Andrew Guswa, Ph.D.
Assistant Professor of Engineering

Area of Expertise
Civil and environmental engineering

Education
Ph.D., Stanford University, 2000

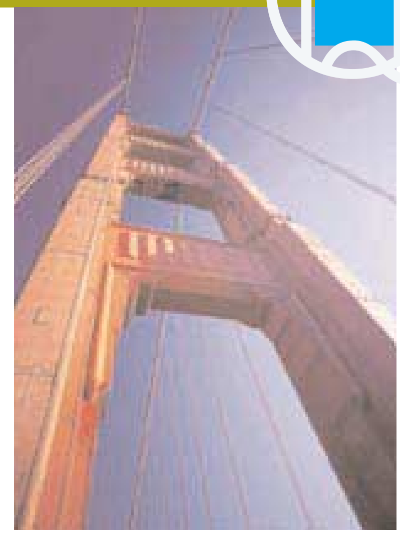
Professional Experience
- Princeton Environmental Institute Post-Doctoral Fellowship, Department of Civil and Environmental Engineering, Princeton University
- Research Associate Monteverde Institute, Monteverde, Costa Rica

Selected Recent Publications
- "Models of soil-moisture dynamics in ecohydrology: a comparative study" (with M. A. Celia and I. Rodriguez-Iturbe), Water Resources Research, 38 (9), 2002.
- "On using the equivalent conductivity to describe solute spreading in geologic environments with low-permeability lenses" (with D. L. Freyberg), Water Resources Research, 38 (8), 2002.

Selected Honors and Awards
- New Century Scholar Workshop for Junior Faculty in Engineering, National Science Foundation
- National Research Council Post-Doctoral Research Associateship (awarded but declined)
- Achievement Rewards for College Scientists Fellowship, Department of Civil and Environmental Engineering, Stanford University

DREW GUSWA

EVER THE SAME RIVER TWICE



ENGINEERING STUDENTS GET THEIR FEET WET IN DREW GUSWA'S ENGINEERING 271 LABORATORY CLASS ON FLUID MECHANICS. LITERALLY.

On an April day barely a week after the last freak snowfall, the Mill River is running steadily. Second-year student Kim Reinauer is up to her waist in the cold, clear water, about half a mile upstream from campus. Clad in waders and carrying an electronic measuring device, Reinauer clambers another yard farther out into the river. She calculates the speed of the water's flow at this location near the river bottom, close to the surface, and halfway between. She calls out the figures to a classmate on shore, who records them in a notebook. Then Reinauer moves on another yard and repeats the process.

When she eventually climbs out of the water, Reinauer exclaims: "It's fun. Minus the numb fingers."

It's also an important lesson in how scientists go about determining an ecosystem's "hydrologic budget," or how much water comes in and goes out. The budget may sound like a simple idea, but the data and mechanisms are surprisingly difficult to determine in the unruly real world. In response to Guswa's challenge to accurately calculate some of the factors that affect the "budget" for this river system, the students have come up with this series of repeated measurements to determine the average velocity of the river and its "Q value," or volume (discharge) per unit time.

Guswa has a longstanding interest in such problems. "I like being outdoors, and I like using models to represent physical processes," he explains.

Models are necessarily a simplification of the outside world, but they are essential to understanding, for example, how the volume and quality of surface water are affected as it moves through soil and is taken up by plants. An accurate model is necessary to understand the physics behind excessive water runoff, algal blooms and eutrophication of water bodies, Guswa maintains. The Stanford Ph.D. hopes his work can be used to help protect rare and unusual environments such as the biological reserves in the remote "cloud forests" of Costa Rica.

With a background in civil engineering, the Picker Engineering Program assistant professor teaches a number of classes, including "Building Big," an introductory course on structures. Modeled after his favorite course when he was an undergraduate at Princeton, this class takes some of the ideas of his mentor, David Billington, a few steps farther.

Aimed at engineering majors and non-majors alike, Building Big shows structure as a unifying force behind the humanities, social sciences, and natural sciences. Guswa uses the Brooklyn Bridge as an example. As would be expected, his students examine the principles of structural mechanics that allow this bridge to carry its own weight and that of all of the traffic on it while resisting wind loads and gravity. But they also learn the art, symbolism, social consequences, and history behind engineer Washington A. Roebling's grand creation.

"All the great engineers and architects share a great aesthetic sensibility," says Guswa.

He thinks that the Brooklyn Bridge—used as the logo of the Picker program's website—is one of the world's great structures, which Guswa defines as "efficient, economical and elegant." For example, the bridge's heavy masonry piers with gothic arches not only look good, but support the bridge's suspension cables. And during the bridge's construction, the piers served another purpose: their great masses of stone pushed down on temporary wooden caissons at the bridge's base, so that laborers known as sandhogs could have a dry hollow in which to work while they shoveled their way through the river bottom to bedrock.

Teaching engineers and non-engineers in the same setting at the same time would seem to be quite a challenge, but Guswa says the situation offers some bonuses: engineering students can explain the science and math to the non-engineers, while history majors can give the extra texture and richness of the story surrounding a structure's development and construction.

Guswa claims it's just a coincidence that his office is located almost directly above the Mill River dam that forms Smith College's Paradise Pond.