Report on Student Interest in a
Water Resources and Environmental Engineering Option
in the Civil Engineering Graduate Program

By

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Abstract
Interest among students in Fresno State’s Civil Engineering program for creating a graduate program option in Water Resources and Environmental Engineering (WR&EE) is strong. Preference for WR&EE areas of practice have increased five-fold during the past five years among students enrolled in CE 180A Project Design, and a survey conducted in December of 2012 reveals that potential enrollment in a WREE graduate program would be significant. The vast majority of senior-level students who completed the survey (70 of 105) would like to be kept informed if the WR&EE program moves forward and 60 of them indicated that they would enroll. However, the survey also indicated that a large percentage of the students would need financial support and, therefore, students’ ability to secure funding would be a major factor in actual enrollment. Details of the study are presented below.

C.E. Program
For decades Fresno State has offered programs of study in Civil Engineering at the undergraduate and graduate levels (B.S. and M.S.). The undergraduate curriculum is wide-ranging, covering quantitative/technical subject areas in math, science, and engineering, and various qualitative/less technical subjects in general education. Students are introduced to several interrelated specialty areas within civil engineering during their junior year: hydraulics, environmental/water resources, soils (geotechnical), structural, and transportation engineering. Following completion of the introductory course students can take technical elective courses in the specialty area. Design concepts are emphasized in most of the electives courses. Students undergo a culminating experience in their senior year in which they must demonstrate competency by completing a two-course sequence of capstone courses – CE 180A Project Design and CE 180B Senior Project. Historically employment prospects have been very good for program graduates in terms of salary, diversity in types of work and geographic location, and demand. The percentage of graduates who secure employment in positions that are directly related to their degree is among the highest of all majors on campus.

Assessment Methodology
CE 180A Project Design Interest Trend Investigation: Each student in CE 180A Project Design selects a preference for one of four specialty areas for which they will demonstrate competency in technical in CE 180A and CE 180B. This data was analyzed to investigate trends during the past five years as an indicator of potential student interest in the proposed WR&EE graduate program option.

Senior & Graduate Student Survey Investigation: In December of 2012 students in senior and graduate level courses were surveyed to determine their level of interest in a proposed option.
Results

**CE 180A Project Design Interest Trend Investigation**

Seniors in the CE 180A Project Design course make known their preference for which technical area of civil engineering design they wish to work in during that course and the one that follows (CE 180A Senior Project). This technical area preference data was collected for the past 5 years and analyzed for use in this study.

Results of that analysis are shown in Figure 1. Inspection of the figures reveals a trend in which preference for the WR&EE area was relatively low five years ago (10%) and has been increasing since to approximately 50% in the Fall of 2012. The trend represents a significant five-fold increase in preference for the WR&EE area.

![Figure 1. CE 180A student preference for WR&EE vs all other technical areas of civil engineering design during the last 5 years (Left: Number of students; Right: Percent of all students).](image)

**Senior & Graduate Student Survey**

Students in senior and graduate level courses were surveyed in December of 2012 to determine their level of interest in a proposed option. The survey administered to students in senior-level courses yielded 105 undergraduate student responses (13 juniors in senior-level courses and 92 seniors). Graduate student responses were 27, bringing the total number of all student responses to 132.

Survey Questions 1 through 5 related to the student’s profession, job title, employer and location, degree program, grade level, and grade point average. Responses to these questions are not included in this report but may be made available upon request. Responses to all other questions (6-19), organized by survey question, are presented below.

**Extent of interest in pursuing graduate studies**

Student interest in pursuing graduate studies was assessed by asking the question “To what extent are you interested in pursuing studies toward a Graduate Degree (either the proposed WREE degree or some
other one)?” The results are shown in Fig. 2. Inspection of Fig. 2, left, reveals that 81% (84) of the 104 senior responses show either moderate interest (51%) or great interest (19%) in pursuing graduate studies. Of the 26 graduate student responses 88% showed great interest in pursuing graduate studies, 4% moderate interest, and 8% no interest (Fig. 2, right). The latter group may consist of students who are nearing completion of their master’s degree.

What students would you hope to gain from completing a graduate program.

Students were asked “What would you hope to gain from completing a graduate program?” The results are shown in Fig. 3. Inspection of Fig. 3, left, reveals that “upgraded knowledge” and “additional personal development” received the greatest number of responses. The remaining choices, “upward mobility in current employment,” “new position with another employer,” and “increased research experience,” received a significant response. Graduate student response (Fig. 3, right) closely paralleled that of the seniors. Students were given an opportunity to write in other motivations for graduate studies and the response is as follows:

**Seniors:** “MBA,” “pay raise,” “find job,” and “Pay raise; less time for P.E.”

**Grad. Students:** “Getting any CE job,” and “Current application of methods.”

Would students enroll in the proposed WREE Graduate Program?

Responses to the question of “Would you enroll in the proposed WREE Graduate Program if one were to be established in the next *_(see below)_* years” are shown in Fig. 4. Data used in Fig. 4 excludes
responses from those who responded "not at all" to the question above of whether or not they were interest in pursuing graduate studies (Fig. 2).

Inspection of Fig. 4, left, reveals that a significant interest in a WE&EE graduate program if it were to be offered within the next 7 years, and that there is a strong preference for the program to be offered earlier in that period. After accounting for multiple “yes” responses, 60 of the 105 seniors (57%) indicated at least one “Yes” answer. It should be pointed out that many of these students would need financial support to enroll (see further below). Graduate student response (Fig. 4, right) indicated that 9 students would likely enroll in the new program.

**Figure 4.** Response to the question of “Would you enroll in the proposed WREE Graduate Program if one were to be established in the next _ (see figure) years?” (Left: Seniors; Right: Grad. students).

**Full-time vs part-time preference**

Responses to the question of “If your answer to #7 was “yes,” would you attend part-time or full time?” are shown in Fig. 5. Inspection of Fig. 5 reveals that 63-percent of seniors and 78-percent of graduate students have a preference for part-time studies.

**Figure 5.** Response to the question of “If your answer to #7 was “yes,” would you attend part-time or full time?” (Left: Seniors; Right: Grad. students).

**Mode of availability to participate in classes**

Responses to the question of “Indicate your availability to participate in classes: … (see choices in the figure)” are shown in Fig. 6. Inspection of Fig. 6 reveals that senior and graduate students both have a
preference for evening classes. Following that, there is substantial support for attending courses both in a daytime/evening combination and in an electronic access (online) mode.

Figure 6. Response to the question of “Indicate your availability to participate in classes:” (see choices in the figure) (Left: Seniors; Right: Grad. students).

Preference for course duration

Responses to the question of “Indicate your preference for courses that can be completed in: … (see choices in the figure)” are shown in Fig. 7. Inspection of Fig. 7 reveals that senior and graduate students both have a strong preference for course durations of a full semester.

Figure 7. Response to the question of “Indicate your preference for courses that can be completed in:” (see choices in the figure) (Left: Seniors; Right: Grad. students).

Preference for program duration

Responses to the question of “What period of time would you be able to commit in completing this program” are shown in Fig. 8. Inspection of Fig. 8 reveals that senior and graduate students as a group have a strong preference for a program of study that can be completed in one to two years, and
secondary preferences for “two to three years” time period and for “whatever time it takes.” Programs of study that go beyond three years have very little support.

**Figure 8.** Response to the question of “What period of time would you be able to commit in completing this program?” (Left: Seniors; Right: Grad. students).

**Employer support for graduate studies**

Responses to the question of “Would your current employer provide any of the following? (Check all that apply)” are shown in Fig. 9. Inspection of Fig. 9 reveals that senior and graduate students largely indicated that the question was not applicable to their situation. As for the other responses, the greatest response was for “release time to attend classes” (14 seniors and 4 graduate students). There was modest support in the form of “research facilities” and “mentored support.” Particularly important are the graduate student responses in which not one student indicated that they could receive support from their employers in the form of tuition and fees. Relevant is the fact that 15 of the 27 graduate students who participated in the survey indicated that they were working --12 working in engineering (4 are research assistants, 8 work off-campus) and the other 3 work in non-engineering areas (off campus).

**Figure 9.** Response to the question of “Would your current employer provide any of the following? (Check all that apply)” (see figure for choices) (Top: Seniors; Bottom: Grad. students).

**Preference for mode of course delivery**

Responses to the question of “What would be your preference as to how courses are delivered? (Check all that apply) (see choices in the figure)” are shown in Fig. 10. Inspection of Fig. 10 reveals that senior and graduate students both have a preference for traditional courses delivered at the university, and
online instruction is a close second among seniors (for graduate students it is much lower). In addition, laboratory-based instruction was well supported.

**Figure 10.** Response to the question of “What would be your preference as to how courses are delivered? (Check all that apply)” (see choices in the figure) (Left: Seniors; Right: Grad. students).

**Computer-based educational technology literacy**

Responses to the question of “Would your computer knowledge/ability allow you to use computer-based technology for educational purposes?” are shown in Fig. 11. Inspection of Fig. 11 reveals that nearly all senior and graduate students believe that they have sufficient computer knowledge/ability to use computer-based technology for educational purposes.

**Figure 11.** Response to the question of “Would your computer knowledge/ability allow you to use computer-based technology for educational purposes?” (Left: Seniors; Right: Grad. students).

**Access to equipment for distance learning mode of instruction**

Responses to the question of “Would you have access to the required equipment if the program is offered through distance learning? (Check all that apply) (see choices in the figure)” are shown in Fig. 12. Inspection of Fig. 12 reveals that senior and graduate students have access to a wide variety of equipment if the program is administered through distance learning mode.
**Financial aid assistance required?**

Responses to the question of “Would you require university financial assistance to pursue this degree?” are shown in Fig. 13. Responses shown include only the students who indicated that they would enroll in the proposed WREE Graduate Program. Inspection of Fig. 13 reveals that 77-percent of seniors and 73-percent of graduate students would need financial assistance to pursue the WR&EE degree. Therefore, students’ ability to secure funding would most certainly be a major determinant of actual enrollment.

**Would the student like to be kept informed if the WR&EE program moves forward?**

Responses to the question of “If this program moves forward, would you like to be kept informed?” are shown in Fig. 14. Inspection of Fig. 14 reveals that the vast majority of senior-level students (70 of 105) would like to be kept informed if the WR&EE program moves forward, and that just under half of the graduate students would like to be kept informed. Some of the graduate students would be near
graduation and others are specializing in areas outside of WR&EE and therefore it is not surprising that the percentage is lower in that group.

![Bar chart](chart.png)

**Figure 14.** Response to the question of “If this program moves forward, would you like to be kept informed?” (Left: Seniors; Right: Grad. students).

**Students’ comments or suggestions regarding this proposed graduate program**

Students taking the survey were given an opportunity to make any comments or suggestions regarding this proposed graduate program. The responses, grouped by program and by subject (major thrust of comment), are summarized below.

Student comments are largely supportive of the creation of a WR&EE option in the MSCE graduate program. Concern exists among some undergraduate seniors that existing courses are not being offered with sufficient frequency, that the creation of a new WR&EE program option would make this situation worse, and that any new faculty or resources should be used instead to mitigate this problem. These comments are based on two mistaken notions as follows: (1) that undergraduate courses would be offered less frequently if the WR&EE were to be created, and (2) that new faculty or resources would be necessary (and made available to) the proposed WR&EE program. Our best assessment of the issues is that neither of the concerns noted above would occur. The rational/ basis for this statement can be found in the WR&EE Option Proposal, section 1.15. “Additional instructional resources needed to implement and sustain the program.”

**Student comments:**

C.E. Seniors:

**A. Creation of a WR&EE Program (support, criticism, other):**

1. **Supportive:**
   a) Specializing in Environmental under Civil. I'd like a grad program for this.
   b) I am interested in this graduate program. wesleyzimmerer@gmail.com
   c) Sounds very interesting, would like to know more about the program
   d) Must be stablish, there is a lot of students graduating each semester
   e) It would be the leading school in the Central Valley.
   f) It should make a good program for unemployed graduates and also enhance their skills.
   g) Would like to see WREE degree
   h) I would really love to keep studying in case there are no jobs open
   i) It will be a great opportunity for me since my emphasis in civil engineering is water resources and environmental engineering.

2. **Critical:**
   a) Make sure to open necessary courses in order to graduate in the first place. Worry about the graduate program in the future. Open more class sections, hire more professors, offer courses more frequently - not every 2 semesters.
   b) Increase the number of instructors instead to provide more than one course and/or instructor per semester.

3. **Other:**
a) What is WREE?
b) Its easy. [WW - Intent not clear]
c) Its just too bad it is being offered now vs being offered previously, only due to my grade level [WW comment - this senior may think that WREE is a B.S. degree?]

B. Program/Course Structure, Curriculum, Mode of Course Delivery:
1. Partnership with EWB or Peace Corps
2. Make it available for everybody that want to pursue a degree in civil engineering
3. Evening & on-line courses would be a plus; counting some undergraduate Courses towards the units would be nice.
4. Have less Powerpoint and get students involved with written examples
5. See comment A.2.a. above.
6. Perhaps emphasis on the environmental side, like air quality for example.
7. Would like to see local issues covered such as: Irr. System efficiency, Rural distribution system.

M.S.C.E. (Graduate) Students:

A. Creation of a WR&EE Program (support, criticism, other):
1. Supportive:
   a) Sounds like it would be great for some people, just not myself.
   b) I am interested because if I were to work for the public sector I would benefit from this degree.
   c) I hope this moves forward, it sounds great.
   d) This is a great program. The instructors are very knowledgable about the subjects.
   e) If the program was available a previous semester I would have enrolled. However, I will be graduating soon.
2. Critical:
   See comment 3.a. below (possibly a criticism of the WR&EE option idea).
3. Other:
   a) Create a M.S. in Structural Engineering Program!
   b) I thought we already had a WREE in CE.

B. Program/Course Structure, Curriculum, Mode of Course Delivery:
1. Profession oriented; practical, updated curriculum.
2. Advanced fluid mechanics and hydraulics structures classes .. Please!!!

Students’ thoughts on what relevant skills/ experience they possess
Responses to the question of “What relevant skills/experience do you have?” are provided below

C.E. Seniors:  U. Courses
ArcGIS, AutoCAD, M.S. Office; Fluent in Spanish
Computers; Problem solving.
CalTrans volunteer
Database management
Educational experience
Almost done w/ BS
Water well drilling (reverse-rotary)/ rehab/ testing; Interned at Provost & Pritchard; Some experience w/ water resources engr. programs (EPANET, Flowmaster, HEC-RAS, etc..)
A little ArcGIS, WaterGEMS, SewerCAD
General knowledge on different computer applications used in this area (AutoCAD, SewerGEMS, WaterGEMS, EPANET, etc..)
Preparatory requirements for environmental, many design projects in water/structures.
Build up on wastewater Phase II Fresno & Injection gas facility in Madera
AutoCAD, WaterGEMS, CE Water classes/ design courses.
Wastewater treatment plant, natural gas injection plant.
Environmental
BS Civil engr.
Standard BS curriculum
BSCE curriculum
2 years internship at BRA; BS curriculum
6 months internship  Ground water analysis; water resources; BS.
Tri-lingual; employed in a field of emergency for 2+ years.
Some research experience; Prof. engr. experience
Work experience, BS degree.
5 years
6 months internship (Engr.) Water CMP design
CAD, MS Office, ArcGOS, Sourfire
Plan review, 2010 building codes, CRC, CBC, CMC, CEC, ADA
Chemistry minor; Water emphasis in BS program
AutoCAD, StormCAD, WaterCAD, SewerCAD, Salesperson, managing business.
Four summer internships.
[not legible]
Practical experience including WDS Analysis with Bentley software & EPANET.
Worked for private consulting firm and Regional Water Quality Control Board
Just the basic information in water. Everything
Extensive background in water resources topics
CE 141, EPANET, SewerCAD, other W.R. programs [software]
Knowledge of engineering fundamentals
1.75 years of internships.

**MSCE Stud.:**
4 years in Air Force as a Civil Engineer
BS in CE (structures+Geotech), AutoCAD, Microsoft Office software.
BS in water resources/ environmental engineering
None for WREE save for MSCE & BS water courses.
computer application
Engr. Student Assist. For Dept. Water Resources; HEC-RAS modeling, San Joaquin and Merced River Restoration studies.
Working with DWR Just school
Bentley software, Excel, AutoCAD, worked at the RWQCB as an intern.
Survey, Construction, Musician
Worked at @ DTSC CAD, Design, Visual Basic programming.