BROWN AND CALDWELL

Quarterly

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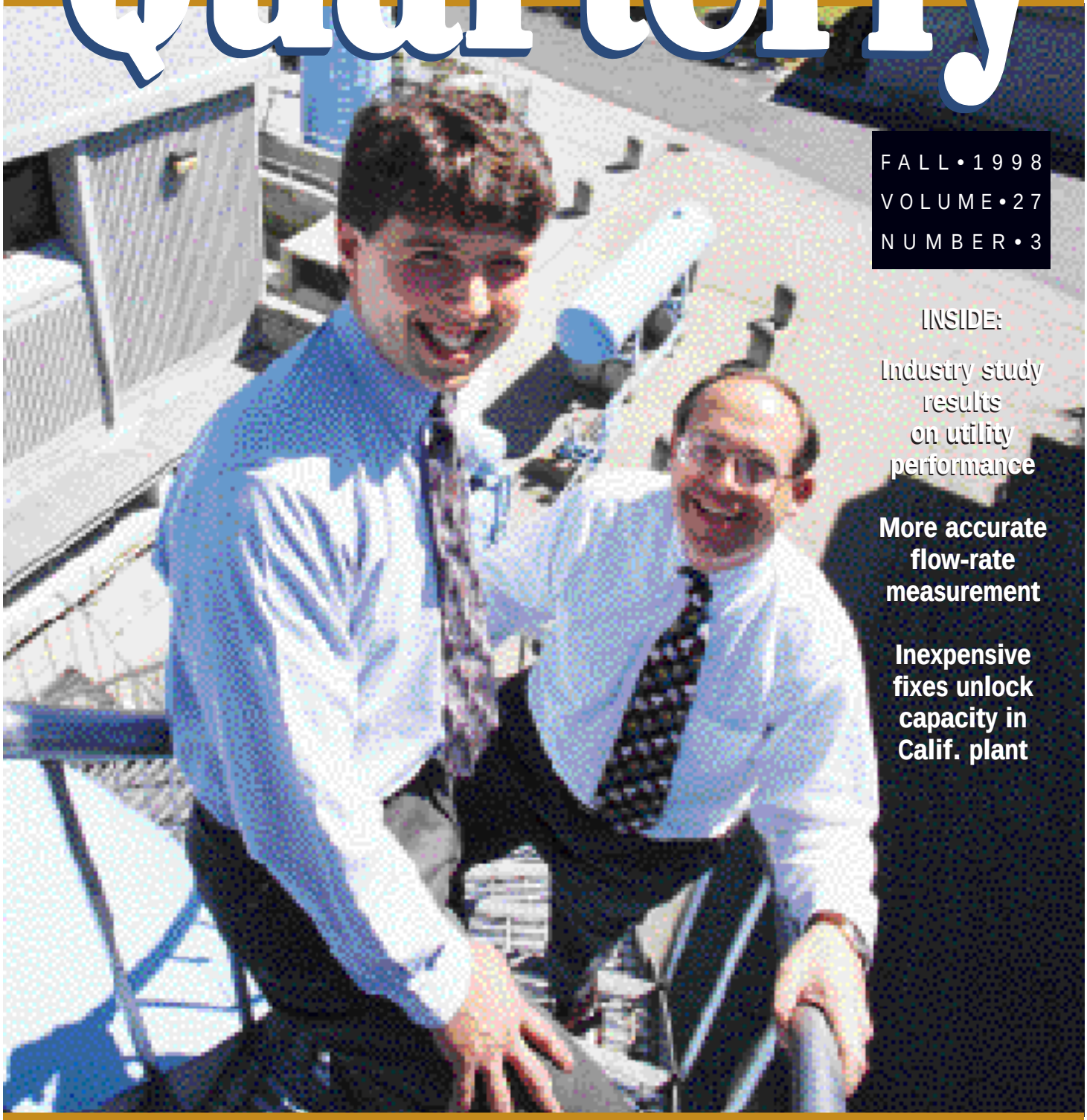

INSIDE:

Industry study results on utility performance

More accurate flow-rate measurement

Inexpensive fixes unlock capacity in Calif. plant

Featured this issue — LOTT's creative wastewater plan formulates a new approach

BROWN AND CALDWELL

Quarterly

Mike Sharar (right), LOTT Partnership administrator, and Chris Cleveland, Brown and Caldwell project manager, at LOTT's wastewater treatment plant. Brown and Caldwell performed a comprehensive plant optimization that unlocked 8 million gallons/day of capacity without compromising water quality. This capacity is worth approximately $40 million in reduced costs to the community.

PHOTO BY JOEL W. ROGERS

Marketing Communications Manager Terry Peckham

Editor/ Staff Writer Lisa Bernstein

Assistant Andrea Atkins

Produced by DIABLO PUBLICATIONS (925) 943-1111

To speak with a Brown and Caldwell representative, call us at (800) 727-2224 or visit our web site at www.brownandcaldwell.com.

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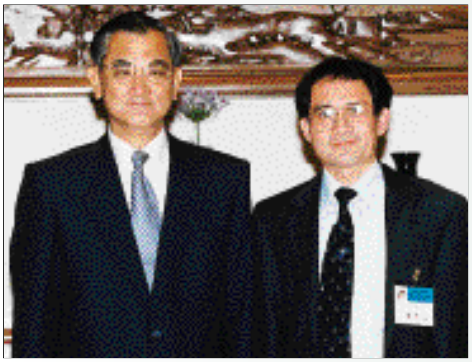


Joe Wong (right), Brown and Caldwell engineer and new president of the Chinese-American Environmental Protection Association, shown with Chan Lien, vice president of the Republic of China on Taiwan.

Wong Becomes President of Chinese-American EPA

Managing engineer **Joe Wong** became president of the Chinese-American Environmental Protection Association (CAEPA) in May 1998. CAEPA's approximately 250 members are environmental professionals based throughout the U.S. and the Far East. Wong recently participated in the Conference of Overseas Chinese Professional Association Presidents held in Taipei, Taiwan, where he met with the Republic's president, vice president, premier, and a number of ministers and administrators, including the administrator of environmental protection. Wong also visited the construction site of the advanced industrial-wastewater reclamation project in Kaohsiung, which he was instrumental in designing and implementing [see *Quarterly*'s winter 1998 issue for details].

Pumping Station Design Book Updated

The long-awaited second edition of "Pumping Station Design" (Butterworth, $175) is now available. **Garr Jones**, senior vice president, is a co-editor and the author of three chapters. **Robert Benfell, Geoffrey Carthew, David Eisenhauer, Rhys McDonald, Steve Merrill, Marc Pritchard, Jim Schettler,** and **Rich Skeehan** of the company also contributed.

The first edition, which won the 1989 award for best engineering text from the American Publishers Association, has been considered the definitive book on pumping station design. Its thorough treatment of all related technical issues has made it a key reference for engineers of any kind of treatment plant, regulator station, or similar project involving hydraulics and using mechanical and electrical equipment.

The new edition includes updated versions of all chapters and new information on vibration control and structural, electrical, and HVAC design. New sections on wet well design address the improved self-cleaning wet well and the self-cleaning wet well for constant-speed pumping stations, both Brown and Caldwell innovations. Significant text additions reflect revisions to the Hydraulics Institute's widely used standard for pump intake design, which Brown and Caldwell helped to change.

Location Change in Louisiana

Brown and Caldwell's Baton Rouge office has moved. The new address and phone numbers are 11550 Newcastle Avenue, Suite 140, Baton Rouge, La. 70816, phone (504) 295-3700 and fax (504) 295-3704.

Continued on page 6

Speaking the Language of Financial Management:

Utility Managers and Boards Can Find Common Ground

No contradiction exists between serving the public and being competitive, says Diane Levin, when financial measurement tools provide the framework for decision-making.

Utilities are struggling to gain compliance, deliver service, and now, be competitive. Common tactics include benchmarking, re-engineering, and reducing operating costs. Yet two questions keep coming up: How do we know whether we're competitive? Will we be able to sustain service over time? The lessons of private companies reveal some answers.

How do we know whether we're competitive? For utilities, rates generally are the measure of competitiveness. To use private-sector jargon: water is a commodity and rates (price) must be competitive (low) and consistent. For the private sector, however, price is *not* the measure of competitiveness — nor should rates be considered the ultimate measure of utility competitiveness.

The ultimate value of a private company is generally measured by return on equity, which indicates whether the shareholder is getting value from the investment. A high return on equity can be achieved only when a company clearly understands customer needs and has the operational savvy to meet them.

In the utility world, the parallel to return on equity is return on assets. Ratepayers are the equivalent of shareholders, and they seek the highest value from their tax dollars. But as return on equity isn't the only measure of value for private businesses, return on assets isn't the only such measure for utilities. They also need to measure factors such as assets per customer, operating costs, debt, and how reserve funds balance upcoming capital requirements. These common financial metrics can give the public a complete understanding of utility performance.

How do we sustain customer service while becoming competitive? Using rates as the sole measure of competitiveness can lead to too much emphasis on annual results. Even in the world of quarterly earnings, private-sector boards emphasize the company's long term. Public utilities must balance short-term and long-term viability. Utilities can do so by making all decisions within a business and financial context, with the goal of creating the most value for the investment. Decisions must be based on financial performance — while meeting customer requirements.

What does this mean for utility managers and boards? Utility directors will gain flexibility, and boards will gain a definitive way to measure value, by adopting the private-sector goal of improving financial performance, and using standard metrics to do it.

For example, utility managers and boards can review capital decisions with the objective of increasing return on assets in addition to achieving compliance. This lets them look comprehensively at the utility as a business and make program-level decisions. The dialogue becomes framed by bigger questions. What projects are essential to the utility's mission? What projects are good, but can wait? What are the risks from different sequences and options? What are the tradeoffs between the infrastructure master plan, treatment-plant master plan, and a mixture of both, in terms of the return on ratepayer investment?

In planning and budgeting, managers can assess tactics that balance revenue, operations, and assets, while meeting service goals. This entails finding ways to *increase* revenue, *decrease* operations expenses, and *keep assets at just the right level* to provide service. Using return on assets and other financial measures, utilities can find the correct blend of operating expenditures to avoid costly emergency construction; forecast needs; plan prudently; and relate cost-of-service to revenue.

Utility managers and boards shouldn't fear that classic financial measurement tools obviate commitments to compliance and customer service. On the contrary, financial tools should be applied to achieve these commitments. Customers may require low cost, or high customization. Objectives may be qualitative, such as a good working environment or ethical behavior. Commitments may include community-valued programs to increase public education, access to facilities, participation of historically underutilized businesses, and work/study. Whatever the goals, utilities can reach them using the framework of financial management.

The public values dialogue in a common business language to meet goals, as demonstrated by the proliferation of contract operations. Most contract operations agreements build in rate increases over time, yet the public is voting yes on them. The public wants measurable commitments to results.

Utilities facing today's tightened economic conditions may see a contradiction between doing the right thing and being competitive. Yet public utility managers and boards can work together to do both, if they treat competitiveness not as an add-on requirement, but as a context for management.

Diane Levin

LOTT's Creative Wastewater Plan: Reduce, Recycle, and Manage Capacity

A Washington community cuts new costs by formulating a wastewater management approach that focuses on flow reduction, effluent recycling, and "just-in-time" capacity additions.

Brown and Caldwell has led the formulation of an unconventional approach to wastewater resources management for the cities of Lacey, Olympia, and Tumwater and Thurston County, Wash. (LOTT). Called "The Highly Managed Alternative," the comprehensive, 20-year, "living" plan offers new ways to consider wastewater services, planning, and management.

Unlike traditional plans, this one adds small units of capacity "just in time" in response to measured needs and conditions. It also shifts toward water recycling as a primary focus. Shaped by unusually intense public involvement, the plan culminates three years of planning by LOTT and the Brown and Caldwell team.

"This program changes the way wastewater services are planned and managed, since we have a structured way to create many solutions," says Brown and Caldwell project manager Chris Cleveland. "Also, it reduces the burden on existing ratepayers to fund capital improvements in advance, and it minimizes stranded investments."

"Thinking out loud" with the public

The LOTT Wastewater Management Partnership manages services for one of the state's fastest-growing regions, a 14,000-acre, urbanized area of about 125,000 people. In response to regulatory requirements, in 1994 the Partnership completed a wastewater plant upgrade to advanced secondary treatment employing biological nitrogen-removal and ultraviolet disinfection.

But even with this $47 million upgrade and planned measures to reduce storm water and wastewater flows, a 1994 study showed that flows could exceed permitted capacity by

Mike Sharar, LOTT Partnership administrator, and Chris Cleveland, Brown and Caldwell project manager, at the head of Budd Inlet, Wash. The company led a scientific study of the inlet, determining that increased effluent discharge in winter would not harm the marine environment, but that summer water-quality conditions were sensitive.

PHOTOS BY JOEL W. ROGERS

2001. The LOTT Partnership assigned Brown and Caldwell — and its team members Barney & Worth, Robinson & Noble, Adolfson Associates, Evans Hamilton, Reid Crowther, and others — to plan new approaches. The team had to consider a host of physical challenges, including substantial rainwater inflow and groundwater infiltration into the sewers; 500 acres of combined sewers that cannot be cost-effectively separated; a nutrient-limited marine-water estuary receiving LOTT's treated effluent; and expected doubling of customers by 2010. Also, the requirements of Washington's administrative code, Growth Management Act, and Department of Ecology had to be met.

From the beginning, the team committed itself to a completely open planning process in which all wastewater management options would be considered. The broad community would *control* the outcome in a highly public process of "thinking out loud." Citizens were involved through surveys, newsletters, hearings, workshops, stakeholder interviews, and television and video outreach. The key public values identified include:

- Unprecedented support for environmental protection
- Nearly equal support for cost control
- A focus on maximizing the use of existing facilities before investing in new ones
- A commitment to recycling water resources

Reduction, recycling, and reserve discharge

The Partnership, public, and Brown and Caldwell team explored a number of program directions to manage wastewater so as to reflect public values. Four directions form the core of the new plan.

1 Flow Restriction. The plan will reduce the need for new capacity by reducing wastewater flow, rainwater inflow, and groundwater infiltration, and by removing some of the barriers to on-site system use by citizens. Wastewater-related water consumption will be reduced through incentive programs. LOTT has already begun several pilot projects. Brown and Caldwell's custom-developed analytical model evaluated the cost-effectiveness of inflow and infiltration programs. As a result, LOTT will likely focus on side sewer replacement instead of sewer main rehabilitation. The use of composting toilets, graywater separation systems, and other on-site systems by motivated

citizens will be facilitated, with continued safeguarding of public health.

2 Reclamation. Wastewater treated to meet state Class A standards (suitable for full body contact) will be used for irrigation and commercial/industrial purposes within Thurston County. Most likely, remote satellite reclamation plants, near the water's eventual use, will handle from 1 to 5 million gallons per day (mgd).

3 Groundwater Recharge. More-highly-treated wastewater will replenish groundwater supplies. Class A reclaimed water will be circulated through a series of ponds integrated into community amenities, then will enter infiltration basins. The basins will allow the treated water to soak through the ground to the aquifer, gaining final treatment in soil. Facilities will handle up to 5 mgd year round.

4 Increased Winter Discharge to Budd Inlet. Brown and Caldwell performed a comprehensive optimization of the treatment plant, unlocking an additional 8 mgd of capacity without compromising water quality. This capacity is worth approximately $40 million in reduced costs to the community. Consequently, the company led a scientific study of Budd Inlet, an estuary on Puget Sound that receives LOTT's treated effluent, and determined that increased wintertime discharge would not adversely impact the marine environment. The Budd Inlet study also confirmed that summertime water-quality conditions are very sensitive, and that discharges at levels above those now permitted should not be sought by LOTT although LOTT is a minor contributor.

LOTT's permitted discharge levels are now limited during wet weather, but these limitations are difficult to plan for, since forecasting long-term precipitation is difficult. If permitted discharges during winter are allowed to increase, then enforcement actions by the Department of Ecology would be shifted to the summer, when flow and loading conditions are easier to plan for, because they are linked to increases in population and employment. This shift would allow LOTT to gradually, cost-effectively increase water recycling through upland discharges and reduce its reliance on disposal to a marine outfall in Budd Inlet. Access to this formerly stranded capacity offers LOTT a comparatively low-cost way to create the reserve capacity needed to implement the plan.

A living plan

The new plan will be continuously adjusted to precisely meet short-term capacity requirements with capital investments. "This means facilities planning never stops," says Mike Sharar, LOTT Partnership administrator, "but with 'just-in-time' expenditures rather than the traditional 'large plant' approach, our ratepayers win…not only from the perspective of present worth, but also with progressively more water recycling."

The recommended draft plan was completed by the Brown and Caldwell team in August 1998. The four governmental members of the LOTT Partnership are scheduled to adopt the final plan in December.

For more information, contact Brown and Caldwell project manager Chris Cleveland at (360) 943-7525.

The Brown and Caldwell team used some of the materials shown to intensively involve the public in wastewater planning. Also shown are laboratory analysis tools for the Budd Inlet scientific study; a sleeve to mark pipelines carrying reclaimed wastewater; and elements being distributed to citizens to reduce wastewater flow.

FLEXIBLE SOLUTIONS FOR A NEW MILLENNIUM

A typical facilities plan would call for a single large treatment plant. The Highly Managed Alternative responds flexibly to changing regulations, population growth, technological developments, and other conditions. And it reformulates some of the key elements of wastewater planning:

- **Focus on the environment.** Reclamation and recharge areas are selected based on environmental suitability, then sites and projects are defined. This streamlines implementation and permitting. Traditional facilities select a solution first, and only then identify environmental impacts.
- **Flexibly managed financing.** Matching bite-sized capacity increases with actual growth, the plan sharply reduces up-front capital costs and virtually eliminates long-term financing. Cost impacts can be equitably distributed among existing and future ratepayers — growth paying for growth — while monthly sewer fees cover operating costs.
- **Incremental capacity,** "just in time." Small capacity increases of 0.5 to 1.0 mgd each allow system changes to more closely match customer needs. They also avoid overcommitment to a single technical approach, allowing benefits from technological improvements and decreasing costs. Also, shortening the time between identifying a capacity need and implementation means more accurate adjustment to population growth and flow reduction performance.
- **Amplified concept of capacity.** Unlike traditional approaches, a resource-based approach focuses first on recycling treated effluent, second on the treatment needed to support that use, third on regional conveyance, and fourth on collection.
- **Continuous monitoring and planning.** A comprehensive system collects information from several sources. Data on treatment, conveyance, and collection system capacity are tracked, and decisions to add capacity are triggered by measured conditions balanced by a long-term vision. Each identified need is developed into a project, with its own planning, design, and construction steps. Multiple projects proceed under varying stages of development, any one of which can be advanced as needed.

New Utility Study Highlights Top-Performing Management Strategies

A study of more than 100 public and private water and wastewater utilities reveals opportunities to increase competitiveness by managing capital more effectively.

A recent study provides a vivid snapshot of water and wastewater utility performance in the new competitive era, and uncovers methods — involving effective capital planning and management — to improve it.

The study was performed by The BTI Consulting Group (Boston), a leading international market research and management consulting firm. The study included a double-blind survey of more than 100 water and wastewater utilities, whose managers responded to BTI with complete anonymity. The study was sponsored by Brown and Caldwell, who set two goals for the work: 1) enable clients to more accurately compare their operations with those of other utilities and 2) identify methods to improve utilities' performance.

The study had three elements. First, BTI conducted an in-depth survey of the managers of 118 public and private water and wastewater utilities, interviewing them to uncover their top concerns and current approaches to improving performance. Next, BTI evaluated the business performance of the surveyed utilities using a common set of private-sector measures. Finally, Brown and Caldwell and BTI analyzed the results, identified top-performing tactics, and outlined ways they could be more methodically applied. Data and conclusions were released in August 1998.

Among the study's key conclusions are these:

- Water and wastewater utilities have a pressing need for money to improve and expand their infrastructure.
- Most of these utilities, however, are not making decisions about capital spending that maximize their assets — which they must do to achieve financial viability and meet the challenges of aging infrastructure, growth, and increasing regulatory pressure.
- Utilities that are not "best in class" can achieve a total of $9 billion in savings through better capital management.

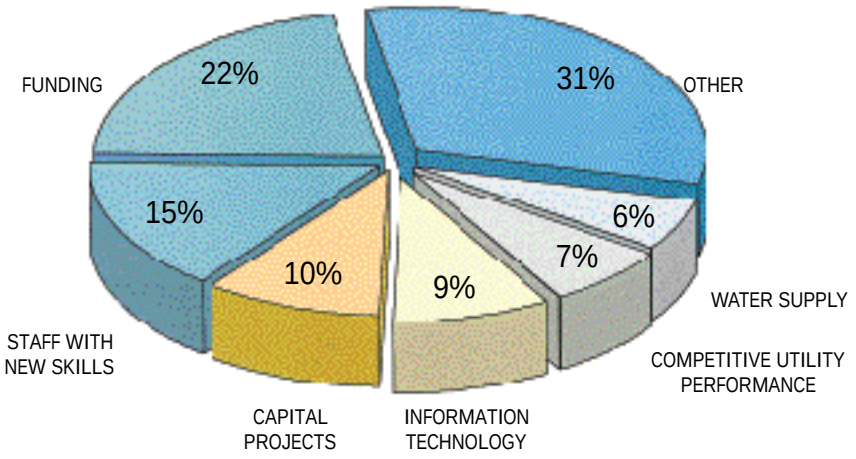


Figure 1. The managers of 118 surveyed public and private water and wastewater utilities identified their organizations' greatest unmet needs.

Finding 1: Greatest need is access to money

To understand today's context and concerns, interviewers surveyed the 118 utility managers, using open-ended, unstructured techniques that let them define the issues in their own words. As Figure 1 shows, the greatest identified need is funding for capital improvements. With the end of large federal capital grants, obtaining funding is a problem. Of particular concern is the compelling need for infrastructure rehabilitation, which does not bring in additional revenue. "Capital projects" was identified as the third-largest unmet need, and "competitiveness" and "water supply" were the fifth- and sixth-largest.

Money is the explicit or implicit need behind all of these identified pressing issues. In examining management options, utility leaders therefore will focus on how to make improvements that reduce the need for funding or that make them attractive to financiers.

Finding 2: $9 billion can be saved through effective asset management

The study also interviewed the utilities about how they measure their competitiveness. It found that the technique used most often was benchmarking (Figure 2). Despite the widespread use of this tool, it was not clearly known among the surveyed utilities what constituted "best in class" or which utilities had achieved superior performance.

So BTI applied private-sector business tools to determine what constitut-

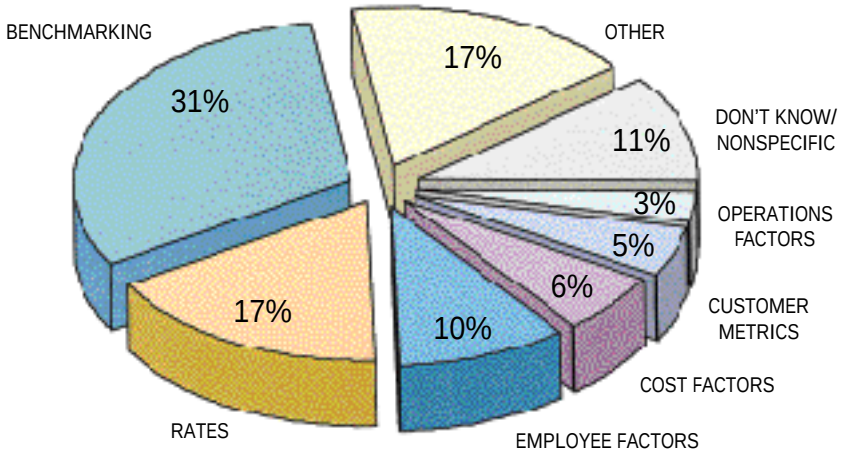


Figure 2. The pie illustrates how the surveyed utility managers presently measure their utilities' competitiveness.

ed best-in-class. This evaluation focused on the utilities' financial statements. Because privately held organizations are measured by their return on equity, the study evaluated the closest comparable measurement, return on assets, which reflects how efficiently and effectively resources are utilized. This makes it a powerful measurement for evaluating competitiveness.

The study revealed that of the 118 surveyed private and public water and wastewater utilities, the best in class have a return on assets of 10.5 percent — twice that of the average surveyed utility. By increasing their return on assets, most utilities can achieve significant savings. "The study shows that utilities have a $9 billion opportunity to improve their asset management in a highly capital-intensive industry," says Michael Rynowecer, president of The BTI Consulting Group. "Furthermore, the data suggest that there is room for improvement for those who are currently best-in-class."

Finding 3: Smart capital management and operational design yield savings

Using the survey and evaluation results, BTI then identified which actions most effectively achieved the superior performance that was demonstrated by the high return on assets of the best-in-class utilities. The actions were found to be information technology upgrades, innovative billing, reducing electrical operating costs, re-examining financing strategies, strategic outsourcing, and staff reorganization.

Finally, the Brown and Caldwell/BTI team assessed which top-performing tactics could be applied more methodically by utilities — in an overall, return-on-assets strategy — to achieve even better performance, more reliably. As utility managers shift to this strategy, they will begin to measure their organizations as they would a business. Such a shift will lead to changes in a number of traditional approaches to utility management.

Find capacity by maximizing existing assets. Most plants are not operated as efficiently as possible because managers are not using newly available tools to maximize assets. Brown and Caldwell's analysis shows that 20 percent more capacity usually can be gained through system tuning.

Expand facilities "just in time." Investor-owned utilities add capacity only as it is needed to serve customers. This reduces costs and allows new customers to shoulder the expense of new capacity.

Link decisions about capital and operating expenditures. The focus on reducing operating expenses has led to situations in which total costs actually increase. "In today's world, where managers are focused solely on reducing operating costs, we are seeing inappropriate increases in capital expenditures to compensate for reduced operational spending," notes Jack Warburton, Brown and Caldwell senior vice president.

In decisions about capital, closely consider return on assets. To be competitive, utilities need to incorporate return-on-assets-related criteria in all decision-making, from top-level goals down to the individual project level.

Focus on additional areas for decision-making. With a return-on-assets-driven approach to utility management, the areas of capital needs planning, risk management, plant optimization, and capital implementation are promising targets for savings. The approach gives utilities more choices about how to achieve the ultimate objective of high-quality service at the lowest total cost.

For more information, contact Diane Levin at (503) 977-6631. Survey results may be purchased from The BTI Consulting Group at (617) 439-0333.

TRADITIONAL APPROACHES TO UTILITY MANAGEMENT	NEW APPROACHES TO UTILITY MANAGEMENT
Add capacity	Find capacity by maximizing existing assets
Design and build for projected needs	Expand "just in time"
Decisions about capital and operating expenditures are separate	Decisions about capital and operating expenditures are linked
Capital decisions are based on demand and compliance	Capital decisions are based on return on assets as well as demand and compliance
Benchmarking	Business management
Board-level discussions focus on projects	Board-level discussions focus on mission

Clarifier Capacity Dramatically Increased at Calif. Plant

Eric Wahlberg, **Hany Gerges**, and **Rhys McDonald** of Brown and Caldwell helped save the city of Vacaville, Calif., $1.2 million dollars by prescribing inexpensive fixes that unlock significant capacity in the four existing secondary clarifiers at the city's Easterly Wastewater Treatment Plant.

During design of the plant's expansion, West Yost & Assoc. hired Brown and Caldwell to evaluate the clarifiers' capacity and to maximize their efficiency. The team used sophisticated hydrodynamic modeling [see illustration] to analyze each clarifier's hydraulic problems and test potential corrective measures. Then, the team prescribed low-cost modifications that drastically reduced effluent concentrations. Overall, the improved clarifier performance equaled 4.5 million gallons per day of unlocked capacity. This enabled plant expansion to be scaled back.

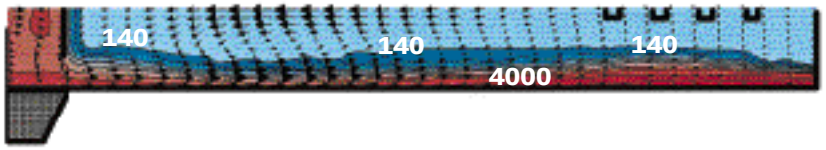
"Everyone knew that secondary clarifier No. 4 was especially performance-limited," says Wahlberg, "but the results were even more dramatic than we expected." After the modifications, it can operate with an increased effluent flow rate and effluent concentrations of only 19 milligrams per liter (mg/l), whereas those concentrations would have been an unacceptable 149 mg/l at the greater flow rate without the fixes.

Before modifications:

Effluent concentrations of 149 milligrams per liter (mg/l)

After modifications:

Effluent concentrations of 19 mg/l



Effluent flow rate: 3.0 million gallons per day

Brown and Caldwell used sophisticated hydrodynamic modeling to analyze the secondary clarifiers at the Vacaville, Calif., Easterly Wastewater Treatment Plant. The illustrations show the velocity field and solids distribution of the plant's secondary clarifier No. 4. The size of the arrows and their direction indicate the velocity at the point corresponding to the arrow tail. Suspended solids concentrations are indicated by iso-concentration lines (in milligrams/liter) and coloring. The "before" illustration shows a classic end-wall effect, which lifts solids into the effluent. The "after" illustration shows the elimination of this problem by the addition of effluent launders and the extension of the inlet baffle. Both cases assume an effluent flow rate of 3.0 million gallons/day, which was made possible by the modifications.

Brown and Caldwell's approach to optimizing primary sedimentation tank and secondary clarifier performance focuses on getting the most out of existing tankage. The first step is a series of diagnostic tests to identify and quantify performance problems. Because the team rarely discovers a single cause of poor performance, the tests are designed to accurately pinpoint various causes of poor effluent quality. For primary sedimentation tanks, diagnostic testing includes evaluation of the non-settleable suspended solids concentration in the influent and generation of an ideal settling curve that describes suspended solids removal under varying surface overflow rates. For secondary clarifiers, the team evaluates dispersed and flocculated suspended solids concentrations and performs a state point analysis to determine ideal capacity. The team uses high-accuracy modeling, stress testing, and flow pattern testing to further analyze problem sources and corrective measures.

With proper diagnosis, the team can prescribe and implement the right solution. For the Vacaville plant, it included extending the inlet baffle in each of the four secondary clarifiers, modifying the effluent launder systems in clarifiers No. 1, 2, and 3, and installing a new effluent launder system and sludge withdrawal system in clarifier No. 4.

Joining Brown and Caldwell…

Sam Kruse, P.E., has joined the company's Houston office, where he is responsible for municipal services. A former vice president of a large Houston firm, Kruse has 22 years of engineering experience. He has managed design and construction of many public works and land development projects in the Texas Gulf Coast region…**Brad Hart, R.G.**, is a senior hydrogeologist with 15 years of specialized experience in modeling groundwater and vadose zones. Hart provides site characterization services for mining and municipal projects through the Carson City, Nev., and Phoenix offices…Also augmenting BC's Phoenix staff is **Robert Kelley, Ph.D.**, previously the manager of biotechnology research at the Institute of Gas Technology. Kelley has developed and implemented innovative soil remediation technologies, including specific solutions for manufactured gas plant (MGP) sites. He is helping to implement Brown and Caldwell's MGP environmental management and remediation program…Now leading the watershed/water quality discipline in Denver is **Julie Vlier, P.E.**, a longtime Colorado resident with more than 14 years of experience in water resources management and planning, water quality engineering, water rights, and municipal utilities. Vlier continues to serve her fourth year as a member of the Colorado Water Quality Control Commission, which establishes the state's water quality standards, classifications, and policy.

Five Promotions to VP


Bill Faisst

Twenty-two-year Brown and Caldwell veteran **Bill Faisst, Ph.D., P.E.**, has been appointed vice president. In addition to working closely with many of the company's long-term water and wastewater clients, Faisst supplies technical leadership regarding marine outfalls and the planning and design of potable- and recycled-water systems…**Dan Skalsky, P.E.**, was named a company vice president as well as manager of the Atlanta office in June. Skalsky has eight years of experience with Brown and Caldwell, previously serving as a regulator with the Ohio EPA and chief engineer for the Cobb County, Ga., water system. In addition to his management responsibilities, Skalsky has expanded the company's client base in Atlanta and Charlotte and helped to develop its services in watershed management and competitive utility performance…Also instrumental to the company's water, wastewater, and environmental engineering work in the Southeast is newly appointed vice president **Jim Hawkins, P.E.** With 18 years of experience as a consulting engineer, Hawkins joined Brown and Caldwell last year to establish the company's presence in Charlotte, N.C. He has led a number of projects for the City of Charlotte and others…**Cynthia Paulson, Ph.D., P.E.**, also was promoted to vice president in June. An 11-year veteran of Brown and Caldwell, Paulson leads the management team for the Denver office's integrated water practice, which includes water quality, wastewater, and water treatment and distribution. Paulson is a widely recognized technical expert on the impact of point- and non-point-source pollutants and the performance of waste load allocations…**Chris Cleveland, P.E.**, also has been named vice president. During his eight years with the company, he has been responsible for significant aspects of the recent wastewater plant expansion in Renton, Wash.; performed biosolids planning for the entire Seattle Metro service area; and served as project manager for the Lacey-Olympia-Tumwater-Thurston County (LOTT), Wash., wastewater resources management plan [see cover feature this issue]. Cleveland leads the company's Olympia office.


Dan Skalsky


Jim Hawkins


Cynthia Paulson


Chris Cleveland

WEFTEC Alert

This year's Water Environment Federation Conference in Orlando provides further proof of what many now hold as fact: the environmental industry is one that has come to expect innovation and advancement. As always, Brown and Caldwell people from across the country will be heavily involved in the conference, sharing their own technical achievements through seven workshop presentations and 11 papers. Topics this year include the pros and cons of ultraviolet disinfection systems; process control for industrial activated sludge systems; new developments in rate setting; watershed-based effluent trading; privatization and creative financing; an interactive debate on issues in liquids/solids separation; and a whole-plant approach to evaluating capacity.

Brown and Caldwell conference participants will be standing by to talk with clients and colleagues at Booth 3180 in the exhibit hall. For a guide to Brown and Caldwell presentations and papers, contact Andrea Atkins at (800) 727-2224.

TECHNICAL PAPERS

The technical papers listed below are available to readers. For copies, please write, call, or e-mail Andrea Atkins, Brown and Caldwell, 3480 Buskirk Avenue, Pleasant Hill, Calif., 94523, (800) 727-2224, aatkins@brwncald.com, or access them via our web site at www.brownandcaldwell.com.

PARKER, D.S., et al.
"Making a Trickling Filter/Solids Contact Process Work for Cold Weather Nitrification and Phosphorus Removal" No. 674

MURRAY, D.S.
"Operating Costs of Medium-Pressure Ultraviolet Disinfection Systems" No. 675

DeGOLIAN, P.C. et al.
"Development and Application of a Water Quality Monitoring Plan for the Lake Lanier Watershed Study" No. 676

HAWKS, L.J., et al.
"Volunteer Monitoring: A Critical Piece of Watershed Protection" No. 677

SKALSKY, D., et al.
"Integrating Public Involvement into the Lake Lanier Watershed Study" No. 678

KLOPPING, P.H. et al.
"Pulp and Paper Mills' Top Ten Wastewater Treatment Problems and How to Avoid Them" No. 679

MELCER, H.
"Full-Scale Experience with Biological Process Models — Calibration Issues" No. 680

UTHE, W.
"Enhancing Anaerobic Digester Performance, Submerged Fixed Cover Digesters" No. 681

PARKER, D., et al.
"Process and Kinetic Analysis of Nitrification in Coupled Trickling Filter Activated Sludge Systems" No. 682

McCARTHY, B., et al.
"Applicability of Thermophilic Anaerobic Digestion for the West Point Treatment Plant" No. 683

NEWMAN, G., et al.
"Centridry: Combined Dewatering and Drying, King County's Evaluation Program" No. 684

VAUGHAN, F., et al.
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Flow-Rate Measurement Using Dye Dilution Increases Accuracy

Flow rate is the basis of engineering design, process control, discharge permitting, and cost allocation for water and wastewater systems. Yet flow measurement inaccuracies are common, leading to unnecessary expense, operation headaches, permit violations, and even legal disputes.

The accuracy of virtually any flow measurement system can be evaluated using the dye dilution technique to independently measure flow. "The concept behind the technique is simple, but numerous factors can affect accuracy," says **Rhys McDonald**, the Brown and Caldwell environmental scientist who has refined the method. "We've developed a rigorous protocol and custom instrumentation that provide highly accurate results under a wide range of conditions and flow rates."

During an assignment to test flow measurement at the City of Vacaville, Calif., wastewater treatment plant, Thayne Loendorf, engineering technician from Brown and Caldwell's Portland, Ore., office, assisted by a member of the plant's operations staff, prepares background samples using one of Brown and Caldwell's specially outfitted vans.

Inaccuracy in flow data is rarely obvious. A flow meter may appear to be perfectly installed and calibrated according to instrumentation standards, yet produce inaccurate measurements. This is because flow-meter manufacturer tests and specifications are typically based on ideal hydraulic conditions, which can differ greatly from actual field conditions. Even for seemingly well-calibrated flow meters, independent flow testing using the dye-dilution technique often reveals inaccuracies resulting from non-ideal hydraulic conditions, incorrect or inappropriate installation, signal processing errors, maintenance lapses, and other factors.

In the dye dilution technique, a nontoxic fluorescent dye is injected at a known rate into the flow stream to be measured. After complete mixing in the flow stream, dye concentrations are measured downstream. The dilution of the dye after mixing is directly proportional to the flow rate; therefore, the product of the dye injection rate times the dilution equals the stream's flow rate.

Over the last 18 years, Brown and Caldwell has tackled each area where inaccuracies may occur during the tests and has developed custom equipment and techniques to minimize them. The company's dye injection system includes a sophisticated, computer-controlled metering pump, with continuous feedback and data logging for key test parameters. At the downstream sampling point, a continuous dye measurement and data logging system is installed, with a radio telemetry link back to the injection system for real-time feedback during the test. Blank and spiked background samples are prepared for every test. The company installs its own data-loggers on flow meters being tested. All the equipment is typically mounted in specially outfitted vans for testing, but it also can be packaged and shipped anywhere.

The company's testing system can measure flows ranging from a few gallons per minute to over 1 billion gallons per day, with an accuracy of 1 percent. Extensive test documentation is provided, including injection calibration curves, dye sample and background sample results, flow calculations, and time history plots showing both metered flow and dye-calculated flow.

Brown and Caldwell has performed many dozens of tests of flow rate — within collection systems and at wastewater and water treatment plants, industrial facilities, and pump stations. The company's technique is equally applicable to full and partially full pipes, constructed channels, and natural rivers and streams.

McDonald, who has tested nearly every type of flow measurement system available, comments, "Some sites are more challenging than others, but we've always found a way to satisfy the conditions to accurately measure flow."

For more information, call Rhys McDonald at (925) 937-9010.

Maui Water Treatment Plant Switches to Microfiltration

To see the Kamole Weir Water Treatment Facility, one must look up toward the clouds on Haleakala Crater, Maui. There, construction manager **Don Snowden** managed modification work that now enables the plant to meet strict new drinking water standards for surface water. In fall 1996, construction began to convert the Kamole Weir plant — about 1,500 feet up the mountain and at the edge of the rain shadow — to one of the world's largest water treatment facilities using microfiltration. Brown and Caldwell provided independent construction management of the upgrade, which was completed in spring 1998.

Maui's water-related geographical and social conditions are unique. While sugar cane and pineapple production on the other islands has declined over recent years because of water problems, Maui's extensive water catchment and transport systems enable both crops to be produced in abundance. East Maui's windward side has one of the wettest climates in the islands, but it's too steep, and usually too wet, for agriculture. Ditches therefore were constructed, perpendicular to the steep slopes, at the turn of the century to capture the plentiful runoff and transport it to the more level and tillable central valley areas as well as to the leeward side of the island, which would be semiarid without it. Agricultural and commercial interests own Maui's irrigation systems, but the general population has first call on a fixed amount of the water.

The Maui Board of Water Supply elected to install microfiltration membrane systems at the Kamole Weir plant. While similar systems had been incorporated at other island water plants, the Kamole facility receives raw water of extremely varying quality as a result of runoff impacts. At a capture of 0.2 microns, the new membrane filters go far beyond conventional, rapid sand filters in microorganism removal. Microfiltration is a fairly simple concept, but it requires a sophisticated process control and backwash system for effective operation — particularly at Kamole Weir, where eight microfiltration units now operate in parallel.

It proved challenging to start up and test the filters while operations continued using the plant's previous system. In the existing filtration

Craig Goehring

BC Welcomes Eckenfelder, Inc.

Brown and Caldwell's acquisition of Eckenfelder, Inc., this past July brings together two distinguished firms with more than 80 years of environmental experience and success. I am pleased to share with *Quarterly* readers the news that we have created value for our clients, employees, and shareholders.

Amid the loud noise of industry consolidation, word of another merger may hardly come as a surprise. The forces driving this combination, however, are different from those normally cited in the business press.

They begin with many shared values: dedication to client service, the drive for solutions that produce tangible benefits, a passion for quality and doing the right thing, a thirst for innovation, and an intense belief in teamwork. In short, it is a great fit.

The power of this combination has enabled us to hit the ground running. Our project teams are now fully integrated, and knowledge-sharing — the means by which we are able to quickly deliver the best ideas to our clients — is occurring at electronic speed over a highly collaborative information infrastructure. We are operating from a best-practices mind set, whereby each organization is learning and gaining from the strengths of the other. The results so far demonstrate that the sum of both companies is stronger and more competitive than either firm operating independently.

Eckenfelder's 30-year history of serving top industrial companies and solving complex environmental problems translates into millions of dollars in savings and a proven record of innovation. Its integration with Brown and Caldwell creates a national presence that enables Eckenfelder clients to receive the same level of service and ingenuity at more facilities. It also adds full, one-stop engineering, construction, and operations services, and a broader range of project delivery systems.

Eckenfelder expands Brown and Caldwell's geographic coverage in the eastern U.S. by adding two new offices in strategic locations: Nashville, Tenn., and Mahwah, N.J. Eckenfelder's industrial experience supplies new expertise and services that complement our private-sector business, including field and laboratory capability for treatability assessments and analytical testing. This expands our ability to meet the growing need for improved industrial water quality, environmental management and information systems, and risk-based, intrinsic remediation.

When the Eckenfelder folks say, "We wrote the book on industrial wastewater," it's much more than just an expression. Founder Wesley Eckenfelder, Ph.D., is one of the world's foremost authorities on industrial wastewater treatment. I am delighted that he will be working as senior technical director with clients full time. Senior Eckenfelder principals Dr. Jim Clarke and Dr. Bob Mutch also are actively engaged in the firm's work and now serve as senior vice presidents of Brown and Caldwell.

The project teams and technical staff of each firm have already come to rely on the talents and strengths of the other, showing that our values are indeed shared. Our united capabilities are a powerful guarantee that we will continue to deliver client success.

Craig Goehring

system, both cationic polymer coagulant and chlorine disinfectant were fed into the raw water stream at the common flocculators. But both of these chemicals could have damaged the anionic microfiltration membrane that was being installed. Throughout most of the start-up and testing period, plant staff simultaneously ran both the old and the new treatment processes by using non-threatening aluminum chlorhydrate in lieu of the cationic polymer coagulant, except during periods of high raw-water turbidity.

Because the Kamole Weir plant draws from a much larger watershed than all the other East Maui water treatment facilities, it is sometimes the only operating plant during periods of drought. Had El Niño resulted in a more severe drought, start-up and testing would have been an even greater challenge. "We were extremely lucky with El Niño," says Snowden. "All the upcountry plants continued to operate while we were making critical tie-ins at Kamole Weir. But then, things just seem to work out that way, since Maui is *no ka oi* [Maui is the best]."

The eight microfiltration membrane units at the Kamole Weir Water Treatment Facility, Maui.

Eight new ways to increase utility competitiveness

Monday, Oct. 4
7:30 a.m. – 9:30 a.m.

The Peabody
9801
International Drive
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Special workshop

Brown and Caldwell, in conjunction with The BTI Consulting Group, invites WEFTEC attendees to a two-hour workshop and discussion about new data on utility competitiveness. Our new study — conducted by global market research firm BTI and based on in-depth interviews with 118 utilities nationwide — clearly demonstrates how fundamental changes in decision-making can dramatically boost utility performance.

Unleash millions of dollars in savings by linking engineering, finance, and operations

This workshop is designed to be practical, relevant, and informative. Here's what you will learn:

- *How the wastewater industry can save $4 billion in unnecessary expenditures*
- *How other utility directors describe competitiveness and the actions they're taking*
- *Creating win-win relationships with boards and city councils*
- *Utility performance metrics in the year 2020*
- *High-gain activities that will improve your competitiveness . . . even when you think you've done everything you can!*

Who should attend

- *Utility directors*
- *CFOs*
- *Utility managers*

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