

## **AC 2008-2258: AN INTEGRATED SYSTEMIC APPROACH TO DEVELOPING A PROFESSIONAL WATER AND WASTEWATER WORKFORCE: ETD IT/IET INTEREST GROUP**

### **Andrew Ernest, Western Kentucky University**

Dr. Ernest has over 16 years of professional experience with progressively increasing management responsibility. He has managed a variety of organizational units with varying missions, encompassing academic, revenue-driven, research and service activities. He has supervised, students, faculty, administrative and technical staff, and sub-contractors, in a wide range of organizational groups, and directed the research of over 40 M.S. and Ph.D. students. Dr. Ernest has managed over \$12M in projects, coordinated and served as prime contractor on large-scale multi-organization/multi-sector collaborative efforts. He has extensive business and project development, experience both in academic/research and private sector/consulting arenas, technical experience in water resource management, regional environmental sustainability, and hazardous substance/superfund work. Dr. Ernest currently serves as the Director of the Center for Water Resource Studies (CWRS) and the Associate Dean of the Ogden College of Science and Engineering at WKU, and is a Principal Engineer with Ernest and Sons Civil and Environmental Engineering consultants.

### **Jana Fattic, Western Kentucky University**

Jana Fattic is the Associate Director of the Center for Water Resource Studies and Operations Director of the WATERS Laboratory at Western Kentucky University. Ms. Fattic's role as Associate Director of the Center includes budget development and project coordination of state and federal grants totaling over one million dollars annually. Ms. Fattic's responsibilities include day-to day administration, budget and personnel management, quality assurance and quality control, and maintenance of certifications. She holds a Bachelor of Science degree from Western Kentucky University, and has worked in both the public sector as a regulator and private sector as an environmental consultant prior to being employed by the Center.

### **Sherry Reid, Western Kentucky University**

Sherry Reid, Dean of Bowling Green Community College of Western Kentucky University, earned B.A. and M.A. degrees in education from the University of Northern Colorado and is presently a candidate for the Ph.D. in Higher Education Administration from the University of Louisville. Previous postsecondary experience included service as Director of the Skills Development Center at College of Saint Mary in Omaha, Nebraska, and Academic Support Division Chair at Bowling Green Community College of WKU. She was co-Director of the Kentucky Adult Educators Literacy Institute, a grant-funded professional development program for adult educators across the Commonwealth of Kentucky and recently served as a member of the Kentucky Developmental Education Task Force, called by the Kentucky Council on Postsecondary Education.

### **Alan Cranford, Murfreesboro Water & Sewer Department**

Mr. Cranford is a graduate of Athens State College in Athens, Alabama. He earned a Bachelor of Science Degree in Public Administration from Athens State College and an Associate of Science Degree in Water & Wastewater Management & Technology from Shoals Community College. He has been an employee of the Murfreesboro Water & Sewer Department (MWSD), Murfreesboro, Tennessee for five (5) years in the position of Water Treatment Superintendent. Prior to coming to MWSD, he was the Water Plant Manager for the Town of Smyrna, Tennessee for over nine (9) years. He has over 25 years experience in water and wastewater treatment and operations. Mr. Cranford is a certified Grade IV Water Treatment and Grade II Distribution Operator in the State of Tennessee and Grade IV Water and Grade II Wastewater Operator in the State of Alabama. He is an active member of the American Water Works Association (AWWA)

and Kentucky/Tennessee Section American Water Works Association (KY/TN Section AWWA) and he currently serves as the KY/TN Section AWWA Past-Chair. He also serves on the Western Kentucky University's Water and Wastewater Technician Training Institute (WTTI) Steering Committee for developing an Associate Degree program.

# **An Integrated Systemic Approach to Developing a Professional Water and Wastewater Workforce**

## **Abstract**

The Center for Water Resource Studies and the Bowling Green Community College of Western Kentucky University has formed a partnership to address a Water & Wastewater Operator/Technician shortage anticipated over the next few years as "Baby Boomers" retire. The Water and Wastewater Technician Training Institute (WTTI, pronounced "witty"), is a partnership with the employment sector (a growing number of water & wastewater utilities/municipalities/districts), state primacy agencies and technical assistance/trade associations to refine an industry needs driven curriculum that utilizes on-line course delivery to provide options for both traditional & non-traditional students. The partnership is revitalizing an existing Associates Degree program entitled "Water Utilities Management" and integrating 4-year transitions through formal articulation agreements. WTTI takes a pedagogical approach to elevating and transforming the water and wastewater operator positions from trades of last resort, to professions of choice, and integrates practitioners into the recruitment, retention and educational process to achieve a coupled education, training and capacity development environment. A gradual and strategic elevation of the perception, both internal and external, of the trades, through a combination of increased capacity, mobility and accountability will attract high school students whose interests and scholarly record fall between the traditional trades/vocations and academically-based professions, and through inappropriate choices limit their career advancement potential, and elevate skill levels in the critical environmental and public health functions of the water and wastewater utility sector. In order to limit the hurdles associated with integrating regulatory, trade association and academic principles into a single, functional, coherent framework, WTTI is initially focused on Kentucky and Tennessee. However, as a demonstrably functional framework is put in place, extrapolating to address other regional policy, academic discipline and industrial sector issues becomes a logistical rather than conceptual challenge. Partnering utilities and municipalities are developing internship and co-operative educational opportunities to ensure work-based experiences for students in the program, while the trade associations have committed to developing scholarship programs to lessen the financial disincentive for potential students. Academic content is provided by core university faculty, while practitioner oriented content is provided by qualified trade association and utility/municipality staff eligible for adjunct faculty status. Committed to the precept of open-knowledge, WTTI is extending and coupling an open-source hybrid practitioner cyber-collaboratory (based on Drupal) with an open-source course management system (Moodle) to integrate the learning environment with practitioners and enhance retention of both students and the retiring practitioner knowledge-base. All instructors (academic and practitioner) involved in the program will undergo collaborative professional development to ensure that they are receptive to the unique structure of the program. All aspects of the program will be available through this on-line environment, allowing current practitioners to participate both as mentors, and as students pursuing career advancement goals. Experiential components of the program include on-line virtual activities, as well as opportunities provided by partnering utilities and municipalities local to the student.

## Background

The Water and Wastewater Technician Training Institute (WTTI) was formed to address a Water & Wastewater Operator/Technician<sup>1</sup> shortage anticipated over the next few years as "Baby-Boomers" retire<sup>2</sup>. This, coupled with non-competitive wages, an increasing training burden<sup>3</sup> and the perception that these positions are jobs of "last resort", create a challenge acknowledged by state regulatory agencies and water resource professionals charged with maintaining capacity. The current workforce was constituted in the 1970s, in the aftermath of the establishment of the environmental laws, and is comprised predominantly of the "Baby-Boomer" generation. Without a clearly defined, industry-driven career advancement pathway for senior operators, the potential for new recruits is typically limited to those for whom the industry is a passion, or to those for whom the job is one of "last resort". This is especially true for the new generation of potential recruits, for whom career, personal and social expectations are radically different from that of the "Baby-Boomer" generation. Under these conditions, the workforce evolution process tends to function in "batch" mode, with a residence time on par with the working lifetime of the employee, with replenishment being driven by loss of qualified operators from the public sector to the more lucrative private sector, and a more limited number of career advancements into supervisory or management positions. A more sustainable workforce management process relies on a "continuous flow" model, in which a clearly defined career advancement pathway exists within the industry, acting as an ongoing inducement for new recruits, especially those of the younger generations.

WTTI pursues a pedagogical approach to elevating and transforming the water and wastewater operator positions from trades of last resort, to professions of choice, and the integration of practitioners into the recruitment, retention and educational process to achieve a coupled education, training and capacity development environment. A gradual and strategic elevation of the perception, both internal and external, of the trades, through a combination of increased capacity, mobility and accountability will attract high school students whose interests and scholarly record fall between the traditional trades/vocations and academically-based professions, and through inappropriate choices limit their career advancement potential.

## Goals

The WTTI program aspires to:

- Initiate dialog to effect fundamental change in the structure of the water and wastewater industry to ensure workforce sustainability and encourage a culture of continuous improvement.
- Develop a model process for recruiting and retaining water and wastewater technicians and operators in Kentucky and Tennessee, that can be extrapolated to other states with different regulatory structures, and to other critical environmental trades.
- Develop a broad-based learning model that is tuned to the changing expectations of the new generation of technicians that integrates professional development, academic credibility and career mobility into a holistic approach to state and industry driven certification and capacity development.

## Objectives

WTTI goals are being achieved through the following objectives:

- Develop an integrated, on-line curriculum that provides both rigorous Science, Technology, Engineering, Mathematics (STEM) content, along with practitioner certification based training to allow students to meet both the trade-related expectations, but also allow for further academic and career advancement.
- Recruit students from high schools who would typically directly enter the workforce or a trade/vocational school, but have demonstrated potential for success in an academic program if a perceptible practitioner focus can be maintained.
- Provide an alternate continuing education pathway to the traditional training coursework model, that adds, with minimal overhead, academic credibility and career advancement potential for currently engaged operators in a manner that permits them to progress “in-place”.
- Integrate modular course concepts into the curriculum to enable incremental student progression and inclusion of training/short-course content into the student's academic degree plan.
- Develop an administrative process for integration of training course content and other relevant professional experiences into the program that ensures compliance with both academic standards and professional competency expectations.
- Develop a seamless transition process for program students to continue on to receive a 4-year degree if interested.
- Develop an open-source, web-based learning environment that integrates the traditional curricula teaching models (e.g. Course Management Systems such as Moodle) with practitioner focused cyber-collaboratory tools (e.g. traditional Content Management Systems – CMS - such as Drupal and Joomla!) to provide a platform for integrating the student learning environment into practitioner collaboration environment, and vice-versa.
- Develop a network of currently practicing, about to retire, and retired operators and technicians actively participating in the cyber-collaboratory to expand their own capacity, and to effectively retain the knowledgebase for the benefit of new recruits.
- Facilitate practitioners engaging in the cyber-collaboratory to actively participate in the curricula training components of the learning environment as mentors.

## Management

In order to ensure management and operational continuity, a formal organizational hierarchy has been put into place that maximizes the competing needs of stakeholder responsiveness, extensibility and stability. Program management is executed by this team using initial elements (a Drupal CMS<sup>9</sup>) of the on-line learning environment proposed to be developed. The same asynchronous model will be used during project implementation with interaction occurring primarily on-line via the beta versions of the integrated learning environment being developed. Quarterly face-to-face meetings are also planned. Project tracking is also centralized via the CMS.

## Organizational Groups

A key goal is to extend and replicate the program to address national needs. In order to ensure that the management structure can evolve as the program scope grows, committee membership is defined by organizational group - **Academic Institutions, Certifying Agencies, Trade Associations, and Utilities/Municipalities.**

**Academic Institutions:** One of the options for meeting national need is to replicate the program to as many geographically dispersed institutions as possible. In order to maximize manageability during the initial stages, only one academic institution, Western Kentucky University, is offering content and degrees. Within Kentucky, the Kentucky Community and Technical College System are to be invited to participate as local program providers. Similar opportunities are being investigated specifically in Tennessee, and in other states. Initially, WKU will be the sole academic institution represented on the steering committee. As the program evolves, a manageable strategy for representing multiple institutions will be developed.

**Certifying Agencies:** Initial deployment of the program is focused in Kentucky and Tennessee. In Kentucky, operator certification and training is housed in the Division of Compliance Assistance, while facility operational regulation is housed in the Division of Water. In Tennessee, both are housed within the Tennessee Department of Environment and Conservation, and its Fleming Training Center. Initially, the certifying agencies will be represented by DCA, DOW, and TDEC. As the program covers more states, a more manageable strategy, involving multi-state organizations such as the Association of State Drinking Water Administrators will be implemented.

**Trade Associations:** The Kentucky Water and Wastewater Operators Association, the Kentucky Rural Water Association, the Tennessee Association of Utility Districts, and the Kentucky/Tennessee section of the American Water Works Association are the key trade associations that will represent both the operators and the employers (utilities/municipalities). Scalability may be achieved through national association counterparts such as the National Rural Water Association and the American Water Works Association.

**Utilities/Municipalities:** While the representatives from the trade associations are most often operators or managers themselves at member utilities or municipalities, it is important the this sector be represented directly in the WTTI management structure. This can be a large organizational group, that can be further subdivided into operational size and management/regulatory model (i.e. utility, district, municipality, etc).

## **Governance Structure**

The key to success of the WTTI program is establishment and maintenance of a governance structure that ensures programmatic direction is driven by practitioners rather than academicians. While ultimate responsibility for academic credibility and accreditation rests on the program faculty, program sustainability is defined in terms of the value placed on graduates by employers, and their regulators.

**Steering Committee:** A steering committee, comprising of delegates from the key partnering organizations, provides general directional and advisory support for the academic institutions offering the formal content. The steering committee has been active since January of 2007. The steering committee will develop the bylaws under which WTTI will operate. The current incarnation of the Steering Committee includes representatives from the Bowling Green Community College, the Center for Water Resource Studies, the Kentucky Division of Compliance Assistance (responsible for operator certification), the Kentucky Division of Water (responsible for regulation), the Fleming Training Center of the Tennessee Department for Environmental Quality, the Kentucky-Tennessee section of the American Waterworks Association, the Kentucky Rural Water Association, the Kentucky Water and Wastewater Operator's Association, the Tennessee Association of Utility Districts, the Bowling Green Municipal Utilities (KY), the Glasgow Water Company (KY), Hardin County Water District #2 (KY), and the Murfreesboro Water Utility (TN).

Several standing committees have been identified as being needed to focus and direct program development in particular areas of activities. The standing committees are initially setup to cover as many topic areas with a minimum number of committees possible. Initial differentiation is based more on consistency in membership than on coherence in topic area. As the program evolves, further discrimination may develop.

**Curriculum and Faculty Development:** This subcommittee is charged with continued development of the curriculum and ensuring that all faculty, both full-time and adjunct, receive adequate pedagogical training to excel in the WTTI environment. A key milestone in this subcommittee's function will be during the annual WTTI conference, when curriculum issues will be a main topic, and faculty development workshops will be made available.

**Recruitment and Student Success:** This subcommittee will be charged with developing and implementing strategies to ensure the success of students from initial contact to graduation or transition to baccalaureate programs. Activities that this group will be engaged in include coordinating the scholarship programs being developed by the trade associations, internship opportunities being developed by the utilities, and mentoring programs with experienced operators. A student-mentor development track will be investigated for the annual WTTI conference. Recruitment activities will be conducted at partner trade association annual conferences.

**Certifications and Policy:** The Certifications and Policy subcommittee will be made up of representatives from the certifying agencies and trade associations. The principle role of this group is to ensure that the training expectations and certification requirements of all participating states are incorporated into the curricula process. This subcommittee will act in counterpoint to the curricula committee, and as such, no overlap in membership is expected. Additional goals of this committee are to facilitate inter-state reciprocity and act as a multi-sector forum for promoting the WTTI goals, such as promoting the adoption of career advancement incentive programs by employers. Prior to

involvement with WTTI, the AWWA representative on the Steering Committee was instrumental in getting the Town of Smyrna, TN to adopt an education reimbursement policy<sup>36</sup>. Exchange of ideas and outcomes such as this are key to the success of WTTI.

**Replication and Sustainability:** The Replication and Sustainability subcommittee will be charged with developing and implementing strategies to extend the WTTI model initially developed in Kentucky and Tennessee to the rest of the states, for ensuring continuation and growth.

## **WTTI Activities**

**On-Line Course Management:** A portable on-line learning environment will be developed around the open source course management system Moodle<sup>4</sup>. Course content will be packaged and delivered within an existing Moodle site maintained by the CWRS<sup>5</sup>. Much of the BGCC course offerings are available as WKU Ecourses site<sup>6</sup>, delivered using the proprietary Blackboard<sup>7</sup> application. Program appropriate portions of this content will be migrated to the Moodle environment, along with new content developed specifically for WTTI. The WTTI Moodle platform will be archived periodically for packaging and provision to other partners for dissemination by partnering academic institutions as they join WTTI.

**On-line Professional Community:** Social networking concepts have been adapted to develop an on-line professional community using the open source content management system Drupal<sup>8</sup> hosted by the CWRS<sup>9</sup>. This site is already being used to provide support for the Center's small drinking water<sup>10</sup> and wastewater<sup>11</sup> systems technical assistance programs, funded by the U.S. Environmental Protection Agency for over 8 years. The site also hosts the Kentucky Water/Wastewater Agency Response Network<sup>12</sup>, and all other CWRS on-line interactions with water and wastewater utilities. This extensive on-line community is a natural basis for forming mentor-mentee operator relationships and professional interaction between operators of all grades and locations. An operator/employer job board has already spawned on this site as a direct result of the discussions of the steering committee.

**Virtual Laboratories:** Rudimentary virtual experiments are being developed to enable on-line students to grasp the necessary basics of water and wastewater laboratory analyses. Wherever possible existing applications, such as those available through the NSF funded Virtual Courseware Project<sup>13</sup> and David Blauch's Virtual Chemistry Experiments and Exercises<sup>14</sup> will be utilized. More visual and interactive applications such as Brigham Young University's ChemLab<sup>15</sup> and NASA Learning Technologies<sup>16</sup> MathTrax and VirtualLab will be reviewed to determine the appropriate balance between the audio-visual experience and content delivery.

**Local Experiential Programs:** Localized experiential programs are being developed, building on the concepts developed at the Experiential Learning Center<sup>17,18</sup>, for remote students in as close a proximity to their location as possible. For students local to the WKU campus, the WATERS facilities and staff will be used to provide access to hands-on experiences to support the on-line content. Partnering organizations, in particular utilities and municipalities, will provide internet and computer access to participating students, along with access to any laboratory facilities for hands-on experiences.



**Internships and Co-Operative Education Programs:** Partnerships with existing water & wastewater utilities are being explored, established and expanded to develop additional internship/hands-on applications at operating plants, including the establishment of co-operative education programs. The WTTI Recruitment and Student Success subcommittee will work with the career services centers at partnering academic institutions to develop specific guidelines differentiating academic internships, paid internship and cooperative education programs similar to those produced by the University of Connecticut<sup>19</sup>. The South Carolina ATE Scholars<sup>20</sup> program at Florence-Darlington Technical College will be used as a model to maximize the experiential learning value to students and return on investment value for the employer. WKU students may receive 1 credit hour of credit for every 80 hours of supervised program-appropriate internship executed with a participating utility. Internship opportunities with specific utilities and municipalities will be initially recruited using grant-funded cost-share to leverage existing and potential employer programs.

**Industry Standards and Workplace Competencies:** The certification processes of relevant state agencies & industry groups are being incorporated as far as possible (potentially including certification authority) to maximize cross-over between academic degree and industry expectations and valuations. An existing trade association management training course sequence, the Utility Management Institute<sup>21</sup>, will be incorporated as a management component of a technology-based curriculum. Existing trade-association and certifying agency technical training content will be utilized for the technology-driven components of the curriculum. Qualified (as defined by the community college and the certifying agencies) instructors will be recruited through the trade associations to serve as adjunct faculty in the Community College to deliver technical content. The WTTI Certifications and Policy subcommittee will work in counter-point with the Curriculum and Faculty Development subcommittee to ensure certifying authority content requirements in all participating states are met as the curriculum evolves.

**Curriculum:** Core community college faculty will deliver science fundamentals, with support from science/engineering research faculty to develop cutting-edge curriculum content. Formal articulation agreements will be finalized with 4-year programs to provide a pathway for academic advancement.

**Associates Degree:** Several associates degree programs<sup>22,23,24</sup> with similar goals were reviewed to support the initial development of a 2-year curriculum. The Environmental Technician program at the University of Alaska Southeast<sup>25</sup>, serving remote and culturally unique systems, was reviewed in particular as a program partner with the CWRS in the USEPA funded small drinking water systems Technical Assistance Center Network<sup>26</sup>. Further, several of the practitioners serving on the Steering Committee graduated from similar programs. These individuals, along with trainers from the Kentucky and Tennessee certifying agencies, and faculty from the community college, constituted the initial Curriculum and Faculty Development subcommittee. This committee met in late summer of 2007 and developed a 63 hour curriculum that will serve as the starting point for evolution. A synopsis can be found below:

- **General Education:** 21 hours, including Introduction to College Writing; Business & Professional Speaking; Introduction to Psychology; and a humanities course.
- **Core:** 21 hours, including Basic Accounting; Introduction to Computers; Basic Business Communications; Business Seminar; and Supervisory Management.
- **Concentration:** 18 hours including Water Supply and Wastewater Control; Water Distribution and Wastewater Collection Systems; and Water and Wastewater Instrumentation and Control; and specialization in either Water or Wastewater:
- **Water:** Introduction to Water Treatment Processes; Calculation and Hydraulics for Water; and Advanced Water Treatment Processes.
- **Wastewater:** Introduction to Wastewater Treatment Processes; Calculation and Hydraulics for Wastewater and Stormwater; and Advanced Wastewater Treatment Processes.
- **Electives:** 3 hours, such as Electrical and Mechanical Systems

**Articulation Agreements:** A 2004 study by the Kentucky Council on Post-secondary Education<sup>27</sup> identified four key barriers to transfer from community college to four year institution:

- Financial barriers limit students' access to postsecondary education and transfer;
- Students' perception of the benefit of higher education is overshadowed by their desire for employment and stability;
- The delivery of academic services at the baccalaureate level can be a barrier to student transfer and degree attainment; and
- Academic planning, preparation, and knowledge about transfer can limit students' understanding and success within the transfer process.

The unique role of the BGCC as one of the five academic colleges within WKU, goes a long way to addressing all but the first barrier. Transferability<sup>28</sup> is a key consideration in developing the WTTI curriculum.

Articulation agreements are being developed with the Applied Technology program in the Architectural and Manufacturing Sciences Department, and the Public Management program in the Political Science Department of WKU.

**Public Management:** The Political Science department at WKU offers a baccalaureate degree in Political Science with a Public Management track, as well as a Master of Public Administration (MPA). These programs provide knowledge and skills appropriate for management in public, not-for-profit, and private sector organizations. The MPA is designed to provide additional training and career development opportunities for practicing public managers. The curricula provide a balanced blend of both the practical and the theoretical approaches to the art and science of public administration. The program is a member of the National Association of Schools of Public Affairs and Administration (NASPAA).

**Applied Technology:** The 4-year degree in Technology Management is designed for students who have graduated from a 2-year technical college with either a certificate or associate degree. This major enables graduates to apply their 2-year technical education toward a 4-year degree. The Architectural and Manufacturing Sciences department provides graduates with management backgrounds to advance in their chosen career paths. The program is popular with recent graduates from technical colleges, and individuals currently employed in business and industry seeking career advancement. Classes are delivered on the main campus, available at other locations through interactive TV, and via the web.

**Recruitment and Retention:** The Regional Science Resource Center, specializing in environmental outreach to middle and high school students and teachers, along with the water and wastewater trade associations, will develop a targeted recruitment toolbox. A modular course structure will be developed and deployed to improve the integration and relevance between science fundamentals and applied technical content, and to allow students to make incremental advances. Current and retired practitioners will be engaged into mentoring roles. Ongoing faculty development opportunities will be developed and provided for users of proposed materials.

**Outreach and Recruitment:** For high school graduates who might directly enter the workforce as an operator, the primary detractor from entering a higher education science track, is the combined effect of the cost of the education, the time it takes to graduate, and the lack of clarity in the job prospects at the end of the academic tenure. For example, a high school graduate with an interest in the environment, might face four years to get a degree in Biology, \$25,000 or more in tuition and books, and still not have a clear idea of what job awaits him or her upon graduation. Each detractor, time, cost and job definition should be addressed to effectively recruit operators. By providing an on-line associates degree track, the issue of time can be offset somewhat. Industry provided internships and scholarships will go a long way to offsetting cost, as well as providing a strong indicator of job availability upon graduation. Finally, an academic degree program that is tied to a specific trade such as water and wastewater operations, provides clarity in job prospects.

Practicing operators will be recruited to work with the Regional Science Resource Center as part of their regular science outreach efforts to engage middle- and high-school students in discussions and activities that highlight the value of the water professional and the contribution operators make to society. Recruitment efforts will be carefully coordinated with other aspects of the WTTI activities to reflect advances in professional career advancement potential and employer professional development commitments. Internship commitments of partnering employers (utilities, districts and municipalities) will be matched with grant funds and integrated into the recruitment materials developed. The partnering trade associations, KRWA, KWWOA and AWWA, are developing scholarship programs to further enable students access to higher education. Other traditional methods of outreach and recruitment, such as summer bridge programs, are routinely implemented at WKU. Coordination with these programs will continue to ensure exposure for WTTI.

**Modular Courses:** The use of modularized courses to improve retention and student success is well documented<sup>31,32</sup>, and has even been applied to internship/apprenticeship situations<sup>33</sup>. Each

technical content area course will be developed with a modular structure. The goals of this process are to maximize engagement and knowledge retention by the students; incorporate as far as possible, approved contact certification and continuing education credits offered by partnering agencies; and to complement experiential components such as the Localized Experiential, and Internship and Cooperative Education Programs.

**Mentors:** Of critical importance to the retention and success of WTTI students, is their continued connection with practitioners. A goal of WTTI is to ensure that as many technical content courses are taught by experienced and qualified practitioners as possible. Beyond the use of practitioner/instructors, the Recruitment and Student Success subcommittee will identify and recruit experienced operators near, at or in retirement to act as mentors for students in the program. Mentor-student interaction will be enabled via the on-line professional networking environment<sup>9</sup>. In addition to providing access to mentors, this process will act to retain some of the knowledge-base of the experienced workforce nearing retirement. Face-to-face interactions between faculty, students and mentors will be enabled at the annual WTTI conference.

**Faculty Development:** Considering the uniquely integrated nature of the program, and the involvement of practitioners in core academic functions, on-going faculty development activities are critical in ensuring student success. Faculty development activities will be the responsibility of the Curriculum and Faculty Development subcommittee.

## Summary

Introduced in this paper is a holistic approach to addressing national workforce shortages in the water and wastewater industry. The program has been under development for over a year, and is beginning the implementation phase. WTTI seeks to effect long term systemic change in the industry by encouraging non-confrontational dialog between regulators, employers, trainers and academics in order to evolve a more sustainable, effective, and productive workforce. WTTI tunes recruitment, training and educational programs to the younger generations, with their characteristic professional, personal and social norms and expectations. The program is beginning a pilot phase focused on Kentucky and Tennessee.

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