HUMBOLDT STATE UNIVERSITY

ASCE

STUDENT CHAPTER
AMERICAN SOCIETY OF CIVIL ENGINEERS
ENVIRONMENTAL RESOURCES ENGINEERING

ERE MESSENGER

Volume 16, Number 2 Spring 2003

ERE Curriculum Changes: Engineering Design and Computational Methods

by
C. Mike Anderson, PE
ERE Professor and Chair

Effective Spring 2003, there are changes to two areas of the undergraduate ERE curriculum: engineering design and computational methods. The numbers of required courses and units remain unchanged, but some content and distribution changes are significant. The changes were approved too late to appear in the 2002-2003 printed catalog, but we expect them to be posted to the HSU On-Line Catalog at <www.humboldt.edu/~catalog> by mid February 2003.

Engineering Design

We replaced our old elective course ENGR 490 "Senior Design Project" with a new required course ENGR 492 "Capstone Design Project." The primary purpose of ENGR 492 is to demonstrate to students, faculty, potential employers and grad schools, and the Accreditation Board for Engineering and Technology (ABET) that all ERE graduates have the ability to apply the engineering design process to solve complex, broad-based environmental resource problems. ENGR 492 focuses entirely on the engineering design process and its application to solve real ERE problems. Capstone (or culminating) is a key word here; ENGR 492 is the last in a series of course containing engineering analysis and design. Projects will involve multiple aspects of air-water-land-energy issues learned from previous required and elective courses. Broad project themes include: prevention and control of pollution, allocation and management of resources (especially scarce resources), and sustainable development.

Under the old scheme, students selected four senior design electives from an approved list. Under the new scheme, students select three senior design electives from the approved list, plus all students take ENGR 492. In selecting their three elective senior design courses, students choose the topics they wish to cover. Students in ENGR 492 do not choose the topic, but rather show that they are competent in the broad areas of their degree title, Environmental Resources Engineering. This change will make it much easier for us to demonstrate to ABET that all of our students have received the required capstone design experience.

Finally, we added a new senior

• continued on page 5

ENGR 492. Capstone Design Project. 3 units. Culminating ERE design experience based on knowledge gained from previous coursework. Application of the engineering design process to develop a system, process or management plan to solve a significant, open-ended ERE problem. To be taken final senior semester (within 16 units of graduation).

In This Issue

Alumni Profiles

Joaquin Wright (ERE 2002)
Engineer
Bryan A. Stirrat & Associates
Diamond Bar, CA 91765
jwright@bas.com
www.bas.com

I often wondered what I would really be doing after school was over. Although my classes were interesting, it was hard to see how they would pertain to a "real" job. I ended up working for Bryan A. Stirrat and Associates in the landfill business, you know….Garbage. In this business our projects encompass almost all the "disciplines" within environmental engineering.

To help current ERE students see what they might expect in our field, in the real world, I have summarized below two of the projects I am currently working on.

Belmont Learning Complex in Los Angeles, California.

We are designing and installing a Methane extraction and removal system on 40 acres of residential land in a neighborhood directly north of downtown Los Angeles. A methane extraction system is to be installed under the new school at the site, Belmont Learning Complex.

The project was resurrected after it had been shut down in mid stream, around 1998. The first construction companies did not account for environmental concerns to a level appropriate, and as a consequence the construction was halted. Four years later, with a new team of constructors and engineering firms, it has been restarted and construction is scheduled for April 2003. We have been hard a work developing a system that will insure no migrating gas from the old oil fields comes up into the school buildings, fields or play areas. It might sound simple, but it is quite a challenge to develop membrane and extraction systems that are going to be installed under and into existing and planned buildings. We have to account for all the underground utilities, keeping our system below them and allowing for our system to drain as well; it is an engineering design challenge. Along with the extraction system we also are putting in detection devices and blowers that can evacuate all the buildings of "contaminated" air instantly, if the need arises. During the design process we have other engineers and geologists drilling at the site and taking soil samples, water samples, and running tests to get information that will help us design the correct system for the site. I am one of four design engineers focusing on the membrane and gas removal system. In the end, our portion alone will be approximately $4 million. The total project is estimated to cost at least $80 million. Needless to say, if we need something to help us do our work, we get it.

Prima Deschutes Landfill in Irvine, California.

Prima has been the most interesting of my projects. During the permitting involved with the local government to expand the site (something that happens every year or so) all the various government agencies have there input. As a result of the last go around, we mitigated many riparian areas, rebuilt a stream and its relative ecosystem around the site, and we designed and constructed a new area of expansion, which we call "cells". In order to move and rebuild a stream in the hills, every type of biologist, environmental engineer, soils engineer, and politician had a part to play.

In the end I got to design the stream and it's basic structure (under a much more experienced engineer) as we rerouted the stream down the mountain away from the future cell. Due to natural constraints (the mountain) we had to build into it waterfalls and energy dissipation structures as well as riparian areas and marsh areas. All of this was accomplished under the eye of nearly every regulatory agency that every existed!!! It was a neat project to be part of.

To end my time on the soap box, here is one piece of advice .... Listen up when your instructors talk about the projects they have worked on. This is the best information you can glean from school. It is where the true gems of information are that can shed some light as to what we actually do as environmental engineers. Personally, I find it very fulfilling. I am very proud to have survived the meat grinder I call ERE at HSU. It was and is no cakewalk, as we all know, but it has served me well.

If you plan to head for southern California when you graduate, please send me your resume. I will do what I can to help you find opportunities. It is a small world and the more HSU ERE graduates that work in it the better we will all be. ERESA

S T A F F

EDITOR
Celeste M. Peltier

FACULTY ADVISOR
Mike Anderson

PRINTING
University Graphic Services

For comments or subscriptions:
ERESA@axe.humboldt.edu

To the optimist, the glass is half full.

To the pessimist, the glass is half empty.

To the engineer, the glass is twice as big as it needs to be.

INTERNSHIPS FOR ERE STUDENTS

by
Barbara Peters
Career Counselor
HSU Career Center

What is an internship and why should you do one? An internship is defined as an "out of classroom" experience related to the student's major or career goals. The position can be a volunteer position, offer a stipend (a fixed amount of pay), or provide an hourly wage; positions can be offered part-time during the school year or full-time over the summer. Some employers offer "summer jobs" that can even fall under the "internship" definition because they relate to the student's major.

The importance of completing an internship in your field cannot be stated too strongly. In my 26+ years of working with college students, I am constantly reminded of the value a student gains from working in his/her field over the summer or during the school year. In fact, in the "Survey of Graduates" that the HSU Career Center conducts every year, "work/volunteer/internship experience" in consistently listed as the most important factor that graduates mention in assisting them to obtain their first job after graduation. An internship can help the student focus their educational and career goals, apply what they are learning in the classroom to actual engineering projects, gain experience, and make contacts which are invaluable when it comes to job hunting after graduation.

The best time to start researching and applying for summer internships is early in the Spring semester, although some internships and summer jobs will not be advertised until May. Some samples of internships that have been available for ERE students in the past include the following:

- Indian Health Service (PHS) – Student Engineer (COSTEP) to design and construct water, wastewater, and solid waste facilities for Indian communities throughout the country. Deadline is December 31, but applications accepted year-round.
- Environmental Protection Agency – Waste Management Intern. Offered through the Environmental Careers Org. (www.eco.org).
- CalTrans – Engineering Student Assistant. Various locations throughout northern California. Deadline varies – usually in March
- Calif Dept of Water Resources – Flood Mgt Student Assistant
- Idaho Department of Environmental Quality – Environmental Trainee
- City of Eureka – Engineering Aide
- Central Contra Costa Sanitary District – Engineering Intern (6 month position)
- County of Humboldt – Engr Aide. Deadline usually in March
- John Carollo Engineers (Walnut Creek) – Summer Engr Intern
- Foresight Energy Company (Larkspur, CA) – Solar/Efficiency Intern
- Golder Associates (Roseville, CA) – Engineering Student Intern
- Pacific Gas & Electric – Environmental Engineering Intern
- Pacific Soils Engineering – Summer Engineering Intern
- URS Corporation – Design Engineering Intern
- SHN Engineering – Environmental Engineering Intern

Current internships advertised through the HSU Career Center can be accessed through the Career Center webpage (www.humboldt.edu/~career). After you register through MonsterTRAK, go to the "Jobs and Internships" section of MonsterTRAK. In the "keyword" block, type "Humintern SNRE/" – this will give you the current "Science, Natural Resources and Engineering" internships being advertised:

- Sonoma County Water Agency – NR Program Assistant
- Biogeochemical Research Initiative for Education (BRIE) – Undergraduate Fellowship. Deadline is February 28, 2003.
- Consumer Energy Council of America – Public Policy Intern. Internships available year-round.

Other opportunities currently available for ERE students can be found in binders in the HSU Career Center or on-line with the National Science Foundation (Research Experience for Undergraduate – REU positions) at www.nsf.gov

- Natural Resources Conservation Service – SCEP position in Engineering in California. Deadline extended to January 21, 2003.
- U.S. Forest Service – SCEP positions in Civil Engineering throughout U.S. – HSU deadline for interviewing on campus: January 31, 2003; deadline for applying directly to USFS regions. Deadline - February 28, 2003.
- Environmental Protection Agency – Student Temporary Employment Program (STEP) positions in Engineering in North Carolina. Deadline - March 28, 2003. (see www.epa.gov/jobs).
- Department of the Navy – Engr Aid/Tech (STEP) in Pacific Geographic area. Deadline: Open. (See www.usajobs.opm.gov).
- Colorado State University – REU program in Water Research. $2400 stipend. Deadline – March 28, 2003.
- University of Idaho – REU program in Environmental Research for under-represented students. $3528 stipend. Deadline – March 15, 2003.
- University of Notre Dame – REU

position in Water Resources in Developing Countries. Deadline – February 17, 2003.

- Washington University in St. Louis – REU position in Environmental Engineering Science Program. $4000 stipend. Deadline – March 15, 2003.
- Rowan College of Engineering (New Jersey) – REU position in Pollution Prevention. $1000 monthly stipend. Deadline – March 14, 2003.
- Clarkston University (New York) – REU position in Environmental Sciences and Engineering. $3500 stipend. Deadline – March 1, 2003.
- North Carolina State University – REU position in Green Processing. Deadline – February 28, 2003.

As the semester continues, more internships and other summer opportunities will be advertised through MonsterTRAK, in the ERE Department, and on-line. The Career Center usually sends an e-mail advertisement to Mike Anderson and/or Beth Eschenbach in the ERE Department and they will forward these e-mails to students on their listservs. Students can also pursue setting up their own internships or summer opportunities with private engineering firms. Several resources are available to help students identify environmental engineering firms. The Career Center has a copy of the Selection Guide, published by the American Academy of Environmental Engineers. The American Consulting Engineers Council has a website (http://206.135.109.15) where students can search for engineering firms by topical area. And, students can also locate consulting firms in specific geographic areas by using the "Yellow Pages" of the telephone directory.

When applying for internships and summer jobs, you will need to fill out an employer's application, complete a federal resume (kept in a database at www.usajobs.opm.gov), or submit a resume and cover letter. Students can pick up a Resume Guide in the HSU Career Center (NHW 130). Barbara Peters, Career Counselor for the ERE major, is available by appointment to check over applications, resumes, and cover letters. Just stop by the HSU Career Center or call 826-3341 to schedule an appointment.

To summarize, here are some basic tips to remember when applying for internships and summer jobs:

- Start early in Spring semester and continue looking throughout the Spring.
- Prepare your resume, cover letter, and federal resume in advance.
- Monitor MonsterTRAK (www.humboldt.edu/~career) weekly for any newly advertised opportunities.
- Check the federal government website (www.usajobs.opm.gov), Student Jobs section, weekly for any new Engineering Aid/Tech positions.
- Check your e-mail regularly for any internships sent to you by the Career Center or faculty in your department.
- Watch the bulletin boards or doors of faculty offices.
- Do your own searches for summer internships on-line.
- Contact consulting engineering firms to set up your own internships.

Good luck and happy hunting! ERESA

ERE Curriculum Changes

• continued from page 1

design elective, ENGR 498 "Directed Design Project," to provide students the opportunity to earn design credit for independent projects under the direction of an ERE faculty member.

Computational Methods

We deleted three required 3-unit courses and replaced them with three new required 3-unit courses. The old courses are: MATH 225 "Applied Linear Algebra with Ordinary Differential Equations" and ENGR 221, 321 "Computational Methods I and II." The new courses are ENGR 225, 325, 326 "Computational Methods I, II, III." All three new courses have two 1-hour lectures and one 3-hour lab

• continued on page 11

The Moment

by
Thavisak Syphanthong
ERE Senior

The Moment we met is like
The Moment of Inertia
When the two of us are standing
On this earth here
And our velocities are crossing the control volume
Of love and despair
In hopes of crossing the northern and southern
Hemisphere
Which is the sum of the torque
From London to New York
That would return vectors
Of **r** and **v**
That are the symbolizations of you and me
And **w** is the omega
Of a rotary water sprinkler
That sprinkles tears of rain
When doctors operate the brain
To dig up emotions
That would dry up oceans
And there are operating systems
That can calculate
The inflow of steam engines
And pistons
But they cannot compare
With the steam rising
When we are kissing
And they can program a program
To find pressure heads
Of wells that are missing
But they cannot derive something as essential
As the Art of Kissing
And our Love is like
The flow of groundwater
That is u-surfaced from the earth first
And purified through
A drinking water system
That is aggravated, coagulated
And agitated until the mixture is complete
And we meet together as one
In the Moment that we met.

A SUSTAINABLE AGRICULTURE INTERNSHIP IN WILLOW CREEK

by
Charles Lessmann
Grad Student in Environmental Systems/IDT

ZZZZZZZzzzzzzzzzz...... And then, blink-blink, I am awake. It's always easier for me to wake up outdoors. I jump from the tent in a flourish of zippers, and walk out to the field to pick corn. It's cold, dim, and wet in the corn before the sun comes up, but I don't mind, 'cause it's gonna be over a hundred today. The sun climbs over the crest of neighboring Six Rivers National Forest, and beams a bright good morning from the East.

The corn is picked and stacked inside the cooler in an hour – only need 15 boxes for the farmers' market in Weaverville today. Everything picked this morning will be on the truck to Weaverville this afternoon. Beans are the next harvest on the agenda. But string beans take forever to pick - the crisp little legumes hide under the plant's broad-leafed canopy like my nose under this wide-brimmed hat. By 11:00 am, 300 pounds of beans are washed, bagged, and stacked in the cooler. They will be picked again in a couple days. Green beans, yellow beans, romano beans, and French filet beans – some remain on the plants or in the field, but the soil will welcome them back soon enough with a warm dirt hug.

Michael Peterson is on the tractor planting winter crops as full-time "hands" Paul, Tim and I start picking the cucumbers. At 18 acres, Willow Creek Farm is a small operation as California agriculture goes. But Michael is forever rotating fields to maximize productivity, and the earth responds. The snow peas of May and June are gone, replaced by October's brussel sprouts. Tim and I finish picking the lemon cucumbers, while Paul washes up the slicing "cukes." Then we continue on to the summer squash and zucchini. It's still before noon and that's a good thing, because the squash need to stay cool (and in a couple hours it's going to be too hot to walk barefoot in the field anyway). When we're finished with the squash, everyone packs up the truck and Paul drives it over to Weaverville.

Once the truck is gone, it's time for a break. The midday heat is brutal, but luckily the Trinity River is next door. Whoooeeee, the water is welcomingly cold. Nerve endings scream, then fall silent as the relentless current whooshes present into past, and my core temperature returns to normal. I dry off on a nearby hunk of basalt, and walk back to the farm for a bite of lunch in the small outdoor kitchen. Later, there are baby cabbages to protect from an outbreak of pigweed.

The afternoon cruises by in contemplative meditation, as the "hula hoe" sluices easily through the soft topsoil. The humble tool is basically a metal "O" on a stick. By stirring up the top few inches of soil, I create a "dust mulch" - a layer of soil that will be unable to germinate weed seeds. Soon the cabbages will be big enough to shade out any competitors, and the weed invasion will be turned back again. Timing is everything in organic agriculture. A couple of well-timed weeding sessions, combined with equally timely watering, can be enough to bring a dense crop to harvest.

After we check irrigation lines and hydrants, Michael turns on the water just before dark, to give the ripening melons and winter squash a thorough soaking. Watering at night keeps evaporation to a minimum. Aqueous love from the Trinity will be turned into veggies by tomorrow's sun. We look for severe leaks or washouts in the irrigation line. There are none. The workday is over.

Tonight, New Orleans Tim is preparing dinner in the form of organic-vegetarian-Ital-Cajun-stir-fry fusion. "Needs a little more *olive earl*," he says, as the madman Lee Perry dubs away on the small kitchen boom box. My body is sore, but not as sore as last week or the week before. The grinder's wheel of manual labor continues to slowly sharpen my mind. When I started this sustainable agriculture internship (ENGR 699) in May, I was long on sustainability rhetoric, but short on practical experience. Now, in July, I've learned I can help the Earth grow completely organic food – by the truckload – for four and five local markets weekly. Sustainability was a hollow word to me before this experience. But through this fulfilling work, I've found that sustainability is sustainable for me. ERESA

Some MIT Course Evaluations:

"This class was a religious experience for me...I had to take it all on faith."

"Text makes a satisfying 'thud' when dropped on the floor."

"Problems sets are a decoy to lure you away from the real exam material."

"Textbook is confusing...someone with a knowledge of English should proofread it."

"Help! I've fallen asleep and I can't wake up!"

"Text is useless. I use it to kill roaches in my room."

"The absolute value of the course was less than epsilon."

"I didn't buy the text. My $60 was better spent on the Led Zeppelin tapes I used while doing problem sets"

"Information was presented like a ruptured fire hose–spraying in all directions–and no way to stop it."

"What's the value of the text? It is printed on high quality paper."

REMOVAL OF SELENIUM THROUGH REDUCTION IN ANAEROBIC SOILS:
A COLUMN STUDY

by
Mark Leisenring (ERE 2001) and Jim Howell (ERE 1994)
GeoSyntec Consultants, Inc.
Portland, OR

Abstract: A static column study was conducted for three weeks in September 2002 to identify an effective soil medium for reducing selenium in the surface waters of San Diego Creek in Orange County, California. Six media mixtures were examined, each consisting of one or more of the following: native soil, silica sand, chopped cattails, municipal green waste, coconut fiber (coir), and sodium acetate. Wetland soil from the San Joaquin Marsh was used as the inoculum for each of the mediums, as it was believed that these anaerobic soils contained selenium-reducing bacteria. The results of the study indicate that the medium consisting of native soil, silica sand and chopped cattails was effective at removing soluble selenium from the source water and had other desirable characteristics (ie. inexpensive, easy to obtain, no unwanted chemicals, etc.). This media mixture was chosen for further study in a mesocosm-scale experiment.

Background

Selenium concentrations in the base flows of San Diego Creek are frequently observed at levels that exceed the California Toxics Rule (CTR) chronic toxicity criteria for the protection of aquatic life (40 CFR §131.38). The current source of selenium in the watershed (Hibbs and Lee, 2000) is the historically reduced soils of the Swamp of the Frogs, which have been exposed to a fluctuating groundwater table ever since the swamp was drained for agriculture in the early 1900's. Exposure to oxygenated groundwater slowly releases soluble selenium from the historic soils of the swamp into the groundwater that eventually enters the creek.

The Irvine Ranch Water District (IRWD) has initiated a pilot study to examine the treatability of selenium-laden waters using a subsurface flow constructed wetland design that would function similarly to the historic Swamp of the Frogs by immobilizing selenium in reduced sediments. The pilot study was divided into two parts. The first is a laboratory-scale static column test, and the second is a field-scale dynamic mesocosm test. Limited results of the laboratory column test are presented in this article.

Objectives and Approach

The purpose of the column study was to identify an effective and efficient selenium-reducing medium for further study at the flow-through mesocosm level. Six soil mixtures, approximately proportioned by wet volume, were chosen for analysis:

- Medium 1: 90% native soil, 10% wetland soil;
- Medium 2: 60% native, 10% wetland soil, and 30% sand;
- Medium 3: 50% native soil, 30% silica sand, 10% wetland soil, 10% chopped cattails;
- Medium 4: 50% native soil, 30% silica sand, 10% wetland soil, and 10% green waste;
- Medium 5: 50% native soil, 30% silica sand, 10% wetland soil, and 10% coir; and
- Medium 6: 90% silica sand, 10% wetland soil, and 5 mmol sodium acetate.

Research on the biogeochemical behavior of selenium in anaerobic soils revealed that selenium reduction generally follows the sequential reduction (i.e. increasing oxidation-reduction potential (ORP) of dissolved oxygen, nitrate, manganese(IV), and iron(III). Sulfate reduction generally follows selenate and selenite reduction (Masscheleyn et. al., 1991). Consequently, field measurements of DO and ORP were taken daily to estimate the onset of reduction and determine when sampling for laboratory analysis would begin.

The columns were made out of 6-inch diameter polyvinyl chloride (PVC) cut to 5-foot lengths. Labcock valves installed in the bottom of the columns were used to collect samples. Six different detention times were examined for the six media mixtures under static conditions. A separate column was used for each media-detention time combination. Two laboratory samples (standard plus one replicate) were taken from two separate columns at the end of each scheduled detention time, resulting in 36 columns that were each sampled twice. The prepared media was placed into the columns, above a 4" bottom layer of #20 filtration sand. A mesh filter was used to prevent clogging of the port.

Water Quality Monitoring

The columns were filled with media and source water on August 26, 2002., n August 27 field monitoring began. Two field probes were placed into two of three inline cells for measurement of DO and ORP. Water temperature was also recorded. Due to very low flow rates observed in the first two media mixtures, it was decided to abandon these columns. On September 7, nearly two weeks after the beginning of the experiment, the columns containing the four remaining mediums were drained and refilled from the bottom with source water. The drain water was analyzed for the entire suite of laboratory parameters shown in Table 1. Official sampling for the analytical suite of parameters began on September 9 and followed every 2 days for a total of 5 sampling events.

Table 1. Suite of Analytical Water Quality Parameters

Dissolved organic carbon (mg/L)	Nitrate as N (mg/L)
Total organic carbon (mg/L)	Nitrite as N (mg/L)
Hydrogen ion (pH)	Dissolved oxygen (DO)
Iron (II) and Iron (III) (mg/L)	Dissolved selenium (mg/L)
Dissolved manganese (mg/L)	Total selenium (mg/L)
Total manganese (mg/L)	Sulfate (mg/L)
Oxidation-reduction potential (mV)	

Results

Dissolved organic carbon is a measure of the amount of electron donor available for microbial metabolism, which tends to catalyze the reduction of electron acceptors, such as oxygen, nitrate, selenium, manganese, iron, and sulfate. Figure 1 compares dissolved organic carbon to dissolved selenium for all of the columns on Sept 7. Notice the general inverse relationship between dissolved organic carbon and dissolved selenium, indicating that the lack of sufficient electron donors in Mediums 5 and 6 contributed to the relatively high dissolved selenium concentrations in the effluent.

Samples taken from Sept 9 through Sept 19 were analyzed for the entire suite of analytical parameters. The first samples analyzed revealed that Mediums 3 and 4 already had effluent selenium concentrations less than the laboratory reporting limit of 5 mg/l (these results were shown for discussion purposes only; any values reported below the reporting limit are not considered to be the true value). Dissolved selenium concentrations for each column of each media type are shown in Figure 2. Note that all of the columns had dissolved selenium concentrations below the reporting limit on the final sampling date (Sept 19). An interesting phenomenon observed in these data is the significant reduction in dissolved selenium in the second sample (replicate) taken from a column as compared to the first sample (standard). The reason for these “dips” in concentrations is undetermined. However, it is speculated that these reductions are due to the uneven distribution of electron donor and/or microbial populations caused by refilling the columns from the bottom with source water on Sept 7.

Notice that the samples taken from Medium 6 on Sept 11 and 13 had selenium concentrations greater

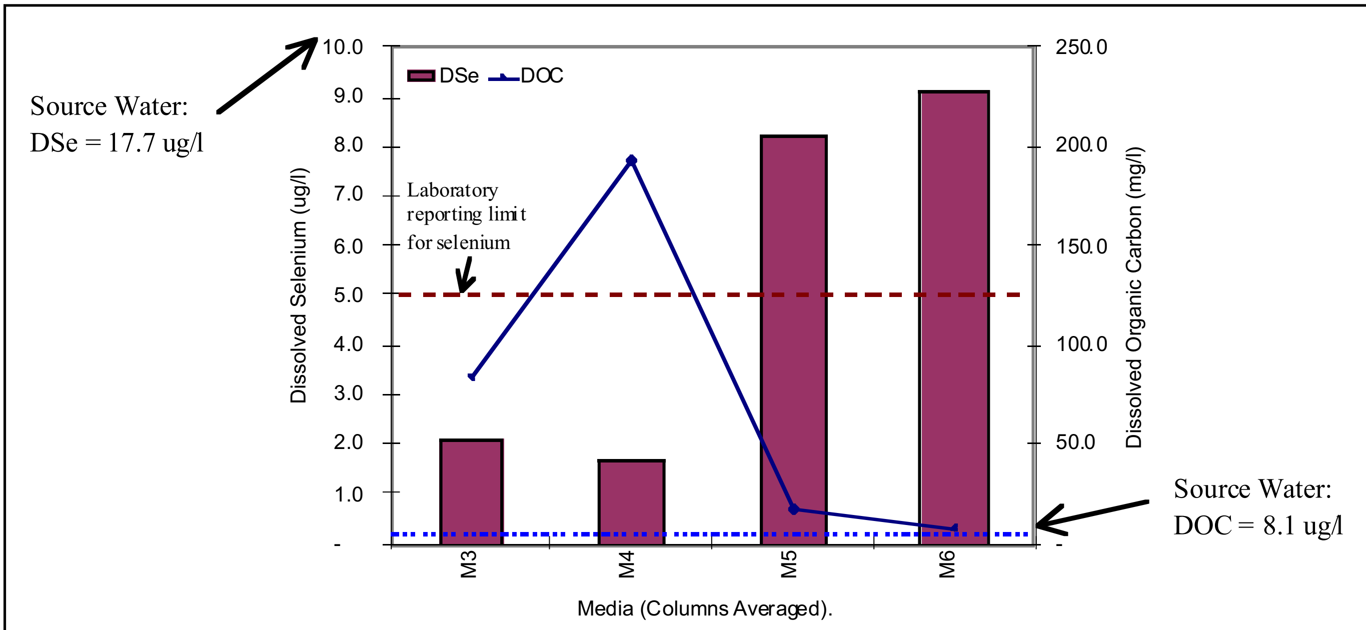

Figure 1. Dissolved Selenium vs Dissolved Organic Carbon (September 7, 2002)

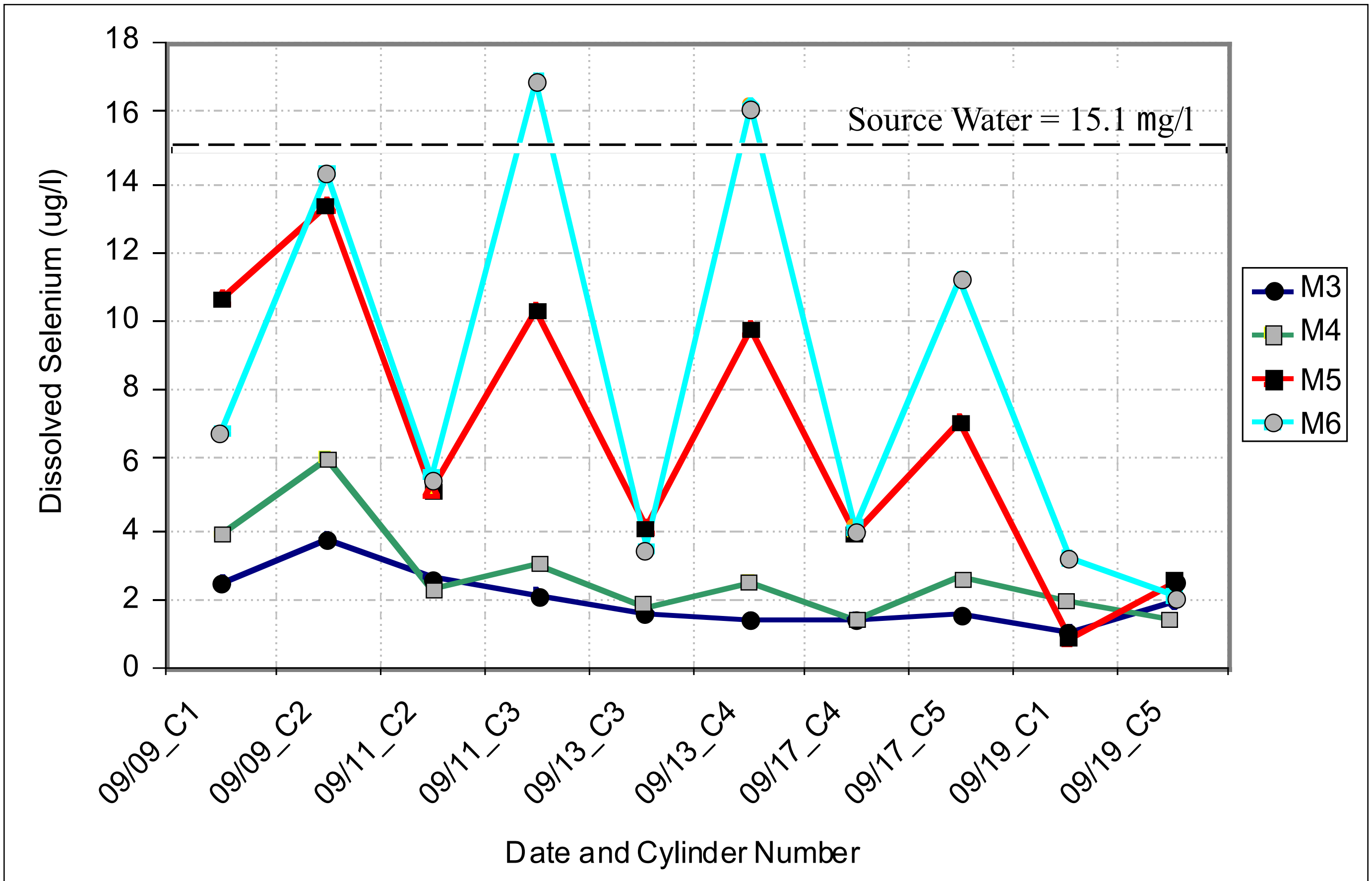

Figure 2. Dissolved Selenium Concentrations for Each Column for Each Media Type

than the source water. One possible explanation for these elevated concentrations is the influent water temporarily oxidized selenium that had been reduced and sequestered in the media prior to draining the columns on Sept 7.

To examine the selenium reduction recovery rate of each media type the difference between the average of the Sept 7 concentrations and the average of the Sept 9 concentrations relative to the difference between the existing concentrations (Sept 7) to the new source water concentration are shown in the Table 2. As can be seen from the table, Medium 3 was the least affected by the inundation of selenium-laden oxygenated waters.

Discussion and Conclusion

The results of the column study indicate that Medium 3 (50% native soil, 30% silica sand, 10% wetland soil, 10% chopped cattails) and Medium 4 (50% native soil, 30% silica sand, 10% wetland soil, and 10% green waste) are the best selenium-reducing media mixtures of the four ultimately tested. The high dissolved organic carbon observed in the effluent of these two media as compared to the other two is the most likely cause of the quick reduction in dissolved selenium concentrations. Over longer periods of time, Medium 5 may begin to have higher dissolved organic matter as the coconut fiber (coir) breaks down, resulting in greater selenium reduction. Medium 6 has the potential of being a viable selenium-reducing medium if more acetate were added. The mass of acetate that was added to Medium 6 was based on estimates of the amount of bioavailable iron in the silica sand and other electron acceptors in the source water (i.e. DO, selenium, and manganese). The concentrations of manganese in the effluent relative to the concentrations in the influent indicate that a large mass of manganese may be present in the silica sand, which was not accounted for, that effectively "consumed" the small quantity of acetate that was added.

Recommendations For Further Research

Based on the analysis of the results of the column experiment it is recommended that Medium 3 be used for further study in the flow-through

Table 2. Percent increase in dissolved selenium concentrations relative to source water.

Media	3	4	5	6
% Increase Relative to New Source Water	8.2%	32.1%	120.2%	32.6%

mesocosm experiment. The green waste mixture had comparable results, but it is not as favorable due to the variability that municipal "green waste" may have (i.e. could be grass clippings, woody debris, leaf litter, etc.). Also, "green waste" has the potential of containing undesirable chemicals such as pesticides and herbicides. Furthermore, Medium 3 had less of a response to the influx of fresh source water than Medium 4, indicating that it is a better candidate for the flow-through mesocosm experiment. It is believed that the addition of acetate, as was used in Medium 6, may be useful if, during the mesocosm experiment, dissolved organic carbon is observed to decrease.

Several lessons learned during the column experiment lead to the following recommendations:

- Perform hydraulic conductivity and effective porosity tests of the native soils to ensure that adequate flow rates and volume will be available for sampling.
- Measure the bioavailable iron and manganese in the native soils and sand so a more accurate estimate of the amount of electron donor needed to reduce the influent selenium concentrations can be calculated.
- Include a dissolved oxygen sampling port that gives a direct measurement within the soil matrix rather than in the effluent.
- Increase the frequency of sampling and/or number of samples to estimate rates of geochemical transformations or other trends.

References

Hibbs, Barry J. and M.M. Lee (2000). "Sources of Selenium in the San Diego Creek Watershed", *Final report to Defend the Bay and the California Urban Environmental Research & Education Center*, Department of Geological Sciences, CSULA.

Masscheleyn, P.H., R.D. Delaune, and W.H. Patrick, Jr. (1991). "Biogeochemical Behavior of Selenium in Anoxic Soils and Sediments: An Equilibrium Thermodynamics Approach." *Environ. Sci. Health*. A26(4): 555-573. ERESA

EDUCATING PROFESSIONALS IN CONSTRUCTED WETLAND TECHNOLOGY

-or-

"...ISN'T A SEPTIC LEACHFIELD JUST A VEGITATED GRAVELBED... ?"

by
Daryl Van Dyke
Grad Student in Environmental Systems/IDT

This past May, the 2002 Constructed Wetlands Workshop drew a capacity crowd of professionals representing many fields, countries of origin, and stakeholder interests. Practicing engineers, wastewater treatment plant mangers, wastewater treetment plant operators, bioremediation professionals, and representatives of public and private wildlife and conservation interests came together on the HSU campus to interact with Dr. Bob Gearheart and invited speakers.

The workshop was set for three days, and we were fortunate to have an unseasonable sunny and warm early Humboldt summer. On day one, after coffee, juice, and some of Barbara's delicious sweet-breads, Bob was on top for overviews (both hydrologic and biotic) which segued into design criteria. By the afternoon, various voices that shared interests or points of view cultivated a dialogue on the design and implementation of constructed wetlands to achieve a range of ecosystem and waste treatment benefits.

Bob fielded a wide range of questions about various facets of wetland and conventional wastewater treatment, responding with characteristic knowledge, candor and humor about ecological function at the center of wetland design. At one point, a discussion of field application for adsorption and infiltration as a disposal/recharge strategy veered toward septic leachfield design; Bob noted the connection and steered us back to the issue at hand.

The program included talks by (ERE alums) Laura Kadlecik and Eric Strecker on stormwater treatment applications to constructed wetlands, and (ERE alum) Mike Wilson led a tour of the Potawot Indian Health Village stormwater wetland system. Fellow ERE alum George Waller discussed the selection of plant species for wetland construction. Yociel Marrero Baez from Cuba gave an educational account of pursuing ecological reactors in a peri-urban Havana.

By day three, the atmosphere in the hall was friendly but focused. Folks had settled into their spots in the room and we were ready to talk wetlands. Bob Bastion of the EPA finished up with audience questions on the regulatory aspects of wetland implementation, pulling together a list of questions and concerns and distilling the reasons behind the regulations. Several field trips emphasized points that design criteria and plots of nitrogen distributions can't: wetlands as habitat, wetlands as waste treatment and recreational area simultaneously, and how our wetlands interface with municipal Arcata flows into the surrounding watershed.

The workshop concluded with a group photo. The crowd dispersed, visions of birds and suspended/attached microbial communities dancing in our heads. We won't look at a marsh or a wastewater treatment plant in the same way again. ERESA

ERE Curriculum Changes

• continued from page 4

per week. In addition, the name of ERE elective course ENGR 421 has been changed, from “Computational Methods III” to “Computational Methods IV.” The new courses cover essentially the same topics as the old courses, but the material has been substantially rearranged.

The primary purpose of the change is to separate linear algebra and ordinary differential equations so that each can be taught with the proper prerequisites at the right level of sophistication and at the right time in the sequence with other ERE major courses. It will also allow us to better integrate environmental resources engineering applications into the teaching of differential equations so students will be better prepared to use the material in later ERE courses.

Table 1 shows how the new ENGR 225, 325, 326 “Computational Methods” series is sequenced with other key ERE and Math courses in the ERE major curriculum. MATH 115 “Algebra and Elementary Functions” is not required, but is included because most ERE students take it to prepare for calculus.

Table 1. Sequencing of ENGR 225, 325, 326 with key ERE and Math courses in ERE major

Semester 1	Semester 2
MATH 115 ENGR 115 **ENGR 225**	MATH 109 ENGR 215
Semester 3	**Semester 4**
MATH 110 ENGR 210 ENGR 323 **ENGR 325**	MATH 210 ENGR 211
Semester 5	**Semester 6**
ENGR 313 **ENGR 326** ENGR 331(C)	ENGR 333

The New ERE Curriculum

Figure 1 shows the new requirements for the ERE major, effecive Spring 2003. Changes are in bold print. ERESA

ENVIRONMENTAL RESOURCES ENGINEERING
Requirements for the Major

A minimum grade of C- is required for all courses. Engineering courses may not be repeated more than two times.

LOWER DIVISION

MATH	109, 110, 210	Calculus I, II, III	4, 4, 4
CHEM	109, 110	General Chemistry I, II	5, 5
BIOL	105	Principles of Biology	4
PHYX	110	General Physics II	4
ENGR	115	Introduction to ERE	3
ENGR	210	Solid Mechanics: Statics	3
ENGR	211	Solid Mechanics: Dynamics	3
ENGR	215	Introduction to Design	3
ENGR	**225**	**Computational Methods I**	**3**

UPPER DIVISION

PHYX	315	Electronic Instrumentation	3
ENGR	313	Systems Analysis	4
ENGR	323	Probabilistic Analysis of Envir Systems	3
ENGR	324	Envir Monitoring & Data Analysis	3
ENGR	**325**	**Computational Methods II**	**3**
ENGR	**326**	**Computational Methods III**	**3**
ENGR	330	Mechanics & Science of Materials	3
ENGR	331	Thermodynamics & Enery Systems I	3
ENGR	333	Fluid Mechanics	4
ENGR	350	Introduction to Water Quality	3
ENGR	353	Environmental Health Engineering	3
ENGR	410	Environmental Impact Assessment	3
ENGR	416	Transport Phenomena	3
ENGR	435	Solid Waste Management	3
ENGR	440	Hydrology I	3
ENGR	**492**	**Capstone Design Project**	**3**

Major Elective Program

MAJOR ELECTIVE PROGRAM

With advice and approval of an ERE faculty advisor and the ERE Department Chair, select one upper division science or natural resources course and three senior engineering design courses from the following lists to form a coherent elective program.

One science/NR course from: (See catalog for list of courses.)

Three engineering design courses from:

ENGR	418	Applied Hydraulics	3
ENGR	421	Computational Methods III	3
ENGR	431	Air Quality Engineering	3
ENGR	441	Hydrology II	3
ENGR	443	Groundwater Systems	3
ENGR	445	Water Resources Planning & Mgt	3
ENGR	448	River Hydraulics	3
ENGR	451	Water & Waste Water Treatment Engr	3
ENGR	461	Environmental Geotechnology	3
ENGR	466	Earthquake Engineering	3
ENGR	471	Thermodynamics & Energy Systems II	3
ENGR	473	Building Energy Analysis	3
ENGR	475	Renewable Energy Power Systems	3
ENGR	477	Solar Thermal Engineering	3
ENGR	481	Selected Topics w/ Design	3
ENGR	**498**	**Directed Design Project**	**3**

FIGURE 1. New (Spring 2003) Requirements for the ERE Major (**Changes in Bold**)

Thanks for Making It Possible...

WINZLER & KELLY
CONSULTING ENGINEERS

633 Third Street ▼ Eureka, CA 95501-0417
P.O. Box 1345, Eureka, CA 95502-1345

Engineering . . .

A.M. BAIRD
Engineering & Surveying
1100 Main Street
Fortuna, CA 96540
707-725-5182
FAX 707-725-5581

Yesterday . .
Today . .
Tomorrow . .
Forever.

LACO ASSOCIATES
CONSULTING ENGINEERS

21 West 4th Street
Eureka, CA 95501
Phone: 707-443-5054 CE 14398
FAX: 707-443-0553 TE 0037

S H N Consulting Engineers & Geologists
812 West Wabash
Eureka, CA 95501
707-441-8855
FAX 707-441-8877

SE
SPENCER ENGINEERING & CONSTRUCTION MGT, INC.
1933 CENTRAL AVE., SUITE C 707-839-4336
MCKINLEYVILLE, CA 95521 FAX 707-839-4012

ERE Student Association, ASCE Student Chapter
Department of Environmental Resources Engineering
Humboldt State University
Arcata, CA 95521-8299
eresa@axe.humboldt.edu

NON-PROFIT ORG.
U.S. POSTAGE
PAID
PERMIT No. 78
Arcata, CA 95521

Printed on 100% recycled paper
HSU is an AA/EO institution.