth	$	0.67	per	Sq. Ft
1/2" I.D. Soaker Hose	$	0.36	per	Lin Ft
1/4" Hardware Cloth	$	0.53	per	Sq. Ft
1-1/2" ABS Pipe	$	0.30	per	Lin Ft
1-1/2" PVC Pipe	$	0.30	per	Lin Ft
13 Gallon Trash Can	$	5.00	per	Trash Can
16 Qt. Igloo Can Cooler	$	23.00	per	Cooler
18 Gallon Tote	$	5.00	per	Tote
2' Ladder	$	30.00	per	Ladder
2" ABS Pipe	$	0.40	per	Lin Ft
2" PVC Pipe	$	0.40	per	Lin Ft
2"x4" 3M Steel Wool	$	0.83	per	Pad
20 Gallon Trash Can	$	8.00	per	Trash Can
25' Extension Cord	$	27.00	per	Cord
2x4 Dimensional Lumber (Doug Fir)	$	0.25	per	Lin Ft
3" Corrugated Pipe	$	0.50	per	Lin Ft
3/4" Black Electrical Tape	$	0.08	per	Lin Ft
3/4" Thick. Plywood	$	1.06	per	Sq. Ft
3/8" Nylon Rope	$	0.20	per	Lin Ft
3/8" Plywood	$	0.50	per	Sq. Ft
30 Gallon Tote	$	8.00	per	Tote
32 Gallon Trash Can	$	13.00	per	Trash Can
36 Gallon Garbage Bag	$	0.63	per	Bag
3M Compressed Air Dust Remover	$	4.67	per	Can
4' Ladder	$	40.00	per	Ladder
4" Corrugated Pipe	$	0.60	per	Lin Ft
409 Original Cleaner	$	0.16	per	Fl. Oz
4x4 Dimensional Lumber (Doug Fir)	$	0.75	per	Lin Ft
5 Gallon Bucket	$	2.50	per	Bucket
5 Gallon Bucket Lid	$	2.50	per	Lid
5/8" Carpet Pad	$	0.44	per	Sq. Ft
5/8" I.D. Garden Hose	$	0.66	per	Lin Ft
50 Gallon Tote	$	15.00	per	Tote
6' Ladder	$	60.00	per	Ladder
8"x6"x2" (Approx.) Grout Sponge	$	2.00	per	Sponge
94 Qt. Igloo Cooler	$	90.00	per	Cooler

Item	Per Unit Price		
Armor-All Leather Care Protectant	$ 0.35	per	Fl. Oz
Armor-All Original Protectant	$ 0.31	per	Fl. Oz
Banana Boat SPF 50 Sunblock Lotion	$ 1.31	per	Fl. Oz
Bolts	$ 0.05	per	Bolt
Bounce Dryer Sheet	$ 0.25	per	Sheet
Brawny Paper Towels	$ 0.05	per	Sq. Ft
Burlap Blanket	$ 0.14	per	Sq. Ft
Charcoal	$ 0.50	per	Lbs
Clorox Disinfecting Wipes	$ 0.04	per	Wipe
Clorox Ultra Bleach	$ 0.13	per	Fl. Oz
CLR Cleaner	$ 0.31	per	Fl. Oz
Coffee Filter	$ 0.03	per	Filter
Cotton Balls	$ 0.02	per	Cotton Ball
Diamond Strike Anywhere Matches	$ 0.03	per	Match
Downy Fabric Softener	$ 0.50	per	Fl. Oz
Drano Clog Remover	$ 0.16	per	Fl. Oz
Duct Tape 20 Yd Roll	$ 10.00	per	Roll
Febreze Fabric Refresher	$ 0.22	per	Fl. Oz
Fram Car Air Filter S/N CA9482	$ 12.00	per	Filter
Fram Extra Guard Oil Filter S/N PH4967	$ 6.00	per	Filter
Fram Fuel Filter S/N G7612	$ 23.00	per	Filter
Hydrogen Peroxide	$ 0.06	per	Fl. Oz
Mylar Emergency Sleeping Blanket	$ 3.00	per	Blanket
Nails	$ 0.05	per	Nail
Nuts	$ 0.05	per	Nut
Off! Deep Woods Insect Repellent	$ 1.25	per	Fl. Oz
Original Swiffer Duster	$ 1.08	per	Duster
Ortho Weed-B-Gon Max	$ 0.44	per	Fl. Oz
Oxyclean Stain Remover	$ 1.20	per	Lb
Paint Thinner	$ 0.08	per	Fl. Oz
Painter's Plastic	$ 0.10	per	Sq. Ft
Palmolive Ultra Dishwashing Liquid	$ 0.23	per	Fl. Oz
Pine-Sol All-Purpose Cleaner	$ 0.07	per	Fl. Oz
Play Sand	$ 0.10	per	Lbs
Pledge Furniture Polish	$ 0.22	per	Fl. Oz
Prestone Anti-Freeze 50/50	$ 0.08	per	Fl. Oz
Pumice Stone (1/2"X2"x4" Max Size)	$ 6.00	per	Stone
Screws	$ 0.05	per	Screw
Sham-Wow	$ 5.00	per	Sq. Ft
Silicone (Black Only)	$ 6.00	per	Tube (10 oz)
Stainless Steel Safety Wire	$ 0.25	per	Lin Ft

Item	Per Unit Price			
Standard Air Conditioner Filter	$	2.67	per	Filter
Tarp	$	0.10	per	Sq. Ft
Tide Concentrated Liquid Detergent	$	0.25	per	Fl. Oz
Towels	$	1.00	per	Towel
Turtle Wax Hard Shell Paste Wax	$	0.55	per	Fl. Oz
WD-40 Lubricating Spray	$	0.75	per	Fl. Oz
Weed Control Fabric	$	0.11	per	Sq. Ft
Windex Glass Cleaner	$	0.16	per	Fl. Oz
Window Screen Mesh	$	0.31	per	Sq. Ft
Window Squeegee	$	6.00	per	Squeegee

Appendix B: Operational Costs

Item	Per Unit Price			
Adjustable wrenches	$	3.00	per	Unit-Hour
Basic Socket Set	$	5.00	per	Unit-Hour
Caulking Gun	$	2.00	per	Unit-Hour
Channel Locks	$	1.50	per	Unit-Hour
Cordless Drill	$	10.00	per	Unit-Hour
Cordless Skill Saw	$	15.00	per	Unit-Hour
Drill Bits (each)	$	1.50	per	Unit-Hour
Hand Saw	$	10.00	per	Unit-Hour
Operator Costs	$	25.00	per	Unit-Hour
Pipe Wrench	$	5.00	per	Unit-Hour
Pliers	$	1.50	per	Unit-Hour
Screwdrivers (each)	$	1.00	per	Unit-Hour
Standard Builder's Hammer	$	5.00	per	Unit-Hour
Utility Knife	$	2.00	per	Unit-Hour
Wire Cutters	$	2.00	per	Unit-Hour