Spring 2017

CWR 4812 Water Resources Design

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CWR 4812: Capstone Environmental/Water Resources Design
ENV 6564: Environmental Engineering Design
Department of Civil & Environmental Engineering
University of South Florida
CMC 13, Thursdays 5:00-7:45 p.m.

Instructors:

Sarina Ergas, PhD, PE Professor, CEE Office: Office Hours: Wednesdays: 3:00-5:30 pm Thursdays: 1:00-3:00 pm	Tom Cross, P.E. Adjunct Instructor, USF Project Manager, TETRA TECH

Course Description:

A capstone Water Resources/Environmental Engineering design experience. Real world design projects will be selected from one of the following topic areas: industrial and domestic water and wastewater treatment; water transport, and hydraulic systems. Prerequisites: Fluid Mechanics (EGN 3353), Environmental Engineering I (ENV 4001), Water Quality & Treatment (ENV 4417), Water Resources Engineering (CWR 4103); Co-requisite (for students enrolled in CWR 4812): Professional and Ethical Issues in Engineering (CGN 4122).

Text: Tchobanoglous, G.; Leverenz, H. (2013) A guidance manual on the preparation of technical reports, papers, and presentations, Revised 2nd edition, Dept. Civil & Environmental Engineering, University of California, Davis (available on Canvas).

References (most are available through library reserves):

Charbeneau R.J. (2000) *Groundwater Hydraulics & Pollutant Transport*, Waveland Press, Long Grove, IL (available from Dr. Nachabe).

Crittenden, J.C., Trussell, R.R., Hand, D.W., Howe, K.J., Tchobanoglous, G. (2012) *MWH Water Treatment: Principles and Design*, 3rd Edition, Wiley, Hoboken, NJ.

Lin, S.D.; Lee, C.C. (2007) *Water and Wastewater Calculations Manual*, 2nd Ed, McGraw-Hill, NY, NY (available online through the USF library).

Mihelcic, J.R and Zimmerman, J.B. (2014) *Environmental Engineering: Fundamentals, Sustainability, Design*, 2nd Edition, John Wiley and Sons, Inc..

Roberson, J.A., Cassidy, J.J., Chaudhry, M.H. (1998) *Hydraulic Engineering* 2nd Ed. Wiley, Hoboken, NJ.

Tchobanoglous, G., Stensel, H.D., Tsuchihashi, R., Burton, F.L., Abu-Orf, M., Bowden, G., Pfrang, W. (2014) *Metcalf & Eddy Wastewater Engineering*, 5th Ed., McGraw-Hill, NY, NY.

USEPA (1978) *Analysis of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems*, Report 430/9-77-015, Washington DC.

USEPA (1980) *Construction Costs for Municipal Wastewater Treatment Plants: 1973-1978*, Report 430/9-80-003.

Viessman, W. and Hammer, M.J. (2009) *Water Supply and Pollution Control* 8th edition, Prentice Hall, Upper Saddle River NJ, ISBN: 978-0-13-233717-5.

WEF and ASCE (2009), *Design of Municipal Wastewater Treatment Plants - Manual of Practice (MOP) 8*, 5th edition, WEF Press, Alexandria, VA, ISBN: 978-0-07-166358-8

Attendance: Students are expected to attend all classes and to arrive at class on time. If you need to miss a lecture, field trip or presentation, you will need approval from Dr. Ergas and will have to discuss what make-up work you need to do with your project manager and other teammates.

Laptops and mobile devices: use of laptops, cellphones, cameras and other mobile devises during class lectures is prohibited without permission of the instructors.

Email: Everyone is responsible for checking their Canvas email regularly. Schedule changes, field trip information, etc. will be announced by email via the Canvas program or to the project managers for each team. Feel free to contact the instructors by email with questions.

Accommodations for students with disabilities: USF is committed to providing reasonable support for students with disabilities. Students with disabilities are responsible for registering with Students with Disabilities Services (SDS) in order to receive academic accommodations. SDS encourages students to notify instructors of accommodation needs at least five business days prior to needing the accommodation. A letter from SDS must accompany this request.

Academic honesty: The USF Academic Integrity Policy applies and can be found at http://usfweb2.usf.edu/usfgc/ogc%20web/currentregs/USF3-027.htm. The policy covers plagiarism, cheating, fabrication, forgery, obstruction, multiple submissions, assisting another person in acts of academic dishonesty and computer misuse.

Academic Continuity in the Event of a Campus Closure: In the event of an emergency, it may be necessary for USF to suspend normal operations. During this time, USF may opt to continue delivery of instruction through methods that include but are not limited to: Canvas, Skype, and email messaging and/or an alternate schedule. It's the responsibility of the student to monitor Canvas site for each class for course specific communication, and the main USF, College, and department websites, emails, and MoBull messages for important general information.

Grading: Course grades will be based on the following:

Class participation and attendance, field trips and preparation for meetings.	10%
Outside talk attendance and summary reports (2)	10%
Scope of work	10%
Phase I Oral Progress Report	10%
Phase I Written Report	10%
Phase II Oral Progress Report	10%
Final Oral Presentation	15%
Final Written Report	25%
Evaluations by team members regarding contributions to the team report and presentations.	**

****Evaluations by team members will be taken into consideration when determining final grades.

Team Projects: Students will be divided into teams of 4-5 students. All students in the team are collectively responsible for what is presented and submitted by the group. Each student will be asked to fill out a form at the end of the semester grading the contribution of each team member.

Field trips: Tours will be scheduled to field sites. Additional field-work will be organized by your team. Dates, locations and attendance will be documented by the project manager.

Outside talks or public meetings: Each student is required to attend two professional talks or public meetings on topics related to the course. The instructors will provide information on local and regional meetings and conferences on the Canvas site. Extra credit will be granted to students who provide timely information on relevant talks and meetings to the class. You will need to submit a brief summary report on the talk/meeting you attended. The report should include the name, title and affiliation of the speaker

(or group) (or other relevant information), the date, location and event where the talk was given, and a short (300-500 word) summary.

Florida Water Environment Association Student Design Competition: Two teams will be using their projects as part of the FWEA design competition. Teams entering the competition must comply with all rules and deadlines required for both the class and the competition. Note that student grades in the class are not dependent on their participation in the competition.

Major Course Topics: A variety of environmental and water resource engineering topics including domestic, industrial and agricultural water and wastewater treatment processes, hazard and solid waste management, environmental and economic sustainability, sustainable international development, global climate change, air pollution, stormwater management, water resource systems.

Course Learning Objectives

1. Become familiar with the design process for environmental and water resource systems, including establishing design criteria, technical aspects of process design and cost estimation.
2. Learn how to prepare engineering design reports and make technical oral presentations.

Course Outcomes

By the end of the semester students will:

1. Analyze and interpret information on existing water infrastructure, water quality and quantity from a municipal utility.
2. Develop design criteria that need to be met when designing environmental and water resources systems including the system's:
    a. Ability to handle projected or permitted inputs to the system over the design life,
    b. Cost effectiveness, reliability and sustainability.
    c. Ability to maintain compliance with local, state and federal rules and standards,
    d. Having sufficient redundancy for continued operation during maintenance, equipment failures or emergencies.
3. Use modern engineering techniques, skills and tools to design appropriate environmental and water resource systems to meet the needs of a community.
4. Carry out detailed cost estimates of capital and operations and maintenance (O&M) costs for selected alternative designs and perform an economic analysis of design alternatives including present worth analysis and payback period.
5. Developed detailed design documents for recommended alternative designs, including equipment specifications, process flow diagrams, tables of design parameters and CAD drawings.
6. Communicate effectively in public, within the design team, and to a "client" both orally and in writing.
7. Experience in working productively with others who possess different technical skills and backgrounds to design environmental and water resources systems to meet specified criteria.

Tentative Schedule

Date	Topic	Activities/Deliverables
Jan 12	Introduction to instructors, clients and projects	Team members and projects
Jan 19	Engineering and project management	Each team will arrange to tour field sites and meet with clients
Jan 26	Team consultations: Team (time): 1(5:00), 2(5:20), 3(5:40), 4(6:10), 5(6:30), 6(6:50), 7(7:10)	
Feb 2	Sewer Systems/ Wastewater Review	Scopes of work due all teams
Feb 9	Scopes Feedback: Team (time): 3(5:00), 4(5:20), 5(5:40), 6(6:10), 7(6:30), 1(6:50), 2(7:10)	
Feb 16	Biosolids Alternatives/ Potable and Reclaim Water Distribution Systems	
Feb 23	Phase I Oral Progress Report All Teams	
Mar 2	Aquifer Storage & Recovery/ Econ I	Phase I written reports due
Mar 9	Feedback on Phase I: 5(5:00), 6(5:20), 7(5:40), 1(6:10), 2(6:30), 3(6:50), 4(7:10)	
Mar 16	*Spring Break*	
Mar 23	Integrating Sustainability into Engineering Design/ Econ II	
Mar 30	Phase II Oral Progress Report All Teams	
Apr 6	Team consultations: 5(5:00), 6(5:40), 7(6:20),	
Apr 13	Team consultations: 1(5:00), 2(5:40), 3(6:20), 4(7:00)	
Apr 20	TBA	
TBA	Final presentations in Palmetto during week of April 24th	
May 2	Final reports due	

***Consultations:** Teams will come to these meetings with a written summary of the progress made on each major task and prepared to discuss their projects with the instructors.

Client Contact Information

Allen Tusing, atusing@palmettofl.org, (941) 723-4580

Javier A. Vargas, jvargas@palmettofl.org, (941) 723-4580

Project Summary: Capstone Water Resources / Environmental Engineering Design works with local municipal agencies on water infrastructure problems. This semester we will be working with the City of Palmetto, Florida DPW on a *water utility master plan*. The projects will be carried out in two phases. Phase I will be an assessment of existing infrastructure and recommendations for improvements to meet the City's future needs. Phase II will be a preliminary design and economic analysis of one capital improvement project (CIP) identified during Phase I. Each team of 3-5 students will work on one of the following sub-projects:

Team 1: Water distribution system
Team 2: Sewer system
Team 3: Wastewater treatment facility
Team 4: Biosolids management options
Team 5: Reclaim water system
Team 6: Aquifer storage and recovery system
Team 7: Sneed Island sewerage/decentralized treatment alternatives

Deliverables, Due Dates and Format Requirements

Item	Due Date	Format (see also additional notes below)
Project teams	**1/19/17**	**<1 page + resumes**
Name of your firm, name and contact information for the project manager (PM) and a 1-page resume for each team member using a consistent format.		
Phase I Scope of Work	**2/2/17**	**12 pt font, 1.5 spacing, 1" margins, 4-5 pages**
Each team will provide a written scope of work (SOW) for Phase I. Once the instructors have approved the SOW, your firm will be able to proceed with the project. The following sections must be included: 1. Letter of transmittal (outside the page limits): The official means of transmitting the report to your client. Describe what the report is for, indicate that the work was done in accordance to accepted engineering practices and note that your client may contact you with any questions or concerns. Your stationary should include your company name and logo. The project manager must sign the letter. 2. Background: Give the location of the project and provide a brief description of the current system. Discuss the regulatory framework for your project. 3. Objectives: Clearly describe the major problem(s) that you will be addressing based on your preliminary analysis and discussions with the clients. 4. Project tasks: Provide a description of the tasks that will be carried out to achieve the overall objectives for Phase I. 5. Timeline and Roles: Provide a chart showing the major tasks, schedule for completing each task and the team member who will be the lead on each task. 6. References: Provide citations for material borrowed from other authors in ASCE format (see below).		
Phase I Oral Progress Report	**2/23/17**	**15 minute timed PowerPoint presentation**
The first oral progress report should provide a summary of the work completed for Phase I and should generally **follow the outline of the Phase I written report shown below**. Handouts of the slides should be provided for the instructor and client(s). Oral presentations will be evaluated based on the following: 1. Is the background information sufficient to understand the project? 2. Is the material presented technically correct? 3. Is the material well organized? 4. Are key points summarized and the next steps clearly stated? 5. Delivery: Confident? Too fast? Audience contact? 6. Quality of visual aids and/or handouts 7. Did the group handle questions well? 8. Did group stay within allotted time constraints?		
Phase I Written Report	**3/2/17**	**12 pt font, 1.5 spacing, 1" margins, 10-15 pages**
The Phase I written report will be graded and the feedback should be included in the final report. The following sections must be included: 1. A letter of transmittal (see above, not counted in the page limits) 2. Cover page (not counted in page limits): The cover page should include the title of the report, your company name, name of all team members, who the report has been prepared for and the date. Do not put a number on this page.		

3. Introduction: The main body of the report begins with an introduction that includes the background, objectives and scope of work. Note that the introduction will be a revision of work already submitted for the SOW deliverable.
4. Assessment of Current Infrastructure: Provide an assessment of the current infrastructure associated with your team's subproject. At minimum this should include its:
    a. Ability to handle projected or permitted inputs to the system over the design life,
    b. Cost effectiveness, reliability and sustainability.
    c. Ability to maintain compliance with local, state and federal rules and standards,
    d. Having sufficient redundancy for continued operation during maintenance, equipment failures or emergencies.
5. Future Utility Needs: Provide an assessment the City's future infrastructure needs associated with your sub-project. Future needs should take into consideration future population projections, operational problems, future regulations, aging equipment and improvements in technology.
6. Recommendations: Provide a listing of capital improvement projects to meet the needs identified along with a prioritization of these projects.
7. Phase II SOW: Identify at least one capital improvement project for Phase II design. The Phase II SOW should include the following elements:
    a. Brief overview of the project.
    b. Project Tasks, Timeline and Roles (similar to Phase I SOW)
    c. Evaluation criteria: describe how you will evaluate your design alternatives. Examples of evaluation criteria are in the following list but each team should develop its own criteria:
        i. Be able to handle projected or permitted inputs to the system over the design life,
        ii. Be cost effective - include capital and operating costs, equivalent annual costs and payback period (relative to appropriate baseline). Assume a 6% interest rate over a 20 year design life unless instructed otherwise by the client,
        iii. Be proven, reliable and environmentally sound,
        iv. Maintain compliance with local, state and federal rules and standards,
        v. Include sufficient redundancy for continued operation during maintenance, equipment failures or emergencies,
        vi. Consider sustainability metrics such as greenhouse gas emissions, energy, water and chemical use.

Phase II Oral Progress Report	**3/30/17**	**15 minute timed PowerPoint presentation**
The second oral progress report should include approximately 50% of the Phase II project work. It should include background information on the selected project, an overview of your selected alternatives and preliminary results from your alternatives analysis. See above for information on evaluation criteria.		
Final Oral Report	**TBA**	**15 minute timed PowerPoint presentation**
Final oral presentations will presented to the clients at their site. **Note that you will be required to be off campus during the day for this presentation**. At this stage most of your work should be completed and you should be ready to make recommendations to the clients and answer any questions that might arise from your presentations. Slides should be professional, legible from the audience and provide information in summary tables and figures as appropriate.		
Final Written Reports	**5/2/17**	**12 pt font, 1.5 spacing, 1" margins, ≤ 30**

		pages

A written final report is required for each team. The following sections must be included:

1. A letter of transmittal (not counted in page limits)
2. Cover page (Not counted in page limits).
3. Executive Summary (3-5 pages). This is one of the most important sections of a technical report. It offers the busy executive a summary of what is contained in the report. The executive summary should briefly summarize the background, objectives, scope, methods, major findings, conclusions and recommendations. It is appropriate to include one or two summary tables and/or figures in the executive summary (these can also be repeated in the main body of the report).
4. Table of Contents, List of Tables and List of Figures with page numbers (not counted in page limits). Note that tables and figures should be presented in the main body of the report as close as possible after the first reference to the table or figure. Edit the report to minimize blank space.
5. List of Symbols and List of Acronyms in alphabetical order, English first followed by Greek with definitions and units (not counted in page limits).
6. Introduction. See instructions for Phase I report.
7. Phase I Results: This section should include the assessment of the current infrastructure, future utility needs and recommendations. This section should be revised to incorporate all of the feedback given to the team by the instructors for the Phase I report.
8. Phase II Results: This section should be organized and presented in a logical sequence and should include the following sections:
    a) Background on the project
    b) Alternative analysis: provide a brief literature review on each alternative considered and a discussion of its advantages and disadvantages. Provide details of your analysis, including figures, tables, flow charts, assumptions, experimental or modeling results and/or equations used for calculations, economic and/or sustainability analysis. Refer to figures and tables in the Appendices where appropriate.
    c) Selected alternative: provide a clear rationale for why you chose the selected alternative(s) based on your stated evaluation criteria. For the selected alternative(s), provide a detailed engineering and economic analysis including flow charts and CAD drawings. Your economic analysis should include tables detailing how capital and O&M costs were calculated. Where appropriate, present worth and payback period should be calculated.
9. Conclusions. The final section should provide brief summary of the worked carried out for this project, a discussion of your recommended alternative(s) and any suggestions for future work.
10. References (not counted in page limit) in ASCE format.
11. Appendices (not counted in page limits): Sample calculations (may be neatly handwritten), detailed data tables and schematics, CAD drawing. Refer to all material in the main body of the text.

Additional Format Notes

1. Use the template provided by the City of Palmetto, which includes consistent formatting for headings, subheadings, captions, etc. throughout the report.
2. Equations should be numbered sequentially and all variables fully described including units directly after the equation and in the list of symbols.
3. All data in your reports should be reported to the appropriate number of significant figures.
4. Number pages at the bottom right using 12 point font. The Introduction begins on page 1 of the report with all previous pages being numbered using lower case roman numerals (e.g., i, ii, iii, iv, v, etc.). Use the automatic page numbering function provided with your software.
5. When using tables and figures that are taken from other publications make sure to clearly identify the reference in the figure or table title as either (from xxxx - means you copied the figure directly out of the reference) or (after xxxx - means you took the figure from the reference but made some modifications).
6. Tables and figures should be numbered sequentially and all tables, figures and appendices must be referred to in the text. Table captions should be provided ABOVE the table and figure captions should be provided BELOW the figure.
7. The references section may be single spaced. The citation method used by the American Society of Civil Engineers follows:

Example citations in text:

One author: (Babcock, 1995)
Two authors: (Babcock and Wilson, 1995)
Three or more authors: (Babcock et al., 1995)

Reference format for internet articles:
Author/editor (year) "Title of electronic work". Information supplier, URL. Access date.

Reference format for a book:
Evangelou, V.P. (1998), *Environmental Soil and Water Chemistry: Principles and Applications*, Wiley, New York, NY.

Reference format for a journal article:
Arias, C.A., Bubba, M.D., and Brix, H. (201). "Phosphorus removal by sands for use as media in subsurface flow constructed reed beds," *Water Res*., 35 (5), 1159-1168.

Reference format for a book chapter:
Singh, U. and Uehara, G. (1999). "Electrochemistry of the double layer: Principles and applications to soils." In *Soil Physical Chemistry*, 2nd ed.; D. L. Sparks (Ed.); CRC Press: Boca Raton, FL.

Rubrics - each report is graded by both instructors using a rubric, with specific points for each section. Definitions for what constitutes poor, good or excellent writing, engineering design, teamwork and knowledge of contemporary issues can be found on the Canvas site.

Item	**Points possible**	**Points given**
Letter of transmittal	1	
Cover page	1	
Executive Summary	12	
Tables of contents, figs, tables	1	
List of symbols and acronyms	1	
Introduction		
Background	3	
Objectives	3	
Scope	3	
Phase I Results		
Current infrastructure Assessment	4	
Future Needs	4	
Recommendations	4	
Phase II Results		
Background	3	
Alternatives analysis	10	
Rationale for selected alternative	4	
Conclusions and Recommendations	4	
References	2	
Appendices (including CAD)	5	
Writing		
Focus (meets assigned requirements)	3	
Evidence (appropriate references)	3	
Organization (logical, cohesive)	3	
Format (headings, page numbers, margins, font)	3	
Writing Style (grammar, punctuation, word choice, etc.)	3	
Overall assessment of engineering design	**12**	
Teamwork	**4**	
Knowledge of contemporary issues	**4**	
Total	**100**	