National Decentralized Water Resources Capacity Development Project

# Student Design Competition for Decentralized Wastewater Treatment

University of Arizona
Tucson, Arizona

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# Student Design Competition for Decentralized Wastewater Treatment

## Submitted by University of Arizona Tucson, AZ

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# ABSTRACT

The project team developed a process to conduct a student design competition for undergraduate engineers. The project team piloted the process twice in subsequent years using lessons learned from the first round of competition to improve the process and design problem of the second round. The Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT) web site home page provided the location for participants of the student design competition to

- Register
- Obtain the design problem, ancillary data, and information to assemble a solution
- Conduct discussions and ask questions through a forum of threaded discussions (questions could be identified by topic and responded to specifically)

The design competition was introduced in two phases. Phase 1, initiated in the spring semester of 2002, involved the development of many of the components and pilot-testing of the design competition at two universities as a noncompetitive prototype. Phase 2, conducted in Academic Year 2003–2004, modified the competition based on the feedback and results of Phase 1, included an invitation for all consortium-member institutions to participate, and provided cash awards for the top three participating teams.

The two teams participating both years were brought to the annual National Onsite Wastewater Recycling Association (NOWRA) conference to orally present their design reports, as well as display their designs on posters, which were exhibited to the conference participants. For both years, separate judging panels were assembled that included a representative from each of several sectors, including:

- The general public
- A consulting firm
- US EPA
- Higher education
- An attorney (for the first year only)

There were six general categories of criteria that were used to judge the design reports:

- Completeness of design package
- Creativity of design

- Quality of engineering design
- Quality of management plan
- Effective use of project costs/budget
- Effectiveness of presentation

There were two outcomes of this project:

1. The primary outcome was that 13 undergraduate seniors in engineering
    - Were exposed to a real-life, practical design experience
    - Participated in a national conference
    - Learned more about designing decentralized wastewater treatment systems
2. A secondary outcome was that a design competition methodology was developed and piloted and lessons learned were obtained for future design competitions.

# TABLE OF CONTENTS

# LIST OF TABLES

# 1 INTRODUCTION

Engineering education has essentially ignored a major component of our nation's environmental protection infrastructure—decentralized wastewater treatment. In the *Response to Congress on the Use of Decentralized Wastewater Treatment Systems* (US EPA 1997), it was noted that decentralized and individual wastewater systems serve approximately 25 percent of the US population and approximately 37 percent of new development. Yet, despite the significant portion of our nation's wastewater treatment and disposal capacity, our engineering colleges have been slow to devote significant curriculum time to training new engineers to deal with the needs of this portion of our infrastructure, and even less time in providing hands-on activities to practice the classroom instruction.

The onsite field is an emerging engineering sub-discipline that brings together information from diverse fields ranging from microbiology through soil science and hydrogeology to engineering and environmental public policy. Although having a significant overlap with traditional academic fields, the specific educational needs of the industry are not currently being met. While specific courses presently exist to enhance the competence of engineers and others interested in the discipline (soils, microbiology, sanitary engineering, groundwater hydrology, epidemiology, environmental policy), few dedicated courses are available that bring together the salient issues and information from these fields needed in the onsite industry.

Historically, county sanitarians (generally not engineers) have had the major role in issues relating to the siting, sizing, technology choices, and technical requirements of small, individual, and decentralized onsite wastewater treatment and dispersal systems. As environmental constraints are increasingly enforced and land development pressures increase, these systems are becoming as technologically complex as the community and small city systems of the previous generation.

Engineering education (especially sanitary engineering education) has focused upon the large-scale municipal sewage treatment plants and all their associated scientific, engineering, technical, and regulatory issues. Although much of the curriculum material in the traditional sanitary engineering course is relevant to small systems as well, there are many issues unique to the small-scale system that have been neglected. In particular, the following issues are generally neglected:

- Interactions of soil and treated effluent
- High influent variability of domestic sewage
- The need for simple (passive) low-maintenance systems

- The need to capitalize upon locally available materials for economic reasons
- Fundamental differences in design philosophy between large-scale plants and small-scale plants

Recent efforts have been initiated by several national organizations, particularly the National Onsite Wastewater Recycling Association (NOWRA), the National Environmental Training Center for Small Communities (NETCSC), and the Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT). They have identified the need for specific training in onsite wastewater at engineering schools and have developed or are developing curriculum for both the undergraduate and practitioner audiences. Ideally, students should be given opportunities to practice their classroom instruction with virtual or actual "case studies."

The overall goal of the Student Design Competition for Decentralized Wastewater Treatment was to provide a forum for bringing young professionals into the field of decentralized wastewater treatment in an effort to overcome the "lack of knowledge and public misperception" barrier noted in the US EPA *Response to Congress on Use of Decentralized Wastewater Treatment Systems* (1997).

The intent of the student design competition was to bring together students in the fields of soils and environmental science, engineering, landscape architecture, and public policy development to form a team to solve a community decentralized wastewater treatment problem. The competition was to also involve professors from varied disciplines and to provide an opportunity for the professors to participate in the design competition (as coaches and consultants) and interact with other faculty.

## Project Objectives

The objectives of this competition were to:

- Promote multi-disciplinary teamwork within institutions
- Enhance students' awareness of aspects of community and small-scale wastewater treatment in a watershed context
- Embrace engineering, soil science, hydrology, watershed science, communications, and public policy issues
- Stimulate innovative ideas and solutions to primary environmental concerns associated with onsite wastewater treatment and dispersal

# 2 OVERVIEW

The design competition was introduced in two phases. Phase 1, conducted in the spring semester of 2002, involved the development of many of the components and pilot-testing of the design competition process at two universities as a noncompetitive prototype. Phase 2, conducted during Academic Year 2003, modified the competition based on the feedback and results of Phase 1, included an invitation for all consortium-member institutions to participate, and provided cash awards to the top three participating teams.

## Phase 1—Noncompetitive Piloting of the Competition

The first-year competition was a noncompetitive piloting of the competition. The design problem was to design an onsite wastewater treatment system on a remotely located recreational development. The development was located on a sloping parcel of land next to a lake, which included a four-story hotel/office and approximately 150 home sites. Geotechnical issues included sideslope stability and roadways on the sloping terrain. Environmental issues included protecting the lake environment while providing for water and wastewater infrastructure to this remote development. The design problem utilized data from one of the US EPA National Onsite Demonstration Project (NODP) sites. The community name was kept confidential and all references to the state and the community were removed from the data. Available data included:

- Community layout (plan view)
- Topographic information
- Details showing the location of outcropping rock
- Location of wells
- Location of surface water bodies
- Location of all commercial and municipal facilities (hotels, stores, school, and city vehicle service shop)
- Hydrogeologic studies
- Limited demographic information

In addition, detailed itemized costs for wastewater system components such as a gravity sanitary sewer, manholes, pressure sewer, on-lot interceptor tank, blasting, excavation, and other components were available so that all student competition teams had similar cost data to compare their designs. The data set for the Phase 1 design competition resides with the Project Leader.

The Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT) provided the location for accessing the student design competition materials. A web page was developed, along with a web-based registration form. The students were provided the available data and a problem statement on the web page, as well as a discussion forum to interact with "experts" and to get questions answered. The teams had to register on the web site by the end of February 2002 and complete and submit their design and planning project by postal service by mid-May 2002.

A judging panel was assembled of individuals representing lawyers, the general public, consulting practitioners, regulatory, and academic fields. The judges were to choose the top three projects based upon particular criteria to be determined as part of the project. Factors to be considered included:

- Efficient design
- Minimum disruption to the community
- Best environmental considerations (least impact)
- Public health considerations
- Public planning policy and community involvement
- Operation and management considerations
- Other factors to be determined as part of the project development

Team members from the top three projects were to be provided transportation and lodging to attend the National Onsite Wastewater Recycling Association (NOWRA) annual conference in the fall following the submittal of the design reports.

The conference program chairman for NOWRA was asked to provide a session for the student teams to present their projects and a location in the exhibit hall to display posters developed for the final design report. NOWRA also was to provide free registration to the students. At the NOWRA conference, the team of judges ranked the presentations. No cash prizes were awarded to the design teams in this phase of the project. After the oral presentations, the students, advisors, judges, and project team assembled to debrief the project.

## Phase 2.1—Competitive Piloting of the Project Within Consortium Institutions—First Attempt

Phase 2.1, conducted during the spring semester of 2003, was a competitive design competition with cash awards for the top three winning teams. The design problem used an actual case in Vermont. Stone Environmental, Inc., a consulting firm in Montpellier, VT, agreed to share their data and maps, and helped put together the design problem. They also put together a CD-ROM of the data (the data set, a CD-ROM, and maps for Phase 2 reside with the Project Leader).

All of the necessary information to design the project was again posted on the CIDWT web page with the addition of "profiles" from various sectors that the design would affect, such as homeowners, business people, and community activists (Appendix A includes the CIDWT's Student Design Competition Home Page and profile descriptions). Also, a discussion forum was placed on the CIDWT web site to enable the students to share questions and information. Based on the feedback from the judges and advisors from Phase 1, a new rules package was developed to be more specific in what was expected of the final reports. Teams were expected to register by late February 2003 with a submittal date of mid-May 2003.

No teams registered for the competition. After reviewing the predominant complaint, that most of the senior design classes started in the fall semester and that a spring-only competition was too late in the year for students to participate, the National Decentralized Water Resources Capacity Development Project (NDWRCDP) permitted an extension of the project so that an entire academic year could be used for the design competition.

## Phase 2.2—Competitive Piloting of the Project Within Consortium Institutions—Second Attempt

Phase 2.2, Academic Year 2003–2004, was a competitive competition with cash awards for the top three winning teams. The same design was used as was offered for the spring 2003 competition for which no teams had registered. Each CIDWT institutional representative received an email announcement in late July or early August telling him or her about the student design competition project. A few weeks later, each institutional representative received fliers to be used to market the program at their institution. The CIDWT web site was updated with the new deadlines.

The deadline for registering a team was late February 2004. The deadline for submitting final design reports was mid-May 2004. A judging panel was assembled with representatives from the general public, academia, consulting engineers, and US EPA.

# 3 RESULTS

## Phase 1—Noncompetitive Piloting of the Competition

The first year was the noncompetitive piloting of the Student Design Competition for Decentralized Wastewater Treatment and was completed in the spring semester of 2002. There were two teams: one from the University of Arkansas (advisor Dr. Mark Gross) and one from New Mexico State University (advisor Dr. Adrian Hanson). During Phase 1, an evaluation instrument and decision package was created (see Appendix B).

The judging panel consisted of

- Jim Groom (general public)
- Edwin Swanson (state regulatory)
- Elizabeth Dietzmann (attorney)
- Ed Church (consulting engineer)
- Joyce Hudson (US EPA)
- Ted Loudon (academic)

However, Mr. Swanson was unable to attend the National Onsite Wastewater Recycling Association (NOWRA) conference that year.

The judges reviewed the projects two days before the oral presentations at the NOWRA annual conference. Copies of their completed evaluations are in Appendix C. Each participant received a *Certificate of Participation* and each judge received a *Certificate of Appreciation* (see Appendix D for examples of the two certificates).

The debriefing of the project took place immediately after the oral presentations of the two design teams (see Appendix E for the observations and recommendations of the group). The students generally thought that the problem was difficult, but interesting. The advisors thought the process was good for their students. The judges were disappointed with the level of design. More emphasis was placed on the "bricks and mortar," roads, and utilities than on the actual decentralized wastewater aspects of the problem. Suggestions made during the debriefing after the oral presentations at the 2002 NOWRA conference were incorporated into the Phase 2 Student Design Competition for Decentralized Wastewater Treatment.

The project team started working on the second phase, the competitive design competition, during fall 2002 (immediately after the NOWRA conference in September) so that Phase 2 would be ready for launching in January 2003. Stone Environmental, Inc., hosted the design competition project team to assist in planning and developing the second phase design problem.

## Phase 2.1—Competitive Piloting of the Project Within Consortium Institutions—First Attempt

The Phase 2 problem statement was developed and placed on the Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT) web site. Announcements and the project description were developed and sent to CIDWT institutional representatives in the fall of 2002. (See Appendix F for the project description announcement). Announcements were sent again by email and postal service in January 2003 (Appendix G provides all of the announcements for the entire project in chronological order). No student teams registered for the competition. The National Decentralized Water Resources Capacity Development Project (NDWRCDP) Steering Committee allowed the project team to delay the second-year competition to the 2003 Academic Year. The intention was to enable institutions that are on a fall senior design schedule to participate in a spring-semester competition.

## Phase 2.2—Competitive Piloting of the Project Within Consortium Institutions—Second Attempt

During the fall semester of the Academic Year 2003–2004 competition, announcements were sent out to all CIDWT institutional representatives with fliers to be posted and hand delivered to appropriate professors of engineering; landscape architecture; and soil, water, and environmental sciences. Email reminders were sent before the fall semester started. An announcement for newsletters, magazines, and other popular press was developed in August 2003. Consortium members attending the annual CIDWT meeting in Nashville, TN, on November 6, 2003 received both a flier appropriate for display and an update on the status of competition. Appendix G includes examples of the announcements developed for the August and October 2003 and January 2004 mailings.

Three teams expressed interest and registered for the competition: Massachusetts Institute of Technology (MIT) and two Texas A&M teams (see Table 3-1 for summary information about the teams participating in the Phase 2.2 competition). The MIT team did not have an advisor; the two Texas A&M teams had the same advisor, Dr. Bruce Lesikar.

The project investigator (PI) had sent emails directly to Purdue University (Dr. Don Jones), The Ohio State University (Dr. Karen Mancl), University of Tennessee (Dr. John Buchanan), and Pace University (Dr. Peggy Minnis) to encourage them to have teams from their universities register for the student design competition. The results were poor. Typical responses included that the institution did not have a design group that semester or that the institution was not set up to participate in this kind of competition.

**Table 3-1**
**Summary Information About the Teams Participating in the Phase 2.2 Competition**

| Team Institution | Professor Names | Student Names (Year, Major) |
|---|---|---|
| MIT | No advisor | Bashira Chowdhury (year, major unknown)<br>Adriana Rodriguez (year, major unknown)<br>Veronica Cedillos (year, major unknown) |
| Texas A&M | Dr. Bruce Lesikar | Andrea Froboese (senior, Ag. Engineering)<br>Lisa Grimm (senior, Ag. Engineering)<br>Matt Piazza (senior, Ag. Engineering) |
| Texas A&M | Dr. Bruce Lesikar | Philip Taucer (senior, Biological Engineering)<br>Donna Chudej (senior, Ag. Engineering)<br>Brandi Hanson (senior, Ag. Engineering)<br>Emily Sabato (senior, Ag. Engineering) |

Of the three teams that were registered with the competition, two teams submitted final reports.[1] The judging team consisted of

- Rod Frederick (US EPA representative)
- Mark Gross (both a student design competition project team member and the academic representative)
- Mary Clark (representing design engineers)
- Jim Groom (representing the general public)

Elizabeth Dietzmann was asked to again assist with the legal aspects of the design but was not able to participate.

The design teams provided poster displays and presented their designs orally in a breakout session at the 2004 NOWRA annual conference in Albuquerque, NM. The debriefing occurred that afternoon. Overall, the students were glad that they participated in the design competition because it gave them a practical and solid design experience that is not normally experienced in the undergraduate curriculum. The students felt that the most difficult part of the design report was the "people" part, not the engineering part. Appendix H includes the completed evaluation forms for the Academic Year 2003–2004 competition, Appendix I includes sample certificates of participation and appreciation, and Appendix J includes the debriefing notes from Phase 2.2 of the competition.

[1] The design reports for the two competing teams reside with the Project Investigator, Kitt Farrell-Poe. To request a copy, send an email to kittfp@ag.arizona.edu, or call (928) 782-3836.

As a result of the Phase 2.2 Competition, a student at the University of Arkansas is using the student design reports as models for performing a feasibility study for a small community in the Upper White River watershed in northwest Arkansas and southwest Missouri. The design reports are being used to provide a format for comparing alternatives. The reports are also being used for a format for public meetings and for building community support.

# 4 ANALYSIS AND RECOMMENDATIONS

## Analysis

The Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT) Executive Board believes that the universities need capacity to obtain a broader base of students for a true competition. Fortunately, steps are underway to gain that capacity, namely the development and eventual dissemination of university curriculum for decentralized wastewater management. Another alternative is that the CIDWT would be willing to work with other organizations to jointly run the student design competition. The various issues surrounding the adoption of the student design competition into an institution's curriculum are as follows:

- At present, onsite/decentralized wastewater treatment is being presented in a limited number of classroom-based courses. Farrell-Poe and Trotta (2001) discuss several barriers and impediments to incorporating the engineering aspects of decentralized, alternative, cluster, and onsite systems into an engineering curriculum (web-based or classroom-based). This would include student design competitions involving decentralized wastewater treatment problems. Essentially, professors do not feel that there is enough time to fit onsite/decentralized wastewater treatment into their current curriculum covering municipal wastewater treatment.
- The scope of the problem required a multi-disciplinary team to address all of its aspects. Universities with traditional college and departmental structures do not easily manage multi-disciplinary classes. A problem with a broad scope requires motivated professors from all of the represented disciplines, not just one professor. It is suggested that engineering professors, who can work with soil scientists, be found to try to integrate the disciplines into the design experience. Integration is not easily accomplished in traditional engineering departments.
- Since the design competition was targeted for senior design courses, there is a question about the Accreditation Board for Engineering and Technology, Inc. (ABET—the recognized accrediting organization for college and university programs in applied science, computing, engineering, and technology) approving non-engineers taking the same course. ABET requires senior-level or capstone design courses to only be available for enrollment of engineering students. To overcome this, sponsoring professors would have to open a "special problems" or "independent study" class that meets at the same time that the senior design class meets and then publicize and market the opportunity for non-engineering majors to solve a multi-disciplinary problem.
- This design competition problem was too big in scope to be incorporated into a traditional course as a "project." It really needed to be a separate course, perhaps as a senior "capstone" design experience or a projects-based course.

- In addition, the current design problem is really an entire class project, not a team project (many teams have two to four individuals). It would take a full year to address all the issues in the design problem.
- Several national design competitions are available for students and instructors to select as course projects. Even though few of the competing competitions, if any, are specifically centered on decentralized wastewater treatment, students are not majoring in "decentralized wastewater engineering," they are majoring in broader engineering areas, thus, they have wider interests. (Appendix K includes a table summarizing several competitions that were offered during the project period. These are used as examples of competition for students' time and interest.)
- Not enough professors in academia are comfortable in the decentralized field, thus they do not teach the subject matter sufficiently to support a team. Nor are the professors comfortable enough to "guide" their students. Thus, the need for the national curriculum development project.
- Perhaps the timing of the competition was a little too early in the overall plan. The national curriculum has not been officially released or marketed. With increased usage of the undergraduate curriculum, and increased comfort level of the professors using the curriculum, more demands for practicing good designs in a "safe" environment would be a natural outcome.
- Students have free will over deciding what they will choose for their senior design projects. Unless a "champion" is found that will insist that his or her students take on the Student Design Competition for Decentralized Wastewater Treatment as their senior design project, students will still have the option of choosing other, more "comfortable" projects.
- The promise of financial rewards did not appear to be a motivating factor. Perhaps the prizes were not generous enough.

## Recommendations

The CIDWT recognizes the student design competition as a valuable component of a student's learning experience. The following recommendations are presented for consideration by an entity interested in offering a national Student Design Competition for Decentralized Wastewater Treatment.

- Identify a minimum of five "champions." For any organization to conduct the Student Design Competition for Decentralized Wastewater Treatment, a minimum of five champions would need to be identified who would be interested in implementing the design competition. A sufficient number of interested programs are needed to result in a viable competition. Some teams will not complete the process for a variety of reasons. Therefore, the minimum number of five interested champions is suggested with anticipation that not all teams will be present for the final competition.

Grant money can be used to identify and motivate the faculty for participation in this program. A Request for Proposal (RFP) would identify potential champions. If a minimum number of proposals are not received, then funding could be postponed to a later date when greater interest is expressed. The funding period and thus the commitment to registering a team should be for a minimum of two years.

- Ensure that the timeline for the project recognizes the standard university structure regarding offering of classes in relation to presentations of the final reports at national meetings. Many institutions offer their capstone engineering course during the fall semester. Therefore, professors would need to be aware of the competition and notified of funded proposals in April or early May in preparation for fall-semester classes. Design courses offered during the spring semester could also enter the competition. The reports would then be available for presentation during meetings held in the summer or fall. Therefore, the minimum timeline between identification of the champions and presentation of the completed student projects at an annual meeting would be 18 months. Preparation of the scope of the project would require a greater period of time and would need to be distributed to the champions during the notification in the spring of the year.
- Consider limiting the scope of the project to facilitate completion by students from a single discipline. Departments with traditional approaches to undergraduate education would identify the project as achievable within the scope of their current courses.
- Advertise broadly through multiple organizations, agencies, and institutions including:
  - American Association of Environmental Engineering Professors (AAEEP)
  - American Society of Agricultural Engineers (ASAE)
  - American Society of Civil Engineers (ASCE)
  - National Environmental Health Association (NEHA)
  - National Onsite Wastewater Recycling Association (NOWRA)
  - United States Department of Agriculture-Cooperative States Research, Education, and Extension Service (USDA-CSREES)
  - United States Environmental Protection Agency (US EPA)
  - Water Environment Federation (WEF)
  - Two-year technical colleges
  - Community colleges
- Ensure that each competing team has an advisor. Advisors are essential for the final completion of a report. The MIT team for Academic Year 2003–2004 had no advisor and planned to complete the competition on their own time (outside of class time). It is obvious that an advisor is essential to the successful completion of the team's final report.

- Find sponsors for the program to increase the financial reward or notoriety for the winning teams.
- Consider an alternative method of getting the students involved in real-world problem solving through the use of the design competition problem as a case study for advanced classes or as a capstone design problem. The CIDWT Executive Board envisions the following components of such a course
    1. A faculty champion who serves as the faculty advisor to support students working on the capstone design problem.
    2. Students interested in the topic of onsite wastewater treatment systems would be recruited to participate in the case-study course or capstone course (hopefully, this student pool is created through the onsite wastewater treatment course).
    3. An industry liaison would be identified to work with the individual team to answer student questions, review progress reports, visit the university to present the problem, and review the final report.
    4. Students visit an actual site to learn site assessment techniques and site layout.
- Evaluate opportunities to jointly apply for a USDA Challenge Grant. To build capacity, one of the goals of the CIDWT is to encourage consortium-member institutions to jointly apply for a USDA Challenge Grant, which may provide an opportunity to develop a senior capstone course that may then be used to feed into the design competition. The grant's RFP refers to bringing multiple institutions together as well as cross-discipline hybridization.
- Involve graduate students in the student design competition. If the student design competition is used at the graduate-student level, it could be done as an individual's non-thesis, Masters of Science or Masters of Art project. It would then be entered as an individual project and not entered as a team competition.
- Revise the judging criteria for future competitions to encourage designs that are cost-effective, appropriate to the site(s) and locality, and lean towards the simple rather than the complex.
- Initiate internships and coop programs to provide practical work experience for students. Internships with companies addressing the decentralized field would raise student awareness of opportunities in this field. Also, internships would better integrate both the national curriculum and the student design competition into engineering and environmental sciences curricula. Currently, little is known about onsite/decentralized internships and coop programs. They would need to be funded by industry or colleges.

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# 6 ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AAEEP | American Association of Environmental Engineering Professors |
| ABET | Accreditation Board for Engineering and Technology |
| ASAE | American Society of Agricultural Engineers |
| ASCE | American Society of Civil Engineers |
| CSREES | Cooperative States Research, Education, and Extension Service |
| CWA | Clean Water Act |
| MIT | Massachusetts Institute of Technology |
| NDWRCDP | National Decentralized Water Resources Capacity Development Project |
| NEHA | National Environmental Health Association |
| NETCSC | National Environmental Training Center for Small Communities |
| NM | New Mexico |
| NODP | National Onsite Demonstration Project |
| NOWRA | National Onsite Wastewater Recycling Association |
| PI | Project Investigator |
| P.L. | Public Law |
| SRF | State Revolving Fund of the Clean Water Act |
| T/E | Training and Education |
| TN | Tennessee |
| USDA | United States Department of Agriculture |
| US EPA | United States Environmental Protection Agency |
| WEF | Water Environment Federation |

# A STUDENT DESIGN COMPETITION WEB PAGE AND COMMUNITY PROFILE DESCRIPTIONS FOR PHASE 2 OF THE COMPETITION

**Student Design Competition**
**for**
**Decentralized Wastewater Treatment**



## Introduction

The Consortium is developing and conducting a student design competition for decentralized wastewater treatment to provide a forum for bringing young professionals into the field of decentralized wastewater treatment. The competition is designed to promote multi-disciplinary teamwork, enhance students' awareness of aspects of community and small-scale wastewater treatment, and embrace engineering, soil science, and public policy issues. It is envisioned that the student design teams will bring together college students in the fields of Soils and Environmental Science, Engineering, Landscape Architecture, and Public Policy Development to form a team to solve a community decentralized wastewater treatment problem. Each team will have a coach or facilitator. This coach or facilitator may suggest sources of information to the team, but not actually do work or tell the students how to do it, and their consultation time should be documented in the project report.

This design competition is being introduced in three phases. Phase 1 (Academic Year (AY) 2001-2002) developed and pilot-tested the design competition to two universities as a non-competitive prototype. Phase 2 (AY 2003-2004) modified the previous competition based on the feedback and results of Phase 1 and includes an invitation for all Consortium member institutions to participate. Phase 3 (AY 2004-2005) will again make any appropriate

modifications to the design competition and will include an invitation to any institution that would like to participate.

**Eligibility:**

The 2003-2004 Student Design Competition is open to all student teams enrolled in any member institution of the Consortium of Institutes for Decentralized Wastewater Treatment, as well as friends of the Consortium. This competition may be done in conjunction with design courses.

**Schedule:**

| | |
|---|---|
| Registration of teams | Through February 27, 2004 |
| Design competition projects due | May 21, 2004 |
| Oral presentation of top 3 designs | Annual NOWRA meeting, 7-10 November 2004, Albuquerque, NM |

**Prizes * :**

A cash prize will be awarded to the first-, second-, and third-place winners. The first-place team will receive $1000; second-place team $500; and third-place team $250. Travel funds available for top three teams to go to 2004 annual NOWRA meeting.
(***** Organizers and sponsors reserve the right not to award some or all the prizes if the judges determine that the entries do not meet the competition criteria.)

**To Register a Team:**

1. Register online:
   [http://ag.arizona.edu/waterquality/Forms/DesignCompetitionRegistration/Index.htm] or
2. or contact a team member:
   Kitt Farrell-Poe (928-782-3836; kittfp@ag.arizona.edu )
   Mark Gross (501-575-8767; mgross@engr.uark.edu )

## 2003-2004 Design Problem

**Problem Statement**

Members of a northeastern US community have come to your engineering firm to have help analyzing and designing its decentralized wastewater treatment and dispersal needs. There is a river that runs through the 100-property village, and because the bacterial levels in the river are increasing, the community suspects that the quality of the water in the river is being affected by the onsite wastewater treatment systems surrounding the river. The community was, at one time, a mining town, and thus residential development is dense along the river. There are individual onsite water supplies and septic systems of varying ages and quality. Reports of failing systems

have been made, and in fact, a preliminary survey indicated that all the septic systems need to be replaced.

This community is interested in developing decentralized wastewater treatment system solutions to improve the water quality problems. However, they do not want a lot of unplanned growth; many think their systems are functioning adequately; and others are concerned with their ability to pay for improvements. They are very interested in what their options are and what your engineering firm recommends for construction and management.

Your engineering firm's design package needs to be submitted by 21 May 2004 to:

Dr. Kitt Farrell-Poe, Project Director
University of Arizona
Yuma Agricultural Center
6425 W. 8th Street
Yuma, AZ 85364

**Team Deliverables**

- A discussion of the options considered and recommended village layout with the proposed decentralized wastewater collection, treatment, and dispersal system(s). Decentralized wastewater treatment and dispersal systems include onsite and cluster systems.
- A set of wastewater (collection and) treatment plans and technical specifications (alternative technologies are encouraged). If more than one decentralized wastewater treatment and dispersal approach is being used, show one system/approach in detail with complete construction specifications with the remainder of the systems/approaches described as conceptual plans.
- A plan for developing community buy-in with public hearings and town meetings (three meeting agendas and a one-page education and outreach document for one meeting) - See community profiles .
- A sample easement form and calculate the number of easements the design plan needs.
- A wastewater management plan (you should be considering EPA Onsite Wastewater Treatment Systems Management Models 1 through 5).
- An environmental assessment of the proposed improvements in relation to the following issues:
- Will not result in undue water or air pollution
- Will not cause unreasonable soil erosion or affect the capacity of the land to hold water (stormwater)
- Will not cause unreasonable dangerous or congested conditions with respect to highways or other means of transportation
- Will not have an undue adverse effect on aesthetics, scenic beauty, historic sites or natural areas, nor imperil necessary wildlife habitat or endangered species in the area
- Identifies how the plan impacts growth, public utility services, energy conservation
- Identifies mechanism(s) for the final solution to be financially self-sustaining
- Realistic rate calculations that include the following parameters:

- project cost estimate
- operating and maintenance costs
- debt retirement/service
- capital replacement (reserve) fund
- A letter of transmittal addressed to Dr. Kitt Farrell-Poe .
- An executive summary of the design, public involvement plan, and management plan to be used as the preliminary screening, submitted as both hard and electronic copy.
- A list of people and firms assisting you in your work, their roles, and the approximate amount of time each person or firm assisted your team.

**Assumptions**

- 300 people in the design area
- 100 connections
- each dwelling has three (3) bedrooms
- every building and residence within the study area needs to be addressed in the final decentralized solution (decentralized wastewater treatment and dispersal includes onsite and cluster systems)
- 100% septic tank replacement
- there is no mandatory participation in the management plan
- test pit sites A, B, and C are municipally owned
- test pit sites D and E are privately owned
- you may not cut across Park Street
- each residence has a drinking-water well upgrade of house and their septic tank downgrade of the house
- there can be NO direct discharge into surface waters because of high incidence of recreational activities like swimming
- 30-year project life
- the average income qualifies for low-to-moderate income loans and grants
- this project is eligible for Rural Development funding

**Design Package Requirements**

- engineering drawings will be put onto paper no larger than 11" x 17"
- no colored paper for either designs or design report
- full set of design specifications for one (1) system if more than one system being designed
- section for design calculations

**Design Competition Resources**

- layout of community; locations of buildings, lot sizes, wells, type of buildings & use, and topographic map of community including bedrock outcrops & soil classes [ PDF file ]
- climate data – use Portland, Maine climate data
  - [ http://www.erh.noaa.gov/er/gyx/climate.shtml]
- soil pit data: locations of pits [ PDF file ] and soil analyses results [ PDF file ]

- NRCS Ancillary Septic System Ratings Classes [ PDF file ]
- GIS data [ Zip file ]
- community profiles [ PDF file ]
- evaluation instrument (the judging form) [ PDF file ]
- EPA Onsite Wastewater Treatment Systems Manual, 2002
  - [ http://www.epa.gov/ORD/NRMRL/Pubs/625R00008/625R00008.htm]
- EPA Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems [ PDF file ]
- EPA Management Handbook, draft
  - [http://www.epa.gov/owm/mtb/decent/management.htm#handbook]
- An expert on EPA Onsite Wastewater Treatment Systems Management Models: Dr. Robert "Bob" Rubin, North Carolina State University. To obtain information or clarification on the EPA management models, please contact Dr. Rubin via the discussion forum .
- An attorney, specializing in Management Entities, who can provide "consulting" to the student teams: Elizabeth M. Dietzmann, J.D. To obtain legal information or information on Management Entities, please contact Ms. Dietzmann via the discussion forum .
- Student mentor: A student from the previous year's competition, Shada Roberts of the University of Arkansas, has volunteered to mentor student teams. You may contact her directly via her email ( Shada Roberts ).

## Design Competition Rules

1. Teams are encourage to include engineering students, soil/environmental science students, and public policy students.
2. This is a student project. Team advisors and other faculty may provide technical assistance, and their time shall be billed as consultant time, along with the attorney and regulatory consultant. Project teams are expected to follow the honor system, and truthfully report consultation hours.
3. All questions and answers will be posted through the discussion forum so that all participants obtain the same information.
4. The top three (3) teams, as determined from the review of the Executive Summary and set of design plans, will be expected to make an oral AND poster presentation at the annual meeting of the National Onsite Wastewater Recycling Association during fall 2004. Some travel assistance and funds for poster/presentation materials will be provided.
5. Teams will use the onsite wastewater treatment and dispersal regulations from the State of Maine.

**Sponsors**

- National Decentralized Water Resources Capacity Development Project
- Consortium of Institutes for Decentralized Wastewater Treatment
- National Onsite Wastewater Recycling Association (NOWRA)
- U.S. Environmental Protection Agency (U.S. EPA)
- Water Environment Federation (WEF)

**Committee Members**

The 2003-2004 Committee Members are:

- Kitt Farrell-Poe, Chairperson, University of Arizona; kittfp@ag.arizona.edu
- Mark Gross, University of Arkansas; Mgross@engr.uark.edu

Material last reviewed: November 19, 2003

Onsite Consortium

## Student Design Competition for Decentralized Wastewater Treatment

### Community Profiles

1. An attorney has recently moved into town and purchased a home downgradient from Site A. She has a spring as a water supply and is adamantly opposed to subsurface soil absorption dispersal upslope (upgradient) from her spring.

2. Three (3) homeowners have paid for installing high-tech wastewater treatment systems at their homes within the past five years. The cost of each of the three systems was $12,000. They do not feel that their systems are contributing to water quality problems and are very resistant to modifying their current onsite wastewater treatment and dispersal systems.

3. One homeowner has a shallow well contaminated with fecal coliform. His onsite wastewater system is at least 50 years old. He is very supportive of a community-wide wastewater system that will protect all individual wells and that will be paid for by grants and loans. This homeowner is on a fixed income.

4. A local architect is an avid trout angler and has a home on the river in the community. He has a functioning onsite wastewater treatment and dispersal system, but it is within 50 feet of the river. He is very much concerned about any pipe crossing the river or near the river. He wants to know how the possibility of a pipe breaking will be addressed to protect the river. He does want the community system, is very knowledgeable about decentralized wastewater collection and treatment, and wants all technical issues addressed to protect "his" river.

5. One of the "stronger voices" in the community is an engineer who wants a conventional "big pipe" solution. In his opinion, decentralized wastewater treatment is a second-class band-aid solution.

# B EVALUATION INSTRUMENT AND DECISION PACKAGE FOR PHASE 1

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Spring 2002

Please rate the project in each of the six categories.

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | | |
| Creativity of Design | 0-10 | | |
| Quality of Engineering Design | 0-25 | | |
| Quality of Management Plan | 0-25 | | |
| Effective Use of Project Costs/Budget | 0-10 | | |
| Effectiveness of Presentation | 0-20 | | |
| **Total** | **100** | | |

Evaluator s Name: _____

**Judging Criteria**

*Completeness of Design Package*

A complete and timely design package includes:

- A letter of transmittal to the Project Team.
- A subdivision plat with lots, streets, and possibly a wastewater collection system.
- A set of "buildable" wastewater (collection and) treatment plans and technical specifications.
- A plan for developing community buy-in with public hearings and town meetings.
- A plan for developing the Responsible Management Entity.
- A project cost estimate and costs incurred while developing the plan.
- A presentation that would be appropriate to give at a community planning meeting.

The project is considered late if the project package was delivered to Dr. Farrell-Poe after May 10, 2002.

*Creativity of Design*

The Consortium Student Design Competition Project is looking for creative designs for solving onsite wastewater treatment designs. Thinking "out of the box" should be rewarded if the results are economically, socially, and technically feasible. Consider:

- creative treatment train combinations
- innovative dispersal/reuse concepts
- whether plan effectively integrates the design into other environmental issues & factors

*Quality of Engineering Design*

The design should be technically feasible, easily understood, and build-able. The plan should:

- contain complete set of specifications
- contain bid documents
- be copy-able (no multi-color lines on plans) & transferable

*Quality of Management Plan*

There should be a plan for developing community buy-in with public hearings and town meetings. There should be a plan for developing the Responsible Management Entity. The plan should address the level of management proposed, how the management will be conducted, and estimated annual costs. Complete plans should address:

- who will own the system(s)
- who will maintain/operate the system(s)
- how were rates calculated
- how does the design relate to planning and zoning
- were efforts made to cooperate with existing utilities
- what ordinances/rules & regulations were enacted if any

*Effective Use of Project Costs/Budget*

There are two aspects to this category: estimated cost of the overall project, as designed, and design plan costs. Typically, the design plan costs are in the neighborhood of 5-10% of the overall cost of the project. Operation and maintenance costs should be considered in the plan.

*Effectiveness of Presentation*

The presentation should be developed to be given to a community planning committee. Use of technical jargon, not defined or overly used, is undesirable. Visual aids should be easily understood or well-discussed, easily seen, and appropriately used. Each team is given $200 to prepare for this presentation, therefore, it is expected that a professional presentation will be conducted.

Final score reflects the average of the individual judges' scores.

# C COMPLETED EVALUATIONS FOR TEAMS COMPETING IN THE PHASE 1 COMPETITION

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Academic Year 2002-2003

Please rate the project in each of the six categories. NEW MEXICO STATE

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 6 | Pkg. Is admittedly incomplete: + for honesty this is a wastewater project - should have completed the wastewater portion. Wastewater line profile difficult/impossible to follow. No soil description/discussion or justification of soil. ABS Sys. Design |
| Creativity of Design | 0-10 | 8 | Layout shows creativity. Wastewater system design shows *some* creativity. Incomplete presentation of design detail makes judgement or creativity difficult. |
| Quality of Engineering Design | 0-25 | 15+ | Lack of calculation presentation makes judgement of quality difficult. Found no details on design flow, for instance. |
| Quality of Management Plan | 0-25 | 10? Really none presented | A lot of good general information but no specific mgmt. plans for your community design. Management costs not factored into economic analysis that drive system choice. |
| Effective Use of Project Costs/Budget | 0-10 | 8 | |
| Effectiveness of Presentation | 0-20 | 18 | Very good presentation, exceptional visuals, dominated by one person |
| **Total** | **100** | **65** | |

Evaluator's Name: Ted Loudon

**Project Evaluation Form**
Academic Year 2002-2003

Please rate the project in each of the six categories. NEW MEXICO STATE

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 5 | Considering only 4 team members, a lot got done. Blank forms + boiler plate not much help. |
| Creativity of Design | 0-10 | ? | |
| Quality of Engineering Design | 0-25 | ? | Location of treatment component + sludge would be a real problem with neighbors. |
| Quality of Management Plan | 0-25 | 0 | Very important in real life. There is much more to management than was addressed. |
| Effective Use of Project Costs/Budget | 0-10 | ? | |
| Effectiveness of Presentation | 0-20 | 17+ | Very well presented verbally, although incomplete. I felt that the depth of knowledge was much higher than anticipated. Written materials not as strong. |
| **Total** | **100** | | **General comment: Need to consider more than the pure engineering considerations.** |

Evaluator's Name: Jim Groom

**Project Evaluation Form**
Academic Year 2002-2003

Please rate the project in each of the six categories. NEW MEXICO STATE

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 6 | Lack of specifics on SBR. |
| Creativity of Design | 0-10 | 8 | Roads based on contours, non-linear. |
| Quality of Engineering Design | 0-25 | 18 | Drainfield design inappropriate. Some details missing. Valve box sheet B1, Pg 9. Percolation rate actual application rate. Lack of distribution to field. |
| Quality of Management Plan | 0-25 | 5 | Too many generalities and not enough of how to get it done. |
| Effective Use of Project Costs/Budget | 0-10 | 8 | No final, need added up. |
| Effectiveness of Presentation | 0-20 | 15 | Too many sections. 1-4 in one and tech is second. Plan sheets look good. |
| **Total** | **100** | **60** | |

Evaluator's Name: Ed Church

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Academic Year 2002-2003

Please rate the project in each of the six categories. NEW MEXICO STATE

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 9 | 3 items were not completed. |
| Creativity of Design | 0-10 | 8 | Not as many options were considered & O&M will be high. |
| Quality of Engineering Design | 0-25 | 20 | Tech. specs incomplete & analysis of options — was not as thorough as it could have been. I disagree with running sewer lines down street. |
| Quality of Management Plan | 0-25 | 20 | Lots of general philosophy stated, but not too clear on RME. |
| Effective Use of Project Costs/Budget | 0-10 | 6 | Costs seemed low. |
| Effectiveness of Presentation | 0-20 | 15 | Very thorough presentation, but should be geared to what you would really do for a client or at a public meeting - this was too technical and did not cover management at all. |
| **Total** | **100** | **78** | |

Evaluator's Name: Elizabeth Dietzmann

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Academic Year 2002-2003

Please rate the project in each of the six categories. NEW MEXICO STATE

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 7 | Good to very good; missing letter of transmittal and adequate mgt plan not addressed. Stormwater not addressed. Public involvement plan - somewhat confused with transportation issues. Short time frames for public meetings & comment time. |
| Creativity of Design | 0-10 | 9 | Creativity very good. |
| Quality of Engineering Design | 0-25 | 20 | Appropriate level of detail; O&M not costed out; only capital. Treatment alternatives were adequate to very good. |
| Quality of Management Plan | 0-25 | 5 | Discussion was generic and not specific to the project. Appeared to be quoting guidance from a theoretical perspective. |
| Effective Use of Project Costs/Budget | 0-10 | 5 | Bottom line #'s given; ranking criteria not spelled out. |
| Effectiveness of Presentation | 0-20 | 10 | |
| **Total** | **100** | **56** | |

Evaluator's Name: Joyce Hudson

**Judging Criteria**

*Completeness of Design Package*

A complete and timely design package includes:

- A letter of transmittal to the Project Team.
- A subdivision plat with lots, streets, and possibly a wastewater collection system.
- A set of "buildable" wastewater (collection and) treatment plans and technical specifications.
- A plan for developing community buy-in with public hearings and town meetings.
- A plan for developing the Responsible Management Entity.
- A project cost estimate and costs incurred while developing the plan.
- A presentation that would be appropriate to give at a community planning meeting.

The project is considered late if the project package was delivered to Dr. Farrell-Poe after May 10, 2002.

*Creativity of Design*

The Consortium Student Design Competition Project is looking for creative designs for solving onsite wastewater treatment designs. Thinking "out of the box" should be rewarded if the results are economically, socially, and technically feasible. Consider:

- creative treatment train combinations
- innovative dispersal/reuse concepts
- whether plan effectively integrates the design into other environmental issues & factors

*Quality of Engineering Design*

The design should be technically feasible, easily understood, and build-able. The plan should:

- contain complete set of specifications
- contain bid documents
- be copy-able (no multi-color lines on plans) & transferable

*Quality of Management Plan*

There should be a plan for developing community buy-in with public hearings and town meetings. There should be a plan for developing the Responsible Management Entity. The plan should address the level of management proposed, how the management will be conducted, and estimated annual costs. Complete plans should address:

- who will own the system(s)
- who will maintain/operate the system(s)
- how were rates calculated
- how does the design relate to planning and zoning
- were efforts made to cooperate with existing utilities
- what ordinances/rules & regulations were enacted if any

*Effective Use of Project Costs/Budget*

There are two aspects to this category: estimated cost of the overall project, as designed, and design plan costs. Typically, the design plan costs are in the neighborhood of 5-10% of the overall cost of the project. Operation and maintenance costs should be considered in the plan.

*Effectiveness of Presentation*

The presentation should be developed to be given to a community planning committee. Use of technical jargon, not defined or overly used, is undesirable. Visual aids should be easily understood or well-discussed, easily seen, and appropriately used. Each team is given $200 to prepare for this presentation, therefore, it is expected that a professional presentation will be conducted.

Final score reflects the average of the individual judges' scores.

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Spring 2002

Please rate the project in each of the six categories. UNIVERSITY OF ARKANSAS

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 9 | Wastewater design is quite complete. Presentation of design flow is confusing. Lack of detail on line profile. No presentation or discussion of soil. Soil disposal application rate not justified. |
| Creativity of Design | 0-10 | 7 | Good choice of decentralized concepts. No creativity in subdivision layout, landscaping, (remote) monitoring. |
| Quality of Engineering Design | 0-25 | 20 | Presentation of design is not complete w/adequate plan & profile info. |
| Quality of Management Plan | 0-25 | 5 | Inadequate detail on how management is to be set up. Only generic info given. |
| Effective Use of Project Costs/Budget | 0-10 | 8 | Shows consultant costs; construction cost detail is adequate. Cost detail is adequate. Cost failure not justified as to source and what all is included. Costs appear high. |
| Effectiveness of Presentation | 0-20 | 15 | Good presentation. Presentation clarified design. Visuals (plan) could have been better. |
| **Total** | **100** | **64** | |

Evaluator's Name: Ted Loudon

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Spring 2002

Please rate the project in each of the six categories. UNIVERSITY OF ARKANSAS

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 6 | Should have gotten a more complete package considering that there were 17 team members. Especially management plan. |
| Creativity of Design | 0-10 | ? | |
| Quality of Engineering Design | 0-25 | ? | |
| Quality of Management Plan | 0-25 | 5 | Very important in real life. Good start, but incomplete. |
| Effective Use of Project Costs/Budget | 0-10 | ? | |
| Effectiveness of Presentation | 0-20 | 15 | Well presented verbally. Written materials not as strong. |
| **Total** | **100** | **26** | |

Evaluator's Name: Jim Groom

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Spring 2002

Please rate the project in each of the six categories. UNIVERSITY OF ARKANSAS

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 8 | * Few specifics on how to manage.<br>* Is inclusion of State rules appropriate? |
| Creativity of Design | 0-10 | 6 | Linear design |
| Quality of Engineering Design | 0-25 | 20 | |
| Quality of Management Plan | 0-25 | 5 | * Few specifics of how to do. |
| Effective Use of Project Costs/Budget | 0-10 | 8 | Difficult to determine cost of each phase. |
| Effectiveness of Presentation | 0-20 | 15 | The inclusion of State rules and regulations appropriate as Tech Spec. |
| **Total** | **100** | **62** | **Spell checking & words like "ensure"** |

Evaluator's Name: Ed Church

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Spring 2002

Please rate the project in each of the six categories. UNIVERSITY OF ARKANSAS

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 10 | Items all seemed to be covered. |
| Creativity of Design | 0-10 | 10 | A lot of options were considered. |
| Quality of Engineering Design | 0-25 | 20 | Well done - realistic & affordable. |
| Quality of Management Plan | 0-25 | 25 | Good options were set out for management. |
| Effective Use of Project Costs/Budget | 0-10 | 8 | Good detailed budget considerations - but #'s on rates & reserve accounts were confusing. |
| Effectiveness of Presentation | 0-20 | 20 | Informative & easy to understand. |
| **Total** | **100** | **93** | |

Evaluator's Name: Elizabeth Dietzmann

Onsite Consortium

**Student Design Competition**
**For**
**Decentralized Wastewater Treatment**

**Project Evaluation Form**
Spring 2002

Please rate the project in each of the six categories. UNIVERSITY OF ARKANSAS

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 3 | No letter, no community involvement plan; RME suggestions made, but no decisions. Specifications document was useless. Septage disposal not adequately addressed. |
| Creativity of Design | 0-10 | 8 | Alternatives discussed showed knowledge of decentralized technology although other environmental factors not discussed. |
| Quality of Engineering Design | 0-25 | 15 | Lot of fluff, specifications document consisted of generic documents that weren't project specific. |
| Quality of Management Plan | 0-25 | 12 | 2 recommendations were provided with no decision, very skimpy on approach, no details. |
| Effective Use of Project Costs/Budget | 0-10 | 9 | |
| Effectiveness of Presentation | 0-20 | 20 | Excellent - except the concept that high income users deserve better service. |
| **Total** | **100** | **67** | |

Evaluator's Name: Joyce Hudson

**Judging Criteria**

*Completeness of Design Package*

A complete and timely design package includes:

- A letter of transmittal to the Project Team.
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Final score reflects the average of the individual judges' scores.

# D SAMPLE CERTIFICATES OF PARTICIPATION AND APPRECIATION FOR THE PHASE 1 COMPETITION

Onsite Consortium

# *Certificate of Appreciation*

awarded to:

## Jim Groom

### James Groom Associates

Consortium of Institutes for Decentralized Wastewater Treatment

**Student Design Competition - Judge**

Spring 2002

This project was supported by the National Decentralized Water Resources Capacity Development Project with funding provided by the U.S. Environmental Protection Agency through a Cooperative Agreement with Washington University in St. Louis

19 September 2002

*Date*

K. L. Fanell-Loe

*Signed*

Onsite Consortium

# *Certificate of Participation*

awarded to:

## Shafiqul Islam Abed

Consortium of Institutes for Decentralized Wastewater Treatment
**Student Design Competition**
Spring 2002

This project was supported by the National Decentralized Water Resources Capacity Development Project with funding provided by the U.S. Environmental Protection Agency through a Cooperative Agreement with Washington University in St. Louis

September 19, 2004
*Date*

K. L. Fanell-Lee
*Signed*

# E SUMMARY OF DEBRIEFING COMMENTS FROM THE PHASE 1 COMPETITION

**Debriefing Notes**
**Phase 1 of Student Design Competition**

Took place right after the oral presentations at the 2002 NOWRA conference in Kansas City, KS.

**Observations of Overall Project**

- There are three different standards that the students had to be aware of: water, wastewater, and roads.
- The discussion forum was good, but the answers arrived too late to the students.
- Should consider eliminating the Public Involvement Information Plan.

**Recommendations of Overall Project**

- Students should know Autocad
- The students and New Mexico State University advisor:
  - wanted to know the actual location of the design problem
  - liked the variety of the project because it included roads, utilities, and wastewater treatment
  - keep the variety within the design problem, don't focus too tightly on the decentralized portion
- Wanted the project smaller in scope
- Design calculations should be required in the design package
- Include Construction Industry base specs
- Keep the specifications book, but only provide one copy
- Require no larger than 11" x 17" paper for maps
- Send written work to each judge in advance
- More guidance needed on what was expected particularly the management guide (give better definition or provide guidelines)
- Consider the size of the various universities, # of students per team to try to make the competition more fair
- Have each team keep "exhaustive" list of people and firms who provided assistance to include names and amount of time
- Consider having an entry/registration fee to cover cost of materials and then return some of the unused money if applicable
- Include stormwater

**Recommendations of Design Problem**

- Include soil data
- Include climate data
- The cost analyses should include a value range for the homes in the area
- Include references to community buy-in, mindset
- Include information on the dry utilities such as electrical, phone, cable
- The Phase 1 design problem only had soil data for one section, therefore the onsite choices were very limited
- There were too many houses (15), therefore had to crowd everything to get to work, therefore recommend lower housing densities

# F PROBLEM STATEMENT AND GENERAL ANNOUNCEMENT FOR THE PHASE 2 COMPETITIVE DESIGN COMPETITIONS

Onsite Consortium

# Student Design Competition for Decentralized Wastewater Treatment

## Introduction

The Consortium is developing and conducting a student design competition for decentralized wastewater treatment to provide a forum for bringing young professionals into the field of decentralized wastewater treatment. The competition is designed to promote multi-disciplinary teamwork, enhance students' awareness of aspects of community and small-scale wastewater treatment, and embrace engineering, soil science, and public policy issues. It is envisioned that the student design teams will bring together college students in the fields of Soils and Environmental Science, Engineering, Landscape Architecture, and Public Policy Development to form a team to solve a community decentralized wastewater treatment problem. Each team will have a coach or facilitator. This coach or facilitator may suggest sources of information to the team, but not actually do work or tell the students how to do it, and their consultation time should be documented in the project report.

This design competition is being introduced in three phases. Phase 1 (Academic Year (AY) 2001-2002) developed and pilot-tested the design competition to two universities as a non-competitive prototype. Phase 2 (AY 2002-2003) will modify the competition based on the feedback and results of Phase 1 and includes an invitation for all Consortium member institutions to participate. Phase 3 (AY 2003-2004) will again make any appropriate modifications to the design competition and will include an invitation to any institution that would like to participate.

**Eligibility:** The 2002-2003 Student Design Competition is open to all student teams enrolled in any member institution of the Consortium of Institutes for Decentralized Wastewater Treatment and may be done in conjunction with design courses.

| | | |
|---|---|---|
| **Timing:** | Registration of teams | through January 17, 2003 |
| | Design competition projects due | May 9, 2003 |
| | Oral presentation of top 3 designs | NOWRA meeting, November 7, 2003 |

**Prizes*:** A cash prize will be awarded to the first-, second-, and third-place winners. The first-place team will receive $1000; second-place team $500; and third-place team $250.
(* Organizers and sponsors reserve the right not to award some or all the prizes if the judges determine that the entries do not meet the competition criteria.)

**To register a team:** Go to either the Onsite Consortium website:
[http://www.onsiteconsortium.org/index.cfm] or contact a team member:
Kitt Farrell-Poe (928-782-3836; kittfp@ag.arizona.edu)
Mark Gross (501-575-8767; mgross@engr.uark.edu)

**2003 Design Problem Statement**

Members of a northeastern US community have come to your engineering firm to have help analyzing and designing its onsite wastewater treatment and dispersal needs. There is a river that runs through the 100-property village, and the community suspects that the quality of the water in the river is being affected by the onsite wastewater treatment systems surrounding the river. The community was, at one time, a mining town, and thus residential development is dense along the river. There are individual onsite water supplies and septic systems of varying ages and quality. Reports of failing systems have been made, but there are only three known surfacing failures. This community is interested in developing cluster system solutions where needed to improve the water quality problems. However, they do not want a lot of unplanned growth; many think their systems are functioning adequately; and others are concerned with their ability to pay for improvements. They are very interested in what their options are and what your engineering firm recommends for construction and management.

Your engineering firm's design package needs to be submitted by **9 May 2003** to Dr. Kitt Farrell-Poe, Project Director, University of Arizona, Yuma Agricultural Center, 6425 W. 8th Street, Yuma, AZ 85364.

**Team Deliverables**

- A discussion of the options considered and recommended village layout with the proposed decentralized wastewater collection, treatment, and dispersal system(s).
- A set of wastewater (collection and) treatment plans and technical specifications (alternative technologies are encouraged). If more than one system is being designed, show one system in detail with complete construction specifications with the remainder of the systems described as conceptual plans.
- A plan for developing community buy-in with public hearings and town meetings (three meeting agendas and a one-page education and outreach document for one meeting).
- A sample easement form and calculate the number of easements the design plan needs.
- A wastewater management plan (you should be considering EPA Management Guideline levels 4 & 5).
- An environmental assessment of the proposed improvements in relation to the following issues:
    - Will not result in undue water or air pollution
    - Will not cause unreasonable soil erosion or affect the capacity of the land to hold water (stormwater)
    - Will not cause unreasonable dangerous or congested conditions with respect to highways or other means of transportation
    - Will not create an unreasonable burden on the education facilities of the municipality
    - Will not create an unreasonable burden on the municipality in providing governmental services
    - Will not have an undue adverse effect on aesthetics, scenic beauty, historic sites or natural areas, nor imperil necessary wildlife habitat or endangered species in the area
    - Identifies how the plan impacts growth, public utility services, energy conservation
- Realistic rate calculations that include the following parameters:
    - project cost estimate

    - operating and maintenance costs
    - debt retirement/service
    - capital replacement (reserve) fund
- A letter of transmittal addressed to Dr. Kitt Farrell-Poe.
- An executive summary of the design, public involvement plan, and management plan to be used as the preliminary screening, submitted as both hard and electronic copy.
- A list of people and firms assisting you in your work, their roles, and the approximate amount of time each person or firm assisted your team.

**Assumptions**

- 300 people in the design area
- 100 connections
- each dwelling has three (3) bedrooms
- every building must be connected to the new system(s)
- 100% septic tank replacement
- there is no manditory participation in the management plan
- test pit sites A, B, and C are municipally owned
- test pit sites D and E are privately owned
- you may not cut across Park Street
- each residence has a drinking-water well upgrade of house and their septic tank downgrade of the house
- there can be NO direct discharge into surface waters because of high incidence of recreational activities like swimming
- 30-year project life
- the average income qualifies for low-to-moderate income loans and grants
- this project is eligible for Rural Development funding

**Design Package Requirements**

- engineering drawings will be put onto paper no larger than 11 x 17
- no colored paper
- full set of design specifications for one (1) system if more than one system being designed
- section for design calculations

**Design Competition Rules**

1. Teams are expected to include engineering students, soil/environmental science students, and public policy students.
2. This is a student project. Team advisors and other faculty may provide technical assistance, and their time shall be billed as consultant time, along with the attorney and regulatory consultant. Project teams are expected to follow the honor system, and truthfully report consultation hours.
3. All questions and answers will be posted through the discussion forum so that all participants obtain the same information.
4. The top three (3) teams, as determined from the review of the Executive Summary and set of design plans, will be expected to make an oral AND poster presentation at the National Onsite Wastewater Recycling Association annual meeting in Nashville, Tennessee,

November 7, 2003. Some travel assistance and funds for poster/presentation materials will be provided.

5. Teams will use the onsite wastewater treatment and dispersal regulations from the State of Maine.

**Design Competition Resources**

- layout of community; locations of buildings, lot sizes, wells, type of buildings & use [GIS file, PDF file]
- topographic map of community including bedrock outcrops & soil classes [GIS file, PDF file]
- climate data – use Portland, Maine climate data [http://www.erh.noaa.gov/er/gyx/climate.shtml]
- soil pit data (locations of pits and soil analyses results)
- NRCS Ancillary Septic System Ratings Classes [PDF file]
- community profiles [PDF file]
- evaluation instrument (the judging form) [PDF file]
- An attorney, specializing in Management Entities, who can provide "consulting" to the student teams: Elizabeth M. Dietzmann, J.D. To obtain legal information or information on Management Entities, please contact Ms. Dietzmann via the discussion forum.
- Student mentor: A student from the previous year's competition, Shada Roberts of the University of Arkansas, has volunteered to mentor student teams. Please contact her via xxx.

**Sponsors**

National Capacity Development Project
Consortium of Institutes for Decentralized Wastewater Treatment
National Onsite Wastewater Recycling Association (NOWRA)
U.S. Environmental Protection Agency (U.S. EPA)
Water Environment Federation (WEF)

**Committee Members**

Kitt Farrell-Poe, Chairperson, University of Arizona
Mark Gross, University of Arkansas

# G ALL ANNOUNCEMENTS FOR BOTH PHASE 1 AND PHASE 2 COMPETITIONS

Onsite Consortium

# Announcement of a
# Student Design Competition For Decentralized Wastewater Treatment

September 16, 2002

To all Interested Onsite Consortium Members:

The Student Design Competition Committee of the Consortium of Institutes for Decentralized Wastewater Treatment is pleased to announce the **Student Design Competition for Decentralized Wastewater Treatment**. The competition is supported by the National Decentralized Water Resources Capacity Development Project with funding provided by the U.S. Environmental Protection Agency and is administered by the University of Arizona, Department of Agricultural & Biosystems Engineering.

Students will be provided a local or regional problem statement and the available background data and status of the community mind-set. They will be expected to complete a final "build-able" design and planning project that addresses the environmental impacts and social concerns within the project watershed during the spring academic-year term. Teams can be comprised of students from Soils and Environmental Science, Engineering, Landscape Architecture, and Public Policy Development. Each team will have a coach or facilitator who may suggest sources of information to the team, but not actually do work or tell students how to do it.

The objectives of this competition are to:

- ✓ promote multi-disciplinary teamwork;
- ✓ enhance students' awareness of aspects of community and small-scale wastewater treatment in a watershed context;
- ✓ embrace engineering, soil science, hydrology, watershed science, communications, and public policy issues; and
- ✓ stimulate innovative ideas and solutions to primary environmental concerns associated with onsite wastewater treatment and dispersal.

All interested institutions can find additional information at http://www.onsiteconsortium.org/index.cfm

**Eligibility:** Design competition is open to all student teams enrolled in any Onsite Consortium member institution and may be done in conjunction with design courses.

| **Timing:** | | |
|---|---|---|
| | Registration of teams | January 17, 2003 |
| | Design competition projects due | May 9, 2003 |
| | Oral presentation of top 3 designs | NOWRA meeting, November 7, 2003 |

**Prizes*:** A cash prize will be awarded to the first, second, and third place winners. The first-place team will receive $1000; second-place team $500; and third-place team $250.

(* Organizers and sponsors reserve the right not to award some or all the prizes if the judges determine that the entries do not meet the competition criteria.)

To register a team, either go to the Onsite Consoritum website: [http://www.onsiteconsortium.org/index.cfm] or contact a team member:

Kitt Farrell-Poe (928-782-3836; kittfp@ag.arizona.edu)
Mark Gross (501-575-8767; mgross@engr.uark.edu)
Ted Loudon (517-353-3741; loudon@egr.msu.edu)

**Student Design Competition**
**for**
**Decentralized Wastewater Treatment**

The Onsite Consortium is developing and conducting a student design competition for decentralized wastewater treatment to provide a forum for bringing young professionals into the field of decentralized wastewater treatment. The competition is designed to promote multi-disciplinary teamwork, enhance students' awareness of aspects of community and small-scale wastewater treatment, and embrace engineering, soil science, and public policy issues. It is envisioned that the student design teams will bring together college students in the fields of Soils and Environmental Science, Engineering, Landscape Architecture, and Public Policy Development to form a team to solve a community decentralized wastewater treatment problem. Each team will have a coach or facilitator. This coach or facilitator may suggest sources of information to the team, but not actually do work or tell the students how to do it, and their consultation time should be documented in the project report.

This design competition is being introduced in three phases. Phase 1 (Academic Year (AY) 2001-2002) developed and pilot-tested the design competition to two universities as a non-competitive prototype. Phase 2 (AY 2002-2003) will modify the competition based on the feedback and results of Phase 1 and includes an invitation for all Consortium member institutions to participate. Phase 3 (AY 2003-2004) will again make any appropriate modifications to the design competition and will include an invitation to any institution that would like to participate.

**Eligibility:** The 2002-2003 Student Design Competition is open to all student teams enrolled in any member institution of the Consortium of Institutes for Decentralized Wastewater Treatment and may be done in conjunction with design courses.

| | | |
|---|---|---|
| **Timing:** | Registration of teams | through February 28, 2003 |
| | Design competition projects due | May 9, 2003 |
| | Oral presentation of top 3 designs | NOWRA meeting, November 6/7, 2003 |

**Prizes*:** A cash prize will be awarded to the first-, second-, and third-place winners. The first-place team will receive $1000; second-place team $500; and third-place team $250.
(* Organizers and sponsors reserve the right not to award some or all the prizes if the judges determine that the entries do not meet the competition criteria.)

**To register a team:** Go to either the Onsite Consortium website:
[http://www.onsiteconsortium.org/index.cfm] or contact a team member:
Kitt Farrell-Poe (928-782-3836; kittfp@ag.arizona.edu)
Mark Gross (501-575-8767; mgross@engr.uark.edu)

Hi,

As a member of the Consortium of Institutes for Decentralized Wastewater Treatment, I wanted you to know about the 2003-2004 Student Design Competition co-sponsored by both the Consortium and the National Decentralized Water Resources Capacity Development Project. The Student Design Competition provides a web-based problem requiring a decentralized wastewater treatment solution that is particularly suitable for senior engineering design classes. This competition could also be used as a special problems course for non-engineers. I am attaching a flyer that describes the competition. To see all the details, go to the Onsite Consortium's web site: http://www.onsiteconsortium.org/design.cfm.

I hope your institution will consider registering a team this year. Let me know if you have any questions (kittfp@ag.arizona.edu or 928-782-3836).

Sincerely,

Kitt Farrell-Poe
University of Arizona member institution representative
Student Design Competition Project Leader

# Design Competition Prepares Students for the 21st Century

The Consortium of Institutes for Decentralized Wastewater Treatment has developed a student design competition for decentralized wastewater treatment. The idea is to provide participating schools with a set of data and a problem and ask them to organize a multi-disciplinary team to solve a community decentralized wastewater treatment problem in the context of the watershed in which it resides. By multi-disciplinary, the intention is that student teams should consist of undergraduate college students in the fields of Soils and Environmental Science, Engineering, Landscape Architecture, Hydrogeology, Watershed Science, Communications, and Public Policy Development. Funding for at least two years is being provided by the National Decentralized Water Resources Capacity Development Project.

Beginning in the fall semester of 2003, the Consortium will pilot test the competition as a competitive prototype with a limited number of schools.

Currently, Consortium member institution schools are being invited to participate in the program. Although this design competition is particularly well suited for senior engineering design classes, the teams are expected to include engineering students, soil/environmental science students, watershed science, communication, and public policy students. The design teams will have access to the problem statement, problem background and design resources, and registration information via the web at http://www.onsiteconsortium.org/index.

The teams are expected to produce a final, build-able design and planning project that should include:

- a subdivision plat with lots, streets, and possibly a wastewater collection system
- a set of wastewater collection and treatment plans and technical specifications
- a plan for developing community buy-in with public hearings and town meetings
- a plan for developing the Responsible Management Entity
- a project cost estimate and costs incurred while developing the plan
- a presentation of the final design to be given at the 2004 NOWRA conference

Some of the resources that the Consortium envision making available to the students include Web sites for manufacturers and other sources of information (such as the National Small Flows Clearinghouse and the U.S. Environmental Protection Agency's (EPA) Office of Water Management), and a consulting attorney.

As part of the student project, any advice from advisors, other professors, engineers, consultants, contractors, lawyers, etc., would be considered a billable expense and would be considered in the total planning costs (a consideration in judging the projects). Questions, answers, and other design-problem discussions will be conducted through the Competition's home page on the Consortium's Web site so that all teams can obtain the same information.

The projects will be first judged on paper. The top three student teams will then be expected to attend the NOWRA conference to present their oral and poster presentations for final judging, with travel stipends provided and cash prizes for each of the three top teams.

For more information about the Student Design Competition, click on to the project's home page at **http://www.onsiteconsortium.org/index.cfm** and click on design competition, or contact Kitt Farrell-Poe at (928) 782-3836 or **kittfp@ag.arizona.edu.**

Dr. Kitt Farrell-Poe
University of Arizona
Yuma Agricultural Center
6425 W. 8th Street
Yuma, AZ 85364

Dear Fellow Consortium Institution Representative,

The Consortium of Institutes for Decentralized Wastewater Treatment is conducting its final phase of the Student Design Competition for Decentralized Wastewater Treatment. During the 2002 Spring semester, two universities participated in piloting the design competition in a non-competitive mode. This year, we are opening the competition up to all Consortium member institutions as a competitive process with cash prizes and travel stipends for the top three teams.

Please consider entering a student team to represent your university and member institution. The benefits are multi-fold:

- it provides a real-world problem for undergraduates to practice their engineering skills;
- it provides a forum for bringing young professionals into the field of decentralized wastewater treatment; and
- it provides monetary incentives. The first-place team will receive $1000; second-place team $500; and third-place team $250.

Enclosed are five flyers to post in your department, hand out to senior design course instructors, and share with student clubs. You may even want to open a special problems class to encourage interdisciplinary teams to both work on the design project and receive credit at the same time.

Registering a team is easy.

1) Simply go to the Consortium website: http://www.onsiteconsortium.org/index.cfm,
2) Click on the design competition button in the left-hand navigation bar, and
3) Click on "Team Registration" in the table of contents.

# Design Competition Prepares Students for the 21st Century

The Consortium of Institutes for Decentralized Wastewater Treatment has developed a student design competition for decentralized wastewater treatment. The idea is to provide participating schools with a set of data and a problem and ask them to organize a multi-disciplinary team to solve a community decentralized wastewater treatment problem in the context of the watershed in which it resides. By multi-disciplinary, the intention is that student teams should consist of undergraduate college students in the fields of Soils and Environmental Science, Engineering, Landscape Architecture, Hydrogeology, Watershed Science, Communications, and Public Policy Development. Funding for at least two years is being provided by the National Decentralized Water Resources Capacity Development Project.

Beginning in the fall semester of 2003, the Consortium will pilot test the competition as a competitive prototype with a limited number of schools.

Consortium member institution schools and friends of the Consoritium are being invited to participate in the program. Although this design competition is particularly well suited for senior engineering design classes, the teams are encouraged to include engineering students, soil/environmental science students, watershed science, communication, and public policy students. The design teams will have access to the problem statement, problem background and design resources, and registration information via the web at http://www.onsiteconsortium.org/index (click on design competition).

The teams are expected to produce a final, build-able design and planning project that should include:

- a subdivision plat with lots, streets, and possibly a wastewater collection system
- a set of wastewater collection and treatment plans and technical specifications
- a plan for developing community buy-in with public hearings and town meetings
- a plan for developing the Responsible Management Entity
- a project cost estimate and costs incurred while developing the plan, and
- a presentation of the final design to be given at the 2004 NOWRA conference.

Some of the resources that the Consortium are making available to the students include Web sites for manufacturers and other sources of information (such as the National Small Flows Clearinghouse and the U.S. Environmental Protection Agency's (EPA) Office of Water Management), and a consulting attorney.

As part of the student project, any advice from advisors, other professors, engineers, consultants, contractors, lawyers, etc., would be considered a billable expense and would be considered in the total planning costs (a consideration in judging the projects). Questions, answers, and other design-problem discussions will be conducted through the Competition's home page on the Consortium's Web site so that all teams can obtain the same information.

The projects will be first judged on paper. The top three student teams will then be expected to attend the 2004 NOWRA conference in Albuquerque, NM, 7-10 November to present their oral and poster presentations for final judging, with travel stipends provided and cash prizes for each of the three top teams.

For more information about the Student Design Competition, click on to the project's home page at http://www.onsiteconsortium.org/index.cfm and click on design competition, or contact Kitt Farrell-Poe at (928) 782-3836 or kittfp@ag.arizona.edu.

**2003-2004 Student Design Competition**
**for**
**Decentralized Wastewater Treatment**

The Onsite Consortium is conducting a web-based **student design competition** for decentralized wastewater treatment to provide a forum for bringing young professionals into the field of decentralized wastewater treatment. The competition is designed to promote multi-disciplinary teamwork, enhance students' awareness of aspects of community and small-scale wastewater treatment, and embrace engineering, soil science, and public policy issues. The problem statement is based on real-life situations and issues.

It is envisioned that the student design teams will bring together college students in the fields of Soils and Environmental Science, Engineering, Landscape Architecture, and Public Policy Development to form a team to solve a community decentralized wastewater treatment problem. Each team will have a coach or facilitator. This coach or facilitator may suggest sources of information to the team, but not actually do work or tell the students how to do it. **Cash prizes** will be given to the top three teams!

**Eligibility:** The 2003-2004 Student Design Competition is open to all student teams enrolled in any member institution of the Consortium of Institutes for Decentralized Wastewater Treatment and may be done in conjunction with design courses.

| | | |
|---|---|---|
| **Timing:** | Registration of teams | through February 27, 2004 |
| | Design competition projects due | May 21, 2004 |
| | Oral presentation of top 3 designs | annual NOWRA meeting, 2004 |

**Prizes*:** A cash prize will be awarded to the first-, second-, and third-place winners. The first-place team will receive $1000; second-place team $500; and third-place team $250. Travel funds available for top 3 teams to go to 2004 annual NOWRA meeting.
(* Organizers and sponsors reserve the right not to award some or all the prizes if the judges determine that the entries do not meet the competition criteria.)

**To register a team:** Go to either the Consortium website:
[http://www.onsiteconsortium.org/index.cfm] or contact a team member:
Kitt Farrell-Poe (928-782-3836; kittfp@ag.arizona.edu)
Mark Gross (501-575-8767; mgross@engr.uark.edu)

# H COMPLETED EVALUATION FORMS FOR EACH TEAM BY THE ACADEMIC YEAR 2003–2004 JUDGING PANEL

**Project Evaluation Form**
Academic Year 2003-2004

Please rate the project in each of the six categories. CENTRAL TX WATER CONSULTANTS

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 6 | Transmittal letter not to project team (client). Tech. Specs in proposal, no separate. Plan for buy-in/community planning presentation weak. RME plan very good. Consider school & church. |
| Creativity of Design | 0-10 | 7 | Creativity very good. Design integrates environmental + other factors. Describes factors well. No effluent screens on septic tanks. |
| Quality of Engineering Design | 0-25 | 15 | No complete specs - some including Maine standards in text. Freezing ? drip irrigation. Technically feasible, understandable, buildable. Could be bid, but many questions, e.g., school, church designs |
| Quality of Management Plan | 0-25 | 20 | Mgt plan very good level. Rates and financing for affected entities not clear. Plans for regs, etc. not clear. Mgt alternatives OK, not fully specified. |
| Effective Use of Project Costs/Budget | 0-10 | 6 | Overall costs [??], not broken down for affected parties. Finance plans. |
| Effectiveness of Presentation | 0-20 | 15 | Community 500K ÷ 100 = $5000/connection. Knows subject/plan well. Misses consideration of school + others [(??)]. |
| **Total** | **100** | **69** | |

Evaluator's Name: Rod Frederick

**Project Evaluation Form**
Academic Year 2003-2004

Please rate the project in each of the six Categories. Central Texas Water Consultants

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 5 | No plans. Not much detail |
| Creativity of Design | 0-10 | 7 | Good reuse. Considered a simple septic system & drainfield for school. Should consider other treatment options besides MicroFast as single treatment system. Other environmental issues not considered. |
| Quality of Engineering Design | 0-25 | 15 | No plans.<br>Large gaps in details.<br>No bid documents. |
| Quality of Management Plan | 0-25 | 10 | Inconsistencies between ATU O&M and other O&M.<br>Not much real consideration of how to get to the management structure. |
| Effective Use of Project Costs/Budget | 0-10 | 5 | There seems to be a gap between equipment cost & construction.<br>Rate setting was not done. |
| Effectiveness of Presentation | 0-20 | 17 | Nice technical presentation, good job of presenting the design. |
| **Total** | **100** | **59** | |

Evaluator's Name: Mark Gross

**Project Evaluation Form**
Academic Year 2003-2004

Please rate the project in each of the six categories. CENTRAL TX WATER CONSULTANTS

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 6 | |
| Creativity of Design | 0-10 | 5 | |
| Quality of Engineering Design | 0-25 | 15 | |
| Quality of Management Plan | 0-25 | 10 | |
| Effective Use of Project Costs/Budget | 0-10 | 3 | |
| Effectiveness of Presentation | 0-20 | 10 | |
| **Total** | **100** | **49** | |

Evaluator's Name: Jim Groom

**Judging Criteria**

*Completeness of Design Package*

A complete and timely design package includes:

- A letter of transmittal to the Project Team.
- A subdivision plat with lots, streets, and possibly a wastewater collection system.
- A set of "buildable" wastewater (collection and) treatment plans and technical specifications.
- A plan for developing community buy-in with public hearings and town meetings.
- A plan for developing the Responsible Management Entity.
- A project cost estimate and costs incurred while developing the plan.
- A presentation that would be appropriate to give at a community planning meeting.

The project is considered late if the project package was delivered to Dr. Farrell-Poe after May 10, 2002.

*Creativity of Design*

The Consortium Student Design Competition Project is looking for creative designs for solving onsite wastewater treatment designs. Thinking "out of the box" should be rewarded if the results are economically, socially, and technically feasible. Consider:

- creative treatment train combinations
- innovative dispersal/reuse concepts
- whether plan effectively integrates the design into other environmental issues & factors

*Quality of Engineering Design*

The design should be technically feasible, easily understood, and build-able. The plan should:

- contain complete set of specifications
- contain bid documents
- be copy-able (no multi-color lines on plans) & transferable

*Quality of Management Plan*

There should be a plan for developing community buy-in with public hearings and town meetings. There should be a plan for developing the Responsible Management Entity. The plan should address the level of management proposed, how the management will be conducted, and estimated annual costs. Complete plans should address:

- who will own the system(s)
- who will maintain/operate the system(s)
- how were rates calculated
- how does the design relate to planning and zoning
- were efforts made to cooperate with existing utilities
- what ordinances/rules & regulations were enacted if any

*Effective Use of Project Costs/Budget*

There are two aspects to this category: estimated cost of the overall project, as designed, and design plan costs. Typically, the design plan costs are in the neighborhood of 5-10% of the overall cost of the project. Operation and maintenance costs should be considered in the plan.

*Effectiveness of Presentation*

The presentation should be developed to be given to a community planning committee. Use of technical jargon, not defined or overly used, is undesirable. Visual aids should be easily understood or well-discussed, easily seen, and appropriately used. Each team is given $200 to prepare for this presentation, therefore, it is expected that a professional presentation will be conducted.

Final score reflects the average of the individual judges' scores.

**Project Evaluation Form**
Academic Year 2003-2004

Please rate the project in each of the six categories. GFP ENGR TEXAS A&M

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 8 | Transmittal letter is not to client. Tech specs very good, details plan for buy-in inclusive. Mgt plan OK, includes fact sheet. |
| Creativity of Design | 0-10 | 97 | Very creative. Discussion integrates environmental concerns. Describes factors and use of outs types. Good discussion of site evaluation and soils. |
| Quality of Engineering Design | 0-25 | 20 | Specs mostly complete, hard to follow some plans - need more detail – use Maine specs to biddable, some questions. Biggest flaw = P.T. of septic-tank effluent for drip irrigation. Key plans not copyable (colored lines) |
| Quality of Management Plan | 0-25 | 20 | Specifies Level 5 mgt, not ownership specific. Good capital costs - $? for O&M. Excellent planning + zoning with easements/regs. ? coordinate w/ utilities. |
| Effective Use of Project Costs/Budget | 0-10 | 9 | O&M not specific – calculated for all. Capital costs not split. Great financing plan - could include rural utility as grant |
| Effectiveness of Presentation | 0-20 | 16 | Very detailed. Consider wells + drinking water. Consider soils. Good site evaluations. Knows subject/plan. |
| **Total** | **100** | **82** | |

Evaluator's Name: Rod Frederick

**Project Evaluation Form**
Academic Year 2003-2004

Please rate the project in each of the six categories. GFP ENGR. TEXAS A&M

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 7 | Need buildable plans & specs. Need plot. |
| Creativity of Design | 0-10 | 8 | Considered lots of alternatives & made a decision using combinations. |
| Quality of Engineering Design | 0-25 | 20 | Still need plans, but the calculations and detailed design considerations are excellent here. |
| Quality of Management Plan | 0-25 | 20 | Considered O&M as well as who will manage/own → city. |
| Effective Use of Project Costs/Budget | 0-10 | 9.5 | Good economic analysis that includes financing options, debt retirement, capital replacement costs, etc. Need to set a monthly sewer charge. |
| Effectiveness of Presentation | 0-20 | 18 | Great graphics. Nice sharing of the podium. |
| **Total** | **100** | **82.5** | |

Evaluator's Name: Mark Gross

**Project Evaluation Form**
Academic Year 2003-2004

Please rate the project in each of the six categories. GFP ENGR TEXAS A&M

| Evaluation Category | Scale | Score | Comments |
|---|---|---|---|
| Completeness of Design Package | 0-10 | 7 | |
| Creativity of Design | 0-10 | 7 | |
| Quality of Engineering Design | 0-25 | 20 | |
| Quality of Management Plan | 0-25 | 15 | |
| Effective Use of Project Costs/Budget | 0-10 | 7 | |
| Effectiveness of Presentation | 0-20 | 15 | |
| **Total** | **100** | **71** | |

Evaluator's Name: Jim Groom

**Judging Criteria**

*Completeness of Design Package*

A complete and timely design package includes:

- A letter of transmittal to the Project Team.
- A subdivision plat with lots, streets, and possibly a wastewater collection system.
- A set of "buildable" wastewater (collection and) treatment plans and technical specifications.
- A plan for developing community buy-in with public hearings and town meetings.
- A plan for developing the Responsible Management Entity.
- A project cost estimate and costs incurred while developing the plan.
- A presentation that would be appropriate to give at a community planning meeting.

The project is considered late if the project package was delivered to Dr. Farrell-Poe after May 10, 2002.

*Creativity of Design*

The Consortium Student Design Competition Project is looking for creative designs for solving onsite wastewater treatment designs. Thinking "out of the box" should be rewarded if the results are economically, socially, and technically feasible. Consider:

- creative treatment train combinations
- innovative dispersal/reuse concepts
- whether plan effectively integrates the design into other environmental issues & factors

*Quality of Engineering Design*

The design should be technically feasible, easily understood, and build-able. The plan should:

- contain complete set of specifications
- contain bid documents
- be copy-able (no multi-color lines on plans) & transferable

*Quality of Management Plan*

There should be a plan for developing community buy-in with public hearings and town meetings. There should be a plan for developing the Responsible Management Entity. The plan should address the level of management proposed, how the management will be conducted, and estimated annual costs. Complete plans should address:

- who will own the system(s)
- who will maintain/operate the system(s)
- how were rates calculated
- how does the design relate to planning and zoning
- were efforts made to cooperate with existing utilities
- what ordinances/rules & regulations were enacted if any

*Effective Use of Project Costs/Budget*

There are two aspects to this category: estimated cost of the overall project, as designed, and design plan costs. Typically, the design plan costs are in the neighborhood of 5-10% of the overall cost of the project. Operation and maintenance costs should be considered in the plan.

*Effectiveness of Presentation*

The presentation should be developed to be given to a community planning committee. Use of technical jargon, not defined or overly used, is undesirable. Visual aids should be easily understood or well-discussed, easily seen, and appropriately used. Each team is given $200 to prepare for this presentation, therefore, it is expected that a professional presentation will be conducted.

Final score reflects the average of the individual judges' scores.

# I SAMPLE CERTIFICATES FOR PARTICIPANTS AND JUDGES FOR THE ACADEMIC YEAR 2003–2004 COMPETITION

The Consortium

# *Certificate of Participation*

awarded to:

## *Matt Piazza*

Texas A&M University

Consortium of Institutes for Decentralized Wastewater Treatment
**Student Design Competition**
Academic Year 2003-2004

This project was supported by the National Decentralized Water Resources Capacity Development Project with funding provided by the U.S. Environmental Protection Agency through a Cooperative Agreement with Washington University in St. Louis

November 9, 2004
*Date*

K. L. Fanell-Poe
*Signed*

The Consortium

# *Certificate of Appreciation*

awarded to:

## *Mark Gross*

Consortium of Institutes for Decentralized Wastewater Treatment
**Student Design Competition - Judge**
Academic Year 2003-2004

This project was supported by the National Decentralized Water Resources Capacity Development Project with funding provided by the U.S. Environmental Protection Agency through a Cooperative Agreement with Washington University in St. Louis

November 9, 2004
*Date*

K. L. Fanell-Lee
*Signed*

# J DEBRIEFING COMMENTS FROM PHASE 2.2 OF THE DESIGN COMPETITION

**Debriefing Notes**
**Phase 2 of Student Design Competition**

Took place right after the oral presentations at the 2004 NOWRA conference in Albuquerque, NM.

**General Observations**

- Hardest part of the design report was the "people" part, not the engineering part.

**Benefits or What was "good" about the design competition**

- The students liked that the data was provided in GIS format. It was a way to "force" the students into using GIS data sets – not normally done in undergraduate curricula.
- The students liked participating in the design competition because it provided a practical and solid design experience which is not normally experienced in the undergraduate curriculum.
- The students felt that the information provided was good and valuable and the right amount.

**Challenges or What can be improved about the design competition**

- Post-graduation difficulties in developing a presentation and poster. All of the student this time around either had graduated, gotten a job, and moved away or was in graduate school.
- The design problem did not have many soil test pits which forced the students to only look at those locations where the test pits were (as it turns out, these sites were the only sites that were conducive to soil treatment).
- No state regulations were specified. Students used Maine's regulations because that's the climatological data that was indicated.

**Recommendations of Overall Project**

- The group brainstormed on possible solutions to overcome the dilemma of producing a poster and presentation after graduating:
    - have the students start working on the project in the spring of their Junior year
    - use as a class project – have class break into teams to solve project and have a mini-competition like University of Arkansas did in previous cycle of competition
    - make sure students start in the fall semester, not to be done only in spring semester

# K SUMMARY OF OTHER COMPETITIONS THAT OCCURRED DURING THE PROJECT PERIOD

Summary Table of Selected Competitions for Undergraduate Engineering Students offered during the Student Design Competition project period.

| Title of Competition | Competition Sponsor | Competition Dates | Competition Description | Web site |
|---|---|---|---|---|
| 2nd Annual P3 Award: An National Student Design Competition for Sustainability Focusing on People, Prosperity, and the Planet | EPA | Applications due January 27, 2005 | The P3 competition will provide grants to teams of college students to research, develop, and design solutions to challenges to sustainability. P3 highlights people, prosperity, and the planet - the three pillars of sustainability - as the next step beyond P2 or pollution prevention. The P3 Award program is a partnership between the public and private sectors to progress toward sustainability by achieving the mutual goals of economic prosperity, protection of the natural systems of the planet, and providing a higher quality of life for its people. Approximately 50 grants of up to $10,000 each will be awarded. | A summary of the program can be found athttp//es.epa.gov/ncer/p3/ The 2005 Request for Proposals and more detailed information can be found athttp//es.epa.gov/ncer/p3/designs_sustain_rfp_2005.html |
| Outdoor Shooting Range Student Design Competition for engineering students | FL Dept of Environmental Protection, Nat'l Assn of Shooting Ranges, & Sporting Arms and Ammunition Manufs Institute | Applications due September, 16, 2002 | The objective of this competition is to stimulate innovative ideas and solutins to the primary environmental concerns associated with shooting ranges – lead contamination. The focus will be on shooting ranges in Florida and its environmental, geologic, and geographic conditions, but with applicability to other parts of the country. | http://www.eng.fsu.edu/designcomp |

| | | | | |
|---|---|---|---|---|
| ASAE Environmental Design Competition for Students | American Society of Agricultural Engineers | Applications due May 1, 2001 | The community is requesting a design for a wastewater treatment system. All designs must consider technical, economic, environmental, safety, and social factors. Designs must be presented in the form of a written report for initial judging, with all teams making oral presentations at the annual ASAE meeting. | http://www.ae.iastate.edu/enviroweb/2000-01/page.htm |
| Capstone Design Option for ABE, AME, ChEE, ECE, MSE, OpSci, SIE | University of Arizona | (new course) | We're looking for highly motivated engineering seniors to develop broad, creative design solutions. Students will work in multi-disciplinary teams to create a product or process prototype. Course format will be classes on design process taught by an industry adjunct supported with faculty/ industry consultations, leading to clearly outlined design deliverables. | |
| ASCE Mid-Continent Region Dam Competition 2002 | University of Oklahoma | 2002 | A prospective client wishes to build a dam in Obsidian Canyon. The name is indicative of the material that the canyon walls are made from. Due to this unusual rock formation, the prospective client has decided to hold a competition for the design of the dam. Since obsidian is an easily fractured material, no blasting or modification (i.e., rock anchors, drilling, keying, etc.) of the dam area is permitted. | |

| | | | | |
|---|---|---|---|---|
| Interdisciplinary Contest in Modeling | Nat'l Security Agency and Nat'l Science Foundation | February 7-11, 2002 | This contest encourages students from different disciplines to compete as a team using applied problem-solving techniques to resolve a real-world problem. | http://www.comap.com/undergraduate/contests |
| MCM: The Mathematical Contest in Modeling | The Consortium for Mathematics and its Applications | annual contests | Challenges teams of students to clarify, analyze, and propose solutions to open-ended problems. The contest attracts diverse students and faculty advisors from over 500 institutions around the world. To participate in MCM a team must be sponsored by a faculty advisor from their institution. | http://www.comap.com/undergraduate/contests/mcm |
| ICM: The Interdisciplinary Contest in Modeling | The Consortium for Mathematics and its Applications | annual contests | An international contest for high school students and college undergraduates. ICM is an extension of Mathematical Contest in Modeling (MCM). It is designed to develop and advance interdisciplinary problem-solving skills as well as competence in written communication. | http://www.comap.com/undergraduate/contests/icm/ |

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