

**WHALIN, JSU  
DHS COASTAL RESILIENCE CENTER  
EDUCATION PROJECT  
YEAR 5 PROGRESS REPORT  
July 1, 2019 – June 30, 2020 (Updated 12/15/2020)**

**I. INTRODUCTION**

**Project Title:** PhD in Engineering (Coastal Engineering and Computational Engineering) at an HBCU.

**Principal Investigator Name/Institution:** Robert W. Whalin, Ph.D., P.E., D.CE; Professor of Civil Engineering and Education Director, Coastal Resilience Center of Excellence, Jackson State University (JSU).

**Other Partners/Institutions:** US Army Engineer Research and Development Center, Vicksburg, MS and Texas A&M University at Galveston.

**Short Project Description (“elevator speech”):**

This project focuses on strengthening the establishment and institutionalization of the PhD in Engineering (Coastal Engineering and Computational Engineering concentrations) accomplished during years 1 to 3 of this CRC education project. A steady output of MS and PhD Engineering degree graduates with Coastal Engineering or Computational Engineering concentrations focused on coastal natural disasters is projected to be established by the end of year six. This output of graduates will help increase workforce diversity in the greater Homeland Security enterprise.

**II. PROJECT NARRATIVE:**

- 1. Project overview:** This project directly addresses the education need for graduate engineering programs focused on coastal natural disasters to provide engineers that can help mitigate the ever-increasing cost of damages, especially those from tropical storms and hurricanes, that DHS is confronted with through FEMA missions. Almost no graduate coastal engineering programs are focused on coastal natural disasters and none are located at an HBCU where a large percentage of African American engineers matriculate. Jackson State University has an African American student body exceeding 80% which will directly support the DHS Strategic Plan Goal to Enhance the DHS Workforce, especially the Objective to increase Workforce Diversity and Priority Goal 3 to Enhance Resilience to Disasters. Leverage of federal assets is assured by the Education Partnership Agreement (authorized by Public Law) between the Engineer Research and Development Center and Jackson State University. The Agreement facilitates ERDC providing Adjunct Faculty, student internships and potential use of ERDC experimental and computational facilities for graduate research. An excellent record of DHS End User involvement and transition of graduates to end users continued throughout year five of the Coastal Resilience Center of Excellence. Research staff and graduate students had direct participation in a research project; and in highly relevant hurricane barrier projects nationwide (funded by others)

including the Ike Dike concept for protecting Galveston Island and the greater Houston metropolitan area from devastating, albeit low probability, hurricane surges. Coastal Engineering education programs nationwide have been on a decline for the past two decades and United States leadership in the coastal engineering profession has declined relative to other nations. This project will help ameliorate the trend while increasing the supply of minority coastal and computational graduate level engineers focused on the field of coastal natural disasters.

2. **End users:** A list of end-users that participated in this project during Year 5 follows. Their project role is included focusing on facilitating transitions to these end users as appropriate. Discussions were held with each at either the CRC Annual Meeting, at ERDC, at MS Engineering Society Meetings, during classes or on other professional occasions.

**Table 1: End-User Involvement**

| <u>End-User</u>                            | <u>Agency/Employer</u>   | <u>Project Role (Year 5)</u>   |
|--|--------------------------|--|
| Subject Matter Expert, DHS                 | FEMA Region IV           | Transition, potential employer   |
| Chairman, Free Flow Power Development, LLC | Free Flow Power          | Collaborator (guest lecturer), Transition (assists with student internships/employment).   |
| GIS Specialist                             | MEMA                     | Collaborator, Transition (potential employer of graduates)   |
| Division Chief, MVX                        | USACE Vicksburg District | Transition (potential employer): Sponsored student Society of American Military Engineers. Discussed engineer government careers, employer of graduates. |
| Vice President, PE                         | SDW                      | Transition (potential employer)  |
| Research Engineer                          | USACE, ERDC, CHL         | Collaborator, research advisor for a PhD student: discussed dissertation research several times during Year 5.   |
| Research Mathematician                     | USACE ERDC               | Collaborator, Leveraged Project from TAMUG   |
| Director, ERDC                             | USACE, ERDC              | Transition, signatory for Education  |

|   |                  |   |
|---|------------------|---|
|   |                  | Partnership Agreements; had several discussions during Year 5.                                  |
| Director, Geotechnical and Structures Lab | USACE, ERDC      | Transition; GSL employs graduates. Held discussions.  |
| Research Engineer, CHL                    | USACE, ERDC, CHL | Adjunct Professor, graduate courses; served on two graduate committees and one Qualifying Exam. |
| Research Engineer, CHL                    | USACE, ERDC, CHL | Adjunct Prof., graduate courses; served on one graduate committee and one Qualifying Exam.      |
| Director, Coastal and Hydraulics Lab      | USACE, ERDC      | Approved joint research project and use of ERDC facility for project of mutual interest.        |

There is a very small number of end-users in FEMA, Corps of Engineers Districts, Emergency Management Agencies and private industry contractors who have engineers with graduate Coastal Engineering education (most especially African American and Hispanic American engineers). This project will help ameliorate this critical deficiency in widespread expertise (over 80% of JSU students are minorities, mostly African American). The immense cost to the taxpayers of rescue and recovery from Hurricane inundation, coastal and estuarine flooding from intensified precipitation events and tsunami inundation drives the need for additional engineers with graduate education focused on coastal natural disasters

3. **Unanticipated Problems:** None. A good year. But, I would point out three Year 5 unexpected circumstances. First, two international graduate students were denied student visas to study in the MS Coastal Engineering concentration a week before their departure for JSU in August 2019. Second, the pandemic induced shift to online classes in March 2020 was inconvenient and resulted in cancellation of The Netherlands research trip in May 2020. The third unexpected loss of a projected Year 5 PhD graduate which was an unavoidable occurrence. See Education Milestones.

4. **Students and recent graduates:**

This project is a graduate program only. There are no undergraduate students. The number of students who want to enroll in graduate- level programs is not applicable. The data requested for students enrolled in CRC-supported courses during year 5 is restricted to the Core Coastal Engineering concentration graduate course. Elective courses are not CRC-supported.

The number of student's enrolled in CRC-supported courses during Year 5 was 24. There were zero undergraduates, 9 full time graduate students and 15 working professionals. 54% were minority students. One minority student graduated with a MS Engineering (Coastal Engineering concentration) degree and another minority student graduated with a PhD Engineering (Environmental Engineering concentration) degree. Two other students graduated with a MS Engineering (Civil Engineering concentration) degree. The total

number of MS Engineering (Coastal Engineering concentration) degrees awarded through Year 5 is 11 of which 10 are minorities (6 female and 4 male). Seven of the eleven graduates are employed in the Greater Homeland Security Enterprise. Two of the seven are employed by the Corps of Engineers, one by Texas Department of Transportation and four by private industry engineering and construction firms. Of the four other graduates, one is a post doc in China, one at Nissan, one at Blue Origin and the other is self-employed.

5. **Project Impact:** This project impacted workforce capabilities during year five by graduating an additional MS (coastal engineering concentration student), as scheduled, that was a working professional in private industry. He was African American. One additional MS graduate is scheduled for July 2020. Two additional MS Engineering graduate students completed a year of graduate studies and are scheduled to graduate in May 2021 (one African American and one Caucasian). An additional, two graduate students were recruited to begin Coastal Engineering concentration studies in Fall 2020. Courses are revised every time taught by adding relevant new literature content. Most commonly from publications in the International Conferences on Coastal Engineering (ICCE), Journal of Coastal Engineering and the ASCE Coastal, Oceans, Ports and Rivers Institute journal. It is a responsibility of all faculty professors to update course content each time taught.
  
6. **Institutionalization:** The location where the project deliverables are maintained was confirmed upon submittal of the proposal. It is in the former Coastal Hazards Center, renamed the Coastal Resilience Center office complex (with conference room) in the JSU Mississippi e-Center (a 250ft<sup>2</sup> building on 30 acres). The Education program resides in the Department of Civil and Environmental Engineering and classes taught are part of the Civil and Environmental Engineering Department graduate academic offerings.

The PI prepared all documentation required to gain approval for the PhD Engineering (Coastal Engineering concentration) Degree Program. The PhD Engineering degree was previously approved by the Mississippi Institutions of Higher Learning (IHL) along with concentrations in Civil Engineering, Environmental Engineering, Geological Engineering, Computer Engineering, Computational Engineering and Electrical Engineering. Degrees are approved at the IHL level. Concentrations within degree programs are approved at the University level. Formal institutionalization of a program occurs upon approval of the concentration, in this case, by the university and upon listing the degree program and concentration in the official University Catalog along with the degree requirements, admission requirements, curriculum, class numbers and class descriptions. The Coastal Engineering concentration of the PhD Engineering degree was evaluated, approved and formally signed by (in order):

1. Department of Civil and Environmental Engineering Curriculum Committee
2. Chair, Department of Civil and Environmental Engineering
3. College of Science Engineering and Technology Curriculum Committee
4. Dean, College of Science, Engineering and Technology
5. Jackson State University Curriculum Committee
6. Dean, Graduate Division, Jackson State University
7. Provost and Vice President for Academic Affairs (Approved May 2018)

Post-CRC support will be on an equal footing with all other academic programs at JSU (similar to any university). Requests can and will be made for funds for graduate assistantships, teaching assistantships. Proactive efforts to obtain grants for graduate research assistantships have been and are being made. At the current time, external funding of about \$400,000 annually seems to be relatively stable from the National Science Foundation and Department of Transportation. All are subcontracts from prime grant (Cooperative Agreement) recipients. Excellent partnerships and working relationships with several universities have been developed and nurtured (specifically University of North Carolina, University of Arkansas, Texas A&M University at Galveston, University of Florida and University of Puerto Rico at Mayaguez). Perhaps the most important source of Post CRC support is the Education Partnership Agreement (EPA) with the US Army Corps of Engineers Engineer Research and Development Center in Vicksburg, MS that is fully expected to continue. The EPA facilitates (a) joint research projects with ERDC, (b) ERDC researchers to teach mutually agreeable graduate courses, and serve on graduate committees and (c) use and/or loan of ERDC research equipment (including high performance computing assets).

7. **Interactions with research projects:** Year five interactions with research projects were mostly focused on interactions with the JSU CRC group. After the unexpected departure of one PhD Candidate at the beginning of Year 5, our other PhD Candidate was intensely immersed in his dissertation research and published one journal paper (as a co-author) and submitted another journal paper, as first author, based on his dissertation research. He has a third journal article near completion. One other PhD student was administered the PhD Qualifying Exam during Year 5 and should initiate her research during year six. Both the PhD students have full time engineering jobs in the Greater Homeland Security Enterprise as do four of the five MS students. SUMREX is not an option for students with full time positions. The most unusual and rewarding research experience for our graduate students is to compete to participate in the Independent place-based research in The Netherlands with a group of 15 students competitively selected by a NSF sponsored Partnership for International Research and Education (PIRE) entitled Coastal Flood Reduction. The 15 selected students are from Texas A&M University at Galveston (Prime), Rice University, Texas A&M at College Station, Jackson State University and University of Puerto Rico at Mayaguez. A two week place based research trip to The Netherlands is made during May each year to gain information needed for each student's report. The report is due in August at the end of the summer term. The pandemic cancelled the May 2020 trip where we had one student selected. Through Year 5, six of our students had been selected and produced research reports. The first four research reports (2016 and 2017 trips) are in the fifth listed publication by Kothius, Lee and Brody, Mr. Akil Mohammed who was selected to make the May 2019 trip, completed his research report in August 2019 during Year 5 and earned an A for his Independent Research investigation. Mr. Mohammad received his MS Engineering degree in May 2020. ERDC research engineers gave a lecture in each of my Year 5 academic year courses and I participated in the Tougaloo College research awards day ceremony.



Mr. Akil Mohammad: Making Research Presentation in Netherlands

### III. EDUCATION ACTIVITIES AND TRANSITION MILESTONES

1. **Year 5 Education Activities and Milestone Achievements:** All four Year 5 education activities were completed. There were five education milestones of which four were met and one was partially met. The milestone Award at least one MS Engineering degree and one PhD Engineering degree to Coastal Engineering concentration students was partially met with Award of one MS Engineering degree in May 2020. The totally unexpected withdrawal from the university (to accept an engineering job) of a PhD Candidate (projected to graduate in Year 5) at the beginning of Year 5 caused us to miss the award at least one PhD Engineering degree part of this milestone. The young lady was an international student and her work VISA did not allow her to enroll in a university course to complete her dissertation research. She was scheduled to graduate in May 2020 and was well along with her dissertation research. She is working in the Greater Homeland Security Enterprise with a company that performs design and construction for the U.S. Army Corps of Engineers, State agencies and commercial firms. One PhD Qualifying Exam was scheduled and administered and one student completed the minimum required coursework for the PhD degree. One other student has completed all MS Engineering degree requirements except for one course which he is enrolled in for the Summer 2020 semester. He will graduate in July 2020 and has been accepted to the PhD Engineering degree program. The remaining PhD Candidate will either graduate in December 2020 or May 2021. He has one published paper relating to his dissertation research and has another paper being reviewed for publication. His PhD Preliminary Examination is scheduled for September 2020. This PhD graduate will 100% work for the greater Homeland Security Enterprise since he is an employee of the Coastal and Hydraulics Laboratory of the Engineer Research and Development Center. His dissertation research involves evaluating innovative concepts to mitigate hurricane flooding in back bays along the New Jersey coast.

| <b>Education Activities and Milestones: Status as of 6/30/2020</b>                         |  |                          |   |
|--|--|--------------------------|---|
| <b><u>Education Activities</u></b>   | <b><u>Proposed Completion Date</u></b> | <b><u>% Complete</u></b> | <b><u>Explanation of why activity/milestone was not completed</u></b> |
| Enroll students in Coastal Engineering concentration of MS/PhD Engineering Degree Program. | Continuous                             | 100%                     |   |
| Advise MS/PhD Coastal Engineering concentration students.                                  | Continuous                             | 100%                     |   |
| Schedule PhD Qualifying Exam.  | Continuous                             | 100%                     |   |
| Administer PhD Qualifying Exam.  | Continuous                             | 100%                     |   |
| <b><u>Education Milestones</u></b>   |  | 100%                     |   |

|  |           |      |   |
|--|-----------|------|---|
| Enroll at least two students in Coastal Engineering concentration of PhD Engineering degree program.                   | 6/30/2020 | 100% |   |
| Schedule one or two PhD Qualifying Exams (Coastal Engineering concentration).  | 1/30/2020 | 100% |   |
| Administer one or two PhD Qualifying Exams (Coastal Engineering concentration)   | 6/30/2020 | 100% |   |
| At least one student complete minimum required PhD courses (non-research) in the Coastal Engineering concentration.    | 6/30/2020 | 100% |   |
| Award at least one MS Engineering Degree and one PhD Engineering degree to Coastal Engineering concentration students. | 5/30/2020 | 50%  | The projected PhD graduate accepted a job offer at the start of Year 5. She was an international student and her VISA would not allow her to enroll in dissertation research. |

2. **Year 5 Transition Activities and Milestone Achievements:** Achievements of Activities and Milestones were accomplished as scheduled with the exception of the totally unexpected loss of a PhD Candidate at the beginning of Year 5 as explained above for education milestone. By oversight, one transition milestone was identical to the education milestone. Otherwise, all transition milestones were met.

| <b>Transition Activities and Milestones: Status as of 6/30/2020</b>   |  |                          |   |
|---|--|--------------------------|---|
| <b><u>Transition Activities</u></b>   | <b><u>Proposed Completion Date</u></b> | <b><u>% Complete</u></b> | <b><u>Explanation of why activity/milestone was not completed</u></b> |
| Recruit/sustain both MS and PhD students for Coastal Engineering concentration. Sustainment target is two students for both the MS and PhD program. | Continuous                             | Continuous<br>100%       |   |
| Advise MS and PhD Coastal Engineering concentration students. PI is the primary advisor, records of students advised are kept by PI.                | Continuous                             | Continuous<br>100%       |   |
| <b><u>Transition Milestones</u></b>   |  |                          |   |
| Award at least one MS Engineering degree and one PhD Engineering degree to Coastal Engineering concentration students.                              | 06/2020                                | 50%                      | Identical explanation to Education Milestone 5                        |



|   |         |      |  |
|---|---------|------|--|
| Student employment/matriculation will be tracked post-graduation. | 06/2020 | 100% |  |
|---|---------|------|--|

### 3 **Annual Courses and Enrollments**

The following Tables enumerate the core courses and elective courses taught through Year 5 and their enrollment.

| <b>Table 1: Core Courses (Coastal Engineering Concentration)</b> |   |
|--|---|
| CIV 520  | Advanced Engineering Analysis                       |
| CIV 538  | Coastal Structures                                  |
| CIV 539  | Advanced Coastal Engineering Design                 |
| CIV 631  | Linear Theory of Ocean Waves                        |
| CIV 632  | Tides and Long Waves                                |
| CIV 636  | Spectral Wave Analysis                              |
| CIV 637  | Advanced Design for Breakwater Rehabilitation       |
| CIV 698  | Independent Study (4 Separate Courses of 1-4 hours) |
| CIV 899  | Dissertation Research                               |

| <b>Table 2: Elective Courses</b> |  |
|----------------------------------|--|
| CIV 521                          | Advanced Engineering Analysis II               |
| CIV 535                          | Pavement Design                                |
| CIV 542                          | Advanced Design of Concrete Structures         |
| CIV 544                          | Advanced Design of Steel Structures            |
| CIV 544                          | Advanced Design of Hydraulic Structures        |
| CIV 550                          | Engineering Hydrology                          |
| CIV 561                          | Chemistry for Environmental Engineering        |
| CIV 562                          | Hazardous Waste Engineering                    |
| CIV 566                          | Air Pollution                                  |
| CIV 567                          | Environmental Remediation                      |
| CIV 568                          | Land Disposal of Waste                         |
| CIV 574                          | Engineering Hydrogeology                       |
| CIV 640                          | Finite Element Method                          |
| CIV 642                          | Pre-Stressed Concrete Design                   |
| CIV 661                          | Biological Processes in Wastewater Engineering |
| CIV 675                          | Earth Dams and Slopes                          |

**Table 3: Core and Elective Courses  
Core and Elective Courses Taught with Enrollments (Years 1-5)**

| #CIV631 | Course Title: <u>Linear Theory of Ocean Waves</u>  | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|---------|--|-----------------|-----------------|-----------------|----------------|-----------------|
|         | Status: Developed (D), Revised (R), and/or Taught (T)  | T               | T               | --              | --             | T/C             |
|         | Offering: Elective (E), Concentration (C), Minor (M)   | C               | C               | --              | --             | C               |
|         | Number of Students Enrolled  | 6               | 5               | --              | --             | 5               |
| #CIV637 | Course Title: <u>Advanced Design for Breakwater Rehabilitation</u>                                     | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|         | Status: Developed (D), Revised (R), and/or Taught (T)  | T               | --              | T               | --             | T/R             |
|         | Offering: Elective (E), Concentration (C), Minor (M)   | C               | --              | C               | --             | C               |
|         | Number of Students Enrolled  | 3               | --              | 7               | --             | 8               |
| #CIV642 | Course Title: <u>Pre-Stressed Concrete Design</u>  | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|         | Status: Developed (D), Revised (R), and/or Taught (T)  | T               | --              | --              | T/R            | --              |
|         | Offering: Elective (E), Concentration (C), Minor (M)   | E               | --              | --              | E              | --              |
|         | Number of Students Enrolled  | 4               | --              | --              | 5              | --              |
| #CIV698 | Course Title: <u>Independent Study (4 separate courses)</u>  | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|         | Status: Developed (D), Revised (R), and/or Taught (T)<br>(1 one hour course)<br>(2 three hour courses) | T/R (4 courses) | T/R (4 courses) | T/R (3 courses) | T/R (1 course) | T/R (3 courses) |
|         | Offering: Elective (E), Concentration (C), Minor (M)   | C               | C               | C               | C              | C               |
|         | Number of Students Enrolled  | 1 each          | 1 each          | 1 each          | 1 each         | 1 each (3)      |
| #CIV538 | Course title: <u>Coastal Structures</u>  | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|         | Status: Developed (D), Revised (R), and/or Taught (T)  | --              | T               | --              | T/R            | --              |
|         | Offering: Elective (E), Concentration (C), Minor (M)   | --              | C               | --              | C              | --              |
|         | Number of Students Enrolled  | --              | 6               | --              | 8              | --              |
| #CIV636 | Course title: <u>Spectral Wave Analysis</u>  | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|         | Status: Developed (D), Revised (R), and/or Taught (T)  | --              | T               | T/R             | --             | T/R             |
|         | Offering: Elective (E), Concentration (C), Minor (M)   | --              | C               | C               | --             | C               |
|         | Number of Students Enrolled  | --              | 5               | 5               | --             | 5               |
| #CIV539 | Course title: <u>Advanced Coastal Engineering Design</u>   | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|         | Status: Developed (D), Revised (R), and/or Taught (T)  | --              | T               | --              | T/R            | --              |
|         | Offering: Elective (E), Concentration (C), Minor (M)   | --              | C               | --              | C              | --              |
|         | Number of Students Enrolled  | --              | 6               | --              | 7              | --              |
| #CIV520 | Course title: <u>Advanced Engineering Analysis I</u>   | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|         | Status: Developed (D), Revised (R), and/or Taught (T)  | --              | T               | T/R             | T/R            | T/R             |
|         | Offering: Elective (E), Concentration (C), Minor (M)   | --              | C               | C               | C              | C               |
|         | Number of Students Enrolled  | --              | 9               | 4               | 7              | 8               |
| #CIV535 | Course Title: <u>Pavement Design</u>   | <u>YR 1</u>     | <u>YR 2</u>     | <u>YR 3</u>     | <u>YR 4</u>    | <u>Yr 5</u>     |
|         | Status: Developed (D), Revised (R), and/or Taught (T)  | -               | T               | -               | T/R            | T/R             |

|  |   |             |             |             |             |             |
|--|---|-------------|-------------|-------------|-------------|-------------|
| Offering: Elective (E), Concentration (C), Minor (M) |   | -           | E           | -           | E           | E           |
| Number of Students Enrolled                          |   | -           | 8           | -           | 8           | 9           |
| #CIV542  | Course Title: <u>Advanced Design of Concrete Structures</u>         | <u>YR 1</u> | <u>YR 2</u> | <u>YR3</u>  | <u>YR 4</u> | <u>Yr 5</u> |
|  | Status: Developed (D), Revised (R), and/or Taught (T)               | -           | T           | --          | --          | --          |
| Offering: Elective (E), Concentration (C), Minor (M) |   | -           | E           | -           | --          | --          |
| Number of Students Enrolled                          |   | -           | 9           | -           | --          | --          |
| CIV544   | Course Title: <u>Advanced Design of Steel Structures</u>            | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR4</u>  | <u>Yr 5</u> |
|  | Status: Developed (D), Revised (R), and/or Taught (T)               |             | T           | --          | T           | --          |
| Offering: Elective (E), Concentration (C), Minor (M) |   | -           | E           | --          | E           | --          |
| Number of Students Enrolled                          |   | -           | 8           | --          | 6           | --          |
| CIV544   | Course Title: <u>Advanced Design of Hydraulic Structures</u>        | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u> |
|  | Status: Developed (D), Revised (R), and/or Taught (T)               | -           | T           | -           | T           | --          |
| Offering: Elective (E), Concentration (C), Minor (M) |   | -           | E           | -           | E           | --          |
| Number of Students Enrolled                          |   | -           | 9           | -           | 5           | --          |
| CIV632   | Course Title: <u>Tides and Long Waves</u>                           | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u> |
|  | Status: Developed (D), Revised (R), and/or Taught (T)               | -           | -           | T/R         | -           | --          |
| Offering: Elective (E), Concentration (C), Minor (M) |   | -           | -           | C           | -           | --          |
| Number of Students Enrolled                          |   | -           | -           | 10          | -           | --          |
| CIV550   | Course Title: <u>Engineering Hydrology</u>                          | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u> |
|  | Status: Developed (D), Revised (R), and/or Taught (T)               | -           | -           | T           | -           | --          |
| Offering: Elective (E), Concentration (C), Minor (M) |   | -           | -           | E           | -           | --          |
| Number of Students Enrolled                          |   | -           | -           | 10          | -           | --          |
| CIV661   | Course Title: <u>Biological Processes in Wastewater Engineering</u> | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u> |
|  | Status: Developed (D), Revised (R), and/or Taught (T)               | -           | -           | T           | T           | T/R         |
| Offering: Elective (E), Concentration (C), Minor (M) |   | -           | -           | E           | E           | E           |
| Number of Students Enrolled                          |   | -           | -           | 9           | 6           | 7           |
| CIV561   | Course Title: <u>Chemistry for Environmental Engineering</u>        | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u> |
|  | Status: Developed (D), Revised (R), and/or Taught (T)               | -           | -           | T           | -           | T/R         |
| Offering: Elective (E), Concentration (C), Minor (M) |   | -           | -           | E           | -           | E           |
| Number of Students Enrolled                          |   | -           | -           | 6           | -           | 7           |
| CIV567   | Course Title: <u>Environmental Remediation</u>                      | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u> |

|        |  |             |             |             |             |              |
|--------|--|-------------|-------------|-------------|-------------|--------------|
|        | Status: Developed (D), Revised (R), and/or Taught (T)                    | -           | -           | T           | -           | --           |
|        | Offering: Elective (E), Concentration (C), Minor (M)                     | -           | -           | E           | -           | --           |
|        | Number of Students Enrolled  | -           | -           | 7           | -           | --           |
|        |  |             |             |             |             |              |
| CIV675 | Course Title: <u>Earth Dams and Slopes</u>                               | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u>  |
|        | Status: Developed (D), Revised (R), and/or Taught (T)                    | -           | -           | T           | -           | T/R          |
|        | Offering: Elective (E), Concentration (C), Minor (M)                     | -           | -           | E           | -           | E            |
|        | Number of Students Enrolled  | -           | -           | 9           | -           | 8            |
|        |  |             |             |             |             |              |
| CIV568 | Course Title: <u>Land Disposal of Waste</u>                              | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u>  |
|        | Status: Developed (D), Revised (R), and/or Taught (T)                    | -           | -           | -           | T/R         | --           |
|        | Offering: Elective (E), Concentration (C), Minor (M)                     | -           | -           | -           | E           | --           |
|        | Number of Students Enrolled  | -           | -           | -           | 7           | --           |
|        |  |             |             |             |             |              |
| CIV574 | Course Title: <u>Engineering Hydrogeology</u>                            | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u>  |
|        | Status: Developed (D), Revised (R), and/or Taught (T)                    | -           | -           | -           | T/R         | --           |
|        | Offering: Elective (E), Concentration (C), Minor (M)                     | -           | -           | -           | E           | --           |
|        | Number of Students Enrolled  | -           | -           | -           | 8           | --           |
|        |  |             |             |             |             |              |
| CIV640 | Course Title: <u>Finite Element Method</u>                               | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u>  |
|        | Status: Developed (D), Revised (R), and/or Taught (T)                    | -           | T           | -           | T/R         | --           |
|        | Offering: Elective (E), Concentration (C), Minor (M)                     | -           | E           | -           | E           | --           |
|        | Number of Students Enrolled  | -           | 6           | -           | 7           | --           |
|        |  |             |             |             |             |              |
| CIV681 | Course Title: <u>Excavation Support Systems and Retaining Structures</u> | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u>  |
|        | Status: Developed (D), Revised (R), and/or Taught (T)                    | -           | -           | -           | T           | --           |
|        | Offering: Elective (E), Concentration (C), Minor (M)                     | -           | -           | -           | E           | --           |
|        | Number of Students Enrolled  | -           | -           | -           | 6           | --           |
|        |  |             |             |             |             |              |
| CIV899 | Course Title: <u>Dissertation Research</u>                               | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u>  |
|        | Status: Developed (D), Revised (R), and/or Taught (T)                    | -           | -           | -           | T/R         | T/R          |
|        | Offering: Elective (E), Concentration (C), Minor (M)                     | -           | -           | -           | C           | C (10 hours) |
|        | Number of Students Enrolled  | -           | -           | -           | 1           | 1            |
|        |  |             |             |             |             |              |
| CIV521 | Course Title: <u>Advanced Engineering Analysis II</u>                    | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u>  |
|        | Status: Developed (D), Revised (R), and/or Taught (T)                    | T           | T           | T           | T           | T            |
|        | Offering: Elective (E), Concentration (C), Minor (M)                     | E           | E           | E           | E           | E            |
|        | Number of Students Enrolled  | 6           | 7           | 6           | 5           | 6            |
|        |  |             |             |             |             |              |
| CIV562 | Course Title: <u>Hazardous Waste Engineering</u>                         | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u>  |

|        |   |             |             |             |             |             |
|--------|---|-------------|-------------|-------------|-------------|-------------|
|        | Status: Developed (D), Revised (R), and/or Taught (T) | -           |             |             | -           | T           |
|        | Offering: Elective (E), Concentration (C), Minor (M)  | -           |             |             | -           | E           |
|        | Number of Students Enrolled                           | -           |             |             | -           | 8           |
|        |   |             |             |             |             |             |
| CIV566 | Course Title: <u>Air Pollution</u>                    | <u>YR 1</u> | <u>YR 2</u> | <u>YR 3</u> | <u>YR 4</u> | <u>Yr 5</u> |
|        | Status: Developed (D), Revised (R), and/or Taught (T) | -           | -           | -           | -           | T           |
|        | Offering: Elective (E), Concentration (C), Minor (M)  | -           | -           | -           | -           | E           |
|        | Number of Students Enrolled                           | -           | -           | -           | -           | 9           |
|        | <b>TOTALS</b>   | <b>23</b>   | <b>76</b>   | <b>76</b>   | <b>87</b>   | <b>84</b>   |

#### IV. PUBLICATIONS AND METRICS

##### 1. Publications:

- **Ebersole, Bruce; Richardson, Thomas and Whalin, Robert**, “Minimize Hurricane Surge Penetration into West/Galveston Bays: It's Crucial!” Proceedings, 11<sup>th</sup> Texas Hurricane Conference, University of Houston, Houston, TX, Aug. 2, 2019.
- Hu, Guojing, Lu, Weike; Wang, Feng; and **Whalin, Robert**, “Macroscopic Fundamental Diagram Based Discrete Transportation Network Design,” Journal of Advanced Transportation, February 2020
- **Whalin, Robert W.**, “A PhD in Engineering Degree: Coastal Engineering Emphasis Area,” Proceedings, 126<sup>th</sup> ASEE Conference, Tampa Bay, FL, June 2019.
- **Ebersole, Bruce; Richardson, Thomas W.; Whalin, Robert W.**, “Suppression of Hurricane Surge Forerunner and Peak Surge in Galveston and West Bays Achieved with a Western Segment of the Coastal Spine,” 10<sup>th</sup> Annual Texas Hurricane Conference, University of Houston, Houston, TX; Aug. 3, 2018.
- “NSF-PIRE, Coastal Flood Risk Reduction Program, Authentic Learning and Transformative Education”, Volume 1-2015-2017; Edited by Baukje “Bee” Kothius, Yoonjeong Lee and Samuel Brody, March 2018.
- **Ebersole, Bruce; Richardson, Thomas; and Whalin, Robert, W.**, “Surge Suppression Achieved by Different Coastal Spine (Ike Dike) Alignments”, 9<sup>th</sup> Annual Texas Hurricane Conference, University of Houston, August 4, 2017, Houston, TX.
- **Whalin RW**, Pang Q, Latham J, **Lowe LN**. Assessment of a Summer Bridge Program: Seven Years and Counting, 2017 ASEE National Conference Proceedings, Columbus, OH, June 24-28, 2017.
- **Whalin RW**. HBCU Engineering Faculty and Graduates: Implications for Race, Retention and Graduation Linkages, NAAAS & Affiliates 2016 National Conference Proceedings, Baton Rouge, LA, published Oct. 2016.
- **Whalin RW**, Brody SD, and Merrell WJ. The Galveston Bay Region as an International Test Bed for Flood Risk Reduction, 8<sup>th</sup> Annual Texas Hurricane Conference, University of Houston, Houston, TX, August 5, 2016.
- **Ebersole B, Richardson TW, and Whalin RW**. Modeling Coastal Storms: Past, Present and Future, 8<sup>th</sup> Annual Texas Hurricane Conference, University of Houston, Houston, TX, August 5, 2016
- **Whalin, Robert, W.; Pagan-Trinidad, Ismael; Villanueva, Evelyn; and Pittman, David, W.**, “A Quarter Century of Resounding Success for a University/Federal Laboratory

Partnership”, Proceedings, 123<sup>rd</sup> ASEE Annual Conference and Exposition, New Orleans, LA, June 26, 2016.

\*All names are bold that were funded by CRC; Whalin, Richardson, Ebersole and Lowe

## 2. Performance Metrics

### Whalin: Performance Metrics

| <u>Metric</u>   | <u>Year 1</u><br>(1/1/16 –<br>6/30/16) | <u>Year 2</u><br>(7/1/16 –<br>6/30/17) | <u>Year 3</u><br>(7/1/17-<br>6/30/18) | <u>Year 4</u><br>(7/1/18-<br>6/30/19) | <u>Year 5</u><br>(7/1/19-<br>6/30/20) |
|---|--|--|---------------------------------------|---------------------------------------|---------------------------------------|
| HS-related internships (number)   | 5                                      | 4                                      | 3                                     | 3                                     | 1                                     |
| Undergraduates provided tuition/fee support (number)                                  | 1                                      | 0                                      | 0                                     | 0                                     | 0                                     |
| Undergraduate students provided stipends (number)                                     | 0                                      | 0                                      | 0                                     | 0                                     | 0                                     |
| Graduate students provided tuition/fee support (number)                               | 4                                      | 7                                      | 10                                    | 4                                     | 6                                     |
| Graduate students provided stipends (number)  | 2                                      | 6                                      | 6                                     | 3                                     | 3                                     |
| Undergraduates who received HS-related degrees (number)                               | 2                                      | 3                                      | 3                                     | 3                                     | 3                                     |
| Graduate students who received HS-related degrees (number)                            | 0                                      | 4                                      | 4                                     | 5                                     | 4                                     |
| Certificates awarded (number)   | 0                                      | 0                                      | 0                                     | 0                                     | 0                                     |
| Graduates who obtained HS-related employment (number)                                 | 1                                      | 2                                      | 3                                     | 4                                     | 3                                     |
| Lectures/presentations/seminars at Center partners (number)                           | 1                                      | 1                                      | 1                                     | 1                                     | 1                                     |
| DHS MSI Summer Research Teams hosted (number)   | 0                                      | 0                                      | 0                                     | 0                                     | 1                                     |
| Journal articles submitted (number)<br>(includes peer reviewed conference proceeding) | 2                                      | 0                                      | 0                                     | 0                                     | 1                                     |
| Journal articles published (number)<br>(includes peer reviewed conference proceeding) | 2                                      | 4                                      | 0                                     | 0                                     | 1                                     |
| Conference presentations made (number)  | 2                                      | 4                                      | 3                                     | 2                                     | 2                                     |
| Other presentations, interviews, etc. (number)  | 5                                      | 3                                      | 5                                     | 3                                     | 4                                     |
| Trademarks/copyrights filed (number)  | 0                                      | 0                                      | 0                                     | 0                                     | 0                                     |
| Requests for assistance/advice from DHS agencies (number)                             | 0                                      | 4                                      | 2                                     | 2                                     | 2                                     |
| Requests for assistance/advice from other agencies or governments (number)            | 0                                      | 3                                      | 2                                     | 2                                     | 2                                     |
| Dollar amount of external funding   |  |  | \$941,825<br>(YRs 1-3)                | \$424,854<br>Year 4                   | \$404,791                             |
| Total milestones for reporting period (number)  | 3                                      | 4                                      | 3                                     | 7                                     | 7                                     |
| Accomplished fully (number)   | 2                                      | 3                                      | 3                                     | 7                                     | 5                                     |
| Accomplished partially (number)   | 1                                      | 0                                      | 0                                     | 0                                     | 2                                     |
| Not accomplished (number)   | 0                                      | 1                                      | 0                                     | 0                                     | 0                                     |

