**CIVE 413 – Environmental River Mechanics**
**Fall 2009**

**Instructor:** Brian P. Bledsoe, Ph.D., P.E.
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**Required Texts:** Knighton, A.D. 1998. *Fluvial Forms and Processes*. Arnold Publishers.

Richardson, E.V., D.B. Simons, P.F. Lagasse. 2001. *River Engineering for Highway Encroachments: Highways in the River Environment*. Federal Highway Administration, Report No. FHWA NHI 01-004 HDS-6.

**Course Home Page:** http://www.engr.colostate.edu/~bbledsoe/CIVE413/

**Required Readings:** TBA - available through Electronic Reserve and the CIVE413 website

**Office Hours:** Tuesdays 1:30-3:00 and Thursdays 1:30-3:00 in Engineering A207G (Phone: 491-6580) or by appointment at the Engineering Research Center A201 (Phone: 491-8410)

**Course Description:** Fluvial geomorphology, sediment transport, and river response with special emphasis on environmental aspects. Technical communication across the fields of river hydraulics / mechanics, fluvial geomorphology, water quality management, and aquatic ecology is emphasized. Survey of water quality and quantity issues related to the management of rivers, streams, riparian areas, floodplains, watersheds, and aquatic ecosystems. Students are introduced to standard hydraulic and sediment transport models.

**Learning Objectives**

1. Describe stream and river behavior and response to alterations across different spatial and temporal scales using quantitative and qualitative models
2. Apply standard mathematical and computational models of fluvial processes, including HEC-RAS, HEC-6, and standard sediment transport relationships
3. Design stable channels with varying capacities to transport sand and gravel/cobble materials (longitudinal profile, planform, and cross-section)
4. Understand and be conversant in describing interactions between physical and ecological processes in streams and rivers
5. Gain perspective through case studies that involve balancing consumptive demands and stewardship of rivers in an atmosphere of scientific uncertainty
6. Improved speaking, writing, and critical thinking skills in the context of interdisciplinary water resources issues
7. Exposure to the primary scientific literature and current themes in river research

**Grading System:**

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| Two Hour Exams | 25 % |
| Homework | 30 % |
| Reading Quizzes | 15 % |
| Field Trip & HEC-RAS Lab | 10 % |
| Final Exam | 20 % |

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| **Exams:** | Exam 1 | October 8 |
| | Exam 2 | November 12 |
| | Final Exam | Wednesday, Dec. 16th, 9:10 am – 11:10 am |

**Essential Computer Skills**: Spreadsheets (formulas / Solver), word processing, web browser

**Lab Session:** A computer lab session will be held (to be scheduled in class) to familiarize you with HEC-RAS and stable channel design programs. Basic knowledge of these programs will be essential for successful completion of homework assignments later in the course.

**Field Trip to the Cache la Poudre:** A Saturday field trip will be held (to be scheduled in class) to provide you with an opportunity to observe physical and biological characteristics and processes in and around the Cache la Poudre River (and possibly Spring Creek), to apply concepts from class, and to improve analysis and communication through teamwork.

**Reading assignments and quizzes:** I will endeavor to make this a discussion-oriented course. For this approach to be meaningful and effective, it is essential that you read material as it is assigned prior to our class discussions. To encourage you to do this, I will give several short quizzes throughout the semester to assess whether the reading assignments are being completed and comprehended. You will be able to drop a few of your lowest quiz scores or missed quizzes from your quiz grade. In addition to assigned readings in the text, there may be additional readings that we will be discussing and critiquing during the semester. These will be announced in class.

**Policies:** I will accept late homework submissions up to five days after the due date or before solutions are distributed, whichever comes first. A **penalty of 20% per day** late will be assessed on these assignments. Make-up exams will be given only for university-approved excuses or when you have a note from a medical professional. Please turn off cell phones in the classroom. I will respond to emails written in a professional style (including salutation and attention to correct grammar and spelling). I encourage students to discuss and collaborate on homework and other outside assignments but the final work you turn in should be distinctly your own. CSU policies on academic integrity will be rigorously enforced in this course (see http://catalog.colostate.edu/front/policies.aspx and http://www.academicintegrity.org/educational_resources/pdf/Letter_To_My_Students.pdf).

**Tentative Outline of Topics:**

Introduction to Environmental River Mechanics

Hydraulics and Hydrology Refresher (varies depending on class familiarity)

- Types of flow
- Velocity profiles
- Roughness / Bedforms
- Drainage networks
- Hydrographs
- Recurrence intervals

Erosion and Sedimentation

- Incipient motion
- Modes of sediment transport
- Supply vs. capacity
- Sediment transport equations
- Sediment rating curves

Fluvial Geomorphology

- Fluvial system
- Planform relationships
- Bankfull and effective discharges
- Hydraulic geometry
- Stream classification
- Stream and river response

River Mechanics and Stable Channel Design

- Regime relationships
- Analytical solutions
- Extremal hypotheses
- Geotechnical considerations
- Bank stabilization techniques
- HEC-RAS, SAM, and HEC-6 programs

Applied Aquatic Ecology/Water Quality

- River continuum / discontinuum / mosaic concepts
- Natural flow regime / Instream flows
- Physical, chemical and biological aspects of water quality
- Physical habitat
- Sediment impacts on biota
- Biomonitoring / indicators of ecosystem integrity
- Modeling water quality in streams and rivers

Management and Restoration of Streams and Watersheds

- Water policy
- Riparian areas, wetlands, and floodplains
- Basic concepts and tools
- Strategic vs. tactical restoration
- Watershed analysis

Potential Case Studies:

- Watershed urbanization
- Eagle River and Camp Hale
- Colorado Water District 1 / Snake River Adjudication
- Downstream effects of dams
- Salmon issues in the PNW
- Little Snake River restoration
- Kissimmee River / Everglades
- Nitrogen delivery to the Chesapeake Bay, Albemarle-Pamlico Sound, and the Gulf of Mexico