America’s infrastructure includes millions of miles of buried pipelines to convey water, wastewater, oil and gas, and other industrial fluids. The engineering and management challenges posed by this extensive infrastructure provide job opportunities across several industries. The course prepares students for these jobs by presenting the fundamentals of hydraulics, water quality, planning, engineering and management in an integrated picture of life-cycle management. Source material is drawn from research into the principles of closed conduit hydraulics, network models, water quality in closed systems, internal and external corrosion of buried pipelines, and management systems. The major focus is water supply with additional topics from the fields of oil and gas and other pipeline sectors. Students in hydraulics, environmental, civil infrastructure, energy, geotechnical, and structures fields may benefit from the course and be qualified to work in consulting firms, utilities, regulatory agencies, and supplier firms for pipe systems and equipment.

**Topics**

- Types of pipe and their functions
- Pipe system engineering (structural, construction, jointing)
- Flow and hydraulic principles of closed conduit hydraulics
- Network models for water flow and quality
- Hydraulic machinery and controls
- Hydroelectric energy systems
- Flow perturbations: water hammer, air pockets, intrusions, cross connections, I&I
- Chemistry and biology of fluid flows: emphasis on potable water
- Corrosion of pipelines: internal and external corrosion
- Asset management systems
- Monitoring and optimization of distribution system operations
- Assessment of pipe condition and performance
- Maintenance, renewal and repair, in-situ and trenchless technologies
- Failure modes and diagnosis
- Emergency management
- Aging, deterioration, and tuberculation
- Economics and planning of pipe systems
- Pipe industry organization
- Case studies and policy issues

**Instructor:** Neil S. Grigg, Department of Civil and Environmental Engineering. Textbook material will be drawn from instructor notes and recent research papers and web-based material from pipeline industries and research organizations.
Course procedures

**General procedures**

This is a 500-level course of the Department of Civil and Environmental Engineering, open to graduate and advanced undergraduate students. Because civil engineers and public administrators deal with many infrastructure management issues, this course has broad coverage rather than depth in a single technical area. Because of its emphasis on real situations, case studies are used along with new lecture material. In addition to cases presented by the instructor, students prepare and present cases to the class.

**Use of RamCT for distance and in-class students**

Rather than having a standard textbook, the class draws from many sources and topics, which are integrated on the powerpoint presentations, along with posting of up-to-date documents and references to websites. RamCT will be used to post all lecture material, assignments, and other information. I will try to post each day’s lecture by noon of the day of class.

Distance students view each day’s lecture and complete all assignments. The only difference between distance and in-class students is actual attendance in the classroom.

**Grading procedures**

Grading weights are:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Component</th>
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<tr>
<td>40%</td>
<td>Hour exams (3 mid-terms)</td>
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<tr>
<td>40%</td>
<td>Homework, including class paper (25% of homework grade)</td>
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<tr>
<td>20%</td>
<td>Final exam</td>
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Normally, I give a tentative grade on the last day of class (based on 50-50 homework/paper and exams). Students can accept the grade or take the option of taking the final exam to try to improve it.

**Standards for performance**

Students are expected to perform as professionals in the class. This means they should attend, express interest, ask questions, and behave as they would in a business environment.

**Academic Integrity**

Colorado State University takes academic integrity seriously and requires that no one will use another's work as their own. Of course, academic integrity means more than just avoiding plagiarism. It also involves doing your own reading and studying. It includes regular class attendance, careful consideration of all class materials, and engagement with the class and your fellow students. Any violation of academic integrity will be addressed according to university procedures.