Illinois Institute of Technology

Midterm Report

IPRO 327

Advisors: Prof. Kurzydlo

Sustainable Water Distribution System for Pignon, Haiti

Section 1.0

OBJECTIVES

IPRO 327's objective is to create a complete set of drawings and specifications of a water distribution system for Pignon, Haiti that can be easily built and used by the town. This is a continuation of a spring 2007 IPRO, which completed mapping of the town. We now seek to design the physical water distribution system that can be sustained for twenty years. To do this, we have identified several factors significant to the success of this system that we will be focusing on. These include finding a water source that can provide a continuous and adequate flow of water, design of a pump and the power source to run it, design of water kiosks and faucets, and design of the piping network with erosion protection. User fees will also be determined for both public and private water lines. The water system will also be designed so that its output may grow with the population of the town over the next twenty years. Through our work, we hope to create a system that can be implemented by Pignon to provide a clean and reliable water source for its citizens. These objectives have stayed constant throughout the duration of the project.

Section 2.0

RESULTS TO DATE

The progress can be seen detailed below in the "Results to Date" spreadsheet. All of the preliminary research for the project has been completed and the design of the water distribution system has commenced.

Results to Date:

Task:	Completion:

Group 1	
Analysis required volume	Completed
Pump research	Completed
Pump manufacture research	In-progress
Final pump selection	In-progress
Elevation and pipe network	In-progress
Water purification	In-progress
Cistern design	In-progress
Group 2	
Storage tank foundation	Completed
Storage tank design	In-progress
Construction Research	In-progress
Tank material research	In-progress
Water kiosk preliminary design	Completed
Alternative materials research	Completed
Final Design water kiosk	In-progress
3D View of water kiosk	In-progress
La Tanya Research	In-progress
Group 3	
Survey data	Completed
Pipe material research	In-progress
Pipe Design	Not started
Pipe Drawings	In-progress
Erosion protection	In-progress
Update EPANET model	In-progress
Maps of Pignon	In-progress
Fundraising coordination	In-progress

Group 4	
Project Plan	Finished
Ethics Code	Completed
Meeting Minutes	Up-to-date
Mid-Term Report	Completed
Mid-Term Presentation	In-progress
Final Report	Not Started
IPRO Day Presentation prep	Not Started
Poster	Not Started
Group 5	
Currency research	Completed
Population growth research	Completed
Survey data analysis	In-progress
Budget	Completed
Feasibility research	Completed
Specifications	Not started
Design Manual	In-progress

The current results are a step forward in producing the final product that will address the customers' needs. If the group were to present the city authority what has been completed so far, it would be of no help to them since it does not solve their problem. The potential products resulting from research involved in this project is a set of design manuals that will be given to the governing body of Pignon. Since we will be producing a set of manuals as our deliverables that will be given to a city authority, the final design will have to be approved by a licensed engineer. The format of the product must also be in a professional manner with no discrepancies within the information. With the current results of the completed research, the final product will be able to be designed in a safe and economic fashion.

Section 3.0

REVISED TASK / EVENT SCHEDULE

Several changes were made between the initial forming of the groups and this point in the semester as far as task assignments. In group 1, it was discovered that research would be needed on each pump manufacturer to properly select the needed pump. Therefore, a separate task was created for this. The task of researching a power source, however, was removed from Group 1's to-do list. It was decided that this task would be pursued by members of the IIT chapter of Haiti Outreach. Group 1 also defined separate tasks necessary for the completion of their portion of the project, including finding proper elevations for the cistern and storage tanks, as well as designing the cistern tank. Water purification research was moved from group 2 to group 1.

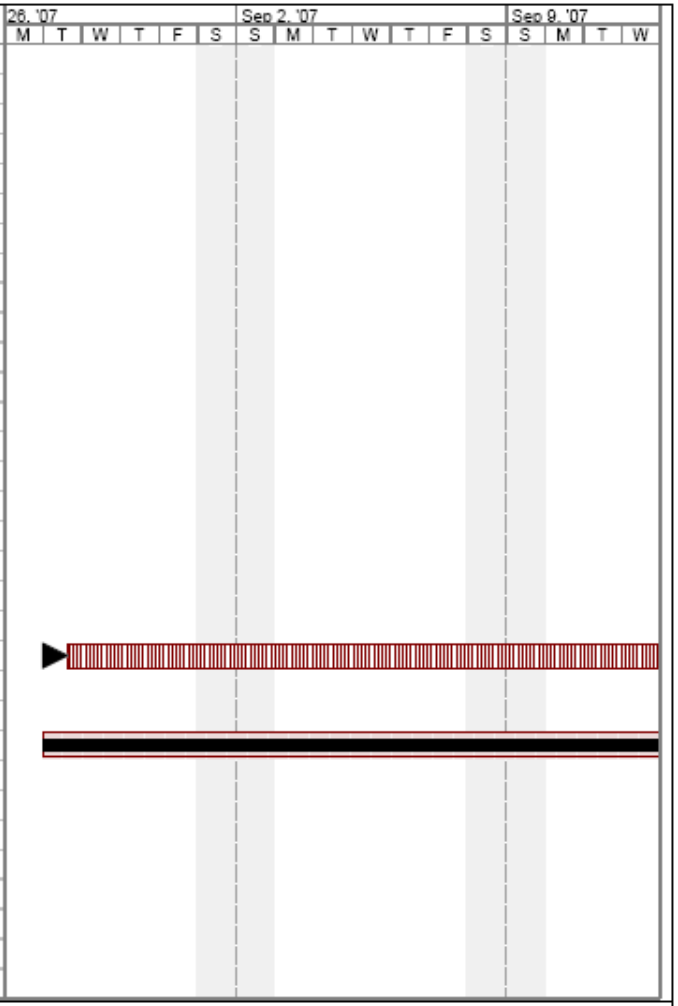
In Group 2, a separate task was defined for the designing of the foundation for the storage tank as this was viewed as needing separate research than for the design of the storage tank itself. The initial design of the water kiosk was completed ahead of schedule but a due date was added for the drawings of the kiosk, both in 3-D and for the final set of specifications. Another subsection of research was defined in order to determine the proper materials for construction as well as determining the most efficient construction methods for this project. One member in Group 2 was assigned the task of researching a possible extension of the current project to another Haitian town called La Tanya.

In Group 3, only one more task was defined. The group did research on the piping material that would be used in the network. In both Groups 3 and 5, several due dates were extended. Group 4 did not change as its tasks are to complete IPRO deliverables. These due dates and tasks were set by the IPRO office before the project began.

The following table shows the major remaining tasks that must be completed. The number of members that will be needed for each task is indicated, as is the number of hours each remaining task is expected to take.

Task	Number of members needed for completion	Expected remaining hours
Pump Selection and Elevation	3	5
Water Purification Research	3	6
Cistern Design	3	4
Tank Storage Design	2	2
Materials Analysis	1	3
Drawings of Water Kiosk	3	8
La Tanya Research	1	4
Updating Maps and Models	4	7
Erosion Protection	2	2
Piping (Sizing and Plans)	8	30
Material Research	1	1
Meeting Minutes	1	5
Final Report	2	14
IPRO Day Materials	2	6
Survey Data and Pop. Research	2	6
User Fee Calculations	2	4
Specifications and Manual	8	30

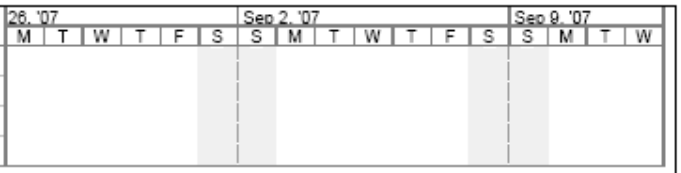
ID	Task Name	Duration	Start	Finish
1	Group 1	32 days	Tue 9/18/07	Tue 10/30/07
2	Analysis of Required Volume of Flow	10 days	Tue 9/18/07	Mon 10/1/07
3	Pump Research	16 days	Tue 9/18/07	Tue 10/9/07
4	Pump Manufacturer Research	32 days	Tue 9/18/07	Tue 10/30/07
5	Elevation of Water Source Analysis	32 days	Tue 9/18/07	Tue 10/30/07
6	Water Purification Research	20 days	Mon 10/15/07	Fri 11/9/07
7	Cistern Design	13 days	Thu 10/4/07	Tue 10/30/07
8	Group 2	43 days	Mon 9/17/07	Tue 11/13/07
9	Storage Tank Foundation Design	12 days	Tue 10/2/07	Tue 10/16/07
10	Tank Storage Design & Analysis	32 days	Tue 9/18/07	Tue 10/30/07
11	Water Kiosk Design	31 days	Tue 9/18/07	Mon 10/29/07
12	Tank Construction and Materials Analysis	17 days	Tue 10/9/07	Tue 10/30/07
13	Drawings of Water Kiosk	16 days	Tue 10/23/07	Tue 11/13/07
14	La Tanya Research	27 days?	Tue 10/9/07	Tue 11/13/07
15	Group 3	38 days	Mon 9/24/07	Tue 11/13/07
16	Update Digital Map of Pignon	11 days	Tue 10/16/07	Tue 10/30/07
17	Update EPANET Model	21 days	Wed 10/3/07	Tue 10/30/07
18	Erosion Protection Research	15 days	Thu 10/11/07	Tue 10/30/07
19	Piping/Sizing and AutoCad Plans	31 days	Wed 10/3/07	Tue 11/13/07
20	Pipe Material Research	22 days?	Tue 10/2/07	Tue 10/30/07
21	Group 4	66 days	Tue 8/28/07	Fri 11/23/07
22	Project Plan	13 days	Thu 9/13/07	Fri 9/28/07
23	Code of Ethics	24 days	Mon 9/17/07	Wed 10/17/07
24	Meeting Minutes	59 days	Tue 8/28/07	Wed 11/14/07
25	Mid-Term Report	12 days	Mon 10/1/07	Mon 10/15/07
26	Mid-Term Presentation	6 days	Mon 10/1/07	Mon 10/8/07
27	Final Report	22 days	Thu 11/1/07	Fri 11/30/07
28	Abstract	18 days	Thu 11/1/07	Mon 11/26/07
29	Posters	11 days	Mon 11/12/07	Mon 11/26/07
30	Group 5	53 days	Thu 9/13/07	Thu 11/22/07
31	Feasability Research	7 days	Thu 9/13/07	Thu 9/20/07
32	Currency Research	6 days	Tue 9/18/07	Tue 9/25/07



Project: Project Plan
Date: Fri 10/26/07

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

ID	Task Name	Duration	Start	Finish
33	Budget Analysis	5 days	Mon 9/24/07	Fri 9/28/07
34	Survey Data and Population Research	32 days	Tue 9/18/07	Tue 10/30/07
35	User Fees Calculations	11 days	Thu 11/1/07	Thu 11/15/07
36	Specifications and Manual	16 days	Thu 11/1/07	Thu 11/22/07



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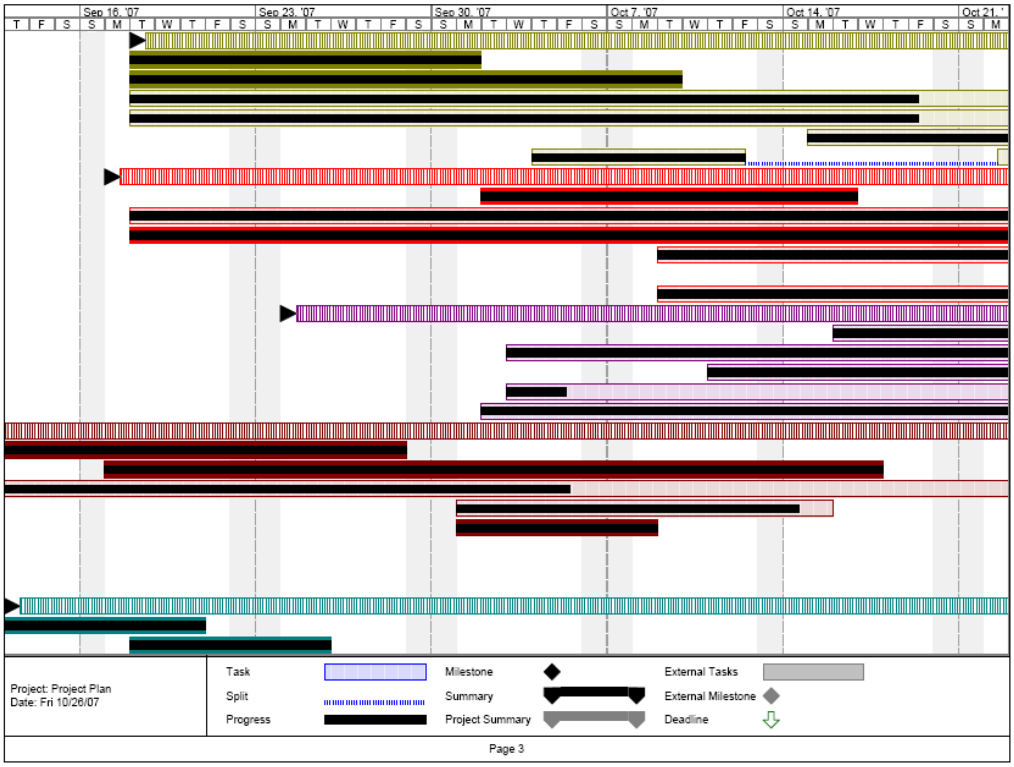
Sep 16, '07
Sep 23, '07
Sep 30, '07
Oct 7, '07
Oct 14, '07
Oct 21, '
Project: Project Plan
Date: Fri 10/26/07
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Summary
Project Summary
External Tasks
External Milestone
Deadline
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Sep 16, '07
Sep 23, '07
Sep 30, '07
Oct 7, '07
Oct 14, '07
Oct 21, '
Project: Project Plan
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External Tasks
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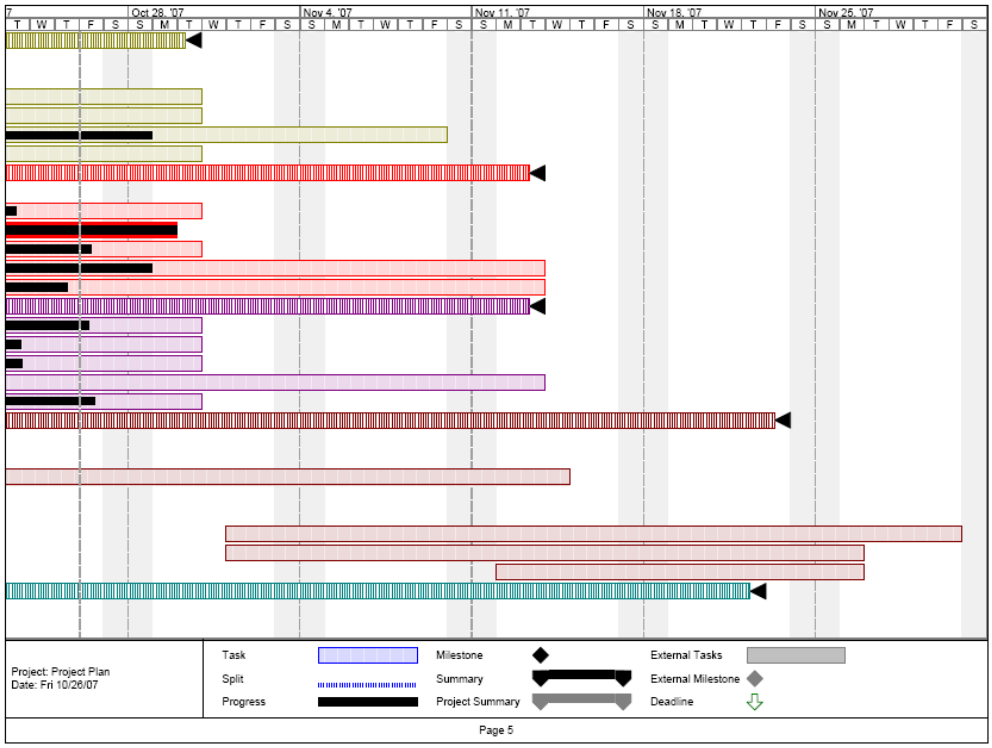
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Oct 28, '07
Nov 4, '07
Nov 11, '07
Nov 18, '07
Nov 25, '07
Project: Project Plan
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Project Summary
External Tasks
External Milestone
Deadline
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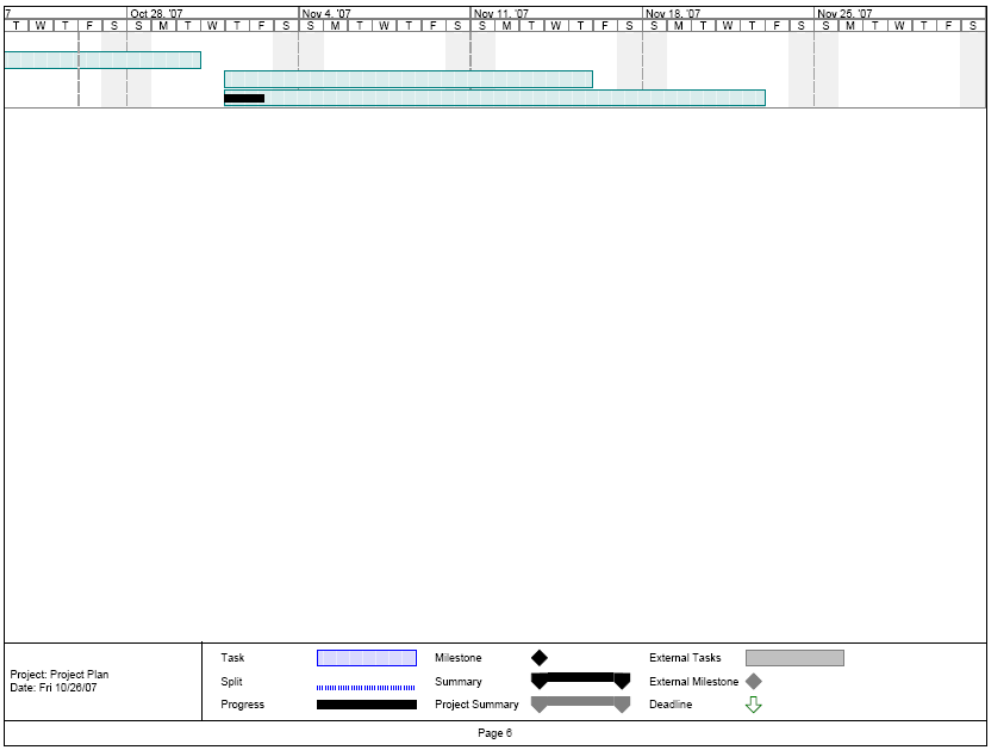
7
Oct 28, '07
Nov 4, '07
Nov 11, '07
Nov 18, '07
Nov 25, '07
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Task
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External Milestone
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Section 4.0

CHANGES IN TASK ASSIGNMENTS AND DESIGNATION OF ROLES AND TEAM ORGANIZATION

Overall, the team organization has not changed drastically. However, there has been some development since the project plan was submitted. Often during a project it is necessary for change to occur to ensure the success of the submittal. Since this project is for the design of a water distribution system and not a new pump or a product that can be created and tested at IIT, a lot of the project cannot change. Through our now extensive involvement with the Haiti Outreach program, much of the research that we would have conducted has been provided for us. Due to this new information, some of the tasks within the groups themselves have been modified and are detailed below.

Group 1 is now working on the filtering system as well as the pump design. The tasks for this group can be described as covering everything in the system design between the spring and the cistern except the storage tank. Originally, this group was going to have to conduct a lot of research to determine what type of water pump would be used in this situation; however, Alex from the Haiti Outreach program has greatly assisted them in selecting a pump. Now the task is focused on designing the cistern and the piping system between the spring and cistern. At the beginning of the semester this group started out with very individualized tasks. Since then it has developed into a group effort towards each task. This change in team organization has happened since the research has been completed and what is left is analytical design of the system, which is reliant on every part of the system. For example it would not be feasible to design the piping system from the spring to the cistern if the size of the cistern was not known.

The second group has decided to divide themselves into two more subdivisions to conquer the tasks in a more efficient manner. They realized that separating the group allowed more individual attention to each task, which should increase the quality of the product. The divisions are separated so that one subdivision will design the storage tank and the other will design the water kiosks. Unlike with Group One, the tasks assigned to

this group have not changed since the project plan was submitted. The two subdivisions of the group meet separately instead of meeting as a whole group since the two tasks are unrelated in terms of design.

Since group 3 is the largest group and also have the most amount of tasks assigned to them, they have also divided themselves. The task of updating the town maps and putting them into a submittal format was added to this group since the beginning of the project. This group task description is as follows: updating maps, interpreting survey data, mechanical design of pipes, erosion protection, and updating the EPANET model. Unlike group two, this group does not have a clear division among them. Tasks are divided among the members and the group still meets as a whole.

No changes have taken place for Group 4 since it consists of only two members and the necessary tasks have been mutually assigned since the beginning of the project. A task, however, has been added to Group 5. The members in this group assisted in interpreting the survey data since some of the feasibility study depended on the survey results. However, in terms of team organization there has been no change to group five.

Following is the updated individual tasks spreadsheet that was presented in the project plan. One of the major changes to individual tasks is that Gustavo is also researching the possibility of building a water distribution system in the town of La Tanya in addition to his storage tank responsibilities. The town of La Tanya is a coastal Haitian town that is in dire need of a water distribution system. The IPRO group was informed about this town through Eric Badger, a Shimer College professor who has worked on a literacy development program in La Tanya. The research will help indicate whether such a project may be feasible as an IPRO in the coming semesters.

Name	Assignments
Ballog, Matthew	IPRO Team Leader Gathering surveys, Coordinating with Haiti Outreach, Planning additional trip to Haiti, Organizing fundraising,

Name	Assignments
Skrebo, Ermin	Solar power pump research, Pump design, Water purification,
Smagur, Peter	Analysis required volume of flow to Pignon, Selection and design

Dennis, Nicole	Deliverables, IPRO Secretary,
Hussaini, Mudassir	Site plan of the existing map of housing and roads with current population,
Kohler, Jonathan	Interpreting survey data, Feasibility research, Specifications, Haiti Outreach, Water quality regulations research,
Lis, Tom	Pump design,
Mendoza, Gustavo	Water tank research - construction options, Masonry construction, La Tanya research,
Mohammed, Ashfaq	Water purification research, Energy solution research,
Nockov, Ivan	Research on alternative materials for water kiosk - shipping containers, Drawings of water kiosk,
Omeralovic, Enis	Panorama of town, Creating site plan of town, Ethics seminar, Maps of Pignon,
Parv, Ionut	Water tank design, Haiti cement research,
Radloff, Eric	Analyzing survey data, Feasibility research, Operations Manual, Haiti Outreach,
Rajic, Ivan	Water kiosk design, Drawings and 3D view of water kiosk design,
Rokita, Mark	IPRO Team Leader, Gathering information from Haiti outreach, Past semester demonstration, Pignon citizen survey interpretation, Fundraising coordination,
Shethwala, Fuzel	Design faucet station, Research materials, 3D model water kiosk,
	of pumps from manufacturer specifications, Research elevations and path for pipe network,
Stella, Meredith	Deliverables, Ethics seminar,
Szwajnos, Joanna	Currency research, Populations growth, Tank design,
Tailor, Kinjal	Ethics Seminar, Project Management Seminar, Water purification research, HDPE vs. PVS research,
Terry, Nastasja	Water purification research, Materials research, Erosion protection design,

Section 5.0

BARRIERS AND OBSTACLES

There are many obstacles that are faced in starting any design project; these obstacles are often increased when the design requirements are unfamiliar to the engineer and/or when the client comes from a different culture. One of the obstacles our IPRO has encountered while completing the planned tasks is thegroup's lack of experience in designing water systems. There is a lot of knowledge in engineering that is developed through time and experience from working on different design projects. This is one of the major reasons why engineers have to have five years of experience in the field before they can test for their professional engineering license. This experience, of course, is extremely limited in our group so tasks take more time and research for completion than was originally anticipated.

Another obstacle the group must deal with is the language and culture barriers. The native language of Haiti is a mix of Creole and French, making translation of documents extremely difficult. Within Pignon there has been an ongoing dispute for the controlling authority of the town. At one point the town had two different mayors. Right now it is still not clear who is the controlling governing body, however all contact to the local authority is achieved through the Haiti Outreach group.

There is also the barrier working with the Haiti Outreach group to accomplish this project. In the United States, every construction project is designed and built to a certain set of standards. In many cases, Haiti does not have clearly defined standards, if any at all. We are faced with the obstacle of designing and planning the safe construction of a water distribution system for this underdeveloped country. The Haiti Outreach group has accomplished various projects in Haiti and the IPRO team needs to rely on their experience to develop an understanding of the available resources and common procedures.

The various tasks of this project have been evenly divided between the five sub teams. Members that are specifically working on the design elements of the project such as the water pumps or the piping system are often found consulting professors. This is an absolute must since none of the members on the IPRO team have designed a water distribution system before and are not licensed engineers. Haiti Outreach has also required that our final design be approved and stamped by a licensed engineer.

In terms of the language barrier, a team member traveled to Haiti at the beginning of the semester to collect surveys from the natives. The member of the team traveled with a translator and had computer software to aid in the translation process. However, the due date of the survey analysis was extended because the time to complete this task was much more substantial than the group anticipated. Since there were approximately two hundred surveys, the responsibility for this task was shared by multiple people. In terms of the difficulties with the local authorities, we are not involved with that communication; Haiti Outreach handles all of the communication with the local authorities.

Our IPRO is having a fairly difficult time overcoming the culture barriers when planning the cost estimates. Since there isn't a set unit price for materials or labor in Haiti, it is difficult to estimate the prices for the project. Since we have not completed a project in Haiti before our lack of knowledge is proving to be a huge setback since the cost estimate has not been started and it is half-way through the semester. The cost estimating group is starting to get more involved with the Haiti Outreach group to gather more information to complete the necessary cost estimates for the project. They are also researching a past IPRO that just completed designing and construction of an addition to the high school in Pignon.

An anticipated future obstacle is getting the design drawings printed in the proper format within the provided budget. It is often expensive to print drawings and since it is not known how many drawings will be needed, it is hard to estimate the cost. Also, the group has not yet contacted a professional engineer who will agree to approve and stamp off on the final design. In order to deal with the identified barriers, the IPRO team is constantly meeting and updating our individual accomplishments. This is especially useful in estimating the number of final drawings that will be needed. Overall, the team has not encountered a barrier that will prevent us from completing the project.

Section 6.0

MIDTERM PRESENTATION SLIDES

IPRO 327

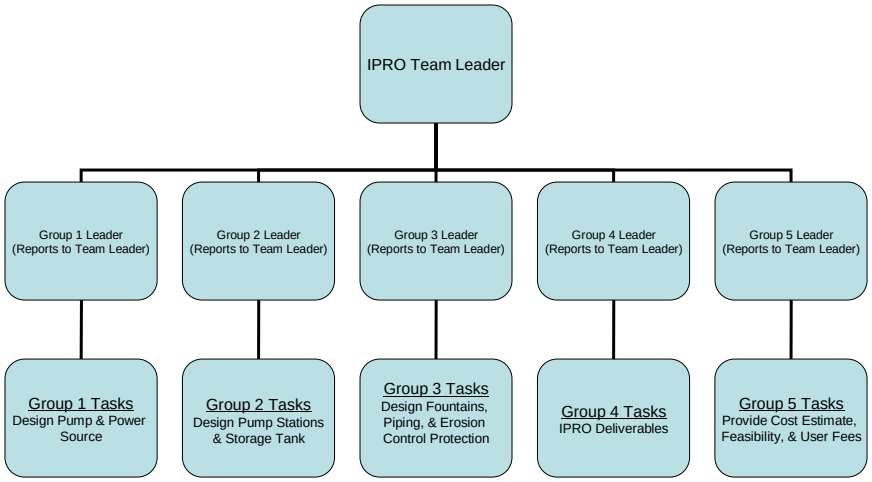
Sustainable Water Distribution System for Pignon, Haiti

MIDTERM PRESENTATION

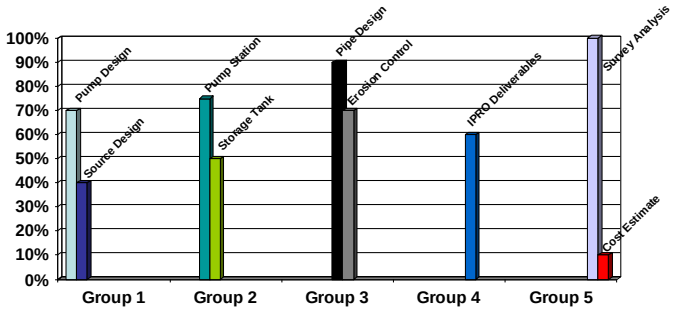
Statement of the Problem

- A water distribution system already exists but maintenance and performance are poor
- Management of the system is not efficient
- The new system must be designed to meet expected demands twenty years from now and must be easily maintained over that duration.

Organization of the Team



Progress Towards Tasks



The current results are a step forward in producing the final product that will address the customers' needs.

This final product will be a set of plans and specifications that will be used to construct the water system.

MAP OF PIGNON

Major Obstacles Encountered

Obstacles	Solution
1. Lack of experience in designing water systems.	1. Research previous designs in other third world countries and obtain advice from professionals in the industry.
2. Language and cultural barrier.	2. Receive translation from Haitian students attending IIT and help from Haiti Outreach-IIT in contacting Haitian authorities.
3. Lack of design and construction standards in Haiti.	3. Rely on Haiti Outreach from their past experiences with similar projects
4. Lack of specific details and parameters necessary for final design of the system.	4. Contact people who have worked or are currently working in Haiti that can obtain necessary information.

Anticipated Challenges

Challenge	Solution
1. Printing final set of design drawings in proper format and within budget.	1. Work with Haiti Outreach to agree on a final format for construction of the project and use money from donations to print plan set.
2. Estimating cost of the project.	2. Work with IPRO 326 and Haiti Outreach on obtaining prices of labor and materials in Haiti.
3. Having a professional engineer approve and stamp our final design.	3. Must contact professors or any other professional engineer to approve our design. In the mean time we must provide a design that will be accepted by a professional.