Website and CD-ROM Development: Digital Images of Water and Wastewater Processes for Engineering Education

Bill T. Ray[1], L. R. Chevalier[1], J. W. Nicklow[1], L. A. Boruszkowski[2], and Scott Simmons[3]

[1]Associate Professor, Department of Civil and Environmental Engineering, Southern Illinois University at Carbondale, MC 6603, Carbondale, IL 62901; Ph: (618) 453-7774; E-mail: ray@engr.siu.edu/
[2]Associate Professor, Department of Cinema and Photography, Southern Illinois University at Carbondale/[3]Graduate Assistant, Department of Civil and Environmental Engineering, Southern Illinois University at Carbondale

Abstract

The purpose of this project is to develop a web site to provide environmental engineering faculty with digital images of water and wastewater processes in order to enhance the classroom learning experience. In addition, a CD-ROM of the same material will soon be available. As this project nears completion, the number of images is increasing rapidly. We have quality digital images of water and wastewater processes. This currently includes approximately 100 different still images and 10 video clips. There are also approximately 150 images of various water resources and hydrologic processes. The still images are available in three resolutions. Low resolution images, 72 dpi, will be available for incorporation into course web pages developed by faculty. High resolution images, 300 dpi, will be available for use in PowerPoint presentations. A third higher resolution is available for printed reports. Similarly, the digital video clips are also available in two resolutions.

In the past, overhead transparencies and slide shows were used to depict engineering schematics and on-site photographs of engineering projects. However, schematics and photographs copied to overhead transparencies are generally of poor quality, and the use of slides requires the instructor to darken the room, inhibiting note-taking. Furthermore, the classroom material is often in the possession of the instructor, limiting or precluding student review outside of the classroom. The availability of web based material, whether from the instructor's web site, or other sources, opens an entirely new venue to assist students in becoming familiar with the various engineering processes. This project is

intended to increase the pool of available images for classroom instruction in environmental engineering.

Introduction

Many engineering faculty now use computer generated slide shows for classroom lectures. This medium allows instructors to easily incorporate schematics and photos into classroom lectures. Integrating images into course instruction gives students the benefit of seeing virtual on-site projects or phenomena, including the application of engineering principles learned in the classroom. This benefit, in turn, tends to clarify concepts and improve the effectiveness of classroom instruction. The students' ability to recognize classroom concepts is simultaneously impacted, thus improving both their technical abilities and confidence.

Unfortunately, there is a dearth of quality engineering process images available. Instructors are often left with copying schematics or photos from textbooks or manufacturer's web sites. These images are almost always of low quality when projected onto a screen for lecture hall viewing. We are in the process of creating a library of digital images and videos of varying resolutions to supplement other instructional materials. For example, there are currently seven images of wastewater aeration processes available in three resolutions. And, there are four images of primary settling tanks and one video. The images are from several different wastewater treatment facilities.

Digital images are available for download in alternative resolutions, as shown in Figure 2. High resolution images (300 dpi, 5" × 7") are recommended for printing; midrange resolution images (72 dpi, 800 × 600 pixels) are recommended for use with a computer and LCD projector; and compressed, low resolution images (72 dpi, 480 × 360 pixels) are recommended for Internet usage and for viewing on a computer monitor. Videos are provided in compressed, low-resolution quality (320 × 240 pixels) that is suitable for Internet delivery and in high-resolution quality (720 × 480 pixels) that is recommended for computerized projection.

Digital Image Collection

To disseminate the material, the authors have developed a website, *Digital Images of Environmental and Water Resources Engineering*. (Chevalier, et al., 2003). Website views are provided in Figure 1. The website includes a database of over two-hundred still images and digital videos that illustrate environmental and water resources engineering principles. The website will also be available, by request, on CD-ROM.

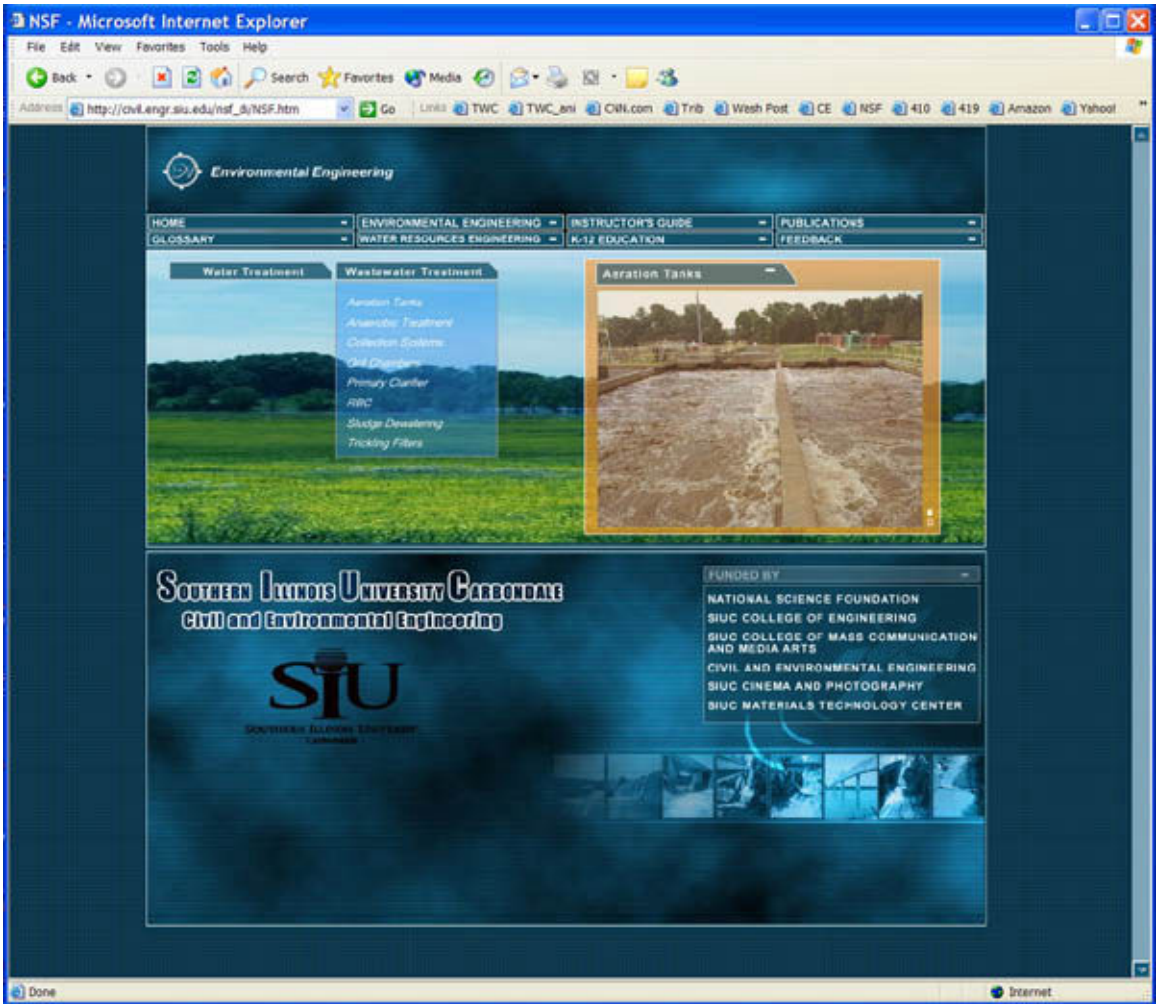


Figure 1. Website main page.

The database was constructed by photographing and filming an array of existing engineering operations, facility renovations, and construction projects, as well as naturally occurring phenomena. Topics that are covered include:

- Unit processes in water treatment, including clarifiers, pumps, filters, filter media, GAC, air stripping, chemical storage, ultraviolet disinfection, and ozone treatment;

- Unit processes in wastewater treatment, including collection systems, grit chambers, primary and secondary clarifiers, aeration tanks, sludge dewatering, anaerobic treatment, trickling filters and media, and rotating biological contactors;

- Hydraulic structures, such as dams, spillways, culverts, bridge piers, storm drains, weirs, and channel improvements;

- Open channel flow, including natural and constructed channels, floodplain definition, stream bank erosion processes, overland flow, and sedimentation.

After entering the web site, one selects either environmental engineering or water resources engineering. Upon selecting environmental engineering, there are links for either water treatment or wastewater treatment. See Figure 2 for a view of this web page.

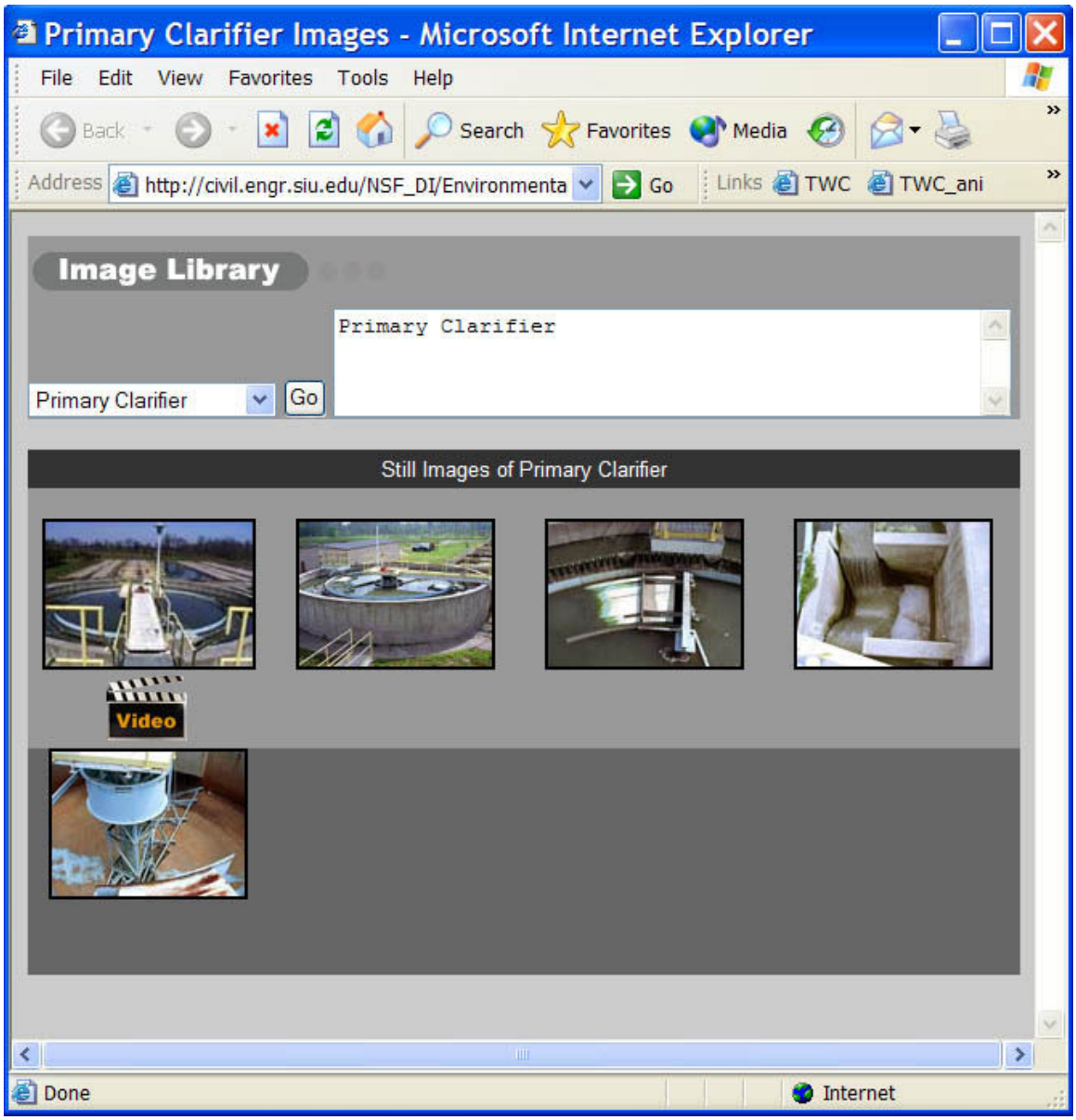
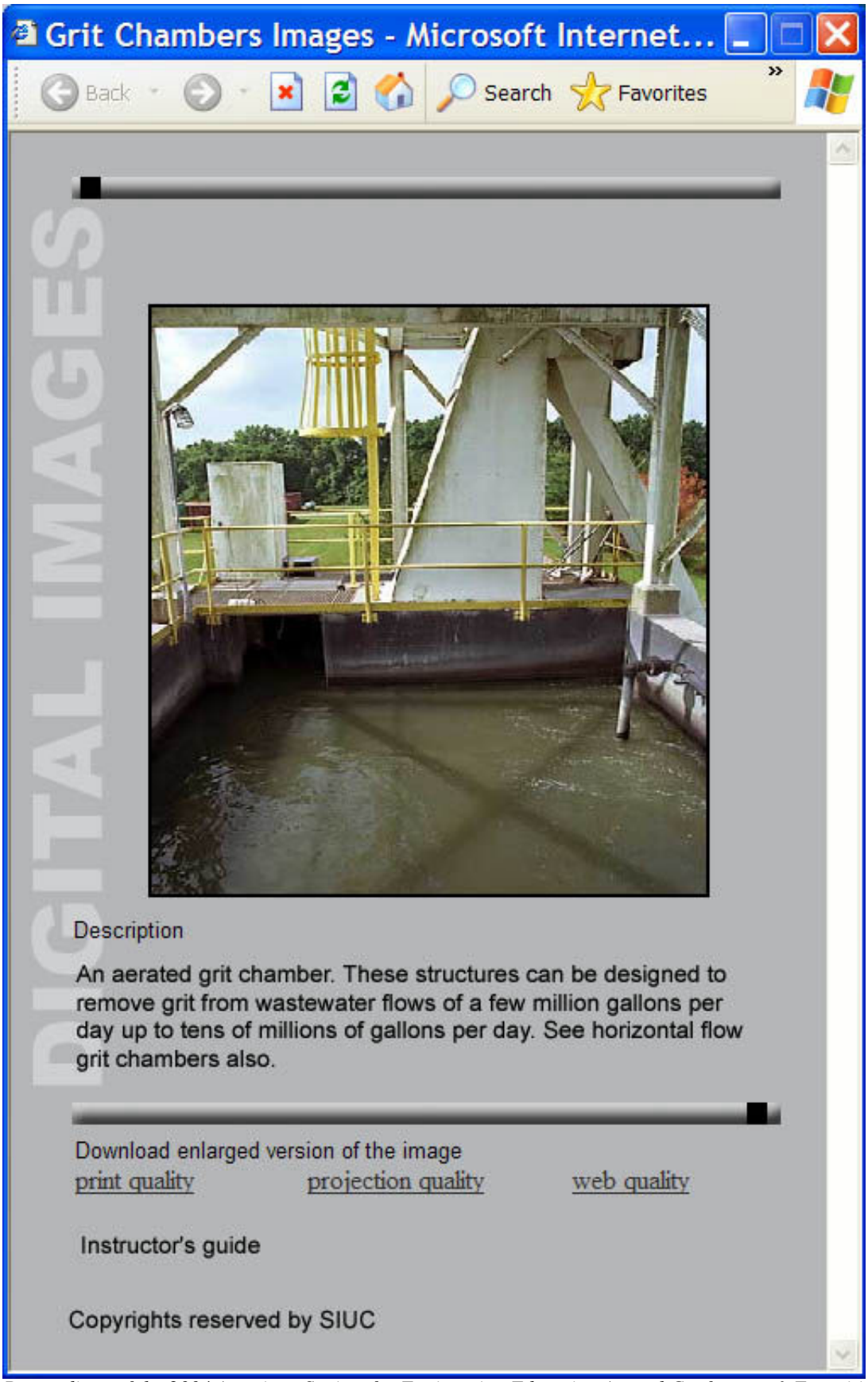


Figure 2. Web page showing available images of primary clarifiers.

Each image has a short description of the process or equipment, along with selections for the three levels of image quality available for download. This is shown in Figure 3 below.



Other Features

The website has a glossary of environmental and hydraulic engineering terms that relate to the images and videos on the site. The authors have also developed and posted (Nicklow, et al., 2003) a comprehensive instructional guide designed to assist instructors with the integration of the images into their classroom. The guide provides recommended hardware specifications, author contact information, and stepwise instructions for incorporating the images into a range of pedagogical approaches. For instructors who primarily use the chalkboard, students can be referred to the website to view the material on their own. For instructors who normally use the chalk board, students can be referred to our website to view the images and videos relevant to the lecture. Instructors who normally use computer generated slide shows (such as Microsoft's PowerPoint) for lectures, the digital images and videos can be directly integrated into the lecture. Instructors that maintain a class website can incorporate the relevant images or videos directly into the class website, or link to our website to allow students to view the images.

Evaluation and Assessment

Feedback is being solicited through the website in an effort to establish how well the project objectives are being met, and suggestions for any improvements. This feedback is sought from two distinct groups, faculty and undergraduate/graduate students. Feedback from faculty is important since the website is intended to provide faculty with material that will enhance their course lecture materials. Feedback from students is important since we intend to produce educational material that improves student understanding of engineering principles. There is a link on the website to a form to provide feedback.

Bibliographic Information

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Biographical Information

Bill T. Ray is an Associate Professor of Civil Engineering at Southern Illinois University Carbondale. He received his undergraduate degree and doctorate from the University of Missouri-Rolla in 1970 and 1984. He received his M.S. degree from the University of Arkansas in 1981. Dr. Ray is a registered professional engineer in Illinois. Dr. Ray's interests are chemical and biological processes and computer applications in engineering education.

Lizette R. Chevalier is an Associate Professor and chair of the Department of Civil Engineering at Southern Illinois University Carbondale. She received her undergraduate degree from Wayne State University in 1988, and her M.S. and Ph.D. degrees from Michigan State University in 1990 and 1994. Dr. Chevalier's teaching and research interests are environmental and water resources engineering, particularly in the area of groundwater flow, transport and remediation. She actively participates in the integration of technology-enhanced education at SIUC.

Dr. John W. Nicklow is currently an Associate Professor in the Department of Civil Engineering at Southern Illinois University Carbondale. He is a registered Professional Engineer in two states and is a Certified Professional Hydrologist with the American Institute of Hydrology. He earned B.S. and M.S. degrees in Civil Engineering from Bucknell University and a Ph.D. in Civil Engineering from Arizona State University. Dr. Nicklow's research and scholarly activities have been devoted to advancements in the fields of water resources systems engineering, hydrosystems modeling, and engineering education.

Ms. Lilly A. Boruszkowski is an Associate Professor in the Department of Cinema and Photography at Southern Illinois University Carbondale. She received her M.F.A. from Northwestern University in 1982.

Mr. Scott Simmons is a Graduate Assistant in the Department of Civil Engineering at Southern Illinois University at Carbondale. He earned his B.S. degree in Civil Engineering, while specializing in Environmental Engineering, from SIUC in 2002. He is currently an Engineer in Training in the state of Illinois. Scott's research interests are in environmental engineering under the field of groundwater remediation technologies.

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