

**Syllabus**  
**CEE 694-50-4225 Wetland Design**  
**University of Louisville, Department of Civil and Environmental Engineering**  
**Speed School Summer Session 2023**

**Course Description**

Wetland Design is a graduate-level, online class that shows how to design and build naturally appearing and functioning wetlands. There are no classroom sessions. The detailed modules explain the values of wetlands, how wetlands were drained, factors affecting site selection for restoration, techniques for construction, and how nonfunctioning wetlands may be repaired. The class focuses on teaching practical, low cost, and highly effective practices for restoring wetlands that will require little, if any maintenance. Specific examples from across North America show how wetlands may be built to improve habitat for rare animals and plants, provide water for livestock, manage stormwater, recharge groundwater, and control flooding. Assignments are completed independently, and generally require working outdoors. Engineering, biology, hydrology, and landscape architecture students are welcome to register. The instructors are actively involved with the restoration of wetlands and streams across North America.

**Registration**

Wetland Design is open to U of L students who are enrolled in a degree program and non-U of L students who would like to take the class. For non-UofL students interested in this course, he/she will have to apply online via School of Interdisciplinary and Graduate Studies <http://louisville.edu/graduate/>, indicate this is for a **non-degree** application. Those holding a bachelor's degree in related field from a regionally accredited institution may apply. You should then request that your college transcripts be sent to U of L. You are responsible for contacting your school(s) and requesting that official transcripts be sent. You are also responsible for any fees associated with these requests.

**Course Instructors**

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Web-site: [www.wetlandrestorationandtraining.com](http://www.wetlandrestorationandtraining.com)

Please send all emails to [tombiebighauser@gmail.com](mailto:tombiebighauser@gmail.com) as he does not use the U of L email system

Completed assignments and questions about the course should be emailed to [tombiebighauser@gmail.com](mailto:tombiebighauser@gmail.com)

Please do not upload assignments to Blackboard for this course

**Credits = 3**

**Course Dates:** May 15 to July 28, 2023

This is an online class where lessons and assignments may be completed at any time during the day or night. Reading assignments, PowerPoint presentations, quizzes, and assignments must be completed by the dates listed in this syllabus, or in advance. The current week's lessons and assignments should be completed prior to the next week's scheduled lessons. Students are expected to work independently in this class. There are no group assignments or required field trips.

### **Student Learning Outcomes**

Through online PowerPoint presentations, readings, and independent assignments requiring trips outdoors, students are expected to:

1. Learn how to identify different types of wetlands.
2. Know the primary values of wetlands of different types.
3. Recognize the signs of wetland drainage and understand the principals of drainage.
4. Know how to select and evaluate sites for wetland restoration and construction.
5. Understand the primary techniques available for building wetlands.
6. Recognize threats to natural and constructed wetlands.
7. Identify how to repair failed wetlands.
8. Explain the concepts of wetland spillway construction and maintenance.
9. Understand how to design wetlands for various purposes.
10. Recognize the basics of supervising the construction and planting of wetlands.
11. Outline strategies for developing partnerships and obtaining funding for wetland projects.
12. Understand the permits required to move forward with a wetland construction project.

### **Textbooks Required:**

Thomas R. Biebighauser, *Wetland Drainage, Restoration, and Repair*, Lexington, KY, University Press of Kentucky, 2007.

May be ordered from:

<https://www.kentuckypress.com/9780813124476/wetland-drainage-restoration-and-repair/>

[http://www.amazon.com/Wetland-Drainage-Restoration-Repair-Biebighauser/dp/0813124476/ref=sr\\_1\\_1?ie=UTF8&qid=1420145665&sr=8-1&keywords=wetland+drainage+restoration+and+repair](http://www.amazon.com/Wetland-Drainage-Restoration-Repair-Biebighauser/dp/0813124476/ref=sr_1_1?ie=UTF8&qid=1420145665&sr=8-1&keywords=wetland+drainage+restoration+and+repair)

Thomas R. Biebighauser. *Wetland Restoration and Construction - A Technical Guide*. Upper Susquehanna Coalition, 186 pages, 2023 3<sup>rd</sup>-edition (earlier editions are acceptable)

May be ordered from:

[https://www.forestry-suppliers.com/product\\_pages/products.php?mi=48410&itemnum=59963](https://www.forestry-suppliers.com/product_pages/products.php?mi=48410&itemnum=59963)

[https://www.amazon.com/Wetland-Restoration-Construction-Technical-Guide-dp-0983455821/dp/0983455821/ref=dp\\_ob\\_title\\_bk](https://www.amazon.com/Wetland-Restoration-Construction-Technical-Guide-dp-0983455821/dp/0983455821/ref=dp_ob_title_bk)

Both books should be ordered well in advance of taking the class. Please do not wait until the last minute to place your order.

## Course Outline

### Week 1

Wetland restoration and values

- a) How wetlands appear and function
- b) The various types of wetlands
- c) Animals and plants found in wetlands

Required reading:

Wetland Drainage, Restoration, and Repair; Introduction

Wetland Restoration and Construction - A Technical Guide; Introduction, Chapter 1

Publications that are listed on Blackboard

PowerPoints to view:

Lesson 1.1 Wetland Restoration and Values

Lesson 1.2 Wetland Definitions and Types

Lesson 1.1 Quiz due by 6:00 PM on Saturday, May 20

Lesson 1.2 Quiz due by 6:00 PM on Saturday, May 20

Assignment 1.0: Wetland and mosquito inventory (due by 6:00 PM on Saturday, May 20)

## **Week 2**

### Wetland Drainage

- a) Moving and channeling streams
- b) Digging ditches
- c) Burying wood, rock, clay tile, and plastic drainage structures
- d) Filling and sloping
- e) Recognizing historically drained wetlands

### Required reading:

Wetland Drainage, Restoration, and Repair; Chapters 1-9

Wetland Restoration and Construction - A Technical Guide; Chapter 2

Publications that are listed on Blackboard

### PowerPoints to view:

Lesson 2.1 Ditching and Filling of Wetlands

Lesson 2.2 Buried Drainage Structures

Lesson 2.3 Identification of Drained Wetlands

Lesson 2.1 Quiz due by 6:00 PM on Saturday, May 27

Lesson 2.2 Quiz due by 6:00 PM on Saturday, May 27

Lesson 2.3 Quiz due by 6:00 PM on Saturday, May 27

Assignment 2.0: Identification of Drained Wetlands (due by 6:00 PM on Saturday, May 27)

## **Week 3**

### Wetland Design

- a) Slope considerations
- b) Soil texture
- c) Surface water and groundwater
- d) Construction techniques

### Assigned reading:

Wetland Drainage, Restoration, and Repair; Chapters 11, 12, 14

Wetland Restoration and Construction - A Technical Guide; Chapter 3, 4

Publications that are listed on Blackboard

### PowerPoints to view:

Lesson 3.1 Wetland Design

Lesson 3.2 Construction of Wetlands Surface Water Technique-Ridge-top Areas

Lesson 3.3 Construction of Wetlands-Surface Water Technique- Riparian Areas

Lesson 3.4 Construction of Wetlands- Surface Water Technique-Compacted Clay Liners

Lesson 3.5 Blue Lake Wetland Restoration Project

Lesson 3.1 Quiz due by 6:00 PM on Saturday, June 3  
Lesson 3.2 Quiz due by 6:00 PM on Saturday, June 3  
Lesson 3.3 Quiz due by 6:00 PM on Saturday, June 3  
Lesson 3.4 Quiz due by 6:00 PM on Saturday, June 3  
Lesson 3.5 Quiz due by 6:00 PM on Saturday, June 3

#### **Week 4**

Wetland Construction and Heavy Equipment

- a) Building wetlands on saturated ground
- b) Groundwater dams
- c) Using aquatic-safe liners

Assigned reading:

Wetland Drainage, Restoration, and Repair; Chapter 13, 15  
Wetland Restoration and Construction - A Technical Guide; Chapter 5, 7  
Publications that are listed on Blackboard

PowerPoints to view:

Lesson 4.1 Construction of wetlands using the groundwater technique  
Lesson 4.2 Construction of wetlands using the liner technique  
Lesson 4.3 Heavy Equipment & Wetland Construction

Lesson 4.1 Quiz due by 6:00 PM on Saturday, June 10  
Lesson 4.2 Quiz due by 6:00 PM on Saturday, June 10  
Lesson 4.3 Quiz due by 6:00 PM on Saturday, June 10

Assignment 4.0: Design a Wetland (due by 6:00 PM on Saturday, June 10)

#### **Week 5**

Wetland spillways, water control structures

- a) Spillway design & construction
- b) Preventing and controlling erosion and head-cuts
- c) Stream restoration concepts and spillway design
- d) Water control structures-values and problems
- e) Installation of water control structures

Assigned reading:

Wetland Restoration and Construction - A Technical Guide; Chapter 12  
Publications that are listed on Blackboard

PowerPoints to view

Lesson 5.1 Wetland Spillway Design

Lesson 5.2 Sumter National Forest Wetland Restoration Program

Lesson 5.3 Water Control Structures

Lesson 5.4 Contracting wetland projects

Lesson 5.5 Controlling Head-cuts That Threaten Wetlands

Quiz 5.1 due by 6:00 PM on Saturday, June 17

Quiz 5.2 due by 6:00 PM on Saturday, June 17

Quiz 5.3 due by 6:00 PM on Saturday, June 17

Quiz 5.4 due by 6:00 PM on Saturday, June 17

Quiz 5.5 due by 6:00 PM on Saturday, June 17

Assignment 5.0: Wetland Spillway Design (due by 6:00 PM on Saturday, June 17)

## **Week 6**

Techniques for restoring wetlands of different types

- a) Spring Restoration
- b) Ephemeral wetlands
- c) Wet-meadow wetlands

Assigned reading:

Wetland Restoration and Construction - A Technical Guide; Chapter 6

Publications that are listed on Blackboard

PowerPoints to view:

Lesson 6.1 Spring Restoration

Lesson 6.2 Restoration of Ephemeral Wetlands

Lesson 6.3 Restoration of Wet-Meadow Wetlands

Quiz 6.1 due by 6:00 PM on Saturday, June 24

Quiz 6.2 due by 6:00 PM on Saturday, June 24

Quiz 6.3 due by 6:00 PM on Saturday, June 24

## **Midterm Exam**

The Midterm Exam must be completed by 6:00 PM on Saturday, June 24, 2023 The Midterm Exam covers PowerPoint Lessons 1.1 – 5.5, related Homework Assignments, and required readings in Wetland Drainage, Restoration and Repair, and Wetland Restoration and Construction - A Technical Guide. The best way to prepare for the Midterm Exam is to stay current with the required readings, PowerPoint Lessons, and Quizzes.

The Midterm Exam includes multiple choice, multiple answer, and essay questions that must be completed. The essay questions are worth 100-points each. Responding to the essay questions will require an understanding of the materials provided. Your answers to the essay questions should be

150 or more words in length, and should contain specific points learned from the course. You will be given a maximum of 3-hours to take the exam, which is open-book. The midterm exam must be completed in one session, it cannot be stopped and resumed at a later time and date as what Blackboard may say. You will be able to review the correct answers to the Midterm, your answers, your score and feedback after everyone in the class have taken the Midterm, and the essay questions have been graded.

## **Week 7**

Establishing Native Vegetation

- a) Forested Wetland Restoration
- b) Establishing trees, shrubs, and wildflowers
- c) Controlling nonnative plants
- d) Managing for specific plants

Assigned reading:

Wetland Drainage, Restoration, and Repair; Chapter 16

Wetland Restoration and Construction - A Technical Guide; Chapter 8

Publications that are listed on Blackboard

PowerPoints to view

Lesson 7.1 Restoration of Forested and Shrub Wetlands

Lesson 7.2 Establishing Vegetation

Lesson 7.3 Planting Wetlands

Lesson 7.4 Reed Canary Grass and Wetland Restoration

Quiz 7.1 due by 6:00 PM on Saturday, July 1

Quiz 7.2 due by 6:00 PM on Saturday, July 1

Quiz 7.3 due by 6:00 PM on Saturday, July 1

Quiz 7.4 due by 6:00 PM on Saturday, July 1

Assignment 7.0: Wetland plant identification and plant sources (due by 6:00 PM on Saturday, July 1)

## **Week 8**

Designing and building wetlands for specific purposes

- a) Wildlife and Fish habitat
- b) Storm water management and flood Control
- c) Groundwater recharge
- d) Livestock watering

Assigned reading:

Wetland Restoration and Construction - A Technical Guide; Chapter 9

Publications that are listed on Blackboard

PowerPoints to view

Lesson 8.1 Wetlands for Treating Storm water and Reducing Flooding

Lesson 8.2 Devin's Ditch Storm-water Wetland Project

Lesson 8.3 Wildlife Habitat Improvement

Lesson 8.4 Wetlands that Help Livestock

Lesson 8.5 Building Wetlands for Rare Amphibians

Quiz 8.1 due by 6:00 PM on Saturday, July 8

Quiz 8.2 due by 6:00 PM on Saturday, July 8

Quiz 8.3 due by 6:00 PM on Saturday, July 8

Quiz 8.4 due by 6:00 PM on Saturday, July 8

Quiz 8.5 due by 6:00 PM on Saturday, July 8

## **Week 9**

Government permits

- a) Section 404
- b) Section 401
- c) Floodplain
- d) Storm water
- e) Archeology
- f) Endangered Species

Assigned reading:

Wetland Restoration and Construction - A Technical Guide; Chapter 10

Publications that are listed on Blackboard

PowerPoints to view:

Lesson 9.1 Government Permits and Approvals for wetland projects

Lesson 9.2 Architects of the Swamp by John Carey, Scientific American, December 2013, pages 75-79

Quiz 9.1 due by 6:00 PM on Saturday, July 15

Quiz 9.2 due by 6:00 PM on Saturday, July 15

Assignment 9.0: Build a wetland in a box (due by 6:00 PM on Saturday, July 15)

## **Week 10**

Wetland maintenance, repair, and renovation and funding wetland projects

- a) Strategy for inspection
- b) Threats to natural wetlands
- c) Repairing failed wetlands
- d) Controlling erosion



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- e) Reducing the need for maintenance
- f) Improving fish and wildlife habitat
- g) Preparing a project proposal
- h) Identifying and working with partners
- i) Nonprofit organizations
- j) How to find funding
- k) Strategies for success

### Assigned reading:

Wetland Drainage, Restoration, and Repair; Chapter 17, 18

Wetland Restoration and Construction - A Technical Guide; Chapter 11, 13

Publications that are listed on Blackboard

### PowerPoints to view:

Lesson 10.1 Wetland Inspection and Maintenance

Lesson 10.2 Wetland Renovation and Repair

Lesson 10.3 Restoration of Wetlands, Streams, and Rivers from Constructed Impoundments

Lesson 10.4: Partnerships and Funding for Wetland Projects

Quiz 10.1 due by 6:00 PM on Saturday, July 22

Quiz 10.2 due by 6:00 PM on Saturday, July 22

Quiz 10.3 due by 6:00 PM on Saturday, July 22

Quiz 10.4 due by 6:00 PM on Saturday, July 22

Assignment 10.0: Wetland Inspection (due by 6:00 PM on Saturday, July 22)

## Week 11

### Final Examination:

The final exam is available online, and must be completed by **6:00 PM on Friday, July 28, 2023**.

You may take the final exam any time or date prior to 6:00 PM on Friday, July 28, 2023. The final exam is cumulative and includes multiple choice, multiple answer, and true and false questions.

The Final Exam does not include essay questions. You will be given a maximum of 3-hours to take the exam, which is open-book. The final exam must be completed in one session, it cannot be stopped and resumed at a later time and date as what Blackboard says). You will be able to review the correct answers to the final exam, your answers, and your score after everyone in the class has taken the final exam.

### Grading

The final letter grade (includes + or -) for the course is based primarily on the total number of points earned for the course. Additional points may be earned by completing extra-credit assignments, and by attending optional field trips that may be offered during the course. Extra credit points will be added to the total number of points you have earned for the course to improve

your letter grade. It is highly recommended that you complete one or more extra-credit assignment to increase the number of points you have earned and to improve your letter grade. Extra-credit assignments may be submitted at any time prior to the due dates listed on Blackboard.

Percent	Letter Grade
97-100	A+
93-96	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-

**Assigned Reading** should be completed prior to reviewing the PowerPoint Lessons and Quizzes for the week. One can expect the information contained in the assigned readings to be included in the Quizzes, Midterm Exam, and the Final Exam. Blackboard will note if the information contained in certain readings will not be tested on in quizzes and exams.

**Quizzes** are posted on Blackboard for each PowerPoint lesson. The quiz should be taken following the completion of the required readings for each week, and after reviewing the respective PowerPoint lesson. You will not do well in this course if you only view the PowerPoint Lessons, and do not read the required books and publications. Taking quizzes is an excellent way to earn points for your letter grade. To receive credit for taking a quiz, the quiz must be completed by the due date and time listed in the syllabus and on Blackboard for that quiz. You are allowed 20-minutes to take each quiz. The quizzes are open book. The quizzes will “disappear” from your view and not be available for taking or reviewing after the due date and time. Extensions will not be given for taking quizzes. The purpose of the quizzes is to provide incentive for staying on schedule with the lessons and assignments. Each quiz must be must be completed in one session, it cannot be stopped and resumed at a later time and date.

*This information will help you avoid confusion when trying to tell the difference between Multiple Choice and Multiple Answer Questions when taking quizzes and exams on Blackboard:*

- Multiple Choice questions have a small circle next to each answer. You can only select one answer at a time. If you click on a second answer, the first one you clicked on will not stay selected.
- Multiple Answer questions have a small square next to each answer. When you click on more than one answer, each one you mark will stay selected.

**Assignments** must be completed and received by [tombiebighauser@gmail.com](mailto:tombiebighauser@gmail.com) by the due date and time listed in the syllabus and on Blackboard to receive credit. Assignments will be graded with full credit being given to work that is complete and responds fully to the guidelines and

questions posted on Blackboard. Assignments will be accepted up to 3-days after the due date; however, the score received will be reduced by 30-percent for each day the assignment is late.

You are asked not to upload your completed assignments to Blackboard. The due dates for assignments are listed on the syllabus, and on Blackboard. Each assignment must be in Word format. Your name must be listed on each assignment. The actual computer file name for each assignment must contain your name and assignment number. Include your last name and assignment number in the subject line of each message. The photos included in each assignment must be reduced in size. The maximum file size for each assignment should be 4MB or less.

### **Instructor Modifications**

PowerPoint Lessons, Reading Assignments, Quizzes, and Assignments will be posted by the instructor two or more weeks in advance of the scheduled lesson date. Material may be added or modified by the instructors up to two weeks prior to the date of the next scheduled class. However, errors will be corrected when found.

### **Questions**

E-mail is the preferred way of asking questions of the primary instructor. Students should e-mail Tom Biebighauser [tombiebighauser@gmail.com](mailto:tombiebighauser@gmail.com) with their questions, and can expect a reply to their e-mail within 24-hours. Tom Biebighauser designs and restores wetlands and streams full-time across the United States and Canada, and generally grades assignments and responds to emails in the evening.

### **Approval Needed for Duplication**

All of the PowerPoint Lessons, Resources, and Assignments relating to this class are copyrighted by Thomas R. Biebighauser. Students are not allowed to duplicate or share these materials electronically or in printed form without advance approval in writing from Thomas R. Biebighauser.

### **Title IX/Clery Act Notification**

Sexual misconduct (including sexual harassment, sexual assault, and any other nonconsensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain confidential support from the PEACC Program (852-2663), Counseling Center (852-6585), and Campus Health Services (852-6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (852-5787) or University of Louisville Police (852-6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is not confidential under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer.

For more information, see the Sexual Misconduct Resource Guide.

<http://louisville.edu/hr/employeerelations/sexual-misconduct-brochure>

### **About the Instructor**

Tom Biebighauser has restored over 2,850 wetlands and streams across Canada, in 26-States, New Zealand, Puerto Rico, and Taiwan since 1979. Tom designs and builds over 100-wetlands and streams each year. Having built over 1,400-dams, he has since decommissioned over 350-dams. He retired in 2013 after working 34-years for the USDA Forest Service as a Wildlife Biologist, where he started wetland and stream restoration programs across the United States. Tom has served as an instructor for the British Columbia Wildlife Federation Wetlands Institute for 16-years, restoring over 250-wetlands and streams across Alberta and British Columbia since 2003. He instructs a Graduate-level class on Wetland Design for Engineers at the University of Louisville Speed School of Engineering, along with a field class for the British Columbia Institute Technology. Tom learned about drainage and irrigation from contractors who spent their lives destroying wetlands. He has developed highly effective and low-cost techniques for building wetlands and streams for rare species across North America. Tom builds habitats that require little, if any maintenance, and do not involve the use of diversions, dams, dikes, pipes, or pumps. He has written 4-books about wetland restoration, and instructs online college and field courses on the topic. Tom received the United States National Wetlands Award for Conservation and Restoration in 2015.