Final Report

Growing Water: 31st St. Eco-Boulevard and IIT Pavilion Prototype
IPRO 322

1.0. Introduction

Current statistics indicate that water shortages will have a greater impact on the world's population in the near future. The Great Lakes contain around 20% of the world's potable water. The city of Chicago recognizes this issue and wants to implement a plan that will responsibly conserve this precious limited resource that we have inherited. Enter Growing Water IPRO. Our mission is to create avenues that transport rain water from the outskirts of Chicago back to Lake Michigan for re-use and consumption instead of allowing the water to drain into the Illinois River and down into the Mississippi River. Another goal is to create purification centers for sewage water that use natural, sustainable means to cleanse the water for reintroduction back into Lake Michigan. These "eco-boulevards" and "living machines" will also serve as educational facilities that promote awareness and responsibility of our precious resource.

2.0. Background

The project will be sponsored by IIT & donors to design and develop an area of land along 31st street that will utilize eco-friendly methods researched by the team. This ipro consists of two challenges. The first challenge is to design and then create an eco-friendly space where eco-boulevards traverse the city of Chicago bringing back rainwater to Lake Michigan from the city's outskirts. The second challenge involves the design and eventually the construction of a living machine that uses natural, sustainable biological processes to purify black water for reintroduction into Lake Michigan.

An adequate amount of research must be compiled to determine viable locations where the eco-boulevards and living machines can be implemented. The eco-boulevards and living machines will serve as educational centers of water conservation and sustainable means of coexisting with our local ecological system. Utilizing case studies of how other countries have created eco-friendly spaces along with researched methods of green roofs, cisterns, permeable paving, natural landscaping and filter strips, a proper eco-boulevard with a habitable social space can be attained.

Case studies of the Parc de La Villette, in Paris, Cultuurpark Westergasfabriek in Amsterdam, Cheonggye Stream in South Korea and many others have proved that such a space can impact an urban area and convert it from a dead zone to a major social attraction for all. Sustainable technologies have been accepted with much success in the Chicago land area. Other than a slight increase in initial cost, there are no downsides to its implementation in design.

A need exists to increase awareness of water conservation. This will especially be the case when land owners of adjacent properties are confronted with the decision of approving construction. The initial cost of construction may be higher due to the implementation of green construction methods. However, the long term financial benefits of maintaining such a facility will offset the initial expenses. The social impact of such a space will turn an area devoid of social activity into a hub of activity that is located within walking range of a beach. The design of the eco-boulevard for 31st street

will be the basis for others in the city. Its impact will be invaluable to its residents as well as the citizens of Chicago.

3.0. Purpose

The ultimate goal of this IPRO is the planning and construction of an Eco-Boulevard along 31st street. To this end, this semester's main objectives were:

- To research and share methods, techniques, practices, equipment, biology, etc. of functional living machines and BMP's (best management practices)and make available that knowledge.
- To compile a number of case studies of existing BMP's and living machines to serve as templates for future reference.
- To create a website that will assist in the education of the public and in the implementation of future IPROs.

4.0. Research Methodology

The first half of the semester was devoted mainly to research and planning. To that end, the class split into two groups, each with two sub-groups.

Eco-Boulevard Ecological

- Researched and catalogued BMP's (best management practices) with regards to methods, practices, structure, biology, etc.

Eco-Boulevard Social

- Tasked with researching ways in which BMP's can be fitted into an existing locale, with special attention paid to making them social centers.

Living Machine Ecological

- Researched the technical aspect of living machines, including the layout and infrastructure of existing living machines, as well as the processes and flora/fauna that go into them.

Living Machine Social

- Compiled a list of potential programs that would occupy a section of the living machine to make it a social attraction instead of a standalone building.

Both Living Machine sub-groups helped to compile a number of green building technologies that would help to take the Living Machine "off the grid", so that it uses a minimum of power from outside sources.

The second half of the semester was focused on creating the website and preparing for IPRO day.

Visual Interactive Model (website team)

- Tasked with design and construction of a website that presents our research and findings in an easy-to-understand, visual manner.

Graphic Design

- Created the graphics used in the website. Also tasked with the design and construction of the templates (with help from people in each sub-group), which summarize the findings of the research conducted.

Presentation

- Designed the abstract brochure, the IPRO day table (including poster, backdrop, etc.), and dealt with remaining IPRO paperwork.

5.0. Assignments

Revised Tasks Event Schedule

Last Name	Name	Major/Minor	Skills and Strengths	Experience and academic interests	Team	Assignments done for IPRO so far
De Vita	Niels	Architecture	CAD drafting Design skills Photoshop skills Model Building Hardworking	Teacher Assistant Architectural Guide to the IIT Campus Interest in building design innovative technologies and structures	1. Social aspect of Eco-Boulevard 2. Research and Development	Helped in the editing of the project plan Independent Research Provided suggestions for possible social components of Blvd. Worked on meeting minutes report Abstract
Kreitzer	Michael	Computer Science	Software Design Java, C, C++, Visual Basic Programming Software Engineering Leadership	Teaching Assistant Interest in: · Real Estate Entrepreneurship · Modelling and Simulation	1. Social aspect of Eco-Boulevard 2. Webpage	Project Plan editing, Readings, Research Website development
Oh	Hyunjoo	Architecture	CAD drafting Design skills Adobe CS 3 skills Sketchup 3D skills Model Building Hardworking	Habitat for Humanity Architectural Practice as an Intern Interest in building design sustainable technologies	1. Social aspect of Eco-Boulevard 2. Graphics Design	Editing project plan Research Reading Provided suggestions for possible social components of Blvd. Contributed to developing website graphics

Vassi	Anna	Chemical Engineering	NMR, FTIR, GC, and IC analysis, Chemical processes flowcharts, Aspentech HYSYS software, Research	Researcher in a chemistry lab Interest in: Process Control Engineering Environmental Engineering	1. Social aspect of Eco-Boulevard 2. Research and Development	Background Reading Research Editing project plan Came up with ideas to contribute to the social aspect of the eco-blvd. Code of ethics Worked on meeting minutes Helped develop final report
Boder	Matthew	Architecture	Autocad 3ds max Photoshop/Illustrator Design Composition	Philosophy, Film, Literature, Architecture, Music, Sustainability	1. Social aspect of Living Machine 2. Webpage	Research Contributed to project plan Website development
Johnson	Drew	Architecture Minor CAE Minor CAD	CAD drafting Design skills Adobe CS 3 skills Maya, Rhino, 3ds max Leadership Hardworking	Lead Ipro 335 Architecture, Philosophy, Graphic Design, Travel	1. Social aspect of Living Machine 2. Webpage	Background Reading Research Lead project plan Research on flash systems Came up with ideas for website development
Fong	Patrick	Architecture	CAD drafting & 3D Modeling Design skills Adobe Illustrator/Photoshop 3ds max + Vray	Architecture, Industrial Design Graphic Design Intern Architect @ SCB	1. Social aspect of Living Machine 2. Graphics Design	Research Edit Project Plan Website icons and revision
Ramey	Ronald	Architectural Engineering	Structural design, Materials, General Design		1. Social aspect of Living Machine 2. Research and Development	Research Edit Project Plan Research alternative energy and how it can be applied and integrated into a living machine Contributed to final report
Stopic	Milena	Architecture	Design Visualisaton	Intern Architect Parametric Design	1.Ecological aspect of Eco boulevard 2. Graphics Design	Readings/Presentations Case studies BMP Research Strategy Code of ethics Icon editing and graphics template development
De Marco	Juan	Architecture	Design Visualisaton	Intern Architect Parametric Design	1.Ecological aspect of Eco boulevard 2. Graphics Design	Readings/Presentations Case studies BMP Research Strategy

Irish	Sean	Architecture	CAD drafting & 3D Modeling Design skills Adobe Illustrator/Photoshop 3ds max + Vray	Interest in building design innovative technologies and structures	1.Ecological aspect of Eco boulevard 2. Graphics Design	Readings/Presentations Case studies BMP Research Strategy Code of ethics Worked on icons and presentation editing
Urdiales	Miguel	Civil Engineering	CAD drafting & 3D Modeling Pro-Engineer	Drafter/Designer work experience, interested in the design and analysis of structures.	1.Ecological aspect of Living Machine 2. Research and Development	Readings/Presentations Case studies project planning Code of ethics Templates presentations Final report
Blackketter	Joshua	Mat. Eng.	Materials Selection, Copy Editing		1.Ecological aspect of Living Machine 2. Research and Development	Readings/Presentations Case studies project planning Final report
Konwar	Riju	BME,CHE, MMAE	Design and Implementation of processes; Engineering conceptualization; LabVIEW, MatLab, HYSYS	Research and Development of Single molecule Magnets	1.Ecological aspect of Living Machine 2. Research and Development	Readings/Presentations Case studies Abstract Final report
Kuzmicki	Kamil		Circuit Analysis		1.Ecological aspect of Living Machine 2. Research and Development	Readings Case studies Final report

No Change in schedule. The change in focus doesn't directly change the tasks pursued.

Changes in Task Assignments and Designation of Roles and Team Organization

There were two different structures within the IPRO. Initially, the team split into the following teams with individual tasks:

Structure I

Team Leaders

- Drew Johnson- Living Machine
- Michael Kreitzer- Eco Boulevard

Sub- Teams

1. Eco Boulevard Social Team
- Niels De Vita
- Michael Kreitzer
- Hyunjoo Oh
- Anna Vassi

2. Eco Boulevard Eco Team
- Sean Irish
- Juan De Marco
- Milena Stopic

3. Living Machine Social Team
- Drew Johnson
- Patrick Fong
- Mathew Boder
- Ronald Ramey

4. Living Machine Eco Team
- Joshua Blackketter
- Miguel Urdiales
- Riju Konwar
- Kamil Kuzmicki
- Ron Ramey

5. Visual Interactive Model Team
- Matthew Boder
- Drew Johnson
- Michael Kreitzer
- Ron Ramey

Sub- Team Leaders
- Michael Kreitzer- Eco Boulevard Social Team
- Juan De Marco - Eco Boulevard Eco Team
- Drew Johnson- Living Machine Social Team
- Riju Konwar- Living Machine Eco Team

Sub Team Responsibilities

3. Living Machine Social Team
- Research social uses for the living machine
- Establish a catalog or “Growing Water Toolkit” of different possibilities for living machine pavilions.
- Prototype what several of these possible catalog solutions could be
- Design visually, a collaboration with the Visual Interactive Model Team, an easy to use interface that allows a user to pick different items from the “Growing Water Toolkit” to create their own living machine pavilion

5. Visual Interactive Model Team
- Design visually, a collaboration with the Living Machine Social Team, an easy to use interface that allows a user to pick different items from the “Growing Water Toolkit” to create their own living machine pavilion
- To research and integrate research from other groups into a web-

based user interface to promote education about how people can get involved and learn about living machine pavilions and eco boulevards

Sub- Team Individual Responsibilities

3. Living Machine Social Team

- Drew Johnson – Research, diagramming, and prototyping
- Patrick Fong – Research, presentation, and design
- Mathew Boder – Research , presentation, and design
- Ronald Ramey – Research on sustainability and integration of alternative energy implementation

*A few weeks prior to IPRO Day, the class regrouped to a different structure to develop the most desired outcome for the final presentation on May 5tt.

Structure II

Sub- Teams

1. Webpage Team

- Drew Johnson
- Michael Kreitzer
- Matthew Boder

2. Graphics Team

- Sean Irish
- Milena Stopic
- Hyunjoo Oh
- Patrick Fong
- Juan De Marco

3. Research and Development/Presentation Team

- Anna Vassi
- Joshua Blackketter
- Miguel Urdiales
- Riju Konwar
- Kamil Kuzmicki
- Ronald Ramey
- Niels De Vita

Sub- Team Leaders

- Michael Kreitzer - Webpage Team
- Milena Stopic – Graphics Team
- Niels De Vita - Research and Development Team

Sub Team Responsibilities

1. Webpage Team
- Research flash systems and find a way to integrate them into our website
- Establish a catalog or “Growing Water Toolkit” of different possibilities for living machine pavilions.
- Design visually an easy to use interface that allows a user to pick different items from the “Growing Water Toolkit” to create their own living machine pavilion

2. Graphics Team
- Create icons for the webpage team
- Organize templates and case studies to be featured in IPRO 322

3. Research and Development Team
- To research to promote education about how people can get involved and learn about living machine pavilions and eco boulevards
- Integrate the collected research into the other two groups (webpage and graphics teams) for a web-based source of information

Sub- Team Individual Responsibilities

1. Webpage Team
- Drew Johnson – Research and presentation
- Michael Kreitzer - Programming
- Matthew Boder – Research and implementation

2. Graphics Team: Each member was expected to gather/develop icons and organize templates to aid the webpage team
- Sean Irish
- Milena Stopic
- Hyunjoo Oh
- Patrick Fong
- Juan De Marco

3. Research and Development/Presentation Team: Each member was responsible for researching and assisting the other two teams with whatever needed and developing several parts of the final report and abstract for IPRO Day
- Anna Vassi
- Joshua Blackketter
- Miguel Urdiales
- Riju Konwar
- Kamil Kuzmicki
- Ronald Ramey
- Niels De Vita

Designation of Roles

A. Assign Meeting Roles

- **Minute Taker:** Milena Stopic
- **Agenda Maker:** Michael Kreitzer
- **Time Keeper:** Riju Konwar

B. Assign Status Roles

- **Weekly Timesheet Collector/ Summarizer:** None. As a group, we decided that we will all keep track of our work by uploading outlines from the individual phases. We do this within our own sub groups which then get discussed with the group as a whole.
- **Master Schedule Maker:** Drew Johnson
- **iGroups:** Drew Johnson

6.0. Obstacles

A. Since this is the first in a continuing series of IPRO classes investigating the possibility of an eco-boulevard on or close to the IIT campus, research has been and will continue to be the primary focus of our efforts. During the first half of the semester, we compiled a substantial amount of information and have not been rigorous enough in including proper references, citations, and other pertinent information. This information is extremely important because we are trying to develop an intelligent base of research that will be accessible and useful for future classes. This reference information will also be important when presenting the research to the IPRO community and the public at large who may inspired to investigate the issues of water conservation themselves. This obstacle is overcome quite easily by quickly determining and recording the source of the research gathered thus far, and being more detailed and through in the identification of the source of future research and facts.

B. Another barrier that our team had faced till the middle of this semester was a lack of efficient communication between the groups themselves and between the subgroups within the larger framework. This was mainly due to the rigorous schedule that most IIT students were confined to follow. However, our attempt of setting up standard meetings on campus was successful in addressing this issue. Group members adhered to the meeting timings and agendas as it accommodated their respective class schedules. A message board was also set up for constant communication if and when the needed. Emailing and filing sharing via IPRO network also proved to be vital asset.

C. The last obstacle that we are facing so far this semester is the development of a coherent and user friendly design for the project

website and presentation. It is important for the inaugural ecoboulevard team to create a simple system of graphic representation for the large amount of information that will be necessary to explain the project and inspire the audience. This system, along with the research will hopefully be well thought out enough that it will be useful for many semesters to come. It is also important to clearly and strongly convey the research and proposal on the class website so that the members of the public, especially those that live close to the proposed site, can be well informed without investing a lot of time. We have begun to set up a collection of simple and clear icons that will be used as the navigation theme for our website. These easily identifiable symbols will be accompanied by an interactive interface that allows for the user to effortlessly engage with the proposal, and develop their own idea of an eco-boulevard while learning about the concept at the same time.

7.0. Results

Case Studies
In the course of the IPRO case studies were done to research ideas for the final development and to aide in teaching the public about living machines and eco-boulevards. Case studies involved research of technology as well as research of locations at which technology was being used. These case studies were made into templates and put onto the website.

Website
The ultimate goal of the IPRO was to get out a website that would help to inform people as to how a living machine works and what comprises an eco-boulevard. The website goal is to spread the word and try to gain support for this green initiative.

Team Results

Graphics Team
- Developed the graphics for the website
- Created the logo for the website and IPRO
- Formatted templates for integration with the website
- Helped to put together the final presentation

Website Team
- Developed a user interface for website
- Developed the database from which the website draws
- Developed the website look, coordinating with the other groups to make it user friendly

Research and Development (Deliverables) Team
- Created reports, abstract, and meeting minutes and responsible for their submission
- Finished gathering information for the case studies

- Co-ordination of IRPO 322's needs for IPRO day table

Eco-Boulevard Social Team

- Research of case studies involving alternative transportation
- Responsible for research into bike/car-share, ways to make the outside spaces attractive
- Creation of initial case studies and research for website
- Brainstorm for website ideas

Eco-Boulevard Ecological Team

- Research of case studies involving natural plants and trees that will create the eco-boulevard
- Responsible for research of indigeous plants to be planted in the eco-boulevard
- Creation of initial case studies and research for website
- Brainstorm for website ideas

Living Machine Social Team

- Research of case studies involving educational programs and ways to inform the public about the idea of a living machine/eco-boulevard
- Responsible for research into alternative energies that can be implemented in Chicago
- Creation of initial case studies and research for website
- Brainstorm for website ideas

Living Machine Ecological Team

- Research of case studies involving the processes by which the water is purified
- Responsible for the rough estimation of size requirements per volume of water
- Creation of initial case studies and research for website
- Brainstorm for website ideas

8.0. Recommendations

Future recommendations for this IPRO would be to focus on the existing database and isolate the optimal case studies that could serve as an inspiration for the 31st Street Eco-boulevard project. Further research also needs to be done on the eco-systems that could be viable for the living machine to be constructed in the IIT campus. An ideal ecosystem is one which will be able to sustain the climate changes in the Chicago area that is both the summer and the winter. These parameters have to be closely examined to ensure that the final choice for ecosystem is one that is local to this geographical region. The “Growing Water.com” website also needs further modification as the research progresses. The current format established could serve as a platform for future endeavors. The “Build your own Eco-boulevard” game in the website also needs further development which would be another important focus for the future IPROs.

9.0. References

- Reading
  - Plan Of Chicago Chapters 1&4 by Burnham and Bennett
  - Articles by Peter Annin:
    - "To have and have not"
    - "Aral Sea"
    - "Reverse a River"
  - "Close Deep Tunnel" by Harold Henderson
  - "Nature's Metropolis"
  - "The Last Drop" by Michael Specter
  - "They Need it. We waste it" by Essay of Water in Chicago
- Case Studies/Research/ Projects
  - "A Guide to Storm Water Best Management Practices" by City of Chicago Richard M. Daley
  - "Chicago Department of Transportation Sustainable Infrastructure Sustainability" Janet L. Attarian, AIA Project Director Streetscape and Sustainable Design Program CDOT Division of Project Development
  - "Chicago Department of Transportation Sustainable Development Initiatives" Streetscape and Urban Design Program CDOT Division of Project Development
  - "Green Light for Green Infrastructure" by Alexandra Dapolito Dunn and Nancy Stoner
  - "Growing Water" Urban Lab (Idea Organization)
  - "Change Course" Metropolitan Planning Counsel
  - "Intergrating Demand-Side Planning and Management into the Water Supply Planning Process" by Jack C. Kiefer, PhD
  - "Environmental Concerns" Lake Michigan Federation
  - "The Hydrology of the Lake Michigan Region" by Douglas Cherkauer
  - "Open Lander" publication of *Openlands and Corlands*
  - "Public/Private Partnerships" American Water
  - "Coordinating Regional Monitoring" by Ric Lawson
  - "Annex 2001- An Update" by Daniel Injerd
  - "A Plan fro Scientific Assessment of Water Supplies in Illinois" by too many contributors to name, George H. Ryan, Governor
  - "Troubled Waters, Meeting Future Water Needs in Illinois"
  - "Strategic Plan for Water Resource Management" Northeastern Illinois Planning Commission
  - International Case Studies
    - "Case Study: France"
    - "Case Study: Kenya"
    - "Case Study: La Plata River Basin"
    - "Case Study: Lake Peipsi"
    - "Case Study: Lake Titicaca"
    - "Case Study: Mali"
    - "Case Study: Mexico State"
    - "Case Study: South Africa"
    - "Case Study: Sri Lanka"

    - "Case Study: Thailand"
    - "Case Study: Tuul River"
- Picture, props etc
- Websites
    - www.sws.uiuc.edu/iswsdocs/DNR2004GovReportFinal.pdf
    - www.epa.state.il.us/water/groundwater/index.html
    - www.sws.uiuc.edu/docs/swfaq
    - www.sws.uiuc.edu/pubdoc/IEM/ISWSIEM2001-03.pdf
    - www.metroplanning.org/cmadocs/changingcourse.pdf
    - www.nipc.org/water_plan_2001.htm

10.0. Acknowledgements

IIT Faculty
Martin Felsen, sponsor, his familiarity with the topic (his having won a history channel challenge with this proposal). He helped to organize and inform the IPRO as to what makes up both a living machine and an eco-boulevard. His knowledge of existing examples and his having experience with brainstorming and working larger groups, his delegation and ideas were of much assistance. Andrew Vesselinovitch, assistant, his familiarity with the topic and his organizational skills aided greatly in the IPRO. Help with ideas and critiques helped to make more a more cohesive final website and helped us to organize tasks.