ABSTRACT – POMEROY TRAIL EAST ANNEX

As part of a program to expand and enhance a multi-user trail system in and around the City, the Newark Park Commission (NPC) is planning the East Annex Project as an addition to the Pomeroy Trail, which improves the mobility of pedestrians and bicyclists throughout the City and provides an important link to North Campus.

The East Annex Project involves drainage and environmental upgrades, wastewater system improvements, re-evaluation of a proposed groundwater remediation program, and infrastructure improvements in a manner that is "context sensitive" and minimizes adverse impacts to the traveling public, natural resources, and existing utilities. The main elements of the Project are:

- A new sewage and septage facility for the City's system on the Curtis Mill site designed for projected 20-year growth north of the White Clay Creek and including a new entrance off Paper Mill Road.
- An unheated service building for the sewage facility that will house three maintenance trucks and a vacuum truck unloading station, in addition to controls and equipment for the pumping station.
- Replacement of the two-lane, 130-foot span Paper Mill Road Bridge.
- Extension of the Pomeroy Trail to the Curtis Mill site and provision for future extension northward into the White Clay Creek Park.
- Improvements to Paul Run, which discharges into White Clay Creek near the trail extension.
- Re-evaluation of an environmental remediation program proposed for contaminated groundwater on the site of the former Acme Gas Works, adjacent to the Curtis Mill site.
- Utilities necessary for all aspects of the Project, including modification of existing utilities.
- Stormwater management associated with the overall Project and all of its elements.

Seventy-eight seniors split into four disciplines (civil-site, environmental, structures, or transportation) and formed six teams to win the commission then perform the preliminary engineering for the complex, multi-discipline project. Four experienced practicing professionals served as discipline instructors. Six younger engineers, all in private practice, served as team mentors. Students produced the following team deliverables, in addition to an individual technical assignment and an individual proposal assignment:

- A team plan for the execution of the work over two semesters.
- A proposal to win the commission for the project.
- An engineering report documenting the preliminary design of the project.
- Formal presentations to the owner's panel of experts for the proposal and the engineering report, plus working presentations in two progress meetings with the owner.

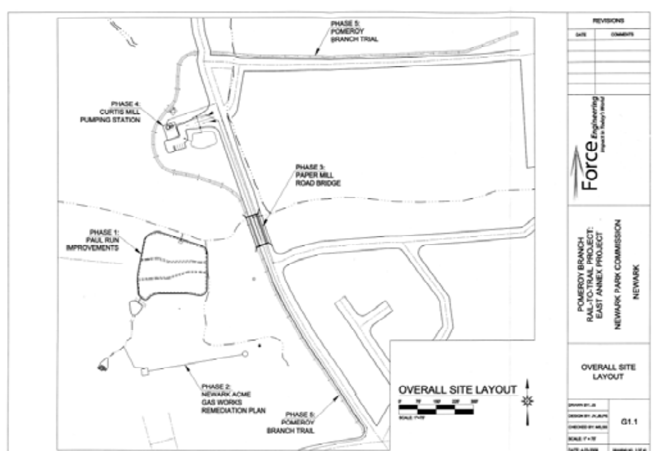
Overview

Seventy-eight seniors split into four disciplines (civil-site, environmental, structures, or transportation) and formed six teams to win the commission then perform the preliminary engineering for a complex, multi-discipline civil engineering project. Four experienced practicing professionals served as discipline instructors. Six younger engineers, all in private practice, served as team mentors.

I.A Project Description

The Newark Park Commission (NPC), a non-profit authority, is a quasi-governmental, public-private partnership that has an ambitious program for the expansion and enhancement of the multi-user trail system in and around the City. The Pomeroy Branch Rail to Trail Project (Pomeroy Trail) is a project currently under development to improve the mobility of pedestrians and bicyclists throughout the City and to provide a north-south link from Cleveland Avenue to Creek Road and the University's North Campus. The proposed alignment of the trail follows an abandoned corridor of the Pomeroy and Western Railroad, which served the industrial heart of the City during the late 19th and early 20th centuries. Many utilities run within the corridor.

The East Annex is a project that the NPC is planning as an expansion of the Pomeroy Trail. The East Annex Project involves drainage and environmental upgrades, wastewater system improvements, re-evaluation of a proposed groundwater remediation program, and associated infrastructure improvements. The Project includes utilization of the abandoned industrial site of the old Curtis Mill, immediately north of the Acme Gas Works site, and extension of the Pomeroy Trail to the Curtis Mill site. Major elements of the East Annex Project include:



- A new sewage and septage facility for the City's system on the Curtis Mill site – the Curtis Mill Pumping Station (CMPS) – designed for projected 20-year growth north of the White Clay Creek and including a new entrance off Paper Mill Road.
- An unheated service building for the CMPS that will house three NPC maintenance trucks and a vacuum truck unloading station, in addition to the control system, pumps, and other equipment associated with the pumping station.
- Replacement of Bridge 1-231, the two-lane, 103-foot span Paper Mill Road Bridge, that crosses White Clay Creek north of the five-point intersection.

- Extension of the Pomeroy Trail multi-user path to the Curtis Mill site and provision for future extension northward, into the White Clay Creek Park.
- Improvements to Paul Run, which discharges into White Clay Creek along the trail.
- Re-evaluation of an environmental remediation program proposed for contaminated groundwater associated with the former Acme Gas Works, with an emphasis on sustainable design and "green" impact.
- Utilities necessary for all aspects of the Project, including modification of existing utilities.
- Stormwater management associated with the overall Project and all of its elements.

The NPC owns the right-of-way of the railroad corridor and is negotiating to purchase or lease a portion of the Curtis Mill site, as recommended under this engineering study.

The main challenge of the Project is to achieve the objectives of this complex, environmentally-driven initiative in a manner that is "context sensitive" and minimizes adverse impact to the traveling public (in all modes), natural resources, and existing utilities. While the path to the Curtis Mill site is seen as an extension of a safe and low-maintenance recreational trail, the NPC believes that it may be beneficial for the extension to establish its own identity in terms of materials, design, and details.

Given the complex nature of the project and the desire of the NPC to consider a range of creative designs, the NPC intends to select more than one team to execute the preliminary engineering, with the understanding that only one team will be selected to execute the final engineering based on the quality of the preliminary submissions.

For the purposes of the project, "preliminary" engineering is defined as 30% to 50% of the engineering that would be required to produce biddable construction documents.

Proposals to provide preliminary engineering were submitted on October 16, 2008. Presentations in support of the proposals were made Monday evening, October 20, 2008. The preliminary engineering studies (final reports) were submitted on April 23, 2009. Presentations that highlighted the preliminary designs were made Monday evening, April 27, 2009.

<ins>Presentations</ins> for the proposal and for the engineering study were evaluated by the owner's panel of experts in three categories, weighted as follows:

- 30% Presence, demeanor, organization, flow, interaction, and communication.
- 50% Delivery of a complete, clear, and coordinated proposal or preliminary design; coverage and quality of technical issues.
- 20% Answers to questions from the owner's panel.

Proposals were evaluated in two categories:

30% Packaging; complete and comprehensive organization; graphics; clarity and conciseness; coordination and integration (of the disciplines); grammar and punctuation.
70% Clear understanding of the project; coverage of important technical issues; possible design surprises; unique qualities and innovative ideas; estimate of engineering labor; projected design schedule.

Final reports were evaluated in two categories:

30% Packaging; complete and comprehensive organization; drawings and graphics; clarity and conciseness; coordination and integration (of the disciplines); grammar and punctuation.
70% Complete, clear, and coordinated design; coverage of technical issues; engineering quality; innovation and unique qualities; project cost estimate; and project schedule.

Combined deliverables were weighted 40% for the presentation and 60% for the proposal or report.

I.B Course Structure

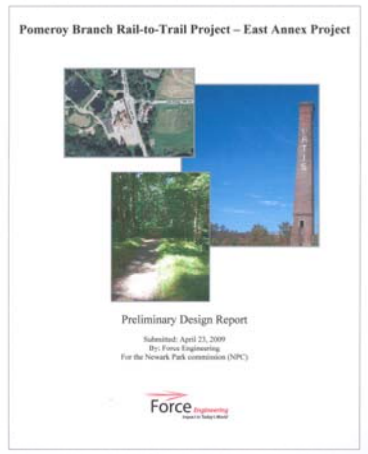
The course is a capstone course taught over two semesters. Students were divided into six teams (or companies) that competed for an engineering commission for the project. Once awarded the commission, the teams competed against each other to produce the best preliminary design.

Each team included four engineering disciplines: civil/land development (civil-site), environmental, structures, and transportation.

Instructors who are practicing professionals presented engineering information, techniques, and strategies in their respective disciplines that built upon prior and concurrent coursework and could be used to develop the preliminary design for the project. In addition, the instructors served as roving, senior mentors for all teams, and as the owner's panel of experts.

A young practicing professional served as the mentor for each team, advising on non-technical aspects of task performance and on team management. The mentors did not tell teams what to do but helped them think critically, think "big picture," think "like an owner," consider options, and weigh advantages and disadvantages.

Several project "deliverables" were required from each team:



1. *Team Plan:* A document that outlined how the team intended to execute its work (fall).
2. *Proposal*: A document that described the team, its personnel and expertise, and the approach it planned to take to the engineering engagement (fall).
3. *Proposal Presentation*: A 20-minute presentation that summarized the important aspects of the proposal (fall).
4. *Progress Meeting*: A 10-minute presentation that summarized the team's progress on the project (late fall and early spring).
5. *Engineering (Final) Report*: A document that detailed the preliminary design (spring).
6. *Engineering Presentation*: A 20-minute presentation that summarized the important aspects of the preliminary design (spring).

All four disciplines also had discipline-specific assignments that related to engineering for the project, one of which was an *individual technical assignment* that was given in the fall semester.

Early in the fall semester, each student was required to produce a *proposal outline* and a draft *project understanding* (that would be used in a proposal).

Each student was required to act as a *presenter* in one of the four presentations. No student could act as a presenter in both main presentations. Each team designated a student evaluator (one for each main presentation) to assess all six team presentations using the same evaluation sheet used by the owner's panel.

Each student was required to complete *peer evaluations* for all teammates late in both semesters. Ratings and comments with regard to commitment (attitude, dedication, and effort) and effectiveness (level and quality of contribution) were collated and presented in an anonymous format to all members of each team by its mentor.

II. Collaboration of Faculty, Students, and Professional Engineers

Winning the commission and executing the project involved close collaboration within and among several groups:

- Students in the four disciplines collaborated in their teams to produce the proposal, the preliminary design (final report), and all presentations.
- Students within each discipline collaborated with those from other teams in the discussions, exercises, and assignments within their own discipline.
- Students within each team had close, continual interaction with their mentor with regard to team management and project execution.

- Students had close interaction with the instructors in the eight discipline lectures and in frequent communication outside class.
- Students had weekly contact with the course coordinator, a practicing professional and former discipline instructor.
- Involvement of regular, full-time faculty tended to be informal, with some students (on some teams) using professors from prior courses as technical experts and advisors. Since discipline instruction was limited, most instructors coordinated with regular faculty regarding the instruction in prerequisite courses and that necessary for project execution.

III. Benefit to Health, Safety, and Welfare of Public

The students' project was an addition to an actual large public project undertaken specifically to benefit the health, safety, and welfare of the public. Particulars of the students' project were tailored to emphasize these concerns, notably the new sewage facility, the new bridge, the extension of the recreational trail, the creek improvements, and the groundwater remediation. The instructors and several guest lecturers, who also were practicing professionals, including representatives from the state board of professional engineers, addressed the fundamental professional responsibility to public health, safety, and welfare.

IV. Impact on Raising Social Consciousness

Student teams were asked to formulate programs for public outreach, resulting in recommendations for on-line data collection, door to door surveys, and public meetings. One team conducted an ad hoc survey of student transportation preferences.

One guest lecturer presented an overview of sustainable design and green building. Most students were keenly interested in this topic and all teams made an effort to incorporate sustainability into their designs. The sustainability theme was worked into many other aspects of the course. For example, a lecture on cost estimating involved the installation of a packaged groundwater treatment unit powered by photovoltaic energy.

Most importantly, students continually were asked to put themselves in the owner's shoes – to make engineering recommendations and decisions on behalf of the community served.

V. Impact of Partnering Teaching and Professional Practice

The four instructors and the coordinator were registered engineers in private practice. The mentors all were young practicing engineers. Most of the more than 10 guest lecturers were practicing professionals.

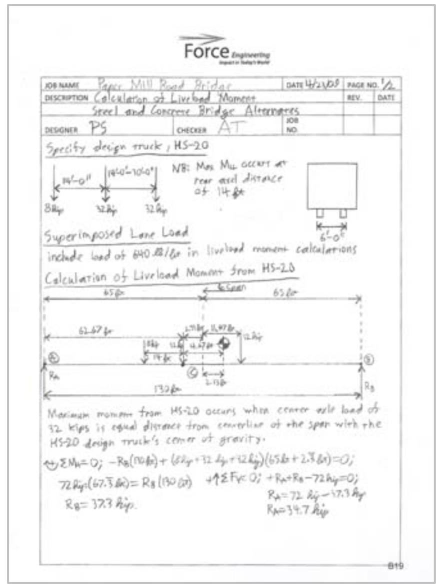
VI. Multidiscipline and Allied Professional Participation

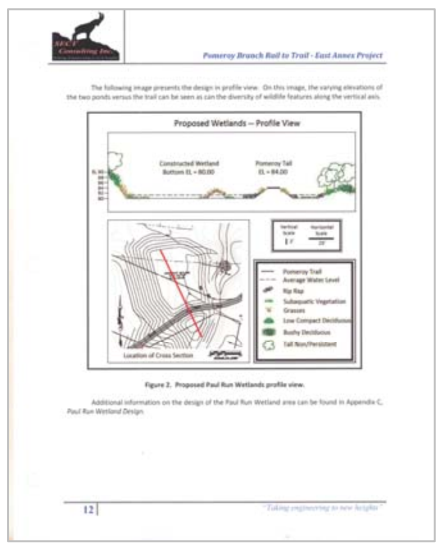
Students chose, gained instruction in, applied, and coordinated the four civil engineering disciplines in their teams' work on the project. The guest lecturer on legal aspects of the project was a prominent real estate attorney. The guest lecturer on sustainable design and green building was a LEED-AP principal architect from a design firm specializing in sustainable projects.

VII. Knowledge or Skills Gained

The objectives of the course and the project were to:

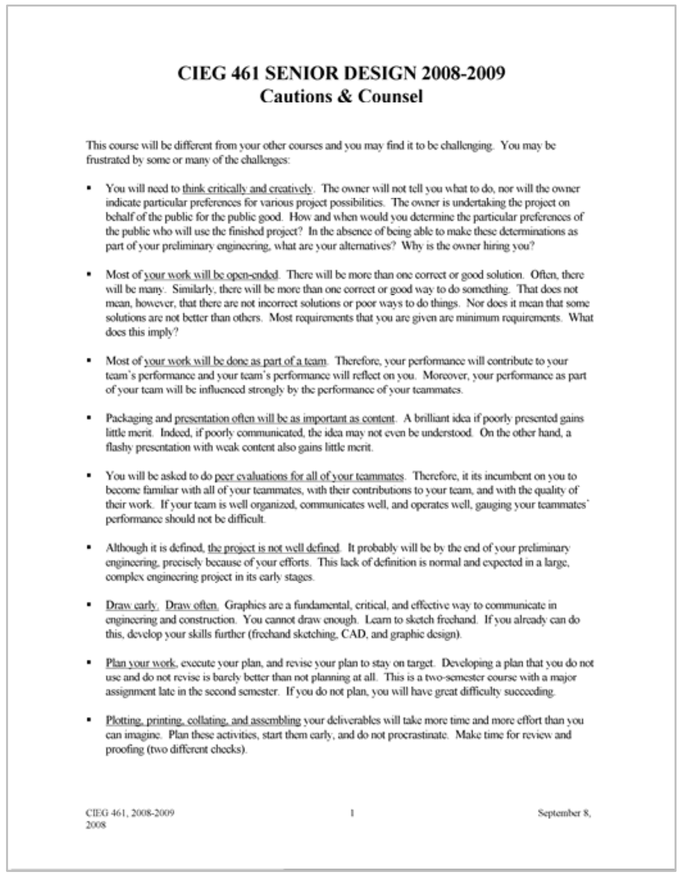
1. Synthesize and apply engineering knowledge and skills acquired in previous courses.
2. Gain additional engineering knowledge and skills necessary for the preliminary design of a complex project at the whole-project level, including legal and regulatory requirements.
3. Understand and apply the basic concepts and procedures of project execution on a complex, multi-discipline civil engineering project (based on an actual, contemporary, nearby project).
4. Develop creative thinking in the application of civil engineering to open-ended tasks.
5. Gain an understanding of typical deliverables on a civil engineering project, and produce the same at the preliminary engineering level.
6. Improve oral and written communication skills.
7. Gain and apply the basic concepts and skills necessary for the production of engineering (CAD) drawings.
8. Gain an understanding of the importance of presenting engineering concepts, strategies, considerations, and results effectively and efficiently.
9. Gain experience in group learning and team work, including the coordination and management of several disciplines.
10. Understand and apply the basic concepts, strategies, and activities related to the procurement of engineering services.
11. Gain a basic understanding of trying to "think like an owner" and achieving a broader engineering perspective, in part by role playing.
12. Develop the ability to critique self-performance and the performance of others in a constructive, non-personal manner.
13. Gain an understanding of ethics and strategies for dealing with ethical dilemmas in engineering practice.
14. Gain an understanding of additional fundamental professional practice issues such as professional responsibility, risk and liability, and professional registration.





Topics covered in pursuit of the course objectives included:

- The concept of engineering design
- Application of engineering in design and project execution (civil-site, environmental, structures, transportation)
- Project management
- Team management
- Written communication
- Codes, permits, and regulations
- Legal issues in projects and professional practice
- Sustainable design and green building
- Oral communication and presentations
- Engineers in construction
- Drawings (fundamentals and basic application)
- Specifications (fundamentals)
- Cost estimating (fundamentals and basic application)
- Ethics
- Project delivery methods
- Professional responsibility (risk, liability, and risk allocation)
- Professional registration
- Critical evaluation (performance of team, teammates, and self)



CIEG 461 SENIOR DESIGN 2008-2009
Cautions & Counsel

This course will be different from your other courses and you may find it to be challenging. You may be frustrated by some or many of the challenges:

- You will need to think critically and creatively. The owner will not tell you what to do, nor will the owner indicate particular preferences for various project possibilities. The owner is undertaking the project on behalf of the public for the public good. How and when would you determine the particular preferences of the public who will use the finished project? In the absence of being able to make these determinations as part of your preliminary engineering, what are your alternatives? Why is the owner hiring you?
- Most of your work will be open-ended. There will be more than one correct or good solution. Often, there will be many. Similarly, there will be more than one correct or good way to do something. That does not mean, however, that there are not incorrect solutions or poor ways to do things. Nor does it mean that some solutions are not better than others. Most requirements that you are given are minimum requirements. What does this imply?
- Most of your work will be done as part of a team. Therefore, your performance will contribute to your team's performance and your team's performance will reflect on you. Moreover, your performance as part of your team will be influenced strongly by the performance of your teammates.
- Packaging and presentation often will be as important as content. A brilliant idea if poorly presented gains little merit. Indeed, if poorly communicated, the idea may not even be understood. On the other hand, a flashy presentation with weak content also gains little merit.
- You will be asked to do peer evaluations for all of your teammates. Therefore, it its incumbent on you to become familiar with all of your teammates, with their contributions to your team, and with the quality of their work. If your team is well organized, communicates well, and operates well, gauging your teammates' performance should not be difficult.
- Although it is defined, the project is not well defined. It probably will be by the end of your preliminary engineering, precisely because of your efforts. This lack of definition is normal and expected in a large, complex engineering project in its early stages.
- Draw early. Draw often. Graphics are a fundamental, critical, and effective way to communicate in engineering and construction. You cannot draw enough. Learn to sketch freehand. If you already can do this, develop your skills further (freehand sketching, CAD, and graphic design).
- Plan your work, execute your plan, and revise your plan to stay on target. Developing a plan that you do not use and do not revise is barely better than not planning at all. This is a two-semester course with a major assignment late in the second semester. If you do not plan, you will have great difficulty succeeding.
- Plotting, printing, collating, and assembling your deliverables will take more time and more effort than you can imagine. Plan these activities, start them early, and do not procrastinate. Make time for review and proofing (two different checks).

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VIII. Viability of Technology Used

All student teams used CAD to produce their project drawings, advanced word-processing (and sometimes scheduling software) to produce their proposals and final reports, and MS Power Point to organize and make their two main presentations.

Students used public or commercial software in their engineering, for example AutoTURN, HydroCAD, and HecRAS.

Most course information and all project requirements, documents, and data were provided on a course web page hosted by the University (Sakai). Although the web page could be configured to include team sub-pages, most teams used commercial internet hosts (i.e., Yahoo and Google) for team communication, scheduling, management, and document administration.