



UNC CHARLOTTE

The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

April 30, 2003

Office of the Chancellor
Telephone: 704/687-2201
Facsimile: 704/687-3219

Dr. Gretchen Bataille
Senior Vice President for Academic Affairs
Office of the President
University of North Carolina
Post Office Box 2688
Chapel Hill, North Carolina 27515-2688

Dear Dr. Bataille:


Enclosed is our request for authorization to establish a Ph.D. program in Infrastructure and Environmental Systems.

UNC Charlotte has assembled a corps of researchers who are working in the science, design, and management of infrastructure and the environmental systems that are affected by infrastructure. The proposed program will be interdisciplinary, with participation by faculty from the Departments of Civil Engineering, Geography and Earth Sciences, Economics, Chemistry, and Biology, and the College of Architecture.

Rapidly growing regions face challenges related to the development of infrastructure to support growth and the impact of infrastructure on the environment. An innovative, interdisciplinary approach is necessary to finding optimal solutions to these infrastructure and environmental challenges. The proposed program's research activity and its development of intellectual capital applied to these challenges will facilitate continued economic growth.

Thank you for your consideration of this request. Interim Provost Wayne Walcott or I would be pleased to respond to any questions that you may have regarding this request.

Sincerely yours,


J. H. Woodward
Chancellor

Enclosures (5 copies of request for authorization to establish)

cc: Interim Provost Wayne A. Walcott
Dr. Robert E. Johnson
Mr. Kenneth A. Lambla
Dr. Schley R. Lyons
Dr. Thomas Reynolds

The University of North Carolina at Charlotte

**Doctor of Philosophy in
Infrastructure and Environmental
Systems**

**Request for Authorization
to Establish**

THE UNIVERSITY OF NORTH CAROLINA

Request for Authorization to Establish a New Degree Program

Ph.D. in Infrastructure and Environmental Systems

Date: April 28, 2003

Constituent Institution: The University of North Carolina at Charlotte

CIP Discipline Specialty Title: Multi/Interdisciplinary Studies, Other

CIP Discipline Specialty Number: 30.9999 Level: B M 1st Prof D

Exact Title of Proposed Program: Ph.D. in Infrastructure and Environmental Systems

Exact Degree Abbreviation (e.g. B.S., B.A., M.A., M.S., Ed.D., Ph.D.): Ph.D.

Does the proposed program constitute a substantive change as defined by SACS? Yes No

a) Is it at a more advanced level than those previously authorized? Yes No

b) Is the proposed program in a new discipline division? Yes No

Proposed date to establish degree program (allow at least 3-6 months for proposal review):

month January year 2004

Do you plan to offer the proposed program away from campus *during the first year of operation*?

Yes No

If so, complete the form to be used to request establishment of a distance learning program and submit it along with this request.

TABLE OF CONTENTS

Request for Authorization To Implement Ph.D. in Infrastructure and Environmental Systems

	<u>Page</u>
Executive Summary	3
I. Description of the Program	6
II. Justification for the Program	12
III. Program Requirements and Curriculum	25
IV. Faculty	38
V. Library	41
VI. Facilities and Equipment	43
VII. Administration	47
VIII. Accreditation	53
IX. Other Supporting Fields	53
X. Additional Information	54
XI. Budget	54
XII. Evaluation Plan	54
XIII. Reporting Requirements	59
XIV. Starting Date and Institutional Approval	59
Appendix I: Consultant's Report	
Appendix II: Curriculum Vitae for INES Faculty	
Appendix III: Internal Letters of Support	
Appendix IV: External Letters of Support	
Appendix V: Budget Information	
Appendix VI: Program Catalogue Copy	

Executive Summary

Overview

Growing, urbanized regions face complex challenges related to the infrastructure needed to support the regions' economic and social development and related to the interplay between the infrastructure and the environment. Finding solutions to these challenges require an innovative approach that considers three aspects -- design, science, and management -- of solutions and that promotes an understanding of the interdependency of the three. These considerations and understandings are best obtained at the global, systems level. The proposed Ph.D. program in Infrastructure and Environmental Systems (INES) provides advanced interdisciplinary studies of the relationship between infrastructure and the environment and the relationship between design, science, and management. It is through this interdisciplinary, systems-based approach that we will arrive at optimal solutions to infrastructure and environmental challenges.

Most Ph.D. programs address a single discipline or a group of disciplines with a primary focus on science, design, or management. Students could develop an interdisciplinary plan of study, but in most cases such is not the purpose of the program. The proposed INES Program will engage students in intensive interdisciplinary study and research. The interdisciplinary nature of the program, with an emphasis on infrastructure and environmental systems in the core curriculum, will inherently educate students about the complex relationships between the infrastructure and environment. As a part of the process, the program core curriculum will also bring together design, science, and management aspects of problems and solutions. Such an approach will allow students to develop, superior solutions as they focus on specific areas of interest following completion of the core curriculum. Robert A. Frosch, a senior research fellow at the Center for Science and International Affairs at Harvard and former National Academy of Engineering senior fellow, sums up the enormity of the approaching demand for highly educated professionals.

“How can we refurbish our older cities without undue disruption? How can we design and build or somehow assemble the equivalent of eight 10-million-person cities a year for the next five decades? How can we site such cities, or have them grow, without damaging the environmental systems that are needed to sustain them? These are challenges of great magnitude. Addressing them will require massive invention and innovation, and different and cheaper techniques, if we have any hope of paying for what we design.” (The Bridge, National Academy of Engineering 29(1), Spring 1999).

Further testament to this challenge is the American Society of Civil Engineers' 2001 estimate that the United States would need \$1.3 trillion invested in infrastructure development and repair over the subsequent five years. These challenges must be addressed through innovative, interdisciplinary approaches.

Program Objectives

The graduates of the INES program will have an understanding of complex, interdisciplinary infrastructure and environmental systems and make significant contributions to the advancement of knowledge of those systems. The educational objectives designed to achieve these goals are:

- to provide students with educational opportunities in science, engineering, and management, culminating in an interdisciplinary research-based Ph.D. in Infrastructure and Environmental Systems;
- to prepare students for careers as doctoral-level research scientists, engineers, and resource and systems managers who will lead in developing the next generation of infrastructure and environmental technology;
- to involve students in the support and expansion of the base of research in rapidly growing fields related to infrastructure and environmental systems in the Charlotte region, North Carolina, and across the nation and world;
- to enhance the educational experience in science and engineering for all students, graduate and undergraduate, at UNC Charlotte; and
- to expand the educational experience of students by participating in the activities of interdisciplinary institutes at UNC Charlotte such as the Global Institute for Environmental and Energy Systems (GIEES), the Center for Transportation Policy Studies, and the UNC Charlotte Urban Institute.

Program Resources

The program will involve faculty from several academic units: Civil Engineering, Geography and Earth Sciences, Economics, Chemistry, Biology, and Architecture. A total of 46 faculty members from these departments have agreed to be directly involved with the program. These faculty members are already involved in research that addresses infrastructure and environmental issues, and they have been actively directing master's students. For example, UNC Charlotte's Global Institute for Energy and Environmental Systems is constructed to address many of these very issues. Other research programs are supported by the University's Biotechnology Lab, the Regional Analytical Chemistry Lab, the Polymer Chemistry Lab, and the Geoenvironmental and Energy System Laboratories. These research programs will be supported and enhanced by the proposed Ph.D. program.

While the program will be supported with the addition of five faculty in the first three years and the addition of facilities to house more faculty, students, and labs, current facilities are sufficient and faculty in the appropriate disciplines are well able to initiate the program.

Two primary pools of prospective students will be 1) graduates of institutions in the state, nation, and other countries and 2) industry professionals from the region. The participating departments offer master's degree programs that also will be a source of some students. Specifically, the master's programs in Civil Engineering, Geography, and Earth Sciences will give the proper background for students to enter the Ph.D. in INES.

The INES program will enjoy a strong relationship with the interdisciplinary Ph.D. programs in Biology and Public Policy, with opportunities for students to take courses in those programs. These programs also contribute to UNC Charlotte's track record of successfully implementing interdisciplinary Ph.D. programs. UNC Charlotte's careful planning has focused on the development of interdisciplinary programs. It is that strategic planning process out of which emerged the proposed INES Program.

Related Programs in North Carolina

Other Ph.D. programs in North Carolina complement, but do not duplicate, the proposed program. These related programs are UNC Chapel Hill's Ph.D. program in environmental sciences and engineering; NC State's Ph.D. program emphasis in water resources and environmental engineering through the Department of Civil Engineering and Ph.D. programs in marine science, atmospheric science, and earth sciences; and Duke University's Ph.D. programs in civil and environmental engineering, ecosystems science, ecology, geochemistry, and climatology. These programs are focused largely on specific disciplines and generally lack the interdisciplinary core of the proposed INES Program.

Student Demand and Projected Enrollments

In light of the dramatic infrastructure development and repair needs and the attendant concerns for the affected environmental systems, graduates will be in demand. Dr. Thomas Theis, a member of the U.S. Environmental Protection Agency Science Advisory Board, former Director of Clarkson University's Center for Environmental Management, and current Director of the University of Illinois-Chicago's Environmental Science and Policy Institute, served as an external consultant in the INES Program's planning. Dr. Theis states

“The graduates of the program will find a ready job market in industry and government (particularly at the federal level), and eventually in academia as this approach becomes more widespread.”

The program is projected to start with four full-time and two part-time students, and it is projected to grow to 16 full-time and four part-time students within four years.

Enrollment Projections in INES Ph.D. Program at UNC Charlotte

Students	Year 1 (2004-2005)	Year 2 (2005-2006)	Year 3 (2006-2007)	Year 4 (2007-2008)
Full-time	4	9	12	16
Part-time	2	3	4	4
TOTALS	6	12	16	20

I. Description of the Program

I.A. Proposed program

I.A.1. Nature of the program

The proposed Ph.D. program in Infrastructure and Environmental Systems (INES) intertwines aspects from three traditional areas of study (design, science, and management) to create a coherent, interdisciplinary program for advanced studies. An additional interplay develops inherently between infrastructure and environmental studies as the design (primarily infrastructure) and science (primarily environmental) areas are interwoven by the Program. Such innovative efforts in doctoral education are rapidly gaining acceptance, as indicated Dr. Thomas Theis (the external consultant on this proposal), who notes in his report (Appendix I) that:

“The National Science Foundation has made it clear for several years that it is interested in advancing new and alternate models of education, including doctoral education.”

(At the time, Dr. Theis, a member of the Science Advisory Board of the U.S. Environmental Protection Agency, served as the Director of the Center for Environmental Management at Clarkson University. He now serves as the Director of the Environmental Science and Policy Institute at the University of Illinois, Chicago).

A growing urbanized region is faced with complex problems related to the environment and the infrastructure. In most urbanized regions, the science, design, and management aspects of infrastructure and environmental operations are treated as separate areas. For example, many government and engineering offices are separated first along the lines of infrastructure and environmental operations and then subdivided into design, science, and management areas. As shown in Figure 1, the INES Ph.D. Program will allow students to cross the boundaries that separate these areas and operations and understand their inter-relationships.

While most Ph.D. programs focus on one discipline or suites of disciplines within the areas mentioned above, the proposed INES Program seeks to engage students in intensive research within an interdisciplinary context. This approach enables students to appreciate, extract, and integrate techniques from the management, science and design dimensions of the issues they study to then develop optimal solutions. Thus, the program will be attractive to students looking to expand their disciplinary knowledge to an understanding of the infrastructure and the environment as inter-related systems. For example, engineering students will understand causes and effects through studies of the physical sciences, and physical science students will understand how to control effects through the application of basic engineering principles. All students will be exposed to management principles relevant to urban infrastructure and environmental issues.

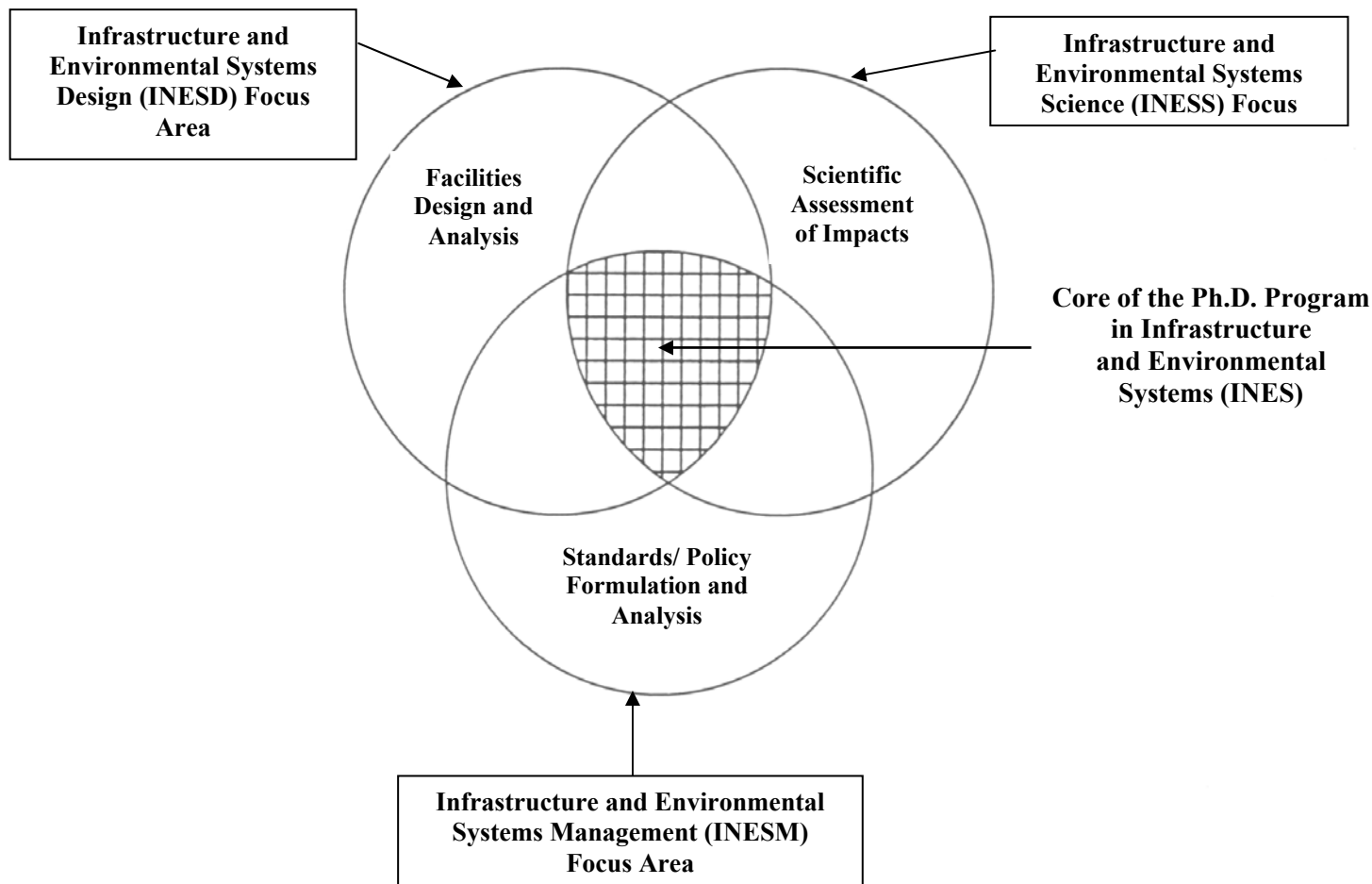


Figure 1. The nature of the proposed Ph.D. program in Infrastructure and Environmental Systems (INES)

I.A.2. Scope of the program

The program provides an integrated and interdisciplinary approach as the only way to successfully prepare students to critically explore and improve infrastructure and environmental systems of the future. The degree requirements comprise a set of INES core courses, INES case studies, an INES seminar series, a set of elective (focus area) courses, opportunities for directed studies, and a dissertation/research requirement. The INES core courses, INES case studies, and INES seminar series are required of all students and tie the program together across disciplines and focus areas. A student and his/her advisory/doctoral committee will then select elective courses that match the student's interest and support the student's doctoral dissertation research.

The target of the INES core is to provide the INES doctoral students, from a diversity of disciplinary backgrounds, with advanced, systems-level understanding of infrastructure and environment systems analysis, development, and management. The core addresses the body of knowledge required of all students in the program and is described later in this proposal. The

goal of the INES focus area elective courses, all of which are offered by collaborating academic departments, is to provide an opportunity for students, their advisers, and the doctoral program committee to select a complementary set of specialized courses around the student's dissertation topic. These courses will enhance students' knowledge in the central core issues as that knowledge is expanded in the direction of students' particular interests.

Each student will focus on a dissertation topic that is nested in one of the components (focus areas) of the program, and will take a number of advanced courses that support that research. These courses may also be categorized under the other two intersecting focus areas of the program. The suite of courses that constitute a focus area is drawn from a variety of regular academic departments, but each course shares the common theme (design, science, or management) of that area. Admitted students can come from any of the diverse set of disciplines that are critical to advanced research on INES. As in almost any Ph.D. program, the academic background, interests, and opportunity of each student will determine the focus of research work within the continuum of possibilities that lie within or surround the core INES program, i.e., design, science, and management.

I.A.3. Intended audience of the program

Robert A. Frosch, a senior research fellow at the Center for Science and International Affairs at Harvard and former National Academy of Engineering (N.A.E.) senior fellow, sums up the enormity of the approaching demand for highly educated professionals.

“How can we refurbish our older cities without undue disruption? How can we design and build or somehow assemble the equivalent of eight 10-million-person cities a year for the next five decades? How can we site such cities, or have them grow, without damaging the environmental systems that are needed to sustain them? These are challenges of great magnitude. Addressing them will require massive invention and innovation, and different and cheaper techniques, if we have any hope of paying for what we design.” (The Bridge, National Academy of Engineering 29(1), Spring 1999).

The diffusion of infrastructure and environmental considerations into virtually all spheres of human endeavor, the increasing population, and the growing urbanization within and outside the United States will provide a multitude of career opportunities for the graduates of the proposed program.

Based on these emerging needs and opportunities, two groups are expected to provide the majority of the students in the proposed program:

- master's graduates in scientific and engineering fields who wish to expand their existing knowledge base with direct application to infrastructure and environmental issues allowing them to pursue work force positions as researchers, analysts, advisers, and managers; and

- science, engineering, and management professionals who seek to intensify their knowledge in their respective areas and then to broaden their understanding of other applications, in order to better prepare themselves for career positions.

Within these two groups, the INES Ph.D. Program will attract students who are interested in addressing the problems and opportunities described by Dr. Frosch. It is expected that most of these students will have primarily scientific and technological backgrounds. However, the Program is intended to appeal to students' interests and to meet emerging professional workforce needs that are not immediately satisfied by most current Ph.D. programs in the sciences and engineering. These interests and needs include:

- an ability to apply scientific and engineering knowledge to both local and global problems concerned with the infrastructure and the environment, with an understanding of the broader impacts of these systems on society;
- an ability to apply knowledge and understanding to the infrastructure and environmental problems facing urban areas;
- a future as a highly educated professional having a strong interdisciplinary background and working in a variety of settings, including private, public, governmental, and academic agencies and institutions;
- an understanding of the development, operation and maintenance of infrastructure systems such as energy facilities, transportation facilities, manufacturing and chemical facilities, municipal facilities, building systems, and agricultural operations and the inter-relationship with the earth's environmental systems such as wetlands, lakes, air, soil and groundwater systems.

It is expected that a large number of students and professionals will enter the program because of the many infrastructure and environmental challenges currently facing U.S. urban regions. As complex bio-socio machines, "biosomas," cities are attractive to students because they require balancing several sets of knowledge in an attempt to create environmentally sustainable, functional, and emotionally satisfying urban systems. UNC Charlotte is located in a 'living lab' (Charlotte) that is ideally suited to serve as a natural laboratory for intensive studies of the relationship between infrastructure development and environmental quality in a rapidly growing urban setting.

I.B. Educational objectives of the program

Faculty members composing the INES Ph.D. Program share a vision of preparing INES graduates who understand complex, interdisciplinary infrastructure and environmental systems and who make significant contributions to the advancement of knowledge of those systems. These faculty members realize that much of the current INES body of knowledge independently describes the assessment and design of components and the management of their assemblages. In many classes and laboratories, little attention is given to the interrelationships among the components, of the economic and societal impact by and upon these systems, and of society's management of these systems through laws, policies, and regulations.

In response to the vision described above, the INES Ph.D. Program supports the educational objectives described below.

- to provide students with educational opportunities in science, engineering, and management, culminating in an interdisciplinary research-based Ph.D. in Infrastructure and Environmental Systems;
- to prepare students for careers as doctoral-level research scientists, engineers, and resource and systems managers who will lead in developing the next generation of infrastructure and environmental technology;
- to involve students in the support and expansion of the base of research in rapidly growing fields related to infrastructure and environmental systems in the Charlotte region, North Carolina, and across the nation and world;
- to enhance the educational experience in science and engineering for all students, graduate and undergraduate, at UNC Charlotte; and
- to expand the educational experience of students by participating in the activities of interdisciplinary institutes at UNC Charlotte such as the Global Institute for Environmental and Energy Systems (G IEES), the Center for Transportation Policy Studies, and the UNC Charlotte Urban Institute.

I.C. The relationship of the proposed program to other programs currently offered at UNC Charlotte

The initial success of the INES Ph.D. Program will depend on the use of existing courses, participation of current faculty members, and utilization of existing laboratories, space, and resources, all currently located in programs at UNC Charlotte. This program will be interdisciplinary and will involve instructors and researchers from several academic units: Civil Engineering, Geography and Earth Sciences, Economics, Chemistry, Biology, and Architecture. Also, collaboration with the graduate program in Engineering Management and the doctoral program in Public Policy is planned.

Faculty members in these supporting departments are already involved in research that is directly applied to the local and regional community and addresses infrastructure and environmental concerns. These departments are also producing graduate students through existing master's programs. Thus, the INES Ph.D. Program is a natural extension of these activities, in terms of conducting applied research related to the infrastructure and the environment and educating graduate students. As such, the INES Ph.D. Program will support and enhance existing programs.

Some of the key faculty members are already engaged in a stimulating interdisciplinary environment at the Cameron Applied Research Center, where they are housed along with both graduate and undergraduate students, in close proximity to active laboratories. Some of these laboratories are the Biotechnology Lab, the Regional Analytical Chemistry Lab, the Polymer Chemistry Lab, and Geoenvironmental and Energy Systems Laboratories. The Global Institute for Environmental and Energy Systems is also in the Cameron Center and provides a dynamic and interactive environment for students, faculty and visiting researchers already working on infrastructure and environmental issues. Other existing classroom and laboratory facilities will be used to support the planned doctoral program, and they are located in the Smith Building (Civil Engineering, Engineering Management), Kennedy Building (Geography and Earth Sciences,

Civil Engineering), McEniry Building (Geography and Earth Sciences, Public Policy)), Burson Building (Chemistry), Friday Building (Economics), and Storrs Building (Architecture).

The participating UNC Charlotte departments mentioned above are currently prepared to support the INES Program initially in terms of courses, faculty, and facilities. These programs have bachelor's and master's degree programs that will provide additional student/faculty interaction. The Department of Civil Engineering operates master's degree programs with specializations in environmental, geo-environmental, and water resources engineering and a variety of infrastructure design and analysis areas such as geotechnical engineering, structural systems and materials, and transportation engineering. The Department of Geography and Earth Sciences offers master's degrees in Geography with focus on research methods, problem formulation and solution, quantitative techniques, computer applications, and geographic information systems (GIS). The Department of Geography and Earth Sciences also has an M.S. degree program in Earth Sciences with a focus in environmental systems science, monitoring, climatology and hydrology, and solid earth science. The department is also well suited to provide the integrative tools and approaches to Geographic Information Science (GIScience), which include, but are not limited to: Geographic Information Systems, Spatial Decision Support Systems, and Spatial Data Analysis. These master's programs in Civil Engineering, Geography, and Earth Sciences will prepare master's graduates for Ph.D. work in Infrastructure and Environmental Systems.

The Department of Biology offers master's degree programs with specializations in ecology/environment and biotechnology/microbiology, among other areas. Biology also offers a Ph.D. program in Biology with a focus on Biomedical Science and Biotechnology. The department has traditionally had two major areas of emphasis: Biotechnology and Environmental Biology. Although most of the resources of the department have been focused on building the Ph.D. program in Biotechnology in recent years, the department has now begun to focus on building the Environmental Biology portion. A new faculty member was added last year with an expertise in aquatic ecotoxicology and the department will add another for the beginning of the 2003-2004 academic year (also aquatic ecotoxicology). The choice of the area of emphasis in rebuilding environmental biology is specifically designed to support the needs of the proposed INES program and to take advantage of existing resources available through the existing Ph.D. in Biology. Several existing courses in these areas are appropriate for inclusion in coursework requirements for the proposed Ph.D. program in Infrastructure and Environmental Systems (see Section III.B.2.1.b). In addition, further coursework will be added as the building of the environmental biology focus progresses. Because of the nature of the faculty that the Biology Department is hiring, many of these courses will be appropriate for the students in the INES program. The existing Ph.D. program in biotechnology will also provide opportunities for collaboration with INES faculty and students because there are several areas of overlap between biology and INES applications. Two interdisciplinary projects are currently underway between faculty and students in Civil Engineering and Biology.

Considering that solutions to environmental problems that attend infrastructure development are not always based on engineering analysis or physical science principles alone, an intersection with the recently established Ph.D. program in Public Policy is planned. The proposed program will draw on the Public Policy Ph.D. Program for courses and expertise. This collaboration should not encumber the Public Policy Program as faculty members are already offering relevant Ph.D.-level courses, which will be available to INES students. This

arrangement will enable the INES doctoral students to acquire proficiency in the formulation of policies, codes, standards, incentives, and penalties to achieve environmental goals associated with the development and operation of infrastructure. In addition, there is a plan to involve highly qualified experts from research laboratories such as those of Duke Energy Corporation and the nearby Electric Power Research Institute (EPRI).

A large number of existing graduate-level courses have been identified in supporting departments and categorized for support of the proposed INES program. Other courses will be developed over time, as needed. A representative list of these courses is provided in Section III.C.1.2. As in the case with Public Policy described above, the interdisciplinary dependency of the INES program on these departments and programs should produce positive results for those units. The INES Program should strengthen existing graduate programs, such as in Architecture, Engineering Management, and Economics, by diversifying the student population in their classes, by producing interdisciplinary research opportunities, and by optimizing the use of facilities and equipment.

II. Justification for the Program

The importance of a high level of study of infrastructure and environmental development, operation and maintenance is apparent from several sources. In the last few years, a number of highly respected universities have implemented a variety of infrastructure and environmental programs at the doctoral level. Some of these programs are described later in this proposal. These institutions responded to emerging needs best described by the American Society of Civil Engineers (ASCE). ASCE estimates that the United States alone will need to invest a staggering \$1.3 trillion to meet emerging needs and failing infrastructure. This is just the beginning of a continuing effort to develop and improve the nation's infrastructure and environment (e.g., transportation systems, water and wastewater systems, building systems, and energy production and distribution systems).

Being prepared for the coming decades of dramatic infrastructure transformation will require a new level of understanding of environmental systems and approaches to control them. The magnitude of this undertaking will also require a large pool of highly educated professionals with an understanding of technology, the environment, management processes, policies and standards, and infrastructure development. The proposed program will support the growing interest in exploring these systems while at the same time meeting a growing need in the professional work force.

II.A. Program basis

II.A.1. Relationship of the Program to institutional mission and strategic plan

The proposed Ph.D. program in Infrastructure and Environmental Systems contributes directly to UNC Charlotte's mission and is a key element in the 2004-2009 Academic Plan.

UNC Charlotte Mission Statement

“UNC Charlotte is the only Doctoral/Research University - Intensive in the Charlotte region, fully engaged in the discovery, dissemination, synthesis, and application of knowledge. It provides for the educational, economic, social, and cultural advancement of the people of North Carolina through on- and off-campus programs, continuing personal and professional education opportunities, research, and collaborative relationships with private, public, and nonprofit institutions. UNC Charlotte has a special responsibility to build the intellectual capital of this area. As such it serves the research and doctoral education needs of the greater Charlotte metropolitan region.”

In addition, the UNC Charlotte Academic Plan identifies seven broad areas of concern or themes: 1) Liberal Education; 2) Business and Finance; 3) Urban and Regional Development; 4) Children, Families, and Schools; 5) Health Care and Health Policy; 6) International Understanding and Involvement; and 7) Applied Sciences and Technologies. The proposed Ph.D. in Infrastructure and Environmental Systems is based on UNC Charlotte’s mission and is a principal element in the fifth and seventh themes of the academic plan. The proposed Ph.D. program emerged as a result of priorities established following a careful weighing of stated needs, resource requirements, program quality, student demand, and faculty staffing.

UNC Charlotte's array of programs will be expanded at the doctoral level to serve the research and education needs of the greater Charlotte metropolitan region, North Carolina, the southeastern region of the U.S., and the nation. This program will strengthen the related undergraduate and graduate programming and encourage even more cooperative programming among various degree programs on the campus. It also will enhance relationship and between UNC Charlotte and the community from which most of the research issues will be generated.

The Academic Plan also states,

“The Charlotte metropolitan region, defined as the counties that ring Charlotte and Mecklenburg County will witness the continuation of several major trends observed over the past two decades.” One trend being *“continued growth and urbanization and the resulting impact on the environment, economic development, crime, transportation, metropolitan infrastructure, and the delivery of public services.”*

Indeed, Charlotte is a major city with a rapidly expanding population and infrastructure and with increasing environmental and infrastructure problems. Consequently, the proposed doctoral program will also make contributions in the critical areas of sustainable infrastructure growth and environmental systems within 100 miles of its metropolitan area. The INES Ph.D. Program will assist UNC Charlotte in realizing its vision of building the intellectual capital of the area and addressing major educational, cultural, technological, social, and economic needs in the greater Charlotte region.

Initial planning for a focus on infrastructure and environmental systems at UNC Charlotte occurred in 1997, and a strong interest in such a program has been evident in each campus academic plan since that time. Duke Energy exemplified industry’s commitment to and interest in this program with the creation of an endowed professorship in environmental science and engineering: the Duke Energy Distinguished Professor of Environmental Engineering and

Science, who has the Department of Civil Engineering and the Department of Geography and Earth Sciences as his home departments and directs the cross-disciplinary, inter-college Global Institute for Energy and Environmental Systems (GIEES).

II.A.2. Relationship of the Program to student demand

In the opinion of Dr. Theis, there is great need for graduates with detailed understanding of design, analysis and policy-making processes and the interactions among them, in the environmental arena. Indeed, Dr. Theis states,

“The graduates of the program will find a ready job market in industry and government (particularly at the federal level), and eventually in academia as this approach becomes more widespread.”

Innovative programs such as this one are usually created in response to both emerging needs and trends into the future. Numerous indicators and projections paint a clear picture of the emerging problems requiring attention and emerging demands for highly educated professionals in this field. A few representative indications and projections describing the emerging demand for INES graduates are presented below. These activities, and many more, involve enormously challenging problems that represent opportunities for INES graduates in research, science, design, and management jobs. Thus, it is reasonable to assume that response to the proposed Program, in terms of student interest, will be strong.

- A survey by Water World Magazine (July/August, 1999, p. 1) indicates that the largest cities in the United States were planning about \$28.1 billion in capital improvements in the next five years, with most having direct environmental impact.
- The strategic plan developed by the U.S. Environmental Protection Agency (USEPA) (EPA/190-R-97-002) calls for the development of screening methods and environmental pollution control measures for about 75,000 chemicals that are now in commerce.
- In the FY 2001 budget alone, an allocation of \$2.4 billion was proposed by the U.S. government for programs aimed at combating global warming.
- The 2000 Ground Water Rule developed by the U.S. EPA to control the exposure of the public to bacteria and viruses in groundwater sources of drinking water is expected to affect about 157,000 public water systems (Water World, June 2000, p. 1).
- Another major development in the U.S. is the passage of the Transportation Equity Act for the 21st Century (TEA-21) which provides \$173 billion for construction intended to repair the nation’s aging infrastructure.
- In response to growing concerns world wide, the Global Alliance for Disaster Reduction (GADR) has intensified its efforts in communications, conferencing, and transferring technology regarding disaster-related aspects of the infrastructure and the environment. UNC Charlotte was recently selected as the international headquarters of GADR, an international consortium of more than 1,000 experts, 80 countries, and several organizations engaged in technical and policy aspects of disaster mitigation.

These examples presented above give testimony to two important facts: first, local, state, national, and international communities are paying more attention than ever before to the serious problems and challenging opportunities facing the environment and the infrastructure. Secondly, UNC Charlotte has the interest, facilities, and expertise to address these issues. These facts will combine to produce a strong student demand for the INES Ph.D. Program.

Other evidence of the demand for graduates of the INES doctoral program is found in the enormous demand for faculty in general. The University of North Carolina system projects the hiring of approximately 10,000 full-time-equivalent faculty members between 2001-02 and 2010-11 to accommodate enrollment growth and faculty attrition. (“The University of North Carolina Faculty Compensation and Competitiveness” Power Point presentation, January 16, 2001.)

The steady-state condition for enrollment beginning in year 4 as described in Table 4 will be achieved by actively recruiting students to the Program from three primary pools: graduates from across the state, nation, and other countries; industry professionals entering graduate school for career enhancement or a career change; and graduates from UNC Charlotte master’s programs seeking to broaden their educational experience beyond their original master’s focus.

It is expected that the percentages of new students coming from the three pools will change from year to year. As a conservative example, however, an annual goal is to recruit at least eight new students per year into the program after four years of operation. This goal can be accomplished by recruiting two graduates of feeder programs in NC (1039 B.S. students in 2002); two graduates of feeder programs in the region (Clemson, Georgia Tech, Virginia Tech, and the University of South Carolina had 435 B.S. graduates in 2002 in one potential feeder program, Civil/Environmental Engineering); two international students; one person from related industries; and one of the master’s graduates from collaborating departments at UNC Charlotte (51 in 2002).

II.A.3. Relationship to societal need (North Carolina and elsewhere)

A few examples of how the proposed program must respond to society’s needs at the national and international levels, by supplying graduates, were presented in Section II.A.2. Similar needs also exist in city, county, and state “societies.” A few examples are presented below, and they are representative of communities across the nation.

In the City of Charlotte

- Rapid urbanization, delicate environmental systems (e.g., propensity to floods and erodible soils), emerging environmental concerns (air quality, water supply and quality, and sprawl), influx of a wide variety of industry, and tremendous load on the existing infrastructure all present tremendous needs for solutions and provide many opportunities for research.
- Charlotte is the largest metropolitan area within the state of North Carolina and is the base for more than one hundred infrastructure development firms. These include major environmental labs engaged in the global energy industry, such as the Duke Energy

Environmental Laboratory and the Electric Power Research Institute (EPRI). The growing number of such firms in the area indicates the growing need for expertise and attention.

- The projected five-year budget for water and wastewater projects in Charlotte alone (Water World, July/August, 1999, pages 1 and 38) is \$215 million.

In Mecklenburg County

- Mecklenburg County Department of Environmental Protection (MCDEP) data show that in 1998, North Carolina ranked 7th in municipal solid waste generation (12.6 million tons) despite being the 11th most populous state in the United States.
- The North Carolina House Bill #859 has set a target of a 40 percent waste reduction per capita that must be attained by 2006. In addition, Mecklenburg County generates more hazardous waste than any other county in North Carolina, owing to the high number of manufacturing and service industries in the region.
- A 1998 inventory study by the UNC Charlotte Department of Geography and Earth Sciences revealed that there are nearly 1,200 sites where contaminants from past land use may introduce barriers to development. To further compound the problem, there are over 1,000 registered underground storage tanks with confirmed leaks.
- The environmental sensitivity of the County is underscored by the existence of more than 2,000 miles of streams.

In North Carolina

- The state's physical infrastructure is expanding at a rapid rate due to a growing population and associated increase in industrial activities.
- It is estimated (Construction Magazine, April 2, 1999, page 28) that up to one-third of the \$1.2 billion North Carolina highway budget for 2000 was allocated to design and construction measures intended to comply with environmental regulations. These trends are expected to continue and expand into the future.
- A growing number of environmental and infrastructure firms in North Carolina (more than one hundred near Charlotte alone) recognize the need for Ph.D. graduates owing to the increasingly complex issues related to their work.
- The North Carolina Natural Hazards Mitigation Plan (409 Plan) of 1999, aimed at developing sustainable, disaster-resistant communities, contains 135 specific "recommendations for action," most of which require the involvement of personnel with high-level analytical training. Examples of tasks in the plan include: conduct comprehensive mitigation planning, increase the resilience of infrastructure to hazards, and maintenance of natural environmental features.

In the U.S. and in the world

- As mentioned earlier in this proposal, ASCE estimates that the United States alone will need to invest a staggering \$1.3 trillion to meet emerging needs and failing infrastructure. This is just the beginning of a continuing effort to develop and improve the nation's infrastructure and environment. There is a growing need for well educated people who can help solve these complicated problems.
- Several programs have been recently initiated by federal agencies in efforts to cut projected carbon emission levels by 31 percent by 2010. As with similar programs in

the past, this national investment is bound to spur industrial activity, thereby creating job opportunities for high-level specialists in infrastructure and environmental systems.

- The U.S. General Accounting Office reported (GAO/RCED-99-86, April 1999, p. 4) that ten U.S. agencies provide about \$413 million in assistance to municipalities and states for Brownfield activities, including investigations.
- Owing to the increasing rate of adoption of International Organization of Standardization (ISO) protocols by corporations and agencies globally, career opportunities are also rapidly opening up in developing countries. In the European Union's 5th Framework for Research (Chemical and Engineering News, June 22, 1999 p. 23), two of the five major themes selected for focus deal with infrastructure and environment.
- In response to continuing infrastructure and environmental concerns worldwide, the 5th International Symposium in Environmental Geotechnology and Global Sustainable Development (ISEGGSD) was hosted in Seoul, South Korea, in 2002. Delegates from around the world selected UNC Charlotte to be the headquarters of the International Society of Environmental Geotechnology (ISEG). As part of the ISEGGSD Symposium series, UNC Charlotte, with the support of Duke Energy and through the Global Institute for Energy and Environmental Systems (GIEES), will host the 2005 International Conference on Energy, Environment and Disasters.

With the INES Ph.D. Program, UNC Charlotte will be well-positioned to respond to these needs. The University has a strong history of assisting society with interdisciplinary research teams of faculty members and students. Examples include the master's programs in Information Technology and Health Administration; Ph.D. programs in Biology, Information Technology, and Public Policy; the NSF Center for Precision Metrology; the Center for Applied GIS; the Center for Transportation Policy Studies; the UNC Charlotte Urban Institute; the Metropolitan Studies Group; and the Global Institute for Energy and Environmental Systems, all of which address society's needs in urban infrastructure and environmental issues.

II.A.4. Impact on existing academic programs at UNC Charlotte

II.A.4.1. Strengthening of other programs by the proposed program

During the past decade, UNC Charlotte made a steady investment in building instructional and research portfolio for graduate and undergraduate students in many areas, including those that converge on infrastructure and environmental systems. The proposed INES Ph.D. program will complete the process by establishing cross-linkages among the participating units at a high intellectual level. It will provide opportunities for UNC Charlotte faculty to collaborate across artificial disciplinary boundaries in the delivery of advanced-level education and research opportunities to support sustainable development in North Carolina and beyond.

In addition to sharing knowledge and expertise, participating programs will be strengthened by sharing laboratories, equipment, and technicians. For example, the University has already invested significantly in research facilities that will support Ph.D.-level investigations in INES. The C. C. Cameron Applied Research Center (CARC) is an applied research facility that has recently added 35,000 square feet and is now home to the Global Institute for Energy and

Environmental Systems (GIEES), which operates several laboratories at the facility. Other units in CARC include the Biotechnology Lab, the Regional Analytical Chemistry Lab, and the Polymer Chemistry Lab. More than 20 faculty members from various departments conduct research and advise students in CARC and benefit from shared resources.

UNC Charlotte has a strong history of innovation in interdisciplinary education and research. Building on this tradition and taking advantage of the interdisciplinary themes promoted by many funding organizations, the INES Ph.D. Program will strengthen supporting programs by increasing opportunities for proposal writing as well as the success rate of acquiring funding. Interdisciplinary work, directed at environmental and infrastructure issues, includes the recent examples described below.

- 1) The Duke Energy Undergraduate Research Fellowships are administered by the Global Institute for Energy and Environmental Systems. During each semester and summer session, undergraduate students from a variety of departments, under the mentorship of faculty members, conduct research on environmental issues.
- 2) Dr. Craig Allen in Geography and Earth Sciences and Dr. Jy Wu in Civil Engineering collaborated in the classroom, laboratory, and field on several projects addressing storm water runoff problems in North Carolina.
- 3) Professor Peter Wong of the College of Architecture and Dr. Martin Kane of Civil Engineering have led, together, teams of Civil and Architecture students to Spain during the past three summers to assess, plan, and design infrastructure and environmental improvement projects.
- 4) Dr. Jim Oliver of the Department of Biology and Dr. John Daniels in Civil Engineering collaborated on a research project addressing the use of exopolysaccharide producing bacteria in strengthening barrier soils.
- 5) Dr. Helene Hilger in Civil Engineering and Dr. Todd Steck in Biology have established a funded collaboration with the North Carolina Department of Environmental and Natural Resources and the Mecklenburg County Land Use and Environmental Services Agency to develop a biotechnology-based fecal tracking method to be used in identifying the source of bacterial pollution in surface water systems.

II.A.4.2. Impact on existing resources

Initially, existing resources will be used to satisfy the needs for the INES Ph.D. Program in terms of faculty members, space, and student support. However, very quickly, additional resources in terms of new faculty positions, GTA funding, and facilities will be required. The INES Program is strongly supported in the strategic plans of the two colleges (Engineering; Arts and Sciences) having primary responsibility for the program and is also supported by UNC Charlotte's "Academic Plan." The deans of the two primary colleges have agreed to provide faculty lines requested in the "Budget" section of this proposal from existing and future faculty allocations. Space for the program will be provided in existing buildings on campus as several departments involved in the Program (Civil Engineering, Geography and Earth Sciences, and Chemistry) backfill into existing space vacated as other departments (Biology) move into new

buildings. Preliminary planning for this space is complete and includes ample space for faculty offices, Ph.D. student offices, classrooms, and research laboratories. The Office of Academic Affairs, the Graduate School, the College of Engineering, and the College of Arts and Sciences have agreed to provide GTA's and tuition grants outlined in the "Budget" section of this proposal.

II.A.4.3. Board of Governors' productivity criteria at UNC Charlotte (current and future)

Table 1: Graduates from Ph.D. Programs at UNC Charlotte

	Academic Year				
	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002
Number of Graduates	3	10	19	24	34

As indicated in Table 1 above, UNC Charlotte continues its steady increase in producing Ph.D. graduates. The INES Ph.D. program will not compete with existing Ph.D. programs at UNC Charlotte and will not lead to low productivity in any program, as defined by the UNC Board of Governors.

II.B. Program duplication and competitiveness

II.B.1. Similar programs offered elsewhere in North Carolina.

In North Carolina, other major universities offering similar programs are located at the following distances from UNC Charlotte.

- UNC Chapel Hill, Chapel, NC [public] (125 miles)
- NC State University, Raleigh, NC [public] (150 miles)
- Duke University, Durham, NC [private] (140 miles)

At Chapel Hill, the Ph.D. program in Environmental Science and Engineering in the School of Public Health is appropriately focused on public health aspects because of the institution's strength in medical and allied sciences. In this program, there is an integration of engineering, science, and policy, but it is focused on environmental effects on humankind. At Chapel Hill, there is also a graduate program in Planning that offers a strong management/policy component, thereby opening up an opportunity for consideration and acceptance of some graduate courses that may be taken there by students.

At North Carolina State University (NCSU), a Ph.D. program in water resources and environmental engineering is offered through the Department of Civil Engineering, which also offers other areas of specialization including: computer-aided engineering, construction engineering and management, structural engineering and materials, coastal and ocean engineering, geotechnical and geo-environmental engineering, and transportation systems. NCSU has also developed strength in industrial ecology. Such a broad offering of programs does provide a Ph.D. student with the option of studying both environmental and infrastructure issues. Additional Ph.D. programs related to environmental analysis are in marine science, atmospheric science, and earth science. These programs are operated through regular academic

programs that are focused largely on those specific disciplines. A recently established Ph.D. program in environmental design is offered through the School of Design. This is neither a natural science nor an engineering-based program, but is geared towards environmental landscaping and architecture.

At Duke University, the Ph.D. program offered through the Department of Civil and Environmental Engineering is mostly focused on water quality modeling/hydrology and solid mechanics/geomechanics/structures. A separate School of the Environment operates Ph.D. programs in ecosystems science, ecology, geochemistry, and climatology.

II.B.2. The difference between the proposed program and other programs

The proposed program is uniquely titled to capture its essence and the niche that it will fill. Components of the proposed INES Program are present in various departments and programs at UNC Charlotte and at the three North Carolina institutions mentioned in the previous section. However, current programs at UNC Charlotte, UNC Chapel Hill, NC State, and Duke are not duplicated by the proposed program. At first glance, it might seem possible that a student with a particular motivation at any of these institutions could construct an INES-type plan of study through an assemblage of various courses. However, most of the students in these programs are not looking for such a program of study. Also, such an approach is not likely to happen because these programs do not inherently support such a plan of study, which would be a multi-disciplinary program that misses the core of the proposed INES Program, i.e., interdisciplinary research and studies aimed at understanding inter-related systems in an environment that fosters collaboration among faculty and students.

The proposed Ph.D. program will provide an opportunity for students to receive doctoral-level education in one of the key areas of sustainable development, and to take advantage of our “living laboratory,” Charlotte. Dr. Thomas Theis notes that the proposed doctoral program in Infrastructure and Environmental Systems distinguishes itself by “establishing a niche from other well-established programs within close geographic proximity” and “provides a complementary mode of scholarship that is exciting and innovative.”

The proposed program presents exciting and unique opportunities for advanced study in that it provides a different basis for doctoral studies. Generally, the basis of a program is a particular focus area (infrastructure, environment, systems, urban studies, management, etc.). Often, the effects on other areas are not considered. The INES Ph.D. Program, on the other hand, is based on understanding the interdisciplinary relationships between infrastructure and environmental systems in urban settings. This understanding is then applied to focus areas to evaluate reaction and response. Therefore, existing degree programs are not duplicated by the proposed INES Ph.D. Program. The proposed program complements the environmental programs across the state and provides an excellent opportunity for state-wide collaboration.

II.B.2.a. Specific comparison to other programs at UNC Charlotte

Programs supporting the INES Ph.D. will be the Departments of Civil Engineering, Geography and Earth Sciences, Biology, Chemistry, and Economics, the College of Architecture, the program of Engineering Management, and the Ph.D. Program in Public Policy. Except for Public Policy and Biology, these programs do not offer Ph.D. degrees, and no single unit can deliver the diverse curriculum required. In addition, the two programs currently offering a Ph.D.

degree, Biology and Public Policy, do not provide an INES emphasis. The interdisciplinary Ph.D. Program in Public Policy focuses on policy theories and policy studies. The Ph.D. in Biology focuses on biotechnological and biomedical issues. It should be noted that the other programs mentioned offer strong master's programs in which faculty members are working with graduate students in the classroom, laboratory, and field in graduate-level coursework and research.

II.B.2.b. Specific comparison to other programs in public and private universities in North Carolina (possible duplications with collaborative, distance education solutions)

Descriptions of and comparisons to other, similar programs in North Carolina are given in Section II.B.1. and Section II.B.2. and are not repeated here. More specifically, the opportunity to reduce possible duplications among these programs and the proposed program through collaboration and distance education are addressed in this section. Several of the supporting programs at UNC Charlotte have a history of collaborating with colleagues at UNC Chapel Hill, NC State, and Duke. For example, Dr. Helene Hilger of the Department of Civil Engineering at UNC Charlotte worked with Dr. Mark Sobsey in the Department of Environmental Sciences and Engineering at UNC Chapel Hill on an assessment of the North Carolina Reuse Regulations for the NC Water Resources Research Institute. Dr. Craig Allan, Dr. Randy Forsythe, and Dr. John Diemer, of the Department of Geography and Earth Sciences at UNC Charlotte, worked with colleagues at NC State and UNC Chapel Hill on a 10-year, EPA319 watershed study. Dr. Jy Wu, of the Department of Civil Engineering at UNC Charlotte, collaborated with colleagues at NC State on storm water runoff and water quality studies and with colleagues at UNC Chapel Hill on drinking water treatment studies.

The INES Ph.D. Program will build upon and expand the existing collaboration among the universities mentioned. Activities such as working jointly on research projects, team-teaching courses, co-advising graduate students, and engaging students in seminars and conferences will be strengthened by the INES Program, which inherently brings faculty together from different disciplines and, as a result, attracts faculty from other campuses. The use of the latest technology to share information and to communicate among the campuses will be critical to effective collaboration. Some distance education technologies can be employed so students can work on projects together and can attend tele-seminars together, thereby reducing duplication of these efforts among the campuses.

II.B.2.c. Comparison to other programs in public and private universities in the region, and in the nation.

Regionally, there are several respected universities outside of North Carolina and within a few hours of Charlotte that offer programs having some of the components in the proposed program.

- Clemson University houses a School of the Environment consisting of three academic departments: Environmental Engineering and Science, Geological Sciences, and Environmental Toxicology. Ph.D. programs focus on the impacts of pollution on human health and the maintenance of a balanced and healthy ecosystem.

- At the University of South Carolina in Columbia, South Carolina, the Department of Civil Engineering offers a Ph.D. degree with focus areas in environmental, geotechnical, structural, and water resources engineering. The School of the Environment offers a program similar to the Management Focus Area of the proposed INES Program, but only at the master's level. This interdisciplinary program attracts students interested in the management of earth and environmental resources.
- The Civil and Environmental Engineering Department at Virginia Polytechnic Institute and State University (Virginia Tech) in Blacksburg, Virginia, offers Ph.D. degrees in Civil Engineering with emphases in several INES component areas including civil infrastructure, environmental, geo-environmental, and systems engineering. Virginia Tech also offers traditional Ph.D. degrees in Environmental Engineering and Environmental Science and Engineering.

Increasingly, it is being recognized that many environmental problems are closely linked to development and operation of infrastructure. This is evident in the comprehensive list of environmental issues developed by the National Academy of Engineering (1999). Despite this recognition by such a prestigious organization, programs at many institutions continue to approach the identification, analysis, and mitigation of environmental and infrastructure problems separately in traditional disciplines and departments that often have both physical and intellectual boundaries.

The emerging trend in doctoral education is to remove barriers that discourage students from studying and working together in an interdisciplinary, systems-oriented setting. Notable examples of these programs include:

- Yale University: Ph.D. program in industrial ecology
- University of California-Berkeley: Ph.D. program in engineering ecology offered by the Civil and Environmental Engineering Department
- Clarkson University: Ph.D. program in environmental manufacturing management
- University of California-Riverside: Ph.D., environmental biotechnology specialization
- Carnegie-Mellon University: Ph.D. program in engineering and public policy
- Columbia University: Earth Engineering Center and Ph.D. in earth and environmental engineering
- Johns Hopkins University: Ph.D. in geography and environmental engineering
- University of Wisconsin: several Ph.D. programs in the Nelson Institute for Environmental Studies and the Center for Sustainability and the Global Environment
- University of Illinois-Chicago: the Environmental Science and Policy Institute
- University of Massachusetts: Ph.D. emphasis on environmental technologies through the Center for Energy Efficiency and Renewable Energy
- University of California-Santa Barbara: Ph.D. program in environmental science and management

In adopting this integrated, interdisciplinary approach, each institution has justifiably selected a focus area that reflects its faculty strength, institutional mission, and regional and external opportunities. For UNC Charlotte, these factors justify a focus in the interplay between the environment and the infrastructure in a rapidly evolving urban center.

II.C. Enrollment

II.C.1. Headcount enrollment

Headcount enrollment and graduation data are presented below in Table 2 and Table 3 for Ph.D. programs at UNC Chapel Hill and NC State University, respectively. These programs were selected because of similarities to the proposed INES Ph.D. Program. Enrollment projections for the INES Ph.D. Program are presented in Table 4

Table 2.. Enrollment and Graduation Data in Ph.D. Program in Environmental Sciences and Engineering at the University of North Carolina at Chapel Hill

Institution	UNC Chapel Hill				
Program Title	Ph.D. in Environmental Sciences and Engineering				
Year	1998	1999	2000	2001	2002
Enrollment	n/a	67	68	60	n/a
Degrees-awarded	n/a	10	14	13	n/a
Comments regarding student demand	Applicant pool for masters and Ph.D. degrees has averaged ~230 over the past 7 years indicating high demand by qualified applicants.				
Comments regarding job placement	An average annual enrollment of approximately 65 Ph.D. students supports the proposed steady-state enrollment projection of 20 students. The average annual graduation of 12 Ph.D. students is approximately 20% of enrollment, and 20% is used for projections in this proposal				
Influence on INES enrollment projections	An average annual enrollment of approximately 65 Ph.D. students supports the proposed steady-state enrollment projection of 20 students. The average annual graduation of 12 Ph.D. students is approximately 20% of enrollment, and 20% is used for projections in this proposal				

Table 3. Enrollment and Graduation Data in Ph.D. Program in Civil Engineering at North Carolina State University

Institution	NC State University				
Program Title	Ph.D. in Civil Engineering				
Year	1998	1999	2000	2001	2002
Enrollment	n/a	66	66	73	n/a
Degrees-awarded	n/a	6	16	9	n/a
Comments regarding student demand	Steady increases in graduate program enrollment over the past 15 years is expected to continue. During this time, the student base has expanded both geographically and in terms of student backgrounds.				
Comments regarding job placement	A full array of job placements has been obtained in academia and industry by the Ph.D. graduates and no future obstacles are expected.				
Influence on INES enrollment projections	A reasonable assumption is that approximately 33% of enrolled students and graduates were in the Environmental Area of Civil Engineering. Therefore, an average annual enrollment of 23 Ph.D. students and an average annual number of 3 Ph.D. graduates in Environmental Engineering indicates a strong demand for such a program and indicates 3 to 4 environmental Ph.D. students are graduated each year.				

Table 4. Enrollment Projections in INES Ph.D. Program at UNC Charlotte

Students	Year 1 (2004-2005)	Year 2 (2005-2006)	Year 3 (2006-2007)	Year 4 (2007-2008)
Full-time	4	9	12	16
Part-time	2	3	4	4
TOTALS	6	12	16	20
Explanation	Based on interest expressed about the INES Ph.D. program, a start-up with 4 full time and 2 part time students is reasonable. The growth to steady-state is based on the experiences of other Ph.D. programs at UNC Charlotte.			

The anticipated steady-state headcount enrollment after four years is anticipated to be:

Full time: 16 Part-time: 4 Total: 20

II.C.2. Student Credit Hour (SCH) production

Table 5. Predicted student credit hours in the INES Ph.D. Program

Year 1	Student Credit Hours		
Program Category	UG	Masters	Doctoral
Category I			126
Category II			
Category III			
Category IV			
Year 2	Student Credit Hours		
Program Category	UG	Masters	Doctoral
Category I			261
Category II			
Category III			
Category IV			
Year 3	Student Credit Hours		
Program Category	UG	Masters	Doctoral
Category I			348
Category II			
Category III			
Category IV			
Year 4	Student Credit Hours		
Program Category	UG	Masters	Doctoral
Category I			444
Category II			
Category III			
Category IV			

III. Program Requirements and Curriculum

III.A. Program Planning

III.A.1. Institutions with similar offerings regarded as high quality

“The seamlessness of science and technology and the interrelation of their sub-fields are demonstrated every day, and advances in one area are necessary for progress in another, and synergies at their interfaces are increasingly important.” [an editorial by Erich Bloch and Charles Vest (Science, Volume 283, March, 1999, page 1639)]

“A more comprehensive approach to our nation’s environmental research and development activities” is advocated and *“the traditional practice of studying isolated environmental problems and devising narrowly-focused control or remediation strategies to manage them will no longer suffice.”* [from the report, *Building a Foundation for Sound Environmental Decisions*, prepared by the National Research Council and published by National Academy Press, 1997]

The experts and organizations quoted above are but a few of many that increasingly recognize that environmental problems are closely linked to development and operation of infrastructure, and, conversely, the behavior of the environment has significant impact on the infrastructure. Despite this recognition, approaches to the identification, analysis, and mitigation of environmental problems at many institutions are for the most part still taught separately in traditional disciplines and departments that often have both physical and intellectual boundaries.

A single Ph.D. program need not address all environmental issues, but the importance of conducting research and education at the interface between traditional disciplines should be emphasized. When a focus is selected a comprehensive and integrated approach is necessary to provide students with a broad perspective that better enables them to meet the challenges of applied research.

In a “best paper” at the 2000 American Society for Engineering Education (ASEE) Conference, Amedudzi, Heraat, Sanford-Bernhardt and McNeil reviewed the emergence of graduate education in infrastructure systems. In a survey of 51 graduate programs across the country, 13 have begun developing infrastructure systems as an area of study to address these up-and-coming problems. Included in Heraat’s list were some of the distinguished institutions listed below (and repeating from page 22) as high-quality programs offering similar programs.

- Yale University: Ph.D. program in industrial ecology
- University of California-Berkeley: Ph.D. program in engineering ecology offered by the Civil and Environmental Engineering Department
- Clarkson University: Ph.D. program in environmental manufacturing management
- University of California-Riverside: Ph.D. specialization in environmental biotechnology
- Carnegie-Mellon University: Ph.D. program in engineering and public policy

- Columbia University: Earth Engineering Center and Ph.D. in earth and environmental engineering
- Johns Hopkins University: Ph.D. in Geography and Environmental Engineering
- University of Wisconsin: several Ph.D. programs in the Nelson Institute for Environmental Studies and the Center for Sustainability and the Global Environment
- University of Illinois-Chicago: the Environmental Science and Policy Institute
- University of Massachusetts: Ph.D. emphasis on environmental technologies through the Center for Energy Efficiency and Renewable Energy
- University of California-Santa Barbara: Ph.D. program in environmental science and management

What is unique about these infrastructure and environmental systems programs is not any individual course, but the manner in which the courses are coordinated from a variety of traditional disciplines to develop a program of interdisciplinary study that prepares students to tackle the unique problems in this field. Each of the infrastructure programs listed above recognizes the paradigm shift in science and technology education from purely technical to a more interdisciplinary and well-rounded model. For example, the program at Santa Barbara is supported by a large NSF grant received in recognition of their unique advanced education model.

In adopting this integrated, interdisciplinary approach, each institution listed above has justifiably selected a focus area that reflects its faculty strength, institutional mission, and regional and external opportunities. For UNC Charlotte, these factors justify a focus on the interplay between the environment and the development and operation of infrastructure in a rapidly evolving urban center.

III.A.2. Other institutions visited or consulted in developing this proposal (see consultant's report in Appendix I)

Several members of the proposal development team for this Ph.D. program reviewed Ph.D. program catalogs of other universities, visited campuses, and discussed the proposed program with various experts, in agencies, private corporations and other institutions. A number of these discussions, although informal, revealed unanimous encouragement for the INES Program and a universal agreement on the need for such a program. A few of those visits and informal discussions are described below.

- Professor Hilary I. Inyang, the Duke Energy Distinguished Professor of Environmental Engineering and Science at UNC Charlotte, visited the Engineering and Public Policy Program of Carnegie-Mellon University and the engineering programs at Clemson University. He also discussed cross-disciplinary approaches to Ph.D. education and research with leaders from Harvard, M.I.T., Berkeley, Rice, and Princeton called together to discuss that specific topic.
- Dr. John Daniels, of the Civil Engineering Department at UNC Charlotte, visited Nanjing University, Peoples Republic of China, in the summer of 2002, to discuss programs with Prof. Shi Bin who works in the areas of Earth Sciences and Geotechnical Engineering;

- Dr. James Bowen, of the Department of Civil Engineering Department at UNC Charlotte, visited University of Limoges, France, in the summer of 2002 to discuss the development of an interdisciplinary environmental laboratory.

Three meetings were arranged for the sole purpose of discussing the proposed INES Ph.D. Program. Those meetings and consultations are described below.

- An external consultant, Professor Thomas Theis, formerly Director of the Center for Environmental Management at Clarkson University and now the Director of the Environmental Science and Policy Institute at the University of Illinois-Chicago was invited to UNC Charlotte to review the plans for the proposed INES program. He visited UNC Charlotte and conducted interviews with key faculty members and students, inspected research facilities and reviewed faculty qualifications. He found that there are adequate program elements in place for the proposed Ph.D. Program in INES. A copy of his consulting report is attached in Appendix I of this proposal.
- Within the state of North Carolina, the plan for the proposed Ph.D. program in INES has also benefited from the support and constructive comments made by personnel of North Carolina State University and the University of North Carolina at Chapel Hill.
 - Dr. David Young of the Civil Engineering Department at UNC Charlotte visited with the Department of Civil Engineering at NC State in February, 2003 and discussed the Proposed INES Ph.D. program with Dr. Downey Brill, the Department Chairman. The discussion was positive with a particularly strong sense of an opportunity to develop a niche area in the interdisciplinary Management Focus Area of the INES Program. Several nationally recognized programs were recommended as models for the proposed program.
 - Dr. David Young of the Civil Engineering Department at UNC Charlotte spoke with Dr. Donald Fox, Assistant Chair of the Department of Environmental Sciences and Engineering in the School of Public Health at UNC Chapel Hill. The discussion and exchange of information was positive with clear indications of strong student demand for the program and high demand for its graduates.

III.B. Admission to the program

Admission requirements to be met by each applicant are presented below. Specific documentation required by the UNC Charlotte Graduate School for admission is also described.

III.B.1. Admission requirements (minimum and general requirements)

Applicants will be reviewed for admission to the Program based on their satisfaction of the requirements described below.

- The equivalent to a U.S. baccalaureate or master's degree from a regionally accredited college or university in Engineering, Earth Sciences/Geology, Chemistry, Biology or a related field with a minimum undergraduate GPA of 3.2 or a minimum graduate GPA of 3.5 (A = 4.0) in all graduate work.

- A minimum combined score of 1500 on the verbal, quantitative and analytical sections of the Graduate Record Examination (GRE) with minimum scores of 500 in each section. (The analytical section of the GRE now has a 6-point scoring system so these proposed numbers must be reviewed).
- A minimum score of 220 (computer-based test) or 550 (paper-based test) on the Test of English as a Foreign Language (TOEFL) for applicants whose native language is not English.
- Three letters of reference, two of which must be from faculty members.
- An essay which addresses the applicant's motivation and area of research interest.

III.B.2. Documents to be submitted for admission

The Graduate School at UNC Charlotte requires the following documents be submitted in the application package for each student:

- Two official transcripts from all colleges and universities attended
- Official GRE scores (verbal, quantitative and analytical)
- Official TOEFL scores if the student's native language is not English
- The UNC Charlotte application for graduate admission form
- Three letters of reference
- The essay which addresses the applicant's motivation, prospective INES Ph.D. program focus area (IESD or IESS or IESM) and research issues of interest

III.C. Degree requirements

The degree of Doctor of Philosophy in Infrastructure and Environmental systems is awarded for completion of scholarly research that advances the knowledge base in the field of that research. Evidence of this is demonstrated by a successful dissertation defense. In addition, recipients of the degree should demonstrate a mastery of relevant subject matter and a potential for success in research and teaching.

III.C.1. Total hours required

As summarized in Table 6, the INES Ph.D. program requires a minimum of 72 post baccalaureate (semester) credit hours (a minor in this program is not applicable). A master's degree in a field that is consistent with the admission requirements presented in Section III.B.1., may count up to 30 hours of transfer credit upon recommendation of the Program and upon approval by the Graduate School.

Table 6. INES doctoral program requirements

	Minimum Credit Hrs. to Degree Required for Master's Entrants	Minimum Credit Hrs. to Degree Required for Bachelor's Entrants
INES Core	15 credit hrs.	15 credit hrs.
Core courses	9 credit hrs.	9 credit hrs.
Case Studies	3 credit hrs.	3 credit hrs.
Seminars	3 credit hrs.	3 credit hrs.
Specialized (Focus Area) Electives	9 credit hrs. ¹	15 credit hrs.
Directed Studies (additional courses/research)	0 credit hrs. ¹	24 credit hrs.
Dissertation Research	18 credit hrs.	18 credit hrs.
Total Credits Beyond Previous Degree	42 credit hrs. ¹	72 credit hrs.

¹ based on a maximum of 30 credit hours transferred from a master's program. Less than 30 credit hours transferred will result in a higher number of credit hours required for graduation.

III.C.2. Graduate course requirements

All courses taken for credit in the program shall be graduate level courses (graduate students only), and the majority shall be at the Ph.D. level (Ph.D. students only). Core courses, case studies courses, and seminar courses designated INES 8XXX and all 8000-level focus area courses will be open only to Ph.D. students. All 6000-level courses available as specialized electives will be open only to graduate students (masters and Ph.D.).

III.C.3. Grades required

As specified by the UNC Charlotte Graduate School, letter grades will be used to scale the quality of each student's completed work as follows: *A*: Commendable (4.0); *B*: Satisfactory (3.0); *C*: Marginal (2.0); *U*: Unsatisfactory (1.0). Each student in the Ph.D. Program must maintain a minimum GPA of 3.0 in all coursework attempted for the degree. An accumulation of two *C* grades or one *U* grade will result in termination of a student's enrollment in the program. Dissertation credits will not be included in the calculation of a student's GPA.

III.C.4. Transfer credit accepted

Upon recommendation by the INES program committee and upon approval by the Graduate School, a certain number of courses in which a student achieved a minimum grade of 'B' will be accepted for transfer credit. The following transfer credit policy will apply:

- A maximum of 30 semester credit hours from a master's degree program in a field that is consistent with the admission requirements stated earlier may count toward the INES Ph.D. degree. This rule may apply whether the master's degree was earned or not. However no more than six hours taken when the student was in non-degree seeking status may be applied toward the doctoral degree.

III.C.5. Other requirements (e.g. residence, comprehensive exams, thesis, dissertation, clinical or field experience, "second major," etc.)

III.C.5.1. Student Advising

Upon acceptance into the Ph.D. Program, a student will be assigned an interim adviser by the Program Director. Within the first year in the Program, each student will select a permanent doctoral research adviser. This selection will be approved by the Program Director and Dean of the Graduate School. At any time a student may request a change in initial supervisor or research adviser. These requests will be submitted to the Program Director for consideration and action.

Details of this process and the responsibilities of each individual and group in terms of student advising are provided in Section VII of this proposal.

III.C.5.2. Plan of study

Students who enter the Ph.D. Program must prepare a plan of study before the end of fourth semester in the Program. The plan of study will propose a schedule for completion of all coursework by the student. Each plan will be approved by the Program Director and the student's doctoral committee.

III.C.5.3. Comprehensive (qualifying) examination and admission to candidacy

Each student must complete a qualifying examination. Students who enter the Ph.D. Program directly from a baccalaureate program generally will sit for this examination before the end of third post-baccalaureate year in the Program; students who enter from a master's degree program must sit for it before the end of their first year in the Program. To sit for this examination, a student must have completed 2 of the 3 required core courses, must have at least a 3.0 GPA, and must have removed all conditions upon admission.

The examination will be a written exam and will address issues covered by the core elements of the program, as well as any focus area material covered by the candidate up to that point. This exam will be developed and administered by each student's doctoral program committee. A student may attempt to pass the qualifying exam no more than twice. Failure a second time will result in termination of enrollment in the Ph.D. Program.

III C.5.4. Admission to Candidacy

After passing the qualifying examination, a student can propose a dissertation topic. A student advances to candidacy after the dissertation topic has been approved by the student's doctoral committee. Candidacy must be achieved within 6 months before the degree is conferred.

III C.5.5. Dissertation requirement

The INES doctoral program includes a minimum of 18 hours of dissertation credit. Each student must complete and defend a dissertation based on a research program approved by the student's doctoral adviser with concurrence by the IPC. The dissertation must be of high quality and represent an original piece of research that advances the body of knowledge in infrastructure and environmental systems. Oral presentation and successful defense of the dissertation before the student's advisory committee in a forum open to the public will be required. A copy of the student's dissertation will be made available to the graduate faculty of the program at least two weeks prior to the public defense. The dissertation must be written in a format acceptable to the Graduate School.

III.C.5.6. Language and research requirements

There is no language requirement in the INES Ph.D. degree. Research requirements in the INES Ph.D. Program are described in Section III.C.1.4.

III.C.5.7. Residency requirement

Each student must satisfy the residency requirement of the program by completing at least 16 credit hours in one period of 12 consecutive months during enrollment in the program.

III.C.5.8. Time limits for completion

No course listed on the candidacy form may be older than eight years at the time of graduation. Courses that exceed this time limit must be revalidated or retaken, whichever the graduate program decides, if they are to count towards the degree program. Transfer credits beyond the baccalaureate degree that count toward the doctorate are not subject to the standard time limit to complete the degree.

III.D. New and existing courses in the program

In the course listings that follow, the following codes are used to explain the course numbering system for both new and existing courses.

- Each course listed carries a four-letter department or program prefix
- Courses at the 8000 level are for doctoral students only. The designation INES 8XXX is for INES-specific core courses and for other current or planned courses to be offered at the Ph.D. level as a part of the INES Ph.D. Program.
- All courses numbered at the 6000 level are offered for graduate students only (masters and Ph.D.).

Students in the INES Program are permitted to take courses numbered at the 6000 level (masters and Ph.D. students only), but they must take the majority of their courses at the 8000 level (Ph.D. students only). All students will be required to take courses in the core of the

program (core courses, seminar courses, and case study course). The core will comprise new courses developed for the INES Ph.D. program, and these are listed and described below.

III.D.1. New courses (required courses are denoted with an (*))

- For the INES Core
 - INES 8XX1(*) Environmental Systems Science and the Infrastructure (3 cr.)
 - INES 8XX2(*) Infrastructure Design and Management of the Environment (3 cr.)
 - INES 8XX3(*¹) Acquisition and Management of Scientific Data (3 cr.)
 - INES 8XX4(*¹) Laws, Standards, Policies, and Regulations (3 cr.)
 - INES 8XX5(*¹) Economic Principles in Infrastructure and Environmental Systems (3cr.)
 - INES 8XX6(*) INES Case Study Course (3 cr.)
 - INES 8XX7(*) INES Seminar Series (3 cr.)

*¹ Students are required to take one of the three courses INES 8XX3, INES 8XX4, and INES 8XX5

- INES 8XX0(*) Doctoral Independent Study and Project
- INES 8999(*) Doctoral Dissertation Research
- INES 9999 Doctoral Residency Requirement

Descriptions of these new courses are provided in the sections below.

III.D.1.1. INES Core (courses + case studies + seminars = 15 credits minimum)

The INES core will focus on basic and advanced level understanding of the principles of the infrastructure and environmental analysis, development, and management. Courses in this core will also emphasize environmental analysis and assessment and effects on the infrastructure, as well as the development and management of the infrastructure and the impact on the environment. Throughout the core, students will study the configuration dynamics and operational issues relevant to the management of a variety of earth, civil, and industrial systems.

INES Ph.D. students will participate in interdisciplinary activities throughout their program of study. Students will begin with a set of interdisciplinary core courses that teaches them about fundamental aspects of the infrastructure and the environmental systems present in all applications of INES. These common aspects are reflected in the five (5) core courses described below. Then, at midpoint, students will participate in an interdisciplinary case-study course, and, finally, throughout the program, students will participate in interdisciplinary seminar courses.

III.D.1.1.a. INES core courses (9 credits minimum)

All students must take INES 8XX1 and INES 8XX2.

- **INES 8XX1 Infrastructure and Environment I (3 credits)**
Principles of energy and mass transport as applied to the atmosphere, hydrosphere, biosphere and earth systems and how these principles impact human activities and the infrastructure. Overview of emerging environmental issues and technologies in the areas of environmental impact and sustainability, industrial ecology, waste utilization, and infrastructural response. Topics include human impacts on climactic variability; geologic instability; the water balance and atmospheric circulation at local and regional scales.
- **INES 8XX2 Infrastructure and Environment II (3 credits)**
Overview of urban infrastructural development. Sustainable design features for facilities including municipal, transit, industrial, agricultural, telecommunications, and waste management. Impact of infrastructure development on environmental management including storm water quality and quantity, soil and channel erosion, urban air quality, sprawl, and waste production, treatment, and storage.

Students must then take at least one course from INES 8XX3, INES 8XX4, and INES 8XX5 depending on the student's background and interests and the recommendations of the student's doctoral committee. Student enrollment in the program during the first 4 years may not justify offering INES 8XX3, INES 8XX4, and INES 8XX5 every semester. Therefore, students may experience a limited selection among these three courses initially.

- **INES 8XX3 Acquisition and Management of Scientific Data (3 credits)**
The study of theories and techniques for acquiring and managing scientific data and information related to the analysis, design, and management of the infrastructure and the environment. Includes pertinent aspects of information technology, such as data mining and data architecture, and includes applications of GIS and non-destructive assessment technologies to data acquisition.
- **INES 8XX4 Laws, Standards, Policies, and Regulations (3 credits)**
The study of legal, political, and regulatory systems as they relate to the infrastructure and the environment. Includes local, state, national, and international codes and standards that govern the analysis, assessment, design, and management of infrastructure and environmental systems.
- **INES 8XX5 Economic Principles in Infrastructure and Environmental Management (3 credits)**
The study of economic concepts that affect the decision-making process in the management of the infrastructure and the environment. Topics include market forces, taxation, budgets, finance, and public goods and their effects on the economic sustainability of the infrastructure and the environment. Students will take this class after satisfying their comprehensive examination requirement.

III.D.1.1.b. INES case study course (3 credits)

After completion of INES core courses, INES students, regardless of focus areas, will come together in an interdisciplinary case-study, capstone-oriented course examining the relationships between the infrastructure and the environment. Case studies will include examples that focus on the Charlotte urban region.

- **INES 8XX6 Case Study Course**

Students will work together on interdisciplinary teams to study relevant environmental and infrastructure problems presented through case studies. The intent of the course is to involve the students directly in ongoing urban community projects.

III.D.1.1.c. INES seminar courses (3 credits)

Throughout the program, INES students, regardless of focus areas, will come together in interdisciplinary seminar courses in which they will make presentations and lead discussions on topics related to their respective focus areas and critique presentations.

- **INES 8XX7 Seminar Course**

Each student will be required to participate actively in program seminars delivered by student researchers, faculty, and invited speakers. These seminars will be advertised to the campus and professional communities. Participation in these seminars will count for 3 credit hours (1 credit hour for each academic year). Prior to graduation, each student will make at least one seminar presentation and provide at least one formal critique of a presentation in this course.

III.D.1.2. Independent Study (1 - 9 credits)

At any time during the INES program, and with approval by the student's doctoral program committee, a student may enroll in an independent study to pursue topics of interest to the student and the professor. The number of independent study credit hours taken each semester must be approved by the student's doctoral program committee. The total number of independent study hours taken during the Ph.D. program cannot exceed 9 credit hours applied towards the INES Ph.D. degree.

- **INES 8XX0 Doctoral Independent Study and Project**

Individual investigation and exposition of results. May be repeated for credit.

III.D.1.3. Dissertation (18 credits minimum)

After completion of the qualifying examination, each INES student will be eligible to enroll in doctoral dissertation research. The number of research credits taken each semester must be approved by the student's doctoral program committee.

- **INES 8999 Doctoral Dissertation Research (1-9 credits)**

Each student will initiate and conduct an individual investigation culminating in the preparation and presentation of a doctoral dissertation.

III.D.1.4. Doctoral Residence

Graduate residence credit should be used only rarely and, if used, a student would sign up only once during his or her last semester prior to graduation. If the student is working on the degree, he or she should sign up for the appropriate course.

- **INES 9999 Doctoral Residence (1 credit)**

Meets Graduate School requirement for continuous enrollment during final term prior to graduation when all course work has been completed.

III.D.2. Existing courses

Initially, the majority of the specialized elective courses taken in the focus areas or as directed studies courses will be selected from existing 6000-level graduate courses or from new 8000-level courses developed for the proposed program. A representative list of courses in each focus area is provided below. As elective courses, none of these courses will be required, but they will be selected by the student and his/her adviser and committee to satisfy the student's educational objectives. It is anticipated that as the program grows and new faculty members participate in the program, new elective courses will be developed and added to each focus area by the various departments involved.

III.D.2.1. Specialized (focus area) elective courses (15 credits minimum)

It is recognized that doctoral degree study requires advanced knowledge of issues, the breadth of which depends on the context and objectives of the academic program. Both the infrastructure and the environment involve broad and multi-faceted issues. The supporting courses (central core, case studies, and seminars) have been designed to provide the student with broad-based understanding of such issues. Beyond the core, a student needs to support doctoral research with enrollment in particular courses related to his/her research. For this reason, 15 credit hours have been reserved for specialized electives. The objective of these specialized electives is to provide an opportunity for students, their advisers, and the doctoral program committee to select a complementary set of specialized courses intended to both focus and broaden the student's area of interest and research.

These courses will come from many fields and sub-fields of various academic departments of UNC Charlotte, and they could come from the two core courses not selected as a part of the core requirement. A few representative courses are listed below. These courses reflect some of the interests and expertise of the supporting departments.

Specialized electives within the three focus areas described previously (INESD, INESS, INESM) are described below. Many courses listed are currently offered in various departments at the master's level, except for the Public Policy courses which are currently offered at the

Ph.D. level. Each department offering or planning one of the courses listed below has agreed to support the INES Ph.D. Program with at least these courses. Upon approval by faculty governance, each course will be cross-listed at the Ph.D. (8000) level.

III.D.2.1.a. Focus Area 1: Infrastructure and Environmental Systems Design (INESD)

The design of infrastructure and environmental systems requires expertise in subject matter areas related to design methodologies including plan formulation, dimensioning of systems that could be structural and/or control systems, selection of material properties, and configuration of monitoring methodologies and approaches. Also, some basic knowledge of the functional requirements of the facilities concerned needs to be provided to the student. The following courses are examples that could be selected to provide students with adequate expertise on design elements of the INES doctoral program.

A representative list of courses to be offered in this focus area is shown below with the responsible department designated in parentheses.

- INES 8XXX Special Topics (in respective departments)
- INES 8XXX Shaping the American City (ARCH)
- INES 8XXX Appropriate Technology and Sustainable Design Methods (ARCH)
- INES 8XXX Transportation Systems Analysis (CEGR)
- INES 8XXX Soil Dynamics and Earthquake Engineering (CEGR)
- INES 8XXX Advanced Waste Containment Systems (CEGR)
- INES 8XXX Sustainable Environmental Systems (CEGR)
- INES 8XXX Optimization of Building Systems (CEGR)
- INES 8XXX Development of Codes and Standards (CEGR)
- INES 8XXX Engineering Systems Integration (EMGT)
- INES 8XXX Industrial Development (GEOG)
- INES 8XXX Site Planning and Development (GEOG)
- INES 8XXX Urban Planning (GEOG)

III.D.2.1.b. Focus Area 2: Infrastructure and Environmental Systems Science (INESS)

Successful development and operation of infrastructure, including methods and approaches to managing the associated environmental and socio-economic impacts, require baseline information on the nature of the ambient environment spatially and temporally. The INES student will be exposed to critical issues and techniques in the central core and will become interested in environmental systems and their response to the operation of the infrastructure. This student will need to deepen his/her knowledge in the methods of physical, chemical and biological characterization of materials and other life support systems in the ecosystem. Particularly, the factors that affect the rates of change in such systems as affected by anthropogenic activities need to be addressed by the majority of the courses selected by advisers for their students in this focus area. Consistent with the foregoing rationale, the following courses have been identified as examples of courses that are relevant to this focus area. It should be noted that scientific assessment cannot be completely divorced from policy formulation and appreciation of the basic approaches to design. For this reason, students will be encouraged to

select courses in this focus area to extend his/her knowledge base in the breadth of issues that pertain to infrastructure and environmental systems.

A representative list of courses to be offered in this focus area is shown below with the responsible department designated in parentheses.

- INES 8XXX Special Topics (in respective departments)
- INES 8XXX Advanced Ecology (BIOL)
- INES 8XXX Microbiology (BIOL)
- INES 8XXX Air Quality Modeling (CEGR)
- INES 8XXX Water Quality Management and Modeling (CEGR)
- INES 8XXX Environmental Aquatic Chemistry (CEGR)
- INES 8XXX Advanced Analytical Chemistry (CHEM)
- INES 8XXX Advanced Energy and Environmental Economics (PPOL/ECON)
- INES 8XXX Designed Experimentation (EMGT)
- INES 8XXX Earth System Analysis: Biogeochemical Cycles (ESCI)
- INES 8XXX Hydrologic Processes (ESCI)
- INES 8XXX Environmental Site Characterization (ESCI)
- INES 8XXX Advanced Soil Science (GEOL)

III.D.2.1.c. Focus Area 3: Infrastructure and Environmental Systems Management (INESM)

To be able to efficiently and effectively plan and manage infrastructure system or environmental system operations, the INES students need to obtain, integrate, and utilize the knowledge in operations efficiency, effective policy development and deployment, legal issues and government regulations, intelligent support systems for decision making, effective environmental and/or socio-economic impact control measures, efficient systems project management, comprehensive evaluation of system performance, and smart systems implementation and management that includes the consideration of facility, people, policy, technology, economics, and procedures. The students who choose to focus in this area of INES will obtain the expertise in effective systems management and implementation in infrastructure system and/or environmental system areas and will work as senior managers and/or researchers in the above areas. The following courses are examples that could be selected to provide students with expertise on systems management that are relevant to infrastructure and environmental systems.

A representative list of courses to be offered in this focus area is shown below with the responsible department designated in parentheses.

- INES 8XXX Special Topics (in departments)
- INES 8XXX Hazardous Waste Management (CEGR)
- INES 8XXX Urban Systems Engineering (CEGR)
- INES 8XXX Benefit-Cost Analysis (ECON)
- INES 8XXX Advanced Project Management (EMGT)

- INES 8XXX Legal Issues in Engineering Management (EMGT)
- INES 8XXX Engineering Systems Integration (EMGT)
- INES 8XXX Urban Planning: Theory and Practice (GEOG)
- INES 8XXX Economics of Decision-Making (MBAD)
- INES 8XXX Technology-Enhanced Decision Making (MBAD)
- INES 8XXX Organizational Leadership and Behavior I (MBAD)
- INES 8XXX Qualitative Methods in Public Policy (PPOL)
- INES 8XXX Advanced Program Evaluation (PPOL)

III.C.1.3. Directed Studies (24 credits minimum)

In recognition of varying backgrounds, preparation, interests, and goals, each student may complete additional credits through directed studies (courses, research, or individual study), with the consent of his/her adviser and doctoral committee. Within the directed studies category, and with the approval of his/her adviser and doctoral committee, a student may complete a maximum of 9 credits of independent study toward the Ph.D. degree

IV. Faculty

IV.A. Faculty members in the Program (INES Program Faculty)

Current UNC Charlotte faculty members who have agreed to be directly involved in the proposed program are listed below. Resumes of these principal faculty members are attached in Appendix II. Brief descriptions of each of the principal faculty member's education, teaching experience, research experience, publications, and experience in directing student research including the number of theses and dissertations directed for graduate programs are provided in the resumes. Additional faculty members are expected to participate as the program grows.

Craig Allan, Ph.D. -----Geography and Earth Sciences
Brian J. Anderson, Ph.D. -----Civil Engineering
Lawrence S. Barden, Ph.D. -----Biology
John Bender, Ph.D. -----Geography and Earth Sciences
Andy Bobyarchick -----Geography and Earth Sciences
James Bowen, Ph.D. -----Civil Engineering
Dale Brentrup, M.Arch. -----Architecture
Harrison S. Campbell, Ph.D. -----Geography and Earth Sciences
Kenneth M. Chilton, Ph.D. -----Geography and Earth Sciences
Brian T. Cooper, Ph. D -----Chemistry
John Daniels, Ph.D. -----Civil Engineering
John Diemer, Ph.D. -----Geography and Earth Sciences
Bernadette T. Donovan-Merkert, Ph.D. ---Chemistry
Thomas D. DuBois, Ph. D. -----Chemistry
Martha C. Eppes, Ph.D. -----Geography and Earth Sciences
Owen Furuseth, Ph.D. -----Geography and Earth Sciences
Janos Gergely, Ph.D. -----Civil Engineering
Kenneth Gonsalves, Ph.D. -----Chemistry

Johnny R. Graham, Ph.D. -----Civil Engineering
Christopher P. Grech, M.Arch. -----Architecture
Edd Hauser, Director, Ph.D. -----Geography and Earth Sciences
Helene Hilger, Ph.D. -----Civil Engineering
Scott P. Hippensteel, Ph.D. -----Geography and Earth Sciences
Gerald Ingalls, Ph.D. -----Geography and Earth Sciences
Hilary I. Inyang, Ph.D. -----Civil Engineering/
Geography and Earth Sciences
Rajaram Janardhanam, Ph.D. -----Civil Engineering
Martin R. Kane, Ph.D., P.E. -----Civil Engineering
Gaines H. Liner, Ph.D. -----Economics
Walter Martin, Ph.D. -----Geography and Earth Sciences
Darla Munroe, Ph.D. -----Geography and Earth Sciences
Craig Ogle, Ph.D. -----Chemistry
Vincent O. Ogunro, Ph.D.-----Civil Engineering
James Oliver, Ph.D. -----Biology
Jordan Poler, Ph.D. -----Chemistry
Stanislov Radchenko, Ph.D. -----Economics
Peter Schwarz, Ph.D. -----Economics
Wade Sisk, Ph.D. -----Chemistry
Inna Sokolova, Ph.D. -----Biology
Todd R. Steck, Ph.D. -----Biology
Gary Teng, Ph.D. -----Engineering Management
David J. Thaddeus, M.Arch. -----Architecture
Mark Thomasson, Ph.D. -----Geography and Earth Sciences
David C. Weggel, Ph.D. -----Civil Engineering
Jy Wu, Ph.D. -----Civil Engineering
Wei-Ning Xiang, Ph.D. -----Geography and Earth Sciences
David Young, Ph.D. -----Civil Engineering

IV.B. The need for new faculty during the next four years

A large number of additional faculty slots will not be required to operate the INES Ph.D. Program as designed. UNC Charlotte has strengthened its faculty in the infrastructure and environmental areas during the past several years by hiring approximately a dozen new faculty members. These faculty members were hired as graduate faculty members with an eventual Ph.D. program in mind. They, plus many of the other faculty members listed above, are currently involved in graduate-level education in terms of teaching, conducting research, and advising graduate students. Therefore, the transition to Ph.D.-level education will not place an uncomfortable burden on them. If indeed there is initially a small teaching and advising overload to start the INES Program, these faculty members are willing to carry that load, for the short term, in order to ensure the success of the Program.

The initiation of this program will require two new faculty members and then three more over the next two years. These faculty members will be hired in critical areas identified by the program leadership, will have responsibilities for teaching in the core of the Program, and will be

given dual responsibilities in the program and their home departments. One of the initial hires is expected to be a Program Director who, in addition to directing the Program, will serve as a faculty member in one of the supporting departments and will teach INES core courses. The Program will also receive at least 8 new GTA positions over the first 3 years. These positions will be used to hire students who will assist faculty members in the laboratory and classroom.

IV.C. Source of funds for new faculty

New faculty positions, to support growth of the proposed new program, will occur through normal university allocations. Funding for new faculty positions will occur as the student enrollment at UNC Charlotte continues to grow. Likewise, UNC Charlotte's recent reclassification to Doctoral/Research University – Intensive status and its eventual reclassification to Doctoral/Research University – Extensive will provide additional funding for faculty positions.

The INES Ph.D. Program has the support of the deans of the two primary supporting colleges in terms of providing allocated faculty positions for the program. Furthermore, faculty retirements will provide additional opportunities to re-invest human resources in this critical area of intellectual activity. Endowments of programs and faculty positions at UNC Charlotte are expected to continue to grow and contribute to this program.

IV. D. Effects of the program on faculty activities

Implementation of the proposed Ph.D. Program will have a number of positive effects on faculty activities. These effects will result from participation in a Ph.D. program, from interdisciplinary collaboration, and from the emphasis on infrastructure and environmental systems. Graduate faculty members in each of the participating departments at UNC Charlotte are already engaged deeply in research and have been operating in research-type environments for a number of years. They will use the Ph.D. platform to expand their research programs. Doctoral students will have longer periods of research apprenticeship than master's students, and faculty members will be able to conduct more comprehensive and in-depth research. More experienced and mature doctoral students, working as GTA's, will provide valuable assistance to faculty members in the classrooms and laboratories.

In recent years, many funding agencies have shown an increased interest in topics that address three aspects or areas of research: (1) research teams comprising interdisciplinary, collaborating researchers from various departments on campus; (2) research that specifically addresses infrastructure and environmental problems; and (3) projects that develop solutions from a systemic basis, as opposed to evaluating only separate components. The INES Ph.D. Program is inherently interdisciplinary and emphasizes infrastructure and environmental research and education using a system-wide approach. These three aspects of the program are timely and attractive and will provide opportunities to faculty members for scholarly work through increased research funding opportunities.

Dr. Hilary Inyang, Director of the Global Institute for Energy and Environmental Systems (GIEES) at UNC Charlotte, notes the positive impact created by interdisciplinary faculty teams

when he summarizes recent activities in GIEES. Many of these faculty members will be members of the INES Program Faculty, and, even though during the past 2 years they are limited to master's level student researchers, they have: served on 10 federal, state and local panels; received 3 professional awards; engaged 10 potential research/program sponsors; authored 15 research proposals (securing more than \$1.1 million in research funding); authored 30 research articles; and served in leadership and editorial positions during the preparation of six special editions of four refereed international journals on critical issues related to advances in infrastructure and environmental systems. This level of activity is significantly greater than the level that existed before interdisciplinary work began in GIEES.

Regarding the benefits of approaching research from a systemic view point, Thomas L. Theis, consultant and reviewer of this proposal, notes the potential positive impact of the proposed Program on researchers and he states,

Such an approach adds value to the research in several ways. First, greater knowledge of the system can inform the research, perhaps by changing the way hypotheses are framed or by creating a new set of critical questions. Second, the systemic view makes possible alternate solutions to the problem at hand. Also as system boundaries expand, new or reframed topics come into view that either weren't obvious prior to expansion or in some cases, didn't even exist," and finally it makes a "larger array of investigative techniques available" to the researcher.

As the INES Ph.D. grows in terms of student enrollment and faculty scholarly activities, care will be taken to avoid significant teaching overloads and to solve problems that may arise from faculty members' duties being shared between the INES Ph.D. Program and the home departments. This care will be exercised through existing annual faculty evaluations conducted in the home departments and by the annual review process of the INES Ph.D. Program, described in Section VII of this proposal.

V. Library

V.A. Library holdings for the proposed program

The J. Murrey Atkins Library of the University of North Carolina Charlotte can adequately support the proposed INES Ph.D. Program (see letter of support from the Library in Appendix III). The library holds more than 725,388 bound volumes and extensive microform collections. As a selective depository of US publications since 1964, the Atkins Library holds more than 958,800 federal documents, including statistics, bibliographies and full text files on compact discs, a large fraction of which will be essential to research and graduate studies in INES. Furthermore, there is a growing collection of more than 53,053 maps, spanning USGS topographic quadrangles to historic WWII-era Defense Mapping Agency maps suitable for use in tracking geomorphic changes. The library also subscribes to about 50 journals that directly pertain to infrastructure and environmental issues.

The Library offers state-of-the-art electronic access to local and worldwide resources. JASMINE, the library's online catalog, provides access to print and non-print resources located

within the Library and available over the web. Networked multitasking computers with high speed printing and download capabilities provide electronic access to local research databases, electronic journals, full-text articles, and Internet connections to the world including NC Live, the North Carolina electronic initiative with access to thousands of databases. Web-based access to Library electronic research materials is also available from other locations on- and off-campus, if license agreements permit.

A more detailed description of the library's holdings and capabilities that specifically support the proposed INES Program is provided in the UNC Charlotte library consultation report included in Appendix III.

Additional support for the INES Program will be provided by the GIEES mini-library located in the C.C. Cameron Center facility. The library holds about 30,000 books, papers and reports on environmental and related issues and is currently used by students and faculty to support projects. Among the periodicals on which subscriptions are retained are Resources Conservation and Recycling; Environmental Monitoring and Assessment; International Journal of Soil and Sediment Contamination; ASCE Journal of Environmental Engineering; Waste Management; Waste Management and Research; and the International Journal of Surface Mining and Reclamation. Students who use the library can also access several environmental websites displayed there to get information on recent advances in the field.

V.B. Improvements to the Library to meet new program requirements in the next 5 years

As indicated in the UNC Charlotte library consultation report (Appendix III), the library's monograph collection in areas relevant to the INES Program is adequate but will need improvements in the future. In comparison to libraries on campuses hosting six similar and highly regarded programs in the U.S., UNC Charlotte's monograph collection lags behind four of them but is ahead of the other two. Likewise, the Library has access, in either electronic format or print, to over 50 percent of the top 2,000 journal titles cited in a broad range of infrastructure and environmental areas. For the INES Program to succeed at the desired level, access to these publications and materials will need to be expanded. The attached library consultation report recommends a small budget to accomplish these improvements gradually over the next few years.

V.C. Contemplated use of other institutional libraries

As discussed in section V.A., UNC Charlotte has access to a national network of libraries. Also, libraries at three other major institutions: UNC Chapel Hill, North Carolina State University and Duke University are within a few hours driving distance and participate in an inter-library loan program.

VI. Facilities and Equipment

VI.A. Facilities available for the proposed program

Several facilities are available at UNC Charlotte to support instruction and research for the planned Ph.D. in Infrastructure and Environmental Systems. The key facilities are those of the Global Institute for Energy and Environmental Systems (GIEES), the Regional Analytical Chemistry Laboratory, the Center for Transportation Policy Studies (CTPS), the UNC Charlotte Urban Institute, the Department of Civil Engineering, the Department of Geography and Earth Sciences, the Department of Biology, and the College of Architecture. GIEES operates several laboratories at the Cameron Center and networks with two other laboratories: Lighting and Building Energy Technology Lab – currently housed in the College of Architecture; and the Water Quality Experimentation Lab – currently housed in the Kennedy Building. GIEES laboratories at the Cameron Center facility are: Bioenvironmental Research Lab; Geosystems Research Lab; Geotexture and Mineralogy Lab; Hydrological Modeling Research Lab; and the Physico-chemical Interactions Research Lab.

The Institute has acquired several pieces of research equipment and office automation within the past year to develop its facilities within the Cameron Applied Research Center. This equipment includes phase-contrast microscopes with color video camera and monitor, TOC analyzer, PCR thermocycler, a bio-incubator, Shimadzu Gas Chromatograph 14A, spectrophotometer, COD heating blocks, atomic absorption spectrophotometer, pilot settling columns, custom-designed desiccation chamber, viscometer, bench top and micro-centrifuges, surface area analyzer, approximately 20 computer workstations and general office equipment. The Institute also has access to a nuclear magnetic resonance machine on-site, as well as complimentary sample analysis equipment operated by the Regional Analytical Chemistry Laboratory. This facility supports ongoing proposal development and research efforts.

Among the research equipment that GIEES plans to acquire are a mobile laboratory for environmental sample acquisition and testing, EDAX-fitted electron microscope for determining the distribution of elements on sample cross-sections, magnetic susceptibility measurement equipment for soils and rocks, equipment for measurement of dielectric characteristics of contaminated materials, and particle size analyzers.

The Department of Civil Engineering operates facilities in the Smith Engineering Building. Facilities available for graduate research and education in INES include the environmental, biotechnology, geotechnical and soils, structural and materials, and transportation laboratories located in Smith and Kennedy buildings. Instruments are available in the environmental research laboratory for the analysis of heavy metals, inorganic and organic specimens, and conventional water quality parameters. Transportation research facilities include a microcomputer laboratory with current highway capacity, traffic signal and traffic network flow models, traffic signal controllers, photometric equipment for traffic control devices, and human factors testing equipment. Structures and materials research facilities include automated data acquisition and control systems, loads frames, static and dynamic servo-hydraulic testing systems, precision electromagnetic force compensation scales, high capacity concrete compression equipment, MTS, Instron, and Satec automated testing equipment, and a scanning electron microscope.

Geotechnical research facilities include multiaxial testing devices, flexible wall permeameters, cyclic triaxial units with servo-controlled testing systems, pressure and displacement transducers, electrical accessories and data-acquisition systems. Field test units like Dutch cone penetrometer and double-ring permeameter are available. Geosynthetic test facilities include pull-out box, clogging-test units, and Instron tensile test machine. Research within the department also utilizes GIS, microcomputers, workstations, and mainframe computers.

Modern facilities are also operated by the Department of Geography and Earth Sciences in McEniry and Kennedy Buildings. Well-equipped laboratories in physical geology, physical geography, historical geology, mineralogy, optical mineralogy, sedimentology, structural geology, geochemistry, hydrology, soil science, meteorology, remote sensing and geographic information systems support both faculty and teaching. Solid earth and sedimentological investigations are supported with a geochemical sample-preparation laboratory, deltec furnace, and inductively coupled plasma emission spectrometer (ICP), X-ray diffractometer, X-ray fluorescence, ICP-MS, rapid sediment analyzers, and a carbon analyzer. The petrology and optical mineralogy facilities include petrographic microscopes linked with image-analysis, photomicrographic and cathodoluminescence systems, as well as slab saws and precision thin-section machinery. An automated proton precision magnetometer, a 12-channel seismograph, a ground-penetrating radar system and resistivity unit are available for field-based geophysical surveys. Total stations, GPS, and theodolite surveying equipment also reside in the Department.

Field hydrolometeorologic studies are supported by a wide array of meteorological and water quality sensors controlled and monitored through modern Campbell Scientific data logging systems. Water quality and biogeochemical investigations are carried out in newly renovated laboratory facilities in the Kennedy building. Chemical analyses are performed with an ICPMS, Shimadzu TOC/TN Analyzer, a DIONEX ion chromatograph (IC) system, ICP spectrophotometer, and a variety of ion selective electrodes. Sample preparation is facilitated with a microwave digestion system. Subsurface investigations are supported by a Soil gas vapor detection system. A Department van is available for field investigations and extensive field instrumentation and camping gear is also on hand.

A recently established computation laboratory for Earth Systems Analysis is housed in the Kennedy Building. The lab has an autonomous A VHRR capture engine running continuously and is achieving daytime NOAA 12, 14 and 15 HRPT data sets. Digital spectroradiometers are available for bench top and field collection of spectra under transmission and reflection modes. ArcInfo (GIS) and ERDAS, GYPSY -OASIS DGPS, and GAMMA (remote sensing) software, Visual Modflow (Groundwater modeling) is supported on several UNIX and NT workstations. A wide assortment of GPS equipment is also housed in the facility. Students in the McEniry building have access to a departmental computer laboratory equipped with networked Apple Macintosh and PC microcomputers, a file server, and printers. This facility is networked to other laboratories on campus and to the Internet via the University's mainframe computers. A separate Geographic Information System (GIS) and remote-sensing laboratory houses a SUN Microsystems 4/390 filesaver, SUN Sparc workstations, digitizers, and a large format color electrostatic plotter. Arc/Info, Erdas and GeoStorm software packages run on the workstations and are used to support classes in GIS, remote sensing, hydrology, image processing, and spatial-decision support systems. The Department also maintains a large collection of geographically

referenced data for use by students and staff in the laboratory. These data sets include satellite imagery, United States Geological Survey map data, and United States Census Bureau files, as well as locally developed data sets. Current NOAA weather data is continuously monitored and archived in the Department weather analysis laboratory.

The research facilities available for the Interdisciplinary Ph.D. in Biology include those facilities in several different departments. The Department of Biology occupies laboratory space in the Cameron Applied Research Center that is equipped with instrumentation needed for a wide range of molecular, microbial, organ, and organismal research, as well as core facilities for imaging and chromatography. The McEniry Building also houses research laboratories, a vivarium, an electron microscopy facility, and a core facility for DNA sequence analysis. The Cannon Research Center of the Carolinas Medical Center contains up-to-date laboratories with emphasis in tissue engineering, cancer therapy, cardiovascular studies, orthopaedic biology and engineering, and molecular biology. Major core facilities include an AALAC-accredited animal facility, electron microscopy, confocal microscopy and image analysis systems. The Department of Chemistry facilities in the Sherman Burson Building and the Cameron Applied Research Center include an array of chemical instrumentation and a computational chemistry laboratory, a scanning tunneling microscopy facility, and the Regional Analytical Chemistry Laboratory core facility. The Department of Physics houses laboratories equipped for high-resolution imaging, spectroscopy, near-field scanning optical microscopy, and fiber sensor development. The College of Engineering facilities include laboratories devoted to precision metrology, device design and testing, microscopy, imaging, computing, microfabrication, and bioprocess technology.

VI.B. Describe the effect of this program on existing facilities

As graduate programs grow at UNC Charlotte, the need for expansion of research facilities has arisen. However, UNC Charlotte is following through on expansion plans associated with the November 2000 bond referendum. As the new buildings come on line in the next few years, there will be opportunities for expansion of the research and office space for the INES program. The Department of Civil Engineering will expand into vacated space in the Cameron Building; the Department of Geography and Earth Sciences will expand in the McEniry Building; and the Department of Biology will move into the new Science and Technology Building. In addition, several existing laboratories in supporting departments such as Civil Engineering, Earth Sciences, Biology and Chemistry will also be used to support the program. However, the program will not put pressure on undergraduate laboratories because most of those labs are used exclusively for instruction and associated student projects.

As mentioned above, planned expansions (within the next 1-2 years) into new and backfilled space by most of the departments and programs supporting the INES Program will provide ample space for INES Program activities for the immediate and near future. This expansion is justified because research at UNC Charlotte has grown rapidly over the past few years in the energy, environmental, and infrastructure sectors, new faculty members and research associates have been added, and graduate student enrollment has increased.

VI.C. Computer and Information Technology services

VI.C.1. Available computer and IT services

UNC Charlotte has adequate computing services to support the instructional, research and administrative computing needs for the INES Ph.D. program. All student computing labs and offices have access to the commodity Internet and Intranet. There are more than 42 student computing labs with a total of more than 1,150 stations. Almost all the computing labs have specialized software and hardware. UNC Charlotte is the member of the North Carolina Research and Educational Network which links it to the North Carolina Supercomputer Center and other computing resources in the State of North Carolina. Each of the participating departments also operates a computer laboratory where specialty software is stored for use by student, faculty, and research associates. For example, the Department of Geography and Earth Sciences operates a computational laboratory for Earth Systems Analysis, housed in the Kennedy Building. The lab has an autonomous A VHRP capture engine running continuously and is achieving daytime NOAA 12,14 and 15 HRPT data sets. ArcInfo (GIS) and ERDAS, GYPSY - OASIS DGPS, and GAMMA (remote sensing) software, Visual Modflow (Groundwater modeling) is supported on several UNIX and NT workstations. The Department also maintains a large collection of geographically referenced data for use by students and staff in the laboratory. These data sets include satellite imagery, United States Geological Survey map data, and United States Census Bureau files as well as locally developed data sets. Current NOAA weather data is continuously monitored and archived in the Department's weather analysis laboratory.

The College of Engineering maintains a dedicated computing network to serve the needs of faculty, staff and students in each of its four departments. This system, known as the Mosaic Computing Environment or just Mosaic, is operated by a seven member staff employed within the College. This system is primarily a mixture of Sun Solaris and Windows XP workstations configured to take advantage of a robust network-based infrastructure. The College has developed a common network file system and authentication infrastructure based on the Advanced File System (AFS) and the Kerberos authentication standard. Civil Engineering students have access to a variety of computer labs and classrooms including a high performance Unix lab, a Unix classroom lab, a Windows classroom lab, and a CAD/Drafting lab/general purpose lab. The classroom labs are equipped with an instructor station and monitors to allow students to watch the instructor's screen while working on a computer during class. In addition, there are over 150 systems available to students under certain circumstances located in special purpose labs, graduate student offices, or other common facilities. The campus also provides general purpose computing labs that are available to engineering students for routine tasks (e.g. word processing, web access) but that do not provide access to discipline-specific software. The College maintains a small computing cluster for CPU intensive calculations that currently includes a dual processor Sun Ultra 60 with 1 GB of RAM and a quad processor Sun Ultra 80 with 2 GBs of RAM. This facility is typically upgraded or enhanced on a two-year cycle. The College also has a variety of other facilities including a Distance Learning Classroom and supplemental instruction facility, a web server, a streaming media server, four multimedia enabled classrooms, loaner laptops, digital camera, and LCD projectors, and a synchronous communications server. The Mosaic Computing Environment provides students and faculty access to a wide range of general purpose and discipline-specific software. There are currently

over 250 unique applications installed on the two primary platforms including many industry standard engineering packages.

VI.C.2. Required computer and IT services

Inherent in the nature of the INES doctoral program will be the requirement to have state-of-the-art computational tools and hardware. IESD comprises several analysis and design courses that typically involve the use of specialized software. These software tools are already in use in the instruction of most of the graduate courses that have been identified for inclusion in the proposed Ph.D. program. Similarly, the IESS focus area requires specialty software that is used for the analysis of environmental processes, their rates of occurrence, and impacts on the ecosystem. IESM involves the use of databases that support codes, standards, and specifications for infrastructure planning, modeling, costing, decision analysis, and operation.

The two primary Colleges (Engineering and Arts and Sciences) supporting this program currently have sufficient computing and information technology capabilities and facilities resources to support the proposed program. A brief description of those facilities is given in Section VI.C.1.

VI.D Financial support for equipment and facilities

In anticipation of the proposed program, both primary Colleges (Arts and Sciences and Engineering) have planned for facilities to house classrooms and laboratories to support the two primary departments in the program. The Department of Geography and Earth Sciences will backfill into space in the McEniry Building vacated as other departments move into new buildings. The Department of Civil Engineering will backfill into space in the Cameron Applied Research Building as several departments move to new buildings on campus. In each case, the backfilled space will include classrooms, faculty offices, graduate student space, computing rooms, and extensive laboratory space, much of which will support the INES Ph.D. Program.

Both Colleges have continued preparations for the INES Ph.D. Program by allocating equipment funds to Geography and Earth Sciences and to Civil Engineering. These funds have come from annual laboratory equipment operating budgets provided by the Colleges and from one-time funds provided to the Colleges by the Provost. Future funding for equipment and facilities will continue to come from these sources as well as from external funding obtained through proposals to agencies and industry.

VII. Administration

VII.A. Administrative Structure

The administrative structure of the planned Ph.D. program is illustrated in Figure 2. The program will be operated as an interdisciplinary cross-college but integrated doctoral program. It will be centrally administered, but with sufficient latitude to accommodate the diversity of disciplinary interests, student backgrounds, and supporting administrative units. The program will be led by a Program Director. Each student will have a Doctoral Program Committee chaired by his/her doctoral research adviser, who will liaise with the Interdisciplinary Ph.D.

Program Committee on INES (IPC) in the advising and implementation of the student's academic program. The IPC will report to and advise the Director of the INES doctoral program. As shown in Figure 2, as justified by the INES program being an academic affairs program, the Director of the INES program will report to an administrative panel of the Dean of the Graduate School, the Dean of the College of Engineering, and the Dean of the College of Arts and Sciences. The IPC will be advised by the Ph.D. Advisory Committee (PAC) comprising representatives from other supporting departments and centers. Descriptions of each person and group and their responsibilities are provided later in this section.

VII.A.1. The Graduate School

The Graduate School is responsible for setting policy regarding the operation of all graduate programs of the University of North Carolina at Charlotte. These policies cover minimum admission standards and performance requirements for successful completion of graduate degree programs. The INES doctoral program will be subject to the rules and policies of the Graduate School.

VII.A.2. The Dean of the Graduate School

The Dean of the Graduate School is responsible for the supervision of all graduate programs consistent with the policies approved by the UNC Graduate Council, the Graduate Faculty, and the Faculty Council. The Dean is the principal officer with the responsibility of ensuring the high quality of all graduate programs, providing oversight on all admission and graduation of graduate students, and appointing faculty to graduate faculty status at the University of North Carolina at Charlotte. It is anticipated that the Dean of the Graduate School will communicate with the Deans' Panel on important programmatic issues.

VII.A.3. The Deans' Panel

The Deans' Panel will comprise the Dean of The College of Engineering and the Dean of the College of Arts and Sciences. The Panel will be responsible for making final decisions on personnel and resources for the program. Together, the two college deans will oversee faculty and resource processes. They will provide general oversight on the program and will be responsible for the initial appointment, bi-annual evaluations, annual salary adjustments, and dismissal of the Program Director. It is anticipated that the Deans' Panel will communicate with the Dean of the Graduate School on important programmatic issues.

VII.A.4. The Program Director

The interdisciplinary Ph.D. Program Director is responsible to the Deans' Panel in the administration of the planned program. The Director will work in consultation with the IPC on matters of policies and operations but will retain final responsibility for the following tasks associated with the administration of the program:

- serving as chairperson of IPC
- serving as liaison with the Dean's Panel, IPC, Department Chairs of collaborating departments on the implementation of the INES Ph.D. program.

- coordinating course scheduling across participating departments
- recruiting students to the program
- maintaining graduate student records
- scheduling of dissertation defenses
- administering the personnel and budget of the program
- representing the program at external consortia organized around advanced studies in the area of Infrastructure and Environmental Systems
- teaching at least one course per year in the program
- reviewing recommendations from doctoral committees regarding students' admission to candidacy

VII.A.5. The Interdisciplinary Ph.D. Program Committee (IPC) on INES

The Interdisciplinary Program Committee (IPC) will be composed of the following administrators and faculty representatives:

- The INES Program Director
- Four representatives of the College of Engineering
 - At least one representative from the Environmental Area of Civil Engineering
 - At least one representative from the Infrastructure Area of Civil Engineering
 - One representative from Engineering Management
- Four representatives from the College of Arts and Sciences
 - Two representatives of the Department of Geography and Earth Sciences
 - One representative from the Department of Chemistry
 - One representative from the Department of Biology

Note, the Program Director will take one seat on the Committee from the department he/she represents, thus making eight seats on the committee. The IPC will serve as an Advisory Committee to the Program Director and will have the following responsibilities:

- initially directing the INES Ph.D. Program until a Program Director is appointed (the initial chair of the IPC will be appointed by the Deans' Panel with input from the Dean of the Graduate School);
- advising the Program Director on all matters related to the program;
- recommending to the Graduate School applicants for admission to the program;
- approving the plan of study for each student;
- approving each student's doctoral committee and dissertation topic;
- assuring the qualifying examination is administered properly;
- determining that the general requirements for graduation have been fulfilled by each candidate;
- recommending new courses or course revisions to faculty members in appropriate departments; and

- recommending members for search committees for recruiting new faculty assigned to the program.

VII.A.6. The Ph.D. Advisory Committee (PAC)

The Ph.D. Program Advisory Committee (PAC) will be composed of the following faculty representatives:

- A representative of the Department of Economics
- A representative of the College of Architecture
- A representative of the Department of Management
- A representative of the Department of Sociology and Anthropology
- A representative of the Doctoral Program in Public Policy
- A representative of the Global Institute for Energy & Environmental Systems
- A representative of the Center for Transportation Policy Studies
- A representative of the UNC Charlotte Urban Institute
- A representative of the College of Information Technology
- Two representatives from industry

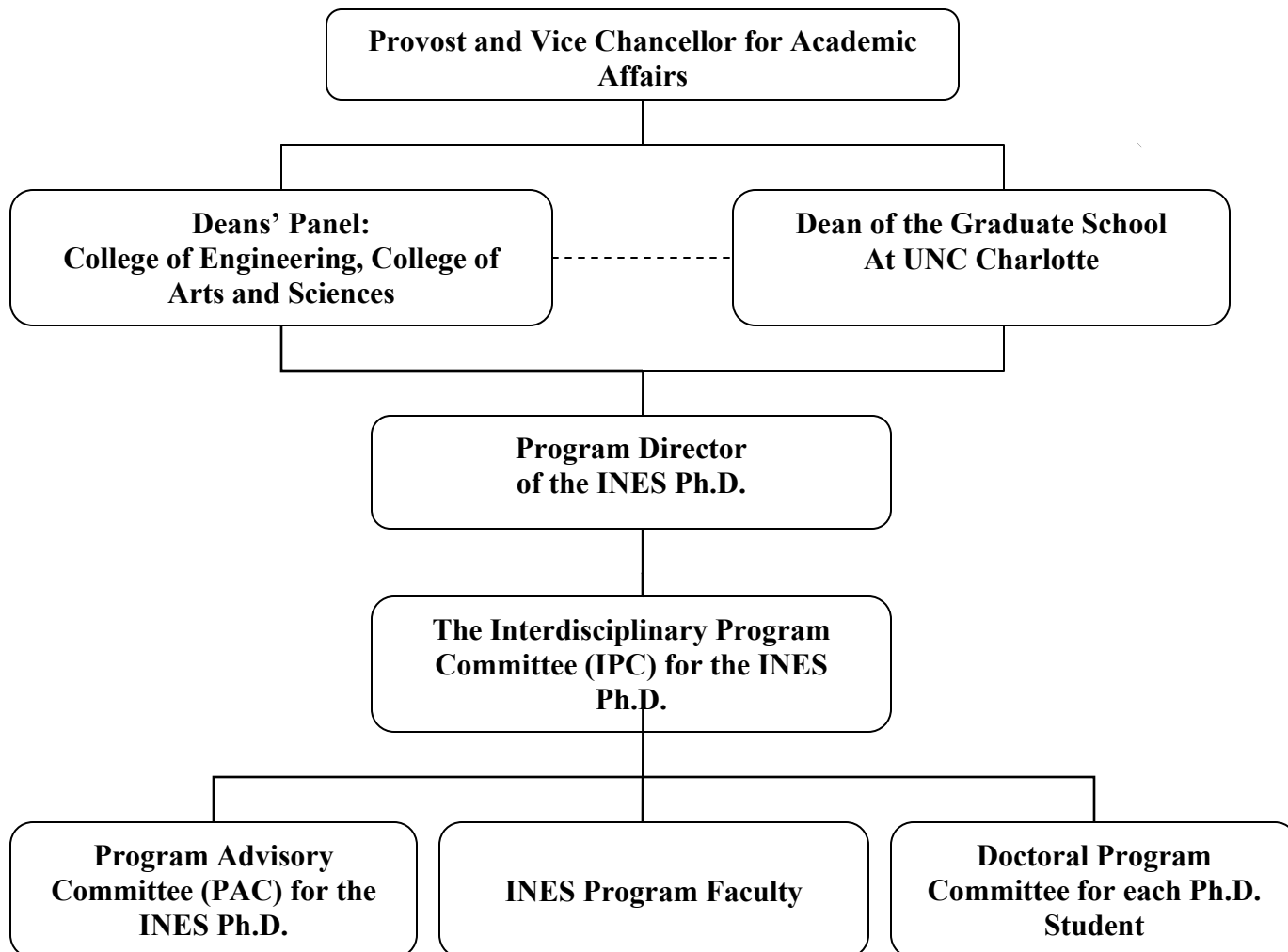


Figure 2. The administrative structure of the planned Ph.D. Program in Infrastructure and Environmental Systems (INES)

The PAC will meet at least annually and serve as an Advisory Committee to the IPC, representing those departments and programs that support the Ph.D. program but are not as heavily involved in terms of courses, students, and research. The PAC will have the following responsibilities:

- advising the IPC on all matters related to the program; and
- assisting with strategic planning for the program

VII.A.7 Program Faculty

Faculty teaching in the INES Program must be members of the UNC Charlotte Graduate Faculty. They will hold appointments in the participating departments and will be appointed to the INES Ph.D. Faculty by the INES Program Director. Participating faculty members will be involved in the following activities:

- teaching INES core courses;
- teaching cross-listed, advanced courses, which make up the elective, focus area course components of the program;
- coordinating the interdisciplinary INES seminar series;
- teaching the interdisciplinary INES case-study course;
- comprising students' doctoral program committee;
- directing students' Ph.D. dissertation research; and
- recruiting new students into the program

All promotion, tenure, annual evaluation, and work load issues for Program Faculty members will be decided by each faculty member's home department, with input from the INES Program.

VII.A.8. Doctoral Research Adviser for each student

Each student will be assigned an interim adviser by the Program Director upon admission into the program. The Interim Adviser, along with 2 other faculty members (at least one from outside the student's home department) assigned by the Program Director, will comprise the Interim Committee. All faculty members on the Interim Committee must be members of the UNC Charlotte Graduate Faculty. The Interim Committee will advise the student on all matters related to his/her plan of study prior to the formation of the Doctoral Program Committee. The interim adviser most commonly will be the faculty member with whom the student has expressed interest to work. This assignment will also depend on the source of the student's financial assistance. Prior to the formation of the student's doctoral program committee and at the request of the student and the Interim Adviser, a permanent adviser will be confirmed by the Program Director as the student's Doctoral Research Adviser. This faculty member must be a member of the INES Ph.D. Faculty and the UNC Charlotte Graduate Faculty.

VII.A.9. Doctoral Program Committee for each Ph.D. Student

Each student's Doctoral Program Committee will contain 5 members. One committee position will be filled by a UNC Charlotte Graduate Faculty member appointed by the Dean of the Graduate School. The remaining four members will be recommended, before the completion of the student's first year in the program, by the student's Doctoral Research Adviser, with input from the Interim Committee. Recommended faculty members should have expertise in the student's area of research interest. The Program Director will approve, with subsequent concurrence by the Dean of the Graduate School, the four recommended faculty members to serve on the student's Doctoral Program Committee. The doctoral program committee of each student will be chaired by the student's Doctoral Research Adviser.

At least three of the Doctoral Program Committee members must be INES Program Faculty members. No more than three doctoral committee members can come from the same academic department, in order to reflect the interdisciplinary nature of the program. The inclusion of one member from outside the University of North Carolina Charlotte is strongly encouraged, and this person must also have appointment to the UNC Charlotte Graduate Faculty.

The student's doctoral program committee will perform the following functions:

- participate in forming the student's plan of study;
- evaluate the student's academic progress;
- administer the qualifying examination;
- evaluate the dissertation proposal;
- administer the dissertation defense; and
- certify to the Program Director the candidate's qualifications for the Ph.D. degree

VIII. Accreditation

VIII.A. Specific Accreditation

There is no professional organization that accredits doctoral programs in the Infrastructure and Environmental Systems (INES) area.

VIII.B. General Accreditation

UNC Charlotte is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (1866 Southern Lane, Decatur, Georgia 30033-4097; telephone number 404-679-4501) to award baccalaureate, master's, intermediate, and doctoral degrees.

The proposed program is not at a more advanced level than those previously authorized for UNC Charlotte. The proposed program is not in a new discipline division and does not constitute a significant modification in the nature and scope of the institution.

IX. Other Supporting Fields

The current status and needed improvements in the primary fields (programs) that will support the INES Ph.D. Program have been described in previous sections of this proposal.

These primary departments and programs will provide the faculty, courses, laboratories, and facilities needed to support the INES Ph.D. Those programs are Biology, Chemistry, Civil Engineering, Economics, Engineering Management, Geography and Earth Sciences, and Architecture. Also, the existing doctoral program in Public Policy provides an opportunity for linkage with the program, primarily in the IESM focus area.

In addition to the courses offered by the primary collaborating departments listed above, other supporting fields (programs) offer advanced graduate courses that may serve as electives to support each student's specific research topic. These courses are offered by the Departments of Mathematics, Business Information Systems and Operations Management, Sociology and Anthropology, Physics and Optical Science, Mechanical Engineering and Engineering Science, Psychology, and Political Science (includes Public Administration), and the College of Information Technology (includes Computer Science). All of these programs are well-established at UNC Charlotte and, therefore, do not need to be developed. The participation of these programs in the INES Ph.D. Program is expected to be slight; therefore, no improvements to these programs are required by the proposed program.

X. Additional Information

Letters of support from other department chairs and deans at UNC Charlotte are presented in Appendix III. Letters of support from interested parties outside of UNC Charlotte are presented in Appendix IV.

XI. Budget

The proposed budget for the INES Ph.D. Program is described in Appendix V of this proposal.

XII. Evaluation Plan

XII.A. Criteria used to evaluate the proposed program

The criteria that will be used to evaluate the planned Ph.D. program include those that address operational efficiency as well as program impact. They are as presented below.

- **Criterion 1:** Degree of involvement and collaboration of faculty and external researchers from a diverse group of sub-disciplines in the program.
- **Criterion 2:** Ability to recruit, retain, and graduate excellent Ph.D. students.
- **Criterion 3:** Level of contribution of doctoral students and their advisers to advances in technology, science, and management/policy through publications, presentations, short-courses and patents.
- **Criterion 4:** Level of employment of graduates from the program and service of such graduates in leadership positions in academe, government, international agencies, and the private sector within and outside the State of North Carolina.

XII.B. Measures to be used to evaluate the program

The following measures will be used to evaluate the performance of the proposed Ph.D. program with respect to the criteria factors described above.

- **Criterion 1**
 - number of courses taken by students from fields outside their doctoral focus areas;
 - number and proportion of faculty from different departments who collaborate on Ph.D. student research; and
 - number of external researchers from industry, other universities and agencies involved in student program committees.

- **Criterion 2**
 - Number of UNC Charlotte graduates recruited, retained, and graduated.
 - Number of non-UNC Charlotte graduates recruited, retained, and graduated.
 - Diversity of academic disciplines in which recruited Ph.D. students gained their B.S. and M.S. degrees.

- **Criterion 3**
 - Average number of research articles published by doctoral students and their advisers.
 - Number of infrastructure and environmental system projects that were affected in North Carolina and elsewhere through research conducted by program students and their advisers.
 - Number of presentations and short-courses taught by doctoral degree candidates.

- **Criterion 4**
 - Number of program graduates who are gainfully employed in their field of study
 - Number of program graduates who serve in leadership positions and/or win professional awards

XII.C. Projected productivity levels

Rapid growth and visibility of UNC Charlotte and the Charlotte region will fuel the growth of the program. In recent years, new Ph.D. programs at UNC Charlotte have exceeded their originally anticipated enrollment. Unique features of the proposed program will offer a distinct opportunity that may not be readily available elsewhere in the U.S. Students will also enroll from Charlotte’s industrial sector, which is the largest in the Carolinas, with numerous companies on the cutting edge of infrastructure development. Finally, few, if any, convenient alternatives for higher education exist in the Charlotte region. In the life-long learning environment today, this opportunity, along with the size of Charlotte, guarantees a continual pool of talented students.

Based on the factors discussed above, the estimated production of Ph.D. graduates from the program for each of the first four years of operation is presented in Table 7. It should be noted that no Ph.D. graduates are expected from the program during the first two years because of the minimum time required to take courses, conduct research, and pass through the required performance evaluation stages.

Table 7. Projected graduation rates of students from the proposed INES Ph.D. Program

Ph.D. Program in Infrastructure and Environmental Systems	Years Since Inception and Degrees Awarded Each Year				
	1	2	3	4	Total
Years	1	2	3	4	Total
Degrees awarded	0	0	1	3	4

XII.D. Recommended consultant/reviewers (they may not be employees of the University of North Carolina)

Reviewers are selected on the basis of their expertise, professional leadership, and the need to cover the three integrated focus areas of the proposed Ph.D. program.

- 1. Dr. William Randall Seeker**
Senior Vice President
General Electric Energy and Environmental Research Corporation
18 Mason, Irvine, CA 92618
Tel: 949/859-8851 Fax: 949/859-3194
Email: randy.seeker@ps.ge.com
USEPA Science Advisory Board

- 2. Prof. Alex Iskandar**
Distinguished Research Professor, CEEST
Research Physical Scientist
U.S. Army Cold Regions Research and Engineering Lab
72 Lyme Road
Hanover, NH 03755
Tel: 603/646-4198 Fax: 603/646-4730
Email: iskandar@crrel.usce.army.mil

- 3. Prof. Lakshmi N. Reddi**
Chair
Department of Civil and Environmental Engineering
Kansas State University
Seaton Hall
Manhattan, KS 66506-2905
Tel: 913/532-5862 Fax: 913/532-7717
Email: reddi@ce.ksu.edu

- 4. Prof. Michael J. McFarland**
Dept. of Civil and Environmental Engineering
Utah State University
Logan, UT 84322-4110
Tel: 435/753-3608 Fax: 435/753-4597
Email: farlandm@utah.uswest.net

- 5. Dr. Jeffrey J. McDonnell**
Richardson Chair in Forest Operations and Watershed Sciences
College of Forestry
017 Peavy Hall, Oregon State University
Corvallis, Oregon 97331
Tel 541/737-8720 Fax 541/737-4316
Email: Jeff.McDonnell@orst.edu

- 6. Mr. Richard Conway, NAE**
Environmental Consultant
612 Linden Road
Charleston, WV 15314-1116
Tel: 304/342-1998 Fax: 304/342-4606
Email: Conwayenv@aol.com
(Ex-member, Science Advisory Board, USEPA)
- 7. Dr. Calvin C. Chien, PE**
Senior Environmental Fellow
DuPont Engineering
P. O. Box 80027
Wilmington, DE 19805
Tel: 302/892-7439 Fax: 302/892-7641
Email: Calvin.C.Chien@usa.dupont.com
(Member, Science Advisory Board, USEPA)
- 8. Prof. Muniram Budhu, PE**
Dept. of Civil Engineering and Engineering Mechanics
The University of Arizona
Tucson, AZ 85721
Tel: 520/621-2145 Fax: 520/621-2266
- 9. Dr Myron J. Mitchell**
Director of Council on Hydrologic Systems Science
Dept of Environmental and Forest Biology
210 Illick Hall
SUNY_ESF
1 Forestry Drive
Syracuse, NY 13210
Tel: 315/470-6765 Fax: 315/470-6934
Email: Mitchell@syr.edu
- 10. Dr. Robert J. Steedman**
Environment Professional Leader
National Energy Board
444 Seventh Avenue, SW
Calgary, Alberta, T2P OX8
Tel: 403/299-3178
Email: resteedman@neb-one.gc.ca
- 11. Dr. Tim Moore (Chair)**
Dept. of Geography
McGill University
Room 626, Burnside Hall
805 Sherbrooke St. W.
Montreal, QC, H3A 2K6
Tel: 514/398-4961 Fax: 514/398-7437
Email: moore@geog.mcgill.ca

XII.E Plan for evaluation prior to completion of the fifth year

Maturation of the proposed program is expected to take about 10 years. The measures for evaluating program success, listed above, will not be realized in four years. Evaluation of the program must, therefore, assess progress toward the steady-state goals. The program will be evaluated internally at the end of each year for the first three years. At the end of the second and fourth years, an external review will be conducted.

The evaluation reports written at the end of the second and fourth years will be submitted to the Senior Vice President, each as two-year progress reports. These reports will include information on the extent to which UNC Charlotte has met projected enrollments and degrees conferred, and, if start-up funds were provided, will report on the readiness of the program to continue once start-up funds are discontinued (generally at the end of the third year). These reports will be submitted as a part of UNC Charlotte's biennial long-range planning submission.

At the end each of the first three years of operation, an internal evaluation will be conducted by the Interdisciplinary Ph.D. Program Committee on Infrastructure and Environmental Systems (IPC). At the end of the second year a review will also be conducted by the Deans' Panel. Based on the results of these reviews, structural and programmatic inconsistencies in the program will be removed. The Graduate School and the Office of Academic Affairs at UNC Charlotte also have mechanisms and processes in place for providing oversight on all graduate programs.

At the end of the fourth year, the second biannual review of the INES Program by the Deans' Panel will follow external evaluation. The proposed program will be assessed to determine if it is meeting the four-year milestones described below.

- Program enrollment in the fourth year should approach 20 students.
- During the fourth year of the proposed program, grant activity by the INES Faculty will be assessed. New external funding generated annually by the INES Faculty should exceed \$1.0M. External funding should be supporting a minimum of 10 Graduate Research Assistants.
- The program should have produced its first graduate by the fourth year of operation.
- At the end of the fourth year, a panel composed of three of the program reviewers, listed above, will be invited to the UNC Charlotte campus to assess the overall success of the program. The report prepared by this panel will be reviewed by the INES Program Director, the INES Program Committee (IPC), the Dean of the College of Arts and Sciences, the Dean of the College of Engineering, and the Provost.
- Changes in the proposed program will be implemented as necessary to allow achievement of program goals.

XIII. Reporting Requirements

Institutions will be expected to report on program productivity after one year and three years of operation. This information will be solicited as a part of the biennial long-range planning revision.

XIV. Starting Date and Institutional Approval

Date proposed degree program was authorized for planning: May 10, 2002

Proposed date of initiation of proposed degree program: January 2004

This proposal to establish a new degree program has been reviewed and approved by the appropriate campus committees and authorities.

Chancellor: _____

Appendix I

Consultant's Report

by Dr. Tom Theis

In the December 2001, Dr. Tom Theis, Director, Center for Environmental Management, Clarkson University, was commissioned by UNC Charlotte to review and comment on a draft of a proposal for a Ph.D. program at UNC Charlotte in Infrastructure and Environmental Systems. His report is included in this appendix.

Review of the Proposed Doctoral Program in Infrastructure and Environmental Systems, University of North Carolina at Charlotte

**Thomas L. Theis
Director, Center for Environmental Management
Clarkson University
Potsdam, NY 13699-5715**

I. INTRODUCTION

A. Summary

It has been proposed to develop a new doctoral level program on the general topic of Infrastructure and Environmental Systems (IES) at the University of North Carolina at Charlotte (Authorization to Plan, 2001). The essential features of this program would be as follows:

- Emphasis on investigating emerging topics and problems associated with the continuing evolution of urban environments.
- A strong interdisciplinary basis for the program with primary contributions from Civil Engineering and Geography and Earth Sciences, and support from Chemistry, Biology, Physics, and Architecture, with coordination by the newly established Global Institute for Energy and Environmental Systems (GIEES).
- A high degree of coordination with the newly established doctoral program in Public Policy.
- Enhanced synergistic activities with other on-campus departments, centers, and institutes to develop new research opportunities on environmental sustainability.
- Research support and advice for local industries and government agencies.

The Charlotte area has experienced significant growth in the recent past and has emerged as a major urban center, regionally and nationally, for banking and manufacturing. The proposed program envisions significant interactions with these entities, using its strong base with Duke Energy as a basis for further collaboration.

Graduates of the program are perceived as providing an important set of skills that involve not only an in-depth technical understanding of design and analysis, but also an appreciation of the need to understand how all the parts of a system function together, and how system behavior can inform policy development. Such skills are not

intentionally included in most doctoral programs and thus are not readily available to prospective employers through Ph.D. graduates.

The new program supports the University's mission to continue progress toward raising its Carnegie Classification, and its goals and aims are consistent with two of its recently developed themes, Urban and Regional Development and Applied Sciences and Technologies. At the present time, the University seeks "Permission to Plan" the program, a necessary step before "Permission to Establish" can be granted.

B. Rationale

The stated rationale for the IES program originates in the scope and magnitude of challenges facing the US in the near future, i.e. infrastructure repair, expansion, and redesign. However the IES program contains a much more holistic vision of the problem, one in which the need is greater than ever to propose new and creative solutions. Since society's urban infrastructure problems are increasingly global and interconnected, this means that awareness of the wider implications of problems and their solutions is needed. This carries with it implications of a "breadth" dimension to the proposed Ph.D., a programmatic feature not traditionally stressed in doctoral studies.

C. Structure of the Program

The IES program is envisioned as engaging students, faculty, and collaborators in inquiry that takes place at the intersection of Scientific Assessment, Design and Analysis, and Policy Formulation and Analysis. Twelve to fourteen core faculty have been identified from across the disciplinary spectrum, and a lengthy list of courses has been compiled that could form the program's pedagogical base. Research areas will most likely be generated by faculty-initiated proposals, which will ultimately form the major funding source for the program. The specifics of program administration, student recruitment, student mentoring, and industrial/government collaboration are unclear at this time, but would presumably be considered at greater depth through subsequent planning procedures.

II. CRITIQUE

A. Program Scope, Direction, and Rationale

The IES proposal presents a bold new approach to doctoral studies, one in which traditional specialization in a research topic is intersected with much broader aims. This is a program that seeks to expose students and faculty to a range of relevant topics, to attempt to integrate these topics into a holistic vision within which students will carry out their research, and from which students will derive a wider array of skills and problem solving tools for application throughout their careers. The development of such a program is ambitious, to say the least, and rather at odds with the traditional philosophy regarding the scope and aim of doctoral studies, a philosophy that has seemingly served academic and national interests well over the years.

There is increasing awareness, however, that there may be value in alternative, some might say complementary, approaches to advanced studies. Two interests drive this awareness. First, it has become clear that the model of economic and technical growth and resource demands that have characterized the United States' advancement over the past two hundred years is not globally sustainable (this is sometimes expressed through the equivalent number of "earths" it would take for the rest of the nations of the world to attain the US standard of living following a similar path—about 300). Second, as globalization of world economies has proceeded, increasing pressure has been, and is being, placed on US businesses, government agencies, municipalities, NGO's, and universities to become more innovative in their approaches to manufacturing, to providing services, and to managing wastes. Such innovation is inherently multidisciplinary and team-oriented in scope, requiring the expertise of many disciplines, and insisting that the participants be able to perceive the wider implications of their work, understand the numerous constraints that exist (and that often arise from factors unrelated to their disciplinary interests), and be capable of responding to different, and often changing, objectives that guide the progress of the work.

Such new approaches to doctoral education have been recognized in many quarters for some time. Many industries, in particular those with multinational interests, often require individuals with doctoral training to perform a variety of functions within the company over the course of their careers, from research to sales to plant and project management. The ability to perceive how the complete industrial system behaves, from

product development and raw material procurement through manufacturing, marketing, and product performance, is crucial to successfully meeting cost and profitability constraints, and to devising approaches to waste management that integrate manufacturing and waste treatment to achieve true waste minimization. Similarly, many governments and government agencies are faced with increasingly stringent compliance goals that are driven by improved understanding of risk, but also a citizenry who increasingly recognize and are driven by quality-of-life issues. Concepts such as “eco-industrial parks”, and the “knowledge city” (part of Bugliarello’s city as *biosoma*) are attempts to optimize many competing interests while meeting the desired objective of creating livable urban environments. The National Science Foundation has made it clear for several years that it is interested in advancing new or alternative models of education, including doctoral education. The Integrative Graduate Education Research and Training (IGERT) program, initiated in 1997, promotes doctoral research and education as taking place highly interdisciplinary environments. This program, now in its fourth year, has funded over seventy sites on a wide range of topics, each with innovative educational approaches.

Central to the nature of doctoral studies congruent with these trends is the need to imbed research topics within a system the boundaries of which are continually expanding. For example if one wishes to scope out a topic having to do with, say, more efficient manufacturing of photographic film, rather than limiting the purview to the walls of the manufacturing plant, the topic might be approached from the point of view of the life-cycle of film (from raw materials procurement to marketing to customer use and disposal), the quantities and types of wastes produced (both inside and exterior to the plant), the impact of waste emissions on the local and global citizenry, and perhaps even the impact of the advent of an alternate technology (such as digital). Such an approach adds value to the research in several ways. First, greater knowledge of the system can *inform* the research, perhaps changing the way hypotheses are framed or creating a new set of critical questions. Second, the systemic view makes possible alternate, sometimes referred to as *supraoptimal*, solutions to the problem at hand. The basic tenet of this approach is as follows: as system boundaries expand, new or reframed topics come into view that either weren’t obvious prior to expansion or, in some cases, *didn’t even exist*.

Third, it makes available a larger array of investigative techniques, such as the life cycle inventory approach and systems analysis that are more relevant to the development of innovative or holistic solutions.

These are the developing trends, and underlying philosophy, within which the proposed IES doctoral program at UNC Charlotte must be viewed. It simultaneously distinguishes itself, establishing a “niche”, from other well-established programs within close geographic proximity (both within and outside of North Carolina), provides a complementary mode of scholarship that is exciting and innovative, aims to produce students who have a different set of skills (integrative) in comparison with those of most traditional doctoral programs (reductionist), and focuses on an emergent theme of national significance — that of the evolution of the urban environment. Graduates of the program will find a ready job market in industry and government (particularly at the federal level), and eventually in academia as this approach becomes more widespread. Perhaps as importantly, UNC Charlotte will become known as an educational institution in which innovative, interdisciplinary educational programs are fostered. Such a reputation will create an environment in which resources, in the form of faculty and students, become self-selective, and proposals for external funds will become more competitive as program managers and reviewers come to recognize the value of UNCC's approach.

B. Areas of Concern

As innovative as the UNC Charlotte IES doctoral program is, there are several areas of concern that should be addressed along the way to its formation. First, it must be recognized that even with all good intentions, there are strong entrenched assumptions about what doctoral studies are supposed to be like. It is inevitable that internal and external (i.e. at the State educational level) differences will emerge over the meaning of “interdisciplinary” as applied to a doctoral program and how the “depth” vs. “breadth” contents of the proposed program will be addressed. In talking to several faculty it became clear that there were important differences among the group, some viewing IES primarily as a way to overcome perceived barriers to doctoral education at UNCC at the State level (but seeing the program itself as rather traditional), others seeing it as

something more cross-disciplinary but unclear how it would be structured. Still others perceive themselves as key people, while some are content to act more in an advisory capacity. **It is recommended that a critical mass of key faculty meet regularly to discuss and reach agreement on the underlying approach to the IES program.** The more this group can learn about interdisciplinary graduate studies from outside sources, the easier it will be to craft a unified strategy for IES and present it to the State authorities.

Second, there is presently a lack of integrating mechanisms in the development documents for IES. Perhaps such mechanisms will be sorted out when the specific structure of the program is addressed. Still, there is a need to recognize that in the absence of a clear set of procedures and practices aimed at perpetuating and insuring the interdisciplinary nature of the program, inertia within the university structure will probably compromise its goals and objectives. For example, although the list of proposed courses from various disciplines is impressive, by themselves their presence may do little more than provide disjointed breadth to the typical student's program, a set of requirements without meaning. It might be advisable to develop a set of new courses (perhaps as few as two) that is specifically designed to provide an integrating framework. In this way when students are exposed to new information through coursework or their research they have a perspective and a set of tools that they can make use of to integrate, organize, and advance their thoughts. Other mechanisms are possible, for example internal and external IES seminars in which students, faculty, and outside experts come together to present potential topics and discuss research findings. **It is recommended, even at this preliminary stage, that consideration be given to developing integrating mechanisms consistent with program philosophy, goals, and objectives that are unique to IES.**

Third, while the development document for IES is clear on the meaning of the term "infrastructure" (inclusive of but considerably more than the physical structures of civilization, the *biosoma*), the use of "system" is less obvious. It has become popular recently to use this term in a variety of contexts, from a general statement of holistic intent, to an emphasis on policy and management ("systems management"), to a focus on root causation ("systemic"), to more technical uses (for example a set of parts that

function together), and then on to derivative terminology (“systematic design”, “systems analysis”). In various places in the document most of these meanings seem to be intended. This may be acceptable as long as the meaning is clear. **A suggestion, which is specifically recommended, is to carefully define what is meant by a “system”, or by the particular use of this or similar terms at appropriate places, in order to avoid ambiguity.**

Fourth, IES would profit greatly from close connections with industry, municipalities, and non-government agencies as a means of developing research topics, securing funding, and providing students with valuable experience (through, for instance, internships). Such liaisons are consistent with the goals of IES, and could help promote a greater degree of collaboration among faculty, students, and external representatives. While internally generated faculty research topics are also an important component of IES, insuring faculty interest and cooperation, research from external sources is often inherently more amenable to multidisciplinary approaches, and can provide a rich source of topics that may ultimately lead to greater federal funding. **It is recommended that IES examine the possibility of connections with external entities (for instance through the “Charlotte Institute”) and formally incorporate them into the program structure.**

Fifth, at present there does not appear to be an appreciation of the valuable role that graduate students will fill in the IES program. Experience elsewhere has demonstrated that high ability, gifted students are often drawn to innovative programs, and that they are prepared to forego matriculation at much more prestigious institutions for programs that possess unique attributes that are consistent with their own career goals. Such students tend to be self-directed, highly articulate, and natural leaders. Often these students make little distinction between value of their research and of their belief in their abilities. Mentoring such students can be challenging, but can also result in a more genuinely collegial environment among faculty and students in the program. More practically, such students can become the best recruiters and general proselytizers for the program. **It is recommended that further thought be given to incorporating students as a “value-added” component of IES, that the kind of student IES seeks be made a**

part of the program development, and that such matters as recruitment, mentoring philosophy, stipend level, and other student-related concerns be addressed.

Appendix II

Faculty Members' Vitae

From Faculty Members
participating in the INES Ph.D. Program

Faculty members who will participate initially in the INES Ph.D. Program are listed in Section IV. Vitae of each of faculty member are included in this appendix.

CURRICULUM VITAE
April 2003
Craig James Allan

EDUCATION

York University	1993	Ph.D.- Physical Geography (Surface Hydrology and Biogeochemistry)
Trent University	1987	M.Sc. Watershed Ecosystems (Chem./Phys. Limnology and Hydrology)
University of Manitoba	1981	B.Sc. Honours Zoology

PROFESSIONAL EMPLOYMENT

A. University

University of North Carolina at Charlotte, Department of Geography and Earth Sciences,
1992-93 Lecturer, 1993-99 Assistant Professor, 1999-Present Associate Professor.

B. Civil Servant

Canadian Department of Fisheries and Oceans, Hydrologic modeling, 1981, Personal
Services Contractor

Canadian Department of Fisheries and Oceans, Bathymetric mapping, 1982 Personal
Services Contractor

University of Manitoba, 1983 Research Assistant for the Natural Resource Institute

Ontario Ministry of the Environment (O.M.E.) and D.F.O, 1987 Personal services contractor

Principal Investigator for the Terrestrial Acidification Project, Experimental Lakes Area

(E.L.A.)

Canadian Department of Fisheries and Oceans (D.F.O.-Level PC1). Hydrochemical
Modeling of the Churchill-Nelson River Hydro Diversion (Historic-Present), 1987-88
Federal Government Term Employee.

C. Private Industry

RHODA Environmental Consultants, 1984 Groundwater Technician

MacLaren Plansearch, Inc., Kawartha Lakes Nutrient Study, 1987 Hydrologic Technician

TEACHING

Graduate committees (supervisor)

2 M.A, Geography, 7 MS Earth Sciences

Graduate committees (committee member)

12 MA Geography, 1 MS Earth Sciences, 16 MS Civil Engineering, 1 PhD Public
Policy, 1 PhD Applied Mathematics.

Graduate Courses

ESCI 6202 Earth Systems Analysis: Biogeochemical Cycles, GEOG 7900 and ESCI 7900

Individual Research Project, GEOG 6800, ESCI 6800 Individual Study in Geography or Earth
Sciences, ESCI 5140 Hydrologic Processes, ESCI 5145 Fluvial Processes, ESCI 5222

Watershed Science.

PUBLICATIONS AND RESEARCH (selected)

Allan, C.J., N.T. Roulet and A.R. Hill. 1993 The biogeochemistry of pristine, headwater Precambrian shield
catchments: an analysis of material transport within a heterogeneous landscape. Biogeochemistry . 22:37-

79.

- Allan, C.J. and N.T. Roulet. 1994. Runoff generation in zero order Precambrian shield watersheds: the stormflow response of a heterogeneous landscape. Hydrological Processes. 8:369-388.
- Allan, C.J., and N.T. Roulet. 1994. The solid phase controls of dissolved aluminum within upland Precambrian shield catchments. Biogeochemistry. 26: 85-114.
- Allan, C.J. 1995. Hydrochemical response of upland Precambrian shield catchments to additions of H₂SO₄ and HNO₃ during snowmelt. Canadian Journal of Fisheries and Aquatic Sciences. 52: 2213-2228.
- Allan, C.J., R.D. Forsythe and J. Diemer. 1997. Piedmont N.C. Wet Retention Basins, Performance Factors, Sedimentation Dynamics and Seepage Losses. N.C. WRRRI Res. Rept. 309, 311 pp.
- Allan, C.J. and A. Heyes. 1998. A preliminary assessment of wet deposition and episodic transport of total and methyl mercury from low order Blue Ridge watersheds, S.E. U.S.A. Water, Air and Soil Pollution, 105: 573-592.
- Wu, J.S., C.J. Allan, W.L. Saunders and J.B. Evett. 1988. Characterization and pollutant loading estimation for urban and rural highway runoff. Journal of Environmental Engineering ASCE, 124(7): 584-592.
- Allan, C.J., A. Heyes, N.T. Roulet, V.L. St. Louis and J.M. Rudd. 2001. The temporal and spatial dynamics of Hg in Precambrian Shield upland runoff. Biogeochemistry, 52(1) 13-40.
- Harman, W.A., C.J. Allan and R.D. Forsythe. 2001. Assessment of Potential Groundwater Contamination Sources in a Wellhead Protection Area. Journal of Environmental Management. 62(3) 271-282.
- Allan, C.J., J.S. Wu, J.B. Evett and W.L. Saunders. First flush analysis of North Carolina highway runoff. Journal of Environmental Engineering ASCE. (submitted).
- R.J. Steedman, R.L. France, C.J. Allan and R.S. Kushneriuk, The Terrestrial Component of the Lake Trout Ecosystem: Land Water and Human Activity in Forested Catchments. In Management of Lake Trout Ecosystems of the Precambrian Shield. J. Gunn and R.A. Ryder, (Eds), (In Press).
- Wu, J.S. and C.J. Allan 2001. Sampling and Testing of Stormwater Runoff from NC Highways. NCDOT Res. Rept. 99-6, 108 p.
- Estes, C. and C.J. Allan. 2002. An Examination of Urban Plunge Pool Morphology. Proceedings of International Erosion Control Association. (33) 237-246.
- C.J. Allan and C. Estes. A Morphological and Economic Analysis of the use of Plunge Pools as Energy Dissipators in Urban Streams. Journal of American Water Resources Research Association. (Submitted).

--- **Grants and Contracts**

- 21 externally funded research grants/or contracts that I served as PI or co PI totaling \$1.38 million. (selected examples below)
- Assessment of clear cutting effects to the hydrochemical exports from terrestrial catchments to Precambrian Shield lakes supporting coldwater fisheries 1995-present. Ontario Ministry of Natural Resources, \$160,000, 2001-02.
- Hydrologic, Water Quality and Stream Bank Stability Monitoring Program for Goose Creek, Mecklenburg/Union County, NC. NCDOT, \$114,234, 2001-2003.
- Development of an Automated GIS based Methodology to Estimate NPS Pollutant Loadings in NC Highway Runoff. NCDOT, \$55,000, with J. Wu and W.N. Xiang. 2002-2003.
- Biogeochemical Investigation of Piedmont and Blue Ridge Riparian Buffer Function. NC Water Resources Research Institute \$80,000, with J. Wu and M. Thomasson. 2002-2004

UNC Board of Governors 2 Page Resume

Name: J. Brian Anderson

Rank: Assistant Professor

Years of Service in current appointment: 1

EDUCATION

Doctor of Philosophy, Civil/Geotechnical Engineering, University of Florida, 2001.
Dissertation Topic : Development of methodology for the determination of constitutive model parameters from insitu tests on Florida soils.

Master of Engineering, Civil/Geotechnical Engineering, University of Florida, 1997.
Thesis Topic: Compilation and analysis of lateral load test case histories to determine optimum input parameters for sand.

Post Baccalaureate Work, Civil Engineering, North Carolina State University, 1995-1996.

Bachelor of Science, Civil Engineering, North Carolina State University, 1995.

Graduate of the North Carolina School of Science and Mathematics, 1991.

RESEARCH EXPERIENCE

Publications

- Anderson, J. B., Townsend, F. C. and Rahelison, L. H. , "Finite Element Analysis of a Sheet Pile Wall Using Insitu Test Based Soil Parameters" , XII Panamerican Conference on Soil Mechanics and Geotechnical Engineering, Boston, Massachusetts, June 21-26, 2003. In Press
- Anderson, J. B., Townsend, F. C., and Grajales, B., "Case Histories Evaluation of Laterally Loaded Piles," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 129, No. 3, pp 187-196, 2003.
- Anderson, J. B. and Townsend, F. C., "A Laterally Loaded Pile Database," Deep Foundations 2002, An International Perspective on Theory, Design, Construction, and Performance, ASCE GSP 116, M. W. O'Neill and F. C. Townsend Eds., ASCE, pp 262-271, 2002.
- Anderson, J. B. and Townsend, F. C., "SPT and CPT Testing for Evaluating Lateral Loading of Deep Foundations," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 127, No. 11, pp 920-925, 2001.
- Anderson, J. B., Grajales, B., Townsend, F. C., and Brown, D., "Validation of P-y Curves from Pressuremeter and Dilatometer Tests at Auburn, Alabama," Behavioral Characteristics of Residual Soils, ASCE GSP 92, Bill Edelen ed., ASCE, pp 77-87, 1999.
- Anderson, J. B. and Townsend, F. C., "Validation of P-y Curves from Pressuremeter Tests at Pascagoula, Mississippi," XI Panamerican Conference on Soil Mechanics and Geotechnical Engineering, 1999.
- Hand, R., Bloomquist, D. G., and Anderson, J. B., "Development of a Cemented Sand Module for the Electronic Cone Penetrometer," Transportation Research Record 1675, TRB, National Research Council, Washington, D.C., pp 10-16, 1999.
- Pinto, P. L., Anderson, B., and Townsend, F. C., "Comparison of Horizontal Load Transfer Curves From Strain Gages and Slope Inclinometer: A Case Study," Symposium on Field Instrumentation for Soil and Rock, *ASTM STP 1358*, G.N. Durham and W.A. Marr, Eds., American Society for Testing and Materials, pp 3-15, 1999.

Grants

StatNAMIC Load Testing in the Geotechnical Centrifuge – A Feasibility Study (UNCC)
Pressuremeter Testing and Calibration Workshop (University of Florida / FDOT)
Plaxis Training – Principles and Applications (U.S. Army Corps of Engineers)
Characterization of a Florida Department of Transportation Geotechnical Research Site (FDOT)
A Compendium of Ground Modification Techniques (FDOT)

TEACHING EXPERIENCE

Graduate

Engineering Principles of Ground Modification (University of Florida)
Geotechnical Engineering for Non-Majors (University of Florida/US Army Corps of Engineers)
Deep Foundation Engineering

Undergraduate

Geotechnical Engineering II

Short Courses

ASCE Computer Software for Design and Analysis of Deep Foundations
University of Florida Department of Continuing Educations - Fundamentals of Deep Foundations:
Including Analysis, Design, Testing and Inspection

EXPERIENCE IN DIRECTING GRADUATE STUDENT RESEARCH

Investigation into the Additional Stiffness Contributions of Bridge Superstructure for Piers under Lateral and Extreme Event Loading

StatNAMIC Load Testing in the Geotechnical Centrifuge – A Feasibility Study

CURRICULUM VITAE
March 2003
Lawrence Samuel Barden

EDUCATION

University of Tennessee, Knoxville	1971-74 Ph.D. Ecology (Fire effects in pine-hardwood forests composition)
University of Maine, Orono	1965-68 MS Wildlife Management
University of Arkansas, Fayetteville	1964-65 Graduate work in Mathematics
Hendrix College, Conway, Arkansas	1960-64 BA with honors in Mathematics

PROFESSIONAL EXPERIENCE

University of North Carolina at Charlotte, 1974-present	Park Ranger, U. S. National Park Service, 1968-1971
Assistant Professor, 1974-1980	Grand Canyon, Grand Teton, Acadia National Park
Associate Professor, 1980-1988	
Professor, 1988-present	

TEACHING

Graduate advisor (with graduation date; * indicates co-advisor with another faculty member)

2005* Crystal Fox MS Salamander populations in Mecklenburg County
2004* James Mason MS Habitat of urban barred owls in Charlotte III
2004* Patti Kelly MS Habitat of urban barred owls in Charlotte II
2003* Eric Harrold MS Habitat of urban barred owls in Charlotte I
2003* Suzanne Savin MS Genetic relations among known populations of *Helianthus schweinitzii*
2001 Bret Estep MS Genetic variation in *Helianthus schweinitzii* as revealed by reciprocal common garden transplants.
2000* Marek Smith MS Survival of wild and captive reared barn owls
1999 Catherine McRae MS Effectiveness of tree girdling and herbicide injection in Piedmont prairie restoration.
1998* Lisa Beckstrom MS Use of Cowans Ford Wildlife Refuge by neotropical migrants.
1997 Eric Davis MS Establishment of a piedmont prairie at Latta Plantation Park.
1997 Nancy Shinn MS Germination/soil disturbance requirements of *Helianthus schweinitzii*: A field experiment.
1994 David Patrick MA Changes in populations of vertebrates after construction of Coddle Creek Reservoir, Cabarrus Co.
1984 Randall Cross MS Effects of controlled burning in a pine forest on species diversity of the bird community.
1983 Eric Storie MS Effects of clearcutting on species diversity of southern Appalachian forests.
1982 William Bromer MS Effects of clearcutting and controlled burning on regrowth of honeysuckle in a Piedmont pine-hardwood forest.

Graduate committees

Scott Diegmann, Chris Matthews, Robert Coxe, Sylvia Larson, Todd Martin, Rebecca Crawford.

Honors advisor

2000 Joanne Lopez BS Bird and vegetation diversity at a Mineral Springs Prairie restoration (co-advisor with Rob Bierregaard)
1997 Krista Nelson BS The role of vegetation on methanotrophic activity in landfill cover soil. (co-advisor with Helene Hilger)
1993 Donna Hood BS with Option in Ecology/Env. Biol. Effects of soil disturbance on germination of *Helianthus schweinitzii* at Gar Creek Preserve.
1993 Craig Welch BS Hunting success of one-eyed screech owls .
1987 Tim Wilson BS Succession after clearcutting on the UNCC Ecological Reserve: a five-year follow-up.
1985 Terri Layel BS Research project at Duke Power Env. Lab. Selenium toxicity in striped bass fed contaminated minnows.

Graduate Courses

2003 BIOL 6090 Prairie Ecology
1995-2003 BIOL 4244/5244 Conservation Biology and lab, fall semesters, internet-based (W)
1992-2003 BIOL 4234/5234 Wildlife Biology and lab, alternate spring semesters, internet-based (W)
1990-2001 BIOL 4144/5144 Advanced Ecology and lab, alternate spring semesters, internet-based (W)

PUBLICATIONS AND RESEARCH

Articles in refereed journals (single author except where noted)

- 2003 Andre Michaux's sumac – *Rhus michauxii* Sargent: where was it found? Accepted by *Castanea*, pending editing. Co-authored with Jim Matthews..
- 2002 Vascular flora of Piedmont prairies: evidence from several prairie remnants. *Castanea* 67:1-12. Co-authored with Eric Davis, Catherine McRae, Bret Estep, and Jim Matthews
- 2000 Population maintenance of *Pinus pungens* (Table Mountain pine) after a century without fire. *Natural Areas Journal* 20: 227-233
2000. A common species at the edge of its range: Conservation of bear oak (*Quercus ilicifolia*) and its low elevation rocky summit community in North Carolina (USA). *Natural Areas Journal* 20: 85-89
- 1999 Rocky microsites prove best for establishment of Schweinitz's sunflower, and endangered species of the Piedmont (North Carolina). *Ecological Restoration* 17: 171-172. With Eric Davis, Nancy Shinn, and Donna Hood.
- 1997 Corrections of the chromosome number, distribution and misidentifications of the federally endangered sunflower, *Helianthus schweinitzii* T&G. *Torreya* 124: 198-209. With J. F. Matthews, L. S. Barden and C. R. Matthews.
- 1997 Historic prairies in the Piedmont of North and South Carolina. *Natural Areas Journal* 17:149-152.
- 1996 A comparison of growth efficiency of plants on the east and west sides of a forest canopy gap. *Bull. Torrey Bot. Soc.* 123: 240-242.
- 1996 On the linear relation between stand yield and integrated light in a shade-adapted annual grass. *Bull. Torrey Bot. Soc.* 123: 122-125.
- 1989 Repeatability in forest gap research: A comparison of studies in Great Smoky Mountains National Park. *Ecology* 70:558-559.
- 1988 Drought and survival of a *Pinus pungens* population: Equilibrium or nonequilibrium? *American Midland Naturalist* 119:253-257.
- 1987 Invasion of *Microstegium vimineum*, an exotic annual shade-tolerant C₄ grass, into a North Carolina floodplain forest. *American Midland Naturalist* 118:40-45.
- 1986 Vegetation structure and bird species diversity in a North Carolina Piedmont forest. *J. Elisha Mitchell Scientific Society* 102:35-41. Second authors, R. D. Brown, R. Cross, and J. F. Matthews.
- 1985 Bear oak (*Quercus ilicifolia*) in North Carolina. *Castanea* 50:121-123.
- 1983 Size, age, and growth rates of trees in canopy gaps of a cove hardwood forest in the southern Appalachians. *Castanea* 48:19-23.
- 1981 Forest development in canopy gaps of a diverse hardwood forest of the southern Appalachian mountains. *Oikos* 37:205-209.
- 1980 Change in abundance of honeysuckle (*Lonicera japonica*) and other ground flora after prescribed burning of a Piedmont pine forest. *Castanea* 45:257-260.
- 1980 Tree replacement in small canopy gaps of a cove hardwood forest in the southern Appalachians. *Oikos* 35:16-19.
- 1979 Serotiny and seed viability of *Pinus pungens* in the southern Appalachians. *Castanea* 44:44-47.
- 1979 Tree replacement in small canopy gaps of a *Tsuga canadensis* forest in the southern Appalachians. *Oecologia* 44:141-142.
- 1978 Regrowth of shrubs in grassy balds of the southern Appalachians after prescribed burning. *Castanea* 43:238-246.
- 1977 Self-maintaining populations of *Pinus pungens* in the southern Appalachian Mountains. *Castanea* 42:316-323.
- 1976 Effects of fire on pine and pine-hardwood forests in the southern Appalachians. *Forest Science* 22:399-403. 2cd author, F. W. Woods.
- 1976 Pine reproduction in the Thompson River watershed, North Carolina. *J. Elisha Mitchell Scientific Society* 92:110-113.
- 1974 Characteristics of lightning fires in southern Appalachian forests. *Proc. Annual Tall Timbers Fire Ecology Conf.* 13:345-361. Second author, F. W. Woods.

Grants and Contracts

- 2001 A fifth-year follow-up on three experiments in prairie restoration. \$4,000 UNCC Foundation Faculty Grant.
- 2001 Genetic diversity of *Helianthus schweinitzii*. \$4,080. UNCC Foundation Research Support Grant. Co-PI with Todd Steck.
- 2000 Restoration of Suther Prairie. \$6,000 US Fish and Wildlife Service
- 2000 Restoration of Mineral Springs Prairie. \$6,000 US Fish and Wildlife Service
- 1999 How to make a prairie without catastrophic fire. \$2,561 (continuation) UNCC Foundation
- 1998 How to make a prairie without catastrophic fire. \$12,720 The North Carolina Nature Conservancy
- 1998 How to make a prairie in North Carolina without catastrophic fire. \$8,750 US Fish and Wildlife Service
- 1998 Population viability of an endangered sunflower. \$3,500 UNCC Foundation
- 1998 How to make a prairie without catastrophic fire. \$5,000 UNCC Foundation
- 1997 Bear oak on King's Pinnacle: A species falling through the cracks. \$3,670. UNCC Foundation.

VITA
JOHN F. BENDER

Education

- Ph.D. Geochemistry (1980), State University of New York at Stony Brook
- M.S. Geochemistry (1972), The Pennsylvania State University
- B.S. Geology (1970), State University of New York at New Paltz

Professional Appointments

- 1992-Present: The University of North Carolina at Charlotte, Professor of Earth Sciences
- 1987-1992: The University of North Carolina at Charlotte, Associate Professor of Earth Sciences
- 1982-1987: The University of North Carolina at Charlotte, Assistant Professor of Earth Sciences
- 1986: Lamont-Doherty Geological Observatory of Columbia University, - Visiting Research Scientist (1/86 - 8/86)
- 1981-1982: State University of New York at Albany, Visiting Assistant Professor of Geology
- 1981-1982: Rensselaer Polytechnic Institute, Adjunct Assistant Professor of Geology
- 1980-1981: Post-doctoral Research Fellow (1980-1981), Joint appointment - Rensselaer Polytechnic Institute and SUNY Albany
- 1975-1980: State University of New York at Stony Brook, Graduate Research Assistant
- 1972-1975: Winthrop College, Instructor of Geology and Chemistry
- 1970-1972: The Pennsylvania State University, Graduate Teaching Assistant

Teaching

Graduate Committees

- Janet Harris, "Petrology and Geochemistry of the Mafic Rocks from the Chagnon Mountain Area, New Brunswick, Canada," M.S. degree, SUNY at Albany, Department of Geology, 1982.
- Dave Gallo, "Tectonics at the Intersection of the East Pacific Rise with Tamayo Transform Faults," M.S. degree, SUNY at Albany, Department of Geology, 1982.
- Emily Klein, LDGO, Ph.D. completed 1988.
- Joe Beaman, "A Petrologic and Geochemical Study of the Coast Range Ophiolite, California: Pashenta Section," M.S. Candidate, University of South Carolina, 1990.
- Dan Miller, LDGO, Ph.D. completed 1991.
- Martha Cox, M.A. degree candidate, UNC Charlotte, Department of Curriculum and Instruction, 1992.
- Jennifer Reynolds, Ph.D. candidate, Lamont Doherty Earth Observation of Columbia University, 1993.
- Doctoral committee member for Bhavini Desai in the Department of Biology, 1999.

Graduate Courses

- GEOL 5100. Igneous and Metamorphic Petrology; GEOL 5130. Optical Mineralogy; GEOL 5175. Geochemistry; GEOL 5185. Mineralogy, Economics and the Environment; GEOL 6103. Earth Systems Analysis: Solid Earth Geochemistry.

Publications and Research

Funded Research

- National Science Foundation grant #OCE-8400517, "Petrogenetic Study of Basalts, From Ridge/Transform Intersections," 4/1/84 - 9/30/86, \$55,080.

- National Science Foundation grant #OCE-8409660, "Geochemical and Petrologic Effects of Transform Faults: East Pacific Rise," 1/15/85 - 1/14/87, \$96,607.
- National Science Foundation Grant #OCE-8614804, "Petrogenetic Studies of East Pacific Rise Basalts," 3/1/87 - 8/3/89, \$65,026.
- National Science Foundation Grant #OCE-8812339, "High Resolution Investigation of Small Offsets Along the East Pacific Rise," 3/1/89 - 8/31/90, \$174,000.
- National Science Foundation Grant #OCE-8812339, "Percussion Coring System: A Supplement to High Resolution Investigation of Small Offsets Along the East Pacific Rise," 5/1/89 - 2/28/90, \$44,529.
- National Science Foundation Grant #OCE-8812339, "High Resolution Investigation of Small Offsets Along the East Pacific Rise," 3/1/90 - 8/31/91, \$44,001.
- National Science Foundation, #OCE-9103374, "Petrological Investigations of Closely Spaced Samples from the EPR: Spatial and Temporal Systematics," 7/1/91 - 6/30/92, \$36,706.
- National Science Foundation, #OCE-9103374, "Petrological Investigations of Closely Spaced Samples from the EPR: Spatial and Temporal Systematics," 7/1/92 - 12/31/93, \$35,496.
- National Science Foundation, Ocean Sciences, Marine Geology and Geophysics, "Chemical and Volcanological Investigations of the Axial Summit Caldera and Cretal Plateau of the East Pacific Rise 9° - 10° N," 6/1/94 - 5/31/96, \$12,145.
- National Science Foundation Ocean Sciences, Marine Geology and Geophysics, "Collaborative Research: Constraints on EPR Magmatism Through Studies of the North Orozco Region," (#OCE-9626973), August 15, 1997 - July 31, 1998, \$194,664.
- National Science Foundation Ocean Sciences, Marine Geology and Geophysics, "Constraints on EPR Magmatism Through Studies of the North Orozco Region," (OCE 972975), August 1, 1998-October 31, 1999, \$39,761.

Refereed Articles

Five most representative publications: (To date, I have published 43 refereed publications. The articles below best represent my research interests.)

- J. Reynolds, J. F. Bender, C. H. Langmuir, K. Kastens, and W. B. F. Ryan. "Petrological Variability and Segmentation in a Temporal Context, East Pacific Rise 12°00' N -12°30' N." *Nature*, 359, (1992), pp.493-499.
- C. H. Langmuir, J. F. Bender, and R. Batiza. "Petrological and Tectonic Segmentation of the East Pacific Rise, 5°30'-14°30'N." *Nature*, 322 (1986) pp. 422-429.
- C. H. Langmuir, and J. F. Bender. "Chemical Variations Around Transform Faults: Observations and Implications." *Earth and Planet, Sci. Lett.* 69 (1984) pp. 107-127.
- J. F. Bender, C. H. Langmuir and G. N. Hanson. "Petrogenesis of Basalt Glasses from the Tamayo Region, East Pacific Rise." *Journal of Petrology* 25 (1984) pp. 213-254.
- J. F. Bender, F. N. Hodges and A. E. Bence. "Petrogenesis of Basalts from the Project FAMOUS Area: Experimental Study from 1 atm. to 15Kb." *Earth and Planet, Sci. Lett.* 41 (1978) pp. 277-302.

Professional Activities

- Co-Chief Scientist CHEPR Expedition on R/V New Horizon, East Pacific Rise 6-15°N, 3/30/85-5/4/85.
- Co-Chief Scientist Venture Leg II Expedition on R/V Thomas Washington, 10/6/89-11/7/89, East Pacific Rise.
- Co-chief Scientist CHEPR Expedition on R/V New Horizon, 1985, East Pacific Rise 6-15°N
JOIDES Lithosphere Panel Member, 1990-present.
- ODP liaison to Inter-Ridge, 1990-present.
- Editor, Proceedings of the Ocean Drilling Program Initial Reports, Volume 136.
- NSF Ocean Sciences Research Panel Member; Marine Geology and Geophysics, 1988, 1989-1992.

Curriculum Vita

April 2003

ANDY RUSSELL BOBYARCHICK

Associate Professor of Earth Sciences
Department of Geography and Earth Sciences
The University of North Carolina at Charlotte

EDUCATION

B.S. Geology (cum laud)	1974	Birmingham-Southern College
M.S. Geological Sciences	1977	Virginia Polytechnic Institute and State University
Ph.D. Geological Sciences	1983	State University of New York at Albany

PROFESSIONAL EMPLOYMENT

Associate Professor with tenure	7/90-present	Department of Geography and Earth Sciences University of North Carolina at Charlotte
Appointed to Graduate Faculty	7/90-present	Department of Geography and Earth Sciences University of North Carolina at Charlotte
Assistant Professor	8/84-6/90	Department of Geography and Earth Sciences University of North Carolina at Charlotte
Instructor	5/87, 6/88	North Carolina System-Wide Field Camp North Carolina State University Raleigh, NC
Lecturer	8/83-7/84	Department of Geography and Earth Sciences University of North Carolina at Charlotte
Consultant	1996-1997	Atlantic Geoscience and Engineering Harrisburg, NC
Adjunct Research Associate	6/93-present	U.S. Geological Survey National Center (Reston, Virginia)
Consultant	2/94	Froehling & Robertson, Inc. Richmond, VA
Consultant	1990	EA Engineering, Science, and Technology, Inc. Charlotte, NC
Consultant	1/90-12/91	North Carolina Geologist Licensing Board Raleigh, NC

TEACHING

Graduate Committees

UNCC Mathematics and Science Education Center Program and Policy Advisory
Committee, 1994-96 1999-2003, UNCC College of Education Teacher Education
Advisory Committee 2000-2003, Department of Geography and Earth Sciences
Earth Sciences Graduate Committee 2002-2004

Graduate Courses

GEOL 4135/5135 Tectonics - (60 contact hours), GEOL 4120/5120 Geologic Mapping and Interpretation - (60 contact hours), GEOL 6651 Earthquakes and Plate Tectonics (Institute for Teachers) - (40 contact hours in two weeks), GEOL 4115/5115 Applied Geophysics - (60 contact hours), GEOL 4000 Regional Geology of the Southern Appalachian Mountains - (45 contact hours), GEOL 6060 Earth Science Field Investigations (Institute for Teachers) - (14 days; 90 contact hours in two weeks), GEOL 4000/5000 Summer Geology Institute for Teachers (various topics) – (5 days; 45 contact hours in one week)

PUBLICATIONS AND RESEARCH

Chapters in Books or Guidebooks

1. Bobyarchick, A. R., 1998, Foliation heterogeneties in mylonites *in* Snoke, A. W., Tullis, J., and Todd, V. R., ed., Fault related rocks: A photographic atlas: Princeton, NJ, Princeton University Press, p. 302-303.
2. BOBYARCHICK, A.R., Edelman, S.H., and Horton, J.W., Jr., 1988, The role of dextral strike-slip in the displacement history of the Brevard zone, *in* Secor, D.T., Jr., editor, Southeastern geological excursions: Fieldtrip Guidebook for the SE Section, Geological Society of America, p. 53-154.

Articles in Journals and Periodicals

1. BOBYARCHICK, A.R., 1981, The Eastern Piedmont fault system and its relationship to Alleghanian tectonics in the Southern Appalachians: *Journal of Geology*, v. 89, p. 335-347.
2. BOBYARCHICK, A.R., 1986, The eigenvalues of steady flow in Mohr space: *Tectonophysics*, v. 122, p. 35-51.
3. BOBYARCHICK, A.R., 1988, Location and geometry of Alleghanian dispersal-related strike-slip faults in the southern Appalachians: *Geology*, v. 16, p. 915-919.
4. BOBYARCHICK, A. R., 1999, The history of investigation of the Brevard fault zone and evolving concepts in tectonics: *Southeastern Geology*, v. 38, no. 3, p. 223-238.
5. BOBYARCHICK, A.R., 2000, Online introduction to Mohr circles: *Journal of the Virtual Explorer*, v.2, p. 10-11 and <http://www.virtualexplorer.com.au>.

Published Abstracts

1. BOBYARCHICK, A.R, 1984, Button schist structure in micaceous mylonites from the Brevard zone, Southern Appalachian Mountains: Tectonic Studies Group Annual Meeting (Swansea, Wales) Program and Abstracts, p. 12.
2. BOBYARCHICK, A.R., 1991, The influence of mesoscopic structural analysis on interpretations of an orogen-parallel shear zone: *Mitt. aus den Geol. Inst. ETH Zürich, Neue Folge*, 239b, p. 104-105. (Ramsay Conference, Zürich, Switzerland)
3. BOBYARCHICK, A.R., 1992, Decoupling of the crust during Alleghanian thrust and strike-slip faulting in the southern Appalachian Mountains: *EOS, Transactions, American Geophysical Union*, v. 73, no. 43, p. 573. [Fall Meeting, American Geophysical Union, San Francisco]
4. BOBYARCHICK, A. R., 1998, Common elements in the evolution of regional shear zones in the Piedmont of the southern Appalachian Mountains (abstract) *in* Lin, S., Bleeker, W., Elliott, C., and van Staal, C. R., ed., Evolution of structures in deforming rocks: Canmore, Alberta, Canada, Geological Association of Canada, Canadian Tectonics Group 18th Annual Meeting.

5. BOBYARCHICK, A.R., 2000, Three-axis Mohr constructions for visualization of deformation: Geological Society of America Abstracts with Programs, v. 32, no. 7, p. A-30 (Reno, NV)
6. BOBYARCHICK, A.R., 2002, Concepts of vorticity in regional shear zones: Geological Society of America Abstracts with Programs, v. 34, no. 6 [Denver, CO]

GRANTS

1. *Shear sense transitions between the Brevard zone and Linville Falls fault* (\$45,000) - National Science Foundation Crustal Structure and Tectonics Program (1989-1991). UNC-Charlotte added \$4,350 to the NSF award.
2. *Anomalous Shear Sense Indicators in an Orogen-Parallel Fault Zone* (\$65,000) - National Science Foundation Crustal Structure and Tectonics Program (1992-1994). UNC-Charlotte added \$8,600 to the NSF award.
3. *North Carolina Leadership Network for Earth Science Teachers* (\$5M) - National Science Foundation Grant to UNC Chapel Hill (1995-98), participant as consultant from UNC Charlotte
4. *The Mountain Run Fault Zone in the Western Virginia Piedmont* (\$4,000) - UNC Charlotte Faculty Summer Research Grant (1999)

James D. Bowen, Ph.D

EDUCATION

Duke University	Botany	B.A.	1979
Vanderbilt University	Civil & Environ. Eng.	M.S.	1983
Massachusetts Institute of Technology	Civil Eng.	Ph.D	1990

RESEARCH EXPERIENCE

Publications (representative list from 40 overall)

- Bowen, J. D., and Hieronymus, J. W. 2003. A CE-QUAL-W2 model of the Neuse Estuary for TMDL development. *ASCE Journal of Water Resources Planning and Management*. (in press)
- Stow, C. A., Roessler, C., Borsuk, M. E., Reckhow, K. H., Bowen, J. D. 2003. A comparison of estuarine water quality models for TMDL development in the Neuse River Estuary. *ASCE Journal of Water Resources Planning and Management*. (in press)
- Bowen, James D., and Hieronymus, Jeffrey W. 2002. Model Predicted Water Quality Response to Reductions in Inorganic and Organic Nitrogen Loading. In *Estuarine and Coastal Modeling: Proceedings of the 7th International Conference*, Spaulding, Malcolm L., (ed.), pp. 244-265. American Society of Civil Engineers, New York, NY.
- Bowen, J. D., and Hieronymus, J. 2000. Neuse River Estuary Modeling And Monitoring Project Stage 1: Predictions and Uncertainty Analysis of Response to Nutrient Loading Using a Mechanistic Eutrophication Model. Report No. 325-D, UNC Water Resources Research Institute, N. C. State Univ., Raleigh, NC.
- Bowen, J.D. Calibration Performance of a Two-Dimensional, Laterally-Averaged Eutrophication Model of a Partially Mixed Estuary. 2000. In *Estuarine and Coastal Modeling: Proc. of the 6th International Conference*, Spaulding, M.L, and Blumberg, A.F. (eds.), pp. 1244-1258. American Society of Civil Engineers, New York, NY.
- Bowen, J.D. 1998. Evaluating the uncertainty in water quality predictions - A case study. In *Estuarine and Coastal Modeling: Proceedings of the 5th International Conference*, Spaulding, M.L, and Blumberg, A.F. (eds.), pp. 252-266. American Society of Civil Engineers, New York, NY.
- Bowen, J.D., R.A. Zavistoski, S.J. Cibik, T.C. Loder III, B.L. Howes, and C.D. Taylor. 1996. Combined Work/Quality Assurance Project Plan (CW/QAPP) for Water Column Monitoring: 1995-1997. Boston: Massachusetts Water Resources Authority. Report ENQUAD 96-11.
- Bowen, J.D., K.D. Stolzenbach, and S.W. Chisholm. 1993. Simulating Bacterial Clustering Around Phytoplankton in a Turbulent Ocean. *Limnology and Oceanography*. Vol. 38, No. 1, p. 36 - 51.
- Bowen, J.D., and K.D. Stolzenbach 1992. The Concentration Distribution Near a Continuous Point Source in Steady Homogeneous Shear. *J. of Fluid Mechanics*. Vol. 95, p. 95 - 110.
- Bowen, J. D., Koussis, A. D., and Zimmer, D.T. 1989. Storm Drain Design: Diffusive Flood Routing for PCs. *Journal of Hydraulic Engineering*. Vol. 115, No. 8, p. 1135 - 1150.
- Armbrust, E.V., Bowen, J. D., Olson, R. J., and Chisholm, S. W.. 1989. Effect of Light on the Cell Cycle of a Marine Synechococcus Strain. *Applied and Environmental Microbiology*, Vol. 55, No. 2, p. 425 - 432.

Research Grants (Representative of 14 overall)

- Principal Investigator, "Development of a Surface Water Object-Oriented Modeling System (SWOOMS) for the Neuse River Estuary, North Carolina," Environmental Protection Agency, October 1, 1999 - September 30, 2003, \$327,612.
- Principal Investigator, "Further Development of the Neuse Estuary Eutrophication Model for Prediction

of Water Quality Improvement,” NC Water Resources Research Institute, January 1, 1999 - December 31, 2000, \$99,003.

Principal Investigator, “Neuse River Water Quality Modeling,” NC Water Resources Research Institute, June 1, 1997 - December 31, 1998, \$76,404.

Co-Principal Investigator, “Application of Morphologic Characterization to Urban Watersheds for Developing Stream Restoration Techniques,” City of Charlotte Stormwater Services, January 1, 1998 - August 31, 1999, \$67,636.

Principal Investigator, Review and Analysis of Water Quality Modeling Performed for the Palisades Project, Lake Wylie, North Carolina,” Mecklenburg County Water Quality Program, January 1, 2003 – December 31, 2004, \$41,818.

Principal Investigator, “Application of the Neuse Estuary Eutrophication Model to the Period Following Hurricane Floyd.” North Carolina Department of Environment and Natural Resources. January 1 – June 30, 2001, \$21,175.

Principal Investigator, “Workshop on the Use of the Watershed Analysis Risk Management (WARMF) Model to Facilitate TMDL Analysis.” Duke Energy Environmental Services, January 1, 2002 – July 31, 2002, \$18,500.

Principal Investigator, “Numerical Modeling of Dissolved Oxygen Dynamics in the Sampit River, SC,” ENSR Corp., December 1, 1996 - May 31, 1997, \$11,079.

Principal Investigator, “A Dye Transport and Mixing Study of the Sampit River, SC,” ENSR Corp., August 1, 1996 - October 31, 1996, \$10,508.

TEACHING EXPERIENCE (graduate courses taught, 7 years at UNC Charlotte)

- Water Quality Modeling
- Water Quality Control
- Aquatic Chemistry
- Fate and Transport Processes
- Hydrodynamics
- Nutrient Pollution
- Advanced Hydraulics
- Water Quality Analysis
- Watershed Based Water Quality Analysis

EXPERIENCE DIRECTING GRADUATE STUDENT RESEARCH

Master’s and Ph.D. Theses Directed (representative list from total of 12 M.S. and 2 Ph.D)

Shawn Wilkerson, “Stream Morphologic Characterization in Support of Stream Restoration,” M.S., graduated.

Jeff Keaton, “Stream Morphologic Characterization in Support of Stream Restoration,” M.S., graduated.

Mary Bonislawsy, “Biological Nutrient Removal in Wastewater Treatment,” M.S., graduated.

Jeff Hieronymus, “Eutrophication Modeling of a Shallow, Eutrophic Estuary,” M.S., graduated.

Regina Guyer, “Process Optimization of Solid Waste Anaerobic Digestion,” M.S., graduated.

Steve Macomber, “Impact Prediction of Reused Wastewater,” M.S., in progress.

George Brandt, “Odor Control in Charlotte Mecklenburg Septic Sewers,” M.S., graduated.

Bill Saunders, “Watershed Analysis of the Effectiveness of Stormwater Detention for Hydrologic Control,” Ph.D., in progress (w/ NCSU).

Mark Borsuk, “Development and Application of a Bayesian Network Model of a Eutrophic Estuary,” Ph.D. graduated (Duke U.)

Bhavana Sinha, “Automated Parameter Estimation of a Eutrophication Model,” M.S., in progress.

Mohammad Madjdinasab, “Dye Tracing to Evaluate the Performance of a Wet Detention Pond,” M.S., in progress.

Deming Chen, “Object-Oriented Water Quality Model Development,” M.S., graduated.

Isaac Sarpong, “Performance of Electric Power Distribution Systems in Recent Hurricane,” M.S., graduated.

Dale A. Brentrup, RA

EDUCATION

- 1982 Master of Architecture and Urban Planning, University of California, Los Angeles,
1981-82 Post Graduate Research Associate, University of California, Berkeley, Center for Environmental
Design Research
1973 Bachelor of Architecture, Arizona State University

RESEARCH EXPERIENCE

Publications

- 2003 *"A Global Educational Imperative: The Anatomy Of Extending The Logic Of Sustainable Stewardship Beyond Architectural Studio Practice Into The Applied Research Laboratory"*; Education Session, ARCC 2003 Research Conference; Tempe AZ. (under peer review)
"A Tale of Six University Buildings: Benchmarking the Capital Building Process"; Real Buildings Session; American Solar Energy Society; Austin, TX. (accepted for publication & final draft)
- 2001 *"A Global Educational Imperative: The Anatomy of Extending Environmental Technologies Logic Into Architectural Studio Practice"*; 18th P L E A International Conference; Florianopolis, Brazil.
"LEEDS Light: The Ecological Limits of Design Integrated Lighting", Lights ON; AIA/CSI/IES.
- 2000 *"Constructing A Systemic Approach To The Design Sciences: Extending The Logic of The Environmental Technologies Into Studio Practice Through IT"*; Journal of the Australia & New Zealand Architectural Science Association; ANZAScA 2000; School of Archt., L A & U D; Univ. of Adelaide; Australia
"Undergraduate Research Training in Design: Using Issue Dualities and Concept Modeling"; International Conference on Architecture and Engineering; E A A E; Schl. of Arch.; Technical University Delft, Netherlands.
"The Impact of Design Practices on Climate - Can Design Mitigate Climate Change?", SE & Mid-Atlantic Regional Symposium Climate Change & Architectural Education; sponsor: Global Possibilities, Earth Group, World Watch, U.S. DOE and Smithsonian; Wash., DC
- 1998 *"Public School Buildings: At What Environmental Cost?"*, Planetary Stewardship Through Architectural Design & Planning; Borah Foundation Sustainable Design Forum; U. Idaho.
- 1996 *"Schoolhouses: Observations on Building Science Education - Applied Laboratory Research & Practice"*; Architectural Research Centers Consortium; Tucson, AZ.
"Three Schoolhouses: A Case Study Assessment of Architectural Systems Performance"; 21st Am. Solar Energy Soc. Proceedings; Asheville, NC: Apr.
- 1993 *"Thermal Design Narrative for Building Evaluation"*; Inside Out 2nd Ed.; p. 92; Wiley & Sons.
- 1991 *"Tall Building Energy & Lighting Studio"*; Architectural Reading Lists and Course Outlines, v.2; Eno River Press.

Research grants

- 2003 *"Assessment of 6 Current Capital Building Projects Against NC High Performance Criteria"*; UNCC Physical Management, \$ 3,000 materials stipend.
"Assessment & Monitoring of Energy the Energy Performance Attributes in State Owned Facilities: UNCC Campus Phase"; State Facilities Utility Savings Initiative Operation and Maintenance Conservation Program (USI O&M program); North Carolina Department of Administration, State Energy Office: \$ 50,000.
- 2002 *"Measuring Critical Impacts of Student Performance & Perceived Teaching Effectiveness in Middle School Classrooms –Using Building Integrated Lighting Methods"* submitted DOE 2002 State Energy Program Special Projects: End-Use Sector: 6.32 Rebuild America, \$ 114, 535.
"New-Generation Energy-Efficient Modular Home for the Carolinas" submitted DOE 2002 State Energy Program Special Projects: 6.56 Zero Energy Homes, \$ 50,000.
"Charlotte Children's Learning Center: Solar & Daylighting Analysis"; Gantt/Huberman Architects & Hardy Holtzman/ Phifer Architects, NY, \$8500.

Research grants (continued)

- 2001 *"Benchmarking The Capital Building Process: Assessing Energy Use In Campus Buildings Against Sustainable High Performance Building Design Alternatives"*, UNCCFRG; \$6,000
"Solar Decathlon Housing Competition", DOE/ NREL, \$5,000
"Visualizing Basic Lighting Science of Design: Light, Color, Perception & Form"; IES Nuckolls Fund; \$20,000 (non-funded)
"Mint Hill Middle School Daylighting Assessment"; Charlotte Mecklenburg Schools & Perkins/ Will Architects, \$3,000
"Monitoring The Daylight Attributes & Socialization Advances in Pre-school Learning Environments"; UNCC Educational Research. & CoA Lighting & Building Energy Technology Lab Collaborative
"Linking Teaching Methods to Improved Analytical and Synthetic Thinking in Professional Architectural Design Education"; FIPSE; \$319,579 (non-funded)
- 2000 *"Constructing A Systemic Approach To Teaching Environmental + Structural + Material Sciences & Technologies in Undergraduate Architectural Curriculum"*; FIPSE, \$457,000. (non-funded)
"Evaluating A Systemic Approach To The Design Sciences: In 3rd Year Studios"; UNCC, CID; \$12,000
- 1999 *"Influencing Public Sector Architecture: A Regional Web-based Journal for the Assessment and Dissemination of Sustainable Design and Development Practices"*; U.S. EPA: \$ 307, 978; Sept. (non-funded)
"Solar Power Roof Daylight Assessment & Evaluation"; Duke Solar, + Innovative Design \$ 11,000
"Blum Engineering Corporate Office Daylighting Assessment & Evaluation"; \$ 3,000
- 1998 *"Visualizing the Design Process In 3rd Year Studios"*; UNCC-CID + external software support \$25,500
- 1997 *"SCHOOLS TO LEARN BY: A Model Public School Facilities Case Study Analysis"*; UNCCFRG; \$5,000
- 1996 *"The Influences of Exterior Fenestration Systems and Interior Enclosure on Space Utilization and Lighting Renovation Options"*; Mecklenburg County, Wallace Kuralt Social Services Center; \$3,000

TEACHING EXPERIENCE (14 years at UNC-Charlotte)

Architectural Design Studio
Environmental Control Systems
Parametric Methods
Light-Revealing Architecture

MEMBERSHIPS AND AFFILIATIONS

- 2001 Faculty Research Fellow; Global Institute for Energy and Environmental Systems, William States Lee College of Engineering Cameron Applied Research Center, UNC-Charlotte.
Member; Energy Technology Advisory Group; NC Energy Office.
Member; Research Advisory Committee, NC Energy Policy Council.
Member; Faculty advisor to the UNCC Physical Facilities Environmental Taskforce
- 2000 Fellowship; Northwest Energy Efficiency Alliance *"Observations on Daylighting Public Schools: student productivity, energy performance and environmental stability"*; Montana Lighting Workshops.
- 1998 Visiting Scholar; Center for Energy Research/ Education/ Service; Ball State Univ.;
Citation: *"Case Study Research Methods: Public School Architecture"*; CERES Visiting Scholars Program; 16th Rpt.; p.5, Aug.
Chair; International Sustainability Session; Solar '98 - Renewable Energy for the Americas; A S E S.
Citation; *"Architecture Prof. helps draw blueprint for - efficient school buildings"*; Charlotte Observer, 9/7.
- 1996 Honor; Who's Who Among America's Teachers, 4th Ed.

CURRICULUM VITAE
April 2002
Dr. Harrison S. Campbell, Jr.

EDUCATION

Ph.D., 1994, Economic Geography / Regional Science, University of Illinois at Urbana-Champaign

M.A., 1987, Geography, University of Illinois at Urbana-Champaign

B.A., 1985, Economics and Geography, Clark University, Worcester, MA

PROFESSIONAL EMPLOYMENT

Associate Professor, Department of Geography and Earth Sciences, University of North Carolina at Charlotte, 2002 to present.

Assistant Professor, Department of Geography and Earth Sciences, University of North Carolina at Charlotte, 1996-2002

Research Assistant Professor, The Institute of Public Policy, George Mason University, Fairfax, VA, 1993 to 1996.

Program and Policy Analyst, Institute of Government and Public Affairs, University of Illinois, Urbana-Champaign, 1987 to 1993.

TEACHING

Graduate Committees

John Gargiulo “*Fortune 500 Headquarter Relocation, 1995-2002: An Empirical Analysis,*” Defended June, 12, 2002.

Lori Quinn “*Redeveloping Underutilized or Vacant Commercial Structures: Determining the Optimal Land Use for Changing Markets,*” Completed May10, 2002.

Kevin White “*The Effects of Architectural Design on Occupancy Rates for Neighborhood Shopping Centers in Mecklenburg, North Carolina,*” Completed May 12, 2002.

Casey Hartl, “*Assessing the Effects of Changing Land Use on Property Values,*” Department of Geography and Earth Sciences, UNC-Charlotte, Defended April, 2001.

Graduate Courses

GEOG 5108 Sport, Place and Development

GEOG 6116 Applied Regional Analysis

GEOG 6104 Industrial Location and Regional Development

PPOL 8610 Urban Regional Environment.

PUBLICATIONS AND RESEARCH

- CAMPBELL, H.S. Jr. and A.W. Stuart (Forthcoming) "Industrial Regions," in *Encyclopedia of Southern Culture*, Chapel Hill: University of North Carolina Press.
- CAMPBELL, H.S. Jr. (2003) "Unearned Income and Local Employment Growth in North Carolina: An Economic Base Analysis," *Southeastern Geographer*, May (In press).
- Graves, B. and CAMPBELL, H.S. JR. (2001) "Paying for the New Economy: The Geography of Equity Finance in North Carolina," *The North Carolina Geographer*, 9, p 24-41.
- CAMPBELL, H.S., JR. (2000). "Education, Training and Regional Development: A Policy-Relevant Agenda for Regional Science," *The Review of Regional Studies*, 30(1): 85-91.
- CAMPBELL, H.S., JR. (2000). "The Economy," Chapter 6 in *The North Carolina Atlas: Portrait for a New Century*, D. Orr and A. Stuart, editors, University of North Carolina Press: Chapel Hill, p. 123-148.
- CAMPBELL, H.S., JR. (1999). "Professional Sports and Urban Development: A Brief Review of Issues and Studies," *The Review of Regional Studies*, 29(3): 272-292.
- CAMPBELL, H.S., JR., K. Elmquist, B. Evans, M. Meyer and D. Wrubel (1999). "Assessing the Costs and Benefits of Incentives in a Carolina County," *Economic Development Review*, 16(3): 21-26. Reprinted from *Papers and Proceedings of the Applied Geography Conference*, 22: 123-131, 1999.
- CAMPBELL, H.S., JR. and Stuart, A.W. (1998). "Foreign Direct Investment in North Carolina," *The North Carolina Geographer*, 6: 37-49.
- Stough, R., Haynes, K. and CAMPBELL, H.S., JR. (1998). "Small Business Entrepreneurship in the High Technology Services Sector: An Assessment for the Edge Cities of the U.S. National Capital Regional," *Small Business Economics*, 10(1): 61-74

Grants and Contracts

- CAMPBELL, H.S., JR. (2001). "A Regional Adjustment Model of North Carolina Counties," University of North Carolina at Charlotte, June, 2001, \$3,500.
- CAMPBELL, H.S., JR. and Furuseth, O.J. (2000). "Evaluation of the Neighborhood Improvement Program: Phase II," City of Charlotte, Department of Budget and Evaluation, April 2000, \$7,000
- D. Hartgen, P.I., CAMPEBLL, H.S., JR. (1998). "Economic Impact of Michael J. Smith Airfield," Carteret County Economic Development Council, September 1998, \$36,000.
- CAMPBELL, H.S., JR. and Furuseth, O.J. (1997). "Evaluation of the Neighborhood Improvement Program: Phase I," City of Charlotte, Department of Budget and Evaluation, March, 1997, \$23,000.

CURRICULUM VITAE
April 2003
Kenneth M Chilton

EDUCATION

University of Louisville, Louisville, KY.

PhD: Urban & Public Affairs (1999). Concentration in Urban Economic Development.

MPA: (1991). Specialization in Community Development.

Centre College, Danville, KY.
BA: Economics (1987).

PROFESSIONAL EMPLOYMENT

University of North Carolina at Charlotte (9/2002 – present). Assistant Professor, Department of Geography and Earth Sciences

Jackson State University (8/2000 – 5/2002). Assistant Professor, Department of Urban & Regional Planning

TEACHING

Graduate committees

.

Graduate Courses

Geography 6106: Planning Theory

Geography 6040: Community Planning Workshop

Geography 5000: Housing Policy

Public Policy 8000: Environmental Policy

PUBLICATIONS AND RESEARCH

Chilton, K.M. 2003. Greyfields Redevelopment: Best Practices in the Field.

Prepared for The Environmental Planning Agency, Region 4. Forthcoming, June.

Chilton, K.M., and M. Dalbey. 2002. The State of the Jackson Metro Area: A Regional Planning Perspective. Mississippi Economic Review and Outlook.

Chilton, K.M. 2001. "Community Reinvestment in Jackson: Analysis of Lending Programs from 1997-2000." The Urban Researcher.

Chilton, K.M. 1999. *Brownfield Redevelopment Processes and Economic Development: A Multiple-Case Study Analysis*. Dissertation completed to satisfy the requirements of the PhD program in Urban and Public Affairs, University of Louisville.

Meyer, P.B., and K.M. Chilton. 1998. *Environmental Insurance for Urban Redevelopment: A Feasibility Study*. Washington, DC: U.S. Department of Housing and Urban Development, Office of Policy Development and Research.

Chilton, K.M. 1998. *Kentucky Buys Recycled: An Implementation Manual for a Buy Recycled Program*. Manual prepared for Kentucky Natural Resources and Environmental Protection Cabinet. Louisville, KY: Center for Environmental Management, University of Louisville.

Chilton, K.M. 1998. "The Myth of the 'Environmental Problem': Cleanup Costs and Brownfield Redevelopment." *Public Works Management & Policy*, vol. 3, no. 8: 220-230.

--- **Grants and Contracts (again may need to select the most representative / latest)**

- Received Summer grant from UNCC to study residential choices of middle- and upper-income African Americans (Summer 2003).
- Preparing report for the Environmental Protection Agency (Region 4) titled *Best Practices in Greyfield Redevelopment* (Summer 2003).
- Acquired funding from the Mississippi Urban Research Council to study the allocation of credit in Jackson's low-to-moderate income neighborhoods (Summer 2001).
- Managed and directed grant for the Kentucky Department of Natural Resources analyzing procurement regulations and recycled products (Spring 1998).
- Researched and co-authored *Feasibility Study of Environmental Insurance for Urban Redevelopment* for US HUD Office of Policy Development and Research (1998).
- Researched and co-authored *Army Recruitment Strategies: Choice-based Conjoint Analysis* for the US Army Recruiting Command (1998).

OTHER RELEVANT PROFESSIONAL EXPERIENCES

"Community Reinvestment or Sprawl? Settlement Patterns of Middle- and Upper-income African Americans." Urban Affairs Association (March, 2003).

"When Institutional Planning Fails: The Case of Jackson, MS." American Collegiate Schools of Planning (November, 2002).

Attended August 2001 Publication Workshop sponsored by the *Journal of the American Planning Association* and the *Journal of Planning Education and Research*.

"Regional Planning & Economic Development: The Challenges of Growth (May 18, 2001). Organizer and Moderator of Conference exploring the impact of Nissan on Jackson, MS MSA.

"Revitalizing the Community through Brownfields Redevelopment." City of Jackson, Brownfields Showcase Kick-off Luncheon. Jackson, Mississippi (May 10, 2001).

"Community Reinvestment and Brownfields: The Missing Corporate Link. Urban Affairs Association. Detroit, Michigan (April 2001).

Brian T. Cooper
Associate Professor of Chemistry

Education:

1994 The University of Arizona, Tucson, Arizona. Ph.D. in Analytical Chemistry.
1989 Purdue University, West Lafayette, Indiana. B.S. in Chemistry.

Professional Experience:

2003– The University of North Carolina, Charlotte. Associate Professor.
1997–2003 The University of North Carolina, Charlotte. Assistant Professor.
1994–1997 Iowa State University, Ames, Iowa. Postdoctoral research associate.
1993 Naval Research Laboratory, Washington, DC. Graduate research assistant.
1989–1993 The University of Arizona, Tucson, Arizona. Graduate teaching/research associate.
1989 Purdue University, West Lafayette, Indiana. Undergraduate research assistant.

Brief Biographical Sketch:

Dr. Cooper is a bioanalytical chemist with research expertise in the areas of capillary/channel electrophoresis, capillary liquid chromatography, ultrasensitive fluorescence detection and imaging, and electrospray and MALDI mass spectrometry. He has taught Principles of Chemistry (CHEM 1251), Quantitative Analysis (CHEM 3111), Instrumental Analysis (CHEM 4111/5111) and has developed and taught courses at the graduate level in Modern Mass Spectrometry (CHEM 6115) and Bioanalytical Techniques (CHEM 4090/5090).

Recent Presentations:

1. Emory, J. M.; Carlin, C. M.; Cooper, B. T. "Single-Molecule Electrophoresis in Microfabricated Glass Channels," poster (JME), National ACS Meeting, New Orleans, LA; March 2003.
2. Sanzgiri, R. D.; Cooper, B. T.; McKinnon, T. A.; Hamper, A. M. "Optimizing Differential Binding in Surfactant Affinity Capillary Electrophoresis," poster (RDS), National ACS Meeting, New Orleans, LA; March 2003.
3. Cooper, B. T.; McKinnon, T. A.; Sanzgiri, R.; Hamper, A. M. "Probing Antibody Conformational Microheterogeneity by Surfactant Affinity Capillary Electrophoresis (SurfACE)," poster (BTC), HPCE Meeting, San Diego, CA, January 2003.
4. Dixon, K. A.; Cooper, B. T. "Nanoflow Electrospray of Tryptic Digests from Gels Containing Ammonium Versus Sodium Dodecyl Sulfate," poster (KAD), SERMACS, Charleston, SC, November 2002.
5. Gunawardena, H. P.; Childs, A. J.; Ross, C. L.; Cooper, B. T. "Protein MEKC: Surfactant Binding and Monoclonal Antibody Analysis," invited talk (BTC), Eastern Analytical Symposium, Atlantic City, NJ, October 2001.

Recent Publications:

1. Cooper, B. T. *J. Am. Chem. Soc.* **2002**, *124*, 13638–13639. Book review of *Applied Electrospray Mass Spectrometry*, Pramanik, B. N.; Ganguly, A. K.; Gross, M. L., Eds., Marcel Dekker: New York, 2002.
2. Cooper, B. T. *J. Am. Chem. Soc.* **2000**, *122*, 3981. Book review of *Microcharacterization of Proteins*, 2nd Ed., Kellner, R.; Lottspeich, F.; Meyer, H. E., Eds., Wiley-VCH: Weinheim, 1999.
3. Cooper, B. T.; Buckner, S. W. "Relaxation of Vibrationally Excited Gas-Phase $\text{Cr}(\text{CO})_5^-$ " *J. Am. Soc. Mass Spectrom.* **1999**, *10*, 950–957.
4. Cooper, B. T.; Buckner, S. W.; Parent, D. C. "Oxidation Reactions and Photochemistry of Aluminum Cluster Anions (Al_3^- to Al_{23}^-)" *Chem. Phys. Lett.* **1998**, *284*, 401–406.
5. Urbansky, E. T.; Cooper, B. T.; Margerum, D. W. "Disproportionation Kinetics of Hypoiodous Acid as Catalyzed and Suppressed by Acetic Acid-Acetate Buffer" *Inorg. Chem.* **1997**, *36*, 1338–1344.

Recent External Grants:

- Research Corporation: “Capillary Electrophoretic Investigations of Conformational Isomerism in Monoclonal Antibodies,” \$36,912 + \$7,000 UNC Charlotte match; May 2001–May 2003.
- NSF: “CAREER: Rapid Ultrasensitive Protein Mapping and Bioanalytical Extension Activities,” \$278,800 + \$24,000 UNC Charlotte match; February 2000–February 2004.
- ORAU Ralph E. Powe Junior Faculty Award: “Protein Charge States in Aqueous Solution,” \$5,000 + \$5000 UNC Charlotte match; July 1999–June 2000.
- NSF (Major Research Instrumentation, Co-PI): “Acquisition of Liquid Chromatography-Mass Spectrometry instrumentation for the Regional Analytical Chemistry Laboratory,” \$139,340 + UNC Charlotte (\$147,935) and industrial (Clariant: \$10,000; Goulston: \$15,000) matches; September 1998–August 2001.

Selected Professional Activities:

- Director of Mass Spectrometry, **Regional Analytical Chemistry Laboratory**, 1998–present.
- American Society for Mass Spectrometry, 1990-1993 and 1998–present.
- Society for Applied Spectroscopy, 1992–present.
- American Chemical Society, 1989–present (Division of Analytical Chemistry, 1993–present).

Dr. John L. Daniels, P.E.

EDUCATION

Lehigh University	Civil Engineering	B.S., 1996
University of Massachusetts Lowell	Civil Engineering	M.S., 1998
University of Massachusetts Lowell	Civil Engineering	D.Eng., 2001

Dissertation: Enhancement of clay-based barrier material resistance to desiccation stress and freeze-thaw cycling using aqueous polymer solutions

RESEARCH EXPERIENCE

Recent Publications (of 26 technical publications):

1. Fang, H.Y. and **Daniels, J.L.** 2004. Introductory Geotechnical Engineering: An Environmental Perspective, Spon Press (Textbook under contract for publication in January 2004).
2. **Daniels, J.L.**, Inyang, H.I. and Brochu, M. Specific surface area of barrier mixtures at various outgas temperatures, ASCE Journal of Environmental Engineering, Special Edition on Waste Containment and Barrier Materials, (accepted).
3. **Daniels, J.L.**, Inyang, H.I. and Iskandar, I. 2003 Durability of Boston Blue Clay in Waste Containment Applications, ASCE Journal of Materials in Civil Engineering, 15(2), 144-152.
4. **Daniels, J.L.**, Inyang, H.I. and Kurup, P. 2002. The influence of dissolved polymers on the properties of earthen barriers used in waste containment applications, The 6th International Symposium on Environmental Geotechnology and Global Sustainable Development, Seoul, Korea, July 2-5, 2002, pp. 363-370
5. **Daniels, J.L.**, Chien, C.C., Ogunro, V.O. and Inyang, H.I. 2000. A comparative analysis of contaminant migration models using barrier material data, Journal of Soil and Sediment Contamination pp. 9:5:487-501.
6. **Daniels, J.L.**, Inyang, H.I. and Fang, H-Y. 2001. Theoretical relationship for scaling freezing-induced damage in barrier systems under laboratory and field conditions. Proceedings of the International Symposium on Application of Natural Materials for Environmental Geotechnology, Tokyo, Japan, October 29-November 2, 2001, pp. 37-55.
7. Inyang, H.I., **Daniels, J.L.** and Chien, C.C. 2000. Methods of analysis of contaminant migration in barrier materials In: Remediation of Hazardous Waste Contaminated Soils, 2nd Edition, Wise et al., editors, pp. 63-82.
8. **Daniels, J.L.**, Inyang, H.I. Howe, G.S. and Ogunro, V.O. 1999. Innovative use of triaxial cell permeameters for measuring the earthen barrier resistance to freeze-thaw degradation under field conditions. Proceedings of the International Symposium on High Altitude and Sensitive Ecological Environmental Geotechnology, Nanjing, PR China pp. 326-333.

Recent Funded Research

- Feasibility of dissolved polymer restoration of deteriorated landfill covers, UNC Charlotte, Graduate School, 4,460, 1/1/02 – 12/31/02, PI, In progress

- The Feasibility of a Next Generation Aerobic Municipal Solid Waste Bioreactor, UNC Charlotte, College of Engineering, 10,000, 1/1/02 – 12/31/02, Co-PI, In progress
- Feasibility of enhanced contaminant attenuation in subgrade soils at the Belews Creek Ash Landfill, Duke Energy, 4,560, 7/25/02 – 12/31/02, PI, Completed
- Interactions between coal combustion ash and flue gas desulfurization sludge: Implications for innovative waste management, Duke Energy, 4,560, 7/25/02 – 12/31/02, PI, Completed
- Use of Duke Power Plant Ash in High Volume Superpave Highway Asphalt Concrete Application, Duke Energy, 19,332, 11/1/02-12/31/03, Co-PI, In Progress
- Permeable reactive layer for trace metals attenuation: A field, laboratory and computer-based assessment, Duke Energy, 85,000, 4/15/03-12/31/03, PI, In Progress

TEACHING EXPERIENCE

Department of Civil Engineering, University of North Carolina, Charlotte, NC

- CEGR 6146-001 Advanced Groundwater Analysis (Spring 2003)
- CEGR 6090-D01 Soil Behavior (Fall 2002)
- CEGR 6090-D01 Environmental Chemodynamics (Spring, 2002)
- CEGR 3258-001 Geotechnical Laboratory (Spring, 2002, 2003)
- CEGR 4090/5090-D03 Soil Improvement in Geotechnical and Geoenvironmental Engineering (Fall, 2001)

Co-Instructor:

- CEGR 6090-H01 Design and Analysis of Waste Containment Systems (Spring, 2001)

Department of Civil and Environmental Engineering, University of Massachusetts, Lowell, MA

Co-Instructor:

- 14.563 Design and Analysis of Waste Containment Systems (Fall 1998, Fall 1999)
- 14.593 Physical and Chemical Interactions in Earthen Barriers (Spring 2000)

Teaching Assistant:

- Surveying (Fall 2000)
- Geomatics (Spring 2000)

EXPERIENCE IN DIRECTING GRADUATE STUDENT RESEARCH

Theses:

- Mr. Raghuram Cherukuri (Expected MSCE: August 2003) Thesis: Geotechnical properties of earthen barriers modified by exopolymeric substances
- Mr. Gautham Das (Expected MSCE August 2003) Thesis: “Use of Permeable Reactive Soils for Heavy Metal Containment”
- Ms. Marie Schmader (Expected MSCE May 2004) Thesis: “Hydrodynamic controls on aerobic bioreactor performance”

Independent Studies/Projects:

- Mr. Gairy Taylor, Project: “The influence of methanotrophic bacteria and biofilm production on the shear strength of landfill cover soils” Spring 2003
- Mr. Dinakar Nimmala, Independent Study: “The influence of biofilm on the heavy metal adsorption characteristics of Piedmont Soils” Spring 2003
- Mr. Raghuram Cherukuri, Independent Study: “Geotechnical and geoenvironmental engineering aspects of geothermal energy” Spring 2002

CURRICULUM VITAE

April 2003

Dr. John A. Diemer

EDUCATION

Ph.D. Geology (1985) Binghamton University; *Sedimentology of the fluvial-marine transition in the Upper Devonian/Lower Carboniferous of Kerry Head, County Kerry, Ireland*; J. Bridge, supervisor.

M.A. Geology (1979) State University of New York at Binghamton; *Isovels and secondary circulation in a high mountain braided delta*; Dr. M. Morisawa, supervisor.

A.B. Geology (1977) Oberlin College

PROFESSIONAL EMPLOYMENT

Associate Professor, University of North Carolina at Charlotte	1994-
Visiting Associate Professor, University of British Columbia	2000
Visiting Fellow, Kingston University, England	1994-1995
Assistant Professor, University of North Carolina at Charlotte	1988-1994
Visiting Assistant Professor, Franklin & Marshall College	1985-1988
Instructor, SUNY - Plattsburgh	1982-1985
Teaching and research assistant, SUNY - Binghamton	1977-1982

TEACHING

Graduate committees

Emily Alexander, “Staphylococcus aureus Induces Tumor Necrosis Factor-Related Apoptosis-Inducing Ligand Expression by Normal Mouse and Human Osteoblasts”, Interdisciplinary Doctoral Program in Biology, supervisor Dr. Michael Hudson, 2000-2002

Ian Eckardt, “Geology and Sequence Stratigraphy of the Permian Basin, New Mexico”, and “Sedimentology of Brown’s Cove, Lake Wylie, NC”, 2002-

Mark Horton, “The Impact of Recent Technological Advances on Archaeological Practice”, Master of Arts in Liberal Studies thesis, 1998-1999.

Shaela Ingham, “Understanding Tragedy: The Importance of Sacrifice in Agamemnon”, Master of Arts in Liberal Studies thesis, 1998-1999.

Frank Irete, “Constructing Nature”, Master of Arts in Liberal Studies thesis, 1997-1998.

Cory LaNeave, “Evaluating BMPs”, M.S. in Civil Engineering, 2001.

Graduate Courses

GEOL 5105 Geomorphology; GEOL 5110 Stratigraphy; GEOL 5125 Geologic Summer Field Camp; ESCI 5233 Geoenvironmental Site Characterization ; ESCI 6060 Geology of North Carolina; LBST 6000 History of Geology

PUBLICATIONS AND RESEARCH

- Belt, E.S., Diemer, J.A., Vuke, S.M., Beutner, E.C., and Cole, B.S., 2002, The Ekalaka Member of the Fort Union Formation, SE Montana, *MT Bureau Mines and Geology Open File Rept. 461*, 56 p.
- Allan, C.J., and Diemer, J.A., 2002, Investigation of stream sediment/phosphorus interactions in the Long Creek watershed, Gaston County, North Carolina, *Final Open File Report to the Gaston County Quality of Natural Resources Commission*, 88 pp.
- Bobyarchick, A.R., and Diemer, J.A., 2000 "Land regions and geology", in: Orr, D.M., and Stuart, A.W., (eds.), *The North Carolina Atlas: Portrait for a New Century*, UNC Press: Chapel Hill.
- Diemer, J.A., Forsythe, R., Engelhardt, D., and Porter, C., 1997, An Early Cretaceous forearc basin in the Golfo de Penas region, southern Chile, *Journal of the Geological Society*, 154, 925-928.
- Belt, E.S., Diemer, J.A., and Beutner, E.C., 1997, Marine ichnogenera within Torrejonian facies (Paleocene) of the Fort Union Fm, SE Montana, *Contributions to Geology, Univ. WY*, 32, 3-18.
- Allan, C., Forsythe, R., and Diemer, J., 1997, *Piedmont N.C. Wet Retention Basins: Performance Factors, Sediment Behavior, and Seepage Losses*, NC WRI, NCSU, Raleigh, NC, 252 p.
- Collie, M., and Diemer, J.A., 1995, *Murchison in Moray: A Geologist on Home Ground With the Correspondence of Roderick Impey Murchison and the Rev. Dr. George Gordon of Birnie*: Philadelphia, American Philosophical Society Transactions, v. 85, part 3, 263 p.
- Diemer, J.A., and Forsythe, R., 1995, Grain size variations within slope facies recovered from the Chile margin triple junction: In Lewis, S.D., Behrmann, J.H., Musgrave, R.J., and Cande, S.C. (Eds.), *Proc. ODP, Sci. Results*, 141: College Station, TX (Ocean Drilling Program, 79-94.
- Nelson, E., Forsythe, R., Diemer, J.A., Allen, M., Urbina, O., 1993, Taitao ophiolite: a ridge collision ophiolite in the forearc of southern Chile (46° S): *Revista Geologica de Chile*, 20, 137-165.

Grants and Contracts

- Beaverdam Creek Watershed Project*, funded by Buck Engineering for \$27,500.
- Arc-Parallel Fault and Fore Arc Rift Development During Collision of the Chile Rise*, submitted December 1, 2002 to NSF-Tectonics for \$225,000.
- Arc-Parallel Fault Motion Associated with Ridge Collision and the Great 1960 Chile Earthquake*, funded by the UNC Charlotte Faculty Research Program for 2001-2002, for \$7540.
- Investigation of Phosphorus Content and Availability in Stream Bed Sediments*, funded by Gaston County from March 15, 2000 to October 31, 2001, for \$28,116.
- Murchison's Field Campaigns in Russia as Documented by His Letters to Charlotte*, August 1, 1998 to July 31, 1999, funded by the American Philosophical Society for \$6,000.
- Phosphorus Content and Availability in Stream and Bank Sediments, Long Creek, Gaston County, North Carolina*, July 1, 1998 to June 30, 1999, funded by Gaston County EPA 319 Long Creek Project with Craig Allan for \$19,816.
- Basin Analysis of an Active Fore-arc Rift, Golfo de Penas, Chile*, May 1, 1997 to August 31, 1999, funded by the Petroleum Research Fund with R. Forsythe for \$25,000.
- In Situ Investigation of Sediment Resuspension and Seepage Losses from a Stormwater Retention Basin in the Piedmont of North Carolina*, 1994-95, funded by NC WRI for \$27,000.
- Evaluation of Environmental Factors Impacting on Wet Retention Basin Performance and Fates of Adsorbed/Desorbed Constituents in Sediment in the Piedmont Province of North Carolina*,

1993- 1994, funded by NC WRRI by Forsythe, Allan, and Diemer for \$38,618.

Grain size analysis of Leg 141 samples, 1992, ODP contract number 666370, for \$12,936.

Field Studies of the Antarctic/Nazca/South American Triple Junction, 1991-93, NSF, Tectonics Program for \$68,057.

BERNADETTE T. DONOVAN-MERKERT

Professor of Chemistry

Education:

1983 Duke University, Durham, NC, B.S. chemistry.
1988 The University of Vermont, Ph.D. in analytical and inorganic chemistry

Professional Experience:

1983 – 1987, 88 The University of Vermont, Teaching Assistant
1987 The University of Vermont, Research Assistant.
1988 - 1990 Dartmouth College, Postdoctoral Research Associate, organometallic chemistry
1990 - 1992 The University of Texas at Austin, Texas, Postdoctoral Associate.
1992 – 1998 The University of North Carolina, Charlotte. Assistant professor.
1996 – 2002 The University of North Carolina, Charlotte. Associate Professor.
2002-present The University of North Carolina, Charlotte. Professor

Brief Biographical Sketch:

Dr. Donovan-Merkert is an analytical/inorganic chemist. Her research is in the areas of redox-promoted reactions of organometallic, inorganic and organic complexes and electrochemically promoted catalytic asymmetric synthesis at chiral modified electrodes. She has taught Analytical Chemistry (Chemistry 3111), Instrumental Analysis (Chemistry 4111) and developed and taught graduate level courses in organometallic chemistry (Chemistry 6126), electroanalytical chemistry, nuclear magnetic resonance spectroscopy (Chemistry 6115/8115).

Recent Papers:

1. "Synthesis of Polymer-Supported Hydrogenation Catalysts via Electrochemical Polymerization of Monomeric Complexes Tethered to Terthiophene" Fouzi, M.; Donovan-Merkert, B.T. AC National Meeting in Boston, MA, August 2002
2. "Polymer modified electrodes formed by electropolymerization of thiophene-tethered chiral organometallic complexes" Donovan-Merkert, B.T., Fouzi, M. Ninth Annual Undergraduate Research Conference, UNC Charlotte, April 19, 2002.
3. "Electrochemistry Studies of Ru BINAP Compound" Andreu, A.; Donovan-Merkert, B.T. *Abstracts of Papers*, 223rd National Meeting of the American Chemical Society, Orlando, FL, April 7 – 11, 2002; American Chemical Society, Washington, DC; INOR 325.
4. "Synthesis and electrochemistry studies of bis(oxazoline) complexes of palladium and platinum" 54th Southeast Regional Meeting of the American Chemical Society, Charleston, SC, November 14, 2002; American Chemical Society, Washington, DC; Paper #343.
5. "Synthesis and electrochemistry studies of bis(oxazoline) complexes of palladium and platinum" Cetto, C.L.; Cihil, C.G.; Donovan-Merkert, B.T. *Abstracts of Papers*, 225th National Meeting of the American Chemical Society, New Orleans, LA; American Chemical Society, Washington, DC, 2002; INOR 683.

Recent Publications:

1. "Rhodocenium Complexes Bearing the 1,2,3-tri-*tert*-butylcyclopentadienyl Ligand: Synthesis and Mechanistic, Structural and Computational Investigations" Donovan-Merkert, B.T.; Clontz, C.R.; Rhinehart, L.M.; Tjiong, H.I.; Carlin, C.M.; Cundari, T.R.; Rheingold, A.L.; Guzei, I *Organometallics* **1998**, *17*, 1716.
2. "Reactions of Odd-Electron Cobaltacycles: Characterization of a Persistent 17-Electron Anionic Intermediate in Electron-Transfer-Catalyzed (ETC) Substitution Reactions" Donovan-Merkert, B.T.; Rieger, P.H.; Geiger, W.E. *Organometallics* **1999**, *18*, 3194.
3. "An electron-transfer induced migratory insertion reaction originating from a 19-electron cobaltacyclic anion" Morneau, A.; Donovan-Merkert, B.T.; Geiger, W.E. *Inorg. Chim. Acta* **2000**, 300-302, 96.

4. "Modeling Nickel Hydrogenases: Synthesis and Structure of a Distorted Octahedral Complex with an Unprecedented[NiS₄H₂] Core" Alvarez, H.M.; Krawiec, M.; Donovan-Merkert, B.T.; Fouzi, M.; Rabinovich, D. *Inorg. Chem.* **2001**, *40*, 5736.
5. "Ring-strain effects on the oxidation potential of enediyne and enediyne complexes" Baldrige, K.K.; Donovan-Merkert, B.T.; O'Connor, J.M.; Lee, L.I.; Closson, A.; Fandrick, D.; Tran, T.; Bunker, K.; Fouzi, M.; Gantzel, P. *Organic and Biomolecular Chemistry* **2003**, *1*, 763.

Recent External Grants

- Senior Faculty Research Support Grant, January 2002 – June 2003, \$6,000.00
- Faculty Research Grant, July 2001 – June 2002, \$5,000.00
- National Science Foundation, 1999-2004, \$225,000.00 + \$48,374 matching, B.T. Donovan-Merkert, P.I. "Asymmetric Hydrogenation at Electrode Surfaces."

Selected Professional Activities:

- Chair, Steering Committee, Undergraduate Research Conference, UNC Charlotte.
- Chair, Nomenclature Committee, Division of Inorganic Chemistry, American Chemical Society.
- Executive Committee, Division of Inorganic Chemistry, American Chemical Society.

THOMAS D. DUBOIS
Professor of Chemistry

Education:

1962 Mc Murry College, Abilene, Texas. BA Chemistry
1965 Ohio State University, Columbus, Ohio M.S. in chemistry.
1967 Ohio State University, Columbus, Ohio Ph.D. in chemistry

Professional Experience:

July 2001 -Present - Chair, Department of Chemistry
Charles H. Stone Professor of Chemistry
Director of the Computational Chemistry and Visualization Laboratory
June 2000-2001 Interim Chair, Department of Chemistry
Director of the Computational Chemistry and Visualization Laboratory
Present - July 1997 Charles H. Stone Professor of Chemistry
Director of the Computational Chemistry and Visualization Laboratory
Present - July 1996 Charles H. Stone Professor of Chemistry
Ph.D. Faculty, Electrical Engineering
Ph.D. Faculty, Mechanical Engineering
Present - July 1977 Professor, Department of Chemistry
July 1977 - July 1971 Associate Professor, Department of Chemistry
July 1971 - June 1967 Assistant Professor, Department of Chemistry
University of North Carolina at Charlotte

Brief Biographical Sketch

Dr. DuBois is an inorganic chemist. His research interests are in modeling complex reaction systems using Hartree-Fock and density functional methods. He has taught Principles of Chemistry (Chemistry 1251 and Chemistry 1252), Microcomputer Interfacing (Chemistry 4115), Computational Chemistry (4200/5200) and developed and taught a graduate level course in Theoretical Inorganic Chemistry (Chemistry 6125).

Recent Papers:

1. Arthur Greenberg, Thomas D. DuBois "Calculated Pathways to Amide N-Oxides" Northeast Regional Meeting of the American Chemical Society, June 27, 2001.
2. W. Michael York, Thomas D. DuBois, John Risley "Molecular Dynamics Simulations of Glycosylasparaginase in Aqueous Solution" Experimental Biology 2001, Orlando Florida, March 31-April4, 2001 Reference FASEBJ. 15, A1172, Abstract No. 9162.
3. Arthur Greenberg and Thomas D. DuBois, "Amide N-Oxides: A computational Study of Their Stabilities," National ACS Meeting, San Francisco, CA March 2000, Abstract No. 506.
4. S. Bobbio, S. Goodwin-Johansson, T. DuBois, F. Tranjan, S. Smith, R. Fair, C. Ball, J. Jacobson, C. Bartlet, N. Eleyan, H. Makki, and R. Gupta: "Integrated Force Array-Positioning Drive Applications": SPIE Conference on Smart Structures and Materials, San Diego, CA, February 1996.
5. A. Greenberg, D. T. Moore and T. D. DuBois, "Are Large Bridgehead Bicyclic Lactams Hyperstable," National Meeting ACS, Chicago, Illinois, August, 1996.

Recent Publications:

1. Arthur Greenberg and Thomas D. DuBois, "Amid-N-Oxides: An Ab Initio Molecular Orbital Study" Jouranal of Molecular Structure 567-568, 303, 2001.
2. Kim, Mahn-Jong, MacDonnell, Frederick M., Gimon-Kinsel, Mary E., DuBois Thomas, Asgharain, Griener, James C., "Global Chirality in Rigid Decametalllic Ruthenium Dendrimers," Angew. Chem. Int. Ed. 2000, 39, 615.
3. Bobbio, Stephen M., Smith, Stephen W., Goodwin-Johansson, Scott, Fair, Richard B., DuBois, Thomas D., Tranjan, Farid M., Hudak, J., Gupta, R., & Makki, Hussein, "Integrated Force Array Interface to External Systems," Proc. SPIE Vol. 3046, 248, (1997).
4. A. Greenberg, D. T. Moore and T. D. DuBois, "Small and Medium-Sized Bridgehead Bicyclic Lactams: A Systematic Ab Initio Molecular Orbital Study," J. Am. Chem. Soc., 118, 8658-8668 (1996).

Recent Patent:

- Stephen M. Bobbio and Thomas D. DuBois, "Method and Apparatus for Forming Hydrogen Fluoride," Patent Number 5,961,031, Issued United States Patent Office, October 5, 1999.

Recent External Grants :

- "Neutral Molecule and Molecule Ion Catalyzed Reactions," Thomas D. DuBois, North Carolina Supercomputing Center, Research Triangle Park, Raleigh, NC, Awarded 250 hours of Cray T916 Time valued at \$35,950, 1999-2000.

Selected Professional Activities:

- Livingstone Endowment Committee, Chair
- MCNC Technical Advisory Committee
- MCNC Curricula Advisory Committee

Other Research Experience

- Computational chemistry, computational materials and Supercomputing.
- Lewis acid-base reaction chemistry and inorganic cluster compounds.
- Photopolymers, photochemistry and lithography.
- Materials processing and plasma chemistry.
- Inorganic polymers and materials having unusual electronic properties.
- Homogeneous and heterogeneous transition metal catalysts.
- Microelectronic and Micromechanical Systems.

Experience in Directing Graduate Student Research

- Mr. K. Kelley "Synthesis and Characterization of Light Emitting Polymers"
- Ms. N. Kachroo "Computational Investigation Into the Biologically Important Phosphorylation and Dephosphorylation Reactions", M.S. May 2001.
- Mr. W. Michael York "Computational Investigations into the Enzymatic Properties of Glycosylasparaginase"

CURRICULUM VITAE
April 2003
MARTHA CARY EPPES

I. EDUCATION

UNIVERSITY OF NEW MEXICO (UNM) 1997-2002; Les McFadden advisor

Ph.D. Geology, Department of Earth and Planetary Sciences

Dissertation: Soil Geomorphology of the north flank of the San Bernardino mountains, California

NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY (NMT) 1994-96; Bruce Harrison, advisor

MS Geology with emphasis in soil geomorphology and environmental geology

Thesis: Spatial and temporal study of soils developing on basalt flows, Potrillo Volcanic Field, New Mexico.

WASHINGTON AND LEE UNIVERSITY (W&L) 1989-93; Ed Spencer, David Harbor advisors

BS Geology, Magna Cum Laude, Honors in Geology

Thesis: Quaternary Glaciation of Middle Roaring Creek Valley, Colorado.

II. PROFESSIONAL EMPLOYMENT

a. ASSISTANT PROFESSOR OF EARTH SCIENCES, University of North Carolina, Charlotte, NC, Dept of Geography and Earth Sciences, Spring 2003-present

b. INSTRUCTOR,

i. UNM, Department of Earth and Planetary Sciences, 1999

ii. Limestone College, Department of Geology, South Carolina, 1997

c. CONSULTING GEOLOGIST

i. URS Corporation, Hubble Springs Trench Project, 2002

ii. New Mexico State Map Project, Cundiyo Quad, NM, 2001

iii. University of Vermont, cosmogenic nuclide sediment transport study, Ft. Irwin, CA, 2001

iv. Lehigh University, Soil laboratory installation, PA, 2000

v. Geohaz Inc., West Mesa Trenching Project, NM, 2000

vi. University of Missouri, Dead Sea Seismic Hazard Project, Jordan; 1997

vii. New Mexico State Map Project, Mt. Washington Quad, NM

viii. William Lettis & Assts. Inc, Tijeras Fault Trench Project, NM

ix. Well log analyses, PNM San Ysidro Gas Storage Reservoir project, NM

x. Zuni Cultural Resource Enterprise, Alamo Project, NM

xi. Office of Contract Archaeology, New Mexico, El Paso Project, TX.

d. TEACHING ASSISTANT,

i. UNM, 1998

ii. NMT, 1995-1996.

III. TEACHING

A. UNDERGRADUATE COURSES

e. Physical Geology

B. GRADUATE COURSES

a. Applied Soil Science

b. Soil Science

C. GRADUATE COMMITTEES

a. Ian Eckardt, MS Geology. Projects: A History of Sedimentation within Brown's Cove. Wireline log subsurface stratigraphy of the Artesia Group, Lea County, NM.

IV. PUBLICATIONS

A. REFEREED PUBLICATIONS

- Eppes, M.**, McFadden, L., Matti, J., Powell, R. Influence of soil development on the geomorphic evolution of landscapes: an example from the Transverse Ranges of California. *Geology*, v.30,n.3 p. 195-198.
- Connell, S., Love, D., Maldonado, f., Jackson, P., McIntosh, W., **Eppes, M.**, 2000. Is the top of the upper Santa Fe Group Diachronous in the Albuquerque Basin? *In* U.S. Geological Survey Middle Rio Grande Basin Study – Proceedings of the Fourth Annual Workshop, Albuquerque, New Mexico, Cole, J. ed. U.S. Geological Survey Open-File Report 00-488.
- Eppes, M.**, Harrison, B., McIntosh, W, 1999. Spatial variability of soils developing on basalt flows in the Potrillo volcanic field: prelude to a soil chronosequence study. *Earth Surface Processes and Landforms*, v. 24, p. 1-16.
- McFadden, L., **Eppes., M.** The origin of cracked stones in desert pavements. *In preparation.*

B. PAPERS PRESENTED AT ANNUAL MEETINGS AND PROGRAM PUBLICATIONS (LAST 3 YEARS)

- Eppes, M.C.**, McFadden, L., Matti, J., Powell, R., 2002. Soil Geomorphology of the North Flank of the San Bernardino Mountains, California,: A summary of Interactions and feedbacks between soil development and landscape evolution at various temporal and spatial scales. GSA 2002 annual meeting. Abstracts with Program, v. 33, n.7.
- McFadden, L., **Eppes, Martha**, Gillespie, A., 2002. Solar insolation and physical weathering in deserts: revisiting an old idea. GSA 2002 annual meeting. Abstracts with Program v. 33, n. 7.
- Nichols, K., Bierman, P., Hooke, R., **Eppes, M.**, Persico, L., Cafee, M., Finkel, R., 2001. Regular Cosmogenic Nuclide Dosing of Sediment Moving Down Desert Piedmonts. *Eos Trans. AGU*, 82(47), Fall Meet. Suppl., Abstract, 2001.
- Eppes, M.C.**, McFadden, L. , Matti, J., Powell, R., Newland, S., 2000. Effects of soil development on tectonic landforms, San Bernardino Mountains, California. GSA 2000 annual meeting. Abstracts with Program, v.32, n.7.
- McFadden, L., Wells, S., **Eppes, M.C.**, Gillespie, A. 2000. Farouk El-Baz Award: The evolution of desert piedmont surfaces: Studies of the origin of desert pavements and soils. GSA 2000 annual meeting. Abstracts with Program, v.32, n.7.

C. FUNDED RESEARCH GRANTS

RETREAT (REtreating TRench, Extension, and Accretion Tectonics) CD project Apennines of Northern and Central Italy , NSF Continental Dynamics, June, 2002. M.Eppes is a funded collaborator with this group.

VI. HONORS, AWARDS AND ACCOMPLISHMENTS

- a. American Quaternary Association Denise Gaudreau Award for Excellence in Quaternary Studies, 2002
- b. Association of Women Geologists Student Award, 2002
- c. Outstanding Ph.D. Student, Dept. of E&PS, UNM, 2002
- d. The College of Arts and Sciences Dean's Dissertation Year Fellowship, UNM, 2001
- e. J. Hoover Mackin Award of the Quaternary Geology and Geomorphology Division of GSA, 2000
- f. GSA student research grant, 2000
- g. UNM Graduate Student Fellowship, 1998-2002
- h. UNM Dept. of E&PS scholarships, 1998-2001
- i. Best Student Paper, NMGS 1998, 1995
- j. Roswell Geological Society Scholarship, 1995
- k. W&L Award in Geology 1990, '92, '93

Curriculum Vitae
April 2003

OWEN J. FURUSETH, Ph.D., AICP

EDUCATION

East Carolina University	1967-71	B.A. Geography and Urban and Regional Planning
East Carolina University	1971-73	M.A. Geography
Oregon State University	1975-78	Ph.D. Geography and Resource Planning

PROFESSIONAL EMPLOYMENT

Assistant Planner, Jacksonville Area Planning Board, Jacksonville, FL, 1973-74.

Associate Planner, Jacksonville Area Planning Board, Jacksonville, FL, and
1974- 1975.

University of North Carolina at Charlotte, 1977 – present
Lecturer, 1977-1979
Assistant Professor, 1980-1984
Associate Professor, 1984-1989
Professor, 1989-present

TEACHING

Graduate Committees

Thesis or Graduate Internship Advisor

Christopher Anderson, 1997	David Martin Nash, 1980
Robert E. Altman, 1990	Janet O'Callaghan, 1991
Sally J. Alhomsy, 1997	Tim Owens, 1998
Catherine Averell, 1991	Mark Rinehart, 2001
Holly Barcus, 1997	Anthony Roberts, 1998
John David Bondurant, 1997	Cheryl R. Roberts, 1984
Vicki Bowman, 1998	Shomali Sengupta, 1996
Robert Deaton, 1996	Suzanne Schwartz, 1983
Althea Douglas, 2000	Bettie Banks Stammerjohn, 1980
Linda Giltz, 1996	Kevin Stewart, 1999
Elizabeth R. Groff, 1994	Deborah S. K. Thomas, 1995
Mark S. Johnson, 1986	Jason Wager, 2001
Mark E. Kirstner, 1986	Jan Whitesell, 1996

Brett Spivey, 1994
Russell T. Krauss, 1993
Sarah LaBelle, 1993
Patti A. Logsdon, 1986
Ben Leatherland, 1999
Tom Ludden, 1999

Carol Wilcox, 1985
Karen R. Zera, 1990

PUBLICATIONS AND RESEARCH

Book

Furuseth, Owen J. and Mark Lapping (eds.). Contested Countryside: the Rural-Urban Fringe in North America. Avebury, Ashgate Publishing, Aldershot, England, 1999.

Chapters in Books

"Service Provision and Social Deprivation," in The Geography of Rural Change Brian Ilbery (ed.) London: Longman, 1998, pp. 233-256.

"North American Agriculture," in North America: Environment and Society. F.W. Boal and S.A. Royle (eds) London: Arnold, 1999, pp. 125-139.

Refereed Articles

Furuseth, Owen J., J. Dennis Lord, and Holly Barcus, "Defining and Measuring Neighborhood Sustainability in Charlotte, NC," Applied Geographical Studies, Vol. 3, No. 1, 1999, pp. 1-22.

Furuseth, Owen J., "New Urbanism, Pedestrianism, and Inner City Charlotte Neighborhoods," Southeastern Geographer, Vol. XXXIX, No. 2, 1999, pp. 145-160.

Furuseth, Owen J., "Charlotte Neighborhood Quality of Life Project," Urban Quality Indicators, Issue 19, Fall 2000. pp. 8-10.

GRANTS AND CONTRACTS

"Countywide Transit Services Plan," TMD Incorporated, May 8, 2000-May 8, 2001, \$28,405.

Student Internship "Charlotte Neighborhood Development Key Business," May, 2000-May 2001, \$11,720.

"Charlotte Housing Quality Study, 2001," Owen J. Furuseth and Tyrel Moore (PIs), Charlotte Neighborhood Development Key Business, May 2001-August 2001, \$44,000.

"Charlotte Neighborhood quality of Life, 2002," Owen J. Furuseth and J. Dennis Lord (PIs), Charlotte Neighborhood Development Key Business

and Charlotte-Mecklenburg Planning commission, July 2001-June 2002,
\$87,900.

OTHER RELEVANT PROFESSIONAL EXPERIENCE

NATO Postdoctoral Fellowship, 1980-81, Research Associate affiliated with the Natural Resources Management Program at Simon Fraser University, Burnaby, British Columbia.

Fulbright Senior Research Scholar, University of Auckland, New Zealand, June-October 1993.

Janos Gergely, Ph.D., P.E.

EDUCATION

Polytechnical Institute of Cluj-Napoca, Romania	Civil Eng.	Dipl. Eng.	1990
University of Utah	Civil Eng.	M.Sc.	1996
University of Utah	Civil Eng.	Ph.D.	1998

(Ph.D. Dissertation Title: “Design Aid for Shear Strengthening of Reinforced Concrete T-joints Using Carbon Fiber Reinforced Plastic Composites”)

RESEARCH EXPERIENCE

a. Representative Publications

- J. Gergely, and D.T. Young, “*In-plane and Out-of-plane Behavior of Unreinforced CMU Walls Retrofitted with Composites*,” Journal of Composites for Construction, ASCE, to be submitted in Spring 2003.
- M. Beigay, D.T. Young, and J. Gergely, “*Composite Wall Anchors*”, Advanced Polymer Composites for Structural Applications in Construction ACIC 2002, Southampton, UK, April 15-17, 2002, proceedings.
- P.R. Salom, J. Gergely, and D.T. Young, “*Torsional Strengthening of Spandrel Beams with FRP Laminates*,” Journal of Composites for Construction, ASCE, accepted Spring 2003.
- J. Gergely, D.T. Young, J.L. Hooks, and N. Alchaar, “*Composite Retrofit of Unreinforced CMU Walls*,” Advancing with Composites (PLAST 2000) International Conference, Milan, Italy, May 2000.
- H. Emmanuel, J. Gergely, and D.T. Young, “*Masonry Composite Bond Behavior*,” University of North Carolina at Charlotte Research Report, September 2000.
- I. Gergely, C.P. Pantelides, and L.D. Reaveley, “*Shear Strengthening of R/C T-joints Using CFRP Composites*,” Journal of Composites for Construction, ASCE, May 2000.
- V.A. Volnyy, C.P. Pantelides, J. Gergely, C.L. Hofheins, and L.D. Reaveley, “*Carbon Fiber Composite Connections For Precast Concrete Wall Panels*”, ACI Structural Journal, submitted, July 1999.
- C.P. Pantelides, I. Gergely, and L.D. Reaveley, “*Retrofit and Test of R/C Bridge Piers With CFRP Composites*,” Journal of Structural Engineering, ASCE, November 1999.
- I. Gergely, C.P. Pantelides, R.J. Nuismer, and L.D. Reaveley, “*Repair of Bridge Pier with Carbon Fiber Composites*,” Journal of Composites for Construction, ASCE, November 1998.

b. Grants

- FRP Clamping of Composite Tapes Attached to Concrete (Sika/Hexcel – finished)
- Masonry Composite Bond Behavior (Edge Structural Composites – finished)
- Evaluation of 4-bolt Moment Connections in Pure Tension (SteelFab – finished)
- Seismic Retrofit of Masonry Structures (National Research Council/National Science Foundation – finished)
- Bridge Analysis vis-à-vis Performance (NCDOT – ongoing)
- Concrete Diffusion Coefficients and Existing Chloride Exposure in North Carolina (NCDOT – accepted)
- RP Retrofit of Unreinforced Masonry Buildings (National Science Foundation – pending)

c. Other Relevant Research Experience

- Chair of the ACI 440M Subcommittee formed to develop a *State-of-the-Art Report* and a *Design Guideline* on masonry/FRP applications in collaboration with TMS Existing Masonry Committee
- With Dr. Young filed a patent application on composite anchoring systems

TEACHING EXPERIENCE

a. Undergraduate Courses

- Civil Engineering Drawing
- Structural Materials Lab
- Reinforced Concrete Design I

b. Graduate Courses

- Timber Design
- Design of Masonry Systems
- Composite Materials
- Structural Strengthening

c. Other Relevant Teaching Experience

- Taught modules on building codes and structural softwares in three classes (Senior Design I and II; and Advanced Structural Analysis)
- Developed and presented two 8-hour PDH seminars for professionals on the composite applications in infrastructure, and on the repair and retrofit of structures

LIST OF GRADUATE STUDENTS

(Advisor to a total of 16 students, including current students)

- Rami Nassar, Walter P. Moore, Orlando FL – graduated
- Nawar Alchaar, Duke Engineering, Charlotte NC – graduated
- Pedro Salom, Zapata Engineering, Charlotte NC – graduated
- Jon Vandergrift, Laurene & Rickher PC, Charlotte NC – graduated
- Qui Nguyen, King-Guinn and Associates, Charlotte NC – graduated
- Habineza Emmanuel, Engineering Consultant, Raleigh NC – graduated
- Mike Beigay, Odell and Associates, Charlotte NC – expected graduation 2003
- Chad Thomas Ritter, Verna Engineering, Charlotte NC – expected graduation 2003
- Brad Stiller, Ralph Whitehead and Associates, Charlotte NC – expected graduation 2003
- Peter Foster, UNC Charlotte, Charlotte NC – expected graduation 2003
- Timothy Laurence, UNC Charlotte, Charlotte NC – expected graduation 2004
- Tim Townsend, Ralph Whitehead and Associates, Charlotte NC – expected graduation 2004
- Jeremy Wallace, UNC Charlotte, Charlotte NC – expected graduation 2003
- Claudia Prado, Stantec Inc., Charlotte NC – expected graduation 2003
- Brian Zapata, UNC Charlotte, Charlotte NC – expected graduation 2004
- Michael Stewart, SteelFab Inc., Charlotte NC – expected graduation 2004

Kenneth E. Gonsalves
Professor of Chemistry

Education:

1969	Delhi University, Delhi, India, BS
1972	Boston College, Chestnut Hill, Massachusetts, MS
1984	University of Massachusetts at Amherst, Amherst, Massachusetts, Ph.D. in Chemistry
1985	Massachusetts Institute of Technology, Cambridge, Massachusetts, Post-doc.

Professional Experience:

1980 - 1984	Research Assistant, Materials Res. Lab. University of Massachusetts at Amherst
1986 - 1990	Stevens Institute of Technology, New Jersey, Assistant Professor.
1990 - 1994	University of Connecticut at Storrs, Storrs, Connecticut, Assistant Professor.
1994 - 1999	University of Connecticut at Storrs, Storrs, Connecticut, Associate Professor.
1997	Harvard University, Cambridge, Massachusetts, Visiting Professor.
1997 - 1998	ININ, Mexico, Scientific Advisor.
1997 - 1999	United States Army Research Lab, Visiting Scientist.
1999 - 2000	University of Connecticut at Storrs, Storrs, Connecticut, Professor.
2000 - present	The University of North Carolina at Charlotte, Professor.

Brief Biographical Sketch:

Dr. Gonsalves is a materials chemist having research interests in the synthesis and characterization of both inorganic and organic soft polymeric materials. Current interests include the development of novel resists for nanolithography, nanostructured materials, biomaterials and the nanofabrication and nanopatterning of biomaterials. He has taught General Chemistry, Organic Chemistry, Advanced Organic Chemistry and graduate level courses in Inorganic Polymers, Polymer Chemistry, Polymer Characterization and organized and presented tutorials dealing with micro and nanoscale synthesis and patterning of materials for the Materials Research Society.

Recent Papers:

1. M.A. Ali and K. Gonsalves "Nanofabrication for Next generation Materials and Devices." NIST, Gaithersburg, Maryland, March 2003.
2. K. Gonsalves "Nanomaterials and Nanofabrication for Next Generation Devices." UNC Charlotte optics faculty seminar, **February 2003**.
3. W. He, N. Batina, M. Hudson, D.B. Poker, and K. Gonsalves "Fabrication of 3-D Bioactive Structure." Mater. Res. Soc., Boston, Massachusetts, **December 2002**.
4. "Nanofabrication for Next Generation Materials & Devices", NIST Gaithersburg MD -Precision Engineering Division/Nanometrology and Nanomanufacturing (**invited**), **March 2003**; with M. A. Ali.
5. "Nanomaterials & Nanofabrication for Next Generation Devices" Optics faculty seminar, UNCC, **Feb. 2003**.

Recent Publications:

1. "Synthesis, Characterization, and Preliminary Biological Study of Poly[3-(t-butoxycarbonyl)-N-vinyl-2-pyrrolidone]," W. He, C. Halberstast, and K. Gonsalves, Biomacromolecules (American Chemical Society), 75-79, (2003).
2. "Micro/nano Machining of Polymeric Substrates by Ion Beam Techniques," W. He, D.B. Poker, N. Batina, and K. Gonsalves, Microeletronic Engineering, Vol.65, issue 1-2, 153-161 (2003).

3. "Nanocomposite Resist System for Next Generation Lithography" L. Merhari , Y. Hu, W. He, W.S. Huang, M. Angelopoulos, W.H. Bruenger, C. Dzionk, M. Torkler and K. Gonsalves, Microelectronic Engineering, 391 (2002).
4. "Micropatterns of a Cell-adhesive Peptide on an Amphiphilic Comb Polymer Film" **Langmuir** **18(8)**, 2975 (2002); with J. Hyun, H. Ma, P. Bannerjee, J. Cole and A. Chilkoti.
5. "Organic-inorganic Nanocomposites: Unique Resists for Nanolithography" **Adv. Mater.** May, **13(10)**, 703, **2001(invited review)**; with L. Marhari, H. Wu and Y. Hu.

Recent External Grants:

- "Nanocomposite Resists for Next Generation Lithography: Development of EUVL Prototypes" SEMATECH Inc., 2003-2005, \$315,000.
- "New Resist Concepts for Electron Projection Lithography for Mass-production of Integrated Circuits with sub- 100nm Critical Dimensions" SPAWAR/DARPA, 1999-2001, \$264K.
- "Assembled Nanotubes as High Sensitivity Resists" SGER, NSF, 2000, \$70,000.

Selected Professional Activities:

- Chairman of Curriculum Evaluation of Polymer Science Program, 1996.
- Organic Chemistry Division Head, University of Connecticut at Storrs, 1995-1996.
- Chairman of UCONN Research Foundation Physical Sciences Review Panel, University of Connecticut at Storrs, 1992-1993.

Johnny Rufus Graham, Ph.D., P.E.

Associate Professor
Department of Civil Engineering
The University of North Carolina at Charlotte

EDUCATION

The University of North Carolina at Charlotte, 1975, B.S. in Engineering
The University of North Carolina at Charlotte, 1984, M.S. in Engineering
North Carolina State University, 1990, Ph.D.

PROFESSIONAL REGISTRATION

Professional Engineer: North Carolina No. 8975

PROFESSIONAL EXPERIENCE

The University of North Carolina at Charlotte, Department of Civil Engineering
Associate Professor, 1998 - Present
Assistant Professor, 1992 - 1998
Visiting Assistant Professor, 1990 - 1992
Lecturer in Civil Engineering, 1984 - 1990
Graduate Teaching Assistant, 1982 -1983

RESEARCH

Principal Investigator or Co-Investigator on 13 externally funded projects with total funding of over \$800,000.

RECENT PUBLICATIONS

"The Effect of Driver Cataract Development on Roadway Sign Nighttime Legibility," Proceedings of the 16th Biennial Symposium on Visibility and Simulation, Iowa City, Iowa, June 2002 (with Justin Carroll, Ellis King, Gary Mancil, Rickilyn Mancil)

"Veterans with Cataracts: Visual Disability in Nighttime Driving," Proceedings of the 3rd Annual Meeting of the Rehabilitation Research and Development, Department of Veterans Affairs, Arlington, VA, February, 2002 (with Gary Mancil, Rickilyn Mancil, Ellis King and Justin Carroll)

"Veterans with Cataracts: Visual Disability in Nighttime Driving," Abstract, Optometry and Vision Science, Vol. 79S, No. 10, October 2002 (with Gary Mancil, Rickilyn Mancil, Ellis King and Justin Carroll)

"Veterans with Cataracts: Visual Disability in Nighttime Driving," Report, Rehabilitation Research and Development Service, Department of Veterans Affairs, Project Number: C2138PC, January 2001 (with Gary Mancil, L. Ellis King, Rickilyn Mancil and Justin Carroll)

"The Relationship Between Stages of Cataract Development and Driver Legibility of Roadway Signs,

Report, Vision Rehabilitation Research Laboratory, W.G. Hefner VA Medical Center, Department of Veterans Affairs, December 2000 (with Justin Carroll and L. Ellis King)

"Subjective Evaluation of Roadway Targets," Research Report, General Electric Lighting Systems, Hendersonville, NC, July 1997 (with L. E. King)

"Intersection Design/Decision Reaction Time for Older Drivers", Transportation Research Record, Transportation Research Board, National Research Council, Washington, D.C. , August 1997 (with David Naylor).

TEACHING EXPERIENCE

Undergraduate Courses: Sophomore Design
Engineering Economics
Advanced Traffic Engineering
Traffic Accident Reconstruction

Graduate Courses: Advanced Traffic Engineering
Urban Traffic Control
Traffic Signal Systems
Intelligent Transportation Systems and Incident Management

EXPERIENCE DIRECTING GRADUATE RESEARCH:

Twelve masters degree graduates
Four masters degree students currently in program

HONORS

Charter member of Tau Beta Pi and Chi Epsilon at UNCC
1988, 1989 and 1990 Outstanding Service Awards from National ASCE
ALCOA Foundation Outstanding Graduate Faculty Award 94/95 Outstanding Undergraduate Teacher in Civil Engineering Award 94/95
ALCOA Foundation Outstanding Undergraduate Faculty Award 97/98

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers 1972 - present; ASCE Student Chapter Faculty Advisor 1988-1992
Institute of Transportation Engineers 1988 - present; ASCE Student Chapter Faculty Advisor 1992- present
Transportation Research Board

Christopher Peter GRECH B.A., B.Arch., R.I.B.A.

ACADEMIC QUALIFICATIONS

- 1983 - 1985 Bachelor of Architecture with Honours -
B.Arch. (Hons).
University of Liverpool School of Architecture,
England.
- 1979 - 1982 Bachelor of Arts in Architecture with Honours -
B.A. (Hons).
University of Liverpool School of Architecture,
England.

PROFESSIONAL MEMBERSHIPS

- Member, Royal Institute of British Architects (R.I.B.A.).
Member, Architects Registration Board, U.K.

PUBLICATIONS (Books)

- 'The Multilingual Dictionary of Architecture and Building
Terms', Routledge, 1998.
Editor and co-ordinator.
- 'The Building Envelope + Connections', (Combined edition),
Butterworth Architecture, Oxford, 1996. Co-author with Dr.
A. J. Brookes.
- 'Connections: studies in building assembly', Butterworth
Architecture, Oxford, 1993.
Co-author with Dr. A. J. Brookes.
Subsequent editions: American, German, Italian, Japanese.
- 'The Building Envelope', Butterworth Architecture, Oxford,
1990. Co-author with Dr. A. J. Brookes.
Subsequent editions: German, Italian, Japanese.
- Commissioning Editor with Butterworth Architecture: NEW
TECHNOLOGY SERIES of publications.
Titles in the series include:
- 'Space Grid Structures', John Chilton, 2000. 'Masted
Structures', Harris + Li, 1996. 'Portable Architecture',
Robert Kronenburg, 1996. 'Supersheds', Chris Wilkinson,
1991. 'Intelligent Skins', Wigginton and Harris, 2002.
'Component Design', Michael Stacey, 2002.

PUBLICATIONS (Articles)

- 'Cladding and curtain walling', AJ Focus, The Architects'
Journal, October 2000, pp. 27 - 34.

RESEARCH

- Computer-Integrated Manufacture of Cladding Systems
(CIMclad). A European Commission funded research program
organised by the universities of Leeds and Loughborough.
Research and Development of Innovative Construction Uses for
Cardboard Tubes (ECOCARD).

RESEARCH GRANTS

- "New Traditions: new technology wood buildings", UNCC
Faculty Research Grant, 2001.

AWARDS

Chartered Institute of Building, U.K., Literary Awards 1999, Commendation for Reference Book. For 'The Multilingual Dictionary of Architecture and Building Terms'.
All Saints Church Bradford, RIBA Design Competition, Commendation, 1993.
AIA Citation of Excellence in International Book Publishing, 1990. For 'The Building Envelope'.
Phillips Lighting, Industrial Design Competition, First Prize, 1985.
Holt Travelling Scholarship, 1982.

TEACHING

Associate Professor, Fall 2001 - Present

College of Architecture, The University of North Carolina at Charlotte, Charlotte, North Carolina.

Courses taught: Third Year Architectural Comprehensive Studio Arch 3101; Architectural Materials Course, Arch 4312/5312; Architectural Elective, Arch 4050/6050, Building Envelopes

Adjunct Assistant Professor 1994-1997

College of Architecture + Urban Planning, The University of Michigan, Ann Arbor, USA.

Courses Taught: Construction I Course, Faculty Team Instructor; Construction II Course. Joint co-ordinator; Florence Program Director, one semester; Graduate Design Studio; Professional Year 1 Design Studio; Professional Year 2 Design Studio
Structure and Skin (509: Experimental Course)

Visiting Lecture Engagements (Construction Technology)

Oxford Brookes University, U.K., 1992 - 1994.
Columbia University, U.S.A., 1994.
ETH Zurich, Switzerland, 1993.
TU Vienna, Austria, 1993.

ACSA TECHNOLOGY CONFERENCES

ACSA Technology Conference, Dallas, 1998, Technology Paper reviewer.
ACSA International Conference, Berlin, 1997, Technology/Computer Paper reviewer.
ACSA Technology Conference, Cleveland, 1996, Session Moderator.

STUDENT ADVISING

Advice and counselling of former CAUP student leading to acceptance to a semester elective at ETH Zurich, Switzerland, 1997.
Advice and counselling of former CAUP student leading to acceptance to the Architectural Association School of Architecture, London, 1996.

OTHER

Graduate Admissions Committee, College of Architecture, University of North Carolina at Charlotte. Spring Semester 2003, Spring Semester 2002.

PRACTICE

Whitby Bird + Partners, Façade Engineering Group, 1998 - 2001

Partner of Penfold Associates, Architects, 1992 - 1994

Arup Associates, London. 1989 - 1991.

Foster & Partners, London, 1986 - 1988.

Heery Architects and Engineers, 1985.

CURRICULUM VITAE
April 2003
Edd Hauser, P.E., PhD

EDUCATION

- North Carolina State University, Transportation Engineering, PhD, 1975
- North Carolina State University, Transportation Engineering, MS, 1966
- UNC Chapel Hill, City & Regional Plng., Master of Regional Planning, 1965
- North Carolina State University Bachelor of Science, Civil Engineering, 1963

PROFESSIONAL EMPLOYMENT

- Director, Center for Transportation Policy Studies, UNC Charlotte (Academic appointments as Professor of Geography and Earth Sciences, and Professor of Civil Engineering)
- Consultant, Kimley-Horn and Associates, Raleigh, North Carolina, 1994-2000
- Assistant to the State Highway Administrator, North Carolina Department of Transportation, 1991-94
- Director, Center for Advanced Transportation Systems Research, Arizona State University, College of Engineering and Applied Sciences, 1990-91
- Associate Professor of Civil Engineering, Arizona State University, 1990-91
- Director, Institute for Transportation Research and Education, University of North Carolina at Chapel Hill, 1984-89
- Executive Director, Southeastern Consortium of University Transportation Centers, 1987-89
- Deputy Director, Institute for Transportation Research and Education, 1979-84
- Adjunct Associate Professor of Civil Engineering, North Carolina State University, 1980-89
- Senior Transportation Systems Planner, Research Triangle Institute, 1969-79
- Visiting Lecturer in Civil Engineering, Duke University, 1973-79
- Assistant Operations Officer, U.S. Army, 815th Battalion (Construction), Army Corps of Engineers, 1967-68
- Post Engineer, Lieutenant, USAR, Corps of Engineers, U.S. Army, 1966-67
- Transportation Planner, Harland Bartholomew and Associates, 1966

TEACHING

- Taught Graduate Courses in Transportation Systems Engineering at Duke University (1975-1979) and at Arizona State University (1990 – 1991)
- Preparing to teach Graduate Course in Transportation Policy in the PhD Program in Public Policy, UNC Charlotte, 2003 -

PUBLICATIONS AND RESEARCH

- "ITS Programs in the North Carolina DOT," Annual Meeting of the IVHS Consortium, Greensboro, NC, 1994
- "An Approach to Developing Integrated, Multimodal Transportation Partnerships," Transportation Research Record , 1997
- "ITS Deployment Program for Metropolitan Nashville and Downtown Parking and Traffic Guidance System," presented at the Southern Section of the Institute for Transportation Engineers, Greenville, South Carolina, April 17, 2000.

- “Application of Best Management Practices and ITS Technologies for the Ohio DOT,” presented at the ASCE (American Society of Civil Engineers) Specialty Conference on Advanced Technologies at the Volpe National Transportation Center, Cambridge, Massachusetts, August 2002.
- “Development of Regional Transportation Authorities: Case Studies in Three Regions in North Carolina,” Presented at the Regional Transportation and Economic Development Conference in Scottsdale, Arizona July 2002.
- “ITS Technologies’ Deployment,” Presented at the ASCE Specialty Conference in Cambridge, Massachusetts, August 2002.
- “Impact of Terrorism on the Travel Industry,” Presented at the Annual MISA Meeting in Charleston, SC, November 2002.

GRANTS AND CONTRACTS

- ITS Best Management Practices and Technologies for Ohio, Ohio Department of Transportation, \$49,976, October 11, 2000.
- Advanced Traveler Information Kiosks for Regional Traveler Information Systems, Touch Information, Inc., \$43,500, November 1, 2000.
- Developing and Conduct of a Training Program for Rural Planning Organizations, North Carolina Department of Transportation, \$42,400, December 2001.

OTHER RELEVANT PROFESSIONAL EXPERIENCES

Associations:

- American Road and Transportation Builders Association (President, Educator’s Division, 1989-91, Board of Directors, 1991-93)
- Council of University Transportation Centers (President, 1985-86)
- Institute of Transportation Engineers
- ITS America
- National Society of Professional Engineers
- North Carolina Public Transit Association
- Professional Engineers of North Carolina (President, Education Division, 1988-89)
- Transportation Research Board
- Transportation Research Forum
- World Council on Transportation Research

Other Specialized Training:

- Transportation and Highway Management Conference, American Association of State Highway and Transportation Officials, Coeur d’Alene, ID, 1987
- Leadership Development Institute, Human Resources Development, Inc., Winston-Salem, NC, 1989
- Leadership Institute, Arizona State University, Executive Education Program, College of Business, Tempe, AZ, 1990
- Transportation Finance, Transportation Research Board, Dallas, TX, 1997

Helene Hilger
Assistant Professor
Civil Engineering
The William States Lee College of Engineering
Ph: 704-687-4373 and email: hhilger@uncc.edu
Fax: 704-687-3115

Research Interests

Major Theme: Microbiological applications for pollution prevention and abatement
My research has involved mercury transformations in activated sludge, sludge bulking, methanotroph mediated methane oxidation in landfills, pathogens in reclaimed water, and the use of genetically modified microorganisms to track fecal coliforms in the environment and to locate methanotrophs in a soil biofilm.

Education

Ph.D., Civil Engineering, North Carolina State University (1998)
M.S., Engineering, University of North Carolina at Charlotte (1983)
B.S., Engineering, University of North Carolina at Charlotte (1980)
B.A., Biology, Rutgers, The State University – New Jersey (1970)

Professional Experience

Assistant Professor, Civil Engineering Dept. UNC-Charlotte (August 1998-present)
Lecturer, Civil Engineering Dept., UNC-Charlotte (August 1993-1997)
Lecturer, Civil Engineering Dept. and Engineering Technology Dept., UNC-Charlotte (1989-1993)
Lecturer, Civil Engineering Dept. UNC-Charlotte (1981-1985)
Design Engineer; Willis, O'Brien and Gere Engineers [now Willis Engineers] (1980-1981)
Research Assistant, Indiana University Chemistry Dept. (microbiology, tissue culture, NMR) (1973-1975)

Publications

Hilger, H.A. and M. Huber-Humer, 2002. Biotic landfill cover treatments for mitigating methane emissions, in press, *Environmental Monitoring and Assessment*, Special Edition on Innovative Technologies and Policies for Waste Management.

Martin, W., K. Woods, H. Hilger, and M. Kane, Advection of surface level ozone from Lowe's Motor Speedway, submitted to *The Journal of Air & Waste Management*.

Hilger, H.A. and M.A. Barlaz, 2001, Anaerobic decomposition of refuse in landfills and methane oxidation in landfill cover soils, Chapter 60 in *Manual of Environmental Microbiology*, 2nd Edition, pp. 541-557, (C.J. Hurst, G.R. Knudsen, M.J. McInerney, L.D. Stetzenbach, and M.V. Walter, eds), ASM Press, Washington, D.C.

Hilger, H.A., M.A. Barlaz, and A. G. Wollum, 2000. Landfill methane oxidation response to vegetation, fertilization, and liming. *Journal of Environmental Quality* 29:324-334.

Hilger, H.A., M.A. Barlaz, and S.K. Liehr, 1999. A mathematical model of multicomponent gas diffusion and biofilm gas exchange associated with methane oxidation in landfill cover soil. *Journal of Environmental Engineering*, American Society of Civil Engineers 125:1113-1123.

Hilger, H.A., M.A. Barlaz and D. F. Cranford, 2000. Exopolymer production in landfill cover soil, *Journal of Soil Biology and Biochemistry* 32:457-557.

Wu, J.S. and H.A. Hilger, 1985. Chemodynamics of mercury in wastewater treatment systems, *AIChE Symposium Series*, No. 243, Vol. 81, pp. 109-118.

Wu, J.S., H.A. Hilger, and M. McDaniel, 1985. Waste Management for Small Quantity Generators: North Carolina Survey, Technical Report, N.C. Board of Science and Technology.

Hilger, H.A. and D. Huisinigh, D., 1985. Profits of Pollution Prevention: A Compendium of North Carolina case studies in resource conservation and waste reduction, North Carolina Board of Science and Technology.

Wu, J.S. and H. A. Hilger, 1984. Evaluation of EPA's hazard ranking system. *Journal of Environmental Engineering*, American Society of Civil Engineers 110:797-807.

Funded Projects

Hilger, H.A., Modeling of methane emissions and oxidation in an experimental biocover using field and laboratory data, \$10,000, SCS Engineers, Inc. with Waste Management, Inc.

Hilger, H.A. and Steck, T. Method development to determine fecal contaminant source information for TMDL assessments, \$75,000, North Carolina Water Quality Group, North Carolina Water Resources Research Institute, 2000-2002.

Hilger, H.A., Methane oxidizer biofilms in landfill cover soil: a study of film formation and community architecture, \$75,000, National Science Foundation, 2000-2001.

Hilger, H.A. and Sobsey, M.D., An assessment of the North Carolina water reuse regulations, \$40,000, North Carolina Water Resources Research Institute, 2000-2001.

Hilger, H.A. Field study: hog farm methane emissions, \$3500, UNC-Charlotte Faculty Grant, 2000.

Hilger, H. A. Performance testing of an anaerobic digester at Duke Engineering and Services, Duke Engineering and Services, \$47,000. 1999-2000.

Hilger, H.A. Exopolymer production and methane flux correlations in landfill cover soil, \$4500, UNC-Charlotte Faculty Research Grant, 1999-2000.

Hilger, H.A. Time-dependent exopolysaccharide production in landfill cover soil simulations. UNC-Charlotte Junior Faculty Summer Grant, 1999.

Hilger, H.A. and Kane, M.S. An analysis of the interaction of regional transit planning, land use planning, and air pollution in the Charlotte Metropolitan Area, \$10,000, UNC Charlotte College of Engineering Major Grant, 1999.

Linden, K.G. and Hilger, H.A. Use of comparison of performance and operations and maintenance costs for three biological nutrient schemes at wastewater treatment plants in North Carolina, \$13,500, subcontracted through Duke University with K.G. Linden, North Carolina Water Resources Research Institute 1998-2000.

Linden, K.G. and Hilger, H.A. Optimization and performance testing of sessile trickling filter and submerged fixed bed pilot at Frito Lay packaging plant, \$30,000 NSW Corporation, 1998-99.

Papers Presented

Anaerobic Digestion of Organic Municipal Solid Waste Fractions, Carolinas Recycling Association Conference, March 14-16, 2000, Myrtle Beach, North Carolina.

Factors that Influence Methane Oxidation in Landfill Cover Soil, Third Swedish Landfill Symposia Oct 6-8 1998 at Lulea University of Technology, Lulea, Sweden

The Impact of Exopolymer on Landfill Methane Oxidation, Seventh Annual Eurowaste Symposium Oct 2-9, 1999, Sardinia, Italy.

Teaching Experience

Introduction to Environmental Engineering
Environmental Engineering Laboratory
Water and Wastewater Engineering
Process Engineering
Solid Waste Management
Dynamics
Fluids Laboratory

Professional Service and Affiliations

Advisor to the UNC-Charlotte Student Chapter of the Society of Women Engineers
Member, American Society of Civil Engineers
Member, NC AWWA-WEF
Member, International Solid Waste Association
Member, Water Environment Federation
Member, Air and Waste Management Association
Member, American Society of Engineering Education
Member, Association of Environmental Engineering and Science Professors
Member, Society of Women Engineers and faculty advisor to student chapter

CURRICULUM VITAE

April 2003

Scott P. Hippensteel

EDUCATION

Ph. D., Geology, 2000, University of Delaware, Newark, Delaware,
Dissertation: *Marsh Bioturbation and Foraminiferal Preservation:
Implications for Reconstructing Paleoenvironments and Resolving Holocene Sea-
level Records.*

M.S., Geology, 1995, University of Delaware, Newark, Delaware,
Thesis: *Foraminifera as Indicators of Overwash Deposits and Barrier
Island Sediment Supply, Folly Beach, South Carolina*

B.S. in Education, Shippensburg University, Shippensburg, Pennsylvania, 1992,
Major in Earth and Space Science Education

PROFESSIONAL EMPLOYMENT

August 2002 – Present: Assistant Professor, Department of Geography and
Earth Sciences, University of North Carolina at Charlotte

August 2000 – August 2002: Lecturer of Earth Sciences, Department of
Geography and Earth Sciences, University of North Carolina at Charlotte

January 2000 - August 2000: Visiting Lecturer of Earth Sciences, Department of
Geography and Earth Sciences, University of North Carolina at Charlotte

July 1997 - August 1999: Instructor, Department of Geology, University of Delaware

TEACHING

Graduate Courses

Geology 5000: Coastal Processes and Environments (Spring 2003)

PUBLICATIONS AND RESEARCH

Hippensteel, S.P., Martin, R.E., Nikitina, D., and Pizzuto, J.E. In press. Taphonomy and the resolution of latest Holocene sea-level and paleoclimate change. *Marine Geology*.

Martin, R.E., Hippensteel, S.P., Nikitina, D., Pizzuto, J.E. In press. Taphonomy and artificial time-averaging of marsh foraminiferal assemblages (Bombay Hook National Wildlife Refuge, Smyrna, DE): Implications for rates and magnitudes of late Holocene sea-level change. In: R.M. Leckie and H.C. Olson (Eds.), *Paleobiological, Geochemical, and Other Proxies of Sea Level Change*. SEPM Special Publication, Tulsa.

Hippensteel, S.P., Martin, R.E., Nikitina, D., and Pizzuto, J.E. 2002. Interannual variation of marsh foraminiferal assemblages (Bombay Hook National Wildlife Refuge, Smyrna, DE): Do foraminiferal assemblages have a memory? *Journal of Foraminiferal Research*, v. 32, n. 2, p. 96 - 108.

Martin, R.E., Hippensteel, S.P., Nikitina, D., Pizzuto, J.E. 2002. Artificial time-averaging of marsh foraminiferal assemblages: Linking the temporal scales of ecology and paleoecology. *Paleobiology*, v. 28, n. 2, p. 263 – 277.

Hippensteel, S. P. and Martin, R. E. 2000. Foraminifera as indicators of storm deposition: Implications for barrier island sediment supply and evolution. In Martin, R. E. (Ed.), *Environmental Micropaleontology*. Kluwer Press, p. 351 - 369.

Hippensteel, S. P., Martin, R. E., Nikitina, D., and Pizzuto, J. E., 2000. The formation of Holocene marsh foraminiferal assemblages, Middle Atlantic Coast, U.S.A.: Implications for Holocene sea-level change. *Journal of Foraminiferal Research*, v. 30, n. 4, p. 272 - 293.

Hippensteel, S. P. and Martin, R. E. 1999. Foraminifera as an indicator of overwash deposits, barrier island sediment supply, and barrier island evolution, Folly Island, South Carolina. *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 149, p. 115 - 125.

Grants and Contracts

2003 Grant from UNC-Charlotte Faculty Grants Program for General Education for development of LBST 2213: Science, Technology and Society, with Andy Bobyarchick and David Griffing (\$2,000)

2003 Contract with the Warren Lasch Conservation Center for Phase "A": Foraminiferal analysis of sediments from the Confederate submarine *H.L. Hunley* (Phase "A" contract for \$325; Phase "B" and "C" for approximately \$3,000)

OTHER RELEVANT PROFESSIONAL EXPERIENCES

Field Work Experience

July 1997 - January 2000: Foraminiferal sampling and lithologic analysis, Bombay Hook National Wildlife Refuge, Smyrna, Delaware (supported by NSF proposal entitled "Taphonomy of Marsh Foraminiferal Assemblages: Implications for Rates and Mechanisms of Holocene Sea-level Rise")

March 1997 - Present: Tracer study, Folly Island, South Carolina. Investigation of bioturbation and sedimentation rates in marsh subenvironments (1997 Joseph A. Cushman Award for Student Research)

VITA

GERALD LYNN INGALLS
Director, Ph.D. in Public Policy
Professor of Geography

I. CURRENT ADDRESS/PERSONAL INFORMATION

Office Address:

Department of Geography and Earth Sciences
University of North Carolina at Charlotte
Charlotte, N.C. 28223

Phone: 704-687-4260
Email: gingalls@email.uncc.edu

II. EDUCATION

	DATE	INSTITUTION
Ph.D.-Geography	1973	Michigan State University
M.A.-Latin American Studies/Geography	1970	University of Florida
B.A.-History--Latin America Concentration	1968	University of Southwestern Louisiana

III. PROFESSIONAL EXPERIENCE

A. Service at Academic Institutions

<u>Institution</u>	<u>Appointment</u>	<u>Years Served</u>
Michigan State University	Instructor	1
Lansing Community College	Instructor	1
UNCC, Date/Level Present Appt.	Professor, August 1988	15
UNCC< Date/Level Initial Appt.	Assistant, August 1973	15
	<i>Total Teaching Experience</i>	32

E. Thesis/Internship Advisor

Chair of 11 thesis committees,

IV. PUBLICATIONS AND RESEARCH

A. Refereed Publications (*Chapters in Books or Articles in Refereed Journals; Chapters or articles in books indicated by year underlined.*) More than 50 refereed journal articles or chapters in books
Articles and book chapters, 1997 to present:

- 2003 "A Visual Resources Inventory Methodology for Small Town and Rural Preservation," in The New Countryside: Critical Questions for the Future of Rural Regions and Communities, Beesley, K. and Millward, H., eds., Wilfrid Laurier University Press, With: Tyrel Moore
- 2001 "Old But New: An Inventory of Textile Mill Reuse in the Charlotte Urban Region." Southeastern Geographer, in May 2001 issue.
- 2000 "Urbanization in North Carolina," in *The North Carolina Atlas: Portrait for a New Century*. Chapel Hill: University of North Carolina Press.
- 1999 "The Future of Racial Gerrymandering: Evidence From North Carolina's 12th Congressional District," invited chapter in Representation, Community and Redistricting in the 1990's: A Geographical Perspective, Shelley, Leib and Webster, eds., Syracuse University Press.
- 1998 "The Limited Vote Alternative To Affirmative Districting," Political Geography, Volume 17, Number 6, 701-728. With Ted Arrington.
- 1997 "Fifty Years of Political Change in the South: Electing African Americans and Women to Public Office." Southeastern Geographer, Volume XXXVII, Number 2. With Leib and Webster
- 1997 "Money Politics in the 'Year of the Woman': US Senate Campaign Financing in Comparative Political Contexts. Part 1. Comparative State Politics, Volume 18, Number 5,. With Jan Kodras and Stan Brunn.
- 1997 "Money Politics in The 'Year of the Woman': US Senate Campaign Financing in Comparative Political Contexts. Part 2. Comparative State Politics, Volume 18, Number 6. With Jan Kodras and Stan Brunn.

D. Papers at Professional Meetings, 1997-present: (*Denotes with published abstract)

- 2002 "Fragmentation, Incorporation and Annexation and Its Impact on Service Delivery: The Case of Charlotte, NC," at the Annual Meetings of the Urban Affairs Association in Boston, MA, March 2002. With Gary Rassel
- 2001 *"Fragmentation, Incorporation and Annexation in a High Growth Automobile-Era City: The Case of Charlotte, North Carolina," presented at the Southeast Conference of Public Administration, Baton Rouge, LA. With Gary R. Rassel.
- 2000 *"Old, But New: An Inventory of Textile Mill Reuse in the Charlotte Urban Region," presented at the Annual Meetings of the Southeastern Division of the Association of American Geographers, Chapel Hill, NC. With Tyrel Moore
- 2000 *"Rural Heritage, Place and Identify Dynamics in Small Towns," presented at the Annual Meeting of the Association of American Geographers, Pittsburgh. With Tyrel Moore.
- 2000 *"Preserving Rural Heritage: Adaptive Reuse of Textile Mills in the Charlotte, North Carolina Urban Region," presented at the Annual Meeting of the Association of American Geographers, Pittsburgh. With Tyrel Moore.
- 1999 "Industrialization, Urbanization and the Social Political Elite in North Carolina," presented at the 1999 meetings of the Eastern Historical Geographers Association, Richmond, VA, September, 1999.
- 1999 "A Visual Resource Inventory and Methodology for Small Town, and Rural Preservation." Presented at the Renal Geography Symposium, Nova Scotia, July 1999.
- 1998 "Developing A Typology of Post-Bellum, African-American Neighborhoods In The American South," at SEDAAG, Memphis. Co-author: Heard

E. Grants and Contracts

Research:

- 2003 Charlotte DOT, Phases 1 and 2. MUMPO Land Use Data Collection and Projections. Paul Smith PI; G Ingalls and V. Bowman, Co Pis, \$50,000
Charlotte DOT, Phase 3 MUMPO Land Use Data Collection and Projections. Paul Smith PI; G Ingalls, Co PI, \$200,000

Educational Funding:

Since 1997 have worked to secure off-campus or non-state funded financing for graduate assistantships.

Entire amount went to student Research Assistantships.

2002	\$35,000	1999	\$79,500
2001	\$48,555	1998	\$60,000
2000	\$184,000	1997	\$55,475

V. PROFESSIONAL AFFILIATIONS

Current Membership:

- Association of Public Policy and Management (APPAM)
- Association of American Geographers (AAG)
- Southeastern Division of Association of American Geographers (SEDAAG)
- North Carolina Geographical Society (NCGS)
- Political Geography Special Interest Group of Association of American Geographers
- Middle East Institute
- International Studies Association-South
- Phi Beta Delta, National Honor Society for International Scholars
- North Carolina Data Network. Academics/consultants engaged in election analysis

HILARY I. INYANG, PH.D.

Duke Energy Endowed Distinguished Professor of Environmental Engineering and Science (1/2001-Present), Professor of Earth Sciences (1/2001-Present), and Director, Global Institute for Energy and Environmental Systems (GIEES) (1/2001), University of North Carolina, Charlotte, NC.

Education

Ph.D., Civil and Construction Engineering, Iowa State University, Ames, Iowa (1989)

M.S., Civil and Environmental Engineering, North Dakota State University, Fargo, North Dakota (1986)

B.S., Civil and Environmental Engineering, North Dakota State University, Fargo, North Dakota (1985)

(Also studied at Oklahoma State University, Stillwater, Oklahoma (1983)

B.Sc., Geology (Hons), University of Calabar, Calabar, Nigeria (1981)

Other Related Experiences (Just a few).

Reviews for Other Peer-reviewed and Refereed Publications

Reviewer, Indian Journal of Pure and Applied Physics (June, 2001).

Reviewer, Water Research (Journal of the International Water Association) (December, 2001)

Reviewer, Environmental Engineering Science (July, 2000).

Reviewer, Geotechnical Testing Journal, ASTM (January, 2000).

Reviewer, Human and Ecological Risk Assessment: an International Journal (June, 2000).

Book Reviewer, "Fluid Transport in Porous Media;" Prieur de Plessis (Ed), published by Computational Mechanics Publications, United Kingdom, 1997, ISBN 185312429X; reviewed for Environmental Monitoring and Assessment (international journal) (January, 1999).

Academic and Professional Publications

Books

Textbook

1. Geoenvironmental Engineering: principles and applications, by Lakshmi N. Reddi and Hilary I. Inyang, Marcell Dekker Publishing Co., New York, ISBN 0-8247-0045-7 (April, 2000), 494 pages.

Edited Books and Conference Proceedings (Just a few).

1. Utilization of Waste Materials in Civil Engineering Construction by Hilary I. Inyang and Kenneth Bergesson, American Society of Civil Engineers Press, New York, ISBN 0-87262-907-4 (1992), 347 pages.

2. Remediation in Rock Masses, by Hilary I. Inyang and Clifford J. Bruell, American Society of Civil Engineers, New York, ISBN 0-7844-0015-6 (2000), 250 pages.

3. Bioremediation of Contaminated Soils, by Donald L. Wise, Debra J. Trantolo, Edward J. Cichon, Hilary I. Inyang, and Ulrich Stottmeister. Marcell Dekker Publishing Company, New York, ISBN 0-8247-0333-2 (2000), 903 pages.

4. Proceedings of the 5th International Symposium on Environmental Geotechnology and Global Sustainable Development, Belo Horizonte, Brazil, by Cassia de Brito Galvao and Hilary I. Inyang, (in CD-ROM) (2000).

5. Proceedings of the 4th International Symposium on Environmental Geotechnology and Global Sustainable Development, Boston, Massachusetts, (2 volumes) by Hilary I. Inyang

and Vincent O. Ogunro (2000), 1614 pages.

Refereed Journals and Peer-Reviewed Proceedings (10 out of more than 50 in the last 5 years)

1. Inyang, H.I., Ogunro, V.O. and Hooper, F. 2002. Simplified calculation of maximum allowable contaminant concentration in waste-amended construction materials. *Resource Conservation and Recycling* (special edition; accepted)
2. Inyang, H.I., Poland, F.G. and De Brito Galvao T.G. 2002. An appraisal of the environmental aspects of natural hazards. *ASCE Natural Hazards Review* (special edition; accepted)
3. Inyang, H.I., Fischer, G.F. and Mbamalu, G.E. 2002. A quantitative methodology for indexing environmental sensitivity and pollution potential. *Environmental Monitoring and Assessment* (special edition; submitted)
4. Inyang, H.I. and Bae, S. 2002. Aqueous PEO loss from desiccating sodium montmorillonite: implications in dust control during mining operations. *Proceedings of the International Symposium and Exhibition on Environmental Issues and Waste Management In Mineral and Energy Production*, Gagliari, Italy (abstract submitted).
5. Daniels, J. L., Inyang, H.I. and Chien, C.C. 2002, Verification of heavy metal sorption in soil-bentonite using SEM/EDXS. *Journal of Environmental Engineering, ASCE* (special edition ; accepted)
6. Daniels, J. L., Inyang, H.I. and Brochu, M. 2002. Aggregation potential and specific surface area of barrier mixtures at various outgas temperatures. *Journal of Environmental Engineering, ASCE* (special edition; accepted)
7. Galvao, T.C., Daniels, J.L. and Inyang, H.I. 2002. Contaminated site characterization and Monitoring. *United Nations Encyclopedia of Life Support Systems, Section 6.38 on Environmental Monitoring* (accepted).
8. Bae, S., Inyang, H.I., Li, K.P., Barry, E., Ryan, D., Kurup, P. and Iskandar, A.. 2002. Soil mineral stabilization using aqueous sodium carboxymethyl cellulose for dust control. *ASCE Journal of Geotechnical and Geoenvironmental Engineering* (submitted).
9. Daniels, J.L., Inyang, H.I. and Ogunro, V.O. 2002. A methodology for fractionation of contaminant volumes to barrier slices. *Proceedings of the 6th International Symposium on Environmental Geotechnology and Global Sustainable Development*, Seoul, Korea, (submitted).
10. Daniels, J.L., Inyang, H.I. 2002. Durability of Boston Blue Clay in waste containment applications. *ASCE Journal of Materials in Civil Engineering* (accepted).

Contributions to Academic, National and International Professional Organizations and Activities (10 out of more than 40)

- Member, International Evaluation Panel convened by the Government of Switzerland for the Swiss Federal Institute for Snow and Avalanche Research (SLF), Research Department on Natural Hazards, Davos, Switzerland (November 11-14, 2001)
- Member, Scientific Advisory Board, 17th Annual International conference on Contaminated Soils, Sediments of Water, Amherst, MA (October 22-25, 2001).
- Member, College Board Development Committee for AP Environmental Science, Educational Testing Service, Princeton, NJ (July 2001-Present)
- Interim President, Global Alliance for Disaster Reduction (an epistemic community of more than 1000 organizations and experts) (2001-present)
- Co-Chair, 7th International Symposium on Environmental Issues in Mining and

- Energy Production, Cagliari, Sardinia, Italy (October 7-12, 2002).
- Co-Chair, International Symposium on Application of Natural Materials for Environmental Geotechnology, sponsored by Committee III of the Japanese Society for the Promotion of Science, Tokyo, Japan (October 29-November 2, 2001).
- General Chair, World Congress on Disaster Reduction, organized by an Alliance of 1,000 organizations led by the American Society of Civil Engineers, Washington, D.C. (2001/2002).
- Scientific Advisory Board Member, First International Congress on Petroleum Contaminated Soils, Sediments and Water, London, United Kingdom (August, 2001).
- Steering Committee Member, Marine Environmental Forum, Center for Marine Science and Technology, New Bedford, MA (March 1, 2000).
- Scientific Advisory Board Member, Tenth Annual West Coast Conference on Contaminated Soils and Water, San Diego, California (March 20-23, 2000).

Some Recent Consulting Activities/Technical Aid

"City of Lowell Acre Revitalization Project," for the Coalition for A Better Acre (CBA), Lowell, Massachusetts (July-December, 2000).

"Contaminated Site Assessment for the Planned Facilities of the Lowell Regional Transit Authority (LRTA)" for LRTA, Lowell, Massachusetts, (June, 2000).

Contributions to Civic, Non-Profit and Volunteer Activities (Just a few).

- Contributor, Charlotte Community Science Forum activities, led by Sigma Xi Society, Discovery Place, Charlotte, NC (January 2002-present).
- Invited Public Lecturer on "Professional Growth in a Diverse and Rapidly Evolving Global Arena" to Graduate Students and Associates of Carnegie-Mellon University and University of Pittsburg, Pittsburg, PA (January 28, 2002)
- Invited Lecturer on "Sampling at Brownfield Sites" at the Forum on Environmental J.O.B.S. in Lowell, Lowell, Massachusetts (February 4, 2000).
- Speaker to the New England Consortium on Hazardous Waste Worker Health and Safety on risks associated with chemicals in the environment, (December 8, 1998).
- Board of Governors Member, Sustainable Development in Africa Network (SUDAN), Uyo, Nigeria, (1998-Present).

Research (Just a few)

Grants and Contracts (more than \$4 million total support in 10 academic years)

Collaborative strategic research and allied activities on energy and the environment; Agency: Duke Energy Corporation; Role: Principal Investigator.

Modeling of contaminant leaching from wastes in the vadose zone; Agency: Committee on Federated Centers and Institutes (CFCI), University of Massachusetts, Lowell, MA; Role: Principal Investigator.

Sorption-desorption cycling and potential contaminant spreading in the Arctic permafrost due to temperature changes; Agency: National Oceanic and Atmospheric Administration; (2000-2001); Role: Principal Investigator.

Scaling of barrier textural effects on source terms for contaminant transport modeling; Agency: U.S. Army Cold Regions Research and Engineering Laboratory; (1997-2000); Role: Principal Investigator.

DR. RAJARAM JANARDHANAM
Professor of Civil Engineering
University of North Carolina at Charlotte
Charlotte, NC 28223-0001 USA

Education:

2003

- PH.D. Civil Engineering, Department of Civil Engineering, Virginia Polytechnic Institute & State University, Blacksburg, USA, 1981
- M.S. Civil Engineering (with distinction), Department of Civil Engineering, Annamalai University, India, 1968
- B.S. Civil Engineering (with honors), Department of Civil Engineering, Annamalai University, India, 1964

Professional Societies - Affiliation:

American Society of Civil Engineers (ASCE)
American Standard Testing Materials (ASTM)
American Society of Engineering Education (ASEE)
Earthquake Engineering Research Institute (EERI)

Teaching Excellence Recognition:

1986 - ASCE - UNCC Student Chapter Outstanding Professor Award
1988 - Tau Beta Pi - UNCC Student Chapter Outstanding Professor Award
1989 - USF - ASCE Class of 1989 Outstanding Professor Award
1990 - USF - University Undergraduate Teaching Enhancement Award
1990 - USF - University Outstanding Undergraduate Teaching Award
1991 - Tau Beta Pi - UNCC Student Chapter Outstanding Professor Award
1991 - Bank of America - UNCC University Teaching Excellence Award
1992 - UNCC - ALCOA Foundation Outstanding Faculty Award (UG)
1994 - Tau Beta Pi - UNCC Student Chapter Outstanding Professor Award
1996 - Tau Beta Pi - UNCC Student Chapter Outstanding Professor Award
1998 - UNCC-ALCOA Foundation Outstanding Faculty Award (G)
1998 - Tau Beta Pi - UNCC Student Chapter Outstanding Professor Award
1998- Bonnie E. Cone Distinguished Professor in Teaching (Finalist)

Academic Honors:

- Secured Honors in B.S. Degree Program in Civil Engineering, 1964.
 - Secured first class with distinctions in M.S. Degree in Civil Engineering, 1968.
 - Inducted into Sigma Xi in 1979 at Virginia Tech (National Honor Society).
 - Inducted into Phi Kappa Phi in 1993 at UNCC (National Honor Society).
- Inducted into Chi Epsilon in 1996 at UNCC (National Civil Engineering Honor Society).

Professional Experience:

July 1993 to Present Professor of Civil Engineering

University of North Carolina at Charlotte

July 1984 to June 1993

Associate Professor of Civil Engineering
University of North Carolina at Charlotte

August 1981 to June 1984

Assistant Professor of Civil Engineering
University of North Carolina at Charlotte

August 1980 to May 1981

Lecturer in Urban and Environmental Engineering
University of North Carolina at Charlotte

FUNDED RESEARCH PROJECTS (As Principal Investigator)

Engineering outreach for Science and math Teachers – 1998-99. Eisenhower Foundation Grant - \$29,400. (Co-PI).

A “Learning Center Approach” for Instruction Assessment- FIPSE Grant, \$169, 575 (1999-2003) (Co-Investigator).

PUBLICATIONS AND PRESENTATIONS

"Strength and Deformation Characteristics of Chemically Stabilized Soils" – Paper accepted for presentation and publication, TRB, Jan., 1998. (with Alagiya)

"Behavioral Response of Partially Buried Polyurethane Tank" – paper accepted for publication at the 13th International Conference of ISPE, Dec. 1997, Columbia, SA (with Y. Hari)

"Finite Element Analysis of Polyurethane Tank," Proceedings of the 13th International Conference on CAD/CAM at Periera, Columbia, December 1997.

"Structural Analysis of (HDPE) Polyethylene Pipe Culvert" – Proceedings of the 14th CARS & FOF 1998, Dec. 1998. (with Malmurugan)

" Finite Element Analysis of HDPE Corrugated Pipe Culver"; Proceedings of the 15th CARS and FOF, Jan. 1999, India. (with Malmurugan)

"Finite Element Analysis of Industrial Steel Stack (Chimney)", Proceedings of the 16th CARS and FOF, June 2000, Trinidad. (with Kaushik Patel)

"Design of an Automated Pallet Dispenser"- FEM Approach; Proceedings of the 17th CARS and FOF, July 2001, Durbin, South Africa. (with Leonard Tollene)

"Pollution generation, migration and mitigation"- Keynote address at the 2nd National Conference on "Pollution Abatement", Annamalai University, July 12, 2002, India.

"Finite Element Analysis of a Bolted Plate Assembly"- the 19th CARS and FOF, July 2003, Kulalumpur, Malayasia. (with Rajesh Patel)

MARTIN R. KANE, Ph.D., P.E.
270 Smith Building
Department of Civil Engineering
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223

EDUCATION:

Michigan State University, Ph.D. Civil Engineering-Transportation, July 1995

- Thesis Title: “The Utility of Useful Field of View Testing and Driver Performance Measurement in Predicting Driver Safety.”

Michigan State University, M.S. Civil Engineering-Transportation, December 1991.

Michigan State University, B.S. Civil Engineering, August 1990.

PRESENTATIONS, PUBLICATIONS AND RESEARCH:

Presentations:

- Work Based Travel Patterns Using GIS, University City Area Committee (Charlotte Chamber of Commerce sub-committee), University Hospital, March 2000
- Rollover Crash Propensity of SUV’s Television Interview, April 2000 (Channel 9)
- Relationships Between Driver Performance and Stated Self-Testing Driver Behavior, presented at the Transportation Research Board sponsored symposium on Night Visibility and Driver Behavior, University of Iowa, April 1996.

Publications:

- Motorist’s Perception of Work Zone Safety, FHWA/NC/99-006, North Carolina Department of Transportation, with L. Ellis King, Kimberly Buch, & Matthew Carpenter, July 1999
- A Predictive Method Concerning Transit Ridership and the Air-Quality Impacts Related to the Development of the Expanded Charlotte Transit System, (pending), Transportation Research Board, National Academy of Sciences, Washington, D.C., with Helene A. Hilger & Walter Martin, July 2000
- Improved Traffic Control Device Design and Placement to Aid the Older Driver, with Richard W. Lyles, Fred Vanosdall, and Francis X. McKelvey, National Cooperative Highway Research Program Project 3-44 Final Report, Transportation Research Board, National Research Council, December, 1997
- The Utility of Useful Field of View Testing and Driver Performance Measurement in Predicting Driver Safety, Michigan State University, July 1995.

Research:

Grants Received:

- Faculty Summer Research Grant, Tele-Traffic Modeling, with Dr. Teresa Dahlberg, Electrical and Computer Engineering, \$8,000.00 1999-2000

- College of Engineering Major Grant, Air-Quality Impacts of the Proposed Charlotte Transit System Expansion, with Dr. Helene A. Hilger & Dr. Walter Martin (Geography), \$9,300.00 1998–1999.
- City of Concord & Cabarrus-South Rowan Metropolitan Planning Organization, Traffic Studies, \$25,500.00 1998-2000
- Motorists Perception of Work Zone Safety, North Carolina Department of Transportation, with Ellis King, \$99,700.00, funded for period July 1, 1997 to June 30, 1998.

TEACHING EXPERIENCE:

University of North Carolina at Charlotte

Courses taught:

CEGR 3152 (Transportation Lab); CEGR 3161 (Transportation Engineering I); CEGR 4262 (Traffic Engineering); CEGR 4184 (Highway Safety); CEGR 3201 (Systems and Design I); CEGR4090/5090 co-listed in GEOGRAPHY as GEOG4040/5040 (Transportation Modeling Practicum); CEGR4171/5171 (Urban Public Transportation); ENGR1202 (Introduction to Engineering Practices and Principles II); Design Studio (with Architecture) Summer Program, Santander, Spain.

Professional Service:

Chair, Student Activities 1999 ASCE National Conference, Charlotte, North Carolina (UNC-Charlotte was host university)

Education Committee Chair, North Carolina Institute of Transportation Engineers (NCSITE) 1999-2001

Local Coordinator/Proctor, Fundamentals of Engineering Exam, 1998-present

Student Chapter/Student Paper Review Panel, Institute of Transportation Engineers (International), 1996-present.

Graduate Students:

Ashish Goswami (1997) Thesis Title: STUDY OF THE EFFICIENCY OF THE MEDIC STATIONS IN MECKLENBURG COUNTY

Louis Raymond (1999) Thesis Title: TRAFFIC IMPACTS OF USING A CELLULAR PHONE AS A TRAVELER INFORMATION SYSTEM IN THE CHARLOTTE AREA

Current Students: Hari Kondamuru, Trisha Henry, Ranjitha Manchukonda

PROFESSIONAL AFFILIATIONS:

Licensed Professional Engineering, North Carolina, 1999-present

Institute of Transportation Engineers 1990-Present

American Society of Civil Engineers (ASCE), 1989-Present

Transportation Research Board, 1992-Present

American Society for Engineering Education, 1997-present

Chi Epsilon, 1994-Present

Eno Fellow, Eno Transportation Foundation, Inc., 1994

Toastmasters International, 1990-Present

Curriculum Vitae

Gaines H. Liner

Associate Professor of Economics

EDUCATION

Ph.D. Clemson University

Ag. Economics, 1971

Dissertation Title: Economic Analysis of Water Supply Alternatives in a Multi-County Industrial Area

M.S. Clemson University

Ag. Economics, 1968

B.S. North Carolina State University, 1965

Ag. Engineering

EMPLOYMENT

The University of North Carolina at Charlotte, 1971-present,

Federal Energy Administration (on leave of from UNCC), 1976-77.

Peer Referred Journal Articles (1990- 2003)

Liner, Gaines H., and Rob Roy McGregor, "Optimal Annexation," *Applied Economics*, vol. 34, 2002, pp. 1477-1485.

Liner, Gaines H., "Core Journals in Economics," *Economic Inquiry*, Vol. 40 (1), Jan. 2002, pp. 138-145.

Liner, Gaines H., "Core Authors and Rankings in Economics," *Atlantic Economic Journal*, Vol. 29 (4), Dec. 2001, pp. 459-468.

Liner, Gaines H., and Rob Roy McGregor, "Institutions and the Market for Annexable Land." *Growth and Change*, Vol. 27, Winter, 1996, pp. 55-74.

Liner, Gaines H., "Risk of Accidents and the Policy of Forced Retirement," *Contemporary Economic Policy*, Vol. XIII, July 1995, pp. 64-76.

Liner, Gaines H., "Is The Age 60 Rule Relevant?" *Applied Economics*, Vol. 26, November 1994, pp. 1055-1060.

Liner Gaines H., "Institutional Constraints, Annexation, and Municipal Efficiency in the 1960s," *Public Choice*, Vol. 79, July 1994, pp. 305-323.

Liner Gaines H., "Institutional Constraints and Annexation Activity in the 1970s," *Urban Studies*, vol. 30, no. 8, 1993, pp. 1371-1380.

Liner, Gaines H., "Annexation Impact on Municipal Efficiency," *The Review of Regional Studies*, Vol 22, No. 1, 1992, pp. 75-87.

Liner, Gaines H., "Annexation Rates and Institutional Constraints," *Growth and Change*, Vol. 21, No. 4, 1990, pp. 80-94.

Papers Presented (1995-2003)

“The United States Economy,” presented to university invitees in International Economics Department, Nankai University, Tianjin, China, May 2002.

“Optimal Municipal Annexation,” presented at the annual meeting of the Southern Regional Science Association, Austin, Texas, April 2001.

"Core Journals and Authors in Economics," presented at the International Atlantic Economic Society meeting, Montreal, October 1999.

"Municipalities, Economic Growth, and Convergence," presented at the Western Economic Association International meeting, San Diego, July 1999.

"Municipalities, Economic Growth, and Convergence," presented at the annual meeting of the Southern Regional Science Association, Savannah, Ga., April 1998.

"Economic Growth Among a Cross-Section of Municipalities," presented at the annual meeting of the 43RD International Atlantic Economic Conference, London, England, March 1997.

"Pilot Age as a Determinant of Accident Involvement," presented at the annual meeting of the Western Economic Association International, San Diego, July 1995.

Courses Taught

1. ECON 2101 Principles of Economics-Macro
2. Econ 2102 Principles of Economics-Micro
3. ECON 303 Economic Concepts
4. ECON 370 Monetary and Fiscal Policy
5. ECON 390 Topics in Energy Economics
6. ECON 390 Topics in Environmental Economics
7. ECON 3090 Topics in Natural Resource Economics
8. ECON 3112 Econometrics
9. ECON 3122 Microeconomics
10. ECON 3123 Macroeconomics
11. ECON 3125 Economics of the Firm
12. ECON 4100 Mathematical Economics
13. ECON 4112 Econometrics II
14. ECON 5090 Topics in Graduate Mathematical Economics
15. MBAD 6112 The Economics of Business Decisions
16. Econ 3895 Directed Study on Mathematical Economics
17. Econ 6800 Directed Study in Graduate Mathematical Economics

Grants (1986-2003)

Johnson Award for teaching, Research, and Development, “Student Manual for Econometric Diagnostic Techniques,” with Rick Zuber, for summer 2002, \$5,000.00.

2000, Curriculum and Instruction Development Grant, "Quantitative Toolkit for Business Students," \$2,850.00.

1990, College, Summer Research Grant, with Rick Zuber, "An Economic Analysis of the Determinants of SAT Scores," \$3,150.

1989, Curriculum and Instructional Development Grant, with Rick Zuber, "A Computer Toolkit for Economics Students," \$6,750.

1988, University Faculty Research Grant, "Fiscal Impact of Reduced Federal Aid to Cities," \$3,200.

1986, College, Summer Research grant, "Fiscal Impacts of Reduced Aid to Cities," \$2,000.

CURRICULUM VITA

April 2003

Walter Martin

Education

Ph.D. 1984, University of Tennessee, Knoxville, Tennessee. Dissertation Title: Agricultural Commercialism in the Nashville Basin, 1850–1860
M.A. 1973, East Carolina University, Greenville, North Carolina. Thesis Title: Perception of Storm Hazard Along the Outer Banks of North Carolina
B.S. 1970, East Carolina University, Greenville, North Carolina. Major: Geography; Minor: Earth Science

PROFESSIONAL EMPLOYMENT

Lecturer, Assistant, and Associate Professor, University of North Carolina, 1979-2003
Recent Expert Opinion Statements, Depositions, and Consulting in Applied Climatology:
City of Concord (Concord, NC): 1 case, 2001-2002; Warren and Kallianos (Charlotte, NC): 1 case, 2001; Hefferon and Hefferon (Charlotte, NC): 1 case, 2000; Paramount Parks (Charlotte, NC): 1 case, 1998; McNeely, Hefferon and Hefferon (Charlotte, NC): 3 cases, 1996-1998; Airline Pilots Association (Charlotte, NC): 1 case, 1993; Trigon Engineering (Charlotte, NC): 1 case, 2000; and Aquila Energy, Kansas City, Missouri, Weather related risk derivatives trading, 1998.

TEACHING

Graduate committees (recent)

Jamie Arnold, M.A., Thesis: A Prognostic Analysis of Cloud to Ground Lightning Intensity in the Carolina Piedmont, 1995-1999, Thesis Advisor, 2001.
Nellie Elguindi, M.A., Geography, Thesis Advisor, Thesis: Assessing the Contribution of Air Pollutants to Asthma Emergency Department Visits: A Case Study of Charlotte, NC, May, 1997.
Shannon Gregory, M.A. Geography, Thesis Advisor, Thesis: A Guide to Products Available from the NEXRAD WSR-88D Radar System, May 1997.
Kevin Woods, M.S, Civil Engineering, Thesis: The Impact of Motorsports Events at Lowes Motor Speedway on Mesoscale Ozone Levels, Thesis Committee Member, 2001.
Steve Prager, M.A., Geography, Thesis: Land-cover Conversion as Measurement of Anthropogenic Impact: A Study Using Landsat MSS Data for Temporal Analysis to Assess Impact in the Metrolina Region from 1973 to 1989, August 1995.
Xin Lu, M.A., Geography, Thesis: A GIS Based Emergency Management System for Extremely Hazardous Chemical Pathway Analysis, July 1995.
Andrew Reser, M.A., Geography, Thesis: Making the Air Quality Connection: the Viability of Transit as a Solution, December 1994.

Graduate Courses

Applied Climatology (ESCI 5150)
Pollution Climatology (ESCI 5000)
Urban Air Quality (ESCI 5000)
Topics in Environmental Science: Air Quality (GEOG 6020)

PUBLICATIONS AND RESEARCH

Articles

- Martin, Walter. (2000) "Air Quality in North Carolina," in Atlas of North Carolina, edited by James Clay and Al Stuart. University of North Carolina Press, Chapel Hill, NC.
- Martin, Walter. An Assessment of Surface-Level Ozone in the Southeast, 1981 - 1993, *Southeastern Geographer* (May 1998), pp 41-57.
- Martin, Walter and others. (1995) "Air Quality and Economic Growth in American Cities 1981-1991" *Transportation Research Record*, 1444 (October) pp 99-108.
- Martin, Walter. (1991) "Identifying Surface Ozone Trends: A Case Study of Charlotte, North Carolina," *Southeastern Geographer* 31 (2) pp 90-102; and published as an abstract in *Geo Abstracts*.
- Martin, Walter. (1991) "Meteorological Conditions Associated with Ozone Pollution During 1988 in Charlotte, North Carolina," in *Air Pollution: Environmental Issues and Health Effects* edited by S. K. Majumdar; E. Willard Miller; and J. J. Cahir. Pennsylvania Academy of Science, Easton, PA 18042
- Martin, Walter. (1993) "Storm Hazard Zones Along the Outer Banks of North Carolina: Cultural and Physical Perspectives," *North Carolina Geographer* 2 (Summer) pp 1-11.
- Martin, Walter. (1991) "Identifying Surface Ozone Trends: A Case Study of Charlotte, North Carolina," *Southeastern Geographer* 31 (2) pp 90-102; and published as an abstract in *Geo Abstracts*.

Grants and Contracts (recent)

- Assessment of Weather Related Power Outages 1995-2003; Duke Energy, 2003.
- Prognostic Indicators of High Lightning Density Events in the Carolina Piedmont, 1995-2000; Duke Energy, \$10,000 (including the cost of data purchased by Duke).
- Helene Hilger, Marty Kane, and Walter Martin. Air Quality Improvements from Proposed Transit in Mecklenburg County, College of Engineering, UNC Charlotte, January, 1999, \$10,500.
- Martin, Walter. UNC Charlotte Faculty Research Grant: Assessment of Urban Ozone Levels Using the 8-hour Standard, 1998, \$4,000
- Martin, Walter and Nellie Elguindi. Spectral Analysis of Air Quality and Asthma Episodes in Charlotte, NC, Carolinas Medical Hospital Authority, Medical Research, for Nellie Elguindi, Spring 1996.
- Martin, Walter. Attaining the Ozone Standard: Identifying Trends in Urban Ozone Concentrations 1981-1993. Center for Transportation and the Environment, Raleigh, N.C. August 1994, \$47,770.

OTHER PROFESSIONAL EXPERIENCES

- Anova and regression methods using JMP software, SAS Institute, Atlanta, Georgia, November 17, 1998.
- University of Michigan, Graduate School of Epidemiology, Environmental Epidemiology and Risk Assessment, Ann Arbor, Michigan, July 1996.
- Short Course: Topics in Advanced Risk Assessment, Environmental Education Enterprises, Charlotte, NC, November 1995.

CURRICULUM VITAE
APRIL 2003
DARLA MUNROE

EDUCATION

2000	Ph.D.	Economic Geography and Regional Science	University of Illinois
1995	M.A.	Applied Economics	University of Michigan
1993	B.A.	Economics and International Affairs	University of Colorado

RELEVANT EXPERIENCE

2002-	Assistant Professor, Department of Geography and Earth Sciences, University of North Carolina at Charlotte.
2000-2002	Postdoctoral Research Associate in Geographic Information Systems (GIS) and Spatial Econometrics at the Center for the Study of Institutions, Population, and Environmental Change (CIPEC) at Indiana University, Bloomington, Indiana.
1999-2000	Graduate Research Assistant in GIS analysis at USACERL (US Army Construction Engineering Research Laboratory), Ecological Processes Division, Champaign, IL.
1996-1999	Graduate Research Assistant, Regional Economics Applications Laboratory (REAL), Department of Geography, University of Illinois, Urbana-Champaign, IL.

TEACHING

GEOG 6030: Advanced Spatial Analysis, Spring 2003

SELECTED PUBLICATIONS AND PRESENTATIONS

- Munroe, Darla, and Abigail York, in Press. Jobs, Houses and Trees: Changing Regional Structure, Local Land Use-Patterns, and Forest Cover in Southern Indiana. Forthcoming in *Growth and Change*.
- Southworth, Jane, Munroe, Darla, and Harini Nagendra, in Press. Land Cover Change and Landscape Fragmentation: Comparing the Utility of Continuous and Discrete Analyses for a Western Honduras Region. Forthcoming in *Agriculture, Ecosystems and Environment*.
- Croissant, Cynthia and Darla Munroe, 2002. Zoning and Fragmentation of Agricultural and Forest Land Use on Residential Parcels in Monroe County, Indiana. *Geography Research Forum* 22.
- Munroe, Darla, Jane Southworth and Catherine Tucker, 2002. The Dynamics of Land-Cover Change in Western Honduras: Exploring Spatial and Temporal Complexity. *Agricultural Economics* 27(3): 355-369.
- Munroe, Darla, 2001. Peasant Farm Efficiency in Poland: An International Perspective. *Regional Studies*, 35(5):459-469.
- Association of American Geographers 99th Annual Meeting. Integrated Econometric Approaches to Studying Forest Cover Change. New Orleans, LA. March 23, 2003.
- Regional Science Association International 49th Annual North American Meeting. A Case of Mistaken Identity: Identifying Spatial Lags in the Presence of Spatial Error Autocorrelation. San Juan, Puerto Rico. November 15, 2002. Co-author Elena Irwin.
- American Agricultural Economics Association (AAEA) Annual Meeting. Estimating Econometric Models of Land Use: Separating Fact from Fiction. Long Beach, CA. July 29, 2002. Organized Symposium, "New Techniques for Land Use Modeling." Co-author Elena Irwin.

- Association of American Geographers 98th Annual Meeting. An Assessment of Zoning as a Factor in Landscape Fragmentation. Los Angeles, CA. March 23, 2002. Co-authors Cynthia Croissant and Abigail York.
- Regional Science Association International 48th Annual North American Meeting. Jobs, Houses, And Trees: Changing Regional Structure, Local Land Use-Patterns, and Forest Cover In Southern Indiana. Charleston, S.C. November 15-18, 2001.
- Association of American Geographers 97th Annual Meeting. Scale Dependence and Land Use Patterns in Poland: A Multi-Scale Spatial Econometric Analysis. New York, NY. March 1, 2001.
- Regional Science Association International 47th Annual Meeting. Technical Efficiency in Polish Peasant Farming: A Composed Error Approach. Chicago, IL. November 10, 2000.
- Regional Science Association International 46th Annual Meeting. The Role of Intraindustry Trade in Interregional Trade in the Midwest of the U.S. Montreal, Canada. November 1999.
- Western Regional Science Association Annual Meeting. Peasant Farm Efficiency in Poland: A Spatial Econometric Analysis. Ojai, CA, February 1999.

CRAIG ALAN OGLE
Professor of Chemistry

Education:

1973 to 1976, Oterbein College, Westerville, Ohio. B.A. in math and chemistry.
1977 to 1980, University of Arizona, Tucson, Arizona. M.S. in organic chemistry.
1980 to 1982, University of Arizona, Tucson, Arizona. Ph.D. in organic chemistry.

Professional Experience:

1976 - 1977, Battelle Memorial Institute, Columbus, Ohio. Research associate.
1982 - 1984, University of Lausanne, Switzerland. Postdoctoral fellow.
1984 - 1985, The University of North Carolina, Charlotte. Lecturer.
1985 - 1991, The University of North Carolina, Charlotte. Assistant professor.
1991 - 1996, The University of North Carolina, Charlotte. Associate professor.
1996 – present, The University of North Carolina, Charlotte. Professor.

Brief Biographical Sketch:

Dr. Craig Ogle is an organic chemist. His present research interests are in the synthesis and characterization of chiral and polymeric materials, the design and synthesis of chiral catalysts for the synthesis of chiral materials and the study of the kinetics of organometallic and polymerization reactions using rapid injection NMR techniques. Dr. Ogle has taught Principles of Chemistry (Chemistry 1251), Organic Chemistry (Chemistry 2131 and Chemistry 2132), Advanced Organic Chemistry (Chemistry 4133, 4134, 4135) and developed and taught graduate level courses in organic chemistry (Chemistry 6135). Dr. Ogle is the founding and current Director of the Chemistry Department's industrial outreach Regional Analytical Chemistry Laboratory.

Recent Papers at Meetings:

1. M. L. Williams and C. A. Ogle "Synthesis and characterization of two new chiral non-transferable ligands for organocuprate reactions." The 223rd National Meeting of the American Chemical Society, Orlando, April 7-11, 2002.
2. A. W. Trammell, F. F. Navarro and C. A. Ogle "Synthesis and reactions of functional monomers for anionic polymerizations." The 223rd National Meeting of the American Chemical Society, Orlando, April 7-11, 2002.
3. J. Human, F. Lin and C. A. Ogle "Chiral non-transferable ligands for use in organocuprate reactions." The 223rd National Meeting of the American Chemical Society, Orlando, April 7-11, 2002.
4. C. A. Ogle, C.Z. Carlin and M. D. Murphy "Rapid injection NMR study of the reaction of sec-butyllithium with styrene and isoprene in toluene." The 225th ACS National Meeting, New Orleans, LA, March 23-27 2003.
5. C. A. Ogle, Cox and Williams "The synthesis and characterization of three new chiral, non-transferable ephedrine and norephedrine based ligands for organocuprate reactions." The 225th ACS National Meeting, New Orleans, LA, March 23-27, 2003.

Recent Publications:

1. Chloro(1,5-cyclooctadiene)(triphenylphosphine)-rhodium(I) Q. L. Horn, D. S. Jones, R. N. Evans, C. A. Ogle and T. Craig Masterman, Acta Cryst. Section E58, m51-52 (2002).
2. "Rapid-Injection NMR Study of Iodo- and Cyano-Gilman Reagents with Cyclo-hexenone: Observation of π -Complexes and their rate of formation." S. H. Bertz, C. M. Carlin, D. A. Deadwyler, M. D. Murphy, C. A. Ogle, and P. H. Seagle, J. Am. Chem. Soc., 124, 13650-13651(2002).
3. "Urotropin azelate: a rather unwilling co-crystal." M. Bonin, T. R. Welberry, M. Hostettler, M. Gardon, H. Birkedal, G. Chapuis, P. Moeckli, C. A. Ogle, K. J. Schenk, Acta Cryst., Section B: Structural Science 59(1), 72-86 (2003).
4. "Lithium Alkoxide Modifiers: Their Effect on the Rate of Polymerization and Propagation of Styrene by Butyllithium, in THF at -80°C." C. A. Ogle, H. C. Johnson IV, X. L. Wang, C. M. Carlin, F. H. Strickler and B. Gordon III, J. Poly. Science Part. A Polymer Chemistry, **37**, 1157-68 (1999).
5. "Re-evaluation of Organocuprate Reactivity. Logarithmic Reactivity Profiles for Iodo- vs. Cyano-Gilman Reagents in the Reactions of Organocuprates with 2-Cyclohexenone and Iodocyclohexane." S. H. Bertz, A. Chopra, M. Eriksson, C. A. Ogle, Chemistry, A European Journal. **1999**, 2680-92 (1999).

Recent Patent:

"Process to selectively place functional groups within polymer chain," United States Patent No. 6,225,415 issued May 1, 2001 to Craig Ogle, assigned to the University of North Carolina at Charlotte.

Recent External Grants and Gifts:

- "Enantioselective conjugate additions with chiral heterocuprates" Research Corporation, 2001-02, \$42,030.
- "Development of a new process for the synthesis of n-butyl lithium" Postin Products, 2001-2 \$43,680.
- "Support of Polymer Research" Kraton Polymers LLC, \$30,000, 2001-02.

Selected Professional Activities:

- Chairman, Carolina-Piedmont Section of the American Chemical Society, 1990 and 1995.
- Director, Regional Analytical Chemistry Laboratory, UNC Charlotte.
- Consultant for FMC Lithium Division, Square D Corp., CEKAL Specialities, Oral B and Wellman, Inc.
- Editorial Board, Main Group Metal Chemistry.

VINCENT OLORUNTOBI OGUNRO, Ph.D.

Assistant Professor, Civil Engineering Department (since July 2001)

A. EDUCATION

Degree	Year	Institution	Department
B.Sc.	1982	University of Ife, Ile-Ife, Nigeria	Civil Engineering
M.Sc.	1988	University of Lagos, Lagos, Nigeria <u>Thesis title:</u> “Cost-benefit analysis of Lagos-Lekki Peninsula-Epe Road”	Civil Engineering
D.E.A.	1991	Institut National des Sciences Appliquées (INSA), Lyon, France <u>Thesis title:</u> “Shear strength characteristics of sand-geomembrane interfaces”	Civil Engineering
Ph.D.	1996	Institut National des Sciences Appliquées (INSA), Lyon, France <u>Thesis title:</u> “Granular soil/geosynthetic interface characterization: influence of test conditions”	Civil Engineering

B. RESEARCH EXPERIENCE

Publications:

- Ogunro, V.O.** and Inyang, H.I. (2003). Relating Batch and Column Diffusion Coefficients for Leachable Contaminants in Particulate Waste Materials. *ASCE Journal of Environmental Engineering (accepted)*
- Ogunro, V.O.**, Inyang, H.I., Hooper, F, Young, D., and Oturkar, A. (2002). Gradation control of bottom ash aggregate in superpave bituminous mixes. *ASCE Journal of Materials in Civil Engineering. (under review)*.
- Inyang, H.I., **Ogunro, V.O.** and Hooper, F. (2002). Simplified calculation of maximum allowable contaminant concentration in waste-amended construction materials. *Resources, Conservation and Recycling, 00, pp. 1-14 (in press)*.
- Daniels, J.L., Inyang, H.I. and **Ogunro, V.O.** (2002). A methodology for fractionation of contaminant volumes to barrier slices. *Proceedings of the 6th International Symposium on Environmental Geotechnology and Global Sustainable Development, Chung-Ang University, Seoul, Korea. July 2-5, pp.381-387*
- Daniels, J.L., Chien, C.C., **Ogunro, V.O.** Inyang, H.I. 2000. A comparative Analysis of Contaminant Migration Models Using Barrier Material Data. *Journal of Soil and Sediment Contamination, 9(5), 487-501*
- Inyang, H.I. and **Ogunro, V.O.** (editors), 2000. Proceedings of the 4th International Symposium on Environmental Geotechnology and Global Sustainable Development. June 2000. Volume 1 (862 pages). Volume 2 (751 pages)
- J.L., Inyang, H.I., Howe, G.S., **Ogunro, V.O.** 1999. Innovative use of triaxial cell permeameters for measuring the earthen barrier resistance to freeze-thaw degradation under field conditions. *Proceedings of the International Symposium on High Altitude and Sensitive Ecological Environmental Geotechnology, Nanjing, P.R. China.*

Inyang, I., Asante-Duah, K. and **Ogunro, V.O.** 1999. Reuse of contaminated soils in constructed facilities. A technical report developed by CEEST UMASS Lowell for the Massachusetts Department of Environmental Protection, Boston, MA, 69 pages

Inyang, I., Daniels, J., **Ogunro, V.O.** 1998. Engineering Controls for Risk Reduction at Brownfield sites. *ASCE Geotechnical Special Publication, No. 82 : Risk-Based Corrective Action and Brownfields Restoration*, Jay N. Meegoda et al. (Editors)

Grants:

- *Use of Duke Power Plant Ash in High Volume Superpave Highway Asphalt Concrete Application*; Sponsor: Duke Energy, Charlotte, NC; (Co-PI: Dr. John L. Daniels; Industry Collaborator: Mr. Berry Hall, Blythe Construction, Inc.); Amount: \$19,332 (12/2002 – 12/2003)
- *The Feasibility of an Innovative 2-Stage Aerobic-Anaerobic Municipal Solid Waste Bioreactor*; funded by: COE, UNC-Charlotte; (Co-PI John L. Daniels); Amount: \$10,000 (01/2002 – 06/2003)
- *Investigation of Possible Abnormality in the Exchange of Na^+ for Cd^{2+} in the Freeze-Thaw of Na-Montmorillonite*; funded by: UNC-Charlotte; Amount: \$5,962 (01/2002 – 01/2003)
- *Sorption-desorption cycling and potential contaminant spreading in the Arctic permafrost due to temperature changes*; Agency: National Oceanic and Atmospheric Administration; (PI: Prof. Hilary I. Inyang); Amount: \$120,000 (2000-2001).
- *Modeling and experimental investigation of heavy metal leachability from Boiler Aggregate (BA) Bituminous Concrete*; Agency: Massachusetts Highway Department; (PI: Prof. Hilary I. Inyang); Amount: \$198,346 (1999-2001).

C. TEACHING EXPERIENCE

Courses Taught (Graduate level)

- Landfill Design (Design and Analysis of Waste Containment Systems)
- Pavement Design
- Designing with Geosynthetics
- Earth Pressure and Retaining Walls
- Ground Improvement
- Geotechnical/Geoenvironmental Site Characterization
- Physico-Chemical Interactions in Earthen Barriers

D. EXPERIENCE IN DIRECTING GRADUATE STUDENT RESEARCH

- Mr. Amit Oturkar. Western & Samson Engineers, Inc., Peabody, MA: “Modeling and experimental investigation of heavy metal leachability from boiler aggregate amended bituminous concrete” (M.S. thesis defense, 02/2001)
- Mr. Ola Lawal. Massachusetts Dept. of Environmental Protection, Springfield, MA: “Contaminant leachability from discrete particles under dynamic conditions” (M.S. thesis defense, 04/2001)
- Mr. John M. Long. “Pressure induced leaching of leachable contaminant particulate waste materials” (M.S. thesis: ongoing)
- Mr. Chris Stahl. “Geotechnical characterization of municipal solid waste under aerobic bioreactor landfill processes” (M.S. thesis: ongoing)

North Carolina Sea Grant Curriculum Vitae

NAME: James D. Oliver

Position: Professor of Biology and Director, Interdisciplinary Biotechnology Program

Professional Address: Department of Biology, University of North Carolina at Charlotte

Telephone: (704) 687-4049

Fax: (253) 736-8431

E-mail: jdoliver@email.uncc.edu

Social Security: 219-48-7705

EDUCATION (most recent first):

Georgetown University (Dept. Biology); Ph.D. 1969-73
University of Arizona (Dept. Microbiology); B.S. 1964-68

PROFESSIONAL EXPERIENCE (include positions, teaching activities and recent grants):

Research area is pathogenic *Vibrio* spp., especially *Vibrio vulnificus*. Have studied numerous aspects of the biology of this human pathogen for 26 years.

Education:

University Ottawa, Canada (Post-Doctoral Fellow, Dept. Biochemistry) 1973-74
University of North Carolina at Charlotte (Assistant, Associate, Professor) 1974-
Director, Interdisciplinary Biotechnology Program 1986-
Senior Faculty Fellow, Global Institute for Energy and Environmental Systems (GIEES) 2001-
University of Göteborg, Sweden (Visiting Professor) 1990
North Carolina State University (Visiting Professor) 1994-1996
Royal Veterinary and Agricultural University, Copenhagen, Denmark (Visiting Professor) 1998

Grants:

EPA. 2001. "Development of a method for resuscitation of *Helicobacter pylori* coccoid cells in environmental waters". \$300,000.
National Marine Fisheries (SK Program). 2002. "The Role of the *rpoS* Gene in Virulence of *Vibrio vulnificus*". \$101,990.
NC Sea Grant Program. 2002. "The Viable but Nonculturable State in Human Bacterial Pathogens in Eastern North Carolina Waters". \$60,500.
CDC and State of North Carolina Dept. Health. 2000-2003. "Isolation and Characterization of Pathogenic *Vibrio* spp. in North Carolina Waters". \$39,600.
FDA. 2001. RAPD PCR Analysis of *Vibrio vulnificus*. \$7000.
NC Sea Grant Program. "Studies on the Virulence of *Vibrio vulnificus* of Different Capsular and LPS Types". \$9400.

SELECTED PUBLICATIONS: (From a total of 100)

Vibrio species. 2001. Oliver, J.D. and J. Kaper. pp. 263-300 *In: Food Microbiology: Fundamentals and Frontiers*, 2nd ed. M.P. Doyle, L.R. Beuchat, T.J. Montville (ed.). Amer. Soc. Microbiol.
Vibrio cholerae, *V. vulnificus*, and other human pathogenic *Vibrio* species. 1997. Dalsgaard, A. and J.D. Oliver. *In: World Health Organization Guidelines for Recreational Water and Bathing Beach Quality*.
The ecology of *Vibrio vulnificus* in estuarine waters of eastern North Carolina. 2003. Pfeffer, C.S. and J.D. Oliver. *Appl. Environ. Microbiol.* (in press, June)
Analysis of *Vibrio vulnificus* from market oysters and septicemia cases for virulence markers. 2003. DePaola, A. et al. (11 authors). *Appl. Environ. Microbiol.* (in press).
Use of diacetyl to reduce the load of *Vibrio vulnificus* in the Eastern oyster, *Crassostrea virginica*. 2003. Birkenhauer, J.B. and J.D. Oliver. *J. Food Protect.* 66:38-43.
Essential role for estrogen in protection against *Vibrio vulnificus* induced endotoxic shock. 2001. Merkel, S.M., S. Alexander, J.D. Oliver, and Y.M. Huet-Hudson. *Infect. Immun.* 69:6119-6122.
Pathogenesis of *Vibrio vulnificus*. 1999. Linkous, D. and J.D. Oliver. *FEMS Microbiol. Lett.* 174:207-214
Randomly amplified polymorphic DNA (RAPD) analysis of clinical and environmental strains of *Vibrio vulnificus* and other *Vibrio* species. 1999. Warner, J.M. and J.D. Oliver. *Appl. Environ. Microbiol.* 65:1141-1144.
RpoS-dependent stress response and virulence determinant production in *Vibrio vulnificus*. Huelsmann, A., I.-S. Kong, H.M. Hassan, and J.D. Oliver. Submitted to *Applied and Environmental Microbiology*.

Jordan C. Poler
Associate Professor Chemistry

Education:

1987 State University of New York, Brockport, New York, B.S. in Chemistry & Physics.
1992 University of North Carolina at Chapel Hill, Ph.D. Physical Chemistry/Materials Science.
1995 Princeton University, Princeton, New Jersey, Post-doc.

Professional Experience:

1985-1987 T. J. Watson Research Center, IBM, Yorktown, New York, Student Internships
1987 C. N. Reilly Fellowship, The University of North Carolina at Chapel Hill, Chapel Hill, NC
1988 Microelectronics Center of North Carolina (MCNC) Fellowship
1988 Dobbins Fellowship, The University of North Carolina at Chapel Hill, Chapel Hill NC
1989 Department of Education (DoE) Fellowship
1989 - 1993 Semiconductor Research Corporation (SRC) Fellowship
1987 - 1993: Research Assistant, University of North Carolina at Chapel Hill, Chapel Hill NC
1990 T. J. Watson Research Center, IBM, Yorktown, New York, Student Intern
1993 - 1995 National Institute of Health (NIH) Postdoctoral Fellowship
1993- 1995 NIH Fellow, Princeton University, Princeton, New Jersey, Research Associate
1995 - 2001 University of North Carolina at Charlotte, Charlotte NC, Assistant Professor
2001- present University of North Carolina at Charlotte, Charlotte NC, Associate Professor

Brief Biographical Sketch:

Dr. Jordan Poler is a materials/physical chemist. His research interests involve the application of scanning probe microscopies (STM, STPM, SPM) and other materials characterization measurements to fundamental studies of surfaces, interfaces and thin films at the nanoscale. He has taught Principles of Chemistry (Chemistry 1251 and Chemistry 1252), Introductory Physical Chemistry (Chemistry 2141), Physical Chemistry (Chemistry 3141 and Chemistry 3142) and developed and taught graduate level courses in physical chemistry dealing with the synthesis and characterization of interfacial and surface phenomena (Chemistry 6082).

Recent Papers:

1. A. Hammond and J.C. Poler, "Preliminary Studies of Surface Energy Modifications by Nanostructuring Polymer Surfaces." Southeast Regional Meeting of the American Chemical Society, Charleston, South Carolina, November 2002
2. A. Hammond and J.C. Poler, "Preliminary Studies of How Polymer Surface Patterning Changes Surface Energy." Ronald E. McNair Scholars Forum, UNC-Charlotte, July 2002
3. A. Hammond and J.C. Poler, "Preliminary Studies of How Polymer Surface Patterning Changes Surface Energy." 8th Annual SAEOPP/UTK McNair National Scholars Research Conference, Knoxville, Tennessee, July 2002.
4. A. Hammond and J. C. Poler, "Variable Angle Spectroscopic Ellipsometry for studies of polymer surfaces: 9th Annual Undergraduate Research Conference, UNC-Charlotte, April 19, 2002.
5. J. Luther and J. C. Poler, "Substrate Directed Self-Assembly of Ru²⁺ Metallodendrimers" 1st Annual GPSG Graduate Research Fair, UNC-Charlotte, April 14, 2001.

Recent Publications:

1. "Scanning Thermopower Microscopy: A Technique for Organic and Biological Molecules Complementary to STM." J.C. Poler, R.M. Zimmermann and E.C. Cox, Procedures in Scanning Probe Microscopies, 55-60 (1998).
2. "Surface Oxidation Kinetics: A Scanning Tunneling Microscopy Experiment." J.C. Poler, J. Chem. Educ. 77, 1198-1200, (2000)
3. "Atomic Force Microscopy of Polymers." J. C. Poler and D. Schiraldi, Encyclopedia of Polymer Science and Technology, 3rd Ed., (2002)
4. "Cross Sectional AFM of Oxidized Porous Silicon" J. C. Poler, Ye, W. B. Drozd, M. A. Hasan, and J. C. Poler, Atomic Resolution Microscopy of Surfaces and Interfaces, Master. Res. Soc. Proc., 466, 63-66 (1997).
5. "Plots of the Amplitude of the Bonding and Antibonding Orbitals Formed by the Overlap of Two H1s Orbitals." R. Zschocher, F. S. Bush, and J. C. Poler, Mathcad Documents for Physical Chemistry, <http://www.niagra.edu/~tjz/mathcad/mathindx.htm>, (1998).

Recent External Grants:

- "Micromolding and Nanoprocessing of 3-D Bioabsorbable Polymer Scaffolds for Tissue Engineering" NSF NSE NIRT grant, **PI**, 2002-2006, **\$1,735,028**
- "Development of High Sensitivity Resists for e-beam Lithography" DARPA grant, co-**PI**, 2002-2004, **\$525,282**
- "Immunology and Cell Viability on Nano-patterned Surfaces" NIH RFA-HL-02-017, **PI**, 2002-2005, **\$577,500**

Selected Professional Activities:

- Chair, Graduate Studies Committee, The University of North Carolina at Charlotte
- Faculty Representative, Industrial Advisory Board, The University of North Carolina at Charlotte
- Ad hoc Curriculum Reform Committee, The University of North Carolina at Charlotte

STANISLAV RADCHENKO
University of North Carolina
Department of Economics

Address: 9201 University City Blvd.
Charlotte, NC 28262
Office Telephone: (704) 687-6157
E-mail: sradchen@email.uncc.edu

Education:

M.A.: Economics Department, Rutgers University, New Brunswick, NJ, 2000
Ph.D.: Economics Department, Rutgers University, New Brunswick, NJ, 2002
B. A.: Donetsk State Academy of Management, Donetsk, Ukraine, 1998

Professional Experience:

2002-present **Assistant Professor of Economics**
Department of Economics, University of North Carolina at Charlotte

Publications:

“A Bayesian Approach to Decomposing Wage Differentials” (joint with Myeong-Su Yun), 2003. *Economics Letters* 78(3), p. 431-436

“A Bayesian Test of Stationarity in a Regression Model with an ARMA Error Term” (joint with Elena Goldman, Teruo Nakatsuma and Hiroki Tsurumi), *American Statistical Association 2001 JSM Proceedings*

“Oil Stock Management and Futures Prices. Empirical Analysis.” (joint with Salah Abosedra), *The Journal of Energy and Development*, forthcoming

Working Papers

“The response of gasoline prices to changes in crude oil prices: asymmetry and lags”
December 2002

“Limited Information Bayesian Analysis of a Simultaneous Equation with an Autocorrelated Error Term and its Application to the U.S. Gasoline Market” (joint with Hiroki Tsurumi), March 2002

“A new Test for Money Supply Volatility Hypothesis”, October 2001

“Bayesian Tests of Cointegration in the framework of ECM model”, August 2001

“A Bayesian Test of Seasonal Unit Root in a Regression Model with an ARMA or ARMA-GARCH Error Term” (joint with Elena Goldman, Teruo Nakatsuma and Hiroki Tsurumi), September 2001

Professional Activities:

Member: International Society for Bayesian Analysis, The Econometric Society, American Economic Association

Referee: Communication in Statistics, Journal of Empirical Finance

Conference Presentations:

“Limited Information Bayesian Analysis of a Simultaneous Equation with an Autocorrelated Error Term and its Application to the U.S. Gasoline Market”
Valencia Bayesian Statistics Meetings 7, Tenerife, Spain, June 2002

“A Bayesian Test of Stationarity in a Regression Model with an ARMA-GARCH Error Term” ISBA Regional Meeting, Laguna Beach, California, January 2001 (presented by coauthor)

CURRICULUM VITA

Peter M. Schwarz Professor of Economics
and Senior Faculty Fellow, Global Institute of Energy and Environmental Systems
University of North Carolina at Charlotte
and
Senior Economist, Energy Resource Planning,
Research Triangle Institute

Office Phone (704) 687-2666 Fax: (704) 687-6442
Email pschwarz@email.uncc.edu

Education:

Ph.D. Economics, 1980	The Ohio State University
Ph.D. Dissertation "The Effects of Peak Load Demand and Energy Charges on the Industrial Use of Electricity"	
M.A. Economics, 1975	The Ohio State University
B.S. Mathematics, 1973	The City College of New York

Research Experience (Primarily Past Five Years)

Refereed Journal Articles

"Renewable Energy from Gasification of Manure: An Innovative Technology in Search of Fertile Policy," Environmental Monitoring and Assessment, Special edition on Innovative Technologies and Policies for Waste Management," John Buckley and Peter Schwarz, Vol. 84, No. 1-2, May 2003, 111-127.

"Industrial Response to Electricity Real-Time Prices: Short-Run and Long-Run," Economic Inquiry (co-authored with Thomas N. Taylor, Matthew Birmingham and Shana L. Dardan), Vol. 40, No. 4, Oct. 2002, 597-610.

"Advance Notice of Real-Time Electricity Prices," Atlantic Economic Journal, Vol. 28, No. 4, Thomas Taylor and Peter Schwarz, December 2000, pp. 478-488.

Other Publications: Books, Chapters in Books, Non-Refereed Articles

Book Review of You Don't Always Get What You Pay For: The Economics of Privatization, by Elliott Sclar, Urban Affairs Review (invited review), forthcoming, July 2003.

Taxes, Trading, or Tandem: Alternatives for Achieving Efficient Air Quality," Critical Issues in International Environmental Taxation, CCH Incorporated, (co-authored with John Buckley), Chicago, IL, 2002, 561-576.

Environmental Economics, in Economics for Today, 3e (Chapter 14), Irvin Tucker, International Thomson, 2002.

"Collaring the Risk of Real-Time Prices: A Merchant Strategy for Utilities," Public Utilities Fortnightly, Vol. 137, No. 9, October 1999, pp. 52-58.

"Despite Political Foot-Dragging, Electricity Deregulation is Coming," Charlotte Business Journal, Vol. 13, Number 51, March 19, 1999, p. 44.

Book Review of Brennan, et al., *A Shock to the System: Restructuring America's Electricity Industry*, Southern Economic Journal, Vol. 64, No. 2, October 1997, pp. 592-594.

Grants

Brownfield Liability and its Consequences for Electricity Deregulation, BarclayAmerican, 2003. Funding Amount: \$4500.

Multiple Pollutant Efficiency Standards for Electricity Production, UNC Charlotte Faculty Research Grant, 2003-2004: \$5950

Hourly Response to Real-Time Electricity Prices: Short-Run and Long-Run, UNC Charlotte Faculty Research Grant, 2000-2001: \$4650

'Near' Real-Time Pricing and Price Uncertainty: An Investigation of Advance Notice, December 1996, Department of Energy Grant, Instrument No. DE-FG48-95R810582, Funding Period: October 1, 1995 through Dec 31, 1996. Funding Amount: \$69,628.

Other Relevant Research Experiences:

Presentations

“Multiple Pollutant Efficiency Standards for Electricity Production,” Midwest Economics Association, St. Louis, MO, March 28-30, 2003. Also at Davidson College, March 14, 2003; UNC Charlotte, March 21, 2003. Forthcoming at Western Economics Association, *Contemporary Economic Policy* invited session, Denver, CO, July 11-15, 2003.

“Industrial Customer Hourly Response to Electricity Real-Time Pricing: Short Run and Long Run,” Rutgers University Advanced Workshop in Regulation and Public Utility Economics, Lake Tahoe, CA, June, 2002. Also at International Congress of Energy and Natural Resource Economics, Monterey, CA June 2002.

"Taxes, Trading, or Tandem: Alternatives for Achieving Efficient Air Quality," Global Conference on Environmental Taxation, Vancouver, Canada, April 1-3, 2001.

“Response of Industrial Customers to Real-Time Electricity Prices: Short-Run and Long-Run,” Rutgers University Advanced Workshop in Regulation and Public Utility Economics, Lake George, NY, May 24-26, 2000.

“The U.S. Economy Today and in the Future,” 80th Anniversary of Nankai University and the Nankai-Fullerton International Economics Forum, October 17-18, 1999, Nankai University, Tianjin, P. R. China.

“Real-Time Pricing and Price Risk,” Israeli Electric Company, Tel Aviv, Israel, July 9, 1996.

Teaching Experience

Courses Taught

Economic Analysis for Public Policy (Public Policy Ph.D. program),
Economics of Business Decisions (MBA),
Energy and Environmental Economics (Undergraduate and M.S. in Economics),
Principles of Public Sector Economics (Undergraduate and M.S. in Economics),
Law and Economics,
Managerial Economics,
Industrial Organization and Regulated Industry,
Economics- Macro, Principles of Economics- Micro

Experience in Directing Graduate Student Research

Directed “The Political Economy and the Performance of Privatization” by Thor Sigfusson, M.S. Economics, 1991.

Committee Member “What Practitioners Think Principals Should Know About School Law in North Carolina” by Walter Zahler, D. Educ., 2001.

Wade Napoleon Sisk
Associate Professor of Chemistry

Education:

1984	University of Iowa, Iowa City. B.S. in chemistry
1990	University of California, Berkeley Ph.D. in physical chemistry.

Professional Experience:

1990 - 1991	Japan Society for the Promotion of Science, Fellowship utilized at Tokyo Institute of Technology, Tokyo, Japan, Postdoctoral Research Fellow.
1991 - 1992	Hitachi Research Laboratory, Hitachi-Shi, Japan, Visiting Research fellow.
1992 - 1993	Brookhaven National Laboratory, Upton, New York, Postdoctoral Research Fellow
1997 - 1998	Science and Technology Agency Fellow at the Institutue of Physical & Chemical Research (RIKEN), Japan.
1993 - 2001	The University of North Carolina, Charlotte. Assistant Professor.
2001 - present	Associate Professor of Chemistry

Brief Biographical Sketch:

Dr. Wade Sisk is a physical/materials chemist having research interests in photochemistry and the photo-degradation of materials. He has taught Principles of Chemistry (Chemistry 1251 and Chemistry 1252), Introductory Physical Chemistry (Chemistry 2141), Physical Chemistry (Chemistry 3141 and Chemistry 3142) and developed graduate level courses in photochemistry (Chemistry 6147/8147).

Recent Papers

1. Photonics West 2003: Optoelectronics – Organic Photonic Materials and Devices, San Jose, CA – Univ. of North Carolina/ Charlotte. Oral Presentation: “Photostabilizing effects of lidocaine and tris(8-hydroxy-quinoline) aluminum on organic fluorescent dyes,” W. N. Sisk, [4991-07] January 27, 2003.
2. Seminar - Department of Chemistry and Physics of Western Carolina University, Cullowhee , NC: "Photostability of Organic Photonic Dyes”, W. N. Sisk, March 1, 2002.
3. OPTO Southeast: Southeast Regional Meeting on Optoelectronics, Photonics, and Imaging by the Optical Society of America (OSA), Clemson, SC. Poster Presentation: “Thermal and Photo stability of polymer-dispersed Pyrromethene 597 laser dye.” Aashim Bhatia and Wade N. Sisk, September 18-19, 2001.
4. OPTO Southeast: Southeast Regional Meeting on Optoelectronics, Photonics, and Imaging by the Optical Society of America (OSA), Charlotte, North Carolina. Oral Presentation: “Photostability and absorption coefficients of 1-duogenylamino-4-tricyanoethenylbenzene/poly (methyl methacrylate) thin films at 532 nm.” M. Bader and W. N. Sisk, September 18-19, 2000.
5. 221st ACS National Meeting, San Diego, CA. Oral Presentation: “Photostability and absorption coefficients of 1-diphenylamino-4-tricyanoethenylbenzene/poly (methyl methacrylate) thin films at 532 nm.” M. Bader and W. N. Sisk, April 1-15, 2001.

Recent Publications:

1. W. N. Sisk, N. Ono, T. Yano, and M. Wada, "Photostability studies of three new bicyclo-boron dipyrromethene dyes," *Dyes and Pigments* **55**, (2002) 143.
2. N. Sarkar, W. N. Sisk, S. Ikeda, H. Hayashi, "Influence of large magnetic fields on nonradiative transitions from the A state of thiophosgene," *Molecular Physics* **100** (2002) 1271.
3. M. Mackey, W. Sisk, "Photostability of Pyrromethene 567 Laser Dye Solutions via Photoluminescence Measurements," *Dyes and Pigments* **51** (2001) 79.
4. K. Kang, W. N. Sisk, M. Y. A. Raja, and F. Farahi, "Field-enhanced Photodegradation of Pyrromethene Dye Films," *J. Of Photochem and Photobiol. A: Chemistry* **121** (1999) 133.
5. W. N. Sisk, M. Y. A. Raja, and F. Farahi, "Photocurrent and Optical Limiting Studies of C₆₀ Films and Solutions," *Int. J. Optoelectronics* **11**, (1997) 325.

Recent External Grants

- The University of North Carolina Charlotte Faculty Research Grant, January 2003, \$6000. "Development of a new process for the synthesis of n-butyl lithium" Postin Products, 2001-2 \$43,680.
- " American Chemical Society Petroleum Research Fund Type B, July 1999 – August 2001, \$30,000 "Study of Polymer-dispersed Pyrromethene Films Carrier Generation Mechanism and Photodegradation"

Selected Professional Activities:

- Served on review panel for Ford Foundation Predoctoral Fellowship for Minorities – March 7-8, 2003, Arlington, VA.
- Appointed to Board of Trustees of Discovery Place Science Museum for three years, 1999 - 2002. Serving on the *Programs and Education Committee*.
- Served as a panelist to review applications for the National Science Foundation's (NSF) International Research Fellowship Program and Distinguished Research Fellowship, Feb. 7-8, 2002, Arlington, VA

Inna Sokolova
Assistant Professor
Biology Department, UNC Charlotte
GIEES, Charlotte

Academic

B.S. St. Petersburg State University, Russia, 1991 (Zoology);
Ph.D. Zoological Institute of Russian Academy of Sciences, 1997 (Zoology), Thesis: “Populational aspects of adaptation of the intertidal gastropod molluscs *Littorina saxatilis* to low salinity”;
Post-doctoral Fellow, Alfred-Wegener-Institute for Polar and Marine Research, Germany, 1999-2001 (Environmental Physiology and Biochemistry);
Post-doctoral Fellow, University of Guelph, Canada, 2001 - 2002 (Molecular Population Genetics),
Assistant Professor, University of North Carolina at Charlotte, 2001 – present.
Research Fellow, Global Institute for Energy and Environmental Systems, Charlotte, 2001 - present

Research

Research interests: Stress physiology, metabolic physiology, ecological toxicology. My current research project focuses on the effects of heavy metals on metabolic physiology and disease resistance of bivalves.

24 scientific publications, 27 papers presented at national and international conferences. Invited research seminars given at 5 universities and research institutes. Reviewing for 3 scientific journals.

Recent papers (last 5 years):

- Sokolov E.P., Pörtner H.O., Lucassen M., **Sokolova I.** Microscale physiological differentiation correlates with a restricted gene flow in *Littorina saxatilis* (Olivi) snails in the White Sea. *Journal of Molluscan Studies*, in press.
- Sokolova I.**, Pörtner H.O. (2003). Metabolic plasticity and critical temperatures for aerobic scope in a eurythermal marine invertebrate (*Littorina saxatilis*, Gastropoda: Littorinidae) from different latitudes. *Journal of Experimental Biology*, 206: 195 - 207.
- Sokolov, E.P., **Sokolova, I.M.**, Pörtner H.O. (2002). Polymorphic microsatellite DNA markers from the marine gastropod *Littorina saxatilis*. *Molecular Ecology Notes* 2: 27-29.
- Sokolov, E.P., **Sokolova, I.M.**, Pörtner H.O. (2001). Composition and relative abundance of microsatellite repeats in genome of *Littorina saxatilis* (Olivi) (Gastropoda: Littorinidae). *Journal of Molluscan Studies* 67: 499 – 501.
- Sokolova, I.M.**, Pörtner, H.O. (2001). Adaptation to high shore life in *Littorina saxatilis* involves improved water conservation abilities and metabolic rate depression. *Marine Ecology Progress Series* 224: 171 - 186.
- Sokolova, I.M.**, Pörtner, H.O. (2001). Temperature effects on key metabolic enzymes in *Littorina saxatilis* and *L. obtusata* from different latitudes and shore levels. *Marine Biology* 139: 113 – 126.
- Granovitch A.I., **Sokolova I.M.** (2001). *Littorina arcana* Hannaford Ellis, 1978 – a new record from the eastern Barents Sea. *Sarsia* 86: 241 – 243.
- Sokolova, I.M.**, Bock, C., Pörtner, H.O. (2000). Resistance to freshwater exposure in White Sea *Littorina* spp. I. Anaerobic metabolism and energetics. *Journal of Comparative Physiology B* 170 (2): 91 – 103.
- Sokolova, I.M.**, Bock, C., Pörtner, H.O. (2000). Resistance to freshwater exposure in White Sea *Littorina* spp. I. Acid-base regulation. *Journal of Comparative Physiology B* 170 (2): 105 – 115.
- Granovitch, A.I., Sergievsky, S.O., **Sokolova, I.M.** (2000). Spatial and temporal variation of trematode infection in coexisting populations of intertidal gastropods *Littorina saxatilis* and *L. obtusata* in the White Sea. *Diseases of Aquatic Organisms* 41: 53 – 64.
- Sokolova, I.M.**, Berger, V.Ja. (2000). Physiological variation related to shell colour polymorphism in White Sea *Littorina saxatilis*. *Journal of Experimental Marine Biology and Ecology* 245: 1 – 23.
- Sokolova, I.M.**, Granovitch, A.I., Berger, V.Ja., Johannesson, K. (2000). Intraspecific physiological variability of the gastropod *Littorina saxatilis* related to the vertical shore gradient in the White and North Seas. *Marine Biology* 137: 297 – 308.

- Sokolova, I.M.** (1995). The influence of trematodes on the demography of *Littorina saxatilis* (Olivi) (Gastropoda: Prosobranchia: Littorinidae) in the White Sea. *Diseases of Aquatic Organisms* 21, 91–101.
- Sergievsy, S.O., Granovitch, A.I. and **Sokolova I.M.** (1997). Long-term studies of the *Littorina obtusata* and *Littorina saxatilis* populations in the White Sea. *Oceanologica Acta* 20 (1), 259 - 265.
- Sokolova, I.M.**, Granovitch, A. I., Sergievsy, S. O. (1997). Shell colour polymorphism in *Littorina obtusata* and *L. saxatilis* populations along a salinity gradient in a White Sea estuary. In: *The responses of marine organisms to their environment*. L.E. Hawkins, S. Hutchinson [Eds.]. University of Southampton. Pp. 57 - 65.
- Sokolova, I.M.** (1995). Embryonic abnormalities in populations of *Littorina saxatilis* (Olivi) (Gastropoda: Prosobranchia) in the White Sea. *Journal of Molluscan Studies* 61 (3), 303–311.
- Granovitch, A.I., Sergievsy, S.O. and **Sokolova, I.M.** (1995). Co-occurrence of several trematode species in the White Sea molluscs *Littorina saxatilis* and *L. obtusata*. *Parazitologiya* 29(6), 45–46 (in Russian with English summary).
- Lyzen (Sokolova), I.M.**, Sukhotin, A.A. and Sergievsy, S.O. (1992). Influence of the infection by trematode partenites on the aquatic respiration rate of the intertidal mollusk *Littorina obtusata*. *Parazitologiya* 26 (6), 521–523 (in Russian with English summary).

Honors and Awards

A. Dogel Honors Award, St. Petersburg State University (1990); International Science Foundation Grad Student Fellowship (1995-1996); Otto Kinne Fellowship for Outstanding Young Scientists, Germany (1995); Alfred-Wegener Institute Guest Scientists Fellowships (1996, 1997, 1998), V.E.Sokolov Fellowship for Outstanding Research In Ecology, Russian Academy of Sciences, Russia (2000); Alexander von Humboldt Fellowship, Germany (1999-2001); Society of Experimental Biology Travel Award (2000, 2002); Scandinavian Society for Parasitology Travel Award (1995)

Teaching experience

Past teaching experience:

1989-1991 Supervised 4-week summer field courses on invertebrate zoology and ecology for the undergraduate students of Leningrad (St.Petersburg) State University

1989-1999 Team-taught two-semester graduate Populational Seminars (2 h/week) at the Department of Invertebrate Zoology of St. Petersburg State University.

1998 - 1999 Worked as a reviewer for the evaluation committee of the Best M. S. Thesis Award at the Faculty of Biology and Soil Sciences of St. Petersburg State University

2000 Consulted the BSc Thesis of Ms. Birgit Eylert (Marine Biology, University of Wales, U.K.)

2001-2002 Guest lecturer for the Ecology and Population Ecology courses at the University of Guelph, Guelph, Canada

Courses taught at the UNCC:

BIOL 2111 Cell Biology Lab
 BIOL 3144 Ecology
 BIOL 6000/8000 Special topics in Biology: Ecotoxicology

I currently supervise Honors and undergraduate student research of 2 students.

Experience in directing graduate student research

1996-1999 Directed a MS thesis of Ms. Marina Kaliberdina “Physiological responses to environmental stress and changes in population structure along the vertical shore gradient in marine gastropods, *Littorina saxatilis*”, St.Petersburg State University, St. Petersburg, Russia

Curriculum vitae

Todd R. Steck, Ph.D.
Associate Professor of Biology
The University of North Carolina at Charlotte
(704) 687-4393, fax 687-3128, E-mail: trsteck@email.uncc.edu
March 2003

Major Research Interests

Molecular microbial ecology, focusing on development of bacterial source tracking methods with an emphasis on detection and study of the viable but nonculturable state in bacteria.

Education

Ph.D.	Biology	University of Rochester	1985
	“Studies on the Role of DNA Gyrase and DNA Supercoiling in <i>Escherichia coli</i> growth”		
M.S.	Biology	University of Rochester	1981
B.S.	Biology	Allegheny College	1979

Research Experience

Publications (past 5 years)

Grey, B., and Steck, T.R. 2001. Concentrations of copper thought to be toxic to *Escherichia coli* can induce the viable but nonculturable condition. *Appl. Environ. Microbiol.* 67(11):5325-5327.

Grey, B., and Steck, T.R. 2001. The viable but non-culturable state of *Ralstonia solanacearum* may be involved in long-term survival and plant infection. *Appl. Environ. Microbiol.* 67(9):3866-3872.

Rivers, B., and Steck, T.R. 2001. Viable but nonculturable uropathogenic bacteria are present in the mouse urinary tract following urinary tract infection and antibiotic therapy. *Urol. Res.* 29:60-66.

Ghezzi, J., and Steck, T.R. 1999. Induction of the viable but nonculturable condition in *Xanthomonas campestris* pv. *campestris* in liquid microcosms and sterile soil. *FEMS Microbiol. Ecol.* 30(3):203-208.

Alexander, E., Pham, D. and Steck, T.R. 1999. The viable but nonculturable condition is induced by copper in *Agrobacterium tumefaciens* and *Rhizobium leguminosarum*. *Appl. Environ. Microbiol.* 65:3754-3756.

Loeb TA, Spring LM, Steck TR, Reynolds TL. 1999. Transgenic Wheat (*Triticum* spp.). In: Bajaj YPS (ed.) *Biotechnology in agriculture and forestry*, Vol. 46, *Transgenic Crops I*. Springer-Verlag, Berlin

External Grants (past 5 years)

“Development of interdisciplinary course entitled Environmental Biotechnology: techniques and applications.” North Carolina Biotechnology Center, \$38,350, 6/03-5/04.
In collaboration with Drs. H. Hilger (Civil Engineering, UNCC) and W. DiBiase (Educ. UNCC)

“Method development to determine the sources of fecal coliforms in surface water.” North Carolina Water Quality Workgroup, \$60,000, 9/01-5/03. In collaboration with Dr. H. Hilger, UNC-Charlotte.

“Resistance of Uropathogenic *E. coli* to Antibiotics in Humans.” Foundation for the Carolinas, \$10,000, 9/01-5/03

“The viable but nonculturable condition in plant-associated microbes.” North Carolina Biotechnology Center, \$40,000, 1997-1999.

”The role of the viable but nonculturable condition in urinary tract infections.“ Foundation for the Carolinas, \$ 7,767, 1998-1999.

Other Relevant Research Experiences

Patent - “Method Development to Determine Fecal Contamination Source Information for TMDL Assessments.” Co-inventor with Dr. H. Hilger (UNC-Charlotte). Full patent submitted April 2002,

On-going collaborative environmental research project with regional institutions.

Working in collaboration with Dr. H. Hilger in Civil Engineering on a project with NC DENR and David Kroening of the Mecklenburg County Land Use and Environmental Services Agency (LUESA) to develop a biotechnology-based fecal tracking method for TMDL plan planning and implementation.

Teaching Experience

Course Regularly Taught (excluding seminars and individualized instruction courses) * courses developed

BIOL 4199/5199	Molecular Biology
BIOL 4168/5168*	Laboratory and Lecture in Recombinant DNA Techniques
BIOL 6000/6040/6102	Graduate Special Topics
BIOL 6600/6800/6900	Graduate Seminar / Tutorial / Thesis Research
BIOL 8040/8102*	Ph.D. Core A, Cell and Molecular Biology
BIOL 8800	Ph.D. Rotation

External Educational Grants (past 5 years)

“Development of interdisciplinary course entitle Environmental Biotechnology: techniques and applications.” North Carolina Biotechnology Center, \$38,200, 3/1/03-2/28/04 (Co-PIs: Drs. H. Hilger and W. DiBiase)

Other Relevant Teaching Experience

Courses/Grants Under Development

In collaboration with Dr. H. Hilger in Civil Engineering, funding was recently received from the North Carolina Biotechnology Center to institute a new interdisciplinary, problem-based learning course. This Environmental Biotechnology course, which will begin fall of 2004, will have upper-level undergraduate and graduate students work in interdisciplinary teams, applying a problem-based learning model, to solve real-world environmental problems using biotechnology-based approaches, potentially working in collaboration with regional scientists from the private and public sector.

Experience in Directing Graduate Students

Number of graduated M.S. students directed: 10.

Titles of theses for three more recent graduates:

“Evaluation of the role of the viable but nonculturable state of *Escherichia coli* in urinary tract infections using a murine model.”

“The role of the viable but nonculturable state of *Ralstonia solanacearum* in soil survival and plant infections.”

“Evaluation of the effects of antibiotic treatment on uropathogenic *Escherichia coli* *in vitro* and *in vivo*.”

Number of completed graduate student Thesis Committees serving as a member: 25

Number of completed graduate student Dissertation Committees serving as a member: 1

Number of M.S. students currently directing: 4

Number of Ph.D. students currently directing: 1

S. Gary Teng, Ph.D., P.E.

EDUCATION

Chung-Yuan University	Industrial Engineering	B.E.	1979
Texas Tech University	Industrial Engineering	M.S.I.E.	1983
Auburn University	Industrial Engineering	Ph.D.	1989

RESEARCH EXPERIENCE

Publications (representative list from 30 in last 5 years and 53 overall)

- S. Teng and S. Garimella, "Manufacturing Cost Modeling in Printed Wiring Board Assembly," *Journal of Manufacturing Systems*, Vol. 17, No. 2, 1998.
- S. Teng, and S. Ho, "Current Problems in FMEA Implementation," *Proc. of the 8th Annual Industrial Engineering Research Conference*, Phoenix, Arizona, 5/1999.
- S. Teng and J. Nelson, "Preparing IE Students for the Future with Industrial Projects," *the 1999 ASEE Annual Conference*, Charlotte, North Carolina, 6/1999.
- S. Teng, "Applying Lean Manufacturing and Six Sigma in Manufacturing Industry," *the 5th Southern New England Science & Technology Exchange Conference*, Hartford, Connecticut, 10/1999.
- S. Teng and S. Ho, "Determining Sample Sizes for Attribute Testing in FMEA," *Advances in Industrial Engineering Theory, Applications and Practice IV*, 11/1999.
- S. Teng, S. Schreiner, and J. Nelson, "Connecting Industrial Practices to Engineering Education with Teaching in the Factory Approach," *Proc. of the 2001 Conference for Industry and Education Collaboration*, San Diego, California, 1/2001.
- S. Teng, S. Schreiner, and J. Nelson, "Teaching in the Factory: Connecting Industry to Engineering Education," *Industry & Higher Education*, Vol. 15, No. 5, 10/2001.
- P. Liu, H. Tsai, and S. Teng, "Web-Based Collaboration for the Rest of Us," *Design Management Journal*, Vol. 13, No. 2, Spring 2002.
- H. Tsai, P. Liu, and S. Teng, "A Collaborative Product Design Environment for Small to Medium Size Companies," *Proc. of the 2002 IE Research Conference*, Orlando, Florida, 5/2002.
- S. Teng and J. Shelnutt, "The Development of an MSEM Program with a Close Tie to Industry," *Proc. of the 2002 ASEE Annual Conference*, Montréal, Québec, Canada, 6/2002.
- P. Liu, S. Teng and H. Tsai, "A Low Cost Team Collaborative Environment for Student Product Design," *Proc. of the 2002 ASEE Annual Conference*, Montréal, Québec, Canada, 6/2002.
- S. Teng and P. Liu, "Collaborative Environments for Managing Industrial Projects," *Proc. of the 2003 ASEE Annual Conference*, Nashville, Tennessee, 6/2003. (to appear)
- S. Teng, S. Ho, and D. Shumar, "Effective Classification of Warranty Returned Parts in a Supply Chain," *Proc. of 2003 Portland International Conference on Management of Engineering and Technology*, Portland, Oregon, 7/2003. (to appear)
- H. Tsai, P. Liu, and S. Teng, "A Web-Based Collaborative Environment for Product Design," *Intl. Journal of Industrial Engineering*. (in review)

- S. Teng, S. Ho, and D. Shumar, "Improving a Supply Chain with Correct Classification of Warranty Returned Parts," *Intl. Journal of Quality and Reliability Management*. (in review)

Research Grants (5 during last 5 years and 18 overall)

- "Development of a Sterolithography Laboratory for Undergraduate Instruction," P. Liu and S. Teng, NSF & Light Sculpting, Inc., \$160,000, 1996-1998.
- SME Grant, S. Teng, P. Liu, and L. Massay, SME Foundation, \$138,777, 1996-1997.
- Summer Research Grant, S. Teng, WNEC, \$2,750, 1998.
- SME Grant, S. Teng, SME Foundation, \$37,450, 1998-1999.
- "An Unused ABB IRB 2000 Robot for Manufacturing Projects and Laboratory," S. Teng and E. Haffner, Hamilton Sundstrand, \$15,000, 1999-2000.

TEACHING EXPERIENCE (graduate courses taught)

- | | |
|--|------------------------------------|
| • Industrial & Technology Management Seminars | • Flexible Manufacturing Systems |
| • Control of Automated Manufacturing Systems | • Advanced Project Management |
| • Industrial Productivity Measurement & Analysis | • Engineering Management Project |
| • Manufacturing Systems Modeling & Control | • Engineering Systems Integration |
| • Plant Layout and Material Handling | • Systems Reliability Engineering |
| • Concepts in World Class Manufacturing | • Reliability Testing and Analysis |
| • Production Management and Control | • Reliability Engineering |

Graduate Program Development:

- Developed a Master of Science in Engineering Management program and a Graduate Certificate program for U.S. Army Natick Soldier Center in 1999.
- Started up a Master of Science in Engineering Management program at UNCC in 2000.

EXPERIENCE DIRECTING GRADUATE STUDENT RESEARCH

Master's Theses Directed

- Hector Jaramillo, "Supply Chain Management for Textile and Apparel Industry," August 2003. (expected)
- Juan P. Niebles, "Supply Chain Management in Utility Industry," December 2003. (expected)
- Karen A. Karppi-Furmack "Using Activity-Based Costing to Develop Direct Labor Hours for Electronics Assembly Modules," December 1994.
- Soma S. Garimella, "Cost and Performance Modeling of Printed Wiring Assembly Manufacturing Systems," December 1994.

David Jacob Thaddeus

EDUCATION

- 1985-1988 Master of Architecture, College of Architecture, the University of Houston
1977-1981 Bachelor of Civil Engineering, the American University of Beirut, Lebanon

PUBLICATIONS

- 2003 Study Guide for the Structural Divisions of the Architect Registration Examination
Manuscript for publication
- 2002 Archiflash: Flashcard System for the Architect Registration Examination (ARE).
Composed and edited cards for the General Structures, Longspan Structures and Lateral Loads
Divisions of the ARE. NALSA Publishing.
- 1995 Spreadsheets for Architects, co-authored with Leonard Bachman,
Book, software and companion manual. Van Nostrand Reinhold.

RESEARCH GRANTS

- 2001 Visualizing the Structural Behavior of Buildings and Long-Span Structures.
Curriculum Instruction Grant (\$5100). University of North Carolina – Charlotte

CONFERENCES

- 2003 Wood Solutions Fair , the Canadian Wood Council Conference. Charlotte, North Carolina
- 2000 Homelands- ACSA Southeast Regional Conference- UNC Charlotte,
Served as discussion panelist for conclusion session
- 2000 New Developments in Teaching Structural Steel- Design and Practice, Chicago, Illinois
Sponsored by the American Institute of Steel Construction (AISC)
- 1999 ACSA International Science & Technology Conference, Montreal, Canada
- 1998 New Developments in Teaching Structural Steel- Design and Practice, Denver, Colorado
Sponsored by the American Institute of Steel Construction (AISC)
- 1996 Habitat for Humanity International Conference. Atlanta, Georgia. Invited to give a
presentation on the sponsorship, design, construction and community impact of a
house in Houston by the UH College of Architecture students for the Zavaleta Family
- 1996 Association of Collegiate Schools of Architecture (ACSA) Summer Technology Conference.
Milwaukee, Wisconsin. First national conference of architectural structures professors from
accredited schools of architecture

ACADEMIC APPOINTMENTS

Teaching Assignments at the College of Architecture, The University of North Carolina - Charlotte

- 1999-Present Associate Professor, undergraduate and graduate courses in Architectural Structures,
Architectural Design Workshops, and Building Systems Integration

Teaching Assignments at the Gerald D. Hines College of Architecture, The University of Houston

- 1997-1999 Associate Professor, undergraduate and graduate courses in Architectural Structures and
Architectural Design Workshops
- 1991-1997 Assistant Professor, undergraduate and graduate courses in Architectural Structures and
Architectural Design Workshops

INVITED TEACHING ENGAGEMENTS

- 2003 Conducted a seminar for the *General Structures / Long Spans* and *Lateral Loads* Divisions of the Architect Registration Exam (A.R.E.)- Invited by the American Institute of Architects-Santa Clara Valley Chapter, San Jose, CA
- 2001-Present Conduct annual seminars for the Structures Divisions and coordinate annual seminars for the Graphics Divisions of the Architect Registration Exam (A.R.E.)- UNC - Charlotte, NC
- 2000-Present Conduct annual seminars for the *General Structures / Long Spans* and *Lateral Loads* Divisions of the Architect Registration Exam (A.R.E.)- Invited by the American Institute of Architects – Houston Chapter, TX
- 1989-2000 Conducted annual / bi-annual seminars for the *General Structures / Long Spans* and *Lateral Loads* Divisions of the Architect Registration Exam (A.R.E.)- Houston, TX
- 1996-1999 Conducted annual Architectural workshops as part of the Museum of Fine Arts' - Houston Educators Workshop

AWARDS & HONORS

- 2001 Board of Governors 2000/01 Teaching Award, presented by the College of Architecture UNCC
- 2000 Board of Governors 1999/00 Teaching Award, presented by the College of Architecture UNCC
- 1999 Outstanding Alumni Achievement Hall of Fame Award, UH Architecture Alumni Association
- 1997 The Educator Award, presented by the American Institute of Architects - Houston Chapter
- 1996 First Annual Faculty Service Award, presented by the Architectural Alumni Association of the College of Architecture, the University of Houston
- 1996 Leadership in Design and Construction Award, presented by Houston Habitat for Humanity to UH Habitat in recognition of the design and construction of the Casas de Esperanza: The Zavaleta Residence at 201 Delmar Street in Houston, Texas
- 1993 Faculty Excellence Award, presented by the University of Houston, College of Architecture
- 1992 Distinguished Service Award, presented by the University of Houston College of Architecture

PROFESSIONAL EXPERIENCE

- 1993- 1999 Lay-Su and Associates, Architects-Engineers, Houston, Texas
- 1988-1989 Tackett.Lodholz Architects, Houston, Texas
- 1987 Center for Environmental Structure-Christopher Alexander, Berkeley, California
- 1982-1984 Middle East Construction Company, Beirut, Lebanon
- 1981-1982 ZAKO General Contractors, Abu Dhabi, United Arab Emirates
- 1980 T.L. Chang and Associates - Architects and Engineers, Taipei, Taiwan

Curriculum Vitae
Revised April 2003
Mark J. Thomasson

EDUCATION

The University of Arizona

Doctor of Philosophy, December 2000

Major: Hydrology

Minor: Soil, Water and Environmental Science, Soil Physics

Directors: Dr. Randy Bassett, Dr. Peter Wierenga

Committee Members: Dr. Paul Ferré, Dr. Shlomo Neuman, Dr. Arthur Warrick, Dr. Jim Yeh

The University of Arizona

Master of Science, August 1997

Major: Hydrology

Director: Dr. Randy Bassett

Committee Members: Dr. Robert MacNish, Dr. Shlomo Neuman

James Madison University

Bachelor of Science, May 1993

Major: Geology

Minor: Environmental and Engineering Geology

PROFESSIONAL POSITIONS

Assistant Professor

Department of Geography and Earth Sciences, The University of North Carolina at Charlotte, August 2002 – Present

Specialty: *Subsurface hydrology*

Postdoctoral Research Associate

Department of Soil and Water Sciences, The University of Arizona, January 2001 – December 2001

Supervisor: Dr. Peter Wierenga

Research Topic: *Flow and transport through the deep unsaturated zone at the field scale*

TEACHING EXPERIENCE

Graduate Committee Member

Donna R. Allen (M.S.)

Hydrological and Biogeochemical Investigations of Riparian Buffers in the Piedmont and Blue Ridge regions of North Carolina

Dept. of Geography and Earth Science, UNC – Charlotte

Current

Assistant Professor

Department of Geography and Earth Sciences, The University of North Carolina at Charlotte, Fall 2002, Fall 2003

GEOL 4145/5155: Applied Hydrogeology

REFEREED PUBLICATIONS, CONFERENCES AND ABSTRACTS

Thomasson, M.J. and Wierenga, P.J. (2003). Spatial Variability of the Effective Retardation Factor in an Unsaturated Field Soil. *Journal of Hydrology, Special Collection*, vol. 272, no. 1-4, p 213-225.

Thomasson, M.J., Wierenga, P.J., Bassett, R.L., and Young, M.H. (1999). Wetting Front Prediction. Presented at the 1999 American Geophysical Union Fall Meeting, December 13-17, San Francisco, CA. *EOS Transactions*, vol. 80, no. 46.

Bassett, R.L. and Thomasson, M.J. (1997). Coupled models and independent constraints. Presented at the 1997 American Geophysical Union Spring Meeting, May 27-30, Boston, MA. *EOS Transactions*, vol. 78, no. 17.

Bassett, R.L. and Thomasson, M.J. (1996). Using a 3-D visualization model and a multicomponent reactive transport code to interpret focused fracture flow at the Apache Leap Research Site, Arizona. Presented at the 1996 Geological Society of America Annual Meeting. *Geological Society of America, Abstracts with Programs*, vol. 28, no. 7.

RESEARCH AND PUBLICATIONS IN PROGRESS

Thomasson, M.J., Wierenga, P.J., and Bassett, R.L. (2003). One-dimensional flow predictions for unsaturated soil with hysteresis at the Maricopa Site in Arizona. (Submitting to *Vadose Zone Journal*.)

Thomasson, M.J. and Wierenga, P.J. (2003). Two-dimensional flow predictions in variably saturated media for the first Las Cruces Trench experiment. (In preparation for *Vadose Zone Journal*.)

Thomasson, M.J. and Wierenga, P.J. (2003). Two-dimensional tritium transport predictions in variably saturated media for the first Las Cruces Trench experiment. (In preparation for *Journal of Contaminant Hydrology*.)

RESEARCH PROJECTS AND FUNDING

Junior Faculty Research Program, University of North Carolina at Charlotte

Estimation of Recharge Beneath Ephemeral-Stream Channels Using Deep-Temperature Profiles
January 2003 – June 2004, Funded, \$5,530

U.S. Geological Survey & Water Resources Research Institute Program

Hydrological and Biogeochemical Investigations of Riparian Buffers in the Piedmont and Blue Ridge regions of North Carolina
2003 – 2004, Funded, \$39,952

CURRICULUM VITAE

DAVID C. WEGGEL

Department of Civil Engineering
The University of North Carolina at Charlotte
9201 University City Boulevard
Phone: (704) 687-6189
Fax: (704) 687-6953
Email: dcweggel@uncc.edu

EDUCATION

- May 1997 The University of Texas at Austin
Ph.D. Civil Engineering
- June 1992 Drexel University
M.S. Civil Engineering
B.S. Civil Engineering
- June 1990 Drexel University
B.S. Architectural Engineering

RECENT RESEARCH TOPICS & PROJECTS

General:

Nonlinear structural analysis techniques / development of wavelet-based signal diagnostics
Dynamics of offshore structures / blast engineering – structural response to extreme loading
Earthquake engineering / structural performance

Experimental Work / Facilities Enhancement (Cal Poly):

Hay Fund solar roof pond project (advisor): shake table model tests of solar roof pond houses subjected to seismic ground motions (externally funded)
Wine barrel rack project (co-adviser): shake table tests of model wine barrel rack systems subjected to seismic ground motions (externally funded); full-scale tests were conducted on UC Berkeley's shake table
Static lateral load tests on wine barrel racks from different manufacturers (externally funded)
Development of a \$20,000 data acquisition system and supporting software (externally funded)
Design and construction of new departmental shake table (materials and labor externally donated)
Calibration of departmental shake table
Rocking of rigid bodies project (advisor): shake table tests of rocking rigid bodies subjected to seismic ground motions

Analytical Work / Numerical Methods:

Wavelet analysis techniques
PEER research: evaluation of strengths and weaknesses in current computer analysis methods for seismic performance (funded by PEER)
Coding of nonlinear dynamics computer program to be used for development of wavelet-based signal diagnostics (funded by Cal Poly State University)
Signal processing
Finite elements / boundary elements

RECENT RESEARCH TOPICS & PROJECTS (continued)

Curriculum Enhancement (Cal Poly):

- Development of ARCE 412, a course entitled “Dynamics of Framed Structures”
- Coding of nonlinear dynamics computer program to be used in ARCE 412 (funded by Cal Poly State University)
- Development of new version of ARCE 351, a course entitled “Structural Computing Analysis I”

Review of Technical Journal and Conference Papers:

- Journal of Applied Ocean Research (JAOR)
- Journal of Structural Engineering (ASCE)
- International Society of Offshore and Polar Engineers (ISOPE)

UNIVERSITY SERVICE (Cal Poly)

- | | |
|------------------------------------|-----------------------------------|
| Facilities Committee, Chair | Research Committee |
| Professional Development Committee | Hearst Visiting Scholar Committee |
| Faculty Affairs Committee | General ARCE Student Advising |
| Senior Project Advisor | |

HONORS & ACTIVITIES

- Drexel University, Student Chapter President and Charter Member National Society of Architectural Engineers (September 1988-September 1989)
- Drexel University, Acting President and Member American Society of Civil Engineers (Summer 1988)
- Member, Chi Epsilon Civil Engineering Honor Society
- Member, American Society of Civil Engineers
- Member, Applied Technology Council
- Member, American Society for Engineering Education

RECENT EXPERIENCE

- | | |
|---------------------------------|---|
| August 2002 - Present | <u>The University of North Carolina at Charlotte, Charlotte, NC</u>
Assistant Professor – Teach structural engineering courses to graduate and undergraduate civil engineering students. Perform experimental and analytical research on a variety of structures and advise graduate students on their research projects. |
| October 2000 - August 2002 | <u>Weidlinger Associates, Inc., New York, NY</u>
Senior Structural Engineer (Blast Engineer) – Designed and retrofitted steel, concrete, and masonry structures and structural components to resist blast and impact loading. Modeled structural components as nonlinear dynamic SDOF and MDOF systems; structural components included walls, beams, columns, slabs, windows, and curtainwall systems. Wrote proposals seeking funding for experimental and analytical research on window and curtainwall systems subjected to blast loading. Designed full-scale test specimens and was involved in experimental research on the behavior of conventionally-designed loading dock slabs retrofitted with composite materials and subjected to blast loading. |
| September 1997 - September 2000 | <u>The California Polytechnic State University, San Luis Obispo, CA</u>
Assistant Professor – Taught structural engineering courses to undergraduate engineering, architecture, and construction management students. Performed numerical research that led to a number of refereed technical publications. Upgraded experimental facilities and performed experimental static and dynamic tests on various structural systems. Served on departmental, college, and university committees. Advised students. |

Jy S. Wu, Ph.D., P.E., P.H.
(CV for IES Doctoral Program Proposal)

Address: Department of Civil Engineering, UNC-Charlotte, Charlotte, NC 28223, jwu@uncc.edu

EDUCATION

B.S. Chemical Engineering, National Taiwan University (1967-1971).

M.S. Environmental Engineering, Asian Institute of Technology (1972-1974).

Ph.D. Chemical Environmental Engineering, Rutgers-State University of New Jersey (1975-1979).

Distinguished Award: John F. Kenney Chair in New Technology and Distinguished Professor (1997-98)

Registered Professional Engineer (P.E.) in Civil Engineering, North Carolina, 1983 (#11327)

Certified Professional Hydrologist (P.H.) by American Institute of Hydrology, 1987 (#671)

Certification: ISO 14000 Awareness, 1998

B.S. Thesis: Stress and Strain Analysis of ABS Resin.

M.S. Thesis: Biological Treatment of Tapioca Starch Wastewater.

Ph.D. Dissertation: Development and Application of a Storm Water Assessment Model.

RESEARCH EXPERIENCE

Selected Publications from Last 5 Years (total publications > 50):

1. *Characterization and Pollutant Loading Estimation for Highway Runoff.* J. of Environmental Engineering, ASCE 124(7):584-592, 1998. (with Craig Allan, Jack Evett, and William Saunders)
2. *Case Study: Regrowth in Two Distribution Systems with High AOC.* Proceedings of AWWA Water Quality Meeting, Texas, 1998 (with D.E. Francisco, F.A. DiGiano, W. Zhang and L. Todd).
3. *Modeling of Immobilized-cell Bioreactor Performance for AOC Removal.* Proceedings of Biofilm Systems, IAWA, New York, Oct. 17-20, 1999. (with S. Nitisravut)
4. *Methanotrophic Activities in Tropical Landfill Cover Soils: Effects of Temperature, Moisture Content and Methane Concentration.* J. of Waste Management and Research, 17:313-323, 1999 (with C. Visvanathan, D. Pokhrel, W. Chiemchaisri and J.P.A. Hettiaratchi).
5. *Reaction Kinetics of Immobilized Cell Denitrification: I Background and Model Development.* J. of Environmental Engineering, ASCE, 127(8):682-688, 2001. (with William Langley and Allen C. Chao).
6. *Reaction Kinetics of Immobilized Cell Denitrification: II Experimental Study* J. of Environmental Engineering, ASCE, 127(8):689-697, 2001. (with William Langley and Allen C. Chao).
7. *Methanotrophic Production of Extracellular Polysaccharide in Landfill Cover Soils.* WS&T, 43(6):151-159, 2001. (with W. Chiemchaisri and C. Visvanathan).
8. *Biological Activities of Methane Oxidation in Tropical Landfill Cover Soils.* J. of Solid Waste Technology and Management, 27(2):97-104, 2001. (with W. Chiemchaisri and C. Visvanathan).
9. *Effects of Trace Volatile Organic Compounds on Methane Oxidation.* Brazilian Archives of Biology and Technology, 44(2):135-140, 2001. (with W. Chiemchaisri and C. Visvanathan).
10. *Artificial Neural Networks for Predicting Flood Stages in Urban Streams.* In: Proceedings Hydrologic Extremes: Challenges for Science and Management, 2002. (with Jun Han and Mark Senior)
11. *Artificial Neural Networks for Forecasting Urban Watershed Runoff and Stream Flows.* Submitted to J. of Hydrologic Engineering, ASCE. (with Jun Han, Shastri Annambhotla, and Scott Bryan)

Externally Funded Research (Selected from 2 millions worth of external grants):

1. "Removal of Organic Residuals in Drinking Water With Entrapped Microbial Technology," P.I. November 1992-October 1995. US Environmental Protection Agency (\$150,000)
2. Monitoring and Statistical Modeling of North Carolina Highway Runoff," P.I. (co-PI: C. Allan and J. Evett), July 1994-May 1996. Center for Transportation and the Environment, NCSU (\$197,422)
3. "Dynamics of Bacterial Regrowth in Water Distribution Systems," P.I., January-June 1997 NC WRRRI-subcontract through UNC-Chapel Hill (\$5,000)
4. "Sampling and Testing of Stormwater Runoff from North Carolina Highways," P.I. (co-PI: C. Allan and J. Evett), October 1, 1998-June 30, 2001. Institute of Transportation Research and Education (\$303,623)

5. "GIS Coverage for Roadway and Sensitive Waters," P.I. January 15, 2002–September 15, 2002, NC Department of Transportation (\$20,000)
6. "Evaluation and Implementation of BMPs for NCDOT's Highway and Industrial Facilities," P.I. (co-PI: C. Allan). July 1, 2002 – December 30, 2004. Institute of Transportation Research and Education (\$224,914)
7. "A Feasibility Study for Developing Real-Time Storm Prediction System," P.I., July 1, 2001 – June 30, 2003. NC WRRRI (\$20,000)
8. "Hydrological and Biogeochemical Investigations of Riparian Buffers in the Piedmont and Blue Ridge Regions of North Carolina." Co-PI (PI: Dr. Craig Allan), July 1, 2002 – July 30, 2003 NC WRRRI (\$39,952)

Other Research Experience/training received:

- 2001- Pre-world Congress Workshop on Disaster Reduction, Reston, Virginia.
- 2001- Water Security Conference, Connecticut.
- 2002- GIS Training Course, RTI, Raleigh.
- 2002- Use of Nexrad Rainfall in Hydrology, Houston, TX
- 2002- Mitigating Severe Weather Impacts in Urban Areas, Houston, TX.
- 2003- RAM-Wsm – Risk Assessment Methodology for Water, Haestad, Charlotte, N.C.

TEACHING EXPERIENCE

Graduate Director and Professor: UNC-Charlotte
 Adjunct Professor: Civil Engineering Department, NCSU
 External Expert and Adjunct Faculty: AIT

Graduate Level Courses Taught at UNC-Charlotte

1. Disaster reduction Engineering
2. Watershed Analysis
3. Stormwater Modeling
4. Advanced Groundwater Analysis-Bioremediation
5. Risk and Reliability Analysis
6. Water Quality Modeling/TMDL

Graduate Level Courses Taught at other Institutions

1. Sludge Management (National University of Singapore)
2. Water Quality Modeling (Asian Institute of Technology)
3. Hazardous Waste Management (National University of Singapore)

Direction of Graduate Student Research

1. Directed more than 50 MS thesis/project research at UNC-Charlotte.
2. Directed 3 doctoral student, as major research advisor and co-chairman, through the inter-institutional Ph.D program with NCSU:
William Langley, 1996. "Denitrification of Groundwater Using Entrapped Microbial Immobilization Technolog". NCSU.
S. Nitisoravut, 1997. "Removal of Assimilable Organic Carbon in Drinking Water Using Immobilized-Cell Bioreactors". NCSU.
Jun Han, 2002. "Development of Near Real-Time Flood Warning Systems". NCSU.
3. Co-direction of doctoral students at another Institute
Wilai Chiemchaisri, 2000. "Methanotrophic Activity in Tropical Landfill Cover Soil", AIT.
Kwannate Manoonpong, in progress. "EPS in Wastewater Treatment Systems". AIT.
4. Direction of doctoral students UNC-Charlotte
Qianhong Tang, in progress, doctoral student with Public Policy doctoral program, Major Advisor.
Roger I. Blue, in progress, doctoral student of Electrical Engineering, Graduate Faculty Representative.

BIOGRAPHICAL SKETCH

WEI-NING XIANG

Professor, Department of Geography and Earth Sciences, University of North Carolina at Charlotte, Charlotte, NC 28223, USA (704)687-4247, wxiang@email.uncc.edu

1. EDUCATION

Postdoctoral Fellow, 1990, Institute of Urban and Regional Development, University of California at Berkeley

PhD (City and Regional Planning), 1989, University of California at Berkeley

MRP (Regional Planning), 1986, University of Massachusetts at Amherst

BS (Geography), 1982, Beijing Normal University, Beijing, China

2. ACADEMIC POSITIONS

Department of Geography and Earth Sciences, University of North Carolina at Charlotte

Professor, July 2001 to present

Associate Professor, July 1996 to June 2001

Assistant Professor, August 1990 to June 1996

National Center for Geographic Information and Analysis, Department of Geography, University of California at Santa Barbara

Visiting professor and visiting research scientist, January 2002 to June 2002

3. SELECTED PUBLICATIONS

Diao, Y., Xiang, W. -N. (2002). Button Design for Map Overlays: 2. Environment and Planning B: Planning and Design, 29(5), pp.673 – 685

Xiang, W. -N. (2001). Weighting-by-Choosing: A Weight Elicitation Method for Map Overlays. Landscape and Urban Planning, 56, 61-73

Xiang, W. -N., Salmon, F.W. (2001). Button Design for Weighted Map Overlays. Environment and Planning B: Planning and Design, 28(5), 655-670.

Xiang, W. -N. (2000). A Theoretical Framework for Weight Value Set Construction in Land Suitability Assessment. Environment and Planning B: Planning and Design, 27(4), 599-614.

Xiang, W. -N. (1998). Assessment of the Buffer-Induced Setback Effects on Riparian Scenic Quality by Digital Tools. Environment and Planning B: Planning and Design, (25)6, pp.881-894.

Xiang, W. -N. (1997). Knowledge-Based Decision Support by CRITIC. Environment and Planning B: Planning and Design, (24)1, pp.69-79.

Xiang, W. -N. (1996a). A GIS Based Method for Trail Alignment Planning. Landscape and Urban Planning, 35(1), pp.11-23.

- Xiang, W. -N. (1996b). Making Better, Quicker, and Wiser Decisions with a Decision Facilitating and Advising System. Environment and Planning B: Planning and Design, 23(4), pp.401-419.
- Xiang, W. -N. (1996c). GIS-Based Riparian Buffer Analysis: Injecting Geographic Information Into Landscape Planning. Landscape and Urban Planning, 34(1), pp.1-10.
- Xiang, W. -N., Stratton, W.L. (1996). The *b*-Function and Variable Stream Buffer Mapping: A Note on "A GIS Method for Riparian Water Quality Buffer Generation". International Journal of Geographical Information Systems, 10(4), pp.499-510.
- Xiang, W. -N. and Whitley, D.L. (1994). Weighting Land Suitability Factors by the PLUS Method. Environment and Planning B: Planning and Design, 21(3), pp.273-304.
- Xiang, W. -N. (1993a). A GIS Method for Riparian Water Quality Buffer Generation. International Journal of Geographical Information Systems, 7(1), pp.57-70.
- Xiang, W. -N. (1993b). Application of a GIS-Based Stream Buffer Generation Model to Environmental Policy Evaluation. Environmental Management: An International Journal for Decision Makers, Scientists, and Environmental Auditors, 17(6), p.817-827.
- Xiang, W. -N. (1993c). A GIS/MMP Based Coordination Model and its Application to Distributed Environmental Planning. Environment and Planning B: Planning and Design, 20(2), pp.195-220.
- Xiang, W. -N., Gross, M., Fabos, J.G., MacDougall, E.B. (1992). A Fuzzy Group Multicriteria Decision Making Model and its Application to Land Use Planning. Environment and Planning B: Planning and Design, 19(1), pp.61-84.

4. SELECTED FUNDED PROJECTS

- 2001 UCAC Plan for University City, North Carolina
- 2000 A Preliminary Assessment of Greenway Potentials for the City of Concord, North Carolina
- 1998 A County-Wide Demography, Employment, and Land Development (DELD) Information and Simulation System, Mecklenburg County, North Carolina
- 1997 Development of A GIS Based Economic Development Information System (EDIS) for the 10 Business Districts, Charlotte, North Carolina
- 1995 GIS-Based Economic Development Analysis for Comprehensive Land Use Planning for the City of Concord, North Carolina
- 1994 Development of a GIS-Based Model for Water Quality Buffer Analysis in the Mountain Island Lake Watershed, Mecklenburg County, North Carolina
- 1992 Application of a GIS-Based Planning Support System to Land Use Plan Generation and Evaluation for the City of Concord, North Carolina

5. BOARD MEMBERS

Member, the Editorial Board, Environment and Planning B: Planning and Design

David T. Young, Ph.D., P.E.

EDUCATION

Clemson University	Civil Eng.	BSCE	1974
Clemson University	Civil Eng.	M.Sc.	1979
Virginia Polytechnic Institute & State University	Civil Eng.	Ph.D.	1985

RESEARCH EXPERIENCE

Publications (representative list from 32 in last 5 years and 57 overall)

- Inyang, H.I., Galvao, T.C., and Young D.T., "Integrating Hazards Control into Sustainable Development Plans," a Special Issue on Natural Hazards and Civil Infrastructure Systems for the Natural Hazards Review, American Society of Civil Engineers, May, 2003, Vol. 4, No.2, pp. 57-58.
- P.R. Salom, J. Gergely, and D.T. Young, "*Torsional Strengthening of Spandrel Beams with FRP Laminates*," Journal of Composites for Construction, ASCE, New York, NY, accepted, April, 2003
- P.R. Salom, J. Gergely, and D.T. Young, "*Torsional Retrofit of Spandrel Beams with Advanced Composite Laminates*," Journal of Structures and Buildings, The Institution of Engineers, London England, accepted, April, 2003
- D. Young, "*Results of Phase II Load Testing on Insulated Wall Panels*," Research Project Report for W.A. Brown and Son, Inc., December 12, 2002.
- Vandergrift, J., Gergely, J. and Young, D.T., "CFRP Retrofit of Masonry Walls," Proceedings of the 3rd International Conference on Composites in Construction, San Francisco, CA, June 10-12, 2002.
- Beigay, M., Young, D.T., Gergely, J., "Composite Wall Anchors, Proceedings of the Conference on Advanced Polymer Composites for Structural Applications in Construction, April 15-17, 2002, The University of Southampton, Southampton, England, Vol. I, No. 5.1, pp. 283-290.
- "Gergely, J. and Young, D.T., "Masonry Wall Retrofitted with CFRP Materials," Proceedings of the 2001 International Conference on Composites in Construction, University of Porto, Porto, Portugal, October 10-12, 2001, pp. 565-569.
- "Gergely, J. and Young, D.T., "In-plane and Out-of-Plane Behavior of Unreinforced CMU Walls Retrofitted with Composites," Proceedings of the 2001 Second International Conference on Engineering Materials, August, 16-19, 2001, San Jose, CA., Vol. II, No. 117, pp. 465-471.
- Young, D.T., "Report on Load-Deformation Research and Testing of N-DEC Underdrain," Research Report CE-NSW01/00, Department of Civil Engineering, UNC Charlotte, NC, submitted to NSW Corporation, Roanoke, VA, May 17, 2000.
- Hooks, J.L., Alchaar, N., Gergely, J., Young, D.T., "Composite Retrofit of Unreinforced CMU Walls," Proceedings for the Conference on Advancing with Composites, Milan, Italy, May 9-11, 2000, pp.327-332.
- Gergely, J., Hooks, J., Alchaar, N., and Young, D., "Composite Retrofit of Unreinforced Masonry Walls," Proceedings of SSRS-2 Conference, Fullerton, CA, March, 2000.
- Hanks, D.K. and Young, D.T., "Accelerated Testing and Mitigation of ASR Using Class F Flyash," Proceedings of the Fourth CANMET/ACI Conference on Durability of Concrete, Sydney, Australia, August, 17-22, 1997.

Research Grants (representative list from 19 during last 5 years and 34 overall)

- “Evaluation of Building Panel Systems,” W.A. Brown and Son, Salisbury, NC, 1997-2003. (several projects totaling ~ \$130,000)
- “Retrofit Using Structural Composites,” Edge Structural Composites, Richmond, CA, 1999-2002, (co-PI with Janos Gergely). (several projects totaling ~ \$45,000)
- “Research and Testing of Plastic Pallets,” NSW Corp., Roanoke, VA, 1999. (\$22,000)
- “Geotechnical Services,” Law Engineering Co., Charlotte, NC, 1997 (\$28,800)
- "Integration of Communication and Design Throughout the CE Curriculum," UNC-Charlotte API Grant, 1996-1997. (\$30,400)
- "Determination of Material Properties of New Gas Line Expansion Joint Materials," Duke Power Co., Charlotte, N.C., 1991. (\$30,000)
- "Upgrade of Existing UTM Machine," NSF ILI Program, May, 1990. (co-PI with Richard Wolny). (\$40,000)
- "Effects of Chloramine Related Corrosion on Distribution System Materials," American Water Works Association, May, 1989 (co-PI with S. Reiber).(\$101,340)
- "Establishment of UNCC as a Site for Undergraduate Research in Civil Engineering," NSF REU Program, December, 1987. (\$40,000)

TEACHING EXPERIENCE (graduate courses taught, 18 years at UNC Charlotte)

- | | |
|--|-----------------------------------|
| • Reinforced Concrete Design II | Prestressed Concrete Design |
| • Design of Masonry Structures | Advanced Structural Analysis |
| • Matrix Methods of Structural Analysis | Finite Element Analysis |
| • Structural Dynamics | Structural Optimization |
| • Analysis of Plates and Shells | Structural Failure Investigations |
| • Disaster Reduction Engineering (Team Taught) | Fracture Mechanics |

EXPERIENCE DIRECTING GRADUATE STUDENT RESEARCH

Master’s Theses Directed (representative list from total of 25)

- Preddy, W.L., “Evaluation of Structural Insulated Panels,” Graduated, May, 2003.
- Jason Vigil, “Determination of Lateral-Torsional Buckling Forces,” Graduated May, 2001.
- Arp, Dean, “Formulation and Development of Tables for the Axial Design Strength of Eccentrically Loaded Single Angle Struts,” Graduated May, 1999.
- Duke, Nancy, “Statistical Analysis of High Strength Concrete Compressive Strength Data,” Graduated May, 1996.
- Fazleabas, Hussein, "Optimum Design of Loadbearing and Non-Loadbearing Concrete Masonry Walls," Graduated May, 1993.
- Wang, Jingye, "Effect of Tendon Debonding on Transverse Tensile Stresses in Pretensioned Concrete Girders," Graduated December, 1991.
- Walden, Gregory, "The Effect of Compaction Energy on the Strength of Roller-Compacted," Graduated May, 1990.
- Soltan, Eyad, "Optimum Design of Load-bearing and Non-Load-bearing Masonry Walls," Graduated May, 1989.
- Dehdasht, Abdolnaby H., "A Finite Element Analysis of Composite Masonry Walls Having Openings," Graduated May, 1988.
- Saba, Elie B., "Optimization of Bolted Timber Joints," Graduated December, 1987.

Appendix III

Internal Letters of Support

From Departments and Colleges at UNC Charlotte
affiliated with the INES Ph.D. Proposal

Several departments and colleges at UNC Charlotte have expressed a desire and interest to support the INES Ph.D. Program. Letters of support from those units are included in this appendix.

CONSULTATION WITH LIBRARY FOR PROGRAM PROPOSAL

Date of initiation of consultation with Library: August 29, 2002

Subject Librarian's evaluation of holdings:

Proposal: Infrastructure and Environmental Systems PhD

Evaluator: Dawn Hubbs, Joanne Klein Date: September 9, 2002

Check one:

- (1) Holdings are superior _____
- (2) Holdings are adequate _____
- (3) Holdings are adequate only if department purchases additional holdings x
- (4) Holdings are inadequate _____

Comments:

The library collection is for the most part adequate to establish the doctoral program in Infrastructure and Environmental Systems. Some additional resources are needed; particularly journal subscriptions, and the collection will need to be developed as the program progresses. The library collection has many strengths, also, to support the program.

The most important component of a library supporting a doctoral program is its journal collection. A search of the 2000 Journal Citation Reports, Science Edition, in the categories of Environmental Science, Ecology, Geography, Geology, Interdisciplinary Geosciences, Limnology, Mineralogy, Remote Sensing, Transportation, and Water Resources, indicated that the library has access, either in print or electronic format, to approximately 50% of the titles listed, including over 50% of the top 100 titles ranked by 2000 Total Cites. The library has access to approximately 55% of the Environmental Science category (attached, AppendixTable 2). Frequently-cited journal titles currently held include *Environmental Science and Technology*, *Chemosphere*, *Water Research*, *Bulletin of Environmental Contamination and Toxicology*. Other representative journals held include *Journal of Environmental Systems*, *International Journal of Rock Mechanics and Mining Sciences*, *Geochimica et Cosmochimica Acta*. However, collection strengths are uneven. The library has access, either in print or electronic format, to 65% of the titles GeoRef, a major geosciences index, classifies as "priority." However, it subscribes, in any format, to only 33% of the Core or Priority titles indexed by Pollution Abstracts. A list of titles (with prices)

(submitted by faculty in participating departments) of additional journal titles necessary for the program is in the budget section of this analysis as Table 1.

Among the library's strengths are its electronic resources. The library has access to over 11,000 electronic journal titles in all subject areas. It has electronic access to the majority of indexes supporting the field:

Cambridge Scientific Abstracts: GeoRef; Environmental Sciences and Pollution Management (subfiles include Pollution Abstracts, Ecology Abstracts, Water Resources Abstracts, Environmental Engineering Abstracts, Risk Abstracts)

Engineering Village: Compendex (Engineering Index)

World Cat

Applied Science and Technology Index

SciFinder Scholar (Chemical Abstracts)

GEOBASE (Geography, Ecology, Earth Sciences)

Diss (Dissertations)

Web of Science (Science Citation Index)

Science Direct (Elsevier)

In addition, the library has free access to several relevant federally-sponsored indexes: Agricola, TRIS, NTIS, Medline.

The library's monographs collection in relevant subject areas (Appendix Tables 3 and 4, attached) was compared to other libraries supporting similar programs: UC Berkeley, University of Wisconsin, University of Massachusetts, Yale, Clarkson, and UC Riverside, both the total collection and additions to the collection since 1995. UNC Charlotte lags significantly behind the larger institutions of UC Berkeley, Wisconsin, Yale (Massachusetts to a lesser extent), but is either ahead or close to Clarkson and UC Riverside. It is recommended that additional funds be allocated to supplement the existing monograph allocation.

Other areas of strength in the library in support of the Infrastructure and Environmental Systems program include the federal documents depository collection, which is very strong in Environmental Protection Agency and Department of the Interior (environmental, water, geological resources) publications. The library has a large map collection, including USGS topographic quadrangles, another strength.

Budget:

As is to be expected, since the journal literature is the primary research resource for any science research program, additional journal titles will be needed. Specifically identified titles and approximate prices are:

TABLE 1			
Title	Print	Online only	Print & Online
Environmental Monitoring & Assessment	\$2,390.	\$2,390.00	\$2,868.00
Soil & Sediment Contamination	\$ 695.	\$ 695.99	\$ 765.00
Waste Management and Research	\$ 399.	\$ 359.00	\$ 438.20
International Journal of Surface Mining & Reclamation			
Environmental Engineering Science	\$ 529.	\$ 505.00	\$ 629.00
Geotechnique	\$ 479.	\$	\$ 479.00
Journal of Colloid and Interface Science	\$3,407.	\$4,493.	\$5,617.00
Industrial & Engineering Chemistry Research	\$1,445.	\$1,517.	NA
Clays and Clay Minerals	\$ 235	NA	NA
Journal of Environmental Quality	\$ 204	\$ 204	\$ 225
Water Air and Soil Pollution	\$3,707	\$3,707	\$4,448
Global Biogeochemical Cycles	\$528	\$ 487	\$ 727
Environmental Geochemistry and Health	\$ 588		\$ 705
Biogeochemistry	\$1,539	\$1,539	\$1,846
Hydrology and Earth System Sciences	\$ 426	NA	NA
Ground Water Monitoring and Remediation	\$ 92	NA	NA
Journal of Chemical Ecology	\$1,447	\$1,447	\$1,736
Journal of Range Management	\$ 140	NA	NA
Global Change Biology	\$ 948	\$ 854	\$1,042
Environmental Toxicology and Chemistry	\$ 810	\$ 755	\$ 930
Environmental Research	\$1,635	\$2,194	\$2,743
Journal of Atmospheric Chemistry	\$ 914	\$ 914	
Environmental Progress	\$ 275	NA	NA
Hydrological Processes	\$2,585		
Environment and Development Economics	\$ 186		
Environment, Development and Sustainability	\$ 263		
Environmental and Waste Management			
Environmental Pollution and Control			
Remediation	\$ 524	\$ 499	\$ 523

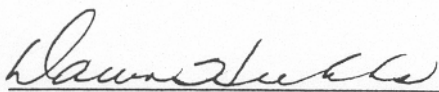
The approximate total for the above, print and online access, is \$35,000. Because of the high rate of inflation for scientific journals the library recommends spending only 60% of the first years' allocation on continuing obligations, and the fact that other titles will be identified as the program develops, we recommend an allocation of \$60,000 for new journal titles.

As mentioned above, the monographs collection is not at par with similar programs at other institutions. A search was conducted of the amount of publishing in specific areas of the 2001/2002 all publishers approval plan through Blackwell. The areas covered were Environmental Engineering, Environmental Studies, Hydrology, Sedimentology, Land and Land Use, Water Conservation, and Sanitary Engineering. The total for the above categories for 2001/2002 was \$35,754. Because not all titles would be appropriate, an estimated \$20,000/year allocation is requested to improve the monographs collection.

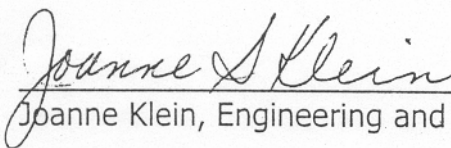
Many government-sponsored environmental reports are published by the National Technical Information Service. An estimated \$2,000/year is requested to purchase relevant NTIS reports.

Another area of supplementation is a small amount of funding to purchase dissertations (especially after the third year of the program) and provide some document delivery for material not obtainable through Interlibrary Loan. An estimated cost for dissertations and document delivery is \$1,000 to \$1,500/year.

Library Materials Funding Request Summary	
Journal Subscriptions	\$60,000 (\$35,000 first year)
Monographs	\$20,000
NTIS Reports	\$ 2,000
Dissertations/Document Delivery	\$ 1,500
TOTAL	\$83,500



Dawn Hubbs, Geography and Earth Sciences Liaison



Joanne Klein, Engineering and Information Technology Liaison

APPENDICES

TABLE 2 Journal Citation Reports 2000 Science Edition, Environmental Science Category

Library owns the following

SPV 98-	STOCHASTIC ENVIRONMENTAL RESEARCH AND RISK ASSESSMENT
SPV 97-	INTERNATIONAL JOURNAL OF BIOMETEOROLOGY
SPV 96-	RADIATION AND ENVIRONMENTAL BIOPHYSICS
SPV 1997-	ARCHIVES OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY
SPV 1996-	BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY
SciDir Abstr	WATER SCIENCE AND TECHNOLOGY
SciD 95-	SCIENCE OF THE TOTAL ENVIRONMENT
SciD 95-	MARINE POLLUTION BULLETIN
SciD 95-	JOURNAL OF AEROSOL SCIENCE
SciD 95-	MARINE ENVIRONMENTAL RESEARCH
SciD 95-	JOURNAL OF CONTAMINANT HYDROLOGY
SciD 95-	JOURNAL OF HAZARDOUS MATERIALS
SciD 95-	INTERNATIONAL BIODETERIORATION & BIODEGRADATION
SciD 95-	WASTE MANAGEMENT
SciD 95-	RESOURCES CONSERVATION AND RECYCLING
SciD 1996-	ENVIRONMENTAL TOXICOLOGY
SciD 1996-	ENVIRONMENTAL TOXICOLOGY AND PHARMACOLOGY
SciD 1995-	ATMOSPHERIC ENVIRONMENT
SciD 1995-	CHEMOSPHERE
SciD 1995-	ENVIRONMENTAL POLLUTION
SciD 1995-	AGRICULTURE ECOSYSTEMS & ENVIRONMENT
SciD 1995-	ECOLOGICAL ECONOMICS
SciD 1995-	ENVIRONMENT INTERNATIONAL
SciD 1995-	ENVIRONMENTAL AND EXPERIMENTAL BOTANY
SciD 1995-	ENERGY POLICY
SciD 1995-	ECOLOGICAL ENGINEERING
SciD 1995-	GLOBAL ENVIRONMENTAL CHANGE-HUMAN AND POLICY DIMENSIONS
ProQ 1993-	AIHAJ
P; SPV 97-	ENVIRONMENTAL MANAGEMENT
P; SPV 96-	ENVIRONMENTAL GEOLOGY
P; SciD 95-	WATER RESEARCH
P; SciD 95-	REMOTE SENSING OF ENVIRONMENT
P; InfT 01-	JOURNAL OF THE AIR & WASTE MANAGEMENT ASSOCIATION
P; Elec	ENVIRONMENT
P; Ebsco	JOURNAL OF ENVIRONMENTAL ENGINEERING-ASCE
P; ACS 96-	ENVIRONMENTAL SCIENCE & TECHNOLOGY
P, InfT 2001-	ARCTIC
P 68-95; SciD 1995-	BIOLOGICAL CONSERVATION
P 1997-	CLIMATIC CHANGE
P 1987-; CW 1999-	COASTAL MANAGEMENT
P	WATER RESOURCES RESEARCH

P	CONSERVATION BIOLOGY
P	WATER ENVIRONMENT RESEARCH
P	WETLANDS
P	JOURNAL OF ENVIRONMENTAL MANAGEMENT
InfT 1999-	ENVIRONMENTAL TECHNOLOGY
InfT 1996-	ALTERNATIVES JOURNAL
Elec	ARCHIVES OF ENVIRONMENTAL HEALTH
Elec	JOURNAL OF ENVIRONMENTAL HEALTH
Elec	POLLUTION ENGINEERING
Ebsco 99-	GEOMICROBIOLOGY JOURNAL
Ebsco 98-	JOURNAL OF TOXICOLOGY AND ENVIRONMENTAL HEALTH-PART A
Ebsco 98-	INTERNATIONAL JOURNAL OF ENVIRONMENTAL HEALTH RESEARCH
Ebsco 98-	JOURNAL OF TOXICOLOGY AND ENVIRONMENTAL HEALTH-PART B-CRITICAL REVIEWS
Docs, elec	ENVIRONMENTAL HEALTH PERSPECTIVES

TABLE 3: Monograph Collections –additions since 1995

<u>LC Subject</u> <u>Heading</u>	<u>UNCC</u>	<u>UC</u> <u>Berkeley</u>	<u>U.</u> <u>Wisconsin</u>	<u>U.</u> <u>Mass.</u>	<u>Yale</u>	<u>Clarkson</u>	<u>UC</u> <u>Riverside</u>
Air Quality	194	233	426	285	272	143	247
Air Quality Management	104	148	256	155	168	88	137
Bridges – Design and Construction	17	74	106	12	7	32	8
City Planning	496	2058	916	422	1394	26	441
Geographic Information Systems	120	288	571	166	279	28	166
Hazardous Waste Sites	48	101	255	98	98	59	76
Hazardous Wastes Stabilization	2	3	3	2	1	0	2
Hydrology	141	156	517	143	246	118	186
Infrastructure Economics	98	301	303	127	222	40	114
Land Use	772	1316	2375	1061	996	104	485
Municipal Finance	11	83	67	16	73	3	11
Public Works	28	107	123	38	116	179	31
Sociology Urban	50	266	178	77	348	6	111
Soil	46	77	136	82	54	46	87

Remediation							
Structural Failures	3	15	13	5	4	5	3
Sustainable Development	345	1545	1503	609	1381	81	628
Transportation Planning	26	133	299	12	131	84	3
Urban Ecology	41	188	123	66	152	5	69
Urban Policy	123	730	503	142	492	50	164
Urban Transportation	88	139	184	92	111	35	78
Water Quality	971	365	1751	980	1226	674	1207
Water Quality Bioassay	8	12	23	14	16	4	16
Water Resources Development	252	479	627	377	470	125	388
Water Supply Engineering	6	7	36	6	33	7	10
Watershed Management	109	185	456	146	218	70	106
Total	4099	9009	11750	5133	8508	2012	4774

Additions to Collections since 1995

<u>LC Subject Heading</u>	<u>UNCC</u>	<u>UC Berkeley</u>	<u>U. Wisconsin</u>	<u>U. Mass.</u>	<u>Yale</u>	<u>Clarkson</u>	<u>UC Riverside</u>
	759	881	1547	1128	928	346	1026
Air Quality Management	406	521	860	602	522	193	568
Bridges – Design and Construction	65	293	407	76	242	87	44
City Planning	2677	15890	6427	4161	7978	154	3061
Geographic Information Systems	197	433	935	257	367	53	289
Hazardous Waste Sites	397	516	1083	816	557	265	653
Hazardous Wastes Stabilization	2	4	4	2	1	9	2
Hydrology	876	1834	2730	1067	1450	592	1136

Infrastructure Economics	236	723	728	385	520	93	315
Land Use	2549	9323	9991	4221	5041	332	2668
Municipal Finance	118	805	638	315	843	25	178
Public Works	216	2151	1687	816	2149	760	377
Sociology Urban	296	1047	898	448	972	20	442
Soil Remediation	118	99	207	172	78	108	169
Structural Failures	30	58	61	38	27	24	24
Sustainable Development	465	1987	1961	904	1740	122	841
Transportation Planning	284	778	1366	215	520	276	163
Urban Ecology	92	487	311	155	299	13	137
Urban Policy	440	3857	1685	658	1512	223	593
Urban Transportation	652	826	1207	756	722	333	510
Water Quality	3080	2230	7429	4081	3912	2177	3974
Water Quality Bioassay	56	67	153	95	81	31	93
Water Resources Development	1158	3362	4346	3362	2720	522	2468
Water Supply Engineering	65	25	415	115	207	64	77
Watershed Management	288	520	1103	447	512	150	263
Total	15522	48717	48179	25292	33900	6972	20071

Collection Total




UNC CHARLOTTE

The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Memorandum

College of Architecture
704/687-4841
FAX: 704/687-3353

To: Tom Reynolds, Dean of the Graduate School
From: Ken Lambla, Dean 
Re: Proposal to establish a Ph.D. in Infrastructure and Environmental Systems
Date: April 18, 2003

I am writing to provide my strong endorsement and support for the proposal to establish a **Ph.D. program in Infrastructure and Environmental Systems** as outlined in your document dated April 1, 2003 revision.

This program is especially important to the College of Architecture for two reasons. Firstly, this program pushes forward the University's expertise in these subjects in support of our goals in "Urban and Regional Development" but also, even more importantly, in terms of a science and design-based expertise in helping direct natural and public resources. Secondly, this proposal provides a landmark programmatic connection between engineering and architecture that is the result of many year of collaboration and shared interested.

I note in particular the educational objective I.B that cites, "To provide opportunities for UNC Charlotte faculty to collaborate across artificial disciplinary boundaries in the delivery of advanced-level education and research opportunities to support sustainable development in North Carolina and beyond." Also, in justifying the program (Section II.A – Program Basis) we will capitalize on the rapidly growing Charlotte region as a laboratory for research programs that address infrastructure and environmental systems design as they pertain to rapidly growing urban center. These objectives are completely consistent with many initiatives within the College of Architecture Academic Plan, especially in the context of our work at the "Charlotte Community Design Studio," our hosting of the "Mayors' Institutes on City Design – South," our initiatives to create a regional "Sustainability Plan" and our work in collaborating with the "Community SUPPORT Project." Likewise, this program would enhance our ability to provide a graduate program concentrations in both "Urbanism" and "Building Technology" as have been recently adopted by college faculty. In fact, of the courses listed in your proposal under III.D.2 (Focus Areas), "Focus Area 1: Infrastructure and Environmental Systems Design," we might in the future consider including two courses being taught which describe the linkage between design and public policy initiatives in the context of urban development.

I thank you for your effort to design this program in an inclusive manner and inform you that I will include this in the College of Architecture Academic Plan to indicate the range of collaborative programs. Please let me know if I can be of further assistance.

cc: David T. Young, College of Engineering
Lee Gray, Interim Chair of Instruction



College of Arts and Sciences
Office of the Dean
Telephone: (704) 687-4303

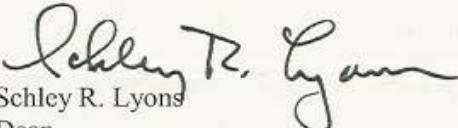
March 28, 2003

Dr. John Bender
Department of Geography and
Earth Sciences
UNC Charlotte

Dear John:

I endorse and support the revised Infrastructure and Environmental Systems Ph.D. proposal. It addresses important and contemporary national problems from a multi-discipline perspective, an approach that is gaining support among professionals focused on refurbishing the nation's older urban areas. My understanding is that the Colleges of Arts and Sciences and Engineering are expected to collectively authorize the employment of five new faculty members over a span of three years after the Ph.D. is approved for implementation. I endorse and support the above request for resources and will collaborate with the Dean of Engineering to make this resource request a reality.

Sincerely,


Schley R. Lyons
Dean

SRL/kag



UNC CHARLOTTE
THE BELK COLLEGE
OF BUSINESS ADMINISTRATION
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

April 10, 2003

Office of the Dean
704/687-2165
Fax: 704-687-4014

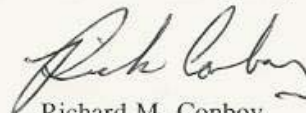
Dr. David Young
Chairperson
Department of Engineering
UNC Charlotte
9201 University City Boulevard
Charlotte, NC 28223

Dear Dave:

Thanks for reviewing the Ph.D. IES proposal with me and helping me understand better what The Belk College of Business Administration's role might be in the program. As I indicated, while we are not in a position to develop any new courses to support the program, it would be feasible for some students from the IES program to enroll in a limited number of existing MBAD courses in the MBA program. As we discussed, those students would typically have some educational background in business or economics, and would meet, to the MBA Director's satisfaction, prerequisites, or reasonable surrogates for prerequisites, for the courses.

Congratulations to you and John on an excellent proposal. I am delighted to add my support.

Best Personal Regards,



Richard M. Conboy
Associate Dean



THE WILLIAM STATES LEE
COLLEGE OF ENGINEERING

Office of the Dean
704/687-2628
Fax: 704/687-2352

March 20, 2003

Dr. Wayne Walcott
Interim Provost
UNC Charlotte

Dear Dr. Walcott:

I fully support the proposed interdisciplinary Ph.D. program in Infrastructure and Environmental Systems. This program provides a unique format in which to build on our tradition and experience with innovative interdisciplinary programs. The proposal makes a clear case for the emerging need and will place UNC Charlotte as a leader in this field. We have been steadily building our faculty strength in this area during the past several years, and we now have 13 faculty members in the Department of Civil Engineering who would be participating in this interdisciplinary program with colleagues from across campus. We also have a faculty member in the Engineering Management Program who is engaged with this Ph.D. program.

We are currently searching for an additional faculty member within the CE Department for the proposed degree program and one in Engineering Management who would likely also be involved as we anticipate rapid growth of this field. As enrollments continue to grow and the proposed Ph.D. program adds new students, I anticipate recruiting additional faculty in this field. We will present our requests for new faculty for this program within the framework of the normal university allocation process. As always, any request will be based on our strategic initiatives and enrollment trends. Based on current indicators, I anticipate that during the next several years we would like pursue two additional faculty members who would be directly participating in the proposed program.

Equipment allocations will also follow usual university procedures. The college request will be ranked in priority order as required by Academic Affairs at the appropriate time. This process has served the equipment needs of the college well and I anticipate that the proposed program can be accommodated in a similar fashion.

Sincerely,

Robert B. Johnson
Dean

/pb

Memo

To: John Bender, Department of Geography and Earth Sciences

From: Mark Clemens, Chair Department of Biology

Date: 4/7/2003

Re: Infrastructure and Environmental Systems proposal



The Biology department strongly supports the IES proposal being submitted for consideration. The program takes advantage of many of the unique interdisciplinary opportunities available at UNC Charlotte and, in particular, the involvement of Biology is consistent with our efforts to strengthen the environmental biology section of our department. I look forward to continue working with you on the implementation of this excellent program in the near future.



To: Drs. John Bender and David Young
IES Ph.D. Proposal Group

From: Dr. Tom DuBois, Chair &
Charles H. Stone Professor
Department of Chemistry

Date: April 4, 2003

Re: IES Ph.D. Proposal

As you are aware the Chemistry Department has participated in the planning of this proposal and supports the establishment of an Inter-Disciplinary Ph.D. Program in Infrastructure and Environmental Systems at UNC Charlotte. The planned interdisciplinary approach provides a broad yet focused programmatic approach. The Department expects that a number of its faculty and students will participate in the program. Students completing their degree work in this program should be well prepared to serve as team members or as team leaders in solving problems related to infrastructure and the environment. As individuals and institutions become increasingly aware of the interplay of infrastructure, environment and local/regional economies, individuals having degrees of type will be sought by informed industries and by city governments across the nation.



THE WILLIAM STATES LEE
COLLEGE OF ENGINEERING

Department of Civil Engineering
704/687-2304
FAX: 704/687-6953

Dr. Thomas L. Reynolds, Dean
The Graduate School
The University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

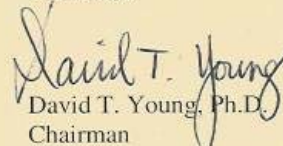
March 31, 2003

Dear Tom:

The faculty in the Department of Civil Engineering strongly endorses the proposal to establish a Ph.D. in Infrastructure and Environmental Systems (IES) at UNC Charlotte. Based on the recommendation of our department's Graduate Committee, our faculty reviewed the proposal and approved it unanimously.

The IES Ph.D. Program is a part of our department's academic plan, as it is our desire to help fulfill the University's mission of providing doctoral level education. The interdisciplinary IES Program is a natural step for the College of Engineering and the College of Arts and Sciences who have a strong record of collaboration in teaching and research at the master's level. We enthusiastically support this effort to enhance and expand those activities.

Sincerely,


David T. Young, Ph.D.
Chairman

UNCC CHARLOTTE

Economics Department
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Memorandum

To: David Young & John Bender
Coordinators for the IES PhD Proposal

From: John Gandar, Chair,
Department of Economics

Subject: Letter of Support for the Proposed IES Ph.D. Program.

Date: April 10, 2003

The Economics Department strongly endorses and supports the proposed doctoral degree in Infrastructure and Environmental Science. We believe that this new program will complement existing graduate programs at this university and will serve the interests of our community and state.

The Department has been involved in discussions leading to the development of this proposed degree program and stands willing to participate in it in the following ways:

- Teaching the proposed IES 8XXX Advanced Energy and Environmental Economics course in Focus Area 2 of the IES program.
- Discussing modifications to the existing Economics courses currently taught for the core of the Public Policy Ph.D. program (PPOL 8640 and 8641) to allow these courses to serve as IES 8XX5 in the core of the IES program and IES 8XXX in Focus Area 3 (as explained in my memorandum of April 9, 2003).
- Have Economics faculty serve on IES program committees, supervise and serve on Ph.D. dissertation committees, and contribute to the program in other ways as appropriate.

If further information is needed on our support for and willingness to participate in this new doctoral program, please contact me at (704) 687-4133 or at via email at jmgandar@email.uncc.edu.

cc. Dr. Claude Lilly, Dean, Belk College of Business Administration
Dr. Richard Conboy, Associate Dean, Belk College of Business Administration

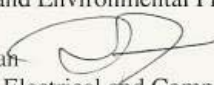


THE WILLIAM STATES LEE
COLLEGE OF ENGINEERING

The Department of Electrical and
Computer Engineering
704/687-2302
FAX: 704/687-2352

MEMORANDUM

TO: Dr. David Young
Infrastructure and Environmental Proposal Group

FROM: Dr. Farid Tanjan 
Department of Electrical and Computer Engineering

DATE: April 28, 2003

SUBJECT: IES Ph.D. proposal

The Department of Electrical and Computer Engineering supports the proposal to establish a Ph.D. Program in Infrastructure and Environmental Systems at UNC Charlotte and wishes the group success in their efforts.



UNCC CHARLOTTE

The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001


THE WILLIAM STATES LEE
COLLEGE OF ENGINEERING

April 7, 2003

704/687-2301
FAX: 704/687-2352

MEMORANDUM

TO: Infrastructure and Environmental Systems (IES) Ph.D. Task Force
(c/o David T. Young)

FROM: S. Gary Teng, Associate Professor and
Director of Engineering Management Program 

SUBJECT: IES Ph.D. Proposal

This is to support the group's effort in the development of a Ph.D. Program in Infrastructure and Environmental Systems at UNC Charlotte. The Engineering Management (EMGT) Program is glad to offer its support in the establishment of this Ph.D. Program. EMGT Program will participate in the program through faculty involvement, IES student enrollment in EMGT courses, EMGT student enrollment in IES courses, and research collaboration, especially in Focus Area 3 Infrastructure and Environmental Systems Management area. With the common interest in Infrastructure and Environmental Systems Management, I believe the two programs will have very close collaboration on many research and teaching activities. The EMGT Program and I intend to offer full support to this IES Ph.D. Program.



UNCC CHARLOTTE

The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

THE WILLIAM STATES LEE
COLLEGE OF ENGINEERING

Department of Engineering Technology

Civil Engineering Technology
Electrical Engineering Technology
Fire Safety Engineering Technology
Manufacturing Engineering Technology
Mechanical Engineering Technology
704/687-2305
FAX: 704/687-6499

MEMORANDUM

TO: Infrastructure and Environmental Systems (IES) Ph.D. Proposal Group

FROM: Anthony L. Brizendine, Ph.D., P.E., P.S. *axb*
Chair, Department of Engineering Technology

DATE: April 25, 2003

RE: Support for IES Ph.D. Proposal

I have reviewed your proposal to establish a Ph.D. Program in Infrastructure and Environmental Systems here at UNC Charlotte, and I want to express my enthusiastic endorsement and support for this proposal.

The insight and wisdom of proposing a multi- and interdisciplinary program that involves and engages talents of several departments is most proper. Cogent policy and progress in the areas of infrastructure and environment rely on the talents and insights of many disciplines engaged through systems based approaches. A program that better prepares future researchers, policy makers, and consultants to consider projects holistically in the context of economic, social, political, scientific and technical factors while underpinning decisions with an ethos of environmental sustainability and ethical consideration will benefit the citizens of North Carolina and beyond. It is clear that this program would provide faculty with an appropriate springboard and equip graduates to make significant contributions at the state, national and international level.

This program confirms experiences that I have encountered professionally through such experiences as while engaged with the USACOE Waterways Experiment Station (WES). On many projects at WES, researchers work in multidisciplinary teams to solve various complex problems. One specific project that I had first-hand experience with considered infrastructure repair, maintenance and rehabilitation, engaging team members to include civil and geotechnical engineers, biologists, hydrologists, archeologists, and various other scientists. This is but one simple example of the interdisciplinary nature of current and future research. The proposed program addresses this straight on in an area that is of critical importance to the state and nation.

As Chair of the Department of Engineering Technology, I can assure you that I will encourage our faculty to engage and lend their expertise in support of collaborative research efforts that this program will surely generate. If I can be of any further assistance to you in the establishment of the Infrastructure and Environmental Systems Ph.D. Program here at UNCC, please do not hesitate to contact me.

The University of North Carolina is composed of the sixteen public senior institutions in North Carolina
An Equal Opportunity/Affirmative Action Employer



UNC CHARLOTTE

Global Institute for Energy and Environmental Systems (GIEES)

CARC Building Room 238

The University of North Carolina at Charlotte

9201 University City Boulevard

Charlotte, NC 28223-0001, USA

Tel. 704/687-3233 Fax 704/687-3115

April 21, 2003

Dr. Thomas L. Reynolds

Associate Provost for Graduate Programs and Dean of the Graduate School

The University of North Carolina at Charlotte

9201 University City Blvd.

Charlotte, NC 28223-0001

Re: PROPOSED PH.D. PROGRAM IN INFRASTRUCTURE AND ENVIRONMENTAL SYSTEMS (IES) AT UNC CHARLOTTE

Dear Dr. Reynolds:

I reviewed the description of the proposed Ph.D. program in Infrastructure and Environmental Systems at UNC Charlotte, and I support the program for its:

- interdisciplinary nature which encourages and allows collaborative education and research across traditional department and college boundaries;
- helping meet current and emerging national and regional environmental and infrastructure needs;
- providing research, problem solving, and higher level education in the areas of infrastructure and environmental at the systems level;
- addressing relationships between infrastructure and environment; and
- providing graduates who are well prepared to take leadership and advisory positions in infrastructure and environmental institutions, organizations, and companies

I wish you success with the proposal.

Yours sincerely,

Hilary I. Inyang, Ph.D.

Duke Energy Distinguished Professor of Environmental Engineering and Science,



Department of Geography
and Earth Sciences
704/687-2293
FAX: 704/687-3182

March 28, 2003

Dr. Thomas L. Reynolds, Dean
The Graduate School
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Tom:

The faculty of the Department of Geography and Earth Sciences have reviewed the materials proposing the establishment of an interdisciplinary doctoral program in Infrastructure and Environmental Systems (IES). The faculty of this department strongly endorse this program and support the earliest implementation of the proposed Ph.D. in IES.

The IES doctoral program draws on the existing research strengths and capabilities of the science faculty in the College of Arts and Science and the engineering faculty in the William States Lee College of Engineering. This new initiative is an excellent match with the institution mission of UNC Charlotte and the current suite of doctoral programs. In summary, the proposed IES Ph.D. is a valuable, new degree program, which we enthusiastically support.

Sincerely,

Owen J. Furuseth
Chair, Department of Geography and Earth Sciences

cc: Dr. Gerald L. Ingalls



THE WILLIAM STATES LEE
COLLEGE OF ENGINEERING

Department of Mechanical Engineering
and Engineering Science
704/687-2303
FAX: 704/687-2352

MEMORANDUM

TO: Dr. David Young
Infrastructure and Environmental Proposal Group

FROM: Dr. Jay Raja
Department of Mechanical Engineering

DATE: April 23, 2003

SUBJECT: IES Ph.D. proposal

Mechanical Engineering and Engineering Science department supports the proposal to establish a Ph.D. Program in Infrastructure and Environmental Systems at UNC Charlotte and wishes the group success in their efforts.

To: Dr. David Young
Chair, Civil Engineering

From: Jerry Ingalls, Director
Ph.D. in Public Policy

Re: IES Proposal to Establish

Date: April 28, 2003

I have reviewed the Ph.D. in Infrastructure and Environmental Systems Proposal to Establish and discussed its merits with you at length. I find the Program described in this Proposal has great promise and the value to the campus and the broader community is clear. We need this type of interdisciplinary focus especially in the critical areas of infrastructure and environment.

I look forward to working with you and the other faculty sponsoring this degree to search for and cement inter-relationships with the Public Policy Ph.D. The potential for collaboration both in the classroom and in research activities are strong and we have already begun to identify how we will cooperate. I enthusiastically endorse this Program.



UNC CHARLOTTE

The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

April 24, 2003

Center for Transportation Policy Studies
1029 Colvard South
704/687-3997
Fax 704/687-3178

Dr. Thomas L. Reynolds
Associate Provost for Graduate Programs
and Dean of the Graduate School
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, North Carolina 28223-0001

Dear Dr. Reynolds:

Re: Proposed Ph.D. Program in Infrastructure and Environmental Systems (IES)

In support of the effort by UNC Charlotte to develop an IES Ph.D. program, the Center for Transportation Policy Studies is pleased to provide a letter of support. Such a program on our campus will fill out a comprehensive program at the doctoral level that will address many urgent and important needs in our society. I quite understand and applaud the effort to provide three "tracks" or focus areas of design, science, and management. Obviously, as it relates to transportation policy, there will be a higher degree of interaction between the management track students and our transportation policy program, but there are aspects of design and science that go into the proper development of transportation and other infrastructure that are also of great interest here.

Professionals are in great demand that have an understanding of the development, operation, and maintenance of transportation systems and other urban and regional infrastructure. Further, it appears that the IES program will engender an appreciation of the interrelationship of the built environment, including transportation systems, with the earth's environmental systems, as well the realities of our political and administrative systems.

I also believe that the IES program will produce highly educated professionals having a strong interdisciplinary background that will be able to function well in a number of work environments, including private, public, governmental, and academic agencies and institutions.

Sincerely,

Edd Hauser, P.E., Ph.D.
Director

Appendix IV

External Letters of Support From notables in the wide field of Infrastructure of Environmental Systems

Experts in the fields of infrastructure and environmental systems were invited to review the INES Ph.D. proposal and to comment. Their letters are included in this appendix.



National Council for Science and the Environment
Improving the scientific basis for environmental decisionmaking

1707 H Street, NW • Suite 200 • Washington, DC 20006
202 530 5810 • Fax 202 628 4311 • www.ncseonline.org

April 24, 2003

Stephen P. Hubbell, Ph.D.
Chair
Donald N. Langenberg, Ph.D.
Vice Chairman
Jon Richard Benedick
President
A. Karm Ahmed, Ph.D.
Secretary-Treasurer
Peter D. Saundry, Ph.D.
Executive Director
Richard C. Bartlett
Robert Dringer, Ph.D.
Charles E. Dayton, Esq.
Mary Anne Fox, Ph.D.
Malcolm Gillis, Ph.D.
Stanley Greenfield, Ph.D.
Dorothy I. Height, Ph.D.
Jens F. Howe, Ph.D.
Jon Randy Johnson
T. Jeffrey Leonard, Ph.D.
Jon Robert S. McNamara
Jon Craig A. Peterson
Donald Pulliam, Ph.D.
Christopher Reade, Ph.D.
Jon Barbara Sheen Todd
Jon Maurice Strong
Jane A. Van Ummersen, Ph.D.

Dr. David Young
Chair, Department of Civil Engineering
University of North Carolina Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Dr. Young,

I write to express my personal support for your proposed Ph.D. program in Infrastructure and Environmental Systems (IES). The program appears to be well-designed, consistent with the current and essential emphasis on integrating environmental science and engineering, and will fill an important need for society and the academic community.

My work with the National Council for Science and the Environment (NCSE) and with our Council of Environmental Deans and Directors brings me in contact with most of the leading academic environmental programs and with the leading federal funders of academic research and education, particularly the National Science Foundation. From this perspective, I can say that your new program embraces the interdisciplinary, problem-oriented approach that many other programs aspire to. The National Science Foundation, reflecting the strong recognition of the academic community and society, is presently undertaking a major effort to understand complex human and environmental systems and to use this understanding to serve society. I have been particularly impressed with the stated eagerness of the engineering community to partner with the scientific community to produce the kinds of technically excellent but broad thinking individuals needed for societal sustainability.

Your proposed program is likely to move beyond the conversation and produce the results in terms of educated graduates and useful knowledge that it is well recognized are needed. Furthermore, because you are at the forefront of establishing such a program, you will become leaders in receiving funding and in providing an example that others will emulate. That such a program is proposed at University of North Carolina Charlotte is entirely appropriate, given your track record of accomplishment and leadership through institutions such as the [Global Institute For Energy and Environmental Systems \(GIEES\)](#).

I wish you all success in establishing this necessary program and look forward to working with you and your colleagues to help connect this new program with other universities and colleges so that you can learn from each other.

With best wishes,

David E. Blockstein, Ph.D.
Senior Scientist, NCSE
Executive Secretary, Council of Environmental Deans and Directors



DUKE ENERGY CORPORATION
526 South Church Street
Charlotte, NC 28202-1802

Mailing Address:
P. O. Box 1006
Charlotte, NC 28201-1006

April 21, 2003

Dr. Thomas L. Reynolds
Associate Provost for Graduate Programs and Dean of the Graduate School
The University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Re: Proposed Ph.D. Program in Infrastructure and Environmental Systems (IES) at
University of North Carolina Charlotte

Dear Dr. Reynolds:

I reviewed the description of the proposed Ph.D. program in Infrastructure and
Environmental Systems at UNC Charlotte, and I encourage the program as it:

- encourages and allows collaborative education and research across traditional department and college boundaries through its interdisciplinary approach;
- addresses current and emerging national and regional environmental and infrastructure needs;
- provides research, problem solving, and higher level education in the areas of infrastructure and environmental at the systems level;
- integrates relationships among the academic disciplines, infrastructure and environment; and
- produces graduates who are well prepared to take leadership and advisory positions in infrastructure and environmental institutions, organizations, and companies

I wish you success with the proposal.

Kindest Regards,

C. Norwood Davis
Managing Director
Corporate Environment, Health & Safety



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

April 21, 2003

Dr. Thomas L. Reynolds
Associate Provost for Graduate Programs
and Dean of the Graduate School
The University of North Carolina at Charlotte
9201 University Club Boulevard
Charlotte, NC 28223-0001

Dear Dr. Reynolds:

I would like to take this opportunity to applaud the efforts of The University of North Carolina at Charlotte in the fulfillment of our strategic research plan. As you are aware, a number of faculty conduct research for the North Carolina Department of Transportation Research Program each year. I can state quite confidently that my customers throughout the DOT continue to be pleased and impressed with these researchers. I anticipate the continuation of a strong relationship with your university.

I have recently read with great interest about a proposal to initiate a doctoral program regarding Infrastructure and Environmental Systems. It is my understanding that this interdisciplinary program would target education and research efforts associated with the many complex environmental issues facing our transportation engineering community. Specifically, it appears that this program would encourage effective collaboration of these efforts across traditional Department and University boundaries. This type of collaboration is commensurate with what is evolving in the transportation community. In recent years, there has been unprecedented cooperation between our Department of Transportation and the Department of Environment and Natural Resources. In fact, many personnel from environmental regulatory agencies serve as advisors on several of our DOT research projects.

You should also be aware that, in the last three fiscal years, greater than 40% of our research funding was directed towards research projects directly related to environmental issues and their effect on transportation planning, design, and construction. As I attend the annual Transportation Research Board meeting each year in Washington, DC, I am reminded of the continuing convergence of environmental stewardship with transportation engineering.

MAILING ADDRESS:

NC DEPARTMENT OF TRANSPORTATION
RESEARCH & ANALYSIS
1549 MAIL SERVICE CENTER
RALEIGH NC 27699-1549

RDROCHELLE @DOT.STATE.NC.US
TELEPHONE: 919-715-4657
FAX: 919-715-0137

WWW.DOT.STATE.NC.US/~RESEARCH

LOCATION:

TRANSPORTATION BUILDING
1 SOUTH WILMINGTON STREET
RALEIGH NC 27601

Dr. Reynolds
April 21, 2003
Page 2

I believe that your proposed program is, indeed, very timely to help meet these growing state regional, and national demands, both in terms of research activity as well as preparing future professionals for careers in this evolving and critical discipline.

I wish you success with this proposal and please let me know me know if I can be of any assistance in this endeavor.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Rochelle". The signature is fluid and cursive, with the first letter of the first name being a large, stylized "R".

Rodger D. Rochelle, PE
North Carolina Department of Transportation
State Research Engineer



Michael F. Easley, Governor
William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources
Alan W. Klimek, P.E. Director
Division of Water Quality

April 28, 2003

Dr. Thomas L. Reynolds
Associate Provost for Graduate Programs and Dean of the Graduate School
The University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Re: Proposed Ph.D. Program in Infrastructure and Environmental Systems (IES) at
UNC Charlotte

Dear Dr. Reynolds:

I reviewed the description of the proposed Ph.D. program in Infrastructure and Environmental Systems at UNC Charlotte, and I support the approach of the proposed program. Much of the efforts in the practical environmental field today require an interdisciplinary approach to adequately address the environmental challenges before us today. The simpler issues in the environmental field, for example water quality impairment resulting from wastewater treatment plant discharges, have tools that we have used over the years that continue to be effective. However, addressing challenges such as nonpoint source pollution require more of an interdisciplinary and collaborative approach.

Many of our waters in North Carolina that are impaired are impaired due to nonpoint source impacts. The historical approach to "end-of-the-pipe" controls will not address these types of impairments. The challenges include defining the sources of impairment, educating the public, and developing collaborative approaches across local governments, state government, public interest groups, agricultural groups, industries, etc. These types of issues require individuals with broader backgrounds and training to enable us to develop creative solutions to the problems facing protecting our environment. Solutions to the more complex problems require the ability to integrate biology, chemistry, infrastructure design and an understanding of the role of management and policy development. Management of the challenges before us requires an iterative and interactive approach to developing and achieving the optimal solution.

I wish you success with the proposal. I believe the program has the possibility of providing graduates who are well prepared to take on leadership and advisory roles in the protection of the environment. These types of skills are necessary in government, environmental institutions, and industrial operations. We certainly would be interested in hiring graduates with such an interdisciplinary education background. I encourage you to move forward with the development of the proposal. If I can be of further assistance, please contact me at 919/733-5083.

Sincerely,

Original Signed by CHS

Coleen H. Sullins, Deputy Director

Water Resources Research Institute
of The University of North Carolina
Box 7912
North Carolina State University
Raleigh, NC 27695-7912

Dr. Kenneth H. Reckhow, Director

Telephone: 919-515-2815
Fax: 919-515-2839
e-mail: ken_reckhow@ncsu.edu

April 24, 2003

Dr. Thomas L. Reynolds
Associate Provost for Graduate Programs and Dean of the Graduate School
The University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Re: Proposed Ph.D. Program in Infrastructure and Environmental Systems (IES) at
UNC Charlotte

Dear Dr. Reynolds:

I reviewed the description of the proposed Ph.D. program in Infrastructure and Environmental Systems at UNC Charlotte, and I am enthusiastically supportive of the program for its interdisciplinary nature which encourages and allows collaborative education and research across traditional department and college boundaries. It will help meet current and emerging national and regional environmental and infrastructure needs by providing research, problem solving, and higher level education in the areas of infrastructure and environmental at the systems level. It addresses relationships between infrastructure and environment and provides graduates who are well prepared to take leadership and advisory positions in infrastructure and environmental institutions, organizations, and companies.

I wish you success with this proposal; the proposed IES Ph.D. program at UNC Charlotte has the potential to be an important addition to higher education.

Sincerely yours,

K.H. Reckhow

Kenneth H. Reckhow

ZAPATAENGINEERING

T R U S T • I N T E G R I T Y • Q U A L I T Y

April 21, 2003

Dr. Thomas L. Reynolds
Associate Provost for Graduate Programs and Dean of the Graduate School
The University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, North Carolina 28223-0001

Re: Proposed Ph.D. Program in Infrastructure and Environmental Systems (IES) at
UNC Charlotte

Dear Dr. Reynolds:

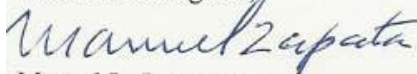
I strongly support the proposed Ph.D. program in Infrastructure and Environmental Systems at UNC Charlotte. As president of an engineering firm executing complex projects across the country, I can attest to the urgent need for such a program to generate the talent required to successfully address the environmental and infrastructure challenges facing our country.

Having reviewed the description of the proposed Ph.D. program I believe its interdisciplinary nature, encouraging collaborative education and research across traditional departments and college boundaries is essential to solve our environmental and infrastructure challenges. This approach will help meet current and emerging national and regional needs in these critical areas of our economy. Large infrastructure projects have a vital and positive impact on economic development, however, poorly planned and executed projects can have deleterious effects on the environment with dire consequences to future generations and the ecosystem. A program such as the one proposed here is a vital step in addressing this issue and achieving sustainable and balanced growth.

Critical components of sustainable growth include adequate research opportunities and higher-level education in the areas of infrastructure and environmental sciences. This education should take place at the systems level addressing the relationships between infrastructure and the environment. Doctoral graduates who are well prepared in these disciplines will take leadership positions in the regional and national economies and are key to our economic success and long-term viability of our society.

I reiterate, therefore, my strong support and encouragement for your continued success in making this proposed Ph.D. program a very successful reality.

With kindest regards,



Manuel L. Zapata, P.E.
President



MECKLENBURG COUNTY
Land Use & Environmental Services Agency
Water & Land Resources

April 28, 2003

Dr. Thomas L. Reynolds
Associate Provost for Graduate Programs and Dean of the Graduate School
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, North Carolina 28223-0001

Re: Proposed Ph.D. Program in Infrastructure and Environmental Systems at
UNC Charlotte

Dear Dr. Reynolds:

Thank you for contacting Mecklenburg County Water & Land Resources regarding the proposed Ph.D. program in Infrastructure and Environmental Systems at UNC Charlotte. I have reviewed the description of the proposed Ph.D. program and offer the following comments to support such a Ph.D. program.

The proposed Ph.D. program in Infrastructure and Environmental Systems and Mecklenburg County Water & Land Resources share the traditional areas of study (design, science, and management) to create a coherent, interdisciplinary program which encourages and allows collaborative education and research across traditional department and college boundaries.

Mecklenburg County Water & Land Resources is comprised of structured programs and core processes whose combined functions include Storm Water Services (Engineering, Planning/Floodplain Management, Operations), Water Quality, Groundwater, Land Development, Zoning and others. Through Storm Water Services Floodplain Management, experience has shown again and again that lives can be saved and damage to property can be reduced significantly by consistently building safer, enforcing tighter development restrictions in the floodplains and making the proper preparation before a disaster occurs. These types of preventive actions play an integral part in Mecklenburg County's Floodplain Management Program.

From the aspect of environmental systems, the Mecklenburg County Water Quality Program is especially interested in supporting the Ph.D. program as the Water Quality environmental protection goal also includes providing research, problem solving, and higher level education in the areas of infrastructure and the environment, resulting in clean water by reducing sediment and fecal coliform bacteria in the local lakes and streams.

Since the mission of Water & Land Resources is to ensure a clean, livable environment through the protection and enhancement of water and land, it appears that the proposed Ph.D. program would provide a technologically advanced training avenue of infrastructure and environmental involvement between educational institutions and governmental entities for sharing engineering knowledge, skills and scientific applications in modeling projects designed to predict the quality of water and suggest positive impacts on future land development regulations. Such an inter-relationship with the environmental systems, such as wetlands, lakes, air, soil and groundwater systems would better prepare master's graduates in scientific and engineering fields and open doors of greater possibilities for those pursuing professional fields as researchers, analysts, advisers and managers.

Ultimately, such a Ph.D. program in Infrastructure and Environmental Systems would not only address the relationships between infrastructure and environment and provide graduates who are well prepared to take leadership and advisory positions in infrastructure and environmental institutions, organizations, and companies, but also would increase public education resources, enhance management of water quality activities and land development regulations through education, legislation and public information that will help allow for increased safety to life and property.

Mecklenburg County Water & Land Resources would strongly support the proposed Ph.D. program in Infrastructure and Environmental Systems at UNC Charlotte as it is a proposed program designed to help meet current and emerging national and regional environmental and infrastructure needs.

Should you have questions or need additional information, please do not hesitate to contact me at 704-336-3736 or e-mail address at canaawd@co.mecklenburg.nc.us. I wish you much success with the proposed Ph.D. Program in Infrastructure and Environmental Systems at UNC Charlotte.

Sincerely,

W. Dave Canaan, Director
Mecklenburg County Water & Land Resources

RALPH WHITEHEAD ASSOCIATES, INC.

Consulting Engineers

Charlotte Atlanta Jacksonville Richmond Rock Hill Pittsburgh Charleston Tallahassee Kansas City

April 24, 2003

Dr. Thomas L. Reynolds
Associate Provost for Graduate Programs and Dean of the Graduate School
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

**SUBJECT: Proposed Ph.D. Program in Infrastructure and Environmental
Systems (IES) at UNC Charlotte**

Dear Dr. Reynolds:

I have just learned of the proposed Ph.D. program in Infrastructure and Environmental Systems at UNC Charlotte and have reviewed the description of the program. I am very pleased with the direction of the proposed program and am writing to express my support for the program.

I am excited about the interdisciplinary nature of the degree. I feel strongly, and have heard several leaders in the engineering profession express a similar conviction, that we need engineers whose training includes more than just the typical technical courses in their specialty. The proposed degree program requires the participants to expand their perspective from what would typically be a narrow focus on a single issue or specialty to a broader perspective. This broader perspective will serve them well in the workplace, and should also equip them to better serve the larger community.

The crossing of normal departmental boundaries in their pursuit of a doctorate will allow the participants to explore and better understand other disciplines. Such knowledge and understanding will certainly prepare them well for work in today's world where, in many situations, there is a necessary interaction between disciplines, an interaction that many do not appreciate because of their lack of exposure. The formulation of this program to encompass infrastructure and environmental systems will provide graduates of the program special opportunities for leadership in industry and the community.

I am also excited about the opportunity for a doctoral program for engineers in Charlotte. I am personally aware of several individuals who are interested in pursuing a doctorate, but do not have an opportunity for earning a doctorate without leaving the area. This program would allow them to remain in Charlotte while pursuing these studies. Hopefully they would then remain in the area to contribute to the growth of the Charlotte region.

I certainly wish you success with the proposed program.

Sincerely,

/signed – delivered via email/

Reid W. Castrodale, PhD, PE
Project Manager / Senior Engineer

Appendix V

Budget Information

Details of the budget for the first 3 years of the INES Ph.D. Program are provided in this appendix.

**Projected Funding for New Degree Program
Ph.D. in Infrastructure and Environmental Systems
Regular Term 2003-2004
(Based on 2002-2003 Change in Student Credit Hours)**

Program Category	Change in Student Credit Hours			Instructional - Position Funding Factors			Instructional Positions Required		
	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral
Category I			0	643.72	171.44	138.41	0.000	0.000	0.000
Category II				487.37	249.94	146.74	0.000	0.000	0.000
Category III				364.88	160.93	122.95	0.000	0.000	0.000
Category IV				230.52	102.45	70.71	0.000	0.000	0.000

Fringes for faculty salaries
FICA @ 7.65%;
Retirement @ 9.71%
Medical @ \$2,933

\$0
 \$0
 \$0

 \$0

Total Positions Required	0.000
Instructional - Position Salary Rate (FY 02)	<u>\$62,573</u>
<i>101-1310</i> Instructional Salary Amount	\$0
Other Academic Costs 44.89300%	<u>0</u>
<i>Purpose 101</i> Total Academic Requirements	\$0
<i>Purpose 151</i> Library 11.48462%	0
<i>Purposes 152, 160, 170 180</i> General Instit Support 54.04980%	0
Neg Adj Factor 50.00000%	n/a
In-state SCHs 0	
Financial Aid (in-state) 67.99800%	<u>0</u>
Total Requirements	<u>\$0</u>

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

Institution	UNC Charlotte			Date	April 30, 2003	
Program (API#, Name, Level)	30.9999 Multidisciplinary Studies, Other (I.E.S.)					
Degree(s) to be Granted	Ph.D.			Program Year	2003-2004	
ADDITIONAL FUNDING REQUIRED - BY SOURCE						
	Reallocation of Present Institutional Resources	Enrollment Increase Funds	Federal/State or Other Non-state Funds (Identify)	New Allocations	Total	
101 Regular Term Instruction						
1210 SPA Regular Salaries	\$10,288				\$10,288	
Secretary (Grade 59) (.5)	10,288					
1110 EPA Non-teaching Salaries					0	
1310 EPA Academic Salaries	200,000	0	0		200,000	
Program Director	100,000					
Assistant Professor (2)	70,000					
Graduate Teaching Positions (4)	30,000					
1810 Social Security	16,087				16,087	
1820 State Retirement	16,507				16,507	
1830 Medical Insurance	5,866				5,866	
2000 Supplies and Materials					0	
2300 Educational Supplies					0	
2600 Office Supplies					0	
3000 Current Services					0	
3100 Travel					0	
3200 Communications					0	
3400 Printing & Binding					0	
5000 Capital Outlay (Equipment)					0	
5100 Office Equipment					0	
5200 EDP Equipment					0	
TOTAL Regular Term Instruction	\$248,748	\$0	\$0	\$0	\$248,748	
151 Libraries						
5000 Capital Outlay (Equipment)		0			0	
5600 Library Book/Journal					0	
TOTAL Libraries	\$0	\$0	\$0	\$0	\$0	
189 General Institutional Support						
2000 Supplies and Materials					0	
2600 Office Supplies					0	
3000 Current Services					0	
3200 Communications					0	
3400 Printing & Binding					0	
5000 Capital Outlay (Equipment)					0	
5100 Office Equipment					0	
5200 EDP Equipment					0	
TOTAL General Inst. Support	\$0	\$0	\$0	\$0	\$0	
999 Multiactivity						
0123 Non-Resident Graduate Assistant Tuition Waivers (2)	\$19,452	\$0	\$0	\$0	19,452	
TOTAL ADDITIONAL COSTS	\$268,200	\$0	\$0	\$0	\$268,200	

NOTE: Accounts may be added or deleted as required.

**Projected Funding for New Degree Program
Ph.D. in Infrastructure and Environmental Systems
Regular Term 2004-2005
(Based on 2003-2004 Change in Student Credit Hours)**

Program Category	Change in Student Credit Hours			Instructional - Position Funding Factors			Instructional Positions Required		
	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral
Category I			126	643.72	171.44	138.41	0.000	0.000	0.910
Category II				487.37	249.94	146.74	0.000	0.000	0.000
Category III				364.88	160.93	122.95	0.000	0.000	0.000
Category IV				230.52	102.45	70.71	0.000	0.000	0.000

Fringes for faculty salaries
FICA @ 7.65%;
Retirement @ 9.71%
Medical @ \$2,933

\$4,358
\$5,531
\$2,670
<hr/>
\$12,559

Total Positions Required	0.910
Instructional - Position Salary Rate (FY 02)	\$62,573
<i>101-1310</i> Instructional Salary Amount	\$56,963
Other Academic Costs 44.89300%	25,572
<i>Purpose 101</i> Total Academic Requirements	\$82,535
<i>Purpose 151</i> Library 11.48462%	9,479
<i>Purposes 152, 160, 170 180</i> General Instit Support 54.04980%	44,610
Neg Adj Factor 50.00000%	n/a
In-state SCHs 0	
Financial Aid (in-state) 67.99800%	0
Total Requirements	\$136,624

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

Institution	UNC Charlotte		Date	April 30, 2003	
Program (API#, Name, Level)	30.9999 Multidisciplinary Studies, Other (I.E.S.)				
Degree(s) to be Granted	Ph.D.		Program Year	2004-2005	
ADDITIONAL FUNDING REQUIRED - BY SOURCE					
	Reallocation of Present Institutional Resources	Enrollment Increase Funds	Federal/State or Other Non-state Funds (Identify)	New Allocations	Total
101 Regular Term Instruction					
1210 SPA Regular Salaries					\$0
1110 EPA Non-teaching Salaries					0
1310 EPA Academic Salaries	98,037	56,963	0		155,000
Assistant Professor (2)	83,037	56,963			
Graduate Teaching Positions (2)	15,000				
1810 Social Security	6,352	4,358			10,710
1820 State Retirement	8,063	5,531			13,594
1830 Medical Insurance	3,892	2,670			6,562
2000 Supplies and Materials		4,000			4,000
2300 Educational Supplies		2,000			
2600 Office Supplies		2,000			
3000 Current Services		5,013			5,013
3100 Travel		2,000			
3200 Communications		1,013			
3400 Printing & Binding		2,000			
5000 Capital Outlay (Equipment)		4,000			4,000
5100 Office Equipment		2,000			
5200 EDP Equipment		2,000			
TOTAL Regular Term Instruction	\$116,344	\$82,535	\$0	\$0	\$198,879
151 Libraries					
5000 Capital Outlay (Equipment)		9,479			9,479
5600 Library Book/Journal		9,479			
TOTAL Libraries	\$0	\$9,479	\$0	\$0	\$9,479
189 General Institutional Support					
2000 Supplies and Materials		10,000			10,000
2600 Office Supplies		10,000			
3000 Current Services		15,000			15,000
3200 Communications		7,500			
3400 Printing & Binding		7,500			
5000 Capital Outlay (Equipment)		19,610			19,610
5100 Office Equipment		9,610			
5200 EDP Equipment		10,000			
TOTAL General Inst. Support	\$0	\$44,610	\$0	\$0	\$44,610
999 Multiactivity					
0123 Non-Resident Graduate Assistant Tuition Waivers (2)	\$19,452	\$0	\$0	\$0	\$19,452
TOTAL ADDITIONAL COSTS	\$135,796	\$136,624	\$0	\$0	\$272,420

NOTE: Accounts may be added or deleted as required.

**Projected Funding for New Degree Program
Ph.D. in Infrastructure and Environmental Systems
Regular Term 2005-2006
(Based on 2004-2005 Change in Student Credit Hours)**

Program Category	Change in Student Credit Hours			Instructional - Position Funding Factors			Instructional Positions Required		
	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral	Undergrad	Masters	Doctoral
Category I			135	643.72	171.44	138.41	0.000	0.000	0.975
Category II				487.37	249.94	146.74	0.000	0.000	0.000
Category III				364.88	160.93	122.95	0.000	0.000	0.000
Category IV				230.52	102.45	70.71	0.000	0.000	0.000

Fringes for faculty salaries
FICA @ 7.65%;
Retirement @ 9.71%
Medical @ \$2,933

\$4,669
\$5,926
\$2,861
<hr/>
\$13,456
<hr/>

Total Positions Required	0.975
Instructional - Position Salary Rate (FY 02)	<u>\$62,573</u>
<i>101-1310</i> Instructional Salary Amount	\$61,031
Other Academic Costs 44.89300%	<u>27,399</u>
<i>Purpose 101</i> Total Academic Requirements	\$88,430
<i>Purpose 151</i> Library 11.48462%	10,156
<i>Purposes 152, 160, 170 180</i> General Instit Support 54.04980%	47,796
Neg Adj Factor 50.00000%	n/a
In-state SCHs 0	
Financial Aid (in-state) 67.99800%	<u>0</u>
Total Requirements	<u>\$146,382</u>

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

Institution	UNC Charlotte		Date	April 30, 2003	
Program (API#, Name, Level)	30.9999 Multidisciplinary Studies, Other (I.E.S.)				
Degree(s) to be Granted	Ph.D.		Program Year	2005-2006	
ADDITIONAL FUNDING REQUIRED - BY SOURCE					
	Reallocation of Present Institutional Resources	Enrollment Increase Funds	Federal/State or Other Non-state Funds (Identify)	New Allocations	Total
101 Regular Term Instruction					
1210 SPA Regular Salaries					\$0
1110 EPA Non-teaching Salaries					0
1310 EPA Academic Salaries	23,969	61,031	0		85,000
Assistant Professor (1)	8,969	61,031			
Graduate Teaching Positions (2)	15,000				
1810 Social Security	18,336	4,669			23,005
1820 State Retirement	871	5,926			6,797
1830 Medical Insurance	72	2,861			2,933
2000 Supplies and Materials		3,000			3,000
2300 Educational Supplies		1,500			
2600 Office Supplies		1,500			
3000 Current Services		6,000			6,000
3100 Travel		2,000			
3200 Communications		2,000			
3400 Printing & Binding		2,000			
5000 Capital Outlay (Equipment)		4,943			4,943
5100 Office Equipment		2,443			
5200 EDP Equipment		2,500			
TOTAL Regular Term Instruction	\$43,248	\$88,430	\$0	\$0	\$131,679
151 Libraries					
5000 Capital Outlay (Equipment)		10,156			10,156
5600 Library Book/Journal		10,156			
TOTAL Libraries	\$0	\$10,156	\$0	\$0	\$10,156
189 General Institutional Support					
2000 Supplies and Materials		10,000			10,000
2600 Office Supplies		10,000			
3000 Current Services		16,000			16,000
3200 Communications		8,000			
3400 Printing & Binding		8,000			
5000 Capital Outlay (Equipment)		21,796			21,796
5100 Office Equipment		10,000			
5200 EDP Equipment		11,796			
TOTAL General Inst. Support	\$0	\$47,796	\$0	\$0	\$47,796
999 Multiactivity					
0123 Non-Resident Graduate Assistant Tuition Waivers (2)	\$19,452	\$0	\$0	\$0	\$19,452
TOTAL ADDITIONAL COSTS	\$62,700	\$146,382	\$0	\$0	\$209,083

NOTE: Accounts may be added or deleted as required.

Appendix VI

Program Catalogue Copy

A description of the INES Ph.D. Program will be provided in the *UNC Charlotte Graduate Catalogue*, and that description is provided in this appendix.

New catalog copy

Admission to the program

Admission requirements to be met by each applicant are presented below. Specific documentation required by the UNC Charlotte Graduate School for admission is also described.

Admission requirements (minimum and general requirements)

Applicants will be reviewed for admission to the Program based on their satisfaction of the requirements described below.

- The equivalent to a U.S. baccalaureate or master's degree, from a regionally accredited college or university, in Engineering, Earth Science/Geology, Chemistry, Biology or a related field with a minimum undergraduate GPA of 3.2 or a minimum graduate GPA of 3.5 ($A = 4.0$) in all graduate work.
- A minimum combined score of 1500 on the verbal, quantitative and analytical sections of the Graduate Record Examination (GRE) with minimum scores of 500 in each section. (The analytical section of the GRE now has a 6 point scoring system so these proposed numbers must be reviewed.)
- A minimum score of 220 (computer-based test) or 550 (paper-based test) on the Test of English as a Foreign Language (TOEFL) for applicants whose native language is not English.
- Three letters of reference, two of which must be from faculty members.
- An essay which addresses the applicant's motivation and area of research interest.

Documents to be submitted for admission

The Office of the Graduate School at UNC Charlotte requires the following documents be submitted in the application package for each student:

- Two official transcripts from all colleges and universities attended
- Official GRE scores (verbal, quantitative and analytical)
- Official TOEFL scores if the student's native language is not English.
- The UNC Charlotte application for graduate admission form
- Three letters of reference
- The essay which addresses the applicant's motivation, prospective INES Ph.D. program focus area (IESD or IESS or IESM) and research issues of interest.

Degree requirements

The degree of Doctor of Philosophy in Infrastructure and Environmental systems is awarded for completion of scholarly research that advances the knowledge base in the field of that research. Evidence of this is demonstrated by a successful dissertation defense. In addition, recipients of the degree should demonstrate a mastery of relevant subject matter and a potential for success in research and teaching.

Total hours required

As summarized in Table 5, the INES Ph.D. program requires a minimum of 72 post baccalaureate (semester) credit hours (a minor in this program is not applicable). A master's degree in an appropriate field, that is consistent with the admission requirements presented in Section III.B.1., may count up to 30 hours of transfer credit upon recommendation of the Program and upon approval by the Graduate School.

Table 5. INES doctoral program requirements.

	Minimum Credit Hrs. to Degree Required for Master's Entrants	Minimum Credit Hrs. to Degree Required for Bachelor's Entrants
INES Core	15 credit hrs.	15 credit hrs.
Core courses	9 credit hrs.	9 credit hrs.
Case Studies	3 credit hrs.	3 credit hrs.
Seminars	3 credit hrs.	3 credit hrs.
Specialized (Focus Area) Electives	9 credit hrs. ¹	15 credit hrs.
Directed Studies (additional courses / research)	0 credit hrs. ¹	24 credit hrs.
Dissertation Research	18 credit hrs.	18 credit hrs.
Total Credits Beyond Previous Degree	42 credit hrs. ¹	72 credit hrs.

¹ based on a maximum of 30 credit hours transferred from a master's program. Less than 30 credit hours transferred will result in a higher number of credit hours required for graduation.

Graduate course requirements

All courses taken for credit in the program shall be graduate level courses (graduate students only), and the majority shall be at the Ph.D. level (Ph.D. students only). Core courses, case studies courses, and seminar courses designated INES 8XXX and all 8000-level focus area courses will be open only to Ph.D. students. All 6000-level courses available as specialized electives will be open only to graduate students (masters and Ph.D.).

Grades required

As specified by the UNC Charlotte Graduate School, letter grades will be used to scale the quality of each student's completed work as follows: 'A': Commendable (4.0); 'B': Satisfactory (3.0); 'C': Marginal (2.0); 'U': Unsatisfactory (1.0). Each student in the Ph.D. Program must maintain a minimum GPA of 3.0 in all coursework attempted for the degree. An accumulation of two "C" grades or one "U" grade will result in termination of a student's enrollment in the program. Dissertation credits will not be included in the calculation of a student's GPA.

Transfer credit accepted

Upon recommendation by the INES program committee and upon approval by the Graduate School, a certain number of courses in which a student achieved a minimum grade of 'B' will be accepted for transfer credit. The following transfer credit policy will apply:

- A maximum of 30 semester credit hours from a master's degree program in an appropriate field, that is consistent with the admission requirements stated earlier, may count toward the INES Ph.D. degree. This rule may apply whether the master's degree was earned or not. However no more than 6 hours taken when the student was in non-degree seeking status may be applied toward the doctoral degree.

Other requirements (e.g. residence, comprehensive exams, thesis, dissertation, clinical or field experience, "second major," etc.)

Student Advising

Upon acceptance into the Ph.D. Program, a student will be assigned an interim adviser by the Program Director. Within the first year in the Program, each student will select a permanent doctoral research adviser. This selection will be approved by the Program Director and Dean of the Graduate School. At any time a student may request a change in initial supervisor or research adviser. These requests will be submitted to the Program Director for consideration and action.

Details of this process and the responsibilities of each individual and group in terms of student advising are provided in Section VII of this proposal.

Plan of study

Students who enter the Ph.D. Program must prepare a plan of study before the end of fourth semester in the Program. The plan of study will propose a schedule for completion of all coursework by the student. Each plan will be approved by the program director and the student's doctoral committee.

Comprehensive (qualifying) examination and admission to candidacy

Each student must complete a qualifying examination. Students who enter the Ph.D. Program directly from a baccalaureate program generally will sit for this examination before the end of third post-baccalaureate year in the Program; students who enter from a master's degree program must sit for it before the end of their first year in the Program. To sit for this examination, a student must have completed 2 of the 3 required core courses, must have at least a 3.0 GPA, and must have removed all conditions upon admission.

The examination will be a written exam and will address issues covered by the core elements of the program, as well as any focus area material covered by the candidate up to that point. This exam will be developed and administered by each student's doctoral program

committee. A student may attempt to pass the qualifying exam no more than twice. Failure a second time will result in termination of enrollment in the Ph.D. Program.

Admission to Candidacy

After passing the qualifying examination, a student can propose a dissertation topic. A student advances to candidacy after the dissertation topic has been approved by the student's doctoral committee. Candidacy must be achieved within 6 months before the degree is conferred.

Dissertation requirement

The INES doctoral program includes a minimum of 18 hours of dissertation credit. Each student must complete and defend a dissertation based on a research program approved by the student's doctoral adviser with concurrence by the IPC. The dissertation must be of high quality and represent an original piece of research that advances the body of knowledge in infrastructure and environmental systems. Oral presentation and successful defense of the dissertation before the student's advisory committee in a forum open to the public will be required. A copy of the student's dissertation will be made available to the graduate faculty of the program at least two weeks prior to the public defense. The dissertation must be written in a format acceptable to the Graduate School.

Language and research requirements

There is no language requirement in the INES Ph.D. degree. Research requirements in the INES Ph.D. Program are described in Section III.C.1.4.

Residency requirement

Each student must satisfy the residency requirement of the program by completing at least 16 credit hours in one period of 12 consecutive months during enrollment in the program.

Time limits for completion

No course listed on the candidacy form may be older than 8 years at the time of graduation. Courses that exceed this time limit must be revalidated or retaken, whichever the graduate program decides, if they are to count towards the degree program. Transfer credits beyond the baccalaureate degree that count toward the doctorate are not subject to the standard time limit to complete the degree.

New and existing courses in the program

In the course listings that follow, the following codes are used to explain the course numbering system for both new and existing courses.

- Each course listed carries a four-letter department or program prefix

- Courses at the 8000 level are for doctoral students only. The designation INES 8XXX is for INES-specific core courses and for other current or planned courses to be offered at the Ph.D. level as a part of the INES Ph.D. Program.
- All courses numbered at the 6000 level and offered for graduate students only (masters and Ph.D.).

Students in the INES Program are permitted to take courses numbered at the 6000 level (masters and Ph.D. students only), but they must take the majority of their courses at the 8000 level (Ph.D. students only). All students will be required to take courses in the core of the program (core courses, seminar courses, and case study course). The core will be comprised of new courses developed for the INES Ph.D. program, and these are listed and described below.

New courses (required courses are denoted with an (*))

- **For the INES Core**

- INES 8XX1(*) Environmental Systems Science and the Infrastructure (3 cr.)
- INES 8XX2(*) Infrastructure Design and Management of the Environment (3 cr.)
- INES 8XX3(*¹) Acquisition and Management of Scientific Data (3 cr.)
- INES 8XX4(*¹) Laws, Standards, Policies, and Regulations (3 cr.)
- INES 8XX5(*¹) Economic Principles in Infrastructure & Environmental Systems (3cr.)
- INES 8XX6(*) INES Case Study Course (3 cr.)
- INES 8XX7(*) INES Seminar Series (3 cr.)

*¹ Students are required to take one of the three courses INES 8XX3, INES 8XX4, and INES 8XX5

- INES 8XX0(*) Doctoral Independent Study and Project
- INES 8999(*) Doctoral Dissertation Research
- INES 9999 Doctoral Residency Requirement

Descriptions of these new courses are provided in the sections below.

INES Core (courses + case studies + seminars = 15 credits minimum)

The INES core will focus on basic and advanced level understanding of the principles of the infrastructure and environmental analysis, development, and management. Courses in this core will also emphasize environmental analysis and assessment and effects on the infrastructure as well as the development and management of the infrastructure and the impact on the environment. Throughout the core, students will study the configuration dynamics and operational issues relevant to the management of a variety of earth, civil, and industrial systems.

INES Ph.D. students will participate in interdisciplinary activities throughout their program of study. Students will begin with a set of interdisciplinary core courses that teaches them about

fundamental aspects of the infrastructure and the environmental systems present in all applications of INES. These common aspects are reflected in the five (5) core courses described below. Then, at midpoint, students will participate in an interdisciplinary case-study course, and, finally, throughout the program, students will participate in interdisciplinary seminar courses.

INES core courses (9 credits minimum)

All students must take INES 8XX1 and INES 8XX2.

- **INES 8XX1 Infrastructure and Environment I (3 credits)**
Principles of energy and mass transport as applied to the atmosphere, hydrosphere, biosphere and earth systems and how these impact human activities and the infrastructure. Overview of emerging environmental issues and technologies in the areas of environmental impact and sustainability, industrial ecology, waste utilization, and infrastructural response. Topics include the human impacts of climactic variability; geologic instability; the water balance and atmospheric circulation at local and regional scales.
- **INES 8XX2 Infrastructure and Environment II (3 credits)**
Overview of urban infrastructural development. Sustainable design features for facilities including municipal, transit, industrial, agricultural, telecommunications, and waste management. Impact of infrastructure development on environmental management including storm water quality and quantity, soil and channel erosion, urban air quality, sprawl, and waste production, treatment, and storage.

Students must then take at least one course from INES 8XX3, INES 8XX4, and INES 8XX5 depending on the student's background and interests and the recommendations of the student's and doctoral committee. Student enrollment in the program during the first 4 years may not justify offering INES 8XX3, INES 8XX4, and INES 8XX5 every semester. Therefore, students may experience a limited selection amongst these three courses initially.

- **INES 8XX3 Acquisition and Management of Scientific Data (3 credits)**
The study of theories and techniques for acquiring and managing scientific data and information related to the analysis, design, and management of the infrastructure and the environment. Includes pertinent aspects of information technology, such as data mining and data architecture, and includes applications of GIS and non-destructive assessment technologies to data acquisition.
- **INES 8XX4 Laws, Standards, Policies, and Regulations (3 credits)**
The study of legal, political, and regulatory systems as they relate to the infrastructure and the environment. Includes local, state, national, and international codes and standards that govern the analysis, assessment, design, and management of infrastructure and environmental systems.
- **INES 8XX5 Economic Principles in Infrastructure and Environmental Management**

(3 credits)

The study of economic concepts that affect the decision-making process in the management of the infrastructure and the environment. Topics include market forces, taxation, budgets, finance, and public goods and their effects on the economic sustainability of the infrastructure and the environment. Students will take this class after satisfying their comprehensive examination requirement.

INES case study course (3 credits)

After completion of INES core courses, INES students, regardless of focus areas, will come together in an interdisciplinary case-study, capstone-oriented course examining the relationships between the infrastructure and the environment. Case studies will include examples that focus on the Charlotte urban region.

- **INES 8XX6 Case Study Course**
Students will work together on interdisciplinary teams to study relevant environmental and infrastructure problems presented through case studies. The intent of the course is to directly involve the students in ongoing urban community projects.

INES seminar courses (3 credits)

Throughout the program, INES students, regardless of focus areas, will come together in interdisciplinary seminar courses in which they will make presentations and lead discussions on topics related to their respective focus areas and critique presentations.

- **INES 8XX7 Seminar Course**
Each student will be required to actively participate in program seminars delivered by student researchers, faculty and invited speakers. These seminars will be advertised to the campus and professional communities. Participation in these seminars will count for 3 credit hours (1 credit hour for each academic year). Prior to graduation, each student will make at least one seminar presentation and provide at least one formal critique of a presentation in this course.

Independent Study (1 - 9 credits)

At any time during the INES program, and with approval by the student's doctoral program committee, a student may enroll in an independent study to pursue topics of interest to the student and the professor. The number of independent study credit hours taken each semester must be approved by the student's doctoral program committee. The total number of independent study hours taken during the Ph.D. program cannot exceed 9 credit hours applied towards the INES Ph.D. degree.

- **INES 8XX0 Doctoral Independent Study and Project**
Individual investigation and exposition of results. May be repeated for credit.

Dissertation (18 credits minimum)

After completion of the qualifying examination, each INES student will be eligible to enroll in doctoral dissertation research. The number of research credits taken each semester must be approved by the student's doctoral program committee.

- INES 8999 Doctoral Dissertation Research (1-9 credits)
Each student will initiate and conduct an individual investigation culminating in the preparation and presentation of a doctoral dissertation.

Doctoral Residence

Graduate residence credit should only be used rarely and if used, a student would only sign up once during his or her very last semester prior to graduation. If the student is working on the degree, he or she should sign up for the appropriate course.

- INES 9999 Doctoral Residence (1 credit)
Meets Graduate School requirement for continuous enrollment during final term prior to graduation when all course work has been completed.

Existing courses

Initially, the majority of the specialized elective courses taken in the focus areas or as directed studies courses will be selected from existing 6000-level graduate courses or from new 8000-level developed for the proposed program. A representative list of courses in each focus area is provided below. As elective courses, none of these courses will be required, but they will be selected by the student and his/her adviser and committee to satisfy the student's educational objectives. It is anticipated that over time as the program grows and new faculty members participate in the program, new elective courses will be developed and added to each focus area by the various departments involved.

Specialized (focus area) elective courses (15 credits minimum)

It is recognized that doctoral degree study requires advanced knowledge of issues, the breadth of which depends on the context and objectives of the academic program. Both the infrastructure and the environment involve broad and multi-faceted issues. The supporting courses (central core, case studies, and seminars) have been designed to provide the student with broad-based understanding of such issues. Beyond the core, a student needs to support doctoral research with enrollment in particular courses related to his/her research. For this reason, 15 credit hours have been reserved for specialized electives. The objective of these specialized electives is to provide an opportunity for students, their advisers, and the doctoral program committee to select a complementary set of specialized courses intended to both focus and broaden the student's area of interest and research.

These courses will come from many fields and sub-fields of various academic departments of UNC Charlotte, and they could come from the two core courses not selected as a part of the core requirement. A few representative courses are listed below. These courses reflect the some of the interests and expertise of the supporting departments.

Specialized electives within the three focus areas described previously (IESD, IEES, IESM) are described below. Many courses listed are currently offered in various departments at the master's level, except for the Public Policy courses which are currently offered at the Ph.D. level. Each department offering or planning one of the courses listed below has agreed to support the INES Ph.D. Program with at least these courses. Upon approval by faculty governance, each course will be cross-listed at the Ph.D. (8000) level.

Focus Area 1: Infrastructure and Environmental Systems Design (IESD)

The design of infrastructure and environmental systems requires expertise in subject matter areas related to design methodologies including plan formulation, dimensioning of systems that could be structural and/or control systems, selection of material properties, and configuration of monitoring methodologies and approaches. Also, some basic knowledge of the functional requirements of the facilities concerned needs to be provided to the student. The following courses are examples that could be selected to provide students with adequate expertise on design elements of the INES doctoral program.

A representative list of courses to be offered in this focus area is shown below with the responsible department designated in parentheses.

- INES 8XXX Special Topics (in respective departments)
- INES 8XXX Shaping the American City (ARCH)
- INES 8XXX Appropriate Technology and Sustainable Design Methods (ARCH)
- INES 8XXX Transportation Systems Analysis (CEGR)
- INES 8XXX Soil Dynamics and Earthquake Engineering (CEGR)
- INES 8XXX Advanced Waste Containment Systems (CEGR)
- INES 8XXX Sustainable Environmental Systems (CEGR)
- INES 8XXX Optimization of Building Systems (CEGR)
- INES 8XXX Development of Codes and Standards (CEGR)
- INES 8XXX Engineering Systems Integration (EMGT)
- INES 8XXX Industrial Development (GEOG)
- INES 8XXX Site Planning and Development (GEOG)
- INES 8XXX Urban Planning (GEOG)

Focus Area 2: Infrastructure and Environmental Systems Science (IESS)

Successful development and operation of infrastructure, including methods and approaches to managing the associated environmental and socio-economic impacts require baseline information on the nature of the ambient environment spatially and temporally. This implies that the INES student who has been exposed to critical issues and techniques in the central core and is interested in environmental systems and their response to the operation of infrastructure needs to deepen his/her knowledge in the methods of physical, chemical and biological characterization of materials and other life support systems in the ecosystem. Particularly, the factors that affect the rates of change in such systems as affected by anthropogenic activities need to be addressed by majority of the courses selected by advisers for their students who express interest in this

focus area. Consistent with the foregoing rationale, the following courses have been identified as examples of courses that are relevant to this focus area. It should be noted that scientific assessment cannot be completely divorced from policy formulation and appreciation of the basic approaches to design. For this reason, students will be encouraged to select courses in this focus area to extend his/her knowledge base in the breadth of issues that pertain to infrastructure and environmental systems.

A representative list of courses to be offered in this focus area is shown below with the responsible department designated in parentheses.

- INES 8XXX Special Topics (in respective departments)
- INES 8XXX Advanced Ecology (BIOL)
- INES 8XXX Microbiology (BIOL)
- INES 8XXX Air Quality Modeling (CEGR)
- INES 8XXX Water Quality Management and Modeling (CEGR)
- INES 8XXX Environmental Aquatic Chemistry (CEGR)
- INES 8XXX Advanced Analytical Chemistry (CHEM)
- INES 8XXX Advanced Energy and Environmental Economics (PPOL/ECON)
- INES 8XXX Designed Experimentation (EMGT)
- INES 8XXX Earth System Analysis: Biogeochemical Cycles (ESCI)
- INES 8XXX Hydrologic Processes (ESCI)
- INES 8XXX Environmental Site Characterization (ESCI)
- INES 8XXX Advanced Soil Science (GEOL)

Focus Area 3: Infrastructure and Environmental Systems Management (IESM)

To be able to efficiently and effectively plan and manage infrastructure system or environmental system operations, the INES students need to obtain, integrate, and utilize the knowledge in operations efficiency, effective policy development and deployment, legal issues and government regulations, intelligent support systems for decision making, effective environmental and/or socio-economic impact control measures, efficient systems project management, comprehensive evaluation of system performance, and smart systems implementation and management that includes the consideration of facility, people, policy, technology, economics, and procedures. The students who choose to focus in this area of INES will obtain the expertise in effective systems management and implementation in infrastructure system and/or environmental system areas and will work as senior managers and/or researchers in the above areas. The following courses are examples that could be selected to provide students with expertise on systems management that are relevant to infrastructure and environmental systems.

A representative list of courses to be offered in this focus area is shown below with the responsible department designated in parentheses.

- INES 8XXX Special Topics (in departments)
- INES 8XXX. Hazardous Waste Management (CEGR)

- INES 8XXX Urban Systems Engineering (CEGR)
- INES 8XXX Benefit-Cost Analysis (ECON)
- INES 8XXX Advanced Project Management (EMGT)
- INES 8XXX Legal Issues in Engineering Management (EMGT)
- INES 8XXX Engineering Systems Integration (EMGT)
- INES 8XXX Urban Planning: Theory and Practice (GEOG)
- INES 8XXX Economics of Decision-Making (MBAD)
- INES 8XXX Technology-Enhanced Decision Making (MBAD)
- INES 8XXX Organizational Leadership and Behavior I (MBAD)
- INES 8XXX Qualitative Methods in Public Policy (PPOL)
- INES 8XXX Advanced Program Evaluation (PPOL)

Directed Studies (24 credits minimum)

In recognition of varying backgrounds, preparation, interests, and goals, each student may complete additional credits through directed studies (courses, research, or individual study), with the consent of his/her adviser and doctoral committee. Within the directed studies category, and with the approval of his/her adviser and doctoral committee, a student may complete a maximum of 9 credits of independent study toward the Ph.D. degree