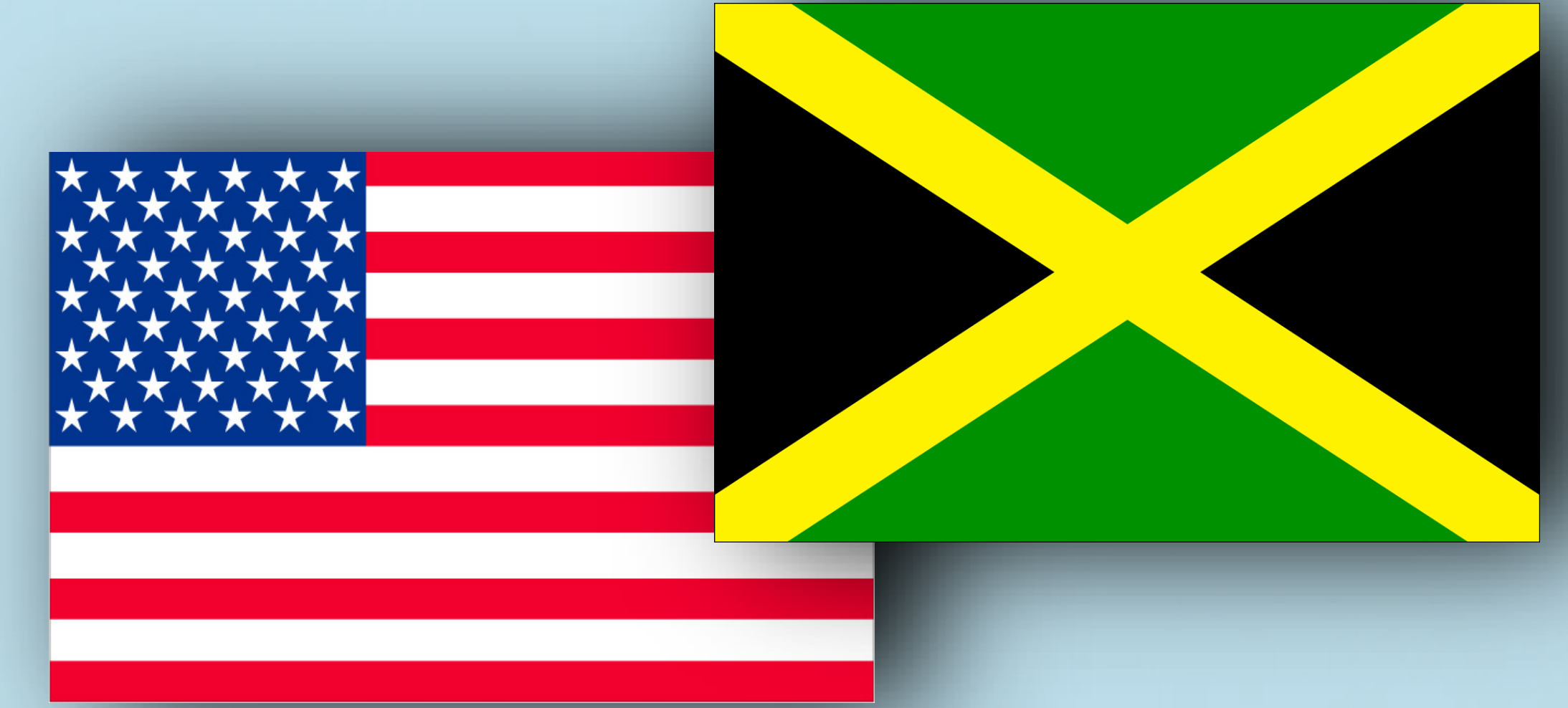


Planting the Seeds of Sustainability

Combating Pollution in Kingston Harbour, Jamaica

Xuanya Zhang, Nesa-Maria Anglin, Timothy Momose, Patrick Ford
 Advisor: Professor Svetlana Nikitina



Environmental Issues

In this project, Team Raytheon set its focus on the Caribbean Cement Company, Ltd. (CCCL). CCCL operates a cement plant in Rockfort on the eastern shore of the Harbour. Its part in the pollution problem is as follows:



(Blake, Chris. 2009)

- Discharge of water contaminated with suspended solids, nitrates, and phosphates, and possibly heavy metals
 - Especially from untreated runoff water from the cement plant
- Effects on the environment:*
 - Degradation of ecosystem seen in reduced overall populations of fish and plants, and in eutrophication.

Solutions

Water Treatment



A water treatment basin in the *Running Water Park*, Chengdu, China (cha138.com)

As a whole, our treatment system will consist of five basins, each of which will filter out a different toxin from the discharged water.

There are two factors which will play an important role in each of the five basins:

- 1) **Soil:** The soils we choose will need to meet requirements for permeability and reactions with pollutants
- 2) **Plants:** They will serve two main purposes:
 - a) To help prevent soil erosion along the banks of the basins, and
 - b) To help to filter pollutants out of the contaminated water.

The five basins are:

Basin	Main Pollutants Treated	Description
1	Suspended solids (TSS)	Settling basin, small amounts of vegetation
2	TSS, nitrates	Uses much vegetation
3	Phosphates	Shallow basin. Uses low-lying vegetation
4	Heavy Metals	Deep water collection basin
5	General filtering	Unlined basin allows some water to enter water table. Great plant species diversity; may include mangroves

Project Objectives

- ❖ To **treat discharge water** from the Caribbean Cement Company, Ltd. using a **biological/natural treatment plant** which requires little energy to operate and which adds to the local ecosystem.
- ❖ To use the water treatment plant as a **hands-on educational tool** to teach citizens in the surrounding area about sustainability.
- ❖ To implement an **educational initiative in local towns** (esp. the fishing village of Rae Town) that would help the people to better protect and sustain their surroundings.



Abstract

For two decades, the Kingston Harbour in Jamaica has been a site for industrial pollution. Toxins emitted by a local cement plant have turned this once celebrated landmark into a dumping area for all those people who make their living in the surrounding communities. Our project aims to alleviate this problem through two separate pathways. The first of our goals is to construct a natural water treatment plant, using a five-part infiltration basin system to remove suspended solids, heavy metals, nitrates, and phosphates from the refuse water that is being discharged from the Caribbean Cement Company into the ocean. The second aspect of our plan deals with educating the public in environmental matters to ensure the sustainability of the technical improvements which we are proposing. We plan on installing video screens and information posters that explain the technology that is being put to use and encourage the visitors to carry forward the ideas which they have learned "in the classroom" back to their homes and towns. We also plan to reach out to local college students to educate the Rae Town fishing village about ways in which they can help to restore the Harbour to its pristine state. Due to the role that the sea plays in the lives of the Kingston Harbour residents, we feel that most members of the community will be receptive to the changes which we hope to implement. The multidisciplinary solution which we are proposing will not only solve a pollution problem, but will lead to the development of environmental awareness about the fragile nature of the ecosystem that the local community relies on.



An example of a vegetated basin for water treatment (University of NH. 2009)




A guide teaches children at the *Running Water Park* in Chengdu, China (up37.com)

Social Issues

One source of pollution in Kingston Harbour is the environmentally irresponsible lifestyles of people living in the area. The lack of sustainability is evident in various problems in the Harbour. For example:

- Many portions of the shoreline are strewn with garbage, such as non-biodegradable plastics.
- The harbour's native mangroves are removed to make room for further expansion of squatter settlements.

An example of an area with these kinds of problems is Rae Town – a squatter settlement of fishermen on the Harbour's northern shore.



Solutions


Education

We will implement educational programs and use hands-on learning for the whole community to ensure that the positive effects of the project last for generations to come. Our plans are based on a cross-cultural comparison with the educational system at a water-treatment park in Chengdu, China. Our plans are:

- 1) **Turn the basins into an environmentally friendly park**
 - Include an explanation of the treatment process
 - Give visitors a chance to test the water
 - Hand out small "gifts": a sample of plants and an environmental guidebook for daily life

Facilities: Educational center, video theater, posters, touch-screen computers, lecture room, gift store

Program: Daily guided tour, daily self-guided tour, documentary-displaying, small quizzes, free hand-outs
- 2) **Teach local citizens about sustainable living**
 - Teaching process takes place in local town
 - Teaching children and teenagers using drawing competitions, writing contests, field trips
 - Teaching the older generation by giving information and showing the results of continued unsustainable living




CCCL's cement plant in Rockfort, Kingston, Jamaica (Caribbean Cement Company, Ltd. 2009)

Next Steps

The implementation of this project idea would require extensive data on the amount and quality of the cement plant's effluent and runoff flows under various conditions. This data would give us an exact picture of what our treatment system would be required to deal with. Therefore, the next step toward the implementation of these plans would be on-site testing which would allow us to finalize a design for our treatment system. Upon completion, our project would begin the process of sustainably cleaning Kingston Harbour. Our solution is sustainable in the following ways:

- Our treatment methods rely on native vegetation, ensuring that the treatment basins will contribute to the ecosystem, being a natural part of the environment.
- Our educational system will put the people of Kingston behind our initiative to clean up the Harbour, so the project will not die from neglect.

Acknowledgements

We would like to thank Svetlana Nikitina, Diran Apelian, Jeanine Plummer, David Ford, and Mona Webber for their contributions to this project.

Selected Bibliography

"Infiltration Systems." Web. *Minnesota Urban Small Sites BMP Manual*. <http://www.metrocouncil.org/environment/Water/BMP/CH3_STInfilBasins.pdf>.

Jones, Eleanor B., et al. "Environmental Impact Assessment: Caribbean Cement Company Expansion and Modernisation Programme." *National Environment and Planning Agency*. 2005. Web. Environmental Solutions, Ltd. <http://www.nrca.org/eias/StAndrew/Carib%20Cement/Carib%20Cement.pdf>.

"Problems Affecting Kingston Harbour." June 6, 2005. Web. <http://www.nrca.org/kingston%20harbour/html/The_Problem.htm>.

Reuters. 2009. <<http://topics.treehugger.com/photo/0cV24qHgEfdXy>>.

"The Wonderful World of Water; Turning Education Into Action." *Kids For Saving Earth*. 2009. Web. <<http://www.kidsforsavingearth.org/>>.