NOVEMBER 2, 2010, 10:19 AM

Rising Seas and the Groundwater Equation

By FELICITY BARRINGER

Luis J. Jimenez for The New York Times A government employee in Mexico City filled barrels for families who do not have tap water piped into their homes. The city has faced water shortages as groundwater runs out from overpumping.

Worldwide overpumping of groundwater, particularly in northern India, Iran, Mexico, northeastern China and the American West, more than doubled from 1960 to 2000 and is responsible for about 25 percent of the rise in sea level, according to estimates in a new study by a team of Dutch researchers published in Geophysical Review Letters.

The general idea that groundwater used for irrigation is running off into ocean-bound rivers or evaporating into the clouds, only to end up raining into the ocean, has been around for two decades or so; it was a focus of a 2005 paper in The Journal of Hydrogeology. But Peter H. Gleick, a leading expert on water issues, said the new paper offers a fresh way of quantifying the phenomenon.

Mr. Gleick, president of the Oakland-based Pacific Institute, said that experts on groundwater issues "have known for a long time that that water ultimately ends up in the oceans and contributes to sea level rise. What we haven't known is the magnitude and severity of the problem."

This study, by a team of researchers based at the University of Utrecht and the International Groundwater Resources Assessment Center in Utrecht in the Netherlands, suggests that, in Dr. Gleick's words, "both the magnitude and the severity of the phenomenon are severe": it estimates that groundwater depletion worldwide went from 99.7 million acre-feet (29.5 cubic miles) in 1960 to 229.4 million acre-feet (55 cubic miles) in 2000.

That volume is almost as much as the combined annual flows of the Ohio and Susquehanna Rivers, as measured by the United States Geological Survey. Put another way, it is 15 times the amount of water used annually by all the users of the Colorado River in the United States, from the cities of Los Angeles, Phoenix and Las Vegas to the farms of the California and Arizona deserts, which produce most of this country's winter fruit and vegetables.

Barton H. Thompson Jr., a Stanford law professor who is co-director of the university's Woods Institute for the Environment, said the Dutch study could help broaden the lens

through which groundwater problems are examined.

"There has been growing recognition that it is not simply a local issue but at least a regional issue," he said. "If you are living in an area where maybe you're not depleting your groundwater but other people nearby are depleting theirs, eventually they are going to have to find other water. They may have to find it nearby, and that may be your water."

What the new study suggests, he added, "is that groundwater depletion is a global problem. Now we have to worry that it's also contributing to sea level rise. It changes the scale of the problem in a way that perhaps we haven't thought about before."

Both Dr. Gleick and Dr. Thompson emphasized the extent to which large agricultural regions in arid or semi-arid areas, from California's San Joaquin Valley to the Ogallala Aquifer under the Great Plains the Yuncheng Basin in northern China, have become dependent on groundwater to grow the crops that sustain both livestock and people.

This dependence may make it hard to change current practices that lead to depletion, Dr. Gleick suggests.

"I do think there's growing awareness of the seriousness of the groundwater overpumping problem, but I think it's going to take more than this wake-up call to change policy, because we're hugely dependent on this unsustainable source of water," he said, adding, "Forty percent of our groundwater withdrawals are coming from unsustainable sources of water."

"By definition, unsustainable means it can't continue forever. This water provides a lot of our food. And we're basically drawing down the bank account."

Groundwater's contribution to sea-level rise will probably diminish, he added, because as groundwater basins are depleted, there won't be as much water left to send through rain clouds to the oceans.

Because of an editing error, an earlier version of this post carried an incorrect measurement conversion; 99.7 million acre-feet is equal to 29.5 cubic miles, not 29.5 million; 229.4 million cubic feet is equal to 55 cubic miles, not 55 million.

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In Theaters Now

October 25, 2010

Slide in EPA Clean Water Criminal Enforcement Continues Under Obama

Criminal enforcement of federal water-pollution laws has continued a more than decadelong slide under the Obama administration, despite pledged improvements, according to U.S. EPA data.

The government reported 32 new Clean Water Act convictions during the fiscal year that ended in September, down from 42 in 2009. The number of criminal water pollution cases initiated by the agency fell from 28 last year to 21 this year.

Both figures have dropped nearly 60 percent since the late 1990s, their highest points in the past 20 years.

The numbers indicate that the Obama administration so far has been unable to reverse a trend that started under President George W. Bush, when EPA criminal enforcement activity dropped in conjunction with a 27 percent cut to U.S. EPA's overall budget, said William Andreen, an environmental law professor at the University of Alabama.

"There is plenty of work to be done in enforcement," said Andreen.

Even as general criminal enforcement activity has shown signs of improvement in the past two years, EPA data shows that Clean Water Act criminal enforcement has not shared in those gains.

The volume of cases and convictions on primarily Clean Water Act charges fell from 2009 to 2010, even though the numbers across all categories of environmental crimes rose. The portion

of that caseload that centered on Clean Water Act crimes fell to 18 percent, the lowest percentage in two decades.

EPA provided the data in response to *Greenwire*'s request for 20 years of end-of-year conviction counts in criminal cases with a lead charge of "33 USC 1319 -- Water Pollution -- Enforcement," a common reference to the enforcement section of the Clean Water Act. EPA officials noted that the data would not count cases that may involve water pollution in which the defendants were charged primarily under a different statute, or cases that were investigated by EPA and then handed off to a state environmental agency for eventual prosecution.

Under President Obama, EPA has pledged to toughen enforcement of the nation's water pollution laws by hiring more investigators, working to close legal loopholes and bringing more cases against polluters. Complicating that effort is a lack of progress in Congress to shore up the legal ambiguities that have increasingly dogged Clean Water Act enforcement.

The law explicitly protects all "navigable" waters, a vague term whose definition has spawned a glut of litigation and forced EPA to delay or drop hundreds of investigations, even as pollution rates of risen, officials have said. Repeated attempts to clarify the law by eliminating the word "navigable" have failed in past Congresses and once again appear stalled (*E&E Daily*, July 21).

Budgetary and personnel problems also have contributed to the slowdown in the agency's criminal enforcement. The total volume of EPA criminal enforcement activity in 2008 slowed to about half the level of the late '90s before beginning to rebound in 2009, according to data posted on EPA's website. The rebound corresponded to the 2008 start of a three-year hiring effort that raised the number of criminal investigators to 206 by the end of last month, a return to late '90s levels, according to an EPA official who spoke on the condition that he not be identified.

"There had been a decline in the number of criminal enforcement special agents," the official said. "It kind of peaked in the late '90s and early 2000s and then began to decline. Obviously, with fewer agents in the field, that does have an impact."

The agency's criminal enforcement office underwent a public shakeup last week. After a watchdog group leaked an internal memo concerning personnel changes, EPA announced that

two top officials in the criminal enforcement office were leaving in the wake of an internal review that cited "arrogant and harsh" disciplinary treatment and poor communication. The review's harsh findings pointed to an unwelcoming work environment that has alienated employees (*Greenwire*, Oct. 21).

EPA touted other, more positive measures of its criminal environmental enforcement efforts, boasting that the agency launched 387 investigations in fiscal year 2009, more than in any of the previous five years. The agency also said the total number of defendants charged with environmental crimes in fiscal year 2010 will be the highest since 2005.

"This Agency has committed to make the most efficient use of resources by targeting the biggest crimes and worst offenders -- and therefore reducing the risks from those offenders that pose the most significant threats to Americans' health," EPA said in a prepared statement.

Andreen noted that conviction statistics do not necessarily measure the effectiveness of criminal enforcement efforts. For example, a strategic decision to pursue tougher, higher-quality cases would likely cause the number to come in lower. EPA said it has worked to pursue higher-quality cases. As an example, the agency increasingly has deferred to other law enforcement agencies in investigating methamphetamine laboratories.

Andreen hesitated to draw conclusions about the effectiveness of the new administration or current EPA leadership, noting that any recent reforms, no matter how effective, may take more time to bear fruit.

"This may reflect both the number as well as the quality of some of the cases that were opened in prior years," Andreen said. "But it is ample reason to keep a close eye on EPA's efforts to rejuvenate criminal enforcement of the Clean Water Act."

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Water summit

Print Page

Leaders look at treated effluent as major source

By Patrick McNamara, The Explorer

Published:
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Explorer file photo, Oro Valley utilizes reclaimed water at golf courses such as the El Conquistador Country Club. The town has an agreement with the City of Tucson to deliver treated water, which is used primarily for turf irrigation and is stored in a reservoir along La Cañada.

Experts and elected officials from across southern Arizona met Friday, Oct. 29 at Oro Valley Town Hall to discuss the future of the area's most precious natural resource: Water.

While surface and groundwater remain in short supply, arid Southwestern states are flush in reclaimed water. It's a resource many at the conference agreed was largely untapped, with the potential to greatly reduce water usage.

"It is one of those resources that's a steady, dependable supply," said conference speaker Steve Olson of the Arizona Municipal Water Users Association.

Reclaimed water, also called effluent, has been treated and cleaned of bacteria and microorganisms. Effluent supplies grow as populations swell. In modern wastewater treatment facilities, effluent emerges almost indistinguishable from tap water.

In Pima County and other areas of the state, reclaimed water is used to irrigate golf courses, public parks, schools and roadway medians. More than 20 of the 39 golf courses in eastern Pima County use reclaimed water for irrigation, according to the Tucson Water Department.

Reclaimed water also could be used in other applications, including recharge.

Chris Avery of Tucson Water said effluent recharge could become a greater use for reclaimed water as more infrastructure is put into place.

Uses for effluent, such as restoration and creation of riparian habitats along washes and dry riverbeds, already occur throughout the county. The county's Roger Road Treatment Facility has been pouring tens of thousands of acre-feet per year into the Santa Cruz River.

Uses like this already contribute indirectly to groundwater recharge, but Avery said effluent would not be used for drinking water or "toilet to tap."

"At some point, we have to find where the additional water resource will come from," Avery said.

Reclaimed water and its uses featured heavily in the discussions about long-term strategies.

Another issue discussed was the use of gray water.

Val Little with the Water Conservation Alliance of Southern Arizona said the group has been advocating for gray water use for years. Unlike effluent, gray water is non-sewage waste residential customers produce through washing machines, showers and faucets. The water is redirected from sewer lines and used for irrigation purposes on the producer's property.

Some homebuilders in Southern Arizona have begun to install gray water harvesting fixtures on new homes. Homes also can be retrofitted to utilize gray water.

According to the Water CASA website, a household of four people can produce an average of 70 gallons of useable gray water each day.

Other discussions focused on groundwater replenishment, renewable water resources and the challenges the Central Arizona Water Project faces.

Arizona has a 2.8-milion acre feet annual allocation of Colorado River water. Fourteen pumps and three tunnels deliver the river water more than 300 miles across the desert and up more than 2,000 feet in elevation.

To pump all that water across the desert takes extraordinary amounts of energy.

"The Central Arizona Project happens to be the largest energy user in Arizona," said Warren Tenney of Metro Water and the

Central Arizona Water Users Association.

Much of that energy comes from the Navajo Power Generating station in Northern Arizona. Bur federal regulators have in recent years set their sights on the power plant, saying the facility produces too much emissions, causing haze.

Tenney said CAP officials are willing to invest some $48 million to make improvements to the plant. Environmental Protection Agency officials likely would require upgrades to clean the air around the power plant that could cost more than $1 billion, Tenney said.

"That could mean we would have to double or triple our water costs," he said.

Perhaps summing up the water situation for most communities across the West, Tenney said: "Any new source of water is going to be expensive — there's no more cheap water in the state."

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Sewage sludge in limbo after cadmium violations

By Wren Abbott 11.9.10
Nogales International

Behind the main facilities at the Nogales International Waste Water Treatment Plant in Rio Rico sits a heap of sewage sludge surrounded by yellow caution tape.

"About 80 metric tons a day we try to get, and of course the dark stuff right there is the fresh stuff we just put down today," an International Boundary and Water Commission (IBWC) employee, who asked that his name not be printed, told the Nogales International. "And it'll sit here until … I don't know. I have no idea."

The sludge pile, which had accumulated for about 60 days when the NI visited the plant in late October, looks and smells like fertilizer – which is what it is, although it's fertilizer made from human waste.

Until mid-August, a company called Synagro Residual Waste Management hauled the sludge, also called biosolids, to Dewitt Ranch in Rio Rico and spread it on pasture land. Now the sludge is in limbo after the Arizona Department of Environmental Quality (ADEQ) halted that practice over environmental concerns.

Beginning in September 2009, the plant started producing sludge with a concentration of the heavy metal cadmium that exceeds the ceiling set by ADEQ, the agency said. A few months earlier, in May 2009, the effluent (treated water) discharged from the plant began showing excessive cadmium levels. That was the same time the plant's upgrade was completed, which included installation of a belt press to remove water from the sludge.

In a compliance order ADEQ issued to the IBWC last month, the agency accused IBWC of failing to notify it that the sludge had exceedances, and admonished IBWC to keep the sludge on-site until a management plan is developed to remedy the problem.

The order states that IBWC is also responsible for notifying contractors handling the sludge, like Synagro, to ensure that high metal sludge isn't applied to a site.

But in September, ADEQ also issued Synagro a notice of violation, which is a warning the agency issues before taking a formal enforcement action, such as a compliance order. The notice alleges that Synagro applied sludge with excessive cadmium to the site, in addition to other related violations.

Who to blame

ADEQ Communications Director Mark Shaffer said that although it was IBWC's responsibility to conduct the tests, Synagro should not have applied the sludge to a site without getting the test results first. Shaffer also said IBWC gave Synagro results in February 2010 showing the cadmium levels in the sludge was almost twice what it should have been, but Synagro continued to apply the sludge anyway.

Management at Synagro, based in Tolleson, Ariz., didn't return calls for comment.

IBWC and Synagro independently reported the cadmium exceedances to ADEQ within a few weeks of each other in August, ADEQ said. By that time, the questionable sludge had been applied to Dewitt's ranchlands for over seven months.

"(Synagro) claims it did not know that the biosolids exceeded the cadmium ceiling concentrations because it did not receive timely certifications from IBWC," Shaffer wrote in an email.

Shaffer said there was also some confusion in interpreting the data because IBWC switched laboratories during the summer.

Rio Rico Rancher: Bring it back

Milo Dewitt, who grazes 300 head of beef cattle and bucking broncos on his 700 acres of pasture, told the NI that he doesn't know a lot about the possible effects of high-cadmium sludge on his land or his livestock. But what he does know is that over the past year, his land yielded more grass and alfalfa than it had in each of the previous nine years that he owned it.

In fact, Dewitt said, it doubled or tripled in production. His profits went up and his livestock stayed healthy.

"I hope they hurry up and come back," Dewitt said. "From my standpoint it's been good. I haven't seen something negative yet."

Before the plant upgrade in 2009, when the plant didn't have the capacity to produce dewatered sludge, a previous contractor injected the product under the surface of the land on Dewitt's ranch. Dewitt said it caused his land to ripple.

"So it was like ocean waved it, rippled it," Dewitt said. "Ruined my fields, in other words. So I charged them to re-level them. I think they put too much in … but this new deal came along, and like I said, it's been nothing but good for me."

Despite Dewitt's good results, Friends of the Santa Cruz River president Sherry Sass said she was concerned to hear that the waste exceeding the limits set by ADEQ had actually been applied to the land.

"If we've got high levels of cadmium in the soil it could potentially be washed into the river," Sass said. "I wouldn't worry so much about the ground water as the surface water impact. Still it's disturbing that that kind of activity has taken place in violation of the standards that are protective."

According to ADEQ, cadmium is carcinogenic and continued exposure to it can also cause kidney, lung and bone problems.

"Cadmium is one of the most toxic metals that we deal with - as a result its (allowed) levels are quite low," said Allen Davis, a professor of civil and environmental engineering at the University of Maryland. "It's highly toxic. If you send cadmium and most metals to waste water treatment plants it'll tend to end up in the sludge, and sludge isn't supposed to have heavy metals in it."

Davis said it's rare for a municipal wastewater treatment plant to be able to filter out heavy metals. In the United States, there are stringent limits for what manufacturers can discharge into wastewater, he said, so it's not necessary for the plants themselves to filter it out.

The technology that manufacturers who produce heavy metals as a byproduct use to pre-treat their discharge has existed for years. The pH of the discharge is simply adjusted by adding a base, making the metals insoluble in water. When the metals precipitate out as solids in the water, they can be filtered

out, Davis said.

International aspect

The treatment plant is fed by sewer systems on both sides of the U.S.-Mexico border, with an estimated 80 percent of the waste coming from Mexico. And while it's managed by the City of Nogales, the IBWC is the only agency that can address the international aspect of the problem and ensure that discharge from the offending manufacturer or manufacturers upstream in Mexico is pre-treated before entering the plant.

IBWC spokeswoman Sally Spener said Monday that test results from September and October showed acceptable cadmium levels in the effluent, suggesting that the sludge would also show reduced cadmium levels. Spener said the source in Mexico had been "identified and addressed," but didn't have any further information about the source.

Spener said IBWC instituted new policies to avoid submitting late reports to ADEQ in future.

"We have new contract requirements for the lab with a quicker turnaround time, and we also automated some of the processes that we need to undertake to analyze some of the data that we receive from the lab," Spener said. "We are working with ADEQ to address these issues and we're committed to full compliance."

Results pending

Within about 30 days, IBWC should have test results back indicating whether the sludge is safe for land application, Spener said. At that point IBWC and ADEQ will decide whether to continue to apply it to land or dispose of it some other way.

"You know, they've got to cover their butt just like a doctor or anybody else," said Dewitt, who hasn't put any fertilizer on his land since the ADEQ embargo and is waiting for the sludge to come back.

"So I hope they do their tests and get lined out again and put it on."

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Drought-stricken Lake Mead falls to a level not seen since 1937

By HENRY BREAN
LAS VEGAS REVIEW-JOURNAL

Oddly, the drought's latest milestone arrived on a rainy day.

Just before noon Sunday, as thunderstorms closed in on the area, the surface of Lake Mead slipped three one-hundredths of an inch to a new low not seen for a lifetime.

The reservoir on the Colorado River hasn't been down this far since 1937, when it was being filled for the first time behind the newly completed Hoover Dam.

Since drought took hold on the Colorado and its tributaries in 1999, the surface of Lake Mead has plunged almost 130 feet and caused fits for the National Park Service and its marina operators who must extend roads, utilities and other services to reach the shrinking shoreline.

The lake's decline poses major problems for the Southern Nevada Water Authority, which draws 90 percent of the Las Vegas Valley's drinking water from intake pipes that will start to shut down should the lake fall another 33 feet.

"I'm worried," authority General Manager Pat Mulroy said. "We're trying everything we can to keep as much water in Mead as we can."

The prognosis looks bleak. Mulroy said federal climate forecasters are predicting abnormally dry conditions during the next two winters in the mountains that feed the Colorado.

If the lake drops another 8 feet, federal officials will declare a shortage on the river, an unprecedented move that would cut Nevada's river share by about 6 percent.

The best Colorado River users can hope for at this point, Mulroy said, is to push that shortage declaration off for a year or two "and then hope the hydrology turns around."

The previous low-water mark for Mead came 54 years ago, on April 26, 1956, when the drought-stricken lake bottomed out at 1,083.19 feet above sea level.

According to the Bureau of Reclamation, the lake hit elevation 1,083.18 between 11 a.m. and noon Sunday and continued to fall. By Monday afternoon, it sank below elevation 1,083 as water was released through Hoover Dam to meet orders downstream from cities and farms in California and Arizona.

Projections by the U.S. Bureau of Reclamation call for Lake Mead to reach a low point of 1,082.1 on Nov. 2. Then it is expected to rise by about 8 feet through the end of February before starting back down again.

Water forecasters expect the lake to hit another record low by May and shrink below elevation 1,077 by September.

Two things will happen at elevation 1,075: The federal government will declare the first-ever shortage on the river, and the Southern Nevada Water Authority board will vote on whether to build a controversial pipeline to tap groundwater across eastern Nevada.

Mulroy said the multibillion-dollar pipeline project would serve as a backup supply for the community, separate from the Colorado River.

The vote on whether to build it will come down to a simple choice, she said: "How much risk do you want to put yourselves in? What's your carrying capacity for risk?"

As for its intake pipes at Lake Mead, the authority is rushing to complete a third straw, at a cost of about $700 million, that will draw water from deeper in the reservoir.

A construction mishap in July delayed the project, but Mulroy said the community will have enough water to last it until the third intake goes online in time for peak summer demand in 2014.

The shrinking reservoir has left boat ramps high and dry and pushed marinas into deeper water.

A decade ago, Lake Mead was home to nine boat launch ramps and six marinas. Five ramps and four marinas remain open today.

"For us, it's business as usual. We've been dealing with low water for 10 years," said Andrew Muñoz, spokesman for Lake Mead National Recreation Area.

The big concern is paying for the work, which has totaled about $36 million since 2000.

Muñoz said the park service funded some of the low-water improvements with proceeds from the sale of federal land in the Las Vegas Valley, but that pot has all but dried up.

Chasing the water also proves costly for marina operators.

Gail Gripentog-Kaiser is manager and part-owner of Las Vegas Boat Harbor. Her family got into the marina business at Lake Mead in 1957, back when the water was "on its way back up" from its previous record low, she said.

Moving a marina into deeper water involves relocating as many as 250 concrete anchors, each weighing more than a ton. Then there is the extension of utility lines that carry water, fuel and electricity downhill and sewage back up. "That's a big expense," Gripentog-Kaiser said.

Callville Bay Resort and Marina was preparing for its next move when an Oct. 4 flash flood caused more than $1 million in damage to the operation.

Boaters still can't refuel at the marina, but all other services have been restored. The facility's private operators are moving the marina another 150 feet out from shore to stay ahead of the falling water level.

"It's the marina business, and I've been in it a long time," said Callville Bay General Manager Kim Roundtree, who has worked at Lake Mead since 1981. "You go with the flow."

Even at its lowest level since it was first filled, Lake Mead remains the largest man-made reservoir in the United States.

The falling water level has caused some problems with access, but it has also unveiled new coves and pristine beaches that used to be underwater, Roundtree said.

"It's a new adventure," Gripentog-Kaiser said of the changing lake. "There's still plenty of space to go re-create for everybody. Once you're out on the water, it's fantastic."

Contact reporter Henry Brean at hbrean@reviewjournal.com or 702-383-0350.

Find this article at:
http://www.lvrj.com/news/drought-stricken-lake-mead-falls-to-a-level-not-seen-since-1937-105232353.html

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OCTOBER 18, 2010

High-Tech Cures for Water Shortages

Software that can spot leaks, improved recycling—and other innovations to keep things flowing

By MICHAEL TOTTY

Can technology solve the world's water woes?

Growing populations are straining supplies in parched areas of the U.S. Southwest, the Middle East and Australia, forcing governments to come up with costly solutions or face the risk of shortages. Other regions have plenty of water but lose billions of gallons a day because of an aging infrastructure prone to leaks and catastrophic failure.

Enter technology.

While there's no single miracle cure for water shortages, a host of innovative technologies already are making headway, or promise to do so in the near future. Sophisticated software can quickly spot leaky pipes, for instance, while new filters can more efficiently draw fresh water from the sea or clean wastewater, using everything from microscopic tubes to proteins found in living cells.

Here's a look at some of the ideas that are being adopted or are on the horizon.

Plugging Leaks

Cities in the developed world have been delivering clean, safe water for more than a century. And that's the problem: The infrastructure is old—in many cases, past the end of its useful life. A 2009 report found that U.S. water systems lose seven billion gallons of treated drinking water every day, enough to meet the average daily needs of 20 million households.

Instituform Technologies Inc.

A crew installing a liner to fix leaky pipes.

Stopping these leaks first means finding them. Utilities have monitoring systems, but the data must be downloaded from sensors that listen for leaks in the field and then analyzed. One way to simplify the job: sensors and software that analyze acoustic signals to more accurately locate leaks. These sensors don't monitor the pipes constantly, but they let utilities conduct regular surveys to look for problems.

One company, Echologics Engineering Inc., based in Toronto, uses sensors that are placed on water hydrants or other above-ground fixtures and can determine within a few inches the location of a leak between the sensors; they can also recognize leaks that occur outside the length of pipe being tested.

Another solution, software from Israel-based TaKaDu, analyzes data from a utility's existing industrial-control systems, using sophisticated algorithms and statistical models to spot anomalies. Although the software can't pinpoint the location of a leak, it can narrow it down to a few blocks.

To reduce time-consuming and disruptive repairs, new technologies make it possible to fix pipes with a minimum of digging. One uses a flexible liner to fill a section of pipe; steam or hot water is then pumped into the liner, causing it to harden and seal any leaks. Insituform Technologies Inc. of St. Louis has a felt-and-fiberglass liner that can withstand the high pressures inside water pipes.

Recycling and Reuse

For most people in the developed world, there's one grade of water that's good for drinking, cooking, watering the lawn and flushing the toilet. That's expensive, wasteful—and unnecessary.

O2 Environmental Inc.

Ultraviolet light treating water headed for reuse.

One answer: Use recycling to expand the supply of water. Rather than dumping treated wastewater into rivers or the ocean, it can be cleaned further for irrigation, industrial or other nonpotable uses, or to be returned to aquifers.

A 250-unit apartment building in New York uses a technology known as a membrane bioreactor, or MBR, from General Electric Co. to process and recycle its wastewater. An MBR combines an ultrafiltration membrane with a system where micro-organisms break down waste. The building recycles the treated wastewater (which is further disinfected with ultraviolet light) to flush toilets, irrigate landscaping and fill the cooling towers for its air-conditioning system. This reduces the building's freshwater draw from the city by more than 75%.

Most of these methods rely on established treatment techniques. But a growing concern over a host of other trace chemicals in wastewater has spurred interest in new technologies. Advanced oxidation, a technique used in industrial water recycling that breaks down trace chemicals using a compound of hydrogen and oxygen, is getting increased attention for municipal reuse. APTwater Inc., a start-up in Pleasant Hill, Calif., is bidding to provide the technology to the city of Anaheim for a demonstration project that would use recycled water for toilet flushing and landscape irrigation in the City Hall complex.

Tapping the Sea

In many places, getting more use out of existing supplies isn't enough—more water is needed to meet the needs of a growing population. In those cases, desalination looks attractive.

NanoH2O Inc.

New, more efficient membranes being tested in desalination cells.

After all, 97% of the world's water is found in oceans but is undrinkable because of its high salt content. Increasingly, communities are turning to desalination to tap that resource.

Most older plants use distillation to separate salt from water. But the process—which basically requires boiling huge volumes of water—carries a high price tag and uses lots of energy. The most common alternative, reverse osmosis, is cheaper, but it's still pricey and energy-intensive. So, researchers are looking to improve the process.

Reverse osmosis uses extremely high pressure to force water through a semipermeable membrane and separate out salts. One technique, developed by NanoH2O Inc., of El Segundo, Calif., adds a thin layer of nanoparticles to a polymer-based membrane. The nanomaterials attract water and reject salts and other particles that can clog other membranes, reducing the energy needed to push water through the membrane.

Another nanotechnology, carbon nanotubes, can be used to make membranes that separate salt and other contaminants. Though the membranes are still in a very early stage of development, developers say they could cut the cost of reverse-osmosis desalination by 25%. Meanwhile, a pair of Danish companies, Aquaporin A/S and AquaZ A/S, are working to develop commercial membranes using aquaporins—proteins that move water in living cells and along the way efficiently separate H2O from other molecules.

Finally, there's an option that turns reverse osmosis on its head: It uses natural "forward," or direct, osmosis to draw fresh water from seawater. Using a membrane, seawater is separated from a liquid with even higher saline concentrations; natural osmotic pressure pulls H2O from the seawater into a solution of ammonia salts, which can be evaporated at a relatively low temperature. Oasys Water Inc. in Cambridge, Mass., expects to have a pilot-scale plant to test the technology by early 2011.

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