

# Board of Governors, State University System of Florida

## Request to Offer a New Degree Program

(Please do not revise this proposal format without prior approval from Board staff)

<b>Florida Atlantic University</b>	<b>Fall 2016</b>
University Submitting Proposal	Proposed Implementation Term
College of Engineering & Computer Science	Department of Civil, Environmental & Geomatics Engineering
Name of College(s) or School(s)	Name of Department(s)/ Division(s)
Environmental Engineering	Bachelor of Science in Environmental Engineering (B.S.E.V.)
Academic Specialty or Field	Complete Name of Degree
14.1401	
Proposed CIP Code	

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

Date Approved by the University Board of Trustees	President	Date
Signature of Chair, Board of Trustees	Date	Vice President for Academic Affairs
		Date

Provide headcount (HC) and full-time equivalent (FTE) student estimates of majors for Years 1 through 5. HC and FTE estimates should be identical to those in Table 1 in Appendix A. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Table 2 in Appendix A. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 (Total E&G divided by FTE).

Implementation Timeframe	Projected Enrollment (From Table 1)		Projected Program Costs (From Table 2)				
	HC	FTE	E&G Cost per FTE	E&G Funds	Contract & Grants Funds	Auxiliary Funds	Total Cost
Year 1	25	15	\$27,462	\$411,932	\$34,000	\$0	\$445,932
Year 2	39	24					
Year 3	55	34					
Year 4	71	42					
Year 5	87	53	\$8,903	\$471,854	\$59,123	\$0	\$530,977

*Note: This outline and the questions pertaining to each section must be reproduced within the body of the proposal to ensure that all sections have been satisfactorily addressed. Tables 1 through 4 are to be included as Appendix A and not reproduced within the body of the proposals because this often causes errors in the automatic calculations.*

## INTRODUCTION

### 1. Program Description and Relationship to System-Level Goals

- A. Briefly describe within a few paragraphs the degree program under consideration, including (a) level; (b) emphases, including concentrations, tracks, or specializations; (c) total number of credit hours; and (d) overall purpose, including examples of employment or education opportunities that may be available to program graduates.

*Program description:* The proposed **undergraduate degree program**, Bachelor of Science in Environmental Engineering (BSEV), integrates principles of engineering, mathematics, earth science, soil science, life science, and materials science with **emphasis on the design and development of solutions to environmental challenges, such as improvement of water and air pollution control, safe disposal of wastes, and the stewardship of our natural resources.**

*Organization:* Program faculty and staff will be headquartered at the FAU Boca Raton campus. The program will be administered initially by a director reporting to the chair of the Department of Civil, Environmental, and Geomatics Engineering and the Dean of the College of Engineering & Computer Science.

*Curriculum:* The Environmental Engineering curriculum has been designed to meet all requirements for accreditation by the Accreditation Board for Engineering and Technology (ABET) with a total of **120 credit hours**. Graduation from an ABET-accredited program is the universally accepted education credential required for professional registration as an environmental engineer. The proposed implementation date is August 1, 2016, with the first students accepted for the Fall 2016 semester. Details of the curriculum are attached. The curriculum was developed with the assistance of the Department Advisory Council comprised of industry representatives.

*Program educational objectives:* The Bachelor of Science in Environmental Engineering (BSEV) degree program in the College of Engineering & Computer Science is designed to provide students with the following program educational objectives:

- A. **Practice environmental engineering** within the general areas of water and wastewater, air quality, solid and hazardous waste, and groundwater and soils in the organizations that employ them.
- B. **Advance their knowledge of environmental engineering**, both formally and informally, by engaging in lifelong learning experiences including attainment of professional licensure, and/or graduate studies.
- C. **Serve as effective professionals**, based on strong interpersonal and teamwork skills, an understanding of professional and ethical responsibility, and a willingness to take the initiative and seek progressive responsibilities.
- D. **Participate as leaders** in activities that support service to, and/or economic development of, the region, the state and the nation.

*Employment/Education Opportunities for Graduates:* This proposal stems from the strong interest and support of the local industry in environmental, civil, geomatics, and construction engineering and the Department's industry advisory council and alumni council. The primary objective is to educate the next generation of environmental engineering professionals. These efforts will be conducted in the context of a world-class education, bringing benefits to our students and the community. Florida, and particularly South Florida, is faced with a great deal of environmental challenges, which will provide numerous employment opportunities in that field. Graduates will have the opportunity to be employed by the **private sector, local**

**and state government, or to start their own engineering practice.** The Department receives an increasing number of inquiries from students interested to study in this field, and also by employers seeking graduates with a degree specialization in environmental engineering. From January to August 2014, we have received 46 inquiries about the environmental engineering program from prospective undergraduate students including transfers from state colleges, out-of-state students, and transfers from 4-year programs both public and private within the state of Florida. In addition, another 17 students from non-engineering majors have inquired about a second bachelor's degree in this area. Currently, students at FAU studying civil engineering or other closely related fields can only experience very few courses in the field of environmental engineering. Only 12 of the last 60 credits are considered fundamental environmental engineering courses in the current civil engineering program and none in the geomatics engineering program; therefore, FAU students are not prepared to compete for environmental engineering related jobs without supplemental training. Graduates with general engineering or ocean/civil engineering degrees alone simply do not have the academic background in environmental engineering to be competitive for these kinds of jobs. Employers are increasingly requiring candidates with general engineering degrees to have additional coursework specialized in environmental engineering and to pass the environmental engineering fundamentals of engineering licensing exam. This proposal addresses this need. Employment opportunities exist in such diverse and rich subjects as: adaptations to climate change, sustainability engineering, alternative energy, urban watersheds, fundamental physicochemical and biological processes in environmental systems and treatment processes, energy management, computational modeling, air quality, environmental microbiology, biotechnology, nanoscience, and green technologies.

*Rationale:* The Department Advisory Council for the Department of Civil, Environmental & Geomatics Engineering [the Department] has urged the faculty to create a Bachelor's of Science degree program specializing in Environmental Engineering, which is the primary purpose of this proposal. Environmental Engineering is a program in very high demand with a bright national outlook, as discussed later in this proposal. The program will train students in the areas of solid and hazardous waste management, water quality and air pollution control, green technologies, and pollution prevention of natural ecosystems and the built environment. Presently, the students in the civil engineering and geomatics engineering programs at FAU, through a series of courses and research activities, are exposed to environmental issues at both Undergraduate (BS) and Graduate (MS) levels. However, students at FAU studying civil engineering, geomatics engineering, or other closely related fields can only experience very few courses in the field of environmental engineering. Only 12 of the last 60 credits are considered fundamental environmental engineering courses in the current civil engineering program and none in the geomatics engineering program; therefore, FAU students are ill-prepared to compete for environmental engineering related jobs without substantial additional training. In addition, the FAU 2006-2010 strategic plan had a proposed environmental engineering graduate degree program slated for 2009, which was never realized. However, since the implementation of a BS program will provide the steady stream of students needed to sustain the graduate program pipeline, it makes sense to implement the undergraduate degree program first.

This new program supports the University's strategic plan to start a new environmental engineering program in 2009 and FAU's newly released Strategic Plan calling for the creation of an Ocean Energy/Environmental Science pillar that will move FAU toward national prominence. The new program would also align well with the state-wide performance metrics by increasing the number of undergraduate degrees and providing an additional STEM program, and it could also feed into the Master of Science with major in Civil Engineering, Water Resources/Environmental Track.

- B. Please provide the date when the pre-proposal was presented to CAVP (Council of Academic Vice Presidents) Academic Program Coordination review group. Identify any concerns that the CAVP review group raised with the pre-proposed program and provide a brief narrative explaining how each of these concerns has been or is being addressed.**

The proposal was presented by the FAU Associate Provost for Programs and Assessment to the CAVP working group at the February 6, 2015 meeting in Orlando. The main comments from the group that were asked to be addressed if the proposal moved forward related to the number of credit hours proposed in relation to ABET accreditation requirements, and the need for more effort to demonstrate demand from employers. Support for the degree proposal was generally strong; however, Florida International University went on record with a concern that they feared the degree would adversely impact the enrollment in a similar degree they currently have in place. FAU was advised that if the proposal moved forward, we would need to demonstrate that there is enough demand (from both students and employers) in the South Florida region to sustain healthy programs at both FIU and FAU.

## **Market Demand**

The Department and the Office of the Provost determined that an external consultant should be hired to conduct an independent market analysis. The external consulting firm **Hanover Research** was contracted to review the demand for the program on July 14, 2015, and they were advised of the concerns raised by FIU regarding the competition for student and employer demand in south Florida for environmental engineering students and graduates. On October 2, 2015, they submitted the results of their market analysis. Through this study, student demand was assessed as measured by degree conferral trends, the labor market outlook was measured by economic forecasts and job posting trends, and market saturation was based upon the number of graduates in the region compared to the number of projected job opportunities.

The findings by Hanover Research indicate that an environmental engineering program at Florida Atlantic University would be **very viable**. In general, the labor market is expected to grow significantly over the next several years and at current, especially in south Florida, **there are not enough graduates** being produced to meet demand in specific areas. For example, the Water Research Foundation is predicting a “workforce crisis” for water utility workers as the industry will see many of its current Baby Boomer Generation employees retire between now and 2020.

Enrollment and degree completions trends for bachelor’s programs in South Florida indicate growing student demand for environmental engineering programs. A scan of programs in the area suggests that Florida International University (FIU) and the University of Miami (UM) are the only institutions within a 100-mile radius of Boca Raton offering bachelor’s programs in this field. Bachelor’s degree completions at these institutions expanded from seven completions in 2010 to 22 in 2014, indicating **rapidly expanding student interest in this field**.

Institutions in South Florida are not currently producing enough graduates to meet the labor market demand for the local environmental engineering workforce. FIU and UM graduated 22 undergraduates in environmental engineering in 2014, while the FDEO projects 191 annual job openings in related positions. Even considering both bachelor’s and master’s degree completions, **these institutions (FIU and UM) only produced enough graduates to fill 17% of the projected annual openings for environmental engineering related positions**.

**A new bachelor’s program in environmental engineering at FAU may expand the future pipeline of students interested in graduate programming in this field.** Student outcomes data from 2011 to 2013 suggests that between 21 and 33 percent of students who studied environmental engineering at a State University System of Florida institution continued their education after graduation. Several Florida institutions have accelerated 4+1 programs that may incentivize students to remain at their undergraduate institution to complete a master’s program, securing a steady pipeline of students for graduate offerings.

According to recent graduation data from 2009-2013 in the State of Florida, about 47 environmental engineering graduates are produced per million people. In South Florida, the current number is only 3 per million, clearly demonstrating that South Florida is failing to produce enough environmental engineers to meet the current demand.

### Curriculum Issue

With respect to the number of credits and requirements for ABET, the proposed environmental engineering curriculum is consistent with all requirements for SACS and has been intentionally designed to meet all requirements for accreditation by ABET, which is the universally accepted education credential required for professional registration. Accreditation reviews are only possible after the program has produced its first graduate. Thus, the ABET review will be requested at the first possible opportunity immediately following the first graduation class. A retroactive provision covers students who graduate prior to the award of accreditation.

According to ABET, the curriculum must:

1. **Prepare graduates to apply knowledge of mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, and fluid mechanics.** This is covered in the basic math and science requirement of a minimum of 32 credit hours. The curriculum will provide 40 credit hours of basic math and science, plus 3 credit hours for CWR3201C-Applied Hydraulics for the fluid mechanics requirement.
2. **Prepare graduates to: (a) formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases; (b) conduct laboratory experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., air, water, land, environmental health); (c) design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and (d) apply advanced principles and practice relevant to the program objectives.** The requirements of (a) are covered in several upper division courses in the required engineering topics; those in (b) are covered in the major water quality and air quality laboratory courses (CWR3201C-Applied Hydraulics, ENV3001C-Environmental Science and Engineering, and ENV4115C- Air Pollution & Control Systems with Lab); those in (c) are covered in the major water quality and air quality laboratory courses (CWR3201C-Applied Hydraulics, ENV3001C-Environmental Science and Engineering and ENV4115C- Air Pollution & Control Systems with Lab) and the senior-level design courses including ENV 4514-Water and Wastewater Treatment Systems, ENV 4341-Solid & Hazardous Waste and Site Remediation, CWR 4202-Hydrologic Engineering, CGN 4803C-CEGE Design 1, CGN 4804C-CEGE Design 2). Finally (d) is covered by the senior-level design courses including ENV 4514-Water and Wastewater Treatment Systems, ENV 4341-Solid & Hazardous Waste and Site Remediation, CWR 4202-Hydrologic Engineering, CGN 4803C-CEGE Design 1, CGN 4804C-CEGE Design 2) and in certain technical electives as well as undergraduate research opportunities and the Innovation Leadership Honors Program in the College.
3. **Prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.** These are covered in the senior-level design courses including ENV 4514-Water and Wastewater Treatment Systems, ENV 4341-Solid & Hazardous Waste and Site Remediation, CWR 4202-Hydrologic Engineering, ENV4702 - Introduction to Pollution Prevention and Sustainability, ENV4053 - Environmental Fate and Transport, CGN 4803C-CEGE Design 1, CGN 4804C-CEGE Design 2), the major water quality and air quality laboratory courses (CWR3201C-Applied Hydraulics, ENV3001C-Environmental Science and Engineering and ENV4115C- Air Pollution & Control Systems with Lab), EGN1002 - Fundamentals of Engineering, and in certain technical electives.

The required core courses include:

- **24 credit hours of general education**, which includes ENC1101 - English Composition I (3 credits) and

ENC1102 - English Composition II (3 credits) as well as the Intellectual Foundation Program courses (2 Foundations of Society & Human Behaviors, 2 Foundations of Global Citizenship and 2 Foundations of Creative Expressions).

- **42 credit hours of basic math and science**, which includes MAC 2311 - Calculus with Analytical Geometry I (4 credits), MAC 2312 - Calculus with Analytical Geometry II (4 credits), MAC 2313 - Calculus with Analytical Geometry III (4 credits), MAP3305 - Engineering Mathematics I (3 credits), STA4032 - Probability & Statistics for Engineers (3 credits), CHM2045 - General Chemistry I (3 credits), CHM2045L - General Chemistry I Lab, PHY2048 - General Physics I (3 credits), PHY2048L - General Physics I Lab (1 credit), PHY2044 - Physics for Engineers 2 (3 credits), PHY2049L - General Physics I Lab (1 credit), CHM2046 - General Chemistry II (3 credits), CHM2046L - General Chemistry II Lab (1 credit), Biological Science Elective (4 credits), and Earth Science Elective (3 credits), as well as one-credit from ENV3001C - Environmental Science & Engineering.
- **53 credit hours of engineering topics** including 48 required credits of: CWR3201C - Applied Hydraulics (3 credits), EGN3311 - Statics (3 credits), CGN2327 - Fundamentals of AutoCAD (3 credits), EGN3331 - Strength of Materials (3 credits), EGN2213 - Computer Applications in Engineering 1 (3 credits), EGN3343 - Engineering Thermodynamics (3 credits), EGN1002 - Fundamentals of Engineering (3 credits), ENV4341 - Solid & Hazardous Waste and Site Remediation (3 credits), ENV4053 - Environmental Fate and Transport (3 credits), ENV4702 - Introduction to Pollution Prevention and Sustainability (3 credits), ENV4115C - Air Pollution and Control Systems with Lab (4 credits), CGN4803C - CEG Engineering Design I (3 credits), CGN4804C - CEG Engineering Design II (3 credits), CWR4202 - Hydrologic Engineering (3 credits), ENV3001C - Environmental Science & Engineering (2 credits), ENV4514 - Water & Wastewater Treatment System (3 credits). In addition, **6 credit hours of technical electives** (Environmental Engineering Technical Electives) from a list provided that includes: CWR4223-Advanced Hydraulic Systems, CCE4031-Construction Project Management, CWR4307-Stormwater Modeling and Management, EGN4613-Engineering Economics, CEG3012C-Soil Mechanics, SUR2104C-Fundamentals of Surveying, and any CEGE graduate course offering, as well as Oceanography (OCE 3008), Sustainable Cities (URP 4403), Environmental Planning Methods (URP 4420), Environment and Disease (ANT 4463), Environmental Ethics (PHI 3640), Global Environmental Politics and Policies (INR 4350), Environmental Economics (ECP 4302), or Entrepreneurship (ENT 4024) offered by other Departments and Colleges.

As shown in Table 1, the proposed program meets or exceeds all ABET requirements. For example, Clarkson University in NY offers an ABET accredited Environmental Engineering program with 120 credits, similar to our proposed program, so FAU would not be the first institution to offer a BS degree in environmental engineering with 120 credits.

**Table 1. Summary of ABET minimum curricular requirements.**

<b>Criterion</b>	<b>ABET Minimum Requirements</b>	<b>FAU Proposed Program</b>
General Education	24 credit hours	24 credit hours
Basic Math and Science	32 credit hours	43 credit hours
Engineering Fundamentals	48 credit hours	53 credit hours

More information about the proposed curriculum is found in the Institutional Readiness section 3.C.

- C. If this is a doctoral level program please include the external consultant’s report at the end of the proposal as Appendix D. Please provide a few highlights from the report and describe ways in which the report affected the approval process at the university.**

This is not a doctoral level program.

**D. Describe how the proposed program is consistent with the current State University System (SUS) Strategic Planning Goals. Identify which specific goals the program will directly support and which goals the program will indirectly support (see link to the SUS Strategic Plan on [the resource page for new program proposal](#)).**

This proposed program is consistent with the Florida Board of Governor's Strategic Plan (2012-2025), specifically:

*Excellence:* By providing a new program in the area of environmental engineering, we will be helping to strengthen the quality and reputation of academic programs, scholarship, research, innovation, and community engagement. This new program will improve the quality and relevance of FAU's pillar of the environment. It will increase the externally funded research, patents, and broad external recognition of our academic and research programs. Also, it will help to meet the community needs and fulfill unique institutional responsibilities by promoting the FAU mission statement of academic and personal development, discovery, and lifelong learning through excellence and innovation in teaching, outstanding research and creative activities, public engagement and distinctive scientific and cultural alliances, all within an environment that fosters inclusiveness. Furthermore, the program will address the community's acute need for environmental engineering graduates and professionals.

*Productivity:* By providing a new program in the area of environmental engineering, we will be increasing the degree productivity in the needed focus area of STEM and the environment. We will be increasing the research and commercialization activities, and increasing the level of community and business engagement. The new program should increase access and production of professional degrees in the state of Florida, while including students from traditionally underrepresented groups, returning adult students (which is a strength of FAU), and distance learning students. Most particularly because the program will be delivered in online and hybrid formats in 120 credits. The new program will also increase the externally funded research, patents, and foster an entrepreneurial culture as well as strengthen the pipeline for researchers pursuing graduate degrees in with an environmental engineering focus at FAU (via the MSCE water resources/environmental track). Also, the proposed program will help to meet the community's need for environmental engineering graduates and professionals trained in a culture of academic and personal development, discovery, lifelong learning, and public engagement. Finally, students and faculty will engage in Florida's growing industry and business community that is focused on the environment – a big part of Florida's economic engine.

*Strategic Priorities for a Knowledge Economy:* By providing a new program in the area of environmental engineering, we will be directly increasing student access and success in degree programs in the STEM fields and other areas of strategic emphasis that respond to existing, evolving, and emerging critical needs and opportunities. In addition, faculty and undergraduate researchers will be better able to attract more research funding from external sources and better able to promote more collaboration with private industry on research projects. Finally, this new program should directly increase the percentage of graduates who continue their education (and get graduate degrees in environmental engineering) or are employed in Florida, in which a large number of environmental-engineering related jobs remain available.

STATE UNIVERSITY SYSTEM GOALS	EXCELLENCE	PRODUCTIVITY	STRATEGIC PRIORITIES FOR A KNOWLEDGE ECONOMY
<b>TEACHING AND LEARNING</b>	DIRECT Strengthen Quality and Reputation of Academic Programs and Universities	DIRECT Increase Degree Productivity and Program Efficiency	DIRECT Increase the Number of Degrees Awarded in STEM and Other Areas of Strategic Emphasis
<b>SCHOLARHIP, RESEARCH AND INNOVATION</b>	DIRECT Strengthen Quality & Reputation of Scholarship, Research, and Innovation	DIRECT Increase Research and Commercialization Activity	DIRECT Increase Collaboration and External Support for Research Activity
<b>COMMUNITY AND BUSINESS ENGAGEMENT</b>	INDIRECT Strengthen Quality & Recognition of Commitment to Community and Business Engagement	DIRECT Increase Levels of Community and Business Engagement	DIRECT Increase Community and Business Workforce

FAU goals

Goal 1: *Access to and production of degrees.* By providing a new program in the area of environmental engineering, we will be increasing access to and production of professional degrees in the state of Florida.

Goal 2: *Meeting statewide professional and workforce needs.* By providing a new program in the area of environmental engineering, we will be helping to meet critical needs in science/engineering/technology fields that deal with the infrastructure design and construction of the natural and the built environment.

Goal 3: *Building world-class academic programs and research capacity.* By providing a new program in the area of environmental engineering, we will be helping to increase the externally funded research, patents, and broad external recognition of our academic and research programs.

Goal 4: *Meeting community needs and fulfilling unique institutional responsibilities.* By providing a new program in the area of environmental engineering, we will promote the FAU mission statement of promoting academic and personal development, discovery, and lifelong learning through excellence and innovation in teaching, outstanding research and creative activities, public engagement and distinctive scientific and cultural alliances, all within an environment that fosters inclusiveness. Furthermore, the program will address the community’s acute need for environmental engineering graduates and professionals.

**E. If the program is to be included in a category within the Programs of Strategic Emphasis as described in the SUS Strategic Plan, please indicate the category and the justification for inclusion.**

The Programs of Strategic Emphasis Categories:

1. Critical Workforce:
  - Education
  - Health
  - Gap Analysis
2. Economic Development:
  - Global Competitiveness



### 3. **Science, Technology, Engineering, and Math (STEM) ✓**

Please see the Programs of Strategic Emphasis (PSE) methodology for additional explanations on program inclusion criteria at [the resource page for new program proposal](#).

This proposed program is included in **Category 3. Science, Technology, Engineering, and Math (STEM)**. It is an engineering discipline with emphasis on natural science, technology, and design.

According to the US Department of Labor Bureau of Labor Statistics:

- Employment is projected to grow about as fast as the average for all occupations, although growth will vary by specialty; overall job opportunities for engineers are expected to be good.
- A bachelor's degree in engineering is required for most entry-level jobs, but some research positions may require a graduate degree.
- Starting salaries are among the highest of all college graduates.
- Continuing education is critical for engineers in order to keep up with improvements in technology.

Environmental engineers are expected to have employment growth of 31 percent over the projections decade, much faster than the average for all occupations. More environmental engineers will be needed to help companies comply with environmental regulations and to develop methods of cleaning up environmental hazards. A shift in emphasis toward preventing problems rather than controlling those which already exist, as well as increasing public health concerns resulting from population growth, also are expected to spur demand for environmental engineers. Because of this employment growth, job opportunities should be favorable.

#### **F. Identify any established or planned educational sites at which the program is expected to be offered and indicate whether it will be offered only at sites other than the main campus.**

The proposed program is expected to be offered at the main Boca Raton campus with online, mostly online, and hybrid eLearning content.

## INSTITUTIONAL AND STATE LEVEL ACCOUNTABILITY

### 1. Need and Demand

- A. **Need:** Describe national, state, and/or local data that support the need for more people to be prepared in this program at this level. Reference national, state, and/or local plans or reports that support the need for this program and requests for the proposed program which have emanated from a perceived need by agencies or industries in your service area. Cite any specific need for research and service that the program would fulfill.

The external consulting firm **Hanover Research** was contracted to review the demand for the program on July 14, 2015, and on October 2, 2015, they submitted the results of their market analysis of environmental engineering programs at the bachelor's level ("*Market Analysis-Environmental Engineering, October 2015,*" see appendix). Through this study, student demand was assessed as measured by degree conferral trends, the labor market outlook was measured by economic forecasts and job posting trends, and market saturation was based upon the number of graduates in the region compared to the number of projected job opportunities.

The findings by Hanover Research indicate that an environmental engineering program at Florida Atlantic University would be **very viable**. In general, the labor market is expected to grow significantly over the next several years and at current, especially in south Florida, **there are not enough graduates** being produced to meet demand in specific areas. For example, the Water Research Foundation is predicting a "workforce crisis" for water utility workers as the industry will see many of its current Baby Boomer Generation employees retire between now and 2020.

#### **Key Findings**

Enrollment and degree completions trends for bachelor's programs in South Florida indicate growing student demand for environmental engineering programs. A scan of programs in the area suggests that Florida International University (FIU) and the University of Miami (UM) are the only institutions within a 100-mile radius of Boca Raton offering bachelor's programs in this field. Bachelor's degree completions at these institutions expanded from seven completions in 2010 to 22 in 2014, indicating **rapidly expanding student interest in this field**.

Institutions in South Florida are not currently producing enough graduates to meet the labor market demand for the local environmental engineering workforce. FIU and UM graduated 22 undergraduates in environmental engineering in 2014, while the FDEO projects 191 annual job openings in related positions. Even considering both bachelor's and master's degree completions, **these institutions (FIU and UM) only produced enough graduates to fill 17% of the projected annual openings for environmental engineering related positions**.

**A new bachelor's program in environmental engineering at FAU may expand the future pipeline of students interested in graduate programming in this field.** Student outcomes data from 2011 to 2013 suggests that between 21 and 33 percent of students who studied environmental engineering at a State University System of Florida institution continued their education after graduation. Several Florida institutions have accelerated 4+1 programs that may incentivize students to remain at their undergraduate institution to complete a master's program, securing a steady pipeline of students for graduate offerings.















*Outlook:* Florida, and particularly South Florida is faced with a great deal of environmental challenges, which will provide numerous employment opportunities in that field into the foreseeable future. The South Florida tri-county area ranks in the top ten in the state of Florida for job openings in environmental engineering fields (Table 2).

**Table 2. 2014 Estimated Employment for Environmental Engineers in Florida by County (Source: Labor Market Statistics, Occupational Employment Projections Unit)**

Rank	Area Name	2014 Estimated Employment for Environmental Engineers
1	<a href="#">Hillsborough County</a>	461
2	<a href="#">Broward County</a>	385
3	<a href="#">Duval County</a>	210
4	<a href="#">Pinellas County</a>	186
5	<a href="#">Leon County</a>	133
6	<a href="#">Polk County</a>	122
7	<a href="#">Miami-Dade County</a>	121
8	<a href="#">Orange County</a>	118
9	<a href="#">Palm Beach County</a>	112
10	<a href="#">Volusia County</a>	112

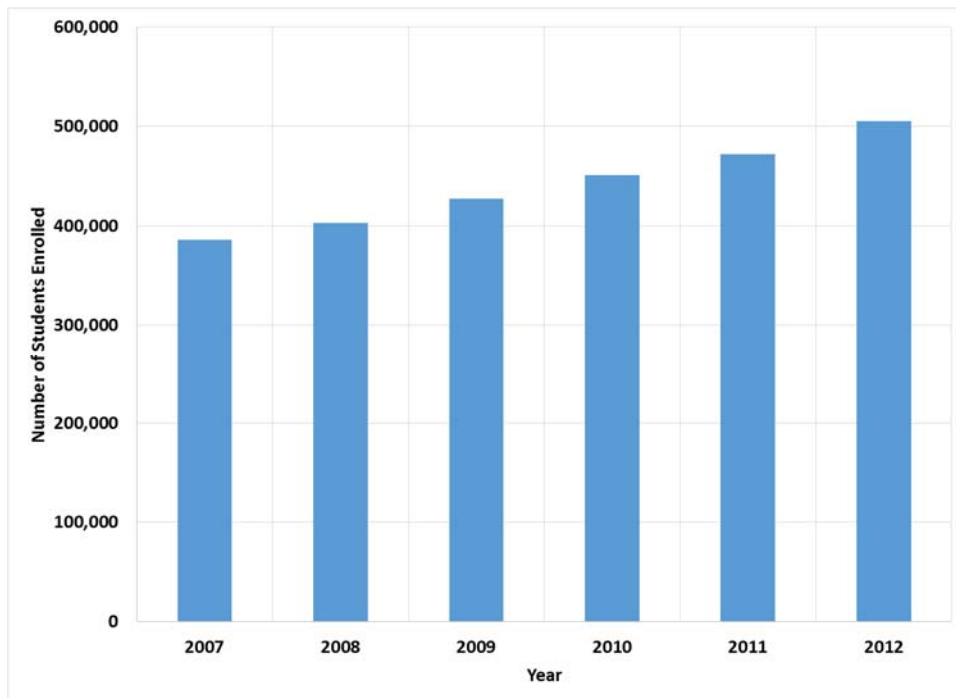
Graduates will have the opportunity to be employed by the private sector, local and state government, or start their own engineering practice. The requirement by the federal government to clean up contaminated sites is expected to help sustain demand for environmental engineering services. In addition, water/wastewater treatment is a major concern in areas of the country where new methods of drilling for shale gas require the use and disposal of massive volumes of water. New environmental engineers will continue to be needed to help utilities, water treatment plants, waste management facilities, and public health departments to comply with any new federal or state environmental regulations. Furthermore, the future of environmental engineering lies in the pollution prevention sector, which is a new field that is required to be taught in ABET-accredited programs. The American Society for Engineering Education (ASEE) tracks annual enrollments in engineering disciplines for 358 member institutions. The ASEE recognizes two relevant engineering disciplines to the proposed program at FAU: Civil and Environmental Engineering (CEE) and Environmental Engineering (EnvE). Enrollments in both CEE and EnvE have expanded rapidly, with nearly three times as many students enrolled in 2014 than there were in 2005 (Yoder 2014). Nationally, student demand for programs in environmental engineering and related fields increased between 2010 and 2014, with an annualized growth of almost 18 percent. In Florida, environmental engineering and civil/environmental engineering occupations rank in the top 5 of engineering-related estimated employment (Table 3), with a bright national outlook and both are considered green occupations.

**Table 3. 2014 Estimated Employment for Engineering-Related Fields (Source: Labor Market Statistics, Occupational Employment Projections Unit)**

Rank	Occupation Title	2014 Estimated Employment
1	<a href="#">Civil Engineers</a>  	13,863
2	<a href="#">Electrical Engineers</a>  	6,983
3	<a href="#">Electronics Engineers, Except Computer</a>  	5,119
4	<a href="#">Aerospace Engineers</a>  	3,439
5	<b>Environmental Engineers</b>  	<b>2,793</b>
6	<a href="#">Computer Hardware Engineers</a>  	1,974
9	<a href="#">Agricultural Engineers</a>  	176

 BRIGHT OUTLOOK NATIONALLY |  BRIGHT OUTLOOK STATEWIDE |  GREEN OCCUPATIONS

Environmental/Environmental Health Engineering programs awarded over 1,300 bachelor’s degrees in 2014, and Environmental Engineering Technology/Environmental Technology programs awarded 126 degrees in 2014, almost twice the number of bachelor’s degrees awarded in 2010 (IPEDS 2014). Degree conferral trends in Environmental/Environmental Health Engineering are most promising in South Florida (within 100 mile radius of Boca Raton), although growth is also robust at the state and national levels. In the South Florida region, programs at FIU and the UM experienced a combined annual growth of over 33 percent. At FIU, the number of bachelor’s degrees awarded grew from just two degrees in 2010 to 16 degrees in 2014, demonstrating substantial growth in student demand over this period. UCF and UF have the largest programs in the state, both awarding 41 bachelor’s degrees in Environmental/Environmental Health Engineering in 2014. According to the Hanover report, “however, with all programs experiencing net growth between 2010, it appears that the market is still not yet saturated for bachelor’s programs in Florida, or the South Florida region in particular” (Hanover 2015). National enrollment in environmental engineering is steadily trending upwards (Yoder 2012), as shown in Figure 1.



**Figure 1. National enrollment trends in environmental engineering undergraduate programs.**

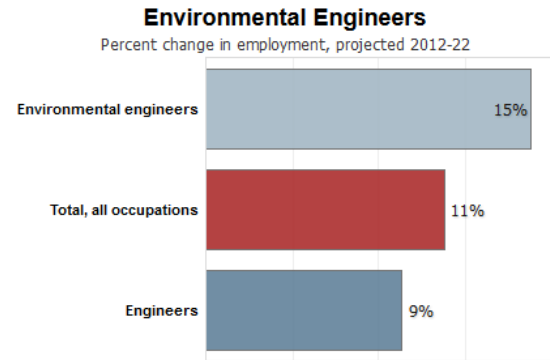
In terms of research, the environmental/water resources faculty in CEGE at FAU are responsible for 45-55% of the Department’s external research funding dollars. And we fully intend to pursue ABET accreditation for the program at the earliest opportunity to help accelerate the enrollment growth.

*Inquiries:* The CEGE department receives an increasing number of inquiries from students interested to study in the field of environmental engineering, and also by local industry recruiters seeking employees with a degree specialization in environmental engineering. From January to August 2014, we received 46 inquiries about the environmental engineering program from prospective undergraduate students including transfers from state colleges, out-of-state students, and transfers from 4-year programs both public and private within the state of Florida. In addition, another 19 students from non-engineering majors have inquired about a second bachelor’s degree in this area. A survey of seniors and recent graduates in the Department in December 2014 revealed that 54.6% of 66 students polled would have been interested in an environmental engineering bachelor’s degree program had it been offered when they entered FAU. Similar

sized institutions in Florida average over 200 environmental engineering applicants per year with about 25-30% enrolling from that pool.

In 2010, a survey was conducted of 130,505 college-bound sophomores that declared majors in Florida’s public schools on the PSAT test. The survey identified 10,310 students projecting engineering degrees, 2,219 projected engineering technology degrees, and 653 in the natural resources/conservation fields. These last two categories are of particular interest because they indicate students that would not otherwise select a 4-year engineering degree, but would be interested in environmental engineering. This represents a potential pool of prospective students for the proposed program.

**Workforce Needs:** Opportunities exist in such diverse and rich subjects as: sustainability engineering, alternative energy, urban watersheds, adaptations to climate change, fundamental physicochemical and biological processes in environmental systems and treatment processes, energy management, computational modeling, air quality, environmental microbiology, biotechnology, nanoscience, and green technologies. With respect to the job outlook, employment of environmental engineers is projected to grow 15% from 2012 to 2022, faster than the average for all job occupations.



Note: All Occupations includes all occupations in the U.S. Economy.  
Source: U.S. Bureau of Labor Statistics, Employment Projections program

According to employflorida.com, environmental engineering has a bright outlook nationally and is a green occupation. The highest number of job openings in the State of Florida with environmental engineering in the title as of September 7, 2014, occurs in the Miami-Fort Lauderdale-Pompano Beach metro service area. In 2012, the median annual wage for environmental engineers was \$80,890, and the top 10% earned more than \$122,290 (<http://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm>). The US Bureau of Labor Statistics predicts the number of new jobs needed between 2012 and 2022 by occupation, as shown in Table 4.

**Table 4. Employment outlook data for 2012-2022 for environmental engineering related occupations.**

Occupation	Number of 2012 Jobs	Projected Number of New Jobs 2012-2022	Projected Growth	2012 Median Pay
Civil/environmental	272,900	53,700	20%	\$80,770
Environmental specialists	90,000	13,200	15%	\$63,570
Environmental engineers	53,200	8,100	15%	\$80,890
Water/Wastewater engineers	53,000	21,100	21%	\$82,220
Environmental engineering technicians	19,000	3,500	18%	\$45,350
<b>Totals</b>	<b>488,100</b>	<b>99,600</b>	<b>Avg = 18%</b>	<b>Avg = \$76,390</b>
<b>Other Related Occupations (arranged alphabetically)</b>				
Agricultural engineers	3,000	800	7%	\$74,450
Atmospheric scientists	11,100	1,100	10%	\$89,260
Chemical engineer	33,300	1,500	4%	\$94,350
Conservation engineer	34,200	900	3%	\$59,060
Energy engineers	133,000	29,500	7%	\$92,680

Occupation	Number of 2012 Jobs	Projected Number of New Jobs 2012-2022	Projected Growth	2012 Median Pay
Engineering managers	193,800	13,100	7%	\$124,870
Fire prevention and protection engineers	24,000	9,700	14%	\$78,820
Geoscientists	38,200	6,000	16%	\$90,890
Health and safety engineers	24,100	2,600	11%	\$76,830
Hydrologists	7,000	2,900	14%	\$75,710
Industrial engineers	223,300	10,100	5%	\$78,860
Marine engineers	7,000	2,600	14%	\$89,550
Mining and geological engineers	7,900	1,000	12%	\$84,320
Natural science managers	51,600	2,900	6%	\$115,730
Occupational safety and health specialists	62,900	4,200	7%	\$66,790
Sales engineers	66,000	5,900	9%	\$91,830
Soil and water conservationists	22,000	6,600	2%	\$61,220

The Florida Agency for Workforce Innovation projects long-term job growth in water/wastewater engineering in Florida to grow by 18% with 110 new job openings per year with a median salary of \$61,800. Florida ranks 16<sup>th</sup> in the nation in job growth for this sector and ranks 6<sup>th</sup> in the nation with the most number of jobs projected for the next ten years, behind only California, Texas, New York, Massachusetts, and Pennsylvania.

Within the period from January 15 – February 15, 2015, a number of job search websites showed a large number of environmental engineering-related postings for employment opportunities in the south Florida region including: Broward, Palm Beach, Miami-Dade, Martin, St. Lucie, Glades, Hendry, Highlands, Indian River, and Okeechobee counties. The results of these searches are summarized in Table 5. It is interesting to note that the number of jobs available in South Florida is a significant percentage of the totals for the state.

**Table 5. Number of recent job postings from the first quarter of 2015.**

Job Site	Florida job postings	South Florida postings
Monster.com	1000+	439
EmployFlorida.com	596	499
Indeed.com	441	98
Careerbuilder.com	309	106
Linkedin.com	257	58
America's job exchange	98	23
US.jobs	27	9

According to data published in the Sun Sentinel on June 27, 2015 from the US Bureau of Labor Statistics, for South Florida there are currently a substantial number of jobs with high salary, as summarized in Table 6.

**Table 6. Summary of jobs and average salary for environmental engineering-related positions in South Florida (taken from Sun Sentinel 2015)**

Job Title	Number	Mean Salary
Environmental Engineer	710	72,100
Environmental Scientists and Specialists	1000	63,340
Environmental Engineering Technicians	180	42,270
Environmental Science and Protection Technicians	390	36,190
Water/Wastewater	1020	51,070
Conservation Scientists	40	85,460
Chemical Engineers	80	77,780
Civil/environmental engineers	3860	88,160
Civil/environmental technicians	640	51,910
Atmospheric scientists	210	90,250
Engineering managers	1890	118,880
Geoscientists	50	93,590
Health and safety engineers	280	67,880
Hydrologists	60	80,730
Industrial engineers	2400+410 techs	70,940+46,440
Marine engineers	460	86,960
Mining and geological engineers	No estimate	71,190
Occupational safety and health specialists	40+410	53,860+67,980
Sales engineers	470	No estimate
Soil and water conservationists	80	64,290

According to the Florida Department of Economic Opportunity (FDEO) projections, there will be about 660 annual job openings related to environmental engineering, with about 191 in the South Florida area. However, the entire State of Florida only produced 204 bachelor's and master's graduates in environmental engineering in 2014. Within South Florida, FIU and University of Miami awarded 22 bachelor's degrees, and FIU awarded 11 graduate degrees in 2014. South Florida institutions only produce about 17 percent of the graduates needed to fill the estimated job openings in environmental engineering in the local area.

**Highlights:**

- The US Bureau of Labor Statistics projects employment of environmental engineers to grow nationally 15% from 2012 to 2022, faster than the average for all job occupations.
- The Florida Agency for Workforce Innovation projects long-term job growth in environmental engineering in Florida to grow by 18%, which is higher than the national average.
- The highest number of job openings for recent environmental engineering graduates in Florida as of September 7, 2014, occurs in the Miami-Fort Lauderdale-Pompano Beach metro service area.
- Median annual wage for environmental engineers in 2012 was \$80,890, and the top 10% earned more than \$122,290 (<http://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm>).
- The US Bureau of Labor Statistics predicts the number of new jobs needed between 2012 and 2022 for environmental engineering-related occupations is 99,600 with another 101,400 in closely-related

fields.

- There were 1232 job postings for environmental engineering related job openings in South Florida in the first quarter of 2015.

Local Industry Demand: According to the career one-stop website of the U.S. Department of Labor, Employment and Training Administration (<http://www.myskillsmyfuture.org>), there are 18,012 water/wastewater and environmental engineering related businesses in Florida, and 8,200 of those environmental engineering businesses are located in south Florida. A recent survey of 25 local businesses determined that 75% of survey respondents would be “most likely” to hire graduates with an environmental engineering undergraduate degree in their company. The other 25% were “likely” to hire environmental engineering graduates, and none of those surveyed responded as “unlikely.”

Examples of businesses surveyed include:

- AECOM
- Calvin Giordano and Associates
- Chen-Moore and Associates
- Continental Florida Materials, Inc.
- Eckler Engineering
- Florida Department of Transportation
- Hazen and Sawyer
- Parsons
- Siemens Group
- South Florida Water Management District
- Engenuity Group, Stantec and many others

These companies range in size from 10 to well over 100 employees, and nearly all have been actively looking for environmental engineering interns over the past two years.

Testimonials: Albert Muniz, P.E., Vice President of Hazen and Sawyer commented at our December 2014 Industry Advisory Council meeting, that a new Environmental Engineering undergraduate degree program would “*raise the bar significantly*” because most applicants to his firm lack the environmental treatment process design skills he needs. Donald A. Eckler, P.E., President of Eckler Engineering remarked that, “*nearly all of his employees are recent FAU graduates, and a new program in environmental engineering would benefit his small business in a great number of ways.*” Edward Kent, Ph.D., P.E. is the chief Environmental Engineering Consultant for Parsons Corporation, and he remarked that, “*Environmental Engineering is the foundation for sustainability of our nation's natural resources. Here in Florida, we have the nexus of steep, long-term population growth and unique natural resources such as coral reefs, the Biscayne Aquifer, and the Everglades. Environmental engineers are in demand for the foreseeable future to assure the quality of life for our people and to protect and preserve our natural resources now and for future generations,*” and his firm would definitely hire FAU Environmental Engineering students if the program were in place.

Potential to Improve Graduate Enrollment: The number of students entering the existing graduate program in civil engineering in the water resources/environmental engineering track at FAU should be improved after this program creates the much needed undergraduate pipeline for the degree. The recent FETPIP list (2012-2013) shows that of the 108 graduates polled from undergraduate environmental engineering programs at UF, UCF, FGCU, and FIU, 55% were employed immediately prior to graduation with an additional 33% going on to graduate school.



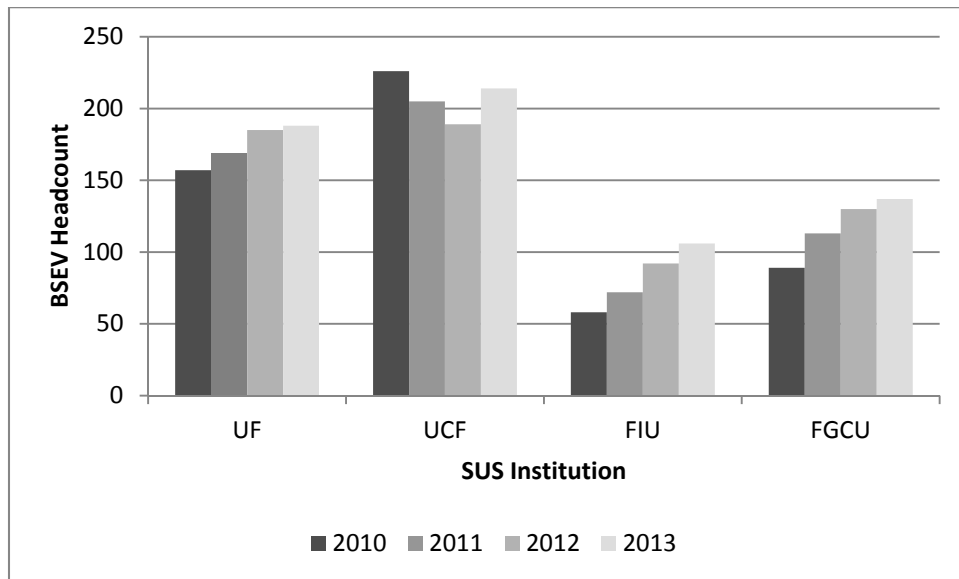
**B. Demand: Describe data that support the assumption that students will enroll in the proposed program. Include descriptions of surveys or other communications with prospective students.**

The Hanover Research market analysis showed national and state trends for enrollment, degree completions, and professional profiles are favorable for a new program in environmental engineering at FAU. A significant share of environmental professionals currently self-report as being from programs outside of the South Florida region; therefore, Hanover Research concludes, **“An additional environmental engineering program in South Florida may serve the population by providing more opportunities for study in the local area.”**

The Department of CEGE faculty and staff receive an increasing number of inquiries from students interested to study in the field of environmental engineering, and also by local industry recruiters seeking potential employees with a degree specialization in environmental engineering. From January to August 2014, we received 46 inquiries about the environmental engineering program from prospective undergraduate students including transfers from state colleges, out-of-state students, and transfers from 4-year programs both public and private within the state of Florida. In addition, another 19 students from non-engineering majors have inquired about a second bachelor’s degree in this area. A survey of seniors and recent graduates in the Department in December 2014 revealed that 54.6% of 66 students polled would have been interested in an environmental engineering bachelor’s degree program had it been offered when they entered FAU.

**C. If substantially similar programs (generally at the four-digit CIP Code or 60 percent similar in core courses), either private or public exist in the state, identify the institution(s) and geographic location(s). Summarize the outcome(s) of communication with such programs with regard to the potential impact on their enrollment and opportunities for possible collaboration (instruction and research). In Appendix C, provide data that support the need for an additional program.**

FIU, FGCU, UCF, and UF are the only SUS universities that have accredited environmental engineering programs in the state of Florida. FIU and the University of Miami (UM) are the only institutions within a 100-mile radius of Boca Raton offering bachelor’s programs in this field. Current enrollment from ABET-accredited institutions in the SUS with BS environmental engineering or related programs from which reported historical data is available and shown graphically in Figure 2 (all are face-to-face programs):



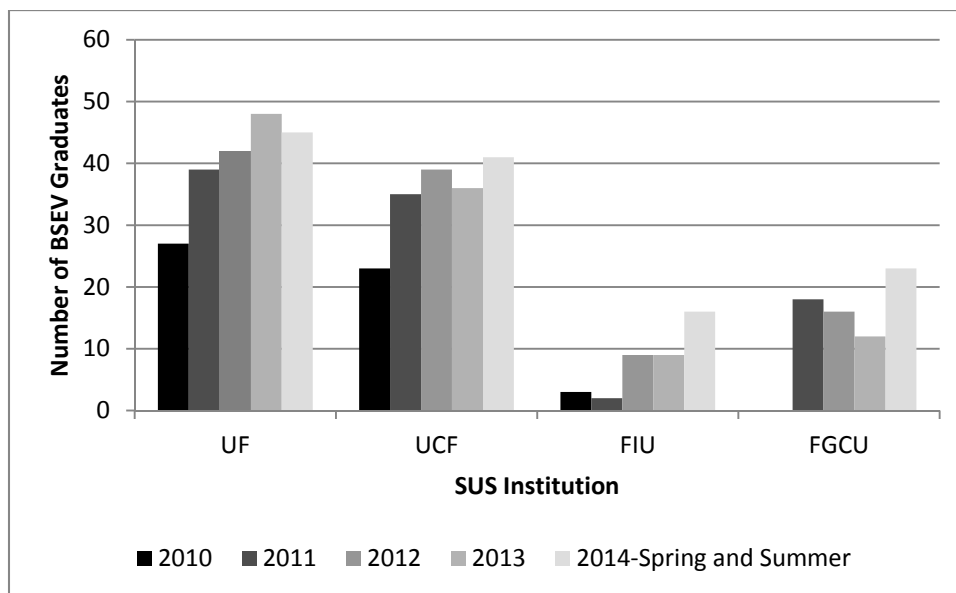
**Figure 2. Historical enrollment data in Environmental Engineering programs in the SUS.**

Note: UF, UCF, and FGCU have traditional environmental engineering programs. The UCF program was originally accredited in 1972, and is the oldest program in the SUS, followed by UF, which was originally accredited in 1977. The program at FIU was originally accredited in 2006 and was originally listed as environmental & urban systems but since then has become a traditional environmental engineering program. The program at FGCU is the youngest and was recently accredited in 2010. Headcounts and numbers of degrees conferred historically at these institutions is shown in Table 7.

**Table 7. Enrollment and Graduation Data for BS in Environmental Engineering, CIP 14.1401)**

Enrollments	2010	2011	2012	2013	Graduates	2010-11	2011-12	2012-13
FGCU	89	113	130	137	FGCU	18	16	12
FIU	58	72	92	106	FIU	2	9	9
UCF	226	205	189	214	UCF	35	39	36
UF	157	169	185	188	UF	39	42	48
<b>Total</b>	<b>585</b>	<b>590</b>	<b>610</b>	<b>645</b>	<b>Total</b>	<b>101</b>	<b>106</b>	<b>105</b>

Current graduation data from ABET-accredited institutions in the SUS with BS environmental engineering or closely related programs are shown graphically in Figure 3 (all are face-to-face programs):



**Figure 3. Historical graduation data in Environmental Engineering programs in the SUS.**

Demonstrated need for graduates: According to recent graduation data from 2009-2013 in the State of Florida, about 47 environmental engineering graduates are produced per million people. In South Florida, the current number is only 3 per million, clearly demonstrating that South Florida is failing to produce enough environmental engineers to meet the current demand. National trends reported by the Bureau of Labor Statistics estimate 10.8% annual growth rate in environmental engineering related jobs. State trends are slightly higher at 13-16%, as reported by the FDEO. The Hanover report (2015) stated that:

*“Employers in the environmental engineering field are expected to add nearly 700 jobs per year in Florida. The Water Research Foundation (WRF) predicts a “workforce crisis” for utility workers, particularly in engineering and operations positions. Due to a wave of retirements from the Baby Boomer Generation, some estimates project between 30 to 50 percent of the environmental engineering workforce will retire between now and 2020. This suggests that there may be a growing need for environmental engineers in*

*utilities, water treatment, and waste management settings to fill upcoming vacancies due to retirements in the industry. Florida is fifth largest employer of environmental engineers by volume in the United States. However, Florida also has the lowest median salary for these positions of any state in the top 10 by volume—more than \$10,000 lower than any other location.”*

This means that employers will encounter difficulty attracting graduates from outside of the local area because more competitive salaries are available elsewhere. Therefore, the local openings will more than likely be filled by graduates who already live in the area.

Relation to existing programs: All of the existing environmental engineering programs in the SUS require 126-128 credits for graduation. Our proposed program is for 120 credits with much of the upper division coursework offered in a hybrid online format with evening hours to allow part-time students and professionals to have access to completing their degree requirements. We are also working with the local state colleges to amend existing articulation agreements to provide smooth transition for transfer students into this program.

Specific differences: The University of Florida program is 127 credits and has a heavy emphasis on hydrology with 7 additional credits in this field compared to the proposed FAU program. CWR4202-hydrologic engineering covers all FE exam topics in the environmental engineering or the civil engineering topical exam and fulfills the ABET requirements on its own. Furthermore, students can opt to take electives offered in this subfield. The Florida Gulf Coast University program is 128 credits and includes a surveying course, an entrepreneurship course, and splits up the wastewater and water supply courses as well as the solid and hazardous waste courses compared to the proposed program at FAU. We do not require surveying for environmental engineering majors (since this is not a topic on the FE exam for environmental engineers), although we do offer a surveying and mapping certificate for interested students. Our water and wastewater course covers the necessary material, and students can specialize in the graduate program or take an elective in these areas. The same is true for the solid and hazardous waste management courses. The University of Central Florida program is also 128 credits and includes a heavy emphasis on process control and chemical engineering (13 credits) as well as a geotechnical engineering course. Our faculty have specified a geology course instead of a soil mechanics course, and our process control topics are woven throughout the curriculum instead of creating additional courses. Finally, Florida International University’s program is 126 credits and has a course in circuits (which is covered in Physics 2), splits the solid and hazardous waste course into two 3-credit classes, has two 1-credit environmental engineering labs, and includes public speaking, engineering economics, and ethics as separate courses that are dealt with in our proposed capstone and other senior level coursework.

- D. Use Table 1 in Appendix A (1-A for undergraduate and 1-B for graduate) to categorize projected student headcount (HC) and Full Time Equivalents (FTE) according to primary sources. Generally undergraduate FTE will be calculated as 40 credit hours per year and graduate FTE will be calculated as 32 credit hours per year. Describe the rationale underlying enrollment projections. If students within the institution are expected to change majors to enroll in the proposed program at its inception, describe the shifts from disciplines that will likely occur.**

The projection of part time and full time students expected to enroll in the proposed environmental engineering program is shown in Table 1 of Appendix A. The following assumptions were used to develop the projections:

1. Based on student interest and surveys conducted in 2014/15, a conservative estimate of headcount entering the program in the first year is 25, assuming that the program is approved in time to conduct marketing promotions for Fall 2016 to attract students. The breakdown of the initial expected group of students is detailed in Table 1 of Appendix A. One of the newest environmental engineering programs in the country (Texas A&M-Kingsville) started with 36

students and grew to 48 in year two. Similarly, UC-Merced started with 5 students in 2005 and added about 14 additional students per year until accreditation in 2013 (n=117).

2. Headcount to FTE conversion was based on the University's overall ratio of headcount to FTE of 1.637.
3. The national average growth in graduates is 13 – 18% per year (Yoder 2012). Mature programs are growing at 5 – 6% per year after being established for more than a decade. Taking the average growth numbers for FGCU and FIU in their early years, about 10-20 new students were added per year; therefore, 14 students were added in year two and 16 per year, thereafter.

Initially we expect several of the students currently in the pre-professional engineering program to declare environmental engineering as the major. The College of Engineering and Computer Science central advising office has also reported a strong interest level from students currently in the pre-professional program at FAU to declare the major when available. It has been known for some time, that this new degree program will be available shortly, so some students have been asking about which courses to take in order to position themselves for when the program is officially approved. We are aware that it is also expected that a small number of students from other engineering majors within the university may wish to change major to environmental engineering most likely from the most closely related discipline of civil engineering, but also a number of non-engineering majors or graduates from environmental-related disciplines are anticipated to change major or register for 2<sup>nd</sup> bachelor's degrees to be eligible for professional licensure. However, the environmental engineering discipline appeals to a wider audience of potential students, and we expect to attract students from outside FAU through our Department's current outreach activities with our partner state colleges and local area STEM magnet schools.

- E. Indicate what steps will be taken to achieve a diverse student body in this program. If the proposed program substantially duplicates a program at FAMU or FIU, provide, (in consultation with the affected university), an analysis of how the program might have an impact upon that university's ability to attract students of races different from that which is predominant on their campus in the subject program. The university's Equal Opportunity Officer shall review this section of the proposal and then sign and date Appendix B to indicate that the analysis required by this subsection has been completed.**

Diversity is a top priority of the College of Engineering and Computer Science and the community of citizens and professionals that it serves. The College has a diverse student body as does the Department of Civil, Environmental & Geomatics Engineering. Florida Atlantic University takes special pride in the diversity of its student body, faculty, and staff. We take tremendous pride in the fact that Florida Atlantic University has long ranked as the most racially, ethnically and culturally diverse institution in Florida's State University System. In 2013, minority students made up 47 percent of the 30,000-member student body. U.S. News & World Report has ranked FAU the 27th most diverse university in the nation. Additionally, a review of U.S. Department of Education data in *Diverse: Issues in Higher Education*, ranks the University 32nd nationally in the number of bachelor's degrees conferred upon minorities. Students from 57 countries received degrees at the University's spring 2013 commencement ceremonies, demonstrating the extent to which FAU has become an international center of learning; in recent years, FAU has hosted students from more than 180 countries. But diversity at FAU is reflected by more than numbers. We celebrate the rich tapestry of cultures, customs, and heritage represented in the University community in a multitude of ways, from formal academic programs and lectures to clubs and social events. The summary of FAU diversity data for Fall 2014 is shown in Table 8.

**Table 8. Summary of FAU diversity data for Fall 2014.**

<b>Diversity</b>	<b>Fall 2014 University</b>	<b>Fall 2014 College</b>	<b>Fall 2014 CEGE</b>	<b>2008 BS Science and Engineering National Average*</b>
<b>American Indian</b>	0.2%	0.3%	0.0%	0.5%
<b>Asian</b>	4.3%	5.9%	2.3%	10.1%
<b>Black</b>	18.6%	12.5%	20.9%	4.9%
<b>Hispanic</b>	23.8%	23.6%	14.0%	5.5%
<b>Pacific Islander</b>	0.1%	0.3%	2.3%	0.5%
<b>Female</b>	57.0%	14.2%	20.4%	36.2%

\* Jaquelina C. Falkenheim (jfalkenh@nsf.gov; 703-292-7798) and Joan S. Burrelli (retired), Science and Engineering Indicators Program, National Center for Science and Engineering Statistics, National Science Foundation, 4201 Wilson Boulevard, Suite 965, Arlington, VA 22230. Source: National Science Foundation/National Center for Science and Engineering Statistics, Scientists and Engineers Statistical Data System (SESTAT): 2008.

The College is an active participant in SECME, Inc., a middle and high school program with a minority focus. It also participates in NSTEP (National Science & Technology Education Partnership), an activity of the Electronic Industries Alliance working to interest young persons in engineering.

The College has a Freshman Learning Community and regularly partners with business, industry, and professional organizations focusing on recruitment and retention for engineering. The College also was a founding partner, along with the FIU College of Engineering, in creation of the Latin American & Caribbean Consortium for Engineering Institutions (LACCEI). LACCEI's focus is collaborative activities and partnerships with engineering and computer science programs throughout Latin America and the Caribbean. The College participated in an eight year NSF grant (called Students to Engineering Practice - STEP) that targeted financially challenged students. Women and minorities were well-represented in this program. A new NSF program focusing on minorities and transfer student retention in STEM is being launched in 2015 with the Office of Undergraduate Research and Inquiry, the College of Science, and the College of Engineering and Computer Science as part of a three-university study. The College also provides free one-on-one tutoring to assist with student retention.

The proposed program substantially duplicates a currently existing program at FIU. At the Council of Associate Vice Provosts meeting in February 6, 2015, FIU had the opportunity to provide input on the proposed program but never voiced any concerns about diversity. This is likely because Colleges of Engineering nationwide are typically considered very diverse (refer to NSF data from Table 8). FAU may in the near future be designated as a minority serving institution, and therefore complement the increased access to undergraduate degrees to minorities by FIU.

According to the Hanover Research market analysis (2015), "Institutions in South Florida are not currently producing enough graduates to meet the labor market demand for the local environmental engineering workforce. FIU and UM graduated 22 undergraduates in environmental engineering in 2014, while the FDEO projects 191 annual job openings in related positions. Even considering both bachelor's and master's degree completions, these institutions only produced enough graduates to fill 17 percent of the projected annual openings for environmental engineering related positions." Furthermore, the environmental engineering degree has a broader appeal to minorities and women in particular. According to the American Society of Engineering Educators ([http://www.asee.org/papers-and-publications/publications/14\\_11-47.pdf](http://www.asee.org/papers-and-publications/publications/14_11-47.pdf) (pg. 12), environmental engineering has the most even distribution of women in any engineering field, with about 48 percent of degrees awarded to women, compared to just 20 percent across all engineering fields.

## 2. Budget

- A. Use Table 2 in Appendix A to display projected costs and associated funding sources for Year 1 and Year 5 of program operation. Use Table 3 in Appendix A to show how existing Education & General funds will be shifted to support the new program in Year 1. In narrative form, summarize the contents of both tables, identifying the source of both current and new resources to be devoted to the proposed program. (Data for Year 1 and Year 5 reflect snapshots in time rather than cumulative costs.)

See attached spreadsheet file (Appendix A-Table 2).

The budget includes reallocated base faculty salaries and benefits for the current faculty members in the program (the percent effort is shown in Table 4), two new faculty members (one starting in Fall 2017 and one starting in Fall 2018), one laboratory technician position (other new recurring), and two graduate student teaching assistant positions with another two to be provided by research contracts and grants funding (by year 5, this number is expected to be 3). The first faculty member starting in Fall 2017 will be in the air pollution/air quality field to fill a gap in our current faculty. As stated earlier, ABET requirements for an air quality lab experience dictate that this new faculty member should have an air pollution background. The second faculty member starting in Fall 2018 will be in the water/wastewater engineering field to provide sufficient faculty to be able to deliver the upper division courses in both Fall and Spring semesters once the headcount increases to beyond 40-50 students. These two new hires are strongly tied to the University's pillars and platforms strategic plan for the race to excellence, particularly in *Ocean Science and Engineering / Environmental Sciences* but also in *Sensors and Smart Systems*. It is anticipated that the two new faculty members will require startup funding and expenses related to preparing their office (phone, computer, work station, etc.) and research/teaching labs. Expenses include computers/printers, phones, copier, postage printing, travel, office supplies, information technology supplies, and specialized software. An allocation for recruiting (brochures, travel, etc.) is also requested to be able to attract new students from outside FAU in the partner state colleges and the local area STEM magnet schools. Operating capital outlay is for purchasing teaching/research laboratory equipment primarily for the specialized air pollution laboratory course (ENV4115C-Air Pollution and Control Systems with Lab). It is anticipated that some of this equipment will be procured from tech fee grants, donations, startup funds from faculty hires, etc. In addition, this proposed program is a priority for the College such that funding will be reallocated to match the university/College priorities.

- B. Please explain whether the university intends to operate the program through continuing education on a cost-recovery basis, seek approval for market tuition rate, or establish differentiated graduate-level tuition. Provide a rationale for doing so and a timeline for seeking Board of Governors' approval, if appropriate. Please include the expected rate of tuition that the university plans to charge for this program and use this amount when calculating cost entries in Table 2.

The proposed program does not intend to operate through continuing education on cost-recovery basis or market tuition rate or differentiated tuition.

- C. If other programs will be impacted by a reallocation of resources for the proposed program, identify the impacted programs and provide a justification for reallocating resources. Specifically address the potential negative impacts that implementation of the proposed program will have on related undergraduate programs (i.e., shift in faculty effort, reallocation of instructional resources, reduced enrollment rates, greater use of adjunct faculty and teaching assistants). Explain what steps will be taken to mitigate any such impacts. Also, discuss the potential positive impacts that the proposed program might have on related undergraduate programs (i.e., increased undergraduate research opportunities, improved quality of instruction associated with cutting-edge research, improved labs and library resources).

It is anticipated that the new environmental engineering program will positively complement the existing civil engineering and geomatics engineering programs by providing increased undergraduate research opportunities for students with environmental interests, improved quality of instruction associated with cutting-edge research in the environmental fields (and since many upper division courses among the three programs overlap, this should translate to improved student outcomes in the better equipped labs with specialized equipment). Many of the civil engineering and environmental engineering courses overlap, so it is expected that class size will increase in courses such as Statics, Strength of Materials, Applied Hydraulics, Hydrologic Engineering, etc. With the laboratory improvement resources in the BSEV budget, these upgraded labs will benefit students in both programs. Department recruitment efforts in targeted STEM magnet schools and partner state colleges will strengthen the pipeline of students in all three programs so that none of the degree programs in the Department will face any negative consequences other than increased class size.

**D. Describe other potential impacts on related programs or departments (e.g., increased need for general education or common prerequisite courses, or increased need for required or elective courses outside of the proposed major).**

Environmental engineering relates strongly to the existing civil and geomatics engineering programs and with multidisciplinary programs such as geosciences, environmental science, political science, chemistry, biology, ecology, and it is also closely aligned with urban and regional planning. Graduates of this proposed program would be excellent candidates for graduate programs in the sciences (geosciences, environmental science, chemistry, biology), political science, and urban and regional planning (and vice versa). Geosciences will provide one of the existing required courses (GLY2010C-Physical Geology/Evolution of the Earth) and several earth science electives; Chemistry will provide required coursework in chemical principles including stoichiometry, equilibrium, and kinetics (CHM2045-General Chemistry 1 and CHM2045L-General Chemistry 1 Lab; CHM2046-General Chemistry 2 and CHM2046L-General Chemistry 2 Lab), Biology will provide another required course (BSC1001-Life Science and BSC1001L-Life Science Lab), Mathematics will provide existing common core classes including the calculus sequence (MAC2311-Calculus with Analytical Geometry 1, MAC2312-Calculus with Analytical Geometry 2, MAC2313-Calculus with Analytical Geometry 3) as well as MAP3305-Engineering Mathematics 1 and STA4032-Probability and Statistics for Engineers. Physics will provide existing common core courses including the calculus-based physics (PHY2048-General Physics 1 (for Engineers), PHY2048L-General Physics Lab 1, PHY2044-Physics for Engineers 2 and PHY 2049L-General Physics Lab 2). Urban and Regional Planning will offer electives such as URP2051-Designing the City, and some of the engineering disciplines currently offer many of the engineering fundamentals coursework needed for this program (e.g. EGN3311-Statics, EGN3331-Strength of Materials, EGN2213-Computer Applications in Engineering, EGN3343-Engineering Thermodynamics, etc.). **Supporting statements were requested of several departments who offer technical electives related to the proposed program, and those documents are found in Appendix H.** Students in the sciences who wish to become licensed engineers will be integrated seamlessly into the BS Environmental Engineering program. With its focus on math, science, general education, and other preparatory work, the first two years of the Environmental Engineering curriculum are much the same as those for other engineering programs in the College. Through existing articulation agreements for engineering majors, almost all of this lower division coursework can be completed at any Florida state college.

**E. Describe what steps have been taken to obtain information regarding resources (financial and in-kind) available outside the institution (businesses, industrial organizations, governmental entities, etc.). Describe the external resources that appear to be available to support the proposed program.**

Because of the very pressing demand for trained engineering professionals in Florida, the proposed Environmental Engineering program is attracting generous offers of help and financial support in the forms of donations from business and industry, private contributions, and contributions in-kind. Once the degree has been approved by the BOT, an extensive program of development and fundraising for support will be implemented by the College's Development Officer and the College's Executive Advisory Council. Concurrently, a capital campaign (\$450K campaign) is planned to secure laboratory naming rights through private donations. Conversations with professional societies and with business and industry show very strong interest in in-kind gifts. Possibilities include use of equipment and/or facilities; provision of speakers, instructors, and mentors; contribution of real-world design problems; provision of summer employment and consulting opportunities for faculty; internships, part-time employment, and scholarships for students. Donations, research contracts, grants, and in-kind gifts supportive of the program are expected. These funds are listed in Appendix A-Table 4 under Contracts & Grants.

Currently available scholarships for students are the following:

- Andrew Montano Scholarship (2) \$1,000 - Open to an incoming freshman, sophomore, junior or senior with a minimum GPA of 3.0, that possesses unmet financial need (completion of FAFSA is required) and is a mechanical engineering major.
- Eric Alexander Engineering and Computer Science Scholarship (2) \$1000 - Awards are available to undergraduate engineering or computer science students who have a minimum 3.0 GPA and who have completed more than 30 credit hours. Preference will be given to students from the Treasure Coast area (Martin and St. Lucie Counties). This scholarship may be renewed for up to four consecutive years if 3.0 GPA is maintained. Pre-engineering students are not eligible for this award.
- Keith and Schnars, P.A. Scholarship Endowment \$900 - Award available to a junior or senior Civil or Geomatics engineering student with a minimum 2.5 GPA who has potential to be a leader in Civil or Geomatics engineering. Recipient must be a U.S. citizen or a local South Florida resident.
- Tyco International Innovation Leadership Endowed Scholarship \$1,000 - Open to an undergraduate engineering or computer science student, who is a U.S. citizen or permanent resident, participating in the Innovation Leadership Honors Program with a minimum GPA of 3.0. Preference will be given to students who are designated as being in an underrepresented segment of the U.S. population in the field of engineering.
- Florida Water Environment Association Scholarship \$1000 - Award available to a full-time civil engineering student with more than 60 credits who demonstrates an interest in water resources, water, and wastewater treatment and related fields. Applicants must have a minimum 3.2 GPA, merit and potential for contribution to the field & profession, and be a member of the Florida Water Environment Association.
- LoBello Innovation Leadership Endowed Scholarship (2) \$1,000 - Awards available to junior or senior engineering or computer science students, who are U.S. Citizens, participating in the Innovation Leadership Honors Program with a minimum GPA of 3.0. Preference will be given to female students in an effort to address the issue of under-representation of women in engineering. This scholarship may be renewed if funding is available.
- Karl K. Stevens Student Scholarship \$1000 - Award available to all junior or senior engineering or computer science students who have displayed leadership while in college.

The College of Engineering and Computer Science received \$119,210.60 in gifts from individuals, corporations and foundations last fiscal year (July 1, 2014 through June 30, 2015).

The CEGE faculty associated with this proposed degree program also have an extensive extramural grant funding record, with 18 projects from 9 different sponsor agencies totaling nearly \$660,000 in the last 5 years. A summary of the project titles, sponsors and award amounts is presented in Table 9.



**Table 9. Summary of Grants Awarded as PI for Participating Faculty (07/01/2011 – 07/01/2015).**

PI	Grant Title	Sponsor	Project Period	Award Amount
Bloetscher	Davie Stormwater Research Program	Town of Davie	2014-2015	\$86,988
Bloetscher	West Palm Beach Stormwater Master Plan	Chen Moore & Associates	2014-2016	\$30,207
Meeroff	Onsite Treatment of Leachate Using Energized Processes	Hinkley Center for Solid and Hazardous Waste Management	2011-2013	\$40,000
Meeroff	Sustainable Management of Pollutants Underneath Landfills	Hinkley Center for Solid and Hazardous Waste Management	2012-2014	\$40,000
Meeroff	Critical Examination of Leachate Collection System Clogging at SWA Disposal Facilities	Solid Waste Authority of Palm Beach County	2012-2014	\$50,000
Meeroff	Year Two Critical Examination of Leachate Collection System Clogging at SWA Disposal Facilities	Solid Waste Authority of Palm Beach County	2013-2014	\$50,000
Meeroff	Safe Discharge of Landfill Leachate to the Environment	Hinkley Center for Solid and Hazardous Waste Management	2013-2014	\$51,780
Meeroff	Assessing Options for On-Site Leachate and Groundwater Management Strategies at Florida Landfills	University of Florida	2013-2014	\$4,836
Meeroff	Safe Discharge of Landfill Leachate to the Environment, Year Two	Hinkley Center for Solid and Hazardous Waste Management	2014-2015	\$53,752
Meeroff	Year 3: Continuation of Critical Examination of Leachate Collection System Clogging at SWA Disposal Facilities	Solid Waste Authority of Palm Beach County	2013-2015	\$19,749
Teegavarapu	In-Filling Missing Daily Rain Gauge Data Using Radar Rainfall Data: Influence of Homogenous Rain Areas	University of Florida	2011-2016	\$15,000
Teegavarapu	Development and Evaluation of Indices for Bias Assessment of Radar-Based Rainfall in South Florida Water Management District	South Florida Water Management District	2012-2012	\$38,000
Teegavarapu	Development and Evaluation of Data Accuracy Assessment Algorithms for Identifying Anomalies in Hydro-Meteorological Data (Phase 1: Stage)	South Florida Water Management District	2013-2013	\$39,000
Teegavarapu	Integrating Virtual 3D Lab Modules for Flood Modeling Studies in Civil Engineering Curriculum: An Inter-University Implementation & Assessment	Purdue University	2013-2015	\$12,998
Teegavarapu	NSF Research Experience for Graduates & Post-Doctoral Scholars: Support to Attend & Participate in Weather Radar & Hydrology (WRaH) Conference in 2014	National Science Foundation	2013-2014	\$19,900
Teegavarapu	Evaluation & Development of Data Accuracy Assessment Algorithms for Identifying Anomalies in Hydro-Meteorological Data (Phase II: Stage)	South Florida Water Management District	2014-2014	\$48,000
Teegavarapu	Data Quality Improvement for NEXRAD and Stage Data	South Florida Water Management District	2014-2015	\$42,500
Teegavarapu	Evaluation of Data Accuracy Assessment Algorithms for Identifying Anomalies Stage Data	University of Florida	2014-2014	\$16,000
TOTAL	18 Projects	8 Sponsors	2011-2015	\$658,710

### 3. Projected Benefit of the Program to the University, Local Community, and State

Use information from Tables 1 and 2 in Appendix A, and the supporting narrative for “Need and Demand” to prepare a concise statement that describes the projected benefit to the university, local community, and the state if the program is implemented. The projected benefits can be both quantitative and qualitative in nature, but there needs to be a clear distinction made between the two in the narrative.

## **Quantitative**

On October 2, 2015, there were 191 job openings in South Florida for environmental engineering graduates, and UM and FIU produced 33 degree completions, if a new FAU degree program in environmental engineering can double the number of graduates that take locally available jobs (n=33), this would mean an addition of \$2.1 million dollars to the local economy based on the median Florida salary for environmental engineers (BLS 2014). If 30% of those graduates continued on to graduate school, this would add another 10-11 students to the MSCV graduate program at FAU and also considerably increase the impact to the local economy because local industry prefers graduates with a master's degree and pays them better than the median salary.

## **Qualitative**

According to the Hanover Research market analysis, "Enrollment and degree completions trends for bachelor's programs in South Florida indicate growing student demand for environmental engineering programs. A scan of programs in the area suggests that Florida International University (FIU) and the University of Miami (UM) are the only institutions within a 100-mile radius of Boca Raton offering bachelor's programs in this field. Bachelor's degree completions at these institutions expanded from seven completions in 2010 to 22 in 2014, indicating rapidly expanding student interest in this field."

The labor market outlook for environmental engineering-related occupations is very strong. The Florida Department of Economic Opportunity (FDEO) forecasts economic growth of around 16 percent in South Florida through 2022 for these environmental engineering fields. Institutions in South Florida are not currently producing enough graduates to meet the labor market demand for the local environmental engineering workforce. FIU and UM graduated 22 undergraduates in environmental engineering in 2014, while the FDEO projects 191 annual job openings in related positions. Even considering both bachelor's and master's degree completions, these institutions only produced enough graduates to fill 17 percent of the projected annual openings for environmental engineering related positions.

A new bachelor's degree program in environmental engineering may expand the future pipeline of students interested in graduate programming in this field. Student outcomes data from 2011 to 2013 suggests that between 21 and 33 percent of students who studied environmental engineering at a State University System of Florida institution continued their education after graduation. Several Florida institutions have accelerated 4+1 programs that may incentivize students to remain at their undergraduate institution to complete a master's program, securing a steady pipeline of students for graduate offerings.

## **4. Access and Articulation – Bachelor's Degrees Only**

- A. If the total number of credit hours to earn a degree exceeds 120, provide a justification for an exception to the policy of a 120 maximum and submit a separate request to the Board of Governors for an exception along with notification of the program's approval. (See criteria in Board of Governors Regulation 6C-8.014)**

The Bachelor of Science in Environmental Engineering (BSEV) program will be offered as 120 credits.

- B. List program prerequisites and provide assurance that they are the same as the approved common prerequisites for other such degree programs within the SUS (see link to the Common Prerequisite Manual on [the resource page for new program proposal](#)). The courses in the Common Prerequisite Counseling Manual are intended to be those that are required of both native and transfer students prior to entrance to the major program, not simply lower-level courses that are required prior to graduation. The common prerequisites and substitute courses are mandatory for all institution programs listed, and must be approved by the Articulation Coordinating Committee (ACC). This requirement includes those programs designated as "limited access."**

If the proposed prerequisites are not listed in the Manual, provide a rationale for a request for exception to the policy of common prerequisites. NOTE: Typically, all lower-division courses required for admission into the major will be considered prerequisites. The curriculum can require lower-division courses that are not prerequisites for admission into the major, as long as those courses are built into the curriculum for the upper-level 60 credit hours. If there are already common prerequisites for other degree programs with the same proposed CIP, every effort must be made to utilize the previously approved prerequisites instead of recommending an additional “track” of prerequisites for that CIP. Additional tracks may not be approved by the ACC, thereby holding up the full approval of the degree program. Programs will not be entered into the State University System Inventory until any exceptions to the approved common prerequisites are approved by the ACC.

The following courses are listed in the Common Prerequisite Manual as the “48 hours” for all engineering programs:

Course Number	Title	Credit hours
ENCX101	English 1	3
ENCX101	English 2	3
MACX311	Calculus I with Analytical Geometry	4
MACX312	Calculus II with Analytical Geometry	4
MACX313	Calculus III with Analytical Geometry	4
MAPX302	Differential Equations	3
CHMX045	General Chemistry 1	3
CHMX045L	General Chemistry 1 Lab	1
PHYX048	Physics 1	3
PHYX048L	Physics 1 Lab	1
PHYX049	Physics 2	3
PHYX049L	Physics 2 Lab	1

For CIP code 14.1401 – Environmental (Health) Engineering programs, CHMX046-General Chemistry 2 (3-credits) and CHMX046L-General Chemistry 2 Lab (1-credit) are also included.

All of these courses are listed in the lower 48 credit requirement of the proposed Bachelor of Science in Environmental Engineering (BSEV) degree program here. No exceptions are requested.

- C. If the university intends to seek formal Limited Access status for the proposed program, provide a rationale that includes an analysis of diversity issues with respect to such a designation. Explain how the university will ensure that Florida College System transfer students are not disadvantaged by the Limited Access status. NOTE: The policy and criteria for Limited Access are identified in Board of Governors Regulation 6C-8.013. Submit the Limited Access Program Request form along with this document.

The proposed program is not Limited Access.

- D. If the proposed program is an AS-to-BS capstone, ensure that it adheres to the guidelines approved by the Articulation Coordinating Committee for such programs, as set forth in Rule 6A-10.024 (see link to the Statewide Articulation Manual on [the resource page for new program proposal](#)). List the prerequisites, if any, including the specific AS degrees which may transfer into the program.

The proposed program is not AS-to-BS capstone. We are currently working with our local state college partners to create articulation agreements for AA and closely related AS programs.

## INSTITUTIONAL READINESS

### 1. Related Institutional Mission and Strength

- A. Describe how the goals of the proposed program relate to the institutional mission statement as contained in the SUS Strategic Plan and the University Strategic Plan (see link to the SUS Strategic Plan on [the resource page for new program proposal](#)).

The Department follows the strategic goals of the College and the University. In addition, Environmental Engineering is part of the Department's name "*Civil, Environmental and Geomatics Engineering*" and the development of a separate Environmental Engineering undergraduate program was always a prime goal for the Department, which has been encouraged by the Department Advisory Council comprised of local industry representatives.

This program supports the College of Engineering and Computer Science strategic goals, specifically:

*Goal 1: Access to and production of degrees diversity.* The new program will add a new BS degree that would supplement the educational opportunities within the University and the community.

*Goal 2: Meeting statewide professional and workforce needs.* Environmental engineering is a very important and in high demand engineering discipline for the state of Florida and provides a lot of employment opportunities within the private and the public sector. In addition, the mere fact that Florida is prone to natural disasters such as flooding, droughts, hurricanes, wildfires and climate change impact creates a special need for environmental engineering.

*Goal 3: Building world class academic programs and research capacity.* Environmental Engineering will be grown along with Civil Engineering, a well-respected existing program. That will enhance the Department's research capabilities. Notably, the Civil Engineering program at FAU won the 2012 National Council of Examiners for Engineering and Surveying (NCEES) Award (\$25,000 Grand Prize Winner) for faculty/student participation in the design of the City of Dania Nanofiltration Facility that is possibly the first in the world water treatment plant to receive a LEED Gold certification. The proposed program will create new opportunities for engineering collaboration with science disciplines, i.e. chemistry, biology, geology, biomedical, etc.

*Goal 4: Meeting community needs and fulfilling unique institutional responsibilities.* By providing graduates trained in environmental engineering the College, is responding to the State-wide need for STEM disciplines, and particularly to those related to ecological and environmental issues.

This program supports the FAU strategic plan, specifically:

*Goal I: Enrich the educational experience.* By providing a new program in the area of environmental engineering, we will be able expand the breadth and scope of FAU's STEM initiatives by increasing the number of students, programs, scholarships and degree awards in a new STEM discipline.

*Goal II: Inspire research, scholarship and creative activity.* By providing a new program in the area of environmental engineering, we will be able to attract, retain, and increase new research, scholarship and creative activities, and support the QEP focused on undergraduate research.

*Goal III: Increase FAU's community engagement.* By providing a new program in the area of environmental engineering, we will be able to expand our successful and positive collaborations with the local public utilities

and private sector consulting firms in FAU's service area to foster externally funded research programs and provide opportunities for experiential learning for our students.

*Goal IV: Leverage momentum toward achieving FAU's strategic goals by being good stewards of its human, technological, physical and financial resources.* By providing a new program in the area of environmental engineering, we will be able to retain students with interest in environmental careers who are currently transferring to other institutions to pursue their undergraduate studies in the field of environmental engineering.

In addition, a program in environmental engineering will contribute to the FAU signature themes of marine and coastal issues (in the areas of water resource planning, water quality protection, air and solid waste management), biotechnology (in the areas of environmental microbiology and pollution prevention), and contemporary societal challenges (in the areas of sustainability and environmental issues).

Furthermore, FAU's newly released draft Strategic Plan calls for the creation of an Ocean Energy/Environmental Science pillar of the university that will move FAU toward national prominence. This proposed program will be a perfect addition to that pillar. The draft FAU strategic plan also lists a set of 6 goals in which our proposed bachelor's degree in environmental engineering can help the University build on existing strengths in the following ways:

- *Boldness: Build a geographically-diverse population of students who excel in focused academic areas and engage in enriching activities that drive them to timely graduation at FAU.* This program will contribute to the main pillar of ocean science and engineering/environmental sciences as well as providing timely graduation by offering an environmental engineering degree with 120 credits as opposed to 126-128.
- *Synergy: Connect the most talented faculty, staff, and students via the pillars and platforms.* This program will contribute to the main pillar of ocean science and engineering/environmental sciences as well as providing opportunities for undergraduate research and inquiry.
- *Place: Deep engagement with South Florida's global communities*
- *Quality: Continuously assessed programs.* The proposed program will be offered with ABET's continuous improvement model for excellence and will be run with a resilient, lean organizational structure that capitalizes on existing world class faculty and staff.
- *Brand: A world-class undergraduate program in environmental engineering will communicate FAU's excellence and key internal stakeholders to a global audience of external constituency groups.*
- *Strategy: This new program will all FAU to become more competitive for public and private funding opportunities.*

### **The Florida Board of Governor's Strategic Plan (2012-2015)**

*Goal 1: Access to and production of degrees.* By providing a new program in the area of environmental engineering, we will be increasing access to and production of professional degrees in the state of Florida.

*Goal 2: Meeting statewide professional and workforce needs.* By providing a new program in the area of environmental engineering, we will be helping to meet critical needs in science/engineering/technology fields that deal with the infrastructure design and construction of the natural and the built environment

*Goal 3: Building world-class academic programs and research capacity.* By providing a new program in the area of environmental engineering, we will be helping to increase the externally funded research, patents, and broad external recognition of our academic and research programs.

*Goal 4: Meeting community needs and fulfilling unique institutional responsibilities.* By providing a new program in the area of environmental engineering, we will promote the FAU mission statement of promoting academic and personal development, discovery, and lifelong learning through excellence and innovation in teaching,

outstanding research and creative activities, public engagement and distinctive scientific and cultural alliances, all within an environment that fosters inclusiveness. Furthermore, the program will address the community's acute need for environmental engineering graduates and professionals.

**B. Describe how the proposed program specifically relates to existing institutional strengths, such as programs of emphasis, other academic programs, and/or institutes and centers.**

The proposed program directly supports the following FAU Strategic Plan Pillars:

1. Ocean Science and Engineering/Environmental Sciences
2. Sensing and Smart Systems

And the following Platforms:

1. Big Data Analytics (supporting the development of tools to mine large datasets)
2. Community Engagement and Economic Development (supporting work with communities to develop tools and solutions to address environmental engineering challenges and economic prosperity)
3. Diversity (environmental engineering typically has a larger percentage of women and minority students enrolled of all of the engineering disciplines)
4. Global Perspectives and Participation (supporting opportunities to share technology and discoveries with other institutions around the globe)
5. Healthy and Environmentally Sustainable Campus (supporting opportunities to incorporate scholarship into campus operations through the capstone project)
6. Leadership, Innovation, and Entrepreneurship (supporting engagement of faculty and students in professional development of leadership, intellectual property, and creation of startup companies)
7. Peace, Justice, and Human Rights (supporting programs that share best practices and promote tolerance particular with respect to environmental justice)
8. Undergraduate Research and Inquiry (supporting opportunities to undergraduate students to participate in Distinction through discovery and undergraduate research and inquiry)

Environmental engineering relates strongly with geology/geography (geosciences), environmental science, and ecology, and it is closely aligned with civil engineering, ocean engineering, mechanical engineering, geomatics engineering and urban/regional planning. It is not uncommon for individuals to be licensed as a professional engineer in environmental engineering and work for a civil engineering firm.

The proposed program links closely with existing FAU undergraduate and graduate programs in engineering, science, and urban & regional planning, and political science. All have been active participants in the development of the program and their letters of support are included in the appendix. The environmental engineering curriculum includes two technical electives selected from a list of offerings from Geosciences, Political Science, Engineering, and Urban & Regional Planning. Capstone projects will involve joint multidisciplinary teams of students from these various fields.

With its focus on math, science, and general education preparatory work, the first two academic years of the environmental engineering curriculum are much the same as those for other engineering programs in the College, with the additional requirement for General Chemistry 2, Biology, and Earth Science (as required by ABET). Through existing articulation agreements with State Colleges, all of this coursework can be completed at any State College in Florida.

The proposed program also integrates with academic programs originating from the Harbor Branch Oceanographic Institute. Many of the HBOI faculty have research interests that overlap environmental engineering topics.

Specific institutes and centers with a high degree of potential collaboration include:

- The Adams Center for Entrepreneurship in the College of Business. The center works with FAU faculty

and students with entrepreneurship interests and assists them with conducting and publishing significant research (Director Kimberly Gramm)

- The Center for Hydrodynamics and Physical Oceanography in the College of Engineering and Computer Science. This center conducts research in areas including ocean modeling, flow measurement and computational fluid dynamics involving near shore processes, nonlinear wave mechanics, turbulent flow, and coherent vortex dynamics. (Director Palaniswamy Ananthakrishnan)
- The Center for Infrastructure and Constructed Facilities in the College of Engineering and Computer Science. Interdisciplinary research projects at the center are conducted by faculty researchers and include areas such as computer science, mechanical engineering, electrical engineering, and environmental engineering (Director Madasamy Arockiasamy)
- The Center for Intermodal Transportation Safety and Security is a state university system-wide project led by FAU and designed to address the potential threat of terrorism affecting the safety and general economic welfare of Florida and its transportation-based infrastructure. The center brings together four universities— FAU, Florida International University, the University of Central Florida and the University of South Florida—in the areas of transportation and urban planning, architecture, engineering, computer and information science and technology, criminology and public administration (Director, Panagiotis Scarlatos)
- The Center for Marine Structures and Geotechniques. The center’s research initiatives encompass broad aspects of marine concrete durability, knowledge-based expert systems applied to structures, transportation structures, advanced high-strength composites, structural dynamics, stochastic modeling of earthquakes, earth structures, foundation scour, sediment transport mechanics, and analysis of environmental systems (Director, Dronnadula Reddy)
- The Florida Center for Environmental Studies. The center serves as a facilitator and coordinator of research and training related to the environment and as a locus for environmental information. Grounding its activities in the Florida sub-tropical environment, the center’s mandate encompasses global tropical and sub-tropical environments and issues related to water dominated ecosystems (Director, Colin Polsky)
- The Pine Jog Environmental Research Center is an environmental education center with the purpose of developing, providing and modeling environmental education programs which foster an awareness and appreciation of the natural world, promote an understanding of ecological concepts and instill a sense of stewardship toward the Earth and all its inhabitants (Director, Susan Toth)
- The Southeast National Marine Renewable Energy Centers (SNMREC) was established to research, design, develop, implement and test ocean energy technologies that are cost-competitive with existing power technologies. As a result, the SNMREC’s approach to ocean energy research and technology demonstration/ validation is a total system – environment, ecology, resource and energy conversion (Director, Susan Skemp)
- The Weppner Center for Civic Engagement’s mission is to develop partnerships between the University and community by providing service opportunities to faculty, staff and students; and to promote the link between curriculum and service fostering civic awareness (Director, Nori Carter)
- The Institute for Sensing and Embedded Network Systems Engineering (I-SENSE) was established in early 2015 to coordinate university-wide activities in the Sensing and Smart Systems pillar of FAU’s Strategic Plan for the Race to Excellence. The major theme areas of infrastructure systems, marine & environment, and medicine & behavior are of interest (Director, Jason Hallstrom)

**C. Provide a narrative of the planning process leading up to submission of this proposal. Include a chronology in table format of the activities, listing both university personnel directly involved and external individuals who participated in planning. Provide a timetable of events necessary for the implementation of the proposed program.**

In 2005, the Dean of the College of Engineering, Karl Stevens, came to a Department faculty meeting to discuss the University’s strategic plan, which showed the creation of an Environmental Engineering

Master’s Degree program. At that time, several inquiries were made by Department faculty as to when the new degree proposal should be prepared, but the faculty were told to wait while the Civil Engineering doctoral degree proposal was submitted. On July 1, 2009, the name of the Department of Civil Engineering was officially changed to the Department of Civil, Environmental & Geomatics Engineering after the merger of the Civil Engineering program with the Geomatics Engineering program. In Fall 2009, Drs. Bloetscher and Meeroff were instructed to prepare a proposal for a new Master’s degree in Environmental Engineering. The exploratory proposal was submitted to the Dean’s office. In 2010, the Chair of the Department instructed Drs. Bloetscher and Meeroff to submit an updated proposal to the Dean’s office. Then in 2011, Drs. Bloetscher and Meeroff were requested to submit an exploratory pre-proposal for a bachelor’s degree in environmental engineering. In 2012, the pre-proposal was updated with comments from the Dean’s office. It was at this time that the Department Advisory Council members approached the Department about the status of the proposal for a new degree program in environmental engineering. Several of the original members of the Department Advisory Council represent local environmental engineering firms. They made a plea that although the civil engineering graduates were competent and well prepared for general civil engineering jobs, they only really have two classes in environmental engineering; therefore, these companies are forced to hire graduates from outside of the area or graduates with Master’s degrees. The solution to this challenge is to pursue a new undergraduate degree program in environmental engineering. A feasibility study form was prepared for the Dean’s office in July 2012 to submit to James Capp in the Provost’s Office for comments. In 2013, the Department leadership changed, and a strategic plan was put in place involving 3 main objectives: 1) Strengthening the geomatics engineering program with renewed recruiting efforts and a pathway to a graduate degree, 2) Creating a joint doctoral degree with Ocean Engineering and also Computer Science, and 3) Creating a new undergraduate degree program in Environmental Engineering. In 2014 at the behest of members of the Department Advisory Council, Dr. Meeroff requested a meeting with the Provost’s Office with Dr. Michelle Hawkins. She explained the new procedures and expressed the Provost Office’s general support for the proposed program.

During Fall 2014, the pre-proposal was submitted to the Provost, and the Associate Provost for Programs and Assessment, Dr. Russ Ivy, submitted the pre-proposal to the Council of Associate Vice Provosts working group at the February 6, 2015 meeting in Orlando, FL. The main comments from the group that were asked to be addressed if the proposal moved forward related to the number of credit hours proposed in relation to ABET accreditation requirements, and the need for more effort to demonstrate demand from employers. Support for the degree proposal was generally strong; however, Florida International University went on record with a concern that they feared the degree would adversely impact the enrollment in a similar degree they currently have in place. FAU was advised that if the proposal moved forward, we would need to demonstrate that there is enough demand (from both students and employers) in the South Florida region to sustain healthy programs at both FIU and FAU. The attached independent market survey from Hanover Research (Appendix D) confirms that there is sufficient demand for both programs. The following timeline summarizes the planning activities (Table 10) and implementation activities (Table 11) associated with this degree proposal.

**Table 10. Summary of Planning Process**

<b>Date</b>	<b>Participants</b>	<b>Planning Activity</b>
Fall 2011	Drs. Bloetscher, Meeroff, Scarlatos Department Advisory Council	DAC members approach the Department to investigate an environmental engineering BS degree program, and Drs. Bloetscher, Meeroff, and Scarlatos develop an exploratory pre-proposal
04/02/2012	Dean’s office, Chair Scarlatos, Meeroff, Bloetscher	Comments received and documents revised
04/26/2012	Bloetscher and Meeroff	Survey of SUS Environmental Engineering curricula



<b>Date</b>	<b>Participants</b>	<b>Planning Activity</b>
09/13/2013	Interim Chair Yong, Meeroff	Dr. Yong named Interim Chair of the Department
10/02/2013	Interim Chair Yong, Meeroff	Dr. Meeroff named Associate Chair of the Department
10/06/2013	Interim Chair Yong, Meeroff, Kaisar, Bloetscher, Nagarajan, Stevanovic, Teegavarapu	Preliminary strategic plan and short term needs assessment for 2 year period of interim chair appointment (includes BS in Environmental Engineering)
10/31/2013	Department Faculty	Comments solicited for the preproposal for the BS in Environmental Engineering
01/09/2014	Department student coordinator (D. Mejia)	Reports 26 inquiries for BS in Environmental Engineering in Fall 2013
02/21/2014	Interim Chair Yong, Meeroff, Environmental Science Program Committee	Dr. Meeroff and Dr. Yong met with Environmental Science Program Committee to discuss creating a 3-credit biology course and an earth science elective as well as adding engineering electives to the environmental science BS/MS program.
04/22/2014	Department Advisory Council, Alumni Advisory Council	Feasibility study and pre-proposal presented to the Department Advisory Council and Alumni Advisory Council for comment in workshop format. Council members request faculty to move forward with the proposal.
08/28/2014	Associate Provost Dr. M. Hawkins, Meeroff, Interim Chair Yong	Planning meeting. Dr. Hawkins laid out the timeline, procedure, and reiterated the Provost Office's support.
09/04/2014	Department Advisory Council Members, Local industry representatives, Department Faculty, Graduating seniors	Survey of whether local companies would hire environmental engineers from FAU, survey of graduating seniors/alumni if they would have studied environmental engineering if offered
09/08/2014	Associate Provost Dr. M. Hawkins	Dr. Hawkins provides essential comments and data resources to improve the pre-proposal
09/14/2014 – 12/12/2014	Megan Davis (HBOI), Dale Gawlick (Environmental Sciences), Charles Roberts (Geosciences), Aimee Arias (Political Science), Michael Harris (Anthropology), Jesse Saginor (URP) Eric Dumbaugh (URP), Steven Bourassa	Contacted for support letters for the pre-proposal and feasibility study
09/22/2014	Dean Ilyas, Associate Dean Zilouchian, Interim Chair Yong	Comments received from Dean's office on draft feasibility study
09/23/2014	Department Faculty	Revised draft feasibility study sent to all Department faculty for comment
09/25/2014	Department Faculty	Feasibility study discussed in Department Faculty meeting.
10/03/2014	Associate Dean Zilouchian, Dean Ilyas	Additional comments on the feasibility study provided by the Dean's office
10/05/2014	Associate Dean Zilouchian, Dean Ilyas, Interim Chair Yong, Dr. Meeroff	Meeting in the Dean's office to discuss revisions

<b>Date</b>	<b>Participants</b>	<b>Planning Activity</b>
10/11/2014	Department Undergraduate Committee (Nagarajan, Meeroff, Scarlatos, Kaiser)	Department committee unanimously approved all 4 new courses for the proposed environmental engineering program
10/17/2014	Department Faculty	Department faculty unanimously approved all 4 new courses for the proposed environmental engineering program
10/22/2014	Ali Zilouchian, Dr. Meeroff, Sudhagar Nagarajan, Edgar An, Jessica Lewis, Vichate Ungvichian, Francisco Presuel-Moreno	College Undergraduate Programs Committee review of the feasibility study and approval of 4 new courses for the proposed environmental engineering program
10/27/2014	Interim Chair Yong, Dean Ilyas	Final revised feasibility study and pre-proposal forms sent to the Dean for approval
10/30/2014	Director of Operations Lynn Asseff	Dean's office engaged to provide assistance in preparing the proposal budget
10/31/2014	Dr. M. Hawkins, Interim Chair Yong, Dr. Meeroff	Draft final version of the documents sent to the Provost's Office
11/03/2014	Director of Operations, Lynn Asseff	Provided updated budget documents
11/04/2014	Dean Ilyas, Associate Dean Zilouchian, Interim Chair Yong, Dr. Meeroff	Corrected version of the documents signed by the Dean's office and forwarded to the Provost's Office
11/07/2014	UUPC	UUPC approved all 4 new courses for the proposed environmental engineering program
11/20/2014	Associate Provost Russ Ivy, Interim Chair Yong, Dr. Meeroff	Dr. Ivy met with the authors to discuss comments to improve the documents
11/25/2014	Faculty Senate Steering Committee	Approved all 4 new courses for the proposed environmental engineering program to consent agenda
12/04/2014	Department Advisory Council Members, Department Faculty, Students	Feasibility study and pre-proposal presented to the Department Advisory Council for comment in workshop format
12/05/2014	Associate Provost Russ Ivy, Interim Chair Yong, Dr. Meeroff	Revised documents sent to the Provost's Office
12/05/2014	Faculty Senate	Approved all 4 new courses for the proposed environmental engineering program from consent agenda
12/17/2014	Associate Provost Russ Ivy, Interim Chair Yong, Dr. Meeroff	Additional revisions requested by Dr. Ivy sent for comment
01/05/2015	Provost G. Perry, Associate Provost Russ Ivy, Associate Provost D. Alperin, Interim Chair Yong, Dr. Meeroff	Additional comments on the data tables in Appendix A and the budget justification
01/08/2015	Ram Narayan, Ravi Kadambala, Ed Kent, Bud Goblisch, Don Eckler, Andre McBarnette, Kevin Leo	Feasibility study sent out for comments and feedback to an external review panel
02/06/2015	Associate Provost Russ Ivy	CAVP meeting in Orlando, FL.

Date	Participants	Planning Activity
02/10/2015	Dr. Vegar Wiik, Executive Director of Executive Programs in the College of Business	Additional comments were solicited from Dr. Wiik to improve the market demand portion of the feasibility study after the comments from the CAVP meeting.
02/24/2015	Dr. Meeroff, Interim Chair Yong	Revisions to the proposal and a short bullet item summary prepared
03/13/2015	Associate Provost Russ Ivy, Interim Chair Yong, Dr. Meeroff	Meeting with Dr. Ivy to discuss major revisions to the proposal
03/17/2015	Associate Provost Russ Ivy, Interim Chair Yong, Dr. Meeroff	Major revisions to include labor market analysis, employment outlook, and student demand surveys
03/19/2015	Assistant Provost V. Brown, Dr. Meeroff, Interim Chair Yong	Meeting with Dr. Brown to discuss the market analysis
04/02/2015	Assistant Provost, V. Brown, Dr. Meeroff, Interim Chair Yong	EAB research request form submitted and placed in the queue
04/29/2015	Associate Provost Russ Ivy, Dr. Meeroff, Interim Chair Yong	Meeting to discuss the pathway forward given EAB delay. Dr. Meeroff notified that the new program application form will be revised in summer
05/22/2015	Assistant Provost, V. Brown, Associate Provost Russ Ivy, Dr. Meeroff, Interim Chair Yong	EAB reveals that the earliest they could start would be September 2015. Dr. Meeroff provided with the new program proposal application forms
06/30/2015	Assistant Provost, V. Brown, Dr. Meeroff	Information request about potential employers
07/14/2015	Assistant Provost, V. Brown, Associate Provost Russ Ivy, Dr. Meeroff, Interim Chair Yong, Kristina DeSanctis, Fox Troilo, Willie Freeman	Scoping call for Hanover Research
07/27/2015 – 09/30/2015	Bud Goblisch (CES), Don Eckler (Eckler), Albert Muniz (Hazen and Sawyer), Robert McSweeney (Calvin Giordano and Associates)	Support letters received from industry

**Table 11. Events Leading to Implementation**

Date	Implementation Activity
07/18/2012	First draft feasibility study submitted to Dean's office for comment
09/09/2014	Draft feasibility study sent to Dean's office for approval to move forward
12/22/2014	Final revisions passed on to the Provost
02/06/2015	CAVP meeting in Orlando
03/31/2015	Decision to formally work with Dr. Brown to conduct a market survey with EAB
06/17/2015	Decision to hire Hanover Research to conduct independent market analysis instead of EAB
10/02/2015	Market analysis submitted with positive recommendation
10/06/2015	CEGE Department approval
10/16/2015	College of Engineering and Computer Science Undergraduate Committee approval
11/06/2015	UUPC approval
11/13/2015	AP&BC approval
11/24/2015	Tentative Steering Committee approval
12/04/2015	Tentative Faculty Senate approval
Early Spring 2016	Tentative Board of Trustees approval

## 2. Program Quality Indicators - Reviews and Accreditation

**Identify program reviews, accreditation visits, or internal reviews for any university degree programs related to the proposed program, especially any within the same academic unit. List all recommendations and summarize the institution's progress in implementing the recommendations.**

All academic programs at FAU are accredited by the Southern Association of Colleges and Schools (SACS) (last accreditation visit 2013). The most related baccalaureate degree programs in Civil Engineering and Geomatics Engineering are accredited by ABET (last accreditation visit 2014).

## 3. Curriculum

**A. Describe the specific expected student learning outcomes associated with the proposed program. If a bachelor's degree program, include a web link to the Academic Learning Compact or include the document itself as an appendix.**

*Student outcomes:* The Bachelor of Science in Environmental Engineering program achieves the program educational objectives by ensuring the following student outcomes, which match the ABET (a) through (k) student outcomes, as follows:

- a) An ability to apply knowledge of mathematics, science, and engineering.
- b) An ability to design and conduct experiments, as well as to analyze and interpret data.
- c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
- d) An ability to function on multi-disciplinary teams.
- e) An ability to identify, formulate, and solve engineering problems.
- f) An understanding of professional and ethical responsibility.
- g) An ability to communicate effectively.
- h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- i) A recognition of the need for, and an ability to engage in life-long learning.
- j) A knowledge of contemporary issues.
- k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The academic learning compact for the proposed Bachelor of Science in Environmental Engineering (BSEV) program is attached (see Appendix E). It is modeled after the existing undergraduate program compacts in the College of Engineering and Computer Science, which assess content knowledge, communication, and critical thinking skills. Those 3 outcomes have been mapped to the ABET student outcomes and individual upper division course outcomes in the academic learning compact.

**B. Describe the admission standards and graduation requirements for the program.**

The admission standards and graduation requirements will be consistent with current University and College of Engineering and Computer Science policies and practices for undergraduate programs. The College of Engineering and Computer Science has a pre-professional program, as follows:

Entering freshmen and all transfer students will be admitted directly to the College's pre-professional program as pre-engineering students. The following are required for students to be admitted to their major of choice in the College of Engineering and Computer Science:

1. Students must meet University admission requirements.
2. In each core course listed below, students must obtain a minimum grade of "C". Advanced placement scores of 4 or above will be given credit for the appropriate course(s). A score of 5 is equivalent to an "A," and a score of "4" is equivalent to a B.
3. A maximum of two attempts for any of the option listed courses will be allowed. Failure to receive a passing grade in the second attempt is grounds for denial of admission to an engineering or computer science program.

Environmental Engineering		
Precalculus Algebra and Trigonometry (3)	MAC 1147	3
General Chemistry 1	CHM 2045	3

The entry-level mathematics requirement for the engineering programs is Calculus with Analytic Geometry 1 (MAC 2311). Students who are placed in lower-level mathematics courses based on their ALEKS test scores and who need to maintain full-time status may have problems finding courses that are accepted in an engineering or computer science program in future semesters. This may delay their entry into a particular engineering or computer science program.

After successfully completing the core courses, students may apply to a particular engineering program. Admission will be based on the student's performance in the core courses. The Division of Engineering Student Services and Advising is available to assist students in selection of a major field of study and can be reached at 561-297-2780 or [engineering-services@fau.edu](mailto:engineering-services@fau.edu). Students with engineering degrees from ABET-accredited institutions will be directly admitted to engineering or computer science programs of their choice.

Students may appeal denial of admission to a major through the academic petition process. For an appeal to have merit, students must explain new academic or personal information as well as extenuating circumstances. The evidence should show a student's case is stronger than the GPA evidence suggests. The faculty coordinator for the pre-professional program will review the petition according to the established College guidelines and make a recommendation to the academic petition committee. The College of Engineering and Computer Science fully complies with the State of Florida Common Prerequisites for Computer Science and for Engineering. Students transferring from Florida community or state colleges who meet the pre-professional program course requirements will be directly admitted to the particular engineering and computer science program of their choice.

The College of Engineering and Computer Science participates in the Southeast Florida Engineering Education Consortium, a collaborative effort among public colleges and universities in this region. Detailed advising sheets outlining the courses needed at the community or state college and at FAU are available for students transferring from Miami Dade, Broward, Palm Beach and Indian River colleges. These sheets also provide a useful guide for students transferring from other institutions. Students should contact their community or state college advisor or the FAU department in which they intend to enroll.

- C. Describe the curricular framework for the proposed program, including number of credit hours and composition of required core courses, restricted electives, unrestricted electives, thesis requirements, and dissertation requirements. Identify the total numbers of semester credit hours for the degree.**

The proposed curriculum is consistent with all requirements for SACS. In addition, the proposed environmental

engineering curriculum has been designed to meet all requirements for accreditation by ABET, which is the universally accepted education credential required for professional registration. Accreditation reviews are only possible after the program has produced its first graduate. Thus, the ABET review will be requested at the first possible opportunity immediately following the first graduation class. A retroactive provision covers students who graduate prior to the award of accreditation.

According to ABET, the curriculum must:

4. **Prepare graduates to apply knowledge of mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, and fluid mechanics.** This is covered in the basic math and science requirement of a minimum of 32 credit hours. The curriculum will provide 40 credit hours of basic math and science, plus 3 credit hours for CWR3201C-Applied Hydraulics for the fluid mechanics requirement.
5. **Prepare graduates to: (a) formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases; (b) conduct laboratory experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., air, water, land, environmental health); (c) design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and (d) apply advanced principles and practice relevant to the program objectives.** The requirements of (a) are covered in several upper division courses in the required engineering topics; those in (b) are covered in the major water quality and air quality laboratory courses (CWR3201C-Applied Hydraulics, ENV3001C-Environmental Science and Engineering, and ENV4115C- Air Pollution & Control Systems with Lab); those in (c) are covered in the major water quality and air quality laboratory courses (CWR3201C-Applied Hydraulics, ENV3001C-Environmental Science and Engineering and ENV4115C- Air Pollution & Control Systems with Lab) and the senior-level design courses including ENV 4514-Water and Wastewater Treatment Systems, ENV 4341-Solid & Hazardous Waste and Site Remediation, CWR 4202-Hydrologic Engineering, CGN 4803C-CEGE Design 1, CGN 4804C-CEGE Design 2). Finally (d) is covered by the senior-level design courses including ENV 4514-Water and Wastewater Treatment Systems, ENV 4341-Solid & Hazardous Waste and Site Remediation, CWR 4202-Hydrologic Engineering, CGN 4803C-CEGE Design 1, CGN 4804C-CEGE Design 2) and in certain technical electives as well as undergraduate research opportunities and the Innovation Leadership Honors Program in the College.
6. **Prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.** These are covered in the senior-level design courses including ENV 4514-Water and Wastewater Treatment Systems, ENV 4341-Solid & Hazardous Waste and Site Remediation, CWR 4202-Hydrologic Engineering, ENV4702 - Introduction to Pollution Prevention and Sustainability, ENV4053 - Environmental Fate and Transport, CGN 4803C-CEGE Design 1, CGN 4804C-CEGE Design 2), the major water quality and air quality laboratory courses (CWR3201C-Applied Hydraulics, ENV3001C-Environmental Science and Engineering and ENV4115C- Air Pollution & Control Systems with Lab), EGN1002 - Fundamentals of Engineering, and in certain technical electives.

The required core courses include:

- **24 credit hours of general education**, which includes ENC1101 - English Composition I (3 credits) and ENC1102 - English Composition II (3 credits) as well as the Intellectual Foundation Program courses (2 Foundations of Society & Human Behaviors, 2 Foundations of Global Citizenship and 2 Foundations of Creative Expressions).
- **42 credit hours of basic math and science**, which includes MAC 2311 - Calculus with Analytical Geometry I (4 credits), MAC 2312 - Calculus with Analytical Geometry II (4 credits), MAC 2313 - Calculus with Analytical Geometry III (4 credits), MAP3305 - Engineering Mathematics I (3 credits), STA4032 - Probability & Statistics for Engineers (3 credits), CHM2045 - General Chemistry I (3 credits), CHM2045L - General Chemistry I Lab,

PHY2048 - General Physics I (3 credits), PHY2048L - General Physics I Lab (1 credit), PHY2044 - Physics for Engineers 2 (3 credits), PHY2049L - General Physics I Lab (1 credit), CHM2046 - General Chemistry II (3 credits), CHM2046L - General Chemistry II Lab (1 credit), Biological Science Elective (4 credits), and Earth Science Elective (3 credits), as well as one-credit from ENV3001C - Environmental Science & Engineering.

- **53 credit hours of engineering topics** including 48 required credits of: CWR3201C - Applied Hydraulics (3 credits), EGN3311 - Statics (3 credits), CGN2327 - Fundamentals of AutoCAD (3 credits), EGN3331 - Strength of Materials (3 credits), EGN2213 - Computer Applications in Engineering 1 (3 credits), EGN3343 - Engineering Thermodynamics (3 credits), EGN1002 - Fundamentals of Engineering (3 credits), ENV4341 - Solid & Hazardous Waste and Site Remediation (3 credits), ENV4053 - Environmental Fate and Transport (3 credits), ENV4702 - Introduction to Pollution Prevention and Sustainability (3 credits), ENV4115C - Air Pollution and Control Systems with Lab (4 credits), CGN4803C - CEG Engineering Design I (3 credits), CGN4804C - CEG Engineering Design II (3 credits), CWR4202 - Hydrologic Engineering (3 credits), ENV3001C - Environmental Science & Engineering (2 credits), ENV4514 - Water & Wastewater Treatment System (3 credits). In addition, **6 credit hours of technical electives** (Environmental Engineering Technical Electives) from a list provided that includes: CWR4223-Advanced Hydraulic Systems, CCE4031-Construction Project Management, CWR4307-Stormwater Modeling and Management, EGN4613-Engineering Economics, CEG3012C-Soil Mechanics, SUR2104C-Fundamentals of Surveying, and any CEGE graduate course offering, as well as Oceanography (OCE 3008), Sustainable Cities (URP 4403), Environmental Planning Methods (URP 4420), Environment and Disease (ANT 4463), Environmental Ethics (PHI 3640), Global Environmental Politics and Policies (INR 4350), Environmental Economics (ECP 4302), or Entrepreneurship (ENT 4024) offered by other Departments and Colleges.

As shown in Table 1, the proposed program meets or exceeds all ABET requirements.

**Table 12. Summary of ABET minimum curricular requirements.**

Criterion	ABET Minimum Requirements	FAU Proposed Program
General Education	24 credit hours	24 credit hours
Basic Math and Science	32 credit hours	43 credit hours
Engineering Fundamentals	48 credit hours	53 credit hours

There are no thesis requirements.

The total numbers of semester credit hours for the degree are shown in detail in the sample flight plan in section A that follows.

- A. Provide a sequenced course of study for all majors, concentrations, or areas of emphasis within the proposed program.

**Bachelors of Science in Environmental Engineering (BSEV) Flight Plan (120 Credits)**

<b>FRESHMAN YEAR</b>					
Fall Term			Spring Term		
ENC 1101	College Writing I	3	ENC 1102	College Writing II (ENC1101)	3
CHM 2045	General Chemistry 1	3	PHY 2048	General Physics 1 (for Engineers) (MAC2311)	3
CHM 2045L	General Chemistry Lab	1	PHY 2048L	General Physics 1 Lab	1
MAC 2311	Calculus w/ Analytical Geometry 1	4	MAC 2312	Calculus w/ Analytical Geometry 2 (MAC 2311)	4
EGN 1002	Fundamentals of Engineering	3	CHM 2046 or CHM 2095	General Chemistry 2 or Chemistry for Engineers	3
			CHM 2046L or EGN 2095L	General Chemistry 2 Lab or Engineering Chemistry Lab	1
		14			15

**Summer Term**

<i>Intellectual Foundations: Society and Human Behaviors 1</i>	3
<i>Intellectual Foundations: Global Citizenship 1</i>	3
	6

<b>SOPHOMORE YEAR</b>					
Fall Term			Spring Term		
PHY 2044	Physics for Engineers 2 (MAC2312 & PHY2043)	3	MAP 3305	Engineering Mathematics I (MAC2312)	3
PHY 2049L	General Physics 2 Lab	1	EGN 3331	Strength of Materials (EGN3311)	3
EGN 3311	Statics (MAC2312 & PHY2043)	3		Earth Science Elective	3
MAC 2313	Calculus w/ Analytical Geometry 3 (MAC2312)	4		Biological Science Elective	4
CGN 2327	Fundamentals of AutoCAD (MAC2311)	3		<i>Intellectual Foundations: Creative Expressions 1</i>	3
		14			16

**Summer Term**

<i>EGN 3343 Engineering Thermodynamics (PHY2043 &amp; MAC2313)</i>	3
<i>Intellectual Foundations: Society and Human Behaviors 2</i>	3
	6

<b>JUNIOR YEAR</b>					
Fall Term			Spring Term		
CWR 3201C	Applied Hydraulics with Lab (EGN3331 & MAP3305)	3	ENV 4514	Water and Wastewater Trt Systems (ENV3001C & CWR3201C)	3
ENV 3001C	Environmental Science & Engineering with Lab (CHM2045+CHM2045L & EGN3331)	3	ENV 4341	Solid & Hazardous Waste and Site Remediation (ENV3001C)	3
STA 4032	Probability & Statistics – Eng	3	EGN 2213	Computer Applications in Eng 1	3
	<i>Intellectual Foundations: Global Citizenship 2</i>	3	ENV 4702	Introduction to Pollution Prevention and Sustainability (ENV3001C)	3
		12			12



<b>SENIOR YEAR</b>					
<b>Fall Term</b>			<b>Spring Term</b>		
<b>CWR 4202</b>	<b>Hydrologic Engineering</b> (CWR3201C)	<b>3</b>	<b>ENV 4115C</b>	<b>Air Pollution &amp; Control Systems with Lab</b> (ENV3001C)	<b>4</b>
<b>CGN 4803C</b>	<b>CEGE Eng Design 1</b> (ENV4514)	<b>3</b>	<b>CGN 4804C</b>	<b>CEGE Eng Design 2</b> (CGN4803C & CWR4202)	<b>3</b>
<b>ENV 4053</b>	<b>Environmental Fate and Transport</b> (ENV3001C)	<b>3</b>		<i>Intellectual Foundations: Creative Expressions 2</i>	<b>3</b>
	<i>Env. Eng. Tech Elective 1</i> Recommend: CCE4031 Construction Project Management	<b>3</b>		<i>Env. Eng. Tech Elective 2</i> Recommend: CWR 4223 Advanced Hydraulic Systems (CWR3201C)	<b>3</b>
		<b>12</b>			<b>13</b>

Total Credits = 120

FE Exam website: For application: <http://www.fbpe.org>; for study materials: <http://www.ncees.org>

### 2015 Florida Atlantic University Bachelor of Science in Environmental Engineering (BSEV) Curriculum [NEW] ABET Table 5.1 – Curriculum Chart

<b>Course (Department, Number, Title)</b>	<b>Math and Basic Sciences</b>	<b>Engineering Topics Check if Contains Significant Design (v)</b>	<b>General Education</b>
ENC1101 -- English Composition I			3
ENC1102 -- English Composition II			3
Foundations of Society & Human Behaviors (1)			3
Foundations of Society & Human Behaviors (2)			3
Foundations of Global Citizenship (1)			3
Foundations of Global Citizenship (2)			3
Foundations of Creative Expressions (1)			3
Foundations of Creative Expressions (2)			3
MAC 2311 -- Calculus with Analytical Geometry I	4		
MAC 2312 -- Calculus with Analytical Geometry II	4		
MAC 2313 -- Calculus with Analytical Geometry III	4		
MAP3305 -- Engineering Mathematics I	3		
STA4032 -- Probability & Statistics for Engineers	3		
CHM2045 -- General Chemistry I	3		
CHM2045L -- General Chemistry I Lab	1		
PHY2048 – General Physics 1 (for Engineers)	3		
PHY2048L -- General Physics I Lab	1		
PHY2044 –Physics for Engineers 2	3		
PHY2049L -- General Physics 2 Lab	1		
CHM2046 -- General Chemistry II	3		
CHM2046L -- General Chemistry II Lab	1		
Biological Science Elective	4		
Earth Science Elective	3		
CWR3201C -- Applied Hydraulics		3	

Course (Department, Number, Title)	Math and Basic Sciences	Engineering Topics Check if Contains Significant Design (v)	General Education
EGN3311 -- Statics		3	
CGN2327 -- Fundamentals of AutoCAD		3	
EGN3331 -- Strength of Materials		3	
EGN2213 -- Computer Applications in Engineering 1		3	
<b>EGN3343 -- Engineering Thermodynamics</b>		<b>3</b>	
EGN1002 -- Fundamentals of Engineering*		3	
<b>ENV4341 -- Solid &amp; Hazardous Waste and Site Remediation*</b>		<b>3v</b>	
<b>ENV4053 -- Environmental Fate and Transport</b>		<b>3v</b>	
<b>ENV4702 -- Introduction to Pollution Prevention and Sustainability*</b>		<b>3v</b>	
<b>ENV4115C -- Air Pollution &amp; Control Systems with Lab*</b>		<b>4v</b>	
CGN4803C -- CEG Engineering Design I*		3v	
CGN4804C -- CEG Engineering Design II*		3v	
<b>CWR4202 -- Hydrologic Engineering*</b>		<b>3v</b>	
<b>ENV3001C -- Environmental Science &amp; Engineering*</b>	<b>1</b>	<b>2</b>	
<b>ENV4514 -- Water &amp; Wastewater Treatment System*</b>		<b>3v</b>	
Environmental Engineering Technical Electives*		6	
<b>TOTALS-ABET BASIC-LEVEL REQUIREMENTS</b>	42	54	24
<b>TOTAL CREDIT HOURS</b>			120
<b>PERCENT OF TOTAL</b>	36%	44%	20%
<b>Total must satisfy either credit hours or percentage</b>			
<b>Minimum Semester Credit Hours</b>	32 HOURS	48 HOURS	
<b>Minimum Percentage</b>	25%	37.5%	

The curriculum must prepare graduates to apply knowledge of mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, fluid mechanics. The curriculum must prepare graduates to formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases; conduct laboratory experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., air, water, land, environmental health); design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and apply advanced principles and practice relevant to the program objectives. The curriculum must prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.

ABET Requirements:

1. Mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, fluid mechanics. **These are marked in yellow.**
2. Formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases. **These are marked in bold.**

3. Conduct laboratory experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., air, water, land, environmental health). **These are marked in orange.**
4. Design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts and apply advanced principles and practice relevant to the program objectives. **These are marked in blue.**
5. The curriculum must prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations. These are marked with an asterisk (\*).

**B. Provide a one- or two-sentence description of each required or elective course.**

ENC1101	College Writing 1 - Writing Across Curriculum (Gordon Rule) - Reading examples of effective expository prose and writing essays practicing the forms of rhetoric. This is a General Education course.
EGN1002	Fundamentals of Engineering - Engineering survival skills: orientation, professionalism, planning, problem solving, creative thinking, software and calculator techniques, time and project management, teaming skills, engineering disciplines, report writing, and technical communications.
MAC2311	Calculus w/ Analytical Geometry 1 - Continuity, differentiability, differential approximation, optimization and curve sketching of functions and inverse functions of a single variable, including treatment of trigonometric functions. Mean value theorem and L'Hopital's Rule. Introduction to integration. This is a General Education course.
CHM2045	General Chemistry 1 - An introduction to chemical principles, including atomic structure, chemical bonding, kinetics, thermodynamics and properties of the elements. This is a General Education course.
CHM2045L	General Chemistry 1 Lab - An introduction to experimental techniques in chemistry designed to demonstrate basic chemical principles. This is a General Education course.
CHM2046	General Chemistry 2 (or CHM2095 Chemistry for Engineers) - Chemical principles including atomic structure, chemical bonding, kinetics, thermodynamics and properties of the elements.
CHM2046L	Engineering Chemistry Lab (or CHM2046L General Chemistry Lab 2) - Experimental techniques in chemistry designed to demonstrate basic chemical principles. Qualitative analysis of selected anions and cations
ENC1102	College Writing 2 - Writing Across Curriculum (Gordon Rule) - A continuation of College Writing 1. This is a General Education course.
PHY2048	General Physics 1 (for Engineers) - Intended for engineering majors, the course surveys fundamental laws and phenomena of mechanics, fluids, and heat. Emphasis on mathematical analysis of physical problems. This is a General Education course.
PHY2048L	Physics Lab 1 - Experiments in mechanics, fluids, heat, wave motion and sound comprise this course. Several classes cover developing theoretical problem solving techniques. This is a General Education course.

PHY2044	Physics for Engineers 2 - Intended for engineering majors, the course surveys fundamental laws and phenomena of electricity, magnetism, and optics. Emphasis on mathematical analysis of physical problems.
PHY2049L	General Physics 2 Laboratory - Experiments in electricity and magnetism, optics, and modern physics comprise this course. Several classes cover developing theoretical problem solving techniques.
MAC2312	Calculus / Analytical Geometry 2 - Logarithmic, Exponential, hyperbolic, and inverse trigonometric functions, techniques of integration, partial fractions, area, trapezoid and Simpson's rules, volume, work; analytic geometry; Taylor approximations; sequences and series; polar representation of complex numbers. This is a General Education course.
CGN 2327	Fundamentals of AutoCAD - Fundamentals of graphical and spatial analysis; graphics and drafting principles; computer-aided drafting; AutoCAD fundamentals; 2D and 3D visualization, modeling, and construction; designing with AutoCAD, civil engineering applications.
MAC2313	Calculus with Analytical Geometry 3 - Vector space, inner product, length, cross product, curves in space; functions of several variables: differentiability, gradient, tangent planes, differential approximation, surfaces, optimization with constraints, multiple integrals, theorems of Green, Stokes and Gauss.
EGN2213	Computer Applications in Engineering 1 - An introduction to programming in MATLAB, this course includes some matrix concepts, input/output statements, for and while loops, if and else-if statements, built-in functions, self-written functions, some built-in solvers and projects illustrating applications to engineering topics.
EGN3311	Statics - Analysis of force and moment systems for static equilibrium of trusses, beams, frames, and machines; elements of frictions; centroid, center of gravity, center of mass, and moment of inertia.
MAP3305	Engineering Math 1 - Complex numbers, matrices, determinants, systems of equations, diagonalization, first and second order linear differential equations and systems thereof, including power series solutions.
EGN3331	Strength of Materials - Concepts of stress and strain; mechanical properties of materials, force, deformation and stress analysis of structural members; stress and strain transformations; principal stresses; failure theories; and concept of buckling.
EGN3343	Engineering Thermodynamics - Topics include properties of a simple pure compressible substance, equations of state, the first law of thermodynamics, internal energy, specific heats, enthalpy and the application of the first law to a system or a control volume. The study of the second law of thermodynamics is also discussed leading to the discovery of entropy as a property and its ramifications.
CWR3201C	Applied Hydraulics - Fundamental properties of incompressible fluids; hydrostatics and fluid motion in closed conduits and open channels; potential flow; boundary layers; preliminary design of hydraulic structures. Laboratory included.
ENV3001C	Environmental Science and Engineering - Physical, chemical, and microbiological components of environmental systems in science and engineering. Introduction to water quality management, air pollution control, solid waste management, pollution prevention techniques, and risk analysis. Laboratory included.

- STA4032 Probability and Statistics for Engineers - Basic concepts of probability; random variables; discrete and continuous probability distributions; functions of random variables; estimation theory; tests of hypotheses.
- CWR4202 Hydrologic Engineering - Fundamental components of the hydrologic cycles, rainfall-runoff processes, evaporation, infiltration and groundwater flow water budgets, introduction to water resources system engineering analysis, hydrologic modeling using simulation and spatial analysis tools.
- ENV4514 Water and Wastewater Treatment Systems - Principles and design of physical, chemical, and biological treatment systems for potable water and wastewater applications.
- ENV4612 Introduction to Pollution Prevention and Sustainability - major physical, chemical, and biological processes of pollutant transformation and transport between air, water, and the subsurface.
- ENV4115C Air Pollution and Control Systems with Lab - Regulations dealing with air quality, basic meteorology, the physics of atmospheric dispersion, indoor air quality, and design of air pollution control systems. Laboratory included.
- ENV4356 Solid and Hazardous Waste and Site Remediation - Regulations dealing with solid and hazardous waste management, design of solid waste management facilities, and design of hazardous waste treatment and site remediation strategies.
- ENV4668 Environmental Fate and Transport - Major physical, chemical, and biological processes of pollutant transformation and transport between air, water, and the subsurface.
- CGN4803C Civil, Environmental & Geomatics Engineering Design 1 - Writing Across Curriculum (Gordon Rule) - Multidisciplinary design teams are formed and projects with multiple realistic constraints are selected for the senior capstone design project. Projects are developed with the advice and approval of a sponsor or client. Project proposals are completed and accepted by sponsor/client. Professional practice issues are also presented and discussed. Laboratory included.
- CGN4804C Civil, Environmental & Geomatics Engineering Design 2 - Writing Across Curriculum (Gordon Rule) - Continuation of CGN 4803C. Multidisciplinary team design projects with multiple realistic constraints culminate with written and oral reports. Design and professional practice issues are also presented and discussed. Laboratory included.

Earth Science Elective:

Recommended: Environmental Science and Sustainability (EVR 1001) - Introduction to the foundations of environmental science, with a focus on global change. The human impact on the environment as it relates to economy, health and ethics is explored. Course includes an emphasis on climate change, ecosystem disruption and solutions. This is a General Education course.

Or

Environmental Issues in Atmospheric and Earth Science (ESC 3704) - Investigation of the complex interactions between humans and their environment. Environmental problems encompassing selected aspects of the atmosphere, hydrosphere, biosphere, and lithosphere: including deforestation, desertification, air and water quality, and processes of land degradation.

Or

Environment and Society (EVR 2017) - Introduction to the study of major environmental problems and issues confronting modern society: economic and ecosystem concepts, population patterns and dynamics, resource use and misuse, environmental quality, and environmental citizenship. This is a General Education course.

Or

Introduction to Physical Geography (GEO 2200C) - The natural environment and its physical patterns - an introduction to landforms, soils, water, vegetation, and other physical features of the earth. Laboratory work.

OR

Coastal and Marine Science (GLY 3730) - Introduction to the study of coastal and marine environments, particularly as they are related to human use and management of biophysical resources. Focuses on materials and dynamic processes of ocean basins, sediments, and seawater; including ocean-climate linkage, greenhouse effect, and sea-level change.

Biological Science Elective:

Life Science (BSC 1005) - A survey of life on earth for non-majors. Evolution, anatomy, physiology, genetics, reproduction, and ecology are stressed. Lectures and discussions also demonstrate how biological knowledge is relevant to social, economic environmental and philosophical problems. This is a General Education course. Life Science Lab (BSC 1005L) - Laboratory investigation of biological knowledge relevant to social, economic, environmental and philosophical problems. This is a General Education course.

Or

Biological Principles (BSC 1010) - A comprehensive treatment of biological principles, including the scientific method, evolution and natural selection, cell biology, energy transformation, reproduction, development, genetics and molecular biology. This is a General Education course. Biological Principles Lab (BSC 1010L) - An introduction to general laboratory procedures to demonstrate the basic principle of biology. This is a General Education course.

OR

Biodiversity (BSC 1011) - An introduction and survey of organismal diversity, including fungi, protists, plants and animals. Phylogenetic relationships, evolutionary mechanisms, and ecological processes are emphasized. Origins of life and human evolution. This is a General Education course. Biodiversity Lab (BSC 1011L) - A survey of the diversity of eukaryotic organisms. This is a General Education course.

Technical Electives:

Advanced Hydraulic Systems (CWR 4223) - Course is designed to present and discuss the hydraulic processes associated with gravity piping systems; initiate and develop design skills for gravity and pressure piping; and for the design of pumping stations for water and wastewater applications.

Stormwater Modeling and Management (CWR 4307) - Presents a comprehensive view of stormwater modeling and management with an emphasis on current modeling techniques and design practices. Provides an in-depth review of fundamentals of hydraulics and hydrology along with spatial analysis tools required for effective stormwater modeling and management.

Construction Project Management (CCE 4031) - Topics covered include planning, design, document preparation, bidding, bid tabulation, construction management, cost estimating, conflict resolution, and scheduling of engineering projects.

Soil Mechanics (CEG 3011C) - Soil properties, identification and classification of earth materials, stress-strain behavior of soils, movement of water through soils. Introduction to geotechnical design. Laboratory included.

Fundamentals of Surveying (SUR 2104C) - Concepts, theory and applications of basic measurement methods used in geospatial data acquisition, such as distance, direction and angle measurements, traverse computation, leveling and height determination, trigonometric leveling, topographic surveying,

horizontal and vertical curves, terrestrial positioning using GPS and GIS. Labs synchronized with the lectures.

Engineering Economics (EGN 4613) - Course introduces concepts of economic decision making, including present worth analysis, cash flow equivalence, replacement analysis, equipment selection

Oceanography (OCE 3008) - Nature of sea water; trace and major constituents; the ocean carbon, phosphorous, and nitrogen cycles; basins, continental shelf, deep ocean floor; thermal vents, manganese nodules, marine sediments; marine life; plate tectonics; estuaries and mixing processes; pollution; corrosion and biofouling; winds, waves, tides, currents and ocean circulation processes; energy (heat, light, sound); depth, temperature, salinity, and other physical effects

Sustainable Cities (URP 4403) - The sustainability of cities has gained attention due to the effects of urbanization on the environment, the economy, and social and political justice. This course focuses on planning as a means of making cities more sustainable.

Environmental Planning Methods (URP 4420) - Focus on balancing growth and development with protection and preservation for natural resources. Emphasizes planning problems and options in suburban and exurban settings. Concern for air, water and land resources, as well as wildlife habitat.

Environment and Disease (ANT 4463) - A study of the evolution of human diseases from ancient times to the present. The influence of culture, society and personal behavior will be explored, along with the relationship between the environment and human genetics.

Environmental Ethics (PHI 3640) - Study of contemporary environmental philosophy and ethical principles and practical issues related to the natural environment.

Global Environmental Politics and Policies (INR 4350) - The study of global environmental politics includes a variety of issues, problems, politics and policies relevant to population growth, resource degradation and the impacts of human economic development. Examines the development of environmental governance, environmental justice movements and efforts to control consumption to enhance sustainability.

Environmental Economics (ECP 4302) - The application of basic economic principles and techniques to the analysis of the cost-benefit trade-offs of those public policy decisions that affect the quality of people's environment.

Entrepreneurship (ENT 4024) - Introduction to the major concepts and fundamental principles for starting a new business. Emphasis will be placed on customer development, business model validation and problems during in the initiation stage.

Other any CEGE graduate course offering

Designing the City (URP 2051) - This course focuses on the process of urbanization and the social, cultural, political, and economic dynamics behind the complex urbanization process. It explores the historical development of cities, how different patterns of human behavior shape the city space, the role of society in place-making, and planning and governance of cities, including related institutions and organizations. This is a General Education course.

**C. For degree programs in the science and technology disciplines, discuss how industry-**

**driven competencies were identified and incorporated into the curriculum and indicate whether any industry advisory council exists to provide input for curriculum development and student assessment.**

The curriculum was developed with the assistance of the Civil Engineering Department Advisory Council comprised of 16 industry representatives, 7 of which are from companies and agencies that have an environmental engineering focus as shown in Table 13.

**Table 13. 2014-15 Civil Engineering Department Advisory Council Members Involved in Curricular Development for BSEV**

First Name	Last Name	Company Name	Email Address
Karl	Kennedy, P.E.	Calvin Giordano & Associates	karl@calvin-giordano.com
Robert	McSweeney, P.E.	Calvin Giordano & Associates	bmcsweeney@calvin-giordano.com
Ben	Chen, Ph.D., P.E.	Chen Moore & Associates	benchen@chenandassociates.com
Donald	Eckler, P.E.	Eckler Engineering	deckler@ecklerengineering.com
Albert	Muniz, P.E.	Hazen and Sawyer	amuniz@hazenandsawyer.com
Edward	Kent, Ph.D., P.E.	Parsons	edward.kent@parsons.com
Jeffrey	Greenfield, Ph.D., P.E.	South Florida Water Management District	jfreenfi@sfwmd.gov

In addition, Carlos Mallol (Montgomery Watson Harza) and Walter Goblisch (CES Consultants) were involved in the development of the curriculum.

- D. For all programs, list the specialized accreditation agencies and learned societies that would be concerned with the proposed program. Will the university seek accreditation for the program if it is available? If not, why? Provide a brief timeline for seeking accreditation, if appropriate.**

The Environmental Engineering curriculum has been designed to meet all requirements for accreditation by the Accreditation Board for Engineering and Technology (ABET), as developed for Environmental and Similarly Named Programs by the learned societies of the American Academy of Environmental Engineers and Scientists (AAEES) and its cooperating societies: American Institute of Chemical Engineers (AIChE), American Society of Agricultural and Biological Engineers (ASABE), American Society of Civil Engineers (ASCE), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), American Society of Mechanical Engineers (ASME), SAE International, and the Society for Mining, Metallurgy, and Exploration (SMME). Specifically, the key criteria include:

- 1. Curriculum.** The curriculum must prepare graduates to apply knowledge of mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, fluid mechanics. The curriculum must prepare graduates to formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases; conduct laboratory experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., air, water, land, environmental health); design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and apply advanced principles and practice relevant to the program objectives. The curriculum must prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.



2. **Faculty.** The program must demonstrate that a majority of those faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, board certification in environmental engineering, or by education and equivalent design experience.

We will absolutely seek ABET-accreditation at the earliest possible opportunity. Graduation from an ABET-accredited program is the universally accepted education credential required for professional registration as an environmental engineer. The proposed implementation date is January 1, 2016, with the first students accepted for the Summer/Fall 2016 semester. Accreditation cannot occur until the after the first graduate. Before seeking ABET accreditation, all eligibility requirements for accreditation by the Engineering Accreditation Commission for Environmental and Similarly Named Programs, which are:

- The program will have program educational objectives, student outcomes, a curriculum, faculty, and facilities, as described in the accreditation criteria. ABET does not accredit certification, training, or doctoral programs. [This criterion is met once the program is approved]
- ABET accepts Requests for Evaluation from post-secondary programs offered by degree-granting institutions with verifiable and recognized governmental, national, or regional authority to confer degrees. [This criterion is met once the program is approved]
- Programs requesting an initial accreditation review must have at least one graduate prior to the academic year when the on-site review occurs. [This criterion is met the moment the first student graduates with the degree]
- The name of a program seeking accreditation must be descriptive of the program's content and be stated exactly the same way on the graduate's transcript and in the institution's literature. [This criterion is met once the program is approved]
- Be accreditable under the Engineering Accreditation Commission (EAC). All engineering programs requesting ABET review must include the word "engineering" in the program name. EAC accredits programs at the following degree levels: bachelor and master. [This criterion is met once the program is approved]
- A preliminary Self-Study Report from all programs seeking initial accreditation is required, if the institution has no currently ABET-accredited programs in that same commission. [This criterion does not apply since all FAU engineering programs are ABET-accredited]

Prior to seeking an accreditation review, the program must have a functioning assessment process in place that meets ABET criteria for accreditation in three areas: Program Educational Objectives, Student Outcomes, and Continuous Improvement.

Briefly, the timeline is as follows:

Year one:

- Formally establish Industry Advisory Council as a Program Advisory Council
- Establish assessment process for Program Educational Objectives, Student Outcomes, and Continuous Improvement
- Establish the two major teaching laboratories required in the ABET guidelines

Year two:

- Prepare for Readiness Review
- Collect samples of student work, syllabi, textbooks, and sample assignments
- Complete Readiness Review (not required) by November 1
- Continue to implement assessment program
- Begin developing Self Study report

Year three:

- First graduate is expected in year three

- Submit official Request for Evaluation (RFE) by January 31 of the year of the program's On-Site Visit
- ABET will set a visit date and form a review team between April and May
- Complete and submit the Self-Study Report to ABET no later than July 1
- The review team assigned to the program begins reviewing the Self-Study Report
- The program's institutional representative is invited to meet the review team chair at Institutional Representatives Day, held in Baltimore, MD, in July
- Prepare for the On-Site Visit
- Finalize the visit schedule, arrange student and faculty interviews, and, set up rooms with display materials for the review team; planning and preparation begins in July
- The On-Site Visit typically lasts three days (usually Sunday through Tuesday), and includes a review of materials; interviews with students, faculty, staff, and administrators; and concludes with an exit meeting, when the team will convey its findings
- 1 Week After the Visit, FAU will provide the review team with any errors of fact resulting from the exit meeting
- Continue to implement assessment program

Year four:

- 2-3 months after the on-site visit, FAU receives the Draft Statement, a formal communication of the review team's findings
- 3-4 months after the visit, during the 30-Day Due Process period, FAU responds to any shortcomings identified in the Draft Statement
- The ABET commissions meet to decide Accreditation Actions in July, and at this meeting our program's accreditation is discussed and determined
- By August 31, the program is formally notified of the accreditation action via the Final Statement to the institution
- Continue to implement assessment program

**E. For doctoral programs, list the accreditation agencies and learned societies that would be concerned with corresponding bachelor's or master's programs associated with the proposed program. Are the programs accredited? If not, why?**

Not applicable, this is not a doctoral program.

**F. Briefly describe the anticipated delivery system for the proposed program (e.g., traditional delivery on main campus; traditional delivery at branch campuses or centers; or nontraditional delivery such as distance or distributed learning, self-paced instruction, or external degree programs). If the proposed delivery system will require specialized services or greater than normal financial support, include projected costs in Table 2 in Appendix A. Provide a narrative describing the feasibility of delivering the proposed program through collaboration with other universities, both public and private. Cite specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.**

The program will train students in the areas of water supply, wastewater treatment, solid/hazardous waste management, air pollution, green technologies, and pollution prevention of natural ecosystems and the built environment. This will be the first program in the SUS that will deliver the ABET requirements in environmental engineering with just 120 credits. The other programs require 126-128 credits.

Program staff and faculty will be headquartered on the Boca Raton campus of FAU, but many of the classes in the program can be delivered via eLearning formats. This program will have an emphasis on hybrid online content in the upper division to increase access and allow part-time students and professionals to

obtain their degrees while still working. Most of the upper division coursework will have class meeting times scheduled for the evening hours if students want to have face-to-face time with faculty, allowing working professionals to attend classes outside of normal working hours if desired. Furthermore, the proposed program will have an integrated 2-semester capstone design sequence involving engineering students from multiple disciplines working together in teams (e.g. civil, geomatics, environmental, etc.). These two courses are also Gordon-rule writing classes, so students will have extra emphasis on improving their communication skills, a priority for being hired in the workplace. FAU also has a focus in undergraduate research, and faculty members in the Department are very active in providing rich opportunities for undergraduates to get involved in research projects.

Current course offerings are planned to use the following possible modes and formats of delivery: live course content with Blackboard collaborate for realtime interaction and recording capabilities, distance learning formats with echo recording and hybrid online lecture content, fully online courses, classes that meet after working hours or on weekends, laboratory sessions using FAU and/or outside agencies/businesses/industries facilities, intense all-day, two-day, or three-day laboratory sessions for distance learning students, and also traditional live course format.

A blended system of delivery modes and formats, each chosen to best fit the pedagogical needs of the particular course and student outcomes will provide convenient access and minimize travel and work disruption for students in the program. The most effective delivery system will undergo continuous improvement after the needs of the students and the achievement of the student outcomes in each course are assessed by the faculty, students, and industry council.

The State articulation agreement and common prerequisites manual assure that nearly every course scheduled for the first two years will be readily available from any State College in Florida. Any additional courses are also available from one of the other programs in the SUS as well.

It is anticipated that most courses will have a substantial online component and many will be offered entirely online or mostly online. Courses originating in the Boca campus of FAU can be delivered to other FAU campuses using the University's existing state-of-the-art videoconferencing capabilities already in place.

#### 4. Faculty Participation

- G. Use Table 4 in Appendix A to identify existing and anticipated full-time (not visiting or adjunct) faculty who will participate in the proposed program through Year 5. Include (a) faculty code associated with the source of funding for the position; (b) name; (c) highest degree held; (d) academic discipline or specialization; (e) contract status (tenure, tenure-earning, or multi-year annual [MYA]); (f) contract length in months; and (g) percent of annual effort that will be directed toward the proposed program (instruction, advising, supervising internships and practica, and supervising thesis or dissertation hours).**

See Table 4 in Appendix A.

- H. Use Table 2 in Appendix A to display the costs and associated funding resources for existing and anticipated full-time faculty (as identified in Table 2 in Appendix A). Costs for visiting and adjunct faculty should be included in the category of Other Personnel Services (OPS). Provide a narrative summarizing projected costs and funding sources.**

See attached spreadsheet file (Appendix A-Table 2). The budget includes reallocated base faculty salaries and benefits for the current faculty members (Bloetscher, Meeroff, Scarlatos, Teegavarapu, and Yi) in the program (the percent effort is shown in Table 4), two new faculty members (one in Fall 2017 and one in

Fall 2018), one laboratory technician position (other new recurring), and two graduate student teaching assistant positions with another two to be provided by research grant funding. The first faculty member will be in the air pollution/air quality sector to fill a gap in our current faculty. The second faculty member will be in the water/wastewater engineering field to provide sufficient faculty to be able to deliver the upper division courses in both Fall and Spring once the headcount increases to beyond 40-50 students.

**I. Provide in the appendices the abbreviated curriculum vitae (CV) for each existing faculty member (do not include information for visiting or adjunct faculty).**

See Appendix G for faculty CV's.

The Department of Civil, Environmental & Geomatics Engineering has 5 faculty currently available for this program. These include: Dr. F. Bloetscher, Associate Professor (tenured), Dr. D. Meeroff, Professor (tenured), Dr. P.D. Scarlatos, Professor (tenured), Dr. R. Teegavarapu, Associate Professor (tenured), and Dr. P. Yi, Assistant Professor (tenure-track), who joined the Department in January 2015. All faculty members teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, board certification in environmental engineering, or by education and equivalent design experience.

**Dr. F. Bloetscher, P.E., LEED AP**, Associate Professor (tenured), is a former utility director for Collier County and the City of Hollywood. He has a Ph.D. in Civil/Environmental Engineering from the University of Miami, a Master of Public Administration from the University of North Carolina at Chapel Hill and a Bachelor of Science in Civil Engineering from the University of Cincinnati. In 2010, he achieved LEED-AP status and became certified as a sedimentation and erosion control inspector in 2011. He has attended the American Water Works Association (AWWA) Annual Conference and Exposition each year since 1994, and chaired the AWWA Sustainable Water Conference twice and attended same each year since 2007. He has developed the technical program each year since 2004. He attended the Groundwater Protection Council Annual Meeting in 2008-2011, the GWPC UIC program in 2014, and took the FL-PE required ethics classes in 2008, 2010 and 2012. He has published an average of 5 peer reviewed papers each year and 6-10 non-peer reviewed papers since 2010, totaling over 220 papers and seven books in his career so far. He has 24 years of experience in government and industry practice with 11 years teaching experience (8 of which are at FAU). He is a professional engineer registered in Florida, North Carolina, Georgia, Ohio, Colorado, Utah, South Carolina, and Tennessee. He is heavily involved with the American Society of Civil Engineers, American Water Works Association, and the Water Environment Federation. Dr. Bloetscher is WAC-certified and has collaborated with Dr. Meeroff to write the first capstone design manual for Civil, Environmental & Geomatics Engineering students, scheduled for release in Spring 2015. Dr. Bloetscher's research interests include: water and wastewater technology, groundwater wells, flow and contaminant transport, wastewater disposal practices and risk assessment, sustainable water resource planning and management, and utility management and finance. Dr. Bloetscher is credentialed to teach the following courses: CGN 2327-Fundamentals of AutoCAD, ENV3001C-Environmental Science and Engineering, CWR4223-Advanced Hydraulic Systems, ENV4514-Water and Wastewater Treatment Systems, CCE4031-Construction Project Management, CGN6506-Infrastructure System Management, CGN4803C-Civil, Environmental & Geomatics Engineering Design 1, and CGN4804C-Civil, Environmental & Geomatics Engineering Design 2.

**Dr. D. Meeroff**, Professor (tenured), serves as the Associate Chair of the Department of Civil, Environmental and Geomatics Engineering and is the Director of the Laboratories for Engineered Environmental Solutions. He also serves on the water quality division laboratory services and biological contaminants committees of the American Water Works Association. In that capacity,

he developed technical sessions, workshops, and webinars, conducted paper reviews for the annual conference proceedings, and conducted annual technical meetings. He is also the student chapter advisor for the FAU joint chapter of the Florida Water Environment Association/American Water Works Association and the FAU Tau Beta Pi engineering honor society. He serves on the Water Environment Federation Students and Young Professionals committee, the Florida Department of Environmental Protection Green Lodging Program Steering Committee, and the EWRI Joint Committee on Environmental Processes and Technologies. Dr. Meeroff is co-chair of the National Pollution Prevention Roundtable Hospitality Research Working Group. He has served as a peer-reviewer for Water Environment Research, Waste Management, Environmental Science and Technology, Journal of Hazardous Materials, and Separation Science and Technology. He is also a textbook reviewer for Cengage Publishing and Kendall Hunt Publishing Company and is on the editorial board of Archives of Hydrosystems Engineering and International Journal of Engineering. He has organized two major research symposia: The Build Green/Save Green Conference and the Innovative Stormwater Designs and Integrating Reclaimed Water into Water Supply – A Full Day Seminar for South Florida. He continues to maintain close collaboration in terms of research and consulting with state agencies such as the Florida Department of Environmental Protection (FDEP), the Florida Department of Health (FDOH), Palm Beach County and Broward County, the City of Miami Beach, the Solid Waste Authority of Palm Beach County, and several private industries as well as the United States Environmental Protection Agency. Dr. Meeroff facilitated two faculty learning communities (undergraduate research and strategies for student success) and participated in several others. Dr. Meeroff is also active in eLearning and undergraduate research initiatives as the College representative on the FAU eLearning Steering Committee and the Distinction Through Discovery Quality Enhancement Plan steering committee. He is certified for Writing Across the Curriculum and completed CEL 1001 eLearning Design/Facilitator Certification. In 2013, he was awarded the Quality Matters Distinction for online teaching. Dr. Meeroff was also awarded the John J. Guarrera Engineering Educator of the Year by the Engineering Council in 2014 and was selected as the FAU Distinguished Teacher of the Year in 2014 by the students. In 2015, he became the first ever recipient of the Distinguished Research Mentor of the Year. Dr. Meeroff received his E.I. license in 1997 and is eligible for professional engineer registration in Florida. His research specialties include water/wastewater treatment processes, solid/hazardous waste management, aquatic water quality and chemistry, and green engineering. Dr. Meeroff is credentialed to teach CHM2095-Chemistry for Engineers and CHM2095L-Chemistry for Engineers Lab, ENV3001C-Environmental Science and Engineering, ENV4514-Water and Wastewater Treatment Systems, CGN4803C-Civil, Environmental & Geomatics Engineering Design 1, ENV6668-Environmental Systems and Processes, ENV6507-Wastewater Engineering, ENV6418-Water Supply and Treatment, and ENV 4341-Solid & Hazardous Waste and Site Remediation.

**Dr. P.D. Scarlatos**, Professor (tenured) was one of the founding members of the Department. Until August 2013, he was the Department Chair of Civil, Environmental and Geomatics Engineering for nine years. He is also the Director of the Center for Intermodal Transportation Safety and Security and the FAU representative of the Transportation Research Board (TRB). He participated as member in four and as co-leader in one Faculty Learning Community (FLC) and received training on Writing Across the Curriculum (WAC) and certification in eLearning Designer/Facilitator. During the same period he attended 44 local, national and international engineering conferences, educational training, and other professional activities, and he presented seven technical papers. He is involved in a variety of research projects with other faculty members and hired as expert witness in two high-profile federal litigation cases. He served as reviewer for: US EPA, NSF and US Fulbright Programs; “Thalis” Research Program proposals (Greece); External Experts Committee for civil engineering programs accreditation and faculty evaluation (Greece); seven national and international technical journals; and various manuscripts of engineering textbooks. Dr. Scarlatos

is a professional engineer registered in Greece, and he has 13 years of government/industry practice with over 28 years teaching experience with 25 of those at FAU. Dr. Scarlatos' research interests include: water resources/environmental engineering, sediment transport, coastal and riverine dynamic processes, and waste management. He is credentialed to teach CWR3201C-Applied Hydraulics, CWR6235-Open Channel Hydraulics, CWR6236-River Mechanics & Sediment Transport, CWR6525-Dynamic Hydrology, EES6025-Modeling Methods in WR/ENV Engineering, EES6357-Stream, Lake, Estuarine Pollution, ENV6441-Contamination of Aquatic Sediments, and CEG6708-Groundwater Contamination, among others.

**Dr. R. Teegavarapu, PE**, Associate Professor (tenured), has served on several national and international committees, which include: Water resources management technical committee of IAHR, AGU Hydrology Group; Task Committee on Statistical Distributions in Hydrology, ASCE; Vice Chair of Radar Rainfall and uncertainty analysis approaches task committees of EWRI-ASCE. He is also a working group member on modeling hydrologic changes and processes of IAHS. He has served as hydrology and hydraulics modeling expert to review floodplain studies conducted by South Florida Water Management District for FEMA. He has chaired, convened and moderated over 20 technical sessions at international conferences organized by ASCE and AGU. He has served as a general co-chair for an international symposium organized by EWRI and ASCE in 2014. He has been invited for special talks and a keynote lecture at international conferences. He has served as a reviewer for over 30 international journals and seven international conferences for several manuscripts and received recognition from editors and editorial board over the past five years. He has authored one book (published by Cambridge University Press) and three book chapters in different books to be published by EWRI-ASCE. He is currently an author of a chapter for Handbook of Hydrology to be published by McGraw Hill. He has served as reviewer for proposals from USGS NIWR, USA and Natural Environment Research Council (NERC), United Kingdom and Canada Foundation for Innovation. He serves on two editorial boards of water resources/civil engineering journals. He is the ASCE FAU faculty advisor. He has served as an expert to provide peer review of several projects completed by South Florida Water Management District. He has been serving on the graduate committee for the College of Engineering and Computer Science at FAU. He presented his technical work at national and international conferences and provided Fundamentals of Engineering reviews at FAU. He has chaired one and participated as a member in two Faculty Learning Communities (FLCs) at FAU related to technology in undergraduate education, assessment of student learning and inquiry-based learning. He has 14 years teaching experience with 8 of those at FAU, and he is very active in the Environmental/Water Resources Institute of the American Society of Civil Engineers as well as the American Geophysical Union. Dr. Teegavarapu is also a licensed professional engineer in Ontario, Canada and Kentucky. His primary research areas are climate change and variability, environmental and water resources systems modeling and management, hydrological processes, watershed modeling and management. He is credentialed to teach CWR4202-Hydrologic Engineering, CWR4307-Stormwater Modeling and Management, and CGN4321-GIS for Civil Engineering Applications as well as CWR6818-Water Resource Systems Engineering and CWR6125-Groundwater Flow.

**Dr. P. Yi**, Assistant Professor (untentured), joined the program in January 2015. He has two masters' degrees in Municipal Engineering (from Harbin Institute of Technology) and Environmental Process Engineering from Johns Hopkins University. His Ph.D. is in Environmental Engineering also from Johns Hopkins University, and he just completed his post-doctoral research appointment with the Connecticut Agricultural Experiment Station with world-renown Dr. Joseph J. Pignatello on "Interactions between engineered nanoparticles with black carbon particles." At Johns Hopkins, he taught Environmental Fundamentals 1, Physical and Chemical Processes in Environmental Engineering 2, and Environmental Engineering Process Lab 1. He received the C. Ellen Gonter Environmental Chemistry Award in 2013 for outstanding research paper, which is

the highest award given to students by the Division of Environmental Chemistry of the American Chemical Society and the Certificate of Merit Award in 2010 for outstanding presentations to the Division of Environmental Chemistry of the American Chemical Society. He is an active member of the Association of Environmental Engineering and Science Professors. His research areas include membrane systems, nanoparticles, and surface chemistry. Dr. Yi is credentialed to teach ENV4514-Water and Wastewater Treatment Systems, ENV 4702-Introduction to Pollution Prevention and Sustainability, ENV 4115C-Air Pollution & Control Systems with Lab, ENV 4053-Environmental Fate and Transport, ENV6668-Environmental Systems and Processes, and ENV6932-Sustainability & Pollution Prevention.

We are requesting one new faculty position to start in year one at the assistant professor level in the area of environmental engineering with an interest in air quality control to effectively deliver the curriculum. We are also requesting for a laboratory technician to support the ABET accreditation requirements for two major laboratory experiences in different media types (e.g. water, air, soil). A second faculty position is requested in year two for an assistant professor in the area of environmental engineering with concentration in water/wastewater engineering processes to allow for offering the upper division courses twice per year so that students can graduate on time. These new hires are a priority for the College. Funding will be reallocated to match the university /College priorities. These two new hires are strongly tied to the University's pillars and platforms strategic plan for the race to excellence, particularly in *Ocean Science and Engineering / Environmental Sciences* but also in *Sensors and Smart Systems*.

- J. Provide evidence that the academic unit(s) associated with this new degree have been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, as well as qualitative indicators of excellence.**

The Department of Civil, Environmental & Geomatics Engineering is very productive in terms of teaching, research and service. Since its inception in 2001, the undergraduate student body has grown from 6 to 352 (Fall 2015 head counts: Civil – 195, Geomatics – 23, Pre-Professional with designation of Civil or Geomatics – 134). There are 45 students currently in the MS program, and 4 Ph.D. students, supervised by the CEGE faculty, are registered in the sustainable infrastructure track in Ocean Engineering. The Department has produced an average of 54 BS degrees and 11 MS degrees each year for the last five years. The faculty, consisting of 14 full time plus 1 quarter time, delivers 30-32 classes each spring and fall semesters. During the 2014-2015 fiscal year, the faculty wrote 26 research proposals as PIs to federal, state and local funding agencies, and 12 of them were awarded for a total of \$1,081,389. The faculty is also very active in university business through various levels faculty committees. Some of them are also active in the national committees of professional associations. 70% of faculty served reviews for technical journals during the last academic year. Two faculty members received the Engineering Education of the Year awards from the National Council of Engineers for 2014 and 2015, respectively; one faculty received the FAU Distinguished Teacher of the Year award in 2014 and FAU Distinguished Mentor of the Year award in 2015; A capstone design project supervised by Meeroff and Bloetscher received the 1st place award from NCEES \$25,000 prize for the Dania Beach LEED Gold Water Treatment Plant Expansion Project; Bloetscher and Meeroff also authored the textbook, *Practical Concepts for Capstone Design Engineering*, which was adopted by 63 schools worldwide; one faculty member's research on intelligent transportation system was cited in a recent article in the Time magazine.

The 2014-2015 Department Dashboard Indicators provide a measure of the productivity of the 14 full time faculty in the CEGE Department:

1. Books (including monographs & compositions)	9
2. Other peer-reviewed publications	54
3. All other publications	40
4. Presentations at professional meetings or conferences	73
5. Productions/Performances/Exhibition	6

1. Faculty memberships on department, college or university committees	50
2. Faculty memberships on community or professional committees	43
3. Faculty serving as editors or referees for professional publications <b>Count should be for the # of Faculty NOT # of publications</b>	14

## 5. Non-Faculty Resources

- K. Describe library resources currently available to implement and/or sustain the proposed program through Year 5. Provide the total number of volumes and serials available in this discipline and related fields. List major journals that are available to the university's students. Include a signed statement from the Library Director that this subsection and subsection B have been reviewed and approved.**

University Library: Carol Hixson, Dean of University Libraries (<http://www.fau.edu/library/>)

The University Libraries include the S.E. Wimberly Library on the Boca Raton campus, collections housed at the Broward County Public Library to serve FAU in downtown Fort Lauderdale, a shared-use library with Broward College in Davie, a 20,000-square-foot library on the John D. MacArthur campus in Jupiter, and Harbor Branch Oceanographic Institute Library located in Ft. Pierce.

The S.E Wimberly Library at Florida Atlantic University (FAU) is a five floor 165,000-square-foot building located in the heart of the Boca Raton campus. It provides faculty and student group study rooms, collaborative workstations, study carrels, seating for approximately 1,099, an electronic classroom, multimedia lab, two assistive technology workstations available for use by persons with disabilities in the Reference Department, a computer lab, and an audiovisual media center. The Media Center (<http://www.library.fau.edu/depts/media/media.htm>) houses the University's primary collection of audiovisual materials. Formats supported by the Media Center include videotape, laserdisc, CD-ROM, DVD, and audiotape. FAU Libraries maintains formal relationships with the Center for Research Libraries, the State University Libraries through the Florida Virtual Campus (FLVC), and regional libraries in the Southeast Florida Library Information Network (SEFLIN). In addition to the computers available for use throughout the library, the entire building is equipped for laptop wireless connectivity. A five-story addition opened in spring 2007 and provides students with a new 24-hour study location and many other features.



The library collection comprises more than 1.4 million volumes, 408,137 electronic books, 1.5 million microforms, and subscriptions to over 700 print and 23,500 electronic journals, as well as comprehensive collections of U.S. and Florida government documents, maps, curriculum materials, DVDs and videos, CDs and CD-ROMs, and other materials.

An online catalog of library holdings provides a listing of materials in the FAU Libraries and the other 11 Florida public university libraries. The library collection, accessible to all faculty and students, comprises over 2.5 million items including books, periodicals, government documents, microforms, maps, media, and other materials. The Library also provides an exceptional offering of electronic resources including access to several hundred databases. Located at: <http://www.fau.edu/library/ecollect/ecollect.php>, users can search across a majority of the libraries' resources with a discovery service called SearchWise, <http://www.fau.edu/library/#>. Faculty and students have remote access capabilities to the virtual library where catalogs, electronic books, full-text databases, electronic reserves, electronic theses and dissertations, and electronic journals are available around the clock regardless of location. These electronic resources can be accessed in the library during library hours of operation, faculty offices, computer labs on campus, and through 24-hour remote access via Off Campus Connect/EZproxy or FAUNet ID at <https://login.ezproxy.fau.edu/login>. Students, faculty, and staff must be current members of FAU and have a valid FAU ID Card in order to utilize EZproxy or FAUNet ID.

Location and arrangement of the print engineering collections: Almost all engineering journals and indexes held by the FAU Libraries are now online and available 24 hours a day at any location. Most users prefer to use the online engineering materials. The engineering print books and journals are catalogued using the Library of Congress classification system. Current year print journals are housed with previous years of print journals and shelved in the library stacks along with the books according to call number. Library services at the SeaTech campus are provided by the Department of Interlibrary Loan (ILL). The University/College Library, Broward College – Florida Atlantic University joint-use facility, <http://ucl.broward.edu/>, serves the library needs of students and faculty located on the Davie Campus. ILL also provides national and international access to articles, books, media, and other resources that may be hard to locate.

Reference services available to students and faculty: Nine librarians and one administrative/professional employee staff a general reference desk sixty hours/week, seven days a week and respond to reference inquiries. Librarians offer one-on-one reference consultation services by appointment covering any library research topic and library instruction sessions may be arranged for classes or individuals.

- Reference & Instructional Services
  - (<http://www.library.fau.edu/depts/ref/refdept.htm>)
- Request a Research Consultation or Faculty Orientation
  - (<http://www.library.fau.edu/eforms/refcon.htm>)

The Main Library's building hours during the 2013-2014 academic year are as follows:  
([http://libguides.fau.edu/lib\\_hours](http://libguides.fau.edu/lib_hours))

Sundays – Noon-Midnight  
 Mondays through Thursdays – 8am-Midnight  
 Fridays – 8am-6pm  
 Saturdays – Noon-6pm

Reference desk hours are as follow:

Sundays – Noon-6pm

Mondays through Thursdays – 10am-8pm  
 Fridays – 10am-6pm  
 Saturdays – Noon-6pm

The library is open 92 hours a week and reference services are available 60 hours a week. Total library traffic for 2012-2013 was 918,645 and traffic for 2011-2012 was 917,742. However, the library is exploring the possibility of 24 hour, 7-days a week access to limited areas of the library in 2015.

Additionally, the Reference Department uses chat, text, email, and phone in addition to in-person service at the Reference Desk. Reference Librarians also update and monitor the Libraries Facebook page and Twitter account. FAU Libraries have joined the statewide Ask-A-Librarian network, which nearly doubles the number of hours that live online help is available to FAU library patrons. FAU librarians are available via the Ask-A-Librarian network from 9 am - 5 pm from Monday through Friday (<http://www.library.fau.edu/depts/ref/askpol.htm>). For all other times, librarians from around the state are available for chat.

During the fall and spring semesters, varieties of workshops are offered on RefWorks (a bibliographic citation management tool), Google Scholar, Avoiding Plagiarism, and an Introduction to Research (<http://www.library.fau.edu/depts/ref/instrsv/mainwksh.htm>). The Reference and Instructional Services Department offers online research guides called LibGuides (<http://libguides.fau.edu/>), including twelve for Engineering and Technology (<http://libguides.fau.edu/cat.php?cid=11415>).

These guides highlight library resources such as directories, encyclopedias, databases, and electronic journals. Instructional classes related to student coursework can be requested by faculty or students through the Library's Information Literacy and Instructional Services unit (<http://www.library.fau.edu/eforms/lybiform.htm>).

The FAU Libraries provide personal computers (PCs), laptops, and various software for the FAU community. The Libraries also offer a limited number of PCs for public use in the First Floor East. The libraries currently own the following:

306 public PCs / 3 public Macs  
 98 public laptops / 12 public MacBooks  
 20 public iPads

Computers are available on a first-come, first-served basis and have the following basic software for FAU patrons and the public: Internet Explorer (Internet Access), Microsoft Office 2010 (Word, Excel, PowerPoint & Publisher), Respondus, and a LockDown Browser. Library users may bring a Flash/USB drive or other type of memory device to save information.

Sixty-two laptops (PCs and Macs) are available in the Libraries' Media Center in LY 122 for FAU library users and affiliates and are for use within the library building. An OWL Card is required for borrowing.

Interlibrary Loan services to students and faculty: The Interlibrary Loan (ILL) Department provides loans of books and photocopies of articles not held at FAU Libraries, as well as ILL materials provided by other libraries via ILLiad. ILLiad (Interlibrary Loan Internet Accessible Database) is the online resource sharing and ILL management system used by the FAU Library to send, receive, and process interlibrary and intralibrary loan requests. The system provides expedited services to FAU ILL users and allows users to track the progress of their requests online. Interlibrary loan extends privileges to all currently-enrolled students, faculty and staff of FAU including distance learners, and in most cases materials are obtained from non-FAU libraries within 7-10 business days. ILL also serves faculty and students at the FAU

SeaTech, HBOI, Davie, and Jupiter campuses, with materials shipped to them by courier. All articles are delivered electronically to the FAU requestor's desktop.

Users must access the ILLiad database to request materials such as books and articles from libraries outside of Florida, and UBorrow to request materials from other State University Libraries. The Interlibrary Loan department keeps in contact with users through ILLiad. Faculty and students are given the option of having articles delivered to them via Electronic Delivery without ever going to the library or waiting for mail delivery. If the lending library charges the Library a fee, this fee is passed on to the requestor and the requestor can indicate in their request how much they are willing to pay for an item. Over 90% of requests are obtained for free. Document Delivery Services for distance learning students provide home delivery of books, documents, copies of articles, and other circulating materials from the FAU Libraries collections, as well as copies of articles obtained through Interlibrary Loan. This service is available to students who are enrolled only in FAU distance learning courses. Once again the ILLiad database is used to process document delivery requests. There is no charge to users for ILLiad, but they are responsible for any return charges that apply.

Currently-enrolled FAU students may borrow books without cost from any State of Florida University System or Community College library via UBorrow. UBorrow, an unmediated borrowing service, increases FAU patrons access to the collections of the other universities in Florida, delivers more quickly than standard Interlibrary Loan, and allows users to keep the borrowed book longer (<http://www.library.fau.edu/depts/access/uborrow.htm>).

The FAU Libraries is a member of the Southeast Florida Library Information Network (SEFLIN), a multitype library cooperative. (<https://netforum.avectra.com/eweb/StartPage.aspx?Site=SEFLIN&WebCode=HomePage>). This membership allows currently enrolled FAU students to borrow books from other SEFLIN member libraries free of charge. In order to utilize this resource, the student must make these transactions in-person at each respective Florida University or state college library or SEFLIN member library. Additionally, each library has its own borrowing policies which FAU students must follow.

Course Reserves for faculty and students: Faculty may place course reference materials and supplemental teaching materials on course reserve for the semester the course is offered. Materials are available to enrolled students from personal copies belonging to the instructor or from the Libraries' collection, in print, electronic, or multimedia formats, in compliance with the Copyright Law of the United States (Title 17, U.S. Code). Some materials can be scanned as electronic documents and made available to students 24/7 by accessing the Course Reserve link on the library's homepage (<http://www.library.fau.edu/depts/access/resfac.htm>).

Seating capacity of the library: The S.E. Wimberly Library has 1,099 study seats and 23 group study rooms. The library is reviewing plans for creating additional seating space on the second floor west wing and the third floor east wing.

Electronic resources available to students and faculty: The FAU Libraries collect electronic resources to support the instructional, research and service activities of the Florida Atlantic University students, faculty and staff. The electronic resources collection includes access to full text database and indexes, electronic journals, e-books, and a growing streaming media collection.

The FAU Libraries are a part of the Florida Virtual Campus (FLVC). As part of the FLVC the Libraries cooperate in the provision and management of a shared electronic collection in support of academic programs at all the State of Florida colleges and universities. The FAU Libraries also participate in consortial purchases and licensing agreements with those state university libraries interested in

acquiring particular resources, including seven major academic publisher packages that significantly increase the Libraries access to full-text materials.

There are numerous electronic resources in engineering and related fields available. A list of the major products follows:

ACM Digital Library  
 ACS (American Chemical Society) Journals  
 Aluminum Industry Abstracts  
 ANTE: Abstracts in New Technologies and Engineering  
 Applied Science and Technology Full Text  
 ASCE (American Society of Civil Engineers) Library  
 ASFA 2: Ocean Technology, Policy and Non-Living Resources  
 ASME (American Society for Mechanical Engineers) Journals  
 Biotechnology and Bioengineering Abstracts  
 Civil Engineering Abstracts  
 Compendex  
 Computer and Information Systems Abstracts  
 Elsevier ScienceDirect  
 Engineered Materials Abstracts  
 Engineering Index Backfile 1884-1969  
 Engineering Research Database  
 IEEExplore/IEL Online  
 Inspec  
 Inspec Archive  
 Materials Research Database with METADEX  
 MathSciNet  
 Mechanical and Transportation Engineering Abstracts  
 Mechanical Engineering Abstracts  
 Morgan & Claypool Synthesis Digital Library of Engineering & Computer Science  
 Risk Abstracts  
 SpringerLink  
 Web of Science  
 Wiley Online Library

Electronic resources are accessible from the Florida Atlantic University Libraries Electronic Collection web page, (<http://www.fau.edu/library/ecollect/ecollect.php>).

Additionally, there is a web page that lists Engineering & Technology Databases, ([http://www.fau.edu/library/ecollect\\_search/?category=5&search\\_category=Search](http://www.fau.edu/library/ecollect_search/?category=5&search_category=Search)). Another web page provides a listing of Engineering & Applied Sciences e-journals, (<http://hx8vv5bf7j.search.serialssolutions.com/?V=1.0&L=HX8VV5BF7J&S=SC&C=TE>).

The online library catalog, Aleph, provides access to the holdings of the eleven state university libraries. This catalog, and a variety of internet and electronic databases, may be accessed through the more than 285 computers located throughout the library. They may also be searched remotely through use of a proxy server. Jacks and wireless network connections located throughout the library, particularly in group study rooms, provide access via individual laptop computers.

Process by which acquisitions of engineering-related materials are made: A designated library representative within each department of the College of Engineering and Computer Science works with

the librarian who is the selector for engineering library materials, (<http://www.library.fau.edu/depts/cd/college.htm>). An approval plan with YBP Library Services, (<http://www.ybp.com/>), is in place for the relevant engineering and computer science subject fields. Approval notifications are reviewed regularly by the selector and the engineering faculty members. Professors may also request other materials and are encouraged to participate in the selection process. Requests for new journal titles are submitted through the online Materials Suggestion Form, (<http://www.library.fau.edu/eforms/printreq.htm>), and reviewed by the Collection Development Unit. The Collection Development Librarian notifies the faculty member that the form has been received and that subscriptions will be initiated pending review by the library's Collection Development Committee and if funds are available.

Professional library staff available and assigned primarily to the engineering unit: Reference librarians provide reference service and bibliographic instruction to the College of Engineering and Computer Science. A designated librarian selects materials in engineering and related fields.

- L. Describe additional library resources that are needed to implement and/or sustain the program through Year 5. Include projected costs of additional library resources in Table 3 in Appendix A. Please include the signature of the Library Director in Appendix B.**

No additional library resources are anticipated at this time.

- M. Describe classroom, teaching laboratory, research laboratory, office, and other types of space that are necessary and currently available to implement the proposed program through Year 5.**

**Instructional and Classroom Support:**

*Classrooms:* FAU has 371 instructional venues across its seven campuses, with 110 designated as "general classroom" and 210 as "class lab" usage. OIT provides the infrastructure, instructional technology, and AV support for 82 percent of those rooms. Of the OIT-supported classrooms, 100 percent now have presentation ability, which includes a computer, projector, DVD player, Symposium (which serves as computer monitor and electronic white board), and document camera, as well as the ability to connect a laptop and use it as the presentation medium. Over 96 percent of the centrally scheduled (some college-managed) classrooms are equipped with presentation capability. OIT has AV technicians on staff whenever classes are in session, including evenings and Saturdays. These staff members can assist faculty and presenters with learning to use the equipment and provide troubleshooting in the event of a technical problem. Of FAU's 370 classrooms, 23 have lecture-capture capability, and 31 of those rooms can also provide live video conferencing for classes as well as thesis and dissertation presentations and other events.

*Instructional and Open Computer Labs:* FAU has nineteen open labs (Boca Raton: twelve; Fort Lauderdale: one; Davie: three; Jupiter: three) and twenty-five instructional labs (Boca Raton: seven; Fort Lauderdale: nine; Davie: six; Jupiter: three). In addition, the Department's students have access to a large computer lab in the library (LY136) and 24-hr card access to labs in buildings 4 and 96. OIT provides support and management for all general instructional and open computer labs on all FAU campuses. This provides students with a high level of uniformity across all campuses. Computers in campus labs have a consistent look and feel, a uniform set of software packages, and access to the printers. Instructional labs provide a teaching console with computer and projector and computers for each student. Specifications and capabilities in each lab are listed on the OIT Website. The computer center's open laboratory is open from a.m. - 10:00 p.m. seven days per week. All computer laboratories in the residence halls, the student apartments, and the Student Union are open twenty-four hours seven days per week.

*Virtual Computer Labs:* FAU also has virtual computing labs, which will allow students anywhere to connect to a virtual computer and launch applications licensed by FAU via VMWare. Current licensed applications include Microsoft Office, Minitab, SPSS, Visual Studio, Notepad, and essentially all software programs necessary for required coursework such as AutoCAD, Revit, EPANet, etc. Applications will be added to the suite as necessary. This project is vital for supporting distance learning students, who require access to discipline-specific applications that are currently available in the physical computing labs.

*Training:* OIT's Instructional Technologies division offers training for the multitude of services OIT provides. Training is available for faculty, staff, and students in the effective use of technology through free instructor-led courses on Google Applications for Education (documents, presentations, spreadsheets, forms, websites, groups, calendar and Google+). In-person training for Blackboard and classroom technology is limited to faculty and graduate teaching assistants. These classes are taught in a computer lab with a hands-on approach. A schedule of the computer training courses is posted on the OIT Website and is published in the weekly University announcements. Computer training courses are offered at the Boca Raton campus and FAU's partner campuses, including Davie, Fort Lauderdale, and Jupiter. In 2011, over 700 training sessions took place, including 460 software application-related workshops and 273 Blackboard sessions. To enable students to complete necessary course tasks, all students have access to online Blackboard tutorials. OIT also provides special courses for departments or other groups and one-on-one sessions on request. These special courses include classes on the use of Word for graduate students who are working on theses and dissertations, orientation on the use of eClassroom/videoconference technologies, and training on the University's Web content management system, OmniUpdate. In addition to designing and delivering training, OIT staff members develop documentation and tutorials including online training videos. Upcoming online training tutorials will feature topics such as an Introduction to eClassrooms, Teaching via Videoconference, and Using Personal Lecture Capture Tools. OIT also makes Microsoft IT Academy online training available to faculty and staff upon request. OIT participates in the annual New Faculty Orientation by providing information about technology support, resources, and services available to faculty at FAU. In addition to centralized training in technology through OIT, FAU's colleges have courses dedicated to helping students become comfortable working with technology. The College of Business requires its majors to enroll in ISM 2000, which introduces students to basic concepts in computer technology and highlights the relevance of computers and their applications to all aspects of life in the modern world. It covers the fundamentals of computer systems, computer networks, software applications, and the Internet, as well as social issues related to the use of computer technology. The College of Engineering offers two online courses, Computer Applications I and II, which cover Word, Access, Excel, and PowerPoint. This lower-division elective is open to students in any major.

*Video Production and Event Support:* OIT provides faculty the opportunity to video record lecture snippets or demonstrations that can be used for classes. It also records and/or Webcasts academic presentations, invited speakers, key meetings (e.g., the search and interview of candidates for FAU president, and the State of the University Address), commencement, and other ceremonies.

*Applications:* FAU licenses the Blackboard learning management system for University use. The Christine E. Lynn College of Nursing and the College of Business use eCollege for some of their graduate programs. FAU also licenses access to Respondus StudyMate, Respondus LockDown Browser, SafeAssign, TurnItIn, Blackboard Collaborate (formerly Elluminate), iTunes U, and lecture capture via Echo 360. Lecture videos are available via Blackboard in various formats to accommodate an array of connection speeds. The full list of software available for college and department purchase for on-site use is available online.

## **Technology Support:**

Help Desk and Technical Assistance: FAU provides technology support in several ways. Many academic colleges have IT staff to serve the college's specific IT needs and support. OIT provides centralized support via an outsourced 24/7 help desk available via phone, chat, and online ticket system. For departments without their own IT staff, OIT has technicians who perform desktop computer installations, troubleshooting, printer setup and troubleshooting, and configuration of mobile devices, among other computer-related issues. OIT has an internal help desk that provides walk-up support, and also handles tickets escalated from the external help desk. Tickets submitted online are handled by the internal help desk, OIT staff, or the college or departmental IT staff. Self-help information is available on the OIT website: [www.fau.edu/helpdesk](http://www.fau.edu/helpdesk). During Freshmen Orientation, OIT provides information and assists with account issues or questions regarding any technology used at FAU. During New Faculty Orientation, OIT presents an overview of technology and services available to faculty and provides assistance with accounts or any technology used at FAU.

#### **Mobile and Web Application Support:**

**Mobile:** FAU's mobile application, is available on smart phones (iPhone, Android phones, BlackBerry, and iPad), provides numerous applications useful to the FAU community: news, athletics information and scores, GPS-enabled maps, the events calendar, University faculty and staff directory, and the course schedule. Future versions will include applications such as Places, which helps people find information about various places, such as restaurants and galleries, on campus, and access to the University web portal, MyFAU. FAU also provides access to academic content on mobile devices through the Echo 360 lecture capture system, iTunes U, and Google Applications.

*E-mail:* Students: FAU provides Google Mail for student e-mail, branded as OwlMail and OwlApps. Students are provided a 25GB mailbox, compared to the 20MB mailbox that the University currently provides. Students also have access to many collaboration tools through OwlApps (documents, presentations, spreadsheets, forms, Websites, groups, calendar and Google+).

Faculty and Staff: Faculty and staff e-mail is now hosted on Microsoft Exchange, providing 2GB mailboxes and the opportunity to share calendars across campus. Faculty and staff also have access to Microsoft SharePoint.

*Web-Based Application Development for FAU Needs:* When commercial applications either do not exist or are prohibitively expensive, OIT can develop Web-based applications to serve various instructional and administrative needs. Some of those developed over the last several years include FAU Scholarship Search, College Assessment of Readiness for Entering Students, Strategies and Tips for Academic Recovery, Electronic Thesis/Dissertation Submission, and Writing Across the Curriculum Submission and Evaluation.

*Software Licensing:* OIT manages site licensing for the University for Microsoft applications, including the full Office suite, SharePoint, Project, and Visio, and malware and virus protection. It also has a volume discount on research applications such as SAS, SPSS, Minitab, and MATHLAB. Faculty and staff may purchase Microsoft Office for home use at a considerable discount, and malware protection software is available to faculty, staff, and students for home use at no cost. The full list of software available for college and department purchase for on-site use is available on the OIT Website.

#### *College Computing Facilities*

(Mahesh Neelakanta, Director, Technical Services Group, <http://tsg.eng.fau.edu/>)

The Technical Services Group is responsible for the computer laboratories and computer support in the College of Engineering and Computer Science. The following laboratories are available in the College (Engineering East Building 96, Engineering West Building 36):

College Open Use Labs:

EG 130 - Mechanical Engineering Open Lab (20 Computers)  
 EG 273 - Engineering Open Use Computing & Teaching Lab (12 Computers)  
 EG 274 - Engineering Open Use Computing Lab (12 Computers)  
 EE 207 - Engineering Open Use Computing & Teaching Lab (30 Computers, 60 Seats)  
 EE 213 - Engineering Open Use Computing & Teaching Lab (18 Computers, 36 Seats)

College Research, Teaching & Computer Labs:

Engineering West Building 36 Labs:

EG 132 - Experimental Methodology Lab

Instructional Services Building 4 Labs:

IS 101 - CITSS Transportation Lab

Engineering East Building 96 Labs:

EE 203 - Microprocessor, Logic Design, Microcontroller Lab  
 EE 205A - Engineering Student Work Lab  
 EE 208 - Senior Projects, Design I and II Lab  
 EE 209 - Controls & Communications Lab  
 EE 212 - Innovation Lab  
 EE 408A - Apple Lab  
 EE 408B - Signal Image & Video Processing Lab  
 EE 409 - Multipurpose Lab (CSI)  
 EE 410A - Web Development Lab  
 EE 410B - Digital Signal Processing Lab  
 EE 413 - Mobile Computing, Sensor and Wireless Lab  
 EE 507A - Empirical Software Engineering Lab (ESEL)  
 EE 507B - BioInformatics Lab  
 EE 508 - RF, Microwave & Satellite Communications Lab

Library Shared Labs:

LY 136 – AutoCAD/Training Lab  
 LY451 – SEFLIN Room

The Technical Services Group installs and maintains all equipment and software, and provides technical support to faculty, staff and students. A listing of the software available in the laboratories is provided at <http://tsg.eng.fau.edu/software/>.

The following is a list of college-wide computing infrastructure components that are available for cloud and high performance computing:

Network Infrastructure:

- 2 x Cisco 6510 10 Gbe Network Switches
- 3 x Brocade 10 Gbe Switches

Virtual Desktop Infrastructure (Private Cloud) Compute Resources:

- 3 x HP C7000 Chassis, 4 x 10 Gigabit Network Interconnect
- 23 x HP BL460c G6 Blade Servers (Each with 2 x Intel Xeon 2.5 Ghz CPU and 64 GB Memory)
- 8 x HP BL460c G7 Blade Servers (Each with 2 x Intel Xeon 2.5 Ghz CPU and 96GB Memory)
- 2 x Dell R825 Rack Servers – 512 GB RAM, 4 x 12 Core AMD Opteron CPU, 10 Gbe Network Interconnect, 1 x Teradici Accelerator
- 2 x Supermicro Rack Servers - 512 GB RAM, 4 x 12 Core AMD Opteron CPU, 10 Gbe Network Interconnect, 1 x Teradici Accelerator



- 1 x Dell R720 Rack Server - 384 GB RAM, 2 x 8 Core Intel Xeon CPU, 10 Gbe Network Interconnect

#### Virtual Desktop Infrastructure (Private Cloud) 3D Dedicated Workstations:

- 18 x Lenovo C20 Workstations (24 GB RAM, 2 x Intel Xeon CPUs, ATI/AMD RG220 Graphics + PCOIP Card)
- 14 x Supermicro Blade Workstations (24 GB RAM, 2 x Intel Xeon CPUs, ATI/AMD RG220 Graphics + PCOIP Card)

#### Virtual Desktop Infrastructure (Private Cloud) 3D Virtualized Machines (TechFee):

- Supermicro Rack Servers – 256 GB RAM, 2 x Intel Xeon CPUs, 2 x NVIDIA K1 GPUs, 1 x Teradici Accelerator
- Supermicro Rack Servers – 256 GB RAM, 2 x Intel Xeon CPUs, 1 x NVIDIA 21 GPU, 1 x Teradici Accelerator

#### Virtual Desktop Infrastructure (Private Cloud) Storage Resources:

- 2 x HP Compellent Storage Cluster (25 TB Total) – 10 Gbe Interconnect
- 8 x HP P4500 SAS Storage Array (57.6 TB Total) – 10 Gbe Interconnect
- 4 x HP P4500 SAS Storage Array (28.8 TB Total) – 10 Gbe Interconnect
- 10 x HP P4500 MDL-SAS Storage Array (120 TB Total) – 1 Gbe Interconnect

#### Dell/Nexenta File Storage Cluster (TechFee):

- 2 x Dell R620 + Dell MD3060e (192 TB Total) – 10 Gigabit Interconnect

#### High Performance Computing Cluster (TechFee):

- 3 x Supermicro Server – 32 GB RAM + 4x12-core AMD Opteron CPU (48 Cores)
- 2 x Supermicro Server – 64 GB RAM + 4x12-core AMD Opteron CPU (48 Cores)
- 3 x SuperMicro Server – 128 GB RAM + 2x8-core AMD Opteron CPU (16 Cores)
- 2 x SuperMicro Server – 512 GB RAM + 4x12-Core AMD Opteron CPU (48 Cores)
- 2 x SUN X4600 Server – 64 GB RAM + 8 x 2.3 Ghz AMD Opteron (32 Cores)

#### High Performance GPU Compute Cluster:

- 8 x Dell Optiplex GX 745 (4 GB MEM, 1.86 Ghz, 200 GB Disk, NVidia 8800 GT GPU)
- 2 x Lenovo C20 (24 GB Mem, 2 x 8 Core Xeon, 200 GB Disk, NVidia 870 GPU)

#### Genie Citrix Cluster:

- 1 x HP Proliant DL360 – 2 x 2.5 Ghz CPU (8 cores), 72 GB, 2 x 1 TB Hard Drive

#### Miscellaneous Storage & Backup:

- 2 x Netapp F240c Cluster Storage Server (2 TB each)
- 3 x Supermicro Storage Servers (14 TB each)
- 1 x Supermicro Backup Server (70 TB)
- 1 x Sun Unified Storage 7210 (12 TB)
- 1 x Dell PowerVault TL2000 Tape Backup (20 TB)
- 1 x HP Tape Backup (150 TB)

#### Division of Engineering Student Services and Advising (<http://www.dessa.fau.edu/dessa>)

The College of Engineering and Computer Science strives to provide a supportive environment that encourages students to interact and connect with one another, explore opportunities and achieve excellence. The Division of Engineering Student Services and Advising (DESSA) is charged with facilitating such academic success by providing assistance in many different areas.

Student Advising: Dr. Lofton Bullard, Director (<http://www.dessa.fau.edu/eng-advising>)

The Department of Engineering Student Advising is a centralized advising facility that provides an environment for student success. The department advises students in seven bachelor degree programs and seven non-degree programs. The seven degree programs are Civil Engineering, Computer Engineering, Computer Science, Electrical Engineering, Geomatics Engineering, Mechanical Engineering, and Ocean Engineering. There is a corresponding non-degree program for each bachelor degree program. The non-degree programs are Pre-Professional programs for students who have not met the minimum entrance requirements for one of the bachelor degree programs. Once those requirements are met the student is admitted into one of the bachelor degree programs. Each advisor specializes in at least two degree programs and is capable of advising all degree programs. All advisors and staff members reside in EE102 which also houses the Department of Engineering Student Services. There is a director, an associate director, four professional advisors, and one receptionist.

DESSA advises students that have earned thirty or more college credit hours. All students must see a college advisor at least once each semester. During the initial visit, the advisor interviews the student to get valuable information about the student's life and academic history. The student is informed about the degree requirements and a plan of study is created. After the initial visit, an advisor evaluates a student's performance and progress in their degree program. The student's plan of study is modified by the advisor if necessary. Students who are identified as at-risk or are having difficulties progressing satisfactory must meet with a college advisor multiple times during the term. During these meetings, strategies are developed that help the student be successful. A plan of study and an estimate of the expected date of graduation are developed and created for each student. The plan of study can be presented on a degree program flowchart, an excel spreadsheet, or a copy of the degree audit. Each student in the college is closely monitored until all degree requirements have been met, and they are ready to graduate.

Course prerequisites are automatically checked during registration. Students who are currently registered for one or more prerequisites for a future course will be given permission to take that course even though the requirements of the prerequisites have not been met. In some departments, advisors check for satisfactory grades and other requirements of the prerequisites; if the prerequisites for a course have not been met, the student is dropped from the course by the advisor. In other departments, the professor is responsible to let students know that they should drop the course if they have not met the prerequisite requirements. Students are also informed about the prerequisite requirements for the courses they wish to register for each semester.

Student Services: Mr. George Edmunds, Director (<http://www.dessa.fau.edu/assistance>)

The mission of Engineering Student Services is to offer a range of programs and services that support academic success and enhance the student experience. The focus is on providing the appropriate assistance to address the student's individual needs. Services include:

- Guidance and Counseling: DESSA staff meets with at-risk students and/or in-crisis students and provides appropriate assistance/referrals to prevent an escalation of the situation. DESSA also facilitates academic petitions and appeals for students seeking late withdrawals, medical withdrawals and for reinstatement into the university.
- Tutoring: DESSA employs high-achieving graduate students that provide free tutoring throughout the week. Students can receive major-specific assistance, as well as tutoring in math and physics. In addition, in partnership with the Department of Mathematical Sciences, DESSA offers a Math Boot Camp once a semester for students struggling with basic trigonometry and pre-calculus concepts. Tutoring includes but is not limited to: Pre-calculus, Calculus I, II and III, Engineering Math I, Physics with Calculus I and II, and engineering program specific courses as required. DESS tries to hire one

tutor that is majoring in Computer Science and Engineering, a second tutor majoring in Electrical Engineering, and a third tutor majoring in either Ocean, Mechanical or Civil Engineering in order to cover all disciplines.

- Learning Communities: Offered to incoming freshmen majoring in engineering; participating students register for the same courses and meet weekly for additional guidance, support and professional development and experiential learning opportunities. This one credit course is taught by DESSA staff in collaboration with the Center for Learning and Student Success and other departments across campus.
- Engineering Student Organizations and Clubs: DESSA staff provides supervision and advising for over (14) engineering professional societies and clubs. Participation in these organizations provides students opportunities for personal growth and professional development in their chosen field of study.
- Student Scholarships: DESSA staff maintains the college's scholarship database and facilitates the process for awarding college based scholarships.
- Recruitment and Orientation: DESSA staff direct and participate in year-round admissions recruitment events, State College Transfer Fairs and Articulation Workshops. During the fall semester, DESSA coordinates a College Open house and facilitates other new student and transfer student orientation events. In addition DESSA provides individual and group tours for prospective students.
- Pre-College Programs: DESSA staff coordinates pre-collegiate programs for potential students to gain exposure to engineering and computer science. These programs include:
  - Summer Engineering Technology Program: A series of week-long camps for high-achieving 7th-9th grade students. Students learn how to think critically in a fun and academically stimulating environment.
  - Engineering Scholars Program: A dual-enrollment program for high achieving 10th-12th grade students in Broward and Palm Beach counties. Enrollment opens in the spring and classes are held over a three-week period in the summer.

DESSA works directly with the University Career Development Center (CDC) to coordinate and provide career advising and guidance services. The CDC provides centralized, comprehensive programs and services to assist students with their career management needs. Professionally trained and nationally certified career counselors work directly with students and focus on providing resources that support the students' employment goals and access to potential employers.

Programs and services include:

- Academic credit Co-op and Internship Programs that enhance academic studies through degree-related work experience. Offered each semester, students can work full or part-time and earn both a salary and academic credit.
- Recruiting Activities that include Career and Technical Job Fairs offered in the fall and spring semesters and Corporate Information Seminars that profile employment opportunities at a specific company and allow students to directly network with employers.
- Professional Workshops and Training that include topics in resume and cover letter writing, interviewing skills, job search techniques, salary negotiation skills, and etiquette.
- Industry Advisory Panels and Forums where students have the opportunity to meet with executive-level business, industry, community and technology leaders and professionals.
- OWL CareerLink - FAU's proprietary centralized job database that provides students access to current full-time, part-time, Co-op and Internship positions and potential employers' access to qualified students.

In addition, the College of Engineering and Computer Science offers Directed Independent Study courses where students under the direction of a faculty member can gain valuable experience in their field through research and computational studies.

Engineering Distance Education courses are also the responsibility of DESSA. Each semester, a variety of graduate and undergraduate courses are offered through distance learning technologies to help meet the needs of students who require more flexibility in their schedule. Course delivery methods include a combination of the following:

- Daily recorded live lecture courses posted online in downloadable video streaming and podcast formats.
- Interactive video courses (Videoconferencing) where live courses are broadcast to remote locations through two-way audio and way video.
- Internet courses (fully or mostly online) which are electronically interactive and use a combination of online resources (chat rooms, threaded discussions, interactive Web pages) to support instruction.

In addition, DESSA coordinates Distance Learning student registration and off-campus examination proctoring services.

Career Development Center (CDC), Sandra Jakubow, Director (<http://fau.edu/cdc/index.php>):

The University Career Development Center is responsible for the Cooperative Education/Internship Program which allows students integrate classroom study with periods of paid, supervised work experience related to their academic majors. Co-op/Internship is offered on a semester basis and can be full-time or part-time. A Co-op/Internship assignment can be multiple times with one employer or different employers for each experience.

The Co-op/Internship is a partnership among the student, the employer, and the Career Development Center. Students may opt to participate in the alternating or parallel program:

- Full-time (Alternating Co-op/Internship): Students alternate semesters of academic study with semesters of full-time, paid Co-op/Internship assignments. Students work full-time for a semester and return to school the following semester to continue their course studies. Students may remain with the same employer during their next Co-op/Internship or accept employment with a new company. Full-time is defined as a minimum of 35 hours per week for 10 consecutive weeks during the summer and 13 consecutive weeks during the fall and spring.
- Part-time (Parallel Co-op/Internship): Students work on a part-time basis while they are enrolled in full-time classes. Part-time is defined as a minimum of 15 hours per week for 10 consecutive weeks during the summer and 13 consecutive weeks during the fall and spring.

Students must have met the following requirements to be eligible for a Co-op/Internship assignment:

- Completed 30 credits of undergraduate coursework or 9 credits of graduate coursework.
- Be enrolled full-time in an undergraduate or graduate degree seeking program and demonstrate progression towards degree.
- Transfer students must complete one semester at FAU.
- FAU cumulative GPA of at least 2.7 undergraduate or 3.0 graduate.
- International students (F-1 status) must have maintained valid F-1 status and full-time enrollment for at least two consecutive semesters prior to the Co-op/Internship start date.
- International students must obtain from International Student and Scholar Services (ISSS) an I-20 and meet all USCIS and/or ISSS requirements.
- Students must apply a semester prior to their participation.
- Students may not currently be a graduate, teaching, or research assistant with their

department.

The Career Development Center will determine eligibility and allow employers access to the database of student résumés. Employers can contact students they are interested in to set up interviews. Students are also encouraged to search for available positions with employers. Students who accept Co-op/Internship employment must enroll in their departmental Co-op/Internship course and must receive department approval if they are seeking elective credit. The Co-op/Internship assignment is recorded on the student's transcript and is graded satisfactory/unsatisfactory.

**Teaching laboratory, research laboratory, and office space:** The Florida Atlantic University Department of Civil, Environmental & Geomatics Engineering has several instructional laboratories and research laboratories occupying 9,231 ft<sup>2</sup> of space. Table 14 lists all laboratories used by environmental engineering students, their location and floor space.

**Table 14. Environmental Engineering Teaching/Research Laboratories**

LABORATORY NAME	ROOM #	Teaching (T), Research (R)	AREA (ft <sup>2</sup> )
Environmental Engineering Process Laboratory	EG-152C	R	303
Environmental Engineering Research Laboratory	EG-154	R	253
Environmental Photochemistry Research Laboratory	EG-153	R	82
Nutrient Analysis Research Laboratory	EG-150	R	79
AutoCAD Laboratory	LY-136	T	1,800
Civil, Environmental & Geomatics Engineering Design Laboratory	LY-451	T	869
Hydrosystems Research Laboratory	EG-229	R	133
Environmental Nanotechnology Laboratory	BS-504	R	662
Environmental Chemistry Teaching Laboratory [Dean's Office]	EG-263	T	1,202
Hydrodynamics Laboratory [Ocean Engineering]	EG-157	T	1,522
<b>Total</b>			<b>6,905</b>

Additional details on the current status of the facilities summarized in Table 14 are described as follows:

**Environmental Engineering Process Laboratory, EG-152C.** This laboratory was recently renovated in 2015 and is the unifying place to achieve departmental goals of educating competent, licensed professional engineers responsible for sustainability of the environment. The major renovation added a walk-in temperature controlled room and a much needed separation from the Materials and Structures lab space in EG152B, which is now closed off with a 10-ft wall and drop ceiling. This space is equipped to allow students to fully experience the state-of-art capabilities of environmental instrumentation and acquire needed knowledge in water purification and mitigating environmental disasters.

**Environmental Engineering Research Lab, EG-154.** The laboratory fosters thesis-based research training to produce the next generation of engineering educators and researchers, a national priority. Its mission is to provide access to scientific and analytical equipment for research and training of civil engineers in the environmental disciplines who are interested in improving the quality of life through sustainability and protection of our environment and natural resources. This means the development of sufficient clean water supplies; the prevention of river, lake, ocean, and groundwater pollution; the maintenance of air quality; the remediation of land and water bodies contaminated with hazardous chemicals; and working with our local industry partners to provide solutions to their technological needs.

**Environmental Photochemistry Research Lab, EG-153.** This lab houses the photocatalytic oxidation chamber and the provisionally-patented photochemical iron-mediated aeration technologies that FAU has pioneered for detoxifying waste. Students can push the boundaries of water and wastewater treatment using advanced oxidation processes.

**Nutrient Analysis Research Lab, EG-150.** This lab is home to FAU's total organic carbon and total nitrogen analyzer and also the solids testing systems. With these facilities, students can explore the nature of nutrient pollution in the environment to better protect our oceans, our coastal zone, our water supplies, and our Everglades.

**AutoCAD Laboratory, LY-136.** Central to engineering education, the AutoCAD Laboratory is constantly upgraded with the latest computer technology, processor speed, and cloud-based sharing of sophisticated 2-D and 3-D design and analysis software for computer-aided design, building information modeling, cost estimation, water resource modeling, and hydraulic simulations with an adjoining printing/plotting area. The AutoCAD lab is temporarily relocated to the Wimberly Library and is in urgent need of a permanent home.

**Civil, Environmental & Geomatics Engineering Design Laboratory, LY-451.** This lab features a private student team planning/meeting space designed to foster students' presentations and team collaboration. There is a state-of-the-art wireless overhead high-definition projection system with projection screen and an automatic high-definition tracking camera to allow students to record presentations. This space was temporarily located to the Wimberly Library SEFLIN Room and is in urgent need of permanent home to meet the demands of our senior design students.

**Hydrosystems Lab, EG-229.** This lab supports simulation and modeling capabilities essential for hydrological, climate variability and climate change studies. It houses several stand-alone machines along with different computational environments accessing cluster computing resources with large RAM and specialized servers. A number of hydrological modeling software, GIS, and several others dealing with hydro-meteorology (precipitation data processing, infilling, radar-based precipitation analysis) software developed at FAU are also available on several computational platforms. A variety of software dealing with optimization and artificial neural networks, data mining and statistical analysis are also available. Computationally intense tasks that handle large data sets in space and time and processing capabilities to handle geospatial analysis and geostatistics are also available for hydrologic simulation and water resources management studies.

**Environmental Nanotechnology Laboratory, BS-504.** Established in 2015, this lab is equipped for investigating environmental nanotechnology and its interactions with environmental chemistry, with research instruments such as dynamic light scattering, zeta potential analyzer, quartz crystal microbalance, UV-vis spectrometer, and gas chromatograph. The research conducted in the lab focuses on interactions of nanoparticles with environmental and biological surfaces and application of nanotechnology in water treatment, environmental remediation, and renewable energy.

**Environmental Chemistry Laboratory, EG-263.** In 2010, the College of Engineering and Computer Science funded construction of the Environmental Chemistry Laboratory in a space previously serving mechanical engineering graduate students. The laboratory contains a teaching station computer with SmartBoard technology that projects to two plasma TV screens. Directly across is an L-shaped teaching assistant prep area equipped with laboratory dishwasher, distilled water machine, dual sinks, goggle sterilizing cabinet, dry stock storage, lab refrigerator/freezer, and eyewash/safety shower station. Across the entrance is a flammable cabinet next to the spill kit containment area, a standing 20°C BOD incubator, and storage cabinet. There is 6-ft fume hood with explosion-proof flammables and corrosives storage underneath. The hood is equipped with water supply. There are four stainless steel sinks and five rows of bench stations for students. Along the back wall is where the incubators, drying oven, biosafety cabinet, autoclave sterilizer are located. The current laboratory is adequate for current and projected instructional and undergraduate teaching/research needs for the near future. Previous needs with respect to additional rapid response pH meters, optical dissolved oxygen probes, and an additional spectrophotometer were addressed in 2014.

**Hydrodynamics Laboratory, EG-157.** The Hydrodynamics Laboratory supports the needs of the Department of Civil, Environmental and Geomatics Engineering and the Department of Ocean and Mechanical Engineering. The laboratory is located in EG157 and occupies approximately 1522 ft<sup>2</sup>. There is a single door exit and a rolling shutter exit to the outside of the building and double door exit to the inside of the building. There is a sink in the room. There is also a 30-ft × 17-ft loft at the second floor level with access through a spiral staircase. The room has 24-ft of counter space (on top of cabinets and drawers). The laboratory is equipped with two 3-ft × 6-ft storage cabinets. There is access from the laboratory to the wind tunnel housed at the back of the room. The lab houses a state-of-the-art hydraulic bench, wave tank, open channel flow apparatus, wind tunnel, and fluid mechanics experiments. The laboratory space and equipment are barely adequate for current instructional needs. The fluid hydraulics bench demonstration unit was replaced in 2014, which was the most needed item to properly deliver the student outcomes in the CWR 3201C Applied Hydraulics course. The following additions to the laboratory would enhance student learning of basic concepts in the near term:

- Flow Over Weir/Notch Apparatus
- Head Loss Measurement of Pipe System
- Pipe Friction Test
- Reynolds Number Experiment Apparatus
- Pelton Turbine Model
- Validation Model of Bernoulli Equation

Office space for each faculty member is currently provided (133 – 162 ft<sup>2</sup>). Office space for the two new faculty members and the lab technician will be requested.

**N. Describe additional classroom, teaching laboratory, research laboratory, office, and other space needed to implement and/or maintain the proposed program through Year 5. Include any projected Instruction and Research (I&R) costs of additional space in Table 2 in Appendix A. Do not include costs for new construction because that information should be provided in response to X (E) below.**

ABET accreditation requires two major laboratory experiences in different media types (e.g. water, air, or soil). Our current water laboratories are excellent (built 2011 and continuously updated), but we currently lack the air quality laboratory; therefore, one additional teaching laboratory (air quality lab) and additional office space (2 assistant professors in environmental engineering with interest in air quality and water/wastewater processes) are requested to effectively deliver the curricular needs based on ABET requirements. We are also including a request for a laboratory technician to support the ABET

accreditation requirements for two major laboratory experiences in different media types (e.g. **water, air,** or soil).

In addition to the space needs, additional laboratory stations for class experiments involving solids filtration, water and wastewater treatment principles, greenhouse effect, mass balance/dilutions, and subsurface contamination will be needed as enrollment grows. Specifically for the air quality lab, there will be a need for organic and inorganic contaminant characterization, involving a GC/MS (gas chromatography/mass spectrometry) instrument station for organic contaminants in air, water, and soil; an ICP/MS (inductively coupled plasma/mass spectrometry) instrument for trace metals contaminants in air, water, and soil matrices; a meteorological station; clean room; air sampling equipment, gas monitoring equipment, handheld FID/PID, electronic nose, mercury meter, air velocity monitor, calibration gases, air quality meters for particle measurement, ammonia, hydrogen sulfide, carbon monoxide, carbon dioxide, methane, VOCs, etc. Some of this equipment is already existing in the Environmental Health and Safety office. It may be possible to work out an arrangement in the early years in which we can share some equipment. Additional lab needs would be determined by the new faculty member. It is anticipated that some of this equipment will be procured with new faculty startup funds. The program is a priority for the College. Funding will be reallocated to match the university/College priorities, particularly since these are strongly tied to the University's pillars and platforms strategic plan for the race to excellence, particularly in *Ocean Science and Engineering / Environmental Sciences* but also in *Sensors and Smart Systems*.

- O. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Table 2 in Appendix A includes only Instruction and Research (I&R) costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs in particular would necessitate increased costs in non-I&R activities.**

No new capital expenditure is anticipated. Additional resources, described in Table 4, are needed to support program faculty (and startup funds and office setup funds), staff, travel, office equipment and supplies, promotional and advertising efforts, and specialized laboratory and instructional equipment and software. Office space for 2 new faculty specializing in air pollution and the other in water/wastewater processes/remediation plus the technician are requested. ABET requires two major instructional teaching lab experiences to "conduct experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., water, air). Therefore, a space will be assigned by the College for the air quality lab, and funds are included in the budget to acquire equipment for the lab. As enrollment increases in the year prior to applying for accreditation, it is likely that the program will need a dedicated advisor in the college of Engineering and Computer Science centralized advising office.

- P. Describe specialized equipment that is currently available to implement the proposed program through Year 5. Focus primarily on instructional and research requirements.**

Existing College staff and resources will provide strong support for the Environmental Engineering Bachelor's degree program. This support includes:

- Computer technician services through the Technical Services Group (TSG)
- Promotional and advertising support through the College Development
- Assistance with Development and Fundraising activities
- Assistance from the Division of Engineering Student Services and Advising with student recruitment and retention, student counseling and petitions, scholarships, and program K-14



outreach activities

- Assistance from the Division of Engineering Student Services and Advising with career development, undergraduate research opportunities, business and industry relations, co-op and internship activities, and placement upon graduation
- Financial management and accounting services
- Other academic, research, personnel, and community outreach services

Financial support will come from a variety of sources, including:

- Florida Atlantic University. The Office of the Provost has committed the continuing funding required for faculty and staff salaries and benefits and for some operational expenses.
- College Carry-Forward Monies. The College has Carry-Forward monies that will be used for purchase of instructional equipment and other appropriate program needs.
- Donations from Business and Industry. The Environmental Engineering program is generating unprecedented offers of help and financial support.
- Private Contributions. Once the program has been approved, an extensive program of development and fundraising for support of the program will be implemented. Some private contributions for program support are already in the works.
- Contributions in Kind. There are endless opportunities for business and industry to support the program through in-kind contributions. Possibilities include use of equipment and/or facilities; provision of speakers and student mentors; contribution of design problems; provision of summer employment and consulting opportunities for faculty; internships, part-time employment, and scholarships for students; etc.

The following tables (Table 15, Table 16, and Table 17) include lists of equipment available to deliver the student outcomes of the proposed environmental engineering degree program.

**Table 15. Environmental Engineering Laboratory Existing Equipment**

<b>Equipment</b>	<b>Quantity</b>
Bench space, total	40 ft <sup>2</sup>
Glassware cabinets	3
Fume hoods, 4 ft × 3.2 ft	3
Custom Bioassay System	1
Biosafety Cabinet, Labconco Purifier Delta Class II, Type A2	1
Chemical Oxygen Demand Heating Block	2
Chromatographic Ion analyzer, Waters	1
Compact Autoclave Sterilizer, NAPCO Model 9000D	1
Composite Sampler, Masterflex E/S	1
Digital Incubator, VWR Model 1525	2
Digital Incubator, VWR Model 1545	1
Digital Mass Balances	2
DR5000 Digital UV-Vis Spectrophotometer	1
Drying Oven, VWR Model 135FM Horizontal Air-Flow	1
Drying Oven, Cole Parmer	1
Filtration Apparatus (vacuum pump, filter holders, manifold)	1
Fluorometer, Ocean Optics	1
High Performance Liquid Chromatography Unit (Waters Breeze System)	1
IDEXX Colilert and Enterolert Quantitation System	1
Ion Specific Probes (nitrate, ammonia, sodium, fluoride)	4
Ion Specific Meters	2
Jar Testing System	1
Koch Membrane Demofilter Unit	1
Large Scale Autoclave Sterilizer	1
Landtec GEM5000+ Air Analyzer	1
Muffle Furnace, Barnstead Type 1400	1
Photoreactor (safety cabinet, microscale reactor, pilot unit; 5-,15-,550-W lamps)	1
Falling Film Pilot Plant Photocatalytic Reactor	1
Portable Turbidity Meters	2
Refrigerated Centrifuge	1
Refrigerator/Freezer	4
Research Vessel, "Minnow", 9.4 ft WaterTender	1
Reverse Osmosis pilot plant	1
Total Organic Carbon Analyzer (Teledyne Tekmar, Apollo unit, with Total Nitrogen, Soil Sampler)	1
Water Purification (Barnstead Diamond UV system, replacement cartridges)	1
Portable Weather Station	3
VWR Circulating Chiller	1
VWR Circulating Water Bath	1
Membrane Skid for RO applications	1
YSI 556 MPS Portable Meter	2
YSI 9000 Photometer	1

**Table 16. Engineering Chemistry Laboratory Existing Equipment**

<b>Equipment</b>	<b>Quantity</b>
Compound microscope with camera attachment	1
BOD Incubator	2
Autoclave Sterilizer	1
Glassware cabinets	3
Fume hood, 6 ft × 3.2 ft	1
Magnetic Stirrer/Hotplate	6
Microbalances	3
DR4000 UV/Vis Spectrophotometer	1
Laboratory Refrigerator/Freezer	1
Distilled Water Machine	1
Ultrasonic Cleaner	1
Gas Law Apparatus Kit	6
BOD Intellical Probe and meter	3
Carbon dioxide vent probe kit	2
Digital barometer	1
Meter docking station	5
pH probe for HqD meter	2
pH probe for sension2	2
Portable spec meter	1
Molecular model kits	10
sensION2 pH/ISE meter	1
Variable pipetters	18
Turbidometer	2
Dessicator cabinets	2
Biosafety Cabinet, Labconco Purifier Delta Class II, Type A2	1
High capacity drying oven	1
High capacity incubator	1
Filtration Apparatus (vacuum pump, filter holders, manifold)	1
Hach Sension3 pH meters	5
Hach Digital Titrator Field Kits	5
Milton Roy Spectronic 601	1
Spectronic 20, Bausch & Lomb	1
YSI 5010 BOD Probe	1
YSI 5100 DO Meter	5
Vortex Mixers	3
UV Viewing Cabinets	3

**Table 17. Hydrodynamics Laboratory Existing Equipment**

Equipment	Quantity
Wind Tunnel (Aerolab 28"x 40") open circuit low-turbulence wind tunnel	1
Falling Ball Viscometers	5
Fluid Circuit System (for pipe flow experiments) to be replaced in fall 2014 by a Computer Controlled Fluid Friction in Pipes Unit with Hydraulics Bench with SCADA	1
Scaled Model for Spillway	1
Inclined Manometer	1
Pitot tube	2
U-tube Manometer	1
Large Wave Tank	1
Small Wave Tank	1
Sting Balance (for wind tunnel)	1
Hydrometers	4
Orifice Meter (fluid circuit system)	1
Venturi Meter (fluid circuit system)	1
PIV system (for 3D Stereoscopic particle velocity measurements)	1
Equipment for fluid property measurements	Several
Weighing Scales	5
<b>Software</b>	
HEC-HMS from USACE	30 computers
HEC-RAS from USACE	30 computers
EPANET from EPA	30 computers

The list of courses in the program served by the environmental engineering laboratories described above is summarized in Table 18.

**Table 18. Summary of Courses Served by Environmental Engineering Laboratories**

Laboratory	Room Number	Courses Using Laboratory
Environmental Engineering Process Laboratory	EG-152C	<ul style="list-style-type: none"> <li>• ENV 4514: 2 classes/yr</li> <li>• EGN 2213: 2 classes/yr</li> <li>• ENV 4341: 1 class/yr</li> <li>• ENV 4053: 1 class/yr</li> <li>• ENV 4702: 1 class/yr</li> <li>• Occasional use by other classes</li> </ul>
Environmental Engineering Research Laboratory	EG-154	<ul style="list-style-type: none"> <li>• ENV3001C: 3 classes/yr</li> <li>• ENV 4053: 1 class/yr</li> <li>• ENV 4702: 1 class/yr</li> </ul>
Environmental Photochemistry Research Laboratory	EG-153	<ul style="list-style-type: none"> <li>• ENV3001C: 3 classes/yr</li> <li>• ENV 4341: 1 class/yr</li> <li>• ENV 4053: 1 class/yr</li> <li>• ENV 4702: 1 class/yr</li> <li>• ENV 4514: 2 classes/yr</li> </ul>
Nutrient Analysis Research Laboratory	EG-150	<ul style="list-style-type: none"> <li>• ENV3001C: 3 classes/yr</li> <li>• ENV 4053: 1 class/yr</li> <li>• ENV 4702: 1 class/yr</li> <li>• ENV 4514: 2 classes/yr</li> </ul>

Laboratory	Room Number	Courses Using Laboratory
AutoCAD Laboratory	LY-136	<ul style="list-style-type: none"> <li>• CGN 2327: 3 classes/yr</li> <li>• EGN 2213: 2 classes/yr</li> <li>• CGN 4803C: 2 classes/yr</li> <li>• CGN 4804C: 2 classes/yr</li> <li>• Occasional use by other classes</li> </ul>
Civil, Environmental & Geomatics Engineering Design Laboratory	LY-451	<ul style="list-style-type: none"> <li>• ENV 3001C: 3 classes/yr</li> <li>• CGN 4803C: 2 classes/yr</li> <li>• CGN 4804C: 2 classes/yr</li> <li>• Occasional use by other classes</li> </ul>
Hydrosystems Research Laboratory	EG-229	<ul style="list-style-type: none"> <li>• CWR 4202: 2 classes/yr</li> </ul>
Environmental Nanotechnology Laboratory	BS-504	<ul style="list-style-type: none"> <li>• ENV 4053: 1 class/yr</li> <li>• ENV 4702: 1 class/yr</li> <li>• ENV 4514: 2 classes/yr</li> </ul>
Environmental Chemistry Teaching Laboratory [Dean's Office]	EG-263	<ul style="list-style-type: none"> <li>• ENV 3001C: 3 classes/yr</li> <li>• EGN 2095L: 3 classes/yr</li> </ul>
Hydrodynamics Laboratory [Ocean Engineering]	EG-157	<ul style="list-style-type: none"> <li>• CWR 3201C: 2 classes/yr</li> </ul>

**Q. Describe additional specialized equipment that will be needed to implement and/or sustain the proposed program through Year 5. Include projected costs of additional equipment in Table 2 in Appendix A.**

In terms of additional specialized equipment needed to sustain the program during its growth in the first five years, the main component will involve expanding existing capabilities up to 8 teaching stations for class experiments involving solids filtration, water and wastewater treatment principles, greenhouse effect, mass balance/dilutions, and subsurface contamination as well as creating a new air pollution laboratory. The air pollution lab will need to have instruments for organic and inorganic contaminant characterization, a GC/MS (gas chromatography/mass spectrometry) instrument station for organic contaminants in water and air and soil, an ICP/MS (inductively coupled plasma/mass spectrometry) instrument for trace metals contaminants in water, air, and soil matrices, a meteorological station; clean room; air sampling equipment, gas monitoring equipment, handheld FID/PID, electronic nose, mercury meter, air velocity monitor, calibration gases, air quality meters for particle measurement, ammonia, hydrogen sulfide, carbon monoxide, carbon dioxide, methane, VOCs, etc. A major renovation in 2014-2015 involving EG152C, EG150, EG153, and EG154 added a walk-in temperature controlled room, expanded nutrient analysis facilities, and a much needed separation from the Materials and Structures lab space for EG152C, which was closed off with a 10-ft wall and drop ceiling.

The AutoCAD Laboratory has shared needs with other programs for additional licenses for critical drafting software, along with a mechanism to include the Revit suite for 3-D drafting and building information modeling. The lab space in LY-136 is temporary, and a permanent space will be allocated by the College in coordination with the Office of the Provost. Similarly, the CECE Design Laboratory (LY451-SEFLIN Room) is adequate for current instructional needs. However, as the student enrollment is growing, we will need additional laboratory space and computer workstations as well as securing a permanent location.

The current Hydrosystems Research Laboratory is adequate for current instructional and undergraduate research needs. However, only two workstations can fit in the space, so as demand dictates, more space and additional workstations and software licenses may need to be obtained.

The Engineering Chemistry Laboratory is adequate for current instructional and undergraduate research needs. Previous needs with respect to additional rapid response pH meters, optical dissolved oxygen probes, and an additional spectrophotometer were already addressed in 2014.

The shared Hydrodynamics Laboratory space and equipment are barely adequate for current instructional needs. The fluid hydraulics bench demonstration unit was replaced in 2014, which was the most needed item to properly deliver the student outcomes in the CWR 3201C Applied Hydraulics course. The following additions to the laboratory would enhance student learning of basic concepts:

- Flow Over Weir/Notch Apparatus
- Head Loss Measurement of Pipe System
- Pipe Friction Test
- Reynolds Number Experiment Apparatus
- Pelton Turbine Model
- Validation Model of Bernoulli Equation

The Environmental Nanotechnology Laboratory is currently being stocked in part with Dr. Yi's startup funds.

To cope with rapid growth in enrollment, a coordinated plan is necessary for meeting the future laboratory needs of the environmental engineering program. A dedicated line of funding for equipment is very unlikely in the near future, considering the recent overall budget deficiencies in the College of Engineering and Computer Science and University levels. In the past, the College has been able to set aside varying amounts for equipment purchase and minor renovations for civil engineering laboratories based on prioritized lists of absolutely essential items. However, it is difficult to plan for equipment acquisitions when available funds range from very little to several tens of thousands of dollars and may appear on short notice. The faculty and industry council have identified resource development as a top priority in all of their recently held bi-annual meetings. Plans are in motion spearheaded by the DAC and Department leadership team (\$450K campaign) to solicit laboratory naming sponsorships to assist with equipment acquisition and repair budgets. We expect to develop a cohesive resource development plan that, among other considerations, will include a mechanism for expanding and maintaining our laboratory facilities and equipment in a logical, prioritized manner.

**R. Describe any additional special categories of resources needed to implement the program through Year 5 (access to proprietary research facilities, specialized services, extended travel, etc.). Include projected costs of special resources in Table 2 in Appendix A.**

No other additional special categories of resources are anticipated at this time.

**S. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5. Include the projected costs in Table 2 in Appendix A.**

The Division of Engineering Student Services and Advising provides students will up-to-date information and assistance with any scholarships available and for which they are eligible. The College has started a policy to award recurring scholarships twice per year, so that deadlines and awards can be coordinated with the start of the semester activities and awards can be celebrated at key events such as Engineer's Week, for example. The Florida Water Environment Association (FWEA) scholarship is given annually to

students interested in the environmental engineering field and is typically awarded at the level of \$1000 – \$2000. Business and industry have expressed strong interest in supporting the Environmental Engineering program through scholarships, but final arrangements must await program approval. Environmental Engineering is an undergraduate program, so graduate assistantships and fellowships are not applicable; however, there is a water resources/environmental engineering track in the Masters of Science Degree in Civil Engineering, and research and teaching assistantships are readily available for those students who wish to continue their studies.

Currently available scholarships for students are the following:

- Andrew Montano Scholarship (2) \$1,000 - Open to an incoming freshman, sophomore, junior or senior with a minimum GPA of 3.0, that possesses unmet financial need (completion of FAFSA is required) and is a mechanical engineering major.
- Eric Alexander Engineering and Computer Science Scholarship (2) \$1000 - Awards are available to undergraduate engineering or computer science students who have a minimum 3.0 GPA and who have completed more than 30 credit hours. Preference will be given to students from the Treasure Coast area (Martin and St. Lucie Counties). This scholarship may be renewed for up to four consecutive years if 3.0 GPA is maintained. Pre-engineering students are not eligible for this award.
- Keith and Schnars, P.A. Scholarship Endowment \$900 - Award available to a junior or senior Civil or Geomatics engineering student with a minimum 2.5 GPA who has potential to be a leader in Civil or Geomatics engineering. Recipient must be a U.S. citizen or a local South Florida resident.
- Tyco International Innovation Leadership Endowed Scholarship \$1,000 - Open to an undergraduate engineering or computer science student, who is a U.S. citizen or permanent resident, participating in the Innovation Leadership Honors Program with a minimum GPA of 3.0. Preference will be given to students who are designated as being in an underrepresented segment of the U.S. population in the field of engineering.
- Florida Water Environment Association Scholarship \$1000 - Award available to a full-time civil engineering student with more than 60 credits who demonstrates an interest in water resources, water, and wastewater treatment and related fields. Applicants must have a minimum 3.2 GPA, merit and potential for contribution to the field & profession, and be a member of the Florida Water Environment Association.
- LoBello Innovation Leadership Endowed Scholarship (2) \$1,000 - Awards available to junior or senior engineering or computer science students, who are U.S. Citizens, participating in the Innovation Leadership Honors Program with a minimum GPA of 3.0. Preference will be given to female students in an effort to address the issue of under-representation of women in engineering. This scholarship may be renewed if funding is available.
- Karl K. Stevens Student Scholarship \$1000 - Award available to all junior or senior engineering or computer science students who have displayed leadership while in college.

Our existing faculty is very active in research. A summary of extramural funding over the last 5 years is listed as follows:

PI	Grant Title	Sponsor	Project Period	Award Amount
Bloetscher	Davie Stormwater Research Program	Town of Davie	2014-2015	\$86,988
Bloetscher	West Palm Beach Stormwater Master Plan	Chen Moore & Associates	2014-2016	\$30,207
Meeroff	Onsite Treatment of Leachate Using Energized Processes	Hinkley Center for Solid and Hazardous Waste Management	2011-2013	\$40,000

PI	Grant Title	Sponsor	Project Period	Award Amount
Meeroff	Sustainable Management of Pollutants Underneath Landfills	Hinkley Center for Solid and Hazardous Waste Management	2012-2014	\$40,000
Meeroff	Critical Examination of Leachate Collection System Clogging at SWA Disposal Facilities	Solid Waste Authority of Palm Beach County	2012-2014	\$50,000
Meeroff	Year Two Critical Examination of Leachate Collection System Clogging at SWA Disposal Facilities	Solid Waste Authority of Palm Beach County	2013-2014	\$50,000
Meeroff	Safe Discharge of Landfill Leachate to the Environment	Hinkley Center for Solid and Hazardous Waste Management	2013-2014	\$51,780
Meeroff	Assessing Options for On-Site Leachate and Groundwater Management Strategies at Florida Landfills	University of Florida	2013-2014	\$4,836
Meeroff	Safe Discharge of Landfill Leachate to the Environment, Year Two	Hinkley Center for Solid and Hazardous Waste Management	2014-2015	\$53,752
Meeroff	Year 3: Continuation of Critical Examination of Leachate Collection System Clogging at SWA Disposal Facilities	Solid Waste Authority of Palm Beach County	2013-2015	\$19,749
Teegavarapu	In-Filling Missing Daily Rain Gauge Data Using Radar Rainfall Data: Influence of Homogenous Rain Areas	University of Florida	2011-2016	\$15,000
Teegavarapu	Development and Evaluation of Indices for Bias Assessment of Radar-Based Rainfall in South Florida Water Management District	South Florida Water Management District	2012-2012	\$38,000
Teegavarapu	Development and Evaluation of Data Accuracy Assessment Algorithms for Identifying Anomalies in Hydro-Meteorological Data (Phase 1: Stage)	South Florida Water Management District	2013-2013	\$39,000
Teegavarapu	Integrating Virtual 3D Lab Modules for Flood Modeling Studies in Civil Engineering Curriculum: An Inter-University Implementation & Assessment	Purdue University	2013-2015	\$12,998
Teegavarapu	NSF Research Experience for Graduates & Post-Doctoral Scholars: Support to Attend & Participate in Weather Radar & Hydrology (WRaH) Conference in 2014	National Science Foundation	2013-2014	\$19,900
Teegavarapu	Evaluation & Development of Data Accuracy Assessment Algorithms for Identifying Anomalies in Hydro-Meteorological Data (Phase II: Stage)	South Florida Water Management District	2014-2014	\$48,000
Teegavarapu	Data Quality Improvement for NEXRAD and Stage Data	South Florida Water Management District	2014-2015	\$42,500
Teegavarapu	Evaluation of Data Accuracy Assessment Algorithms for Identifying Anomalies Stage Data	University of Florida	2014-2014	\$16,000
TOTAL	18 Projects	8 Sponsors	2011-2015	\$658,710

Grant funding has supported 2-6 graduate teaching assistants in the environmental track option of the Masters of Science with major in Civil Engineering over the past 5 years. Some graduate students are supported by 10 hours from the Dean's Teaching Assistantship program. In Appendix A-Table 2, we anticipate 2 teaching assistants to be supported by grant funding and an additional 2 to be supported by the provost fellowship.

**T. Describe currently available sites for internship and practicum experiences, if appropriate to the program. Describe plans to seek additional sites in Years 1 through 5.**

The College of Engineering and Computer Science strongly advocates professional work experience for all of its students prior to graduation. Many students in the College accomplish this by working part time or full time during their studies. Others accomplish this goal by co-op education activities or internships, many of which are made through the College's extensive database of over 500 companies that offer internship/co-op opportunities and regularly hire FAU graduates. The Division of Engineering Student



Services assists students in identifying internships and co-op opportunities and works closely with the FAU Career Development Center. An existing course (CGN3949 – CEGE Co-op – 1 credit) is available for this purpose. Innovation Leadership Honors Program students are required to perform a research-based directed independent study or co-op experience.

Starting with the current Department Advisory Council for the Department of Civil, Environmental & Geomatics Engineering, members with ties to the environmental engineering field will be approached to identify opportunities within their firms and sphere of influence. After year one, a program-specific industry advisory council will be formed and will have one of its three standing subcommittees to focus on developing internships/co-op opportunities. A tracking system will be put in place to monitor success and student outcomes for continuous improvement purposes, and the program will be assessed annually.

## REFERENCES

- Yoder, B. "Engineering by the Numbers." American Society for Engineering Education (ASEE), 2014. pp. 40–41. [http://www.asee.org/papers-and-publications/publications/14\\_11-47.pdf](http://www.asee.org/papers-and-publications/publications/14_11-47.pdf)
- Hanover Research (2015). Market Analysis-Environmental Engineering, Prepared for FAU, October 2015.
- "IPEDS Data Center." National Center for Education Statistics. 2014. <http://nces.ed.gov/ipeds/datacenter/Default.aspx>
- [http://www.asee.org/papers-and-publications/publications/14\\_11-47.pdf](http://www.asee.org/papers-and-publications/publications/14_11-47.pdf) (pg. 12)
- "Fall Student Enrollment in State University System Institutions." State University System of Florida Board of Governors, 2015. [http://www.flbog.edu/resources/iud/enrollment\\_results.php](http://www.flbog.edu/resources/iud/enrollment_results.php)
- "Occupational Outlook Handbook." Bureau of Labor Statistics (BLS). <http://www.bls.gov/ooh/about/occupational-information-included-in-the-ooh.htm>
- "Table 1.7: Occupational Employment and Job Openings Data, with Worker Characteristics." Bureau of Labor Statistics (BLS). p. 7. [http://www.bls.gov/emp/ep\\_table\\_102.htm](http://www.bls.gov/emp/ep_table_102.htm)
- Brueck, T. et al. "Water Sector Workforce Sustainability Initiative." Water Research Foundation, 2010. p. xv. <http://www.waterrf.org/publicreportlibrary/4206.pdf>
- "AWWA State of the Water Industry Report." American Water Works Association (AWWA), 2014. pp. 23–24. <https://www.aspe.org/sites/default/files/webfm/pdfs/AWWASotWIRReport2014.pdf>
- "Employment Projections." Florida Department of Economic Opportunity (FDEO). <http://www.floridajobs.org/labor-market-information/data-center/statistical-programs/employment-projections>
- "Occupational Employment Statistics." Bureau of Labor Statistics (BLS). <http://data.bls.gov/oes/datatype.do>
- "Environmental Engineer Job Postings in 100-Mile Radius of Boca Raton." Indeed.com, September 28, 2015. <http://www.indeed.com/jobs?q=environmental+engineer&l=Boca+Raton%2C+FL&radius=100&jt=fulltime&limit=100&sr=directhire&start=100>
- "Table 1.11: Educational Attainment for Workers 25 Years and Older by Detailed Occupation." Bureau of Labor Statistics (BLS). p. 11. [http://www.bls.gov/emp/ep\\_table\\_111.htm](http://www.bls.gov/emp/ep_table_111.htm)
- "Fall 2014 Fact Book." Office of Planning, Institutional Research, and Assessment, University of Miami, 2015. p. 36. <https://umshare.miami.edu/web/wda/planningresearch/FBFA2014.pdf>
- Jaquelina C. Falkenheim (jfalkenh@nsf.gov; 703-292-7798) and Joan S. Burrelli (retired), Science and Engineering Indicators Program, National Center for Science and Engineering Statistics, National Science Foundation, 4201 Wilson Boulevard, Suite 965, Arlington, VA 22230. Source: National Science Foundation/National Center for Science and Engineering Statistics, Scientists and Engineers Statistical Data System (SESTAT): 2008.

**APPENDIX A - NEW DEGREE PROPOSAL WORKSHEETS**

**TABLE 1-A (DRAFT)  
PROJECTED HEADCOUNT FROM POTENTIAL SOURCES  
(Baccalaureate Degree Program)**

Source of Students (Non-duplicated headcount in any given year)*	Year 1		Year 2		Year 3		Year 4		Year 5	
	HC	FTE	HC	FTE	HC	FTE	HC	FTE	HC	FTE
Upper-level students who are transferring from other majors within the university**	7	4	6	4	5	3	4	2	3	2
Students who initially entered the university as FTIC students and who are progressing from the lower to the upper level***	6	4	12	7	16	10	20	12	24	15
Florida community college transfers to the upper level***	10	6	14	9	21	13	30	18	38	23
Transfers to the upper level from other Florida colleges and universities***	2	1	5	3	8	5	10	6	12	7
Transfers from out of state colleges and universities***	0	0	2	1	5	3	7	4	10	6
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
<b>Totals</b>	<b>25</b>	<b>15</b>	<b>39</b>	<b>24</b>	<b>55</b>	<b>34</b>	<b>71</b>	<b>42</b>	<b>87</b>	<b>53</b>

\* List projected annual headcount of students enrolled in the degree program. List projected yearly cumulative ENROLLMENTS instead of admissions.

\*\* If numbers appear in this category, they should go DOWN in later years.

\*\*\* Do not include individuals counted in any PRIOR CATEGORY in a given COLUMN.

Note: Figures are based on estimates from similar start up programs in the United States, percentage of part-time students and transfers in engineering fields at FAU, and estimates of demand.

**TABLE 2 (DRAFT)  
PROJECTED COSTS AND FUNDING SOURCES**

Instruction & Research Costs (non-cumulative)	Year 1							Year 5					
	Funding Source						Subtotal E&G, Auxiliary, and C&G	Funding Source					Subtotal E&G, Auxiliary, and C&G
	Reallocated Base* (E&G)	Enrollment Growth (E&G)	Other New Recurring (E&G)	New Non-Recurring (E&G)	Contracts & Grants (C&G)	Auxiliary Funds		Continuing Base** (E&G)	New Enrollment Growth (E&G)	Other*** (E&G)	Contracts & Grants (C&G)	Auxiliary Funds	
Faculty Salaries and Benefits	174,375	0	0	0	0	0	\$174,375	307,750	0	0	0	0	\$307,750
A & P Salaries and Benefits	0	0	60,858	0	0	0	\$60,858	70,551	0	0	0	0	\$70,551
USPS Salaries and Benefits	0	0	0	0	0	0	\$0	0	0	0	0	0	\$0
Other Personal Services	0	0	0	0	0	0	\$0	0	0	0	0	0	\$0
Assistantships & Fellowships	0	0	34,000	0	34,000	0	\$68,000	39,415	0	0	59,123	0	\$98,538
Library	0	0	0	0	0	0	\$0	0	0	0	0	0	\$0
Expenses	0	0	46,700	0	0	0	\$46,700	54,138	0	0	0	0	\$54,138
Operating Capital Outlay	0	0	0	96,000	0	0	\$96,000	0	0	0	0	0	\$0
Special Categories	0	0	0	0	0	0	\$0	0	0	0	0	0	\$0
<b>Total Costs</b>	<b>\$174,375</b>	<b>\$0</b>	<b>\$141,558</b>	<b>\$96,000</b>	<b>\$34,000</b>	<b>\$0</b>	<b>\$445,932</b>	<b>\$471,854</b>	<b>\$0</b>	<b>\$0</b>	<b>\$59,123</b>	<b>\$0</b>	<b>\$530,977</b>

\*Identify reallocation sources in Table 3.

\*\*Includes recurring E&G funded costs ("reallocated base," "enrollment growth," and "other new recurring") from Years 1-4 that continue into Year 5.

\*\*\*Identify if non-recurring.

**Faculty and Staff Summary**

Total Positions	Year 1	Year 5
Faculty (person-years)	1.16	2.40
A & P (FTE)	1	1
USPS (FTE)	0	0

**Calculated Cost per Student FTE**

	Year 1	Year 5
Total E&G Funding	\$411,932	\$471,854
Annual Student FTE	15	53
E&G Cost per FTE	\$27,462	\$8,903

**Justification:**

Year one includes 0.75 base salary plus fringe (31%) for affiliated faculty members (Bloetscher, Meeroff, Scarlatos, Teegavarapu, and Yi). A&P includes a laboratory technician position, and assistantships/fellowships are to support two graduate student teaching assistants with an additional 2 from C&G funds in year one and 3 by year 5. Expenses include allocations for software, computers/printers, travel, maintenance, calibration, recruiting, and information technology supplies. New non-recurring funds are requested for initial laboratory needs for air quality lab equipment. Year five reflects a 0.75 base salary plus fringe for affiliated faculty members with 3% per year incremental salary increases. More details are found in INSTITUTIONAL AND STATE LEVEL ACCOUNTABILITY Section 2.A

**TABLE 3 (DRAFT)  
ANTICIPATED REALLOCATION OF EDUCATION & GENERAL FUNDS\***

<b>Program and/or E&amp;G account from which current funds will be reallocated during Year 1</b>	<b>Base before reallocation</b>	<b>Amount to be reallocated</b>	<b>Base after reallocation</b>
B65000 Civil, Environmental & Geomatics Engineering	610,130	174,375	\$435,755
<b>Totals</b>	\$610,130	\$174,375	\$435,755

**\* If not reallocating funds, please submit a zeroed Table 3**

**TABLE 4 (DRAFT)  
ANTICIPATED FACULTY PARTICIPATION**

Faculty Code	Faculty Name or "New Hire" Highest Degree Held Academic Discipline or Specialty	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prg. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prg. Year 5	PY Year 5
A	Daniel Meeroff, Ph.D., E.I. Civil/Env. Engineering	Professor	T FT	Fall 2016	9	0.75	0.35	0.26	9	0.75	0.50	0.38
A	Fred Bloetscher, Ph.D., P.E. Civil/Env. Engineering	Associate Professor	T FT	Fall 2016	9	0.75	0.35	0.26	9	0.75	0.35	0.26
A	P.D. Scarlatos, Ph.D. Civil/Water Resources Eng.	Professor	T FT	Fall 2016	9	0.75	0.25	0.19	9	0.75	0.25	0.19
A	R. Teegavarapu, Ph.D. Civil/Water Resources Eng.	Associate Professor	T FT	Fall 2016	9	0.75	0.25	0.19	9	0.75	0.25	0.19
A	P. Yi, Ph.D. Civil/Env. Engineering	Assistant	TT FT	Fall 2016	9	0.75	0.35	0.26	9	0.75	0.35	0.26
C	New Hire Env. Engineering	Assistant	TT FT	Fall 2017	9	0.00	0.00	0.00	9	0.75	0.75	0.75
C	New Hire Env. Engineering	Assistant	TT FT	Fall 2018	9	0.00	0.00	0.00	9	0.75	0.75	0.75
<b>Total Person-Years (PY)</b>								<b>1.16</b>				<b>2.40</b>

Faculty Code	Source of Funding	PY Workload by Budget Classification		
		Year 1	Year 5	
A	Existing faculty on a regular line	Current Education & General Revenue	1.16	1.28
B	New faculty to be hired on a vacant line	Current Education & General Revenue	0.00	0.00
C	New faculty to be hired on a new line	New Education & General Revenue	0.00	1.12
D	Existing faculty hired on contracts/grants	Contracts/Grants	0.00	0.00
E	New faculty to be hired on contracts/grants	Contracts/Grants	0.00	0.00
<b>Overall Totals for</b>			<b>Year 1 1.16</b>	<b>Year 5 2.40</b>

Note: percent effort is based on anticipated teaching load allocations by faculty teaching in the civil/geomatics engineering program vs. the effort assigned to the environmental engineering program.

**APPENDIX B - SIGNATURE PAGE**

Please include the signature of the Equal Opportunity Officer and the Library Director.

  
\_\_\_\_\_  
Signature of Equal Opportunity Officer

  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Signature of Library Director

  
\_\_\_\_\_  
Date

This appendix was created to facilitate the collection of signatures in support of the proposal. Signatures in this section illustrate that the Equal Opportunity Officer has reviewed section II.E of the proposal and the Library Director has reviewed sections X.A and X.B.

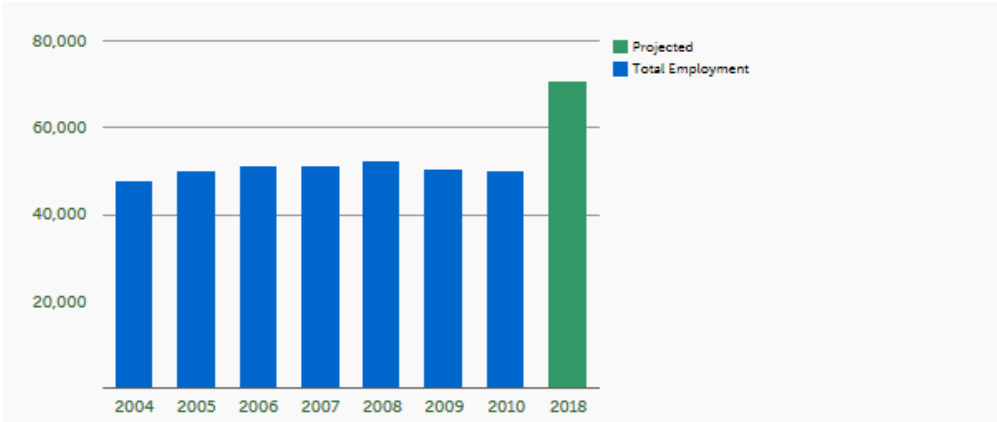


**APPENDIX C - DATA THAT SUPPORT THE NEED FOR THE PROPOSED PROGRAM**

Screenshots of Market Based Demand Surveys and Data Used in the Document:

# Career Outlook for Water/Wastewater Engineers

Also known as: Air Pollution Control Engineer, Environmental Engineer, Environmental Remediation Engineer, Hazardous Substances Engineer, Hazardous Waste Management Control Engineer, Pollution Control Engineer, Soil Engineer, Waste Management Engineer, Wastewater Treatment Engineer, Water Treatment Plant Engineer

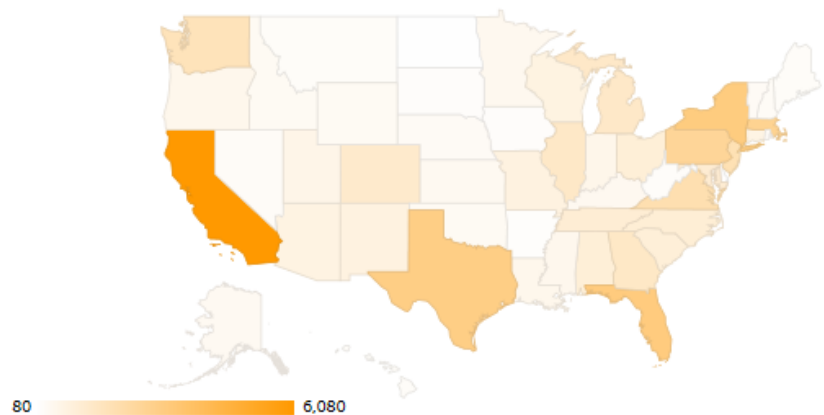


## TOP STATES

There are currently more Water/Wastewater Engineers in the following states

California	6,080
Florida	3,100
New York	3,070
Texas	2,940
Massachusetts	2,660
Pennsylvania	2,500
Virginia	1,930

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<https://www.recruiter.com/careers/water-wastewater-engineers/outlook/>

**BEST JOBS IN AMERICA** CNNMoney/PayScale.com's list of great careers 2012

**20. Environmental Engineer** 20 of 100

Median pay: \$82,300  
 Top pay: \$117,000  
 10-year job growth: 21.9%  
 Total jobs\*: 51,400



**What they do all day?** As quality standards get stricter, demand is growing for environmental engineers to help sample, analyze and design treatment systems for air, water and soil. Companies trying to meet these tougher standards also are hiring environmental engineers as consultants.

**How to get the job?** A bachelor's in environmental engineering is ideal, but related engineering degrees -- mechanical, chemical, civil -- are desirable too. Consulting firms tend to look for a master's in environmental engineering.

**What makes it great?** At a time when so many are worried about climate change, the job is a hands-on way to help improve the environment, one Superfund site at a time. Environmental engineers may choose to tackle larger issues such as global warming or focus on cleaning up a local site or contamination.

**What's the catch?** As engineering pay goes, it's not the highest. Industry and government rules can slow things down, which can be frustrating --K.A.

**Quality of life ratings:**

Personal satisfaction	Low stress	Benefit to society	Flexibility
<b>B</b>	<b>C</b>	<b>B</b>	<b>B</b>

Published: October 29, 2012

**Notes:** All pay data from PayScale.com. Median pay is for an experienced worker (at least five or seven years in the field). Top pay represents the 90th percentile. Job growth is estimated for 2010-20, and based on people working in broader 'job family' from the Bureau of Labor Statistics.

\*Total jobs is estimated number of people working in broader BLS 'job family.'

Sources: PayScale.com, Bureau of Labor Statistics, and CNNMoney research

**Do Environmental Engineers have great jobs, or what?**

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<http://money.cnn.com/pf/best-jobs/2012/snapshots/20.html>

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**15 Most Valuable College Majors**

**No. 5: Environmental Engineering**  
 Starting Median Pay: \$51,700  
 Mid-Career Median Pay: \$88,600  
 Growth in Pay: 71%  
 Projected Job Growth: 23.5%


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<http://www.forbes.com/pictures/lmj45jgfi/no-5-environmental-engineering/>

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### What is the expected job growth of Environmental Engineers?


In addition, over the next 10 years Environmental Engineers will be one of the fastest growing occupations. They should experience a 25.4% rate of growth during this time period.

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In respect to starting your own business, Environmental Engineers rarely feel... [more](#)
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There are approximately 3.0% employed as Environmental Engineers that are... [more](#)
6. [What education level is needed to become a Environmental Engineers?](#)  
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A Day in the Life of an Environmental Engineer


A Day in the Life of an Environmental Scientist

[http://www.studentscholarships.org/professions/542/growth\\_rate/environmental\\_engineers.php](http://www.studentscholarships.org/professions/542/growth_rate/environmental_engineers.php)

Architecture and Engineering &gt;

## Environmental Engineers

EN ESPAÑOL

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Summary

What They Do

Work Environment

How to Become One

Pay







Job Outlook

Similar Occupations

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## Summary

## Quick Facts: Environmental Engineers

2012 Median Pay 	\$80,890 per year \$38.89 per hour
Entry-Level Education 	Bachelor's degree
Work Experience in a Related Occupation 	None
On-the-job Training 	None
Number of Jobs, 2012 	53,200
Job Outlook, 2012-22 	15% (Faster than average)
Employment Change, 2012-22	8,100



Environmental engineers use the principles of engineering, soil sciences, biology, and chemistry to develop solutions to environmental problems.

**What Environmental Engineers Do**

Environmental engineers use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. They are involved in efforts to improve recycling, waste disposal, public health, and water and air pollution control.

**Work Environment**

Environmental engineers work in a variety of settings because of the nature of the tasks they do. When they are working with other engineers and urban and regional planners, environmental engineers are likely to be in offices. When they are carrying out solutions through construction projects, they are likely to be at construction sites.

**How to Become an Environmental Engineer**

Environmental engineers must have a bachelor's degree in environmental engineering or a related field, such as civil, chemical, or general engineering. Employers also value practical experience. Therefore, cooperative engineering programs, which provide college credit for structured job experience, are valuable as well. Getting a license improves the chances of employment.

**Pay**

The median annual wage for environmental engineers was \$80,890 in May 2012.

**Job Outlook**

Employment of environmental engineers is projected to grow 15 percent from 2012 to 2022, faster than the average for all occupations. State and local government concerns regarding water should lead to efforts to increase the efficiency of water use.

**Similar Occupations**

<http://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm#tab-1>

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<a href="#">Teleperformance</a> NW University Blvd Port Saint Lucie, FL	65.3 miles	Business Management Consultants	Management, Scientific, and Technical Consulting Services	500+ employees
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<http://myskillsmyfuture.org/Employers.aspx?onetcode=17208100&detailonetcode=17208101&keyword=environmental+engineer&highestmatch=Environmental+Engineers&zipcode=33498&radius=100&workPref=0&urlreferrer=YourCareerMatches&recordsperpage=10&sortfield=EMPSIZRNG&sortdir=DESC&indgroup=0&indsize=0&showfilter=0>



View the career video:  
[Environmental Engineers](#)

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## State and National Wages

<a href="#">Wage Table</a>	<a href="#">Hourly Wage Chart</a>	<a href="#">Yearly Wage Chart</a>
----------------------------	-----------------------------------	-----------------------------------

Location	Pay Period	2013				
		10%	25%	Median	75%	90%
United States	Hourly	\$23.91	\$30.25	\$39.53	\$49.93	\$58.99
	Yearly	\$49,700	\$62,900	\$82,200	\$103,900	\$122,700
Florida	Hourly	\$17.62	\$21.15	\$29.72	\$43.33	\$55.07
	Yearly	\$36,600	\$44,000	\$61,800	\$90,100	\$114,500

[Occupation Wages FAQs](#)

[Median Wage by Occupation Across States](#)

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[Compare Wages by Metropolitan Areas](#)

**National Data Source:** [Bureau of Labor Statistics, Occupational Employment Statistics Survey](#)

**State Data Source:** [Florida Wage Information](#)

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## State and National Trends

United States	Employment		Percent Change	<a href="#">Projected Annual Job Openings</a> <sup>1</sup>
	2012	2022		
Environmental Engineers	53,200	61,400	+15%	2,110
Florida	Employment		Percent Change	<a href="#">Projected Annual Job Openings</a> <sup>1</sup>
	2012	2022		
Environmental Engineers	2,700	3,170	+18%	110

<sup>1</sup>Projected Annual Job Openings refers to the average annual job openings due to growth and net replacement.

[Occupation Trends FAQs](#)

[Employment Trends by Occupation Across States](#)

[Compare Employment Trends by Occupation](#)

[Employment Trends by Industry and Occupation](#)

**National Data Source:** [Bureau of Labor Statistics, Office of Occupational Statistics and](#)

## Education and Training

Occupation: **Environmental Engineers**

Typical **education** needed for entry: **Bachelor's degree**

Typical **work experience** needed for a job in this occupation: **None**

Typical **on-the-job training** once you have a job in this occupation: **None**

### Related Instructional Programs:

- Environmental/Environmental Health Engineering
- Geotechnical and Geoenvironmental Engineering

### Distribution of Educational Attainment

Occupation	Percent of employees aged 25 to 44 in the occupation whose highest level of educational attainment is						
	Less than high school diploma	High school diploma or equivalent	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree	Doctoral or professional degree
Environmental Engineers	0.2%	3.9%	3.9%	4.2%	47.4%	35.5%	5%
Engineers	0.1%	3.9%	8.7%	8.2%	49.5%	24%	5.7%
Architecture and Engineering	1.1%	9.5%	17.2%	14.3%	38.4%	15.8%	3.7%
Total, All Occupations	9.4%	24.5%	20.2%	8.7%	19.8%	10.1%	7.2%

Find [colleges, training schools and instructional programs](#).

Access additional [Education Resources](#) in the Career Resource Library.

Use the [Financial Aid Advisor](#) to help find funds for financing education.

**WIA Eligible Training Provider List:** <http://etpl.flawwi.com/>

Source: [Bureau of Labor Statistics, Office of Occupational Statistics and Employment Projections](#) (Education/Training Level, Educational Attainment); [National Center for Education Statistics](#) (Typical Instructional Programs)

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## Related Occupation Profiles

### Occupations with similar skill requirements

There is no information about Related Occupations. This may occur because data has not been collected or because this is a composite occupation (e.g., "All Other").

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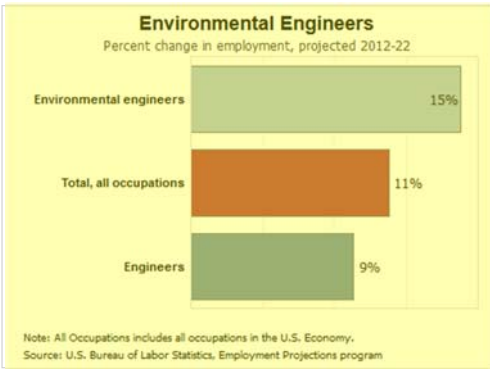
Employment of environmental engineers is projected to grow 15 percent from 2012 to 2022, faster than the average for all occupations.

State and local governments' concerns about water are leading to efforts to increase the efficiency of water use. This focus differs from that of wastewater treatment, for which this occupation is traditionally known.

The requirement by the federal government to clean up contaminated sites is expected to help sustain demand for these engineers' services, particularly those who work for the government sector. In addition, wastewater treatment is becoming a larger concern in areas of the country where new methods of drilling for shale gas require the use and disposal of massive volumes of water. Environmental engineers will continue to be needed to help utilities and water treatment plants comply with any new federal or state environmental regulations.

**Job Prospects**

Job prospects should be favorable because this occupation may experience a wave of retirements. A person can also improve his or her job prospects by obtaining a master's degree in environmental engineering, an advanced degree that many employers prefer.



**Employment projections data for environmental engineers, 2012-22**

Occupational Title	SOC Code	Employment, 2012	Projected Employment, 2022	Change, 2012-22		Employment by Industry
				Percent	Numeric	
Environmental engineers	17-2081	53,200	61,400	15	8,100	<a href="#">[XLS]</a>

SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program

[<- Pay](#)

[Similar Occupations ->](#)



## Summary Report for:

### 17-2081.00 - Environmental Engineers

Updated 2012



Research, design, plan, or perform engineering duties in the prevention, control, and remediation of environmental hazards using various engineering disciplines. Work may include waste treatment, site remediation, or pollution control technology.

**Sample of reported job titles:** Air Pollution Control Engineer; Chief, Pesticides and Toxic Substances Branch; Environmental Analyst; Environmental Engineer; Environmental Remediation Specialist; Global Director Air and Climate Change; Hazardous Substances Engineer; Marine Engineer CPVEC (Marine Engineer Commercial Passenger Vessel Environmental Compliance); Regulatory Environmental Compliance Manager; Sanitary Engineer

Also see: [Water/Wastewater Engineers](#)

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### Tasks

- Design or supervise the design of systems, processes, or equipment for control, management, or remediation of water, air, or soil quality. ✓
- Advise corporations or government agencies of procedures to follow in cleaning up contaminated sites to protect people and the environment. ✓
- Collaborate with environmental scientists, planners, hazardous waste technicians, engineers, experts in law or business, or other specialists to address environmental problems. ✓
- Obtain, update, or maintain plans, permits, or standard operating procedures. ✓
- Serve as liaison with federal, state, or local agencies or officials on issues pertaining to solid or hazardous waste program requirements. ✓
- Provide technical support for environmental remediation or litigation projects, including remediation system design or determination of regulatory applicability. ✓
- Prepare, review, or update environmental investigation or recommendation reports. ✓
- Develop site-specific health and safety protocols, such as spill contingency plans or methods for loading or transporting waste. ✓
- Inspect industrial or municipal facilities or programs to evaluate operational effectiveness or ensure compliance with environmental regulations. ✓
- Provide assistance with planning, quality assurance, safety inspection protocols, or sampling as part of a team conducting multimedia inspections at complex facilities. ✓

[back to top](#)

### Tools & Technology

Tools used in this occupation:

**Air velocity and temperature monitors** — Air velocity meters; Ambient air measurement devices; Nitrogen oxide burners

**Flowmeters** — Flow meters; Pitot tubes

**Mass spectrometers** — Plasma-mass spectrometers; Trace metal analyzers

**Photometers** — Laser photometers; Luminometers

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Link to job banks where you can search for jobs or post your resume. All of the links on this page will open in a new browser window; to return to this page, simply close the new window.

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 Select a State



**Florida State and Private Job Banks**

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Your **state job bank** includes job postings for businesses as well as government positions throughout your state. You may be asked to create a username and password.

State Job Bank	Web Site
Florida Job Bank	<a href="https://www.employflorida.com/">https://www.employflorida.com/</a>

The following **national job banks** allow you to search for job postings in multiple occupations and locations. You may be asked to create a username and password.

National Job Banks	Web Site
America's Job Exchange	<a href="http://www.americasjobexchange.com">http://www.americasjobexchange.com</a>
Careerbuilder.com	<a href="http://www.careerbuilder.com">http://www.careerbuilder.com</a>
EmploymentGuide.com	<a href="http://www.employmentguide.com">http://www.employmentguide.com</a>
Federal Government Jobs	<a href="http://federalgovernmentjobs.us">http://federalgovernmentjobs.us</a>
Flipdog	<a href="http://www.flipdog.com">http://www.flipdog.com</a>
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Monster.com	<a href="http://www.monster.com">http://www.monster.com</a>
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02/10/2015	<a href="#">Environmental Engineer 1</a> GREEN JOB	CDM Smith Inc.	Boca Raton, FL		CORP	2	<input type="checkbox"/>
... Engineers and Scientists on solid waste, water, and wastewater projects. Responsibilities may include: <ul style="list-style-type: none"> <li>o Solid waste planning, design, and permitting support services</li> <li>o Water and wastewater treatment design and permitting services</li> <li>o Conveyance system analysis, design, and permitting services</li> <li>o Data collection and analysis (including field sampling)</li> </ul>							
03/06/2015	<a href="#">Environmental Engineer 6 - Water/Wastewater</a> GREEN JOB	CDM Smith Inc.	Boca Raton, FL		NLX	2	<input type="checkbox"/>
... environmental problems whose solution requires application of advanced treatment technologies, be responsible for directing and planning the work of engineers/scientists and technicians, and contributing to the development of new designs, or innovative treatment techniques, which would be regarded as major advances in the field. As a member of the							
10/08/2014	<a href="#">Senior Civil, Geotechnical or Environmental Engineer or Scientist</a> GREEN JOB	Geosyntec Consultants, Inc.	Boca Raton, FL		PJB	2	<input type="checkbox"/>
... environmental engineering practice and business development efforts. The selected candidate will need to demonstrate and provide superior technical, managerial, and business development expertise in the environmental marketplace. He or she will have full technical responsibility for scoping, performing, and delivering multiple concurrent project							
03/12/2015	<a href="#">Environmental Engineer 1</a> GREEN JOB	CDM Smith Inc.	Fort Lauderdale, FL		PJB	2	<input type="checkbox"/>
... Environmental Engineering required. Position requires ability to obtain an EIT within 18 months of hire. Knowledge of commonly used computer software (Word, Excel, AutoCAD, ArcView) expected. Candidate must have excellent writing and communication skills. Preferred Q							
03/05/2015	<a href="#">Environmental Engineer 6 - Water/Wastewater</a> GREEN JOB	CDM Smith Inc.	Fort Lauderdale, FL		PJB	2	<input type="checkbox"/>

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<b>Environmental Due Diligence Specialist (#3714)</b> - <a href="#">View similar jobs</a>	EMERCON	FL - Ft. Lauderdale (14 miles)	5 Days Ago	
<b>Safety and Environmental Specialist--Clewiston, FL</b> - <a href="#">View similar jobs</a>	US Sugar	FL - West Palm Beach (23 miles)	2 Weeks Ago	
<b>Environmental Specialist</b> - <a href="#">View similar jobs</a>	US Sugar	FL - West Palm Beach (23 miles)	1 Week Ago	

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<p><b>Senior Civil, Geotechnical or Environmental Engineer or...</b> MAR. 13, 2015   Geosyntec Consultants   Boca Raton, FL Geosyntec is seeking a senior engineer or scientist with a background in civil, chemical, geology/hydrogeology, geotechnical, and/or water and natural resources to join our Seattle...</p>	<p><a href="#">View Job</a>   <a href="#">Apply</a>   <a href="#">Save</a></p>
<p><b>OSP Engineer</b> MAR. 14, 2015   AFL   Miami, FL OSP Engineer Job#: 260966 POSITIONS: 1 POSTED: 03/10/2015 JOB TYPE: Full Time LOCATION: Miami, FL DEPARTMENT: OSP CATEGORY: Outside Plant (OSP) Salary: Unit Based BENE...</p>	<p><a href="#">View Job</a>   <a href="#">Apply</a>   <a href="#">Save</a></p>
<p><b>Environmental Specialist</b> MAR. 13, 2015   Covanta   Miami, FL Plant Operations Position Type Full-Time Regular Education Required Bachelors Degree Experience Required Minimum 5 Years Relocation Provided Yes Position Description Covanta is a w...</p>	<p><a href="#">View Job</a>   <a href="#">Apply</a>   <a href="#">Save</a></p>
<p><b>Head of Facility Management - Latin America</b> MAR. 13, 2015   Teva Pharmaceuticals   Weston, FL Engineering - Project Management More information about this job Overview Primary management and oversight of Teva Pharmaceuticals Latin America Facility Organization, management a...</p>	<p><a href="#">View Job</a>   <a href="#">Apply</a>   <a href="#">Save</a></p>

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Supervisory Interdisciplinary And	JACKSONVILLE, FL	Gov	Navy	03/12/15	03/19/15
Environmental Engineer Biologist Recent Graduate	MIAMI, FL	Pub	Army	03/11/15	03/25/15
Environmental Engineer Biologist Recent Graduate	WEST PALM BEACH, FL	Pub	Army	03/11/15	03/25/15
Af Palace Acquire Intern Paq Scientist and Engineer Engineer	EGLIN AFB, FL	Pub	Air Force	11/01/14	07/31/15
Af Palace Acquire Intern Paq Scientist and Engineer Engineer	PATRICK AFB, FL	Pub	Air Force	11/01/14	07/31/15
Af Palace Acquire Intern Paq Scientist and Engineer Engineer	EGLIN AFB, FL	Pub	Air Force	11/01/14	07/31/15
Af Palace Acquire Intern Paq Scientist and Engineer Engineer	PATRICK AFB, FL	Pub	Air Force	11/01/14	07/31/15
Mechanical Engineer	EGLIN AFB, FL	Pub	Air Force	10/01/14	03/31/15
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**Environmental Engineer 6 - Water/Wastewater**  
CDM Smith (Boca Raton, FL)  
first acquired 2015-3-6 0:33 AM

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**Environmental Engineer 4 - Water/Wastewater**  
CDM Smith (Vero Beach, FL)  
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**Environmental Engineer 1**  
CDM Smith (Boca Raton, FL)  
first acquired 2014-11-8 0:24 AM

Jobs 1 - 3 of 3

Location (of 1st 500)  
Boca Raton, FL (within 100 miles) [undo]

Company (of 1st 500)

Time Range

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Environmental Engineers

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- Communication Skills
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### Environmental Engineer

**MRINetwork**  
Fort Lauderdale, FL

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### Environmental Engineer 6 - Water/Wastewater

**CDM Smith**  
Boca Raton, FL

Why CDM Smith? CDM Smith provides lasting and integrated solutions in water, environment, transportation, energy and facilities to public and private clients worldwide. As a full-service co...

Posted: 12 DAYS AGO

### Engineering - Environmental

**Earth Systems**  
Lake Worth, FL

Earth Systems Inc. is an environmental consulting and engineering firm that supports regulatory agencies and private clients in the performance of hazardous waste and petroleum assessment and...

Posted: 13 DAYS AGO

### Office Manager / Human Resources Manager

**Earth Systems**  
Lake Worth, FL

Earth Systems Inc. is an environmental consulting and engineering firm that supports regulatory agencies and private clients in the performance of hazardous waste and petroleum assessment and remed...

Posted: 5 DAYS AGO

### Environmental Engineer 1

**CDM Smith**  
Boca Raton, FL

This position will be located in our Boca Raton Office with periodic travel to other Florida Offices if needed. The qualified candidate will assist mid and senior level Engineers and Scientists on so...

Posted: 24 DAYS AGO

### Environmental Engineer 6 - Water/Wastewater

**CDM Smith**  
Boca Raton, FL

CDM Smith currently has an exciting opportunity for an experienced Senior Wastewater Design Engineer & Project Manager. We are looking for someone who has excellent client interaction skills and can m...

Posted: 6 DAYS AGO


### Water/Wastewater Project Engineer - Hollywood, Florida

**CH2M HILL**  
Fort Lauderdale, FL

Fort Lauderdale, FL. United States Postal Code: 33309 Requisition #: 61091BR Employment Type: Full Time Travel Percentage: 11% to 25% Last Updated: 2015-02-27 Why CH2M HILL For de...

Posted: 17 DAYS AGO



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- Environmental Engineer 4 - Water/Wastewater**  
CDM Smith  
6 days ago

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- Environmental Engineer/Biologist (Recent Graduate)**  
United States Federal Gov...  
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Palm Beach Gardens, FL  [See who you know](#)


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- Environmental Engineer 6 - Water/Wastewater**  
CDM Smith  
7 days ago

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---

- Wastewater/Water Resources Engineer**  
HBC ENGINEERING COMPANY  
11 days ago

Miami-Dade County, FL  [See who you know](#)


---

- Environmental Engineer 6 - Water/Wastewater**  
CDM Smith  
13 days ago

Boca Raton, FL  [See who you know](#)


---

- Data Center Environmental Engineer,( Copper & Fiber)**  
Marten Transport  
15 days ago

Hollywood, FL  [See who you know](#)


---

- Water/Wastewater Project Engineer - Hollywood, Florida**  
CH2M HILL  
18 days ago

Fort Lauderdale, FL  [See who you know](#)


---

- Environmental Engineer**  
MRINetwork  
19 days ago

Fort Lauderdale, FL  [See who you know](#)

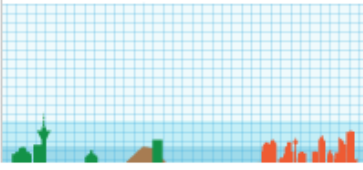
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## Knowledge, Skills, and Abilities

Environmental Engineers are grouped into the following occupations for which the most important knowledge, skills, and abilities (KSAs) are listed.

- [Environmental Engineers](#)
- [Water/Wastewater Engineers](#)

\*\*\*\*\*

### Environmental Engineers

#### Knowledge:

- Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- Chemistry - Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.
- Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- Law and Government - Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process.

#### Skills:

- Reading Comprehension - Understanding written sentences and paragraphs in work related documents.
- Critical Thinking - Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- Active Learning - Understanding the implications of new information for both current and future problem-solving and decision-making.
- Active Listening - Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- Complex Problem Solving - Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.

#### Abilities:

- Written Comprehension - The ability to read and understand information and ideas presented in writing.
- Oral Comprehension - The ability to listen to and understand information and ideas presented through spoken words and sentences.

- Problem Sensitivity - The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- Deductive Reasoning - The ability to apply general rules to specific problems to produce answers that make sense.
- Oral Expression - The ability to communicate information and ideas in speaking so others will understand.
- Written Expression - The ability to communicate information and ideas in writing so others will understand.

Source: [Occupational Information Network: Environmental Engineers](#).

### Tasks and Activities

Environmental Engineers are grouped into the following occupations for which occupation specific tasks, the most important generalized work activities, and detailed work activities are listed.

- [Environmental Engineers](#)
- [Water/Wastewater Engineers](#)

\*\*\*\*\*

### Environmental Engineers

#### Occupation Specific Tasks:

- Design or supervise the design of systems, processes, or equipment for control, management, or remediation of water, air, or soil quality.
- Collaborate with environmental scientists, planners, hazardous waste technicians, engineers, experts in law or business, or other specialists to address environmental problems.
- Advise corporations or government agencies of procedures to follow in cleaning up contaminated sites to protect people and the environment.
- Obtain, update, or maintain plans, permits, or standard operating procedures.
- Serve as liaison with federal, state, or local agencies or officials on issues pertaining to solid or hazardous waste program requirements.
- Provide technical support for environmental remediation or litigation projects, including remediation system design or determination of regulatory applicability.
- Prepare, review, or update environmental investigation or recommendation reports.
- Develop site-specific health and safety protocols, such as spill contingency plans or methods for loading or transporting waste.
- Inspect industrial or municipal facilities or programs to evaluate operational effectiveness or ensure compliance with environmental regulations.
- Provide assistance with planning, quality assurance, safety inspection protocols, or sampling as part of a team conducting multimedia inspections at complex facilities.
- Prepare or present public briefings on the status of environmental engineering projects.
- Develop proposed project objectives and targets and report to management on progress in attaining them.
- Coordinate or manage environmental protection programs or projects, assigning or evaluating work.

- Advise industries or government agencies about environmental policies and standards.
- Direct installation or operation of environmental monitoring devices or supervise related data collection programs.
- Monitor progress of environmental improvement programs.
- Prepare hazardous waste manifests or land disposal restriction notifications.
- Assess the existing or potential environmental impact of land use projects on air, water, or land.
- Prepare, maintain, or revise quality assurance documentation or procedures.
- Assist in budget implementation, forecasts, or administration.
- Provide environmental engineering assistance in network analysis, regulatory analysis, or planning or reviewing database development.
- Develop or present environmental compliance training or orientation sessions.
- Inform company employees or other interested parties of environmental issues.
- Provide administrative support for projects by collecting data, providing project documentation, training staff, or performing other general administrative duties.
- Assess, sort, characterize, or pack known or unknown materials.
- Request bids from suppliers or consultants.
- Develop, implement, or manage plans or programs related to conservation or management of natural resources.
- Write reports or articles for Web sites or newsletters related to environmental engineering issues.

#### Generalized Work Activities:

- Analyzing Data or Information - Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.
- Evaluating Information to Determine Compliance with Standards - Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards.
- Getting Information - Observing, receiving, and otherwise obtaining information from all relevant sources.
- Making Decisions and Solving Problems - Analyzing information and evaluating results to choose the best solution and solve problems.
- Interacting With Computers - Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.

#### Detailed Work Activities:

- Advise others regarding green practices or environmental concerns.
- Assist engineers or scientists with research.
- Confer with other personnel to resolve design or operational problems.
- Confer with technical personnel to prepare designs or operational plans.
- Design environmental control systems.
- Determine operational criteria or specifications.
- Develop technical methods or processes.
- Direct environmental development activities.
- Explain project details to the general public.
- Inspect facilities or sites to determine if they meet specifications or standards.

- Investigate the environmental impact of projects.
- Maintain operational records or records systems.
- Monitor activities affecting environmental quality.
- Package materials for transport.
- Prepare detailed work plans.
- Prepare operational reports.
- Prepare procedural documents.
- Prepare project budgets.
- Prepare technical or operational reports.
- Purchase materials, equipment, or other resources.
- Teach safety standards or environmental compliance methods.
- Test characteristics of materials or structures.
- Train personnel on proper operational procedures.

Source: [Occupational Information Network: Environmental Engineers](#).

### Tools and Technology

Environmental Engineers are grouped into the following occupations for which Tools and Technology information is available.

- [Environmental Engineers](#)
- [Water/Wastewater Engineers](#)

\*\*\*\*\*

Environmental Engineers [View Detailed Report](#)

### Tools:

- Air velocity and temperature monitors - Air velocity meters, Ambient air measurement devices, Nitrogen oxide burners
- Atomic absorption AA spectrometers - Atomic absorption AA spectrometers, Atomic absorption AA spectrophotometers
- Chemiluminescence or bioluminescence analyzers - Fluorescence detectors, Microbics toxicity analyzers
- Mass spectrometers - Mass spectrometers, Plasma-mass spectrometers, Trace metal analyzers
- Photometers - Laser photometers, Luminometers, Photometers

### Technology:

- Analytical or scientific software - ANSYS software, Air dispersion modeling software, DHI Water and Environment MIKE SHE, Ecological risk assessment software, Finite element method FEM software
- Compliance software - Continuous emission management software, Environmental health and safety documentation software, Greenhouse gas management software, Hazardous materials management software, Material safety data sheet MSDS software


- Computer aided design CAD software - Autodesk AutoCAD software, Bentley Microstation, Computer aided design CAD software, Kubotek CADKEY software, SofTech CADRA
- Graphics or photo imaging software - Photogrammetric software, Slam software
- Map creation software - Geomechanical design analysis GDA software, Oil mapping software

Source: [Occupational Information Network: Environmental Engineers](#).



APPENDIX D - EXTERNAL CONSULTANT REPORT

Hanover Research Report



MARKET ANALYSIS –  
ENVIRONMENTAL ENGINEERING

Prepared for Florida Atlantic University

October 2015

In the following report, Hanover Research examines the student and labor market demand for a bachelor's degree in environmental engineering. Hanover also analyzes the market saturation for graduates of the proposed program, considering the current output of students compared to job openings in the state and local area.

 HANOVER  
RESEARCH  
[www.hanoverresearch.com](http://www.hanoverresearch.com)



## **APPENDIX E - ACADEMIC LEARNING COMPACT**

For graduation, students must obtain a grade of “C” or better in all required courses including General Education Requirements, Mathematics & Sciences courses, Engineering Fundamentals courses and Professional Core courses. Students must obtain a 2.0 GPA in all Environmental Engineering courses attempted.

The Department maintains a flowchart listing all required program coursework. This flowchart and a program plan are reviewed with each student on a regular basis by undergraduate advising. The students are required to meet with their advisor each semester before registration for classes. Failure to maintain satisfactory progress in the program will initiate a review process by the Department.

Environmental engineering faculty and industry members of the Department/Program Advisory Council evaluate students on content knowledge, communication skills, and critical thinking skills. Possible outcomes for a student who receives an unsatisfactory evaluation include repeating course, tutoring or additional coursework.

**CONTENT KNOWLEDGE (Declarative Knowledge and Technical Skills): An ability to apply their knowledge of Engineering fundamentals, experimental methodologies and modern engineering tools to identify and formulate engineering solutions.**

**Students will have a working knowledge of math, science and engineering fundamentals and the ability to plan and execute an engineering design to meet an identified need in environmental engineering curricular content areas:**

- a) formulate material and energy balances**
- b) analyze the fate and transport of substances in and between air, water, and soil phases**
- c) conduct laboratory experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., air, water, land, environmental health)**
- d) design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and apply advanced principles and practice relevant to the program objectives**
- e) understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations**

**Specifically with respect to the following engineering core courses:**

CWR3201C	Applied Hydraulics (a,c)
CWR4202	Hydrologic Engineering (d,e)
ENV3001C	Environmental Science and Engineering (a,b,c,d,e)
ENV4356	Solid and Hazardous Waste and Site Remediation (a,b,d,e)
ENV4514	Water and Wastewater Treatment Systems (a,b,d,e)
ENV4612	Introduction to Pollution Prevention and Sustainability (a,b,d,e)
ENV4115C	Air Pollution and Control Systems with Lab (a,b,c,d,e)
ENV4668	Environmental Fate and Transport (a,b,d,e)
CGN4803C	Civil, Environmental & Geomatics Engineering Design 1 (a,b,d,e)

CGN4804C Civil, Environmental & Geomatics Engineering Design 2 (a,b,d,e)

In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provides a composite score (on a scale of 1-5 with 5 being highest) based on assignments, laboratory reports, exams, projects, and other assessments. A score less than 3.5 will result in an improvement strategy to be implemented in the following semester.

The faculty evaluates the content knowledge by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes:

- An ability to apply knowledge of mathematics, science, and engineering (a)
- An ability to identify, formulate, and solve engineering problems (e)
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (h)
- A knowledge of contemporary issues (j)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k)

**COMMUNICATION (Written Communication, Oral Communication, Team/ Collaborative Communication): An ability to communicate and function on effectively multi-disciplinary teams.**

Students will be able to communicate ideas and results to diverse audiences using their knowledge of written, oral and graphical communication, function effectively on teams using their knowledge of team dynamics, team communication, social norms, and conflict management with respect to the following courses:

- CGN4803C Civil, Environmental & Geomatics Engineering Design 1  
 CGN4804C Civil, Environmental & Geomatics Engineering Design 2

Students are required to write technical reports to be evaluated by the faculty members. Students in the design sequence, CGN4803C and CGN4804C, will present oral and written reports to the faculty and the industry members of the Department/Program Advisory Council. The faculty evaluates the content knowledge by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes:

- An ability to function on multi-disciplinary teams (d)
- An ability to communicate effectively (g)

Students receiving unsatisfactory evaluations by the faculty and industry jury will be required to restart the sequence in the following semester.

**CRITICAL THINKING (Analytical Skills, Creative Skills, Practical Skills): Students will apply their discipline-specific knowledge to successfully execute a design with multiple realistic constraints using applicable design codes and standards, conduct experiments, analyze and interpret data, understand professional and ethical responsibility, and recognize the need for engaging in life-long learning.**

All environmental engineering courses contain a critical thinking component. The following courses have more in depth critical thinking components:

- CWR4202 Hydrologic Engineering

ENV4514	Water and Wastewater Treatment Systems
ENV4612	Introduction to Pollution Prevention and Sustainability
ENV4356	Solid and Hazardous Waste and Site Remediation
ENV4668	Environmental Fate and Transport
CGN4803C	Civil, Environmental & Geomatics Engineering Design 1
CGN4804C	Civil, Environmental & Geomatics Engineering Design 2

Analytical skills are assessed through examining the quality of components of design work through oral presentations and/or technical reports. Creative and practical skills are assessed by the instructor examining the quality of the technical solution to a practical problem. The critical thinking skills that students obtained from the above group of courses will be evaluated by the faculty members who teach the courses by giving composite scores (1 through 5, with 5 as the highest) based on assignments, laboratory reports, exams, projects, and other assessments in the Continuous Improvement Worksheet (CIW) at the end of the semester for the following course-specific student learning outcomes:

- An ability to design and conduct experiments, as well as to analyze and interpret data (b)
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability (c)
- An understanding of professional and ethical responsibility (f)
- A recognition of the need for and an ability to engage in life-long learning (i)

The benchmark student success is 3.5. A score less than 3.5 will result in an improvement strategy to be implemented in the following semester.

**APPENDIX F – SUPPORT LETTERS FROM INDUSTRY**

**Calvin, Giordano & Associates, Inc.**  
EXCEPTIONAL SOLUTIONS™

Dr. Yan Yong  
Interim Chair and Professor  
Department of Civil, Environmental and Geomatics Engineering  
Florida Atlantic University  
777 Glades Road, 36 / 231  
Boca Raton, FL 33431

Dear Dr. Yong,

This letter is to document Calvin, Giordano and Associates, Inc. (CGA's) support for the Department of Civil, Environmental and Geomatics Engineering at Florida Atlantic University and its plans for a Bachelor of Science degree program in Environmental Engineering. Environmental Engineers / Engineering which serves the technological needs of society, particularly with regard to clean air, safe drinking water, wastewater disposal, and management of solid and hazardous waste is an essential component to solving environmental problems and issues. It is critical that future environmental engineers be thoroughly prepared not only in mathematics and physics common to other engineering disciplines, but also in the important aspects of chemistry, microbiology, modeling, statistical analysis, simulation, planning, management, public health and climate change, which are highly desired by our industry. Without this preparation, our industry will find it difficult to adjust to the rapid advances in engineering as it pertains to sustainable infrastructure and the society needs.

Our company, Calvin, Giordano & Associates (CGA) has grown dramatically, adding new services, new offices and an incredibly talented group of professionals that have expanded our capabilities into an entirely new and dynamic business model of providing professional municipal and government services. Because of our diversity, CGA offers a host of these professional services as a one-source partner, or can efficiently tackle time-sensitive individual projects, providing customized solutions with handpicked teams of highly experienced professionals.

As quality standards get stricter, demand is growing for environmental engineers to sample, analyze and design treatment systems for air, water and soil. Our company is poised to meet these tougher standards and would benefit, by hiring

Building Code Services  
Coastal Engineering  
Code Enforcement  
Construction Engineering  
and Inspection  
Construction Services  
Contract Government  
Data Technologies  
and Development  
Emergency Management  
Services  
Engineering  
Environmental Services  
Facilities Management  
Indoor Air Quality  
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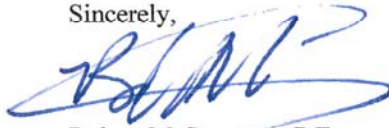
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Suite 600  
Fort Lauderdale, FL  
33316  
954.921.7781 phone  
954.921.8807 fax

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competent graduates from the Environmental Engineering program at Florida Atlantic University.

In closing, and due to our knowledge of the students who have successfully graduated from the Department of Civil, Environmental and Geomatics Engineering at Florida Atlantic University, we are confident that a new undergraduate program in Environmental Engineering would make a valuable contribution by providing a sustainable workforce of highly trained engineers for our industry, and we strongly support the Department's efforts to making this happen as soon as possible.

Sincerely,

A handwritten signature in blue ink, appearing to read 'R. McSweeney', with a large, sweeping flourish at the end.

Robert McSweeney, P.E.  
Director of Construction Engineering



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August 17, 2015

Yan Yong  
Interim Chair and Professor  
Department of Civil, Environmental and Geomatics Engineering  
Florida Atlantic University  
777 Glades Road, 36/231  
Boca Raton, FL 33431

Dear Dr. Yong,

This letter is to document our support for the Department of Civil, Environmental and Geomatics Engineering at Florida Atlantic University and its plans for a Bachelor of Science degree program in Environmental Engineering. Environmental Engineering serves the technological needs of society, particularly with regard to clean air, safe drinking water, wastewater disposal, and management of solid and hazardous waste. Nationwide, we are suffering from a shortage of engineers that possess a rigorous technical foundation and a top level liberal education. It is especially important that future environmental engineers be thoroughly prepared not only in mathematics and physics common to other engineering disciplines, but also in the important aspects of chemistry, microbiology, modeling, statistical analysis, simulation, planning, management, and climate change, which are highly desired by our industry. Without this preparation, our industry will find it difficult to adjust to the rapid advances in engineering as it pertains to sustainable infrastructure and the society needs.

CES CONSULTANTS, INC. (CES) is a full-service engineering firm founded in 2001. The firm, which is minority-owned, provides professional engineering services to municipal and private sector clients. Since the firm's inception, CES personnel have been involved in some of the largest infrastructure improvement projects in Florida. The company's professional staff collectively holds combined experience in the areas of Civil Engineering, Water & Wastewater Design, Roadway, Grading and Drainage Design, Structural Engineering, Mechanical and Electrical Engineering Program Management, Construction Management, Project Control, Cost Control, Estimating, Inspection Services, Permitting Services, QA/QC, Primavera (P6) Scheduling, and Owner Representation.

Our company is comprised of a team of approximately 50 professionals who have worked together on a variety of successful projects, amassing a consistent and proven record of excellent performance. Not only does CES bring clients' plans to life, but it also exceeds their expectations along the way. In the public arena, the firm provides ongoing municipal engineering and construction services for many communities and agencies: Miami-Dade County Aviation Department, Miami-Dade County Water & Sewer Department, Miami-Dade County Public Works Department, City of Miami



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&  
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Construction  
Management

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Services

Geotechnical &  
Materials Testing  
Services

Debris Monitoring  
&  
Removal

Construction

Beach, City of Miramar, City of Homestead, City of Opa-Locka, City of Ft. Lauderdale, South Florida Water Management District, Broward County Housing Authority, and City of Jacksonville, among others.

Our goal as a Company is to grow out of the Small Business Enterprise category and into a successful, midsize firm. In order to do so we will be looking for engineering graduates that have the right technical abilities along with the desire to grow their own career paths. Miami-Dade County Water and Sewer Department alone will be spending \$12 billion over the next 10 years on water and wastewater treatment projects and there is already a shortage of qualified candidates to fill these needs. An FAU graduate with a degree in environmental engineering would be in high demand, and would not be looking for employment for very long.

CES is well positioned to get a lot of this Miami-Dade work and would benefit greatly from having FAU provide us with qualified, environmental engineering candidates to choose from. Having a program like this would also allow us to hire students as interns to supplement their college experience. This is an excellent opportunity for them to see the engineering world as it really exists, and give them first hand exposure to both the work, and the Company.

In closing, we are confident that a new undergraduate program in Environmental Engineering at Florida Atlantic University will make a valuable contribution by providing a sustainable workforce of highly trained engineers for our industry, and we strongly support the Department's efforts to making this happen as soon as possible.

Sincerely,

Walter C. (Bud) Goblisch, P.E.  
Vice President  
1555 Palm Beach Lakes Blvd., Suite 920  
West Palm Beach, FL 33401

1555 Palm Beach Lakes  
Blvd, Suite 920  
West Palm Beach, FL  
33401  
Ph: 561.227.6862  
Fx: 561.855.7630  
www.cesconsult.com



July 27, 2015

Yan Yong  
Interim Chair and Professor  
Department of Civil, Environmental and Geomatics Engineering  
Florida Atlantic University  
777 Glades Road, 36/231  
Boca Raton, FL 33431

Dear Dr. Yong,

Reference: Bachelor of Science Degree Program  
Environmental Engineering

This letter is to document our support for the Department of Civil, Environmental and Geomatics Engineering at Florida Atlantic University and its plans for a Bachelor of Science degree program in Environmental Engineering. Environmental Engineering serves the technological needs of society, particularly with regard to clean air, safe drinking water, wastewater disposal, and management of solid and hazardous waste. Nationwide, we are suffering from a shortage of engineers that possess a rigorous technical foundation. It is especially important that future environmental engineers be thoroughly prepared not only in mathematics and physics common to other engineering disciplines, but also in the important aspects of chemistry, microbiology, modeling, statistical analysis, simulation, planning, and management, which are highly desired by our industry. Without this preparation, our industry will find it difficult to adjust to the rapid advances in engineering as it pertains to sustainable infrastructure and the society needs.

Eckler Engineering is a small environmental engineering firm in Coral Springs, Florida. We have six engineers, five of which have FAU degrees. We intend to continue this hiring practice since the engineers we have hired from FAU are as good as or better than others we have hired or just interviewed. We need well educated engineers capable of producing work when they walk in the door. FAU's graduates have a shorter learning curve than others.

Being a small firm with one office, we do not have the budget to do large, nationwide searches for engineers, let alone pay for moving expenses. Therefore, finding local talent is important to our sustainability. The new Environmental Engineering degree at FAU would be very important for my firm.

In closing, we are confident that a new undergraduate program in Environmental Engineering at Florida Atlantic University will make a valuable contribution by providing a sustainable workforce of highly trained engineers for our industry, and we strongly support the Department's efforts to making this happen as soon as possible.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Donald A. Eckler', is written over a horizontal line.

Donald A. Eckler, P.E.  
President

*Celebrating our 29th Year of Service to South Florida*

4700 RIVERSIDE DRIVE, SUITE 110  
CORAL SPRINGS, FL 33067

954/510-4700  
FAX 954/755-2741





**BUILDING A BETTER WORLD**

Yan Yong, Ph.D.  
Interim Chair and Professor  
Department of Civil, Environmental and Geomatics Engineering  
Florida Atlantic University  
777 Glades Road, 36/231  
Boca Raton, FL 33431

Dear Dr. Yong,

This letter is to document our support for the Department of Civil, Environmental and Geomatics Engineering at Florida Atlantic University and its plans for a Bachelor of Science degree program in Environmental Engineering. Environmental Engineering serves the technological needs of society, particularly with regard to clean air, safe drinking water, wastewater disposal, and management of solid and hazardous waste. Nationwide, we are suffering from a shortage of engineers that possess a rigorous technical foundation and a top level liberal education. It is especially important that future environmental engineers be thoroughly prepared not only in mathematics and physics common to other engineering disciplines, but also in the important aspects of chemistry, microbiology, modeling, statistical analysis, simulation, planning, management, and climate change, which are highly desired by our industry. Without this preparation, our industry will find it difficult to adjust to the rapid advances in engineering as it pertains to sustainable infrastructure and the society needs.

At MWH, we believe growing a great engineering, consulting and construction services company happens from the inside out. We look for people who are drawn to use every talent they possess, plus imagination, determination and a drive to do the extraordinary. We believe that building a great career is as important as *Building a Better World*.

A pre-requisite to for employment at MWH, is a strong academic foundation and a Bachelors of Science Degree from a Civil, Chemical, or Environmental Engineering Program is mandatory. In the next ten years MWH intends to hire approximately seven Graduate Engineers. During the recruitment process schools like Florida Atlantic University will be targeted in pursuit of engineering talent.

In closing, at MWH our employees are our greatest assets and we will grow, inspire, and protect them. We are confident that a new undergraduate program in Environmental Engineering at Florida Atlantic University will make a valuable contribution by providing a sustainable workforce of highly trained engineers for our industry, and we strongly support the Department's efforts to making this happen as soon as possible.

Sincerely,

A handwritten signature in blue ink, appearing to read "Carlos Mallol".

Carlos Mallol, DBA, PE  
MWH Southeast Area Manager

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

2101 NW Corporate Boulevard  
Suite 301  
Boca Raton, FL 33431

561 997-8070  
hazenandsawyer.com

July 28, 2015

Yan Yong, Ph.D.  
Interim Chair and Professor  
**Department of Civil, Environmental and Geomatics Engineering**  
Florida Atlantic University  
777 Glades Road, 36/231  
Boca Raton, FL 33431

**Florida Atlantic University**  
**Environmental Engineering Program**

Dear Dr. Yong:

This letter is to document our support for the Florida Atlantic University Department of Civil, Environmental and Geomatics Engineering and its plans for a Bachelor of Science degree program in Environmental Engineering. Environmental Engineering serves the technological needs of society, particularly with regard to clean air, safe drinking water, wastewater disposal, and management of solid and hazardous waste. Nationwide, we are suffering from a shortage of environmental engineers that possess a rigorous technical foundation and a top level liberal education. It is paramount that future environmental engineers be thoroughly prepared not only in mathematics and physics common to other engineering disciplines, but also in the important aspects of chemistry, microbiology, modeling, statistical analysis, simulation, planning, management, and climate change, which are highly desired by our industry. Without this preparation, our industry will find it difficult to adjust to the rapid advances in engineering as it pertains to sustainable infrastructure and the society needs.

South Florida has an abundance of needs and would greatly benefit from students with roots in the area that desire to be both educated and work nearby. It is rare that educational institutions have the opportunity to recruit and train individuals locally. Hazen and Sawyer is continuously seeking to retain well educated engineers with emphasis on environmental programs. Hence we would support this program.

A major benefit of having a local university is the proximity that this affords students with respect to remaining close to home. This is especially important as professionals start their careers since their support system is local. We have found that connections with the local community is always beneficial.

In closing, we are confident that a new undergraduate program in Environmental Engineering at Florida Atlantic University will make a valuable contribution by providing a sustainable workforce of highly trained engineers for our industry, and we strongly support the Department's efforts to making this happen as soon as possible. Please feel free to call should you have any questions. I can be reached at the above office number or on my cell phone at (954) 849-1616.

Very truly yours,  
**Hazen and Sawyer, P.C.**



Albert Muniz, P.E.  
Vice President



October 26, 2015

Dr. Yan Yong  
Interim Chair and Professor  
Department of Civil, Environmental and Geomatics Engineering  
Florida Atlantic University  
777 Glades Road, 36/231  
Boca Raton, FL 33431

Subject: FAU Bachelor of Science – Environmental Engineering Degree Program

Dear Dr. Yong:

This letter is to document CDM Smith's support for the Department of Civil, Environmental and Geomatics Engineering at Florida Atlantic University and its plans for a Bachelor of Science degree program in Environmental Engineering.

CDM Smith is an international engineering firm, including 10 offices in Florida and an office with over 50 employees in Boca Raton. We provide lasting and integrated solutions in water, environment, transportation, energy and facilities to public and private clients. As a full-service engineering and construction firm, we deliver exceptional client service, quality results and enduring value across the entire project life cycle. The firm is distinguished by our leadership and flexibility in design-build and alternative delivery approaches for environmental and infrastructure projects.

CDM Smith is always looking for talented and qualified graduates from Florida engineering programs to partner with us to meet new infrastructure engineering challenges for the Florida community, and beyond. In Florida, our environmental engineering practice is especially strong, focusing on water and wastewater, water resources, solid waste, and hazardous waste remediation engineering. We believe that in order to continue to maintain and grow our presence in this sector, it is vital to renourish our company with new scientists and engineers by offering excellent career opportunities.

BM109\_Letter





Dr. Yan Yong  
October 26, 2015  
Page 2

An FAU B.S. degree program in environmental engineering would be a great resource not only for students and the local community, but also for engineering firms such as CDM Smith. CDM Smith already has many FAU graduates working with us, and expect this trend to grow with the addition of a FAU B.S. degree program in environmental engineering. Therefore, we strongly support the Department's efforts to making this happen as soon as possible.

Sincerely,

A handwritten signature in blue ink, appearing to read "Kevin C. Leo".

Kevin C. Leo, P.E., BCEE  
Vice President  
CDM Smith Inc.

BM189\_Letter





TAMMY M. MARTIN, P.E.  
Engineering Manager, Water Americas  
2855 N. UNIVERSITY DRIVE, SUITE 210, CORAL SPRINGS, FL 33065  
+1 754-229-3055 | MARTINTM@BV.COM

11/9/2015

Yan Yong  
Interim Chair and Professor  
Department of Civil, Environmental and Geomatics Engineering  
Florida Atlantic University  
777 Glades Road, 36/231  
Boca Raton, FL 33431

Dear Dr. Yong,

This letter is to document our support for the Department of Civil, Environmental and Geomatics Engineering at Florida Atlantic University and its plans for a Bachelor of Science degree program in Environmental Engineering (BSEnvE). Environmental Engineering serves the technological needs of society, particularly with regard to clean air, safe drinking water, wastewater disposal, and management of solid and hazardous waste. Nationwide, we are suffering from a shortage of engineers that possess a rigorous technical foundation and a top level liberal education. It is especially important that future environmental engineers be thoroughly prepared not only in mathematics and physics common to other engineering disciplines, but also in the important aspects of chemistry, microbiology, modeling, statistical analysis, simulation, planning, management, and climate change, which are highly desired by our industry. Without this preparation, our industry will find it difficult to adjust to the rapid advances in engineering as it pertains to sustainable infrastructure and the society needs.

Black & Veatch is a leading global engineering, consulting and construction company. We specialize in these major markets:

- Energy
- Water
- Telecommunications
- Federal
- Management Consulting

Our employee-owned company has more than 100 offices worldwide and is among the *Forbes* "500 Largest Private Companies in the United States." We have been ranked by *Engineering News-Record* as the industry's No. 1 design firm in both Power and Telecommunications and are consistently in the Top 10 in Water. We're also leaders in more than 20 categories among design firms, contractors and environmental companies worldwide.

[www.bv.com](http://www.bv.com)



As local municipalities strive to manage an aging infrastructure, changing regulations, and an increased demand for reclaimed water and other alternative water supplies, the demand for environmental engineering professionals will increase and Black & Veatch will need qualified candidates. We look forward to the opportunity to consider Florida Atlantic University BSEnvE graduates for the future project needs of our offices.

In closing, we are confident that a new undergraduate program in Environmental Engineering at Florida Atlantic University will make a valuable contribution by providing a sustainable workforce of highly trained engineers for our industry, and we strongly support the Department's efforts to making this happen as soon as possible.

Very truly yours,  
BLACK & VEATCH

A handwritten signature in blue ink, appearing to read 'Tammy M. Martin'.

Tammy M. Martin, P.E.  
Engineering Manager

cc: Daniel E. Meeroff  
Lucas Botero  
Isabel C. Botero  
Rafael E. Frias

**APPENDIX G - FACULTY VITAE**

1. **Name** – Frederick Bloetscher, Ph.D., P.E., LEED-AP
2. **Education** – Ph.D. Civil Engineering, University of Miami, 2001
3. **Academic experience**
  - Florida Atlantic University, Associate Professor, 2011- present FT
  - Florida Atlantic University, Assistant Professor, 2005-2011, FT
  - Florida Atlantic University, Adjunct Professor, 2004-2005, PT
  - University of Miami, Adjunct Professor, 2001-2005, PT
4. **Non-academic experience**
  - Public Utility Management and Planning Services, Inc., President, a consulting firm dedicated to evaluation of water, sewer and storm water utility systems, 2000 – date FT/PT since 2005
  - Florida Government Utility Authority, Director of Engineering, Operations and Planning, Responsible for oversight of 5 utility systems totaling 25,000 customers in 6 Florida counties, 1999-2000, FT
  - City of Hollywood, FL, Deputy Public Utilities Director, Responsible for oversight of \$100 million capital improvement program, direct supervision of 27 professional employees in 176 person department, 1994-1999, FT
  - Collier County, Assistant Utilities Administrator, Responsible for strategic master planning, implementation of \$100 million capital improvement program , oversaw management and budgeting of Engineering, Water, Wastewater and Finance Departments, 1989-1994, FT
  - Town of Richlands, NC, Town Administrator/Director of Public Works, 1986-1989, FT
  - Town of Erwin, NC, Town Manager, 1985-1986, FT
  - City of Jacksonville, NC< Utilities Engineer, 1983-1985, FT
5. **Certifications or professional registrations**
  - Professional Engineer's License (North Carolina, Florida, South Carolina, Georgia, Utah, Colorado, Tennessee, Michigan and Ohio).
  - North Carolina General Contractor's License (Public Utilities - #22775)
  - Grade A Water Distribution System Certificate (North Carolina - #4138)
  - Grade B Water Plant Operator's Certificate (North Carolina - #4138)
  - Grade III Water Pollution Control Operator's Certificate (North Carolina - #8967)
  - Grade 4 Collection System Operator's Certificate (North Carolina - # 13150)
6. **Current membership in professional organizations** – American Water Works Association, American Society of Civil Engineers, Water Environment Federation, Florida Water Environment Association, American Society of Testing and Materials,
7. **Honors and awards**
  - Oasis Award – AWWA – 2014
  - NCEES Student Profession Partnership Grand Award 2012
  - Talon Faculty Award for Leadership – Florida Atlantic University, 2012
  - Volunteer of the Year Award, American Water Works Association (inaugural), 2011
  - Robert Claudy Award, Florida Section, American Water Works Association, 2011

- Best Paper Award – FSAWWA Annual Conference 2006, 2008, 2010
  - TIAA-CREF Award, Florida Atlantic University, 2010
  - MAC Council Best Chair Award (Chair of Technical Program FSAWWA conference), 2006
  - Fifth Annual Graduate Student Research and Creativity Forum – Engineering and Biomedical Division, University of Miami, 2001
8. **Service activities** (within and outside of the institution)
- College Graduate Committee (2013 – date), Math Committee (2005-2011), Library Committee (2005-date)
  - Faculty advisor to ASCE (2011-date)
  - Advisory Committee on Water Information (ACWI – advises the USGS, 2006 – date)
  - American Water Works Association (1989 to date)
  - Florida Section American Water Works Association (1989 to date)
  - South Florida Water Management District, Utility Advisory Committee, SFWMD (1994 to 1999, Chairman, 1997-1999, Vice Chairman, 1996); Reuse Subcommittee (Chairman, 1995 to 1997); LEC Peer Review Sub-committee, SFWMD (1997 to 1999); SFWMD Alternative Water Supply Grants Committee (1996 to 1999); Lower West Coast Water Supply Committee - SFWMD (1992 to 1994)
9. **Briefly list the most important publications and presentations from the past five years**
- Bloetscher, F. (2011), *Utility Management for Water and Wastewater Operators*, AWWA, Denver, CO.
  - Bloetscher, F. (2009), *Water Basics for Decision Makers: What Local Officials Need to Know about Water and Wastewater Systems*, America Water Works Association, Denver, CO.
  - Bloetscher, F.; Stambaugh, D., Hart, J., Cooper, J.; Kennedy, K.; Burack, L.S. Ruffini, A.P.; Cicala, A.; Cimenello, S. 2013. Use of Lime, Limestone And Kiln Dust To Resolve Saturation Issues With Reverse Osmosis Treated Wastewater For Injection, *Journal of Water Reuse and Desalination* doi:10.2166/wrd.2013.09
  - Pire-Schmidt, J.; Bloetscher, F.; Meeroff, D.M.; Carsey, T.; Stamates, J.; Sullivan, K.; and Proni, J.R. (2012). Farfield Modeling of the Boynton Inlet Plume, *Environmental Management and Sustainable Development*, 2012, Vol. 1, No. 2.
  - Bloetscher, F. (2012). Protecting People, Infrastructure, Economies, and Ecosystem Assets: Water Management and Adaptation in the Face of Climate Change, *Journal of Water*. doi:10.3390/w40x000x
10. **Briefly list the most recent professional development activities**
- Faculty Learning Community – Writing Enriched Curriculum
  - Presented at 8 conferences in 2013, 4 in 2012, 6 in 2011, 5 in 2010; Over 60 publications in non-peer conferences proceedings, non-peer journals since 2010.





1. **Name** – Daniel E. Meeroff, Ph.D., E.I.
2. **Education** – Ph.D. Civil Engineering, University of Miami, 2001
3. **Academic experience**
  - Florida Atlantic University, Associate Professor, Associate Chair, 2013-present, FT
  - Florida Atlantic University, Associate Professor, Director of the Laboratories for Engineered Environmental Solutions, 2008-Present, FT
  - Florida Atlantic University, Assistant Professor, Director of the Laboratories for Engineered Environmental Solutions, 2003-2008, FT
  - University of Miami, Adjunct Professor, Post-Doctoral Research Fellow, 2001-2003, FT
4. **Non-academic experience**
  - Montgomery Watson, Inc., Consultant, Developed and implemented a microbiological market survey to enumerate, classify, and determine cost data from laboratories in the United States that perform microbiological analyses on drinking water, 2000, PT
  - Florida Government Utility Authority, Operations Consultant, Prepared monthly and annual operations reports and Consumer Confidence Reports for 13 water and wastewater treatment utilities, 1999-2000, PT
  - Harbor Branch Oceanographic Institution, Laboratory Research Chemist, Performed GC/MS water quality analysis for solid waste leachate, surface water, and groundwater samples as part of the Semi-Volatile Organic Analysis division, 1993, FT
5. **Certifications or professional registrations** – State of Florida Board of Professional Engineers. Engineer Intern Certification (1100003721) received September 1998.
6. **Current membership in professional organizations** – American Society of Civil Engineers, Tau Beta Pi, Water Environment Federation, Florida Water Environment Association, American Society of Testing and Materials, American Water Works Association
7. **Honors and awards**
  - FAU Distinguished Teacher of the Year, 2014
  - The Engineers' Council John J. Guarrera Engineering Educator of the Year Award, 2014
  - Quality Matters eLearning Award Winner (EGN2095-Engineering Chemistry, 2013)
  - \$25,000 Grand Prize for the NCEES Engineering Award Connecting Professional Practice and Education
  - FAU Award for Excellence and Innovation in Undergraduate Teaching, 2011
  - Dean's Faculty Award, 2004
  - Florida Water Environment Association, Service Award, 2004, 2005, 2006, 2007
  - University of Miami Distinguished Scholar Award, 2001
  - University of Miami Outstanding Service Award, 1997, 1998
  - University of Miami Presidential Doctoral Research Fellowship, 1997, 1998
  - WEF Student Paper Competition, Masters Category, 1998
  - Florida Tech Faculty Honors Award, 1995
  - NCAA Division II National Soccer Champion, 1991
8. **Service activities** (within and outside of the institution)
  - Associate Chair of the Department

- College Undergraduate Committee, Chair and College Representative to UUPC
- ABET Task Force
- eLearning Steering Committee
- QEP Steering Committee
- College Policy and Development Committee, Member and Secretary
- College Research Committee, Member
- Faculty advisor to Tau Beta Pi and Florida Water Environment Association

**9. Briefly list the most important publications and presentations from the past five years**

D.E. Meeroff, F. Bloetscher, S.C. Long, and T. Bocca (2014). “The Use of Multiple Tracers to Evaluate the Impact of Sewered and Non-Sewered Development on Coastal Water Quality in a Rural Area of Florida.” *Water Environment Research*.

D.E. Meeroff (2013). “Environmental Engineering and Science Laboratory Manual, 1st edition,” Kendall Hunt Publishing Company. With Forward by David Cowan Jr. ISBN: 978-1-4652-2086-8.

D.E. Meeroff (2013). “Engineering Chemistry Laboratory Manual, 1st edition,” Kendall Hunt Publishing Company. ISBN: 978-1-4652-1599-4.

D.E. Meeroff, F. Bloetscher, D. V. Reddy, F. Gasnier, S. Jain, A. McBarnette and H. Hamaguchi (2012). “Application of photochemical technologies for treatment of landfill leachate,” *Journal of Hazardous Materials*, Volume 209–210, pp. 299–307.

D.E. Meeroff, F. Bloetscher, T. Bocca, and F. Morin (2008). “Evaluation of Water Quality Impacts of On-Site Treatment and Disposal Systems on Urban Coastal Waters.” *Water, Air, and Soil Pollution*. Volume 192, Number 1–4. pp. 11–24

**10. Briefly list the most recent professional development activities**

- Faculty Learning Community Co-Leader, “Criteria and Strategies for Student Success During Their Academic Careers and Beyond”
- Facilitator, “Faculty Learning Community for the QEP – Distinction Through Discovery”
- CEL3001 Quality Matters Course
- Blackboard Exemplary Course Catalyst Program
- Sloan-C Online Education Retention Strategies Teaching Certification
- CEL1001 eLearning Designer/Facilitator Certification Course
- 5th Annual Florida Statewide Symposium: Engagement in Undergraduate Research
- Writing Across the Curriculum Certification Training
- 25th Anniversary of the American Society of Filtration Annual Conference
- 3rd Annual Green Lodging Conference
- National Environmental Sustainability Summit

1. **Name** – Panagiotis D. Scarlatos, Dr.-Eng., P.E. (EU)
2. **Education** – Dr.-Eng. Civil Engineering, Aristotle University of Thessaloniki, Greece 1981
3. **Academic experience**
  - Florida Atlantic University, Professor, 2013-present
  - Florida Atlantic University, Professor & Department Chair, 2004-2013
  - Florida Atlantic University, Director of the Center for Intermodal Transportation Safety and Security, 2006-present
  - Florida Atlantic University, Professor, 1996-2004
  - Florida Atlantic University, Associate Professor, 1989-1996
  - Florida Atlantic University, Coordinator of the Civil Eng. Graduate Program, 1996-2001
  - Louisiana State University, Post-Dr. Research Associate, 1982-1985
  - Aristotle University of Thessaloniki, Greece, Assistant Engineer/Lecturer, 1975-1982
4. **Non-academic experience**
  - South Florida Water Management District, Staff Water Resources Engineer, Project manager of various projects (Kissimmee River, Lake Okeechobee, Caloosahatchee River), involved in computer simulations and data analysis for operational plans and management decisions, 1985-1989
  - Greek Railroad Organization (ΟΣΕ), Railroad Engineer, Involved in bridge construction and railroad track improvement projects, 1974-75
  - Greek Army, Corps of Engineers, 2<sup>nd</sup> Lieutenant, Supervisor of military construction projects
  - Consultant, Involved as expert witness in a variety of local, national and international cases of environmental and infrastructure related litigation. Invited as expert consultant in river training, major flood and mudslides cases in Venezuela, 1990-present
5. **Certifications or professional registrations** – Professional Civil Engineer, Greece (EU) Reg. No. 1298, 1972
6. **Current membership in professional organizations** – American Society of Civil Engineers
7. **Honors and awards**
  - Dean’s Faculty Award, College of Engineering, FAU, 2003
  - Teaching Incentive Program Award, College of Engineering, FAU, 1995
  - FEEDS Exceptional Professor Award, Nominated by the Division of Environmental Science and Engineering, HRS Palm Beach County, 1994
  - Fulbright Scholar Research Grantee, 1992
  - Outstanding Achievement and Performance Award, Florida Atlantic University, 1990
  - NATO Research Fellow, 1978-79
  - Merit Scholarship, Institute of National Scholarships, Greece, 1967-1969
8. **Service activities** (within and outside of the institution)
  - Department Undergraduate Committee member
  - Department Graduate Committee member
  - College Personnel Committee member
  - FAU QEP Steering Committee member
  - FAU Credentialing Committee member

- Pollution Prevention Coalition, Palm Beach County, member
- Transportation Research Board, University representative
- 2014 International Conference on Protection and Restoration of the Environment, Scientific Committee member
- Department of Civil, Environmental and Architectural Engineering, University of Miami, Industry Advisory Board member

**9. Briefly list the most important publications and presentations from the past five years**

P.D. Scarlatos and E. Kaisar (2009). "Simulation and Visualization Applications for Security Analysis of Infrastructure Facilities", 2009 EURO SIW, European Simulation Interoperability Workshop, Istanbul, Turkey.

P.D. Scarlatos, E. Kaisar and R. Teegavarapu (2009). "Modeling and Simulation of Catastrophic Events Affecting Critical Infrastructure Systems", 11<sup>th</sup> Int'l Conf. on Mathematical Methods and Computational Techniques in Electrical Engineering, Vouliagmeni, Greece.

E. Kaisar, S. Parr and P.D. Scarlatos (2010). "Traffic Simulation Modeling for Urban Chemical Disaster: Emergency Evacuation Development and Case Study", 8<sup>th</sup> LACCEI Annual Conference, Arequipa, Peru.

E. Kaisar, S. Parr and P.D. Scarlatos (2010). "An Urban Chemical Disaster Traffic Simulation Model: A Case Study for No-Notice Emergency Evacuation Development", 3rd Int'l Conference Urban Planning and Transportation, Corfu, Greece.

D.C. Hoffman and P.D. Scarlatos (2012). "Application of Artificial Neural Network for Prediction of Stable River Geometry" 11<sup>th</sup> International Conference on Protection and Restoration of the Environment, Thessaloniki, Greece.

**10. Briefly list the most recent professional development activities**

- eLearning Designer/Facilitator Certification, Center for eLearning, FAU, Aug. to Nov. 2013
- Academic Biosecurity Workshop, Federal Bureau of Investigations, FAU, 2013
- Co-Leader - Faculty Learning Community: Criteria and Strategies for Student Success during Their Academic Careers and Beyond, FAU, 2013-14
- Member - Faculty Learning Community: Getting the Wizard of Oz into the Undergraduate Curriculum, FAU, 2012-13
- Member - Faculty Learning Community: Teaching High Ability Students, FAU, 2011-12
- The American with Disabilities Act – "Keys to Employment Success", Office of Equal Opportunity Programs, Florida Atlantic University, April 5, 2011
- Member - Faculty Learning Community: Application of Problem Based Learning and Case Based Reasoning to Undergraduate Education, FAU, 2010-11
- Writing Across the Curriculum (WAC) Seminar, Florida Atlantic University, May 12-14, 2010

1. **Name** – Ramesh. S. V. Teegavarapu, Ph.D., P.E.
2. **Education** – Ph.D. Civil Engineering, University of Manitoba, 2000.
3. **Academic experience**
  - Florida Atlantic University, Associate Professor, 2012-present, FT.
  - Florida Atlantic University, Assistant Professor, 2006-2012, Director of the Hydrosystems Research Laboratory (HRL), 2009-present, FT.
  - University of Kentucky Adjunct Professor, 2004-2006.
  - University of Kentucky, Water Resources Research Institute, 2004-2006, FT.
  - University of Kentucky, Civil Engineering, Visiting Assistant Professor, 2001-2004, FT.
  - University of California, Davis, Research Engineer (Post-doctoral work), 2000-2001, FT.
4. **Non-academic experience**
  - Independent expert reviewer for South Florida Water Management District (SFWMD) on several projects.
  - Independent expert reviewer for South West Florida Water Management District (SFWMD) on several projects.
  - Consulting work for Hydrologic Modeling and geospatial analysis.
5. **Certifications or professional registrations** – Kentucky Board of Engineers and Land Surveyors (23112).
6. **Current membership in professional organizations** – Environmental and Water Resources Research Institute (EWRI), American Geophysical Union, IAHR Leadership Team Member, on Climate Change, Surface Water Hydrology Technical Committee (SWHTC) Member, EWRI-ASCE. Member of two Task Committees under SWHTC, ASCE, Hydrology Section, AGU, International Association of Hydrological Sciences (IAHS).
7. **Honors and awards**
  - International Peer Reviewer, Canada Foundation for Innovation, 2013.
  - National Recognition for USGS Project. One of the 9 projects (out of 189) at national level selected by United States Geological Survey (USGS). 2013.
  - Secretary, Surface Water Hydrology Technical Committee, American Society of Civil Engineers, 2012-2014.
  - National Science Foundation (NSF) GRFP Review Panel Member, Oceanic, Atmospheric and Geosciences, GRFP, 2011, 2012, 2013, 2014.
  - Reviewer, Natural Environment Research Council (NERC), United Kingdom, 2010-2011.
  - Outstanding Service as a Technical Program Co-Chair, Award, 2010, EWRI, ASCE.
  - Reviewer, NIWR-USGS National Competitive 104G Grants Program, 2010.
  - National Science Foundation (NSF) GRFP Review Panel Member, Geosciences, 2010.
  - Invited Speaker, Brain Korea 21 (BK21) Program, Seoul, South Korea, 2010.
  - EWRI Task Committee Excellence Award, ASCE-EWRI, 2009, Use and Application of Radar Rainfall Data Task Committee.
  - Excellence and Innovation in Undergraduate Teaching Award, University level award, Florida Atlantic University, 2009.
  - Teacher of the Year, College of Engineering and Computer Science, FAU, 2008.

- Nominated for Distinguished Teacher of the Year (DTOY) award from College of Engineering, one of the nine finalists, Florida Atlantic University, 2008.
  - Frontiers in Assessment Methods for the Environment (FAME) Grant, Association of Environmental Engineering and Science Professors (AEESP), USA, 2003.
  - Natural Sciences and Engineering Research Council (NSERC) Postdoctoral Fellowship, Canada, 2001.
8. **Service activities** (within and outside of the institution)
- Resource Committee Chair of the Department
  - College Graduate Committee, Member
  - Member of Civil Engineering Chair, Dean of Engineering search committees
  - Editorial board member of Hydroinformatics
  - Reviewer of over 50 International journals and 25 international conferences
  - Faculty advisor to ASCE student chapter (2008-2010)
9. **Briefly list the most important publications and presentations from the past five years**
- Ramesh S. V. Teegavarapu, Missing Precipitation Data Estimation using Optimal Proximity Metric-based Imputation, Nearest Neighbor Classification and Cluster-based Interpolation Methods, *Hydrological Sciences Journal*, 2013. DOI:10.1080/02626667.2013.862334.
  - Ramesh S. V. Teegavarapu, Climate Change-Sensitive Hydrologic Design under Uncertain Future Precipitation Extremes, *Water Resources Research*, 49(11), 7804-7814, 2013.
  - Ramesh S. V. Teegavarapu, Statistical Corrections of Spatially Interpolated Precipitation Estimates, *Hydrological processes*, 2013. DOI: 10.1002/hyp.9906.
  - Ramesh S. V. Teegavarapu, Andre Ferreira and S. P. Simonovic, Fuzzy Multi-Objective Models for Optimal Operation of a Hydropower System, *Water Resources Research*, 49, 1–14, doi:10.1002/wrcr.20224, 2013.
  - Ramesh S. V. Teegavarapu, Aneesh Goly and Jayantha Obeysekera, Influences of Atlantic Multi-Decadal Oscillation on Regional Precipitation Extremes, *Journal of Hydrology*, 495, 2013, 74–93.
  - Ramesh S. V. Teegavarapu, *Floods in Changing Climate: Extreme Precipitation*, Cambridge University Press, 2012.
- **Briefly list the most recent professional development activities**
- Faculty Learning Community Member, Technology Enhanced Learning, 2009-2010.
  - Co-Chair, Faculty Learning Community, Inquiry-based Learning, 2010-2011.
  - Faculty Learning Community Member, Assessment strategies for student learning, 2009-2010.

## Peng Yi

Assistant Professor  
Florida Atlantic University  
Department of Civil, Environmental and Geomatics Engineering  
777 Glades Road, EG 224  
Boca Raton, FL 33431  
[pyi@fau.edu](mailto:pyi@fau.edu) or [peng.yi@jhu.edu](mailto:peng.yi@jhu.edu)  
(561) 297-2808 (office)

### **Education**

*Johns Hopkins University, Department of Geography and Environmental Engineering*  
Ph.D., September 2008 to August 2013  
Advisor: Professor Kai Loon Chen  
Dissertation title: “Deposition and Remobilization of Carbon Nanotubes on Silica Surfaces and Model Cell Membranes”

### **Academic Experience**

*Florida Atlantic University, Department of Civil, Environmental and Geomatics Engineering*  
Assistant Professor, December 2014 to present

*The Connecticut Agricultural Experiment Station, Department of Environmental Sciences*  
Postdoctoral Research Scientist, December 2013 to December 2014

*Johns Hopkins University, Department of Geography and Environmental Engineering*  
Research Assistant, September 2008 to December 2013

### **Current Membership in Professional Organizations**

- American Chemical Society
- Association of Environmental Engineering and Science Professors

### **Honors and Awards**

- The C. Ellen Gonter Environmental Chemistry Award 2013 for outstanding research paper, the highest award given to students by the Division of Environmental Chemistry of the American Chemical Society
- Certificate of Merit Award 2010 for outstanding first-time oral presentations presented by the Division of Environmental Chemistry of the American Chemical Society

### **Reviewer for Scholarly Journals**

- Environmental Science & Technology
- Environmental Science & Technology Letters
- Geoderma
- Journal of Hydrology



## **Journal Publications**

1. **Yi, P.**, Pignatello, J. J., Uchimiya, M., and White, J. C., Heteroaggregation of Cerium Oxide Nanoparticles and Nanoparticles of Pyrolyzed Biomass, *Environmental Science and Technology*, 2015, accepted.
2. Speed, D., Westerhoff, P., Sierra-Alvarez, R., Draper, R., Pantano, P., Aravamudhan, S., Chen, K. L., Hristovski, K., Herckes, P., Bi, X., Yang, Y., Zeng, C., Otero-Gonzalez, L., Mikoryak, C., Wilson, B. A., Kosaraju, K., Tarannum, M., Crawford, S., **Yi, P.**, Liu, X., Babu, S. V., Moinpour, M., Ranville, J., Montano, M., Corredor, C., Posner, J., and Shadman, F., Physical, Chemical, and *In Vitro* Toxicological Characterization of Nanoparticles in Chemical Mechanical Planarization Suspensions Used in the Semiconductor Industry: Towards Environmental Health and Safety Assessments, *Environmental Science: Nano*, 2015, 2, 227–244.
3. **Yi, P.** and Chen, K. L., Release Kinetics of Multiwalled Carbon Nanotubes Deposited on Silica Surfaces: Quartz Crystal Microbalance with Dissipation (QCM-D) Measurements and Modeling, *Environmental Science and Technology*, 2014, 48, 4406–4413.
4. **Yi, P.** and Chen, K. L., Influence of Solution Chemistry on the Release of Multiwalled Carbon Nanotubes from Silica Surfaces, *Environmental Science and Technology*, 2013, 47, 12211–12218.
5. Tang, L., Gu, W., **Yi, P.**, Bitter, J. L., Hong, J. Y., Fairbrother, D. H., and Chen, K. L., Bacterial Anti-Adhesive Properties of Polysulfone Membranes Modified with Polyelectrolyte Multilayers, *Journal of Membrane Science*, 2013, 446, 201–211.
6. **Yi, P.** and Chen, K. L., Interaction of Multiwalled Carbon Nanotubes with Supported Lipid Bilayers and Vesicles as Model Biological Membranes, *Environmental Science and Technology*, 2013, 47, 5711–5719.
7. **Yi, P.** and Chen, K. L., Influence of Surface Oxidation on the Aggregation and Deposition Kinetics of Multiwalled Carbon Nanotubes in Monovalent and Divalent Electrolytes, *Langmuir*, 2011, 27, 3588–3599.
8. Xiao, F., **Yi, P.**, Pan, X., Zhang, B., and Lee, C., Comparative Study of the Effects of Experimental Variables on Growth Rates of Aluminum and Iron Hydroxide Floccs during Coagulation and Their Structural Characteristics, *Desalination*, 2010, 250, 902–907.
9. Xiao, F., Zhang, B., Ma, J., **Yi, P.**, and Cui, C., Effects of Low Temperature on Floc Fractal Dimensions and Shape Factors during Alum Coagulation, *Journal of Water Supply: Research and Technology-AQUA*, 2009, 58.1, 21–27.
10. Xiao, F., Ma, J., **Yi, P.**, and Huang, J. H., Effects of Low Temperature on Coagulation of Kaolinite Suspensions, *Water Research*, 2008, 42, 2983–2992.

## **Invited Talks**

1. Release of Multiwalled Carbon Nanotubes from Silica Surfaces, Semiconductor Research Corporation Engineering Research Center for Environmentally Benign Semiconductor Manufacturing TeleSeminar, October 17, 2013.
2. Reversibility of Multiwalled Carbon Nanotube Deposition on Silica Surfaces: A QCM-D Study, American Chemical Society 246<sup>th</sup> National Meeting, September 8–12, 2013, Indianapolis, Indiana.
3. Interaction of Multiwalled Carbon Nanotubes with Model Cell Membranes: A QCM-D Study, Semiconductor Research Corporation Engineering Research Center for Environmentally Benign Semiconductor Manufacturing TeleSeminar, November 1, 2012.

**APPENDIX H - LETTERS OF SUPPORT FROM FAU DEPARTMENTS**

Subject: FW: BS Environmental Engineering New Courses

 [Attachments...](#)

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From: Charles Roberts  
Sent: Wednesday, October 08, 2014 12:34 PM  
To: Dan Meeroff  
Subject: RE: BS Environmental Engineering New Courses

The Department of Geoscience does not see a conflict with these courses, and supports their addition to the Engineering degree program.

Dr. Charles Roberts  
Interim Chair, Department of Geosciences and  
Associate Dean of Graduate Studies  
Charles E Schmidt College of Science  
Florida Atlantic University

From: Colin Polsky  
Sent: Wednesday, October 08, 2014 9:37 AM  
To: Charles Roberts  
Subject: RE: PhD students for spring?

-----Original Message-----

From: Dan Meeroff  
Sent: Tuesday, October 07, 2014 11:15 AM  
To: Charles Roberts  
Subject: BS Environmental Engineering New Courses

Dear Charles:

The Department of Civil, Environmental & Geomatics Engineering is proposing a new BS degree program in Environmental Engineering.

The new courses we are proposing are the following:

- Sustainability and Pollution Prevention (ENV4072)
- Air Pollution and Control Systems (ENV4112)
- Solid and Hazardous Waste and Site Remediation (ENV4341)
- Environmental Fate and Transport (ENV4053)

Please reply if these are ok with you.

--

Daniel E. Meeroff, Ph.D.  
Associate Chair and Professor  
Department of Civil, Environmental & Geomatics Engineering Florida Atlantic University  
777 Glades Road, Building 36, Room 206  
Boca Raton, FL 33431-0991  
Tel.(561) 297-3099

## RE: Question

Aimee Arias

**Sent:** Friday, December 12, 2014 11:22 AM

**To:** Dan Meeroff

**Attachments:**  [INR 4350 SylGEPP-Spq2015-ES.doc \(55 KB\)](#) [Open as Web Page]

Hi Dan,

We typically offer the course once a year. We also offer a U.S. Environmental Politics course that should be included in the catalog by the end of the year. I would not object to including them as electives in your program. I have attached a copy of the syllabus for the course being offered in spring 2015, as I think you would be the best judge of whether or not the course would be a good fit for engineers.

Best,  
Aimee

Aimee Kanner Arias, Ph.D.  
Associate Professor and Chair  
Department of Political Science  
Florida Atlantic University  
777 Glades Road, SO 392A  
Boca Raton, FL 33431  
561-297-3210  
akanner2@fau.edu

-----Original Message-----

From: Dan Meeroff

Sent: Thursday, December 11, 2014 1:59 PM

To: Aimee Arias

Subject: Question

Dear Dr. Kanner:

I talked with Clifford Brown today, and he mentioned that I should touch base with you.

I wanted to include the following courses as possible technical electives for our proposed new environmental engineering bachelors degree program.

INR 4350 Global Environmental Politics and Policies

Do you think these courses would be a good fit for engineers?

How often are they offered? Would you object to including them as electives in our program?

Dan

--

**RE: Question**

Michael Harris

**Sent:** Friday, December 12, 2014 11:40 AM

**To:** Dan Meeroff

Hi Dan,

Shouldn't be a problem. ANT 4463 is taught every fall. PHI 3640 is taught less regularly, but we are putting together another course in Environmental Philosophy that we are test running this spring and we will likely submit new course paperwork for it early in the semester.

Best, Mike

Michael S. Harris  
Chair, Department of Anthropology  
mharris@fau.edu  
561-297-3230  
Interim Chair, Department of Philosophy  
561-297-3868

-----Original Message-----

**From:** Dan Meeroff  
**Sent:** Thursday, December 11, 2014 1:57 PM  
**To:** Michael Harris  
**Subject:** Question

Dear Dr. Harris:

I talked with Clifford Brown today, and he mentioned that I should touch base with you.

I wanted to include the following courses as possible technical electives for our proposed new environmental engineering bachelors degree program.

ANT 4463 Environment and Disease

PHI 3640 Environmental Ethics

Do you think these courses would be a good fit for engineers? How often are they offered? Would you object to including them as electives in our program?

Dan

--

Daniel E. Meeroff, Ph.D.  
Associate Chair and Professor  
Department of Civil, Environmental & Geomatics Engineering  
Florida Atlantic University  
777 Glades Road, Building 36, Room 206  
Boca Raton, FL 33431-0991  
Tel. (561) 297-3099

**Re: Question**

Jesse Saginor

**Sent:** Friday, December 12, 2014 4:45 PM**To:** Dan Meeroff

Dan-

Good to hear from you again. We met a while back at some university event...I think the graduate student organization event or something else over in the Union.

Let me double-check a few things and get back to you by Tuesday next week. I don't foresee any issues, although there are some semesters when URP4420 is not taught. I think it has already been cancelled for next semester and it may not be taught again until 2016 at the earliest. The only issue I see with Sustainable Cities would be the fact that it's a core class, but there are more than enough seats any semester it is taught. Again, let me get back to you by early next week with definitive answers. Thanks for inquiring.

Best,  
Jesse

Sent from my iPhone

> On Dec 12, 2014, at 4:28 PM, Dan Meeroff <dmeeroff@fau.edu>  
wrote:

>

> Dear Dr. Saginor:

> I talked with Ellen Ryan today, and she mentioned that I should touch base with you. I wanted to include the following courses as potential technical electives for our proposed environmental engineering bachelors degree program:

> URP 2051            Designing the City

> URP 4403            Sustainable Cities

> URP 4420            Environmental Planning Methods

> Do you think these courses would be a good fit for engineers? How often are they offered? Would you object to including them as electives in our program?

>

> Happy holidays!

> Dan

> --

> Daniel E. Meeroff, Ph.D.

> Associate Chair and Professor

> Department of Civil, Environmental & Geomatics Engineering

> Florida Atlantic University

> 777 Glades Road, Building 36, Room 206

> Boca Raton, FL 33431-0991

> Tel. (561) 297-3099

<b>Approved by:</b> Department Chair: _____ College Curriculum Chair: _____ College Dean: _____ UUPC Chair: _____ Undergraduate Studies Dean: _____ UFS President: _____ Provost: _____	<b>Date:</b> 10/02/15 10/02/2015 10/10/2015 _____ _____ _____ _____
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Re: AP&BC -- FW: Final revision of Environmental Engineering BS new program

RN

Ronald Nyhan

Reply all |  
Fri 11/13/2015 10:50 AM  
To:

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Fri 11/13/2015 10:50 AM

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[Attachment.pdf64 KB](#)

Arcadia

A majority of APBC members approve the new degree. I believe the next step is to place it on the Steering Agenda.

Ron

Sent from my iPhone

On Nov 13, 2015, at 8:20 AM, Ronald Nyhan <[rcnyhan@fau.edu](mailto:rcnyhan@fau.edu)> wrote:

Greetings:



I hope you have all been able to review the request for the new Environmental Engineering BS program. Please indicate your willingness to vote by e-mail and your decision on recommending the new degree. There is a time crunch (as always). Please respond by Monday. Any problems, questions please contact me.

Thanks,

Ron

**From:** Arcadia Betancourt

**Sent:** Tuesday, November 10, 2015 9:17 AM

**To:** Frederick Hoffman <[HOFFMAN@fau.edu](mailto:HOFFMAN@fau.edu)>; Michael Harris <[mharris@fau.edu](mailto:mharris@fau.edu)>; Jerome Haky <[hakyj@fau.edu](mailto:hakyj@fau.edu)>; Rose Sherman <[rsherman@fau.edu](mailto:rsherman@fau.edu)>; James Kumi-Diaka <[jdiaka@fau.edu](mailto:jdiaka@fau.edu)>; Anita Pennathur <[PENNATHU@fau.edu](mailto:PENNATHU@fau.edu)>; Gary Perry <[perryg@fau.edu](mailto:perryg@fau.edu)>; Dorothy Russell <[DRUSS@fau.edu](mailto:DRUSS@fau.edu)>; Christopher Beetle <[cbeetle@fau.edu](mailto:cbeetle@fau.edu)>

**Cc:** Ronald Nyhan <[rcnyhan@fau.edu](mailto:rcnyhan@fau.edu)>

**Subject:** AP&BC -- FW: Final revision of Environmental Engineering BS new program

Good morning,

Please see the message below from your Chair, Ron Nyhan. Please let me know if you have any questions. Thank you.

Best,  
Arcadia

*Arcadia Betancourt*

Administrative Staff Assistant  
Office of the Provost  
777 Glades Road, Admin. 309  
Boca Raton, FL 33431  
Tel. (561) 297-4747  
Email: [abetancourt@fau.edu](mailto:abetancourt@fau.edu)

All:

The attached proposal for a new bachelor degree has been approved by the Provost and UUGC. By regulation it needs approval by Academic Planning and Budget Committee. Our primary responsibility is to ensure that the proposal is viable financially, i.e. the costs will have a minimum impact on the University. The proposal has that language.

Therefore, if there are no objections I would propose an e-mail vote due to the short time frame. How say you all.

Ron

Begin forwarded message:

**From:** Yan Yong <[yongy@fau.edu](mailto:yongy@fau.edu)>  
**Date:** November 6, 2015 at 3:19:48 PM EST  
**To:** Ronald Nyhan <[rcnyhan@fau.edu](mailto:rcnyhan@fau.edu)>  
**Cc:** Dan Meeroff <[dmeeroff@fau.edu](mailto:dmeeroff@fau.edu)>, Maria Jennings <[mjenning@fau.edu](mailto:mjenning@fau.edu)>  
**Subject:** FW: Final revision of Environmental Engineering BS new program

Dear Ron,

Thank you very much for agreeing to expedite the approval of the attached new degree proposal by the Academic Planning and Budget Committee. As we plan to start the new degree program from fall 2016 and the proposal needs to go through a lengthy approval process from BOT and BOG, I will appreciate it if your committee can make its decision within a week so that Maria Jennings can include this proposal in the agenda of the November Steering meeting.

Please contact me or Dan Meeroff if you have any questions about this new program.

Many thanks,

Yan

*Yan Yong*  
Chair and Professor  
Department of Civil, Environmental & Geomatics Engineering  
Florida Atlantic University  
Office: (561)297-3445

**proved by:**

**Date:**

Department Chair: \_\_\_\_\_

College Curriculum Chair: \_\_\_\_\_

College Dean: \_\_\_\_\_

UUPC Chair: \_\_\_\_\_

Undergraduate Studies Dean: \_\_\_\_\_

UFS President: \_\_\_\_\_

Provost: \_\_\_\_\_

10/30/2015

10/31/2015

11/2/15

11/16/15