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BC TODAY

SERVICE:

Nutrients Strategies

Solving the Nutrients Puzzle

Everyone working on the nutrient puzzle has a common goal: to preserve healthy waterways and livable communities.

Nutrient Strategies Take Shape

Nutrients – primarily nitrogen and phosphorus – have puzzled regulators, wastewater agencies, and agricultural and environmental leaders alike for years. These essential ingredients for life cause problems when overabundant and can originate from almost every part of the landscape. To further complicate matters, different water bodies respond to nutrients in different ways. The appropriate type and level of nutrient control is a subject of investigation and controversy across the nation.

Moves toward more stringent nutrient regulations have forced some twists and turns in the search for solutions to the nutrients puzzle, bringing key pieces into focus. Among them: more clarity on the regulatory front, growing awareness of the economics of compliance, increased emphasis on regional connections, and greater understanding of how technology can help.

Setting the Right Goals

The U.S. Environmental Protection Agency has been pressing toward strict numeric limits, rather than narrative criteria, in water bodies, while environmentalists point to degraded water quality as cause for immediate action. But key questions about ways to solve the puzzle are still under debate: What is the right approach and who is responsible for reducing nutrient releases into the environment?

Industry groups such as the National Association of Clean Water Agencies and other concerned members of the regulated community argue that numeric limits make for an arbitrary, one-size-fits-all approach to a problem that varies significantly. They also point out that numeric criteria are not always grounded in scientific proof regarding cause and effect of nutrients on aquatic life.

"We need to make sure that nutrient goals for the rivers, reservoirs and estuaries are set right in the first place," says Clifton Bell, Brown and Caldwell's water quality/TMDL leader, whose work includes advising industry leaders and developing model-based approaches to derive site-specific water quality goals.

Like many in the industry, Bell advocates equitable approaches that address the many sources of nutrients within a watershed, while taking into account site-specific characteristics of receiving waters. The regulated community has expressed a preference for approaches that allow permit limts to be developed based on factors other than default in-stream concentration targets. For example, Florida's proposed approach includes the option to develop limits based on existing conditions in healthy water bodies, or on established watershed plans.

Controversy lingers over whether point-source dischargers, who have long taken the lead in water quality improvement, are held too accountable for nutrient reduction and at a cost that isn't justified by the incremental improvement in water quality. Recent litigation has challenged various aspects of nutrient regulations, including EPA's right to include non-point source discharges in TMDLs. Still, many states are taking action and beginning to respond with new regulatory initiatives targeted at nutrients.

continued on next page

Working Together Toward Solutions
Two more questions in the nutrient puzzle remain at the forefront: When must I comply and how much will it cost?

"One of the biggest issues in nutrients is funding of the capital projects that will be required for compliance," comments Sarah Reeves, BC regulatory specialist. "Our clients are being proactive, planning ahead, formulating strategies and pooling resources to understand and impact the evolving regulations."

As an example, Reeves was instrumental in forming the Colorado Monitoring Framework, a statewide coalition of industrial and municipal dischargers, stormwater utilities, agricultural interests and watershed groups. The group is focusing shared resources – time, money and experience – on implementation of nutrient regulations, including alternative options such as site-specific standards, variances or changes to proposed standards. Colorado has identified a total nitrogen value of 1.25 to 2.01 milligrams per liter for rivers and streams, a requirement some predict could cost billions and is not attainable with currently available technology.

Combining sound science with shared accountability is another promising approach to the puzzle. "Working together and bringing more interests to the table creates a definite advantage in preparing for the future," Reeves says. The hope is that if municipal, industrial, agricultural and environmental leaders can establish the right goals for nutrient removal, and agree to a common framework for monitoring and achieving those goals, regulators will listen.

Turning to Technology
Even as the regulatory landscape continues to develop, permit limits are coming into focus and the specter of expensive facility upgrades loom on the horizon. With the challenge of tight compliance schedules potentially ahead, some utilities are moving forward with ambitious plans to implement nutrient removal and recovery technologies.

"Both conventional and emerging treatment technologies exist for removing and recovering nutrients, and everyone is looking for ways to accomplish greater nutrient reduction with less capital investment, energy and chemicals," says Dr. Jose Jimenez, P.E., BC's research and innovation leader. "But there is no one right answer and risk has to be managed regardless."

Implementing new technology for something as sensitive as water quality compliance takes time, trial and (hopefully minimal) error to prove the effectiveness of new approaches. Agencies that invest in new solutions and move through the process from pilot to full-scale implementation are hailed as pioneers that advance water quality science and make compliance much easier for their colleagues in the future.

Others, lacking the time to explore new technologies, are turning to mature technologies and looking to align nutrient goals with other long-term infrastructure upgrades and community goals, minimizing the economic impact to ratepayers in the long run by delivering state-of-the-art facilities that meet multiple environmental and social needs.

The Right Moves
As the pieces are moved around until a solution comes together, everyone working on the nutrient puzzle has a common goal: to preserve healthy waterways and livable communities. And although the nutrient puzzle is complex and the answers are still evolving, the good news is pieces are starting to fall into place in the form of model solutions.

MODELS TO FOLLOW

LEADING AGENCIES STEP AHEAD AND FIND SOLUTIONS

Band Together

In many parts of the country, the regulated community is banding together to assess nutrient compliance challenges and advocate for science-based criteria, attainable limits, and flexible permitting strategies. BC's Regulatory Specialist Sarah Reeves and Water Quality/TMDL Leader Clifton Bell are helping organizations like the Colorado Monitoring Framework, the Virginia Association of Municipal Wastewater Agencies, and the National Association of Clean Water Agencies work with policymakers to adopt nutrient regulations that are technically sound, equitable and realistic. Asserts Clifton, "Before we engineer solutions, it's important that nutrient goals are set right in the first place."

SERVICE:

Watershed Protection

LOCATION:

Coosa River Basin
Northwest GA

Work Collaboratively

The proposed Coosa Basin Nutrient Trading Framework lets municipal organizations and agricultural interests work together to protect and restore water quality at lower costs than traditional approaches. For the Coosa River Basin, removing poultry litter from the watershed was found to be a more cost-effective way to reduce total phosphorus, compared to point-source phosphorus reduction at a wastewater facility. The program demonstrates that regional trading frameworks don't have to be complicated and could help NPDES permit holders save millions in meeting permit limits. Pictured left to right are Jerry W. Crawford (Calhoun Utilities), Laurie Hawks (BC) and Robert Shuler (Shuler Farms).

SERVICE:

Nutrient Removal

LOCATION:

Sacramento Regional
County Sanitation District
Sacramento, CA

Trust Proven Technology

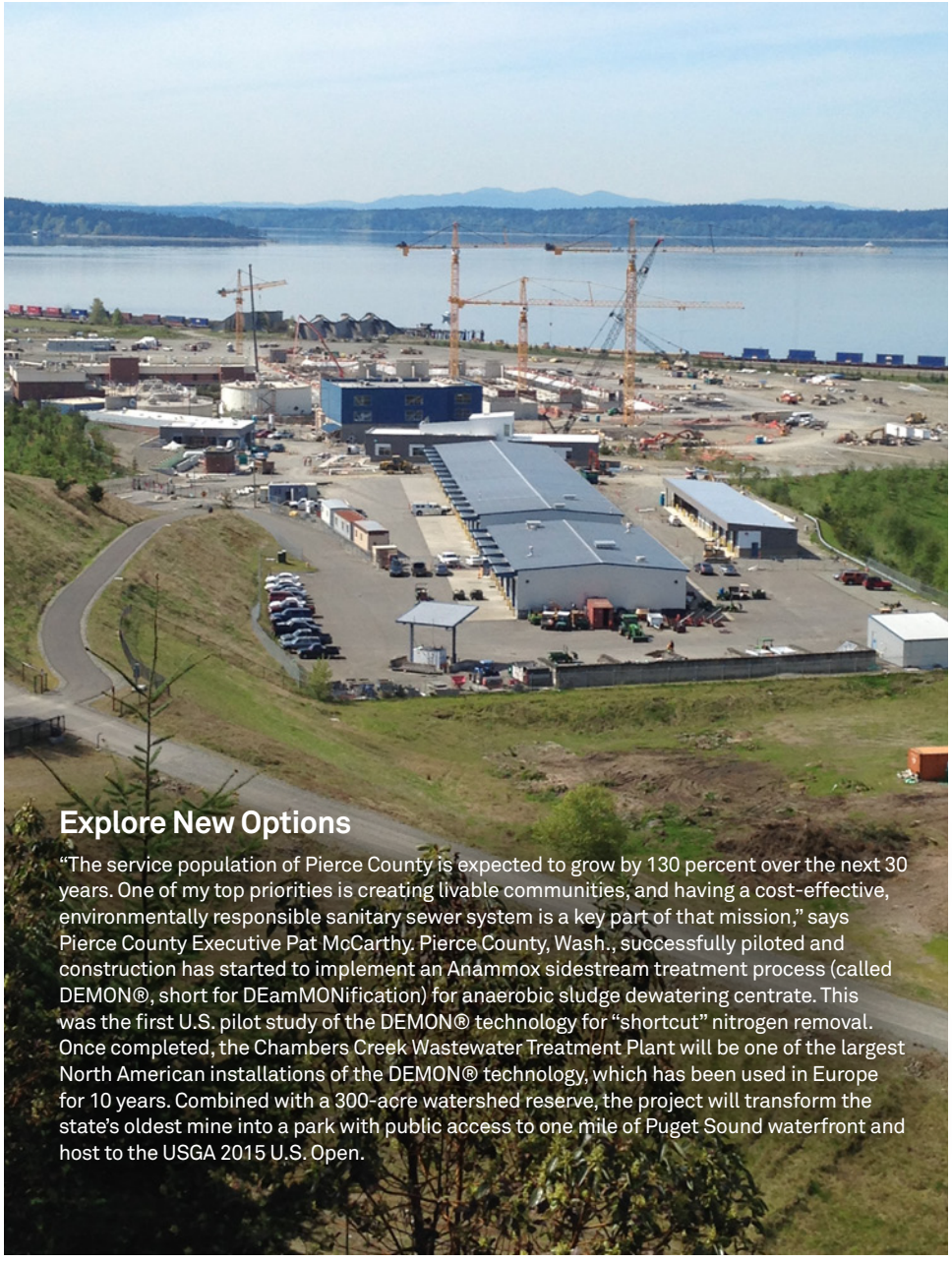
Faced with state mandates that it must construct and operate new treatment processes by 2021, the Sacramento Regional County Sanitation District launched a $2 billion upgrade, known as the EchoWater Project. Permit requirements include lower discharge limits for ammonia and nitrate and Title 22 or equivalent reclaimed water treatment standards, requiring filtration and enhanced disinfection processes. According to Kurt Ohlinger, EchoWater Project chief scientist (retired), the short timeframe to comply was a major driver. "This really limited the alternatives we could consider to proven, mature technologies because there was no time to explore and test emerging nutrient removal technologies, such as shortcut nitrogen removal," he says. "Mature technology at large plants, cost-effectiveness and adaptability to anticipated future treatment requirements drove the decision to select the air-activated sludge, biological nutrient removal (BNR) process."

SERVICE:

Emerging Technologies

LOCATION:

Chambers Creek
Wastewater Treatment Plant
Pierce County, WA



Explore New Options

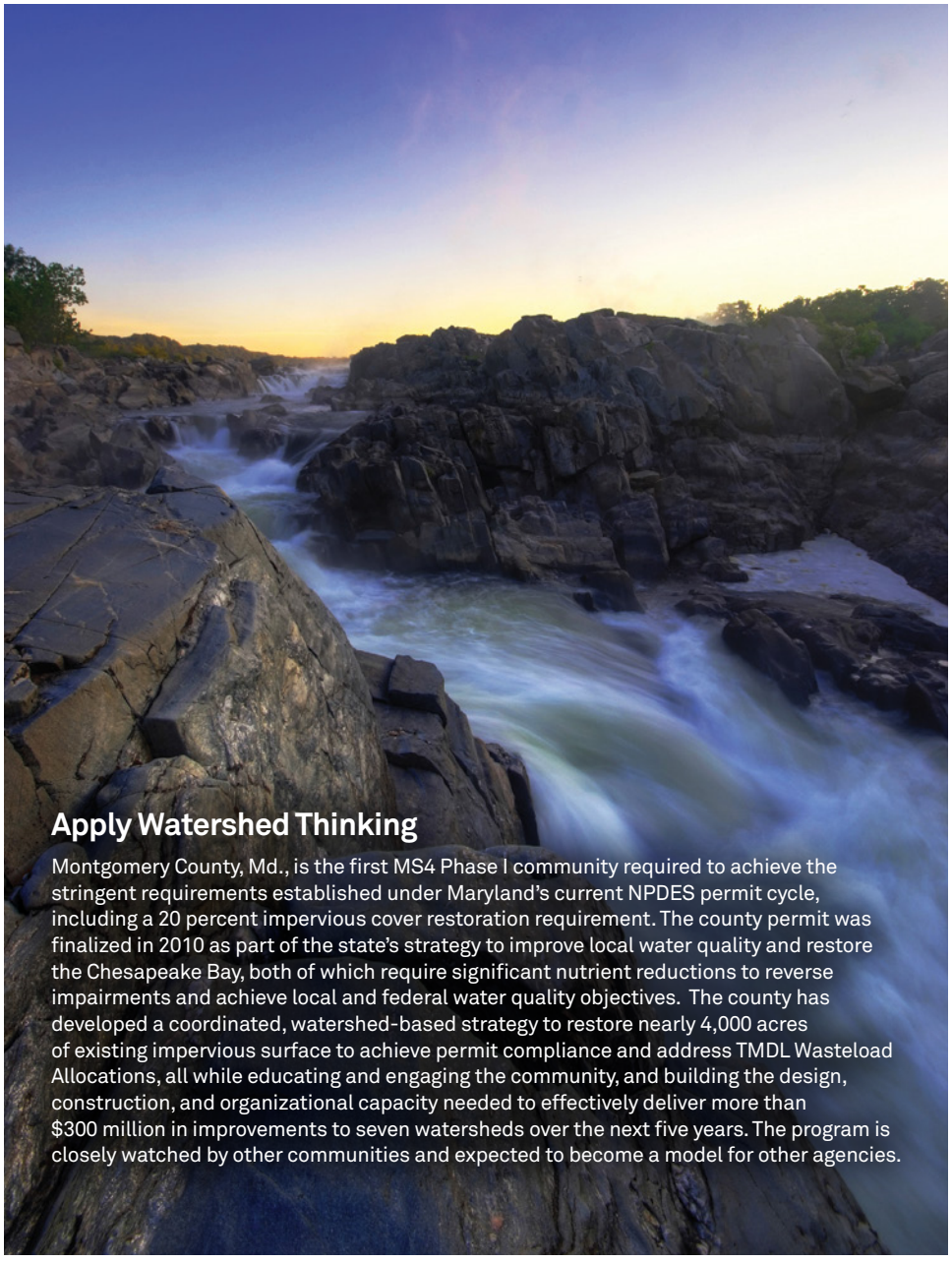
"The service population of Pierce County is expected to grow by 130 percent over the next 30 years. One of my top priorities is creating livable communities, and having a cost-effective, environmentally responsible sanitary sewer system is a key part of that mission," says Pierce County Executive Pat McCarthy. Pierce County, Wash., successfully piloted and construction has started to implement an Anammox sidestream treatment process (called DEMON®, short for DEamMONification) for anaerobic sludge dewatering centrate. This was the first U.S. pilot study of the DEMON® technology for "shortcut" nitrogen removal. Once completed, the Chambers Creek Wastewater Treatment Plant will be one of the largest North American installations of the DEMON® technology, which has been used in Europe for 10 years. Combined with a 300-acre watershed reserve, the project will transform the state's oldest mine into a park with public access to one mile of Puget Sound waterfront and host to the USGA 2015 U.S. Open.

SERVICE:

Program Management

LOCATION:

Chesapeake Bay
Montgomery County, MD



Apply Watershed Thinking

Montgomery County, Md., is the first MS4 Phase I community required to achieve the stringent requirements established under Maryland's current NPDES permit cycle, including a 20 percent impervious cover restoration requirement. The county permit was finalized in 2010 as part of the state's strategy to improve local water quality and restore the Chesapeake Bay, both of which require significant nutrient reductions to reverse impairments and achieve local and federal water quality objectives. The county has developed a coordinated, watershed-based strategy to restore nearly 4,000 acres of existing impervious surface to achieve permit compliance and address TMDL Wasteload Allocations, all while educating and engaging the community, and building the design, construction, and organizational capacity needed to effectively deliver more than $300 million in improvements to seven watersheds over the next five years. The program is closely watched by other communities and expected to become a model for other agencies.

The Technology Game Continues

As the pressure to reduce nutrients in wastewater ramps up, so does the game of balancing the attendant risk of technology with the benefits gained from new solutions for nutrient treatment.

Managing risk in nutrient reduction and removal treatment strategies demands forethought and planning. "The risk of noncompliance is never zero," says Dr. Denny Parker, P.E., Brown and Caldwell's director of technology. "So agencies need to know where the chosen technology is on the risk curve to determine the best way to proactively manage risk."

In his professional endeavors, Parker has studied barriers and enablers that speed technology introduction in the public sector, and he sings the praises of innovators and early-adopter agencies who, despite the risk, pave the way for innovative new technologies that later mature to become conventional solutions. Costs and risks tend to drop as technologies mature and become more accepted in the market, making the upfront investment of early adopters a benefit to the wider industry. Parker's S-curve of innovation and risk in wastewater treatment, first introduced at WEFTEC 2010 and highlighted at the WEFTEC Innovation Showcase in 2013, is helping agencies concerned with nutrients assess their risks and technology options.

"The good news when it comes to nutrients," says Dr. Jose Jimenez, P.E., BC's research and innovation leader, "is that promising new technologies are emerging as we also are finding ways to gain greater nutrient reduction from existing treatment technologies such as trickling filter/solids contact and biological nutrient removal." Beyond knowing the maturity of technologies under consideration, Parker and Jimenez recommend clients approach technology risk management with a few key things in mind.

Communication
Communicate proactively about risks and benefits, they say, and have meaningful discussions with decision-makers and stakeholders about risk, risk management, cost and benefits. Early adoption of innovative technologies can produce tangible benefits (cost savings, energy reduction, sustainability, environmental gains), and risk is present regardless, but can be managed.

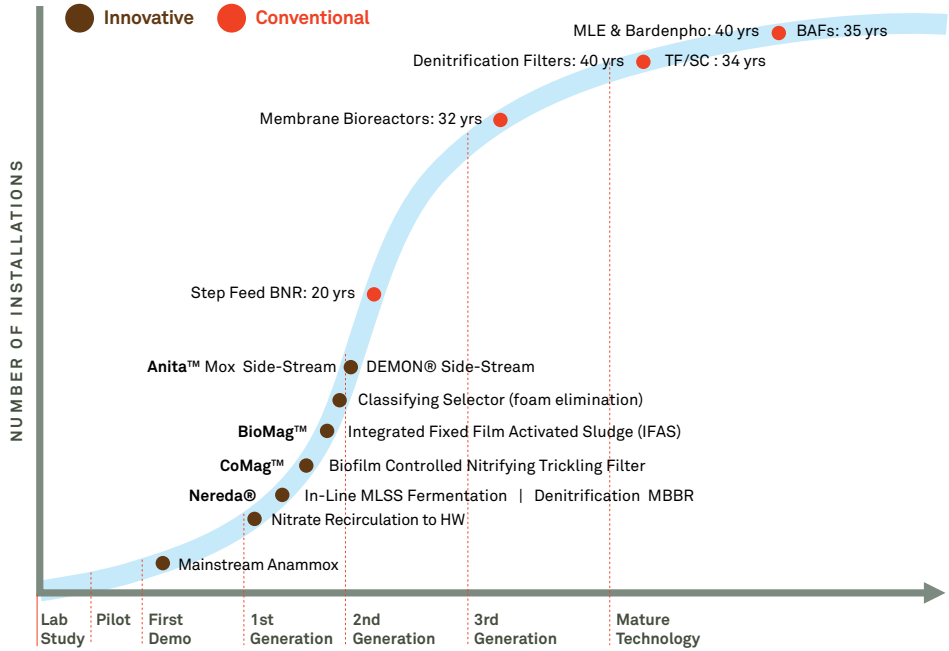
"As understanding of the potential for cost and energy savings goes up, so does the comfort level for innovative nutrient strategies," comments Parker.

Scientific Approach
Apply the scientific method and don't skip steps. Technologies are introduced through a progressive series of steps: basic research, pilot-scale research, and demonstration-scale research to achieve first-demonstration maturity, followed by successive generations of refinement to reach conventional acceptance. Considering operational needs and devising scalable demonstration testing are essential to successful implementation.

"In many circumstances, agencies can take advantage of research and work at other sites, or information available through organizations such as the Water Environment Research Foundation," says Jimenez.

Strategy
Plan risk management strategies to match the situation. "Each stage of development presents unique challenges," says Parker. "Basic science, experience to anticipate and resolve problems, and new models of delivery and risk-sharing become part of a winning game plan for successful technology implementations."

Where are Today's Technologies?



"Agencies can take advantage of research and work at other sites, or information available through organizations such as WERF."

Left: Dr. Denny Parker, P.E.
Right: Dr. Jose Jimenez, P.E.

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