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Small FLOWS

Arcata, California . . . The Rest of the Story

by Deborah Carol
NSFC Contributing Writer

Many people have heard or read about Arcata, California, the small town that for the past 13 years has used a constructed wetlands system to treat their wastewater. But, do you know how it happened that the town came up with and was able to implement the idea of using constructed wetlands to treat wastewater almost 15 years ago? If not, read on for . . . the rest of the story.

The motto is "Flush With Pride," illustrated by a snowy egret straddling a toilet seat and fishing a leaping salmon from the basin. The subject is a "low-tech" constructed wetland treatment facility sitting on beautiful Humboldt Bay in northern California, treating municipal wastewater to levels mandated by California's State Water Quality Control Board (SWQCB) before discharging into that very bay.

Hauser Marsh at the Arcata Marsh and Wildlife Sanctuary, Arcata, California. The headworks are in the background. (Photo by Deborah Carol.)

Expanded and updated from the original 1950s sewage lagoons, the Arcata Marsh and Wildlife Sanctuary (AMWS), dedicated in 1986, serves the community of Arcata, a college town of approximately 15,000, and stands as one of the country's first marsh-ecology sewage treatment systems.

Yet, the road to this achievement involved Arcata in a nearly 15-year-long odyssey, rife with struggles between neighboring communities, bitter political battles, and citizen lawsuits before eventually arriving at this innovative and progressive treatment plant. The AMWS of today is seen as a blend of the conventional and bold for municipal treatment, and by all accounts is "as perfect as you can get," as described by William Rodriguez, director of the SWQCB.

But in 1977, when Arcata first proposed a biological tertiary treatment facility with discharge into the bay, initial responses from the North Coast Regional and State WQCB to Arcata's plan was, "Humboldt Bay does not need anything your waste plant can discharge . . . including distilled water."

How It Started

The picture was a very different one over twenty-five years ago. By 1972, the very real need to clean up Humboldt Bay was apparent, and the battles of what would become known as the "Wastewater Wars" were intensifying. As California's largest estuary system between San Francisco to the south and the Columbia River farther north, Humboldt Bay is home to two-thirds of the state's commercial Pacific oyster harvesting. Throughout the 1960s and into the 1970s, elevated levels of coliform and other signs of significant degradation plagued the bay and resulted in the frequent closure of these oyster beds.

Humboldt Bay's surrounding communities—Eureka, McKinleyville, Manila, Fieldbrook and as many as 10 other municipalities—either depended on failing septic systems that often seeped into creeks, or had antiquated sewage systems. Arcata had a treatment plant utilizing oxidation ponds, which

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NC State Produces Landmark Research on Septic Tank Additives

by M. Caigan McKenzie
NSFC Staff Writer

North Carolina State University has produced landmark research in the form of a master's thesis titled "The Effect of Bacterial Additives on Septic Tank Performance." Gregory H. Clark, currently a consultant at Soil and Environmental Consultant Inc., in Raleigh, North Carolina, wrote the thesis last year while he was a graduate student in North Carolina State University's Soil Science Department.

The research was done under the direction of Professor Michael T. Hoover, Ph.D., of the Soil Science Department, with the oversight of professors Marcia Gumpertz (Statistics Department), Arthur Wollum (Soil Science Department), and Phillip Westerman (Biological and Agricultural Engineering Department), with assistance from Chester Cobb, former agricultural research technician.

Bacterial Additives Defined

For his study, Clark defined bacterial additives as additives that may contain bacterial or enzymatic components, or both.

Overall Goal and Parameters

Clark's primary goal was to quantify the impact of bacterial additives upon septic tank performance through measurements of sludge depth, scum thickness, total suspended solids (TSS), five-day biochemical oxygen demand (BOD_5), and microbial levels within treated and untreated tanks.

To achieve his primary goal, Clark
- monitored and evaluated the effect of bacterial additives on the rate of sludge and scum accumulation in septic tanks,
- assessed the effects of bacterial additives on TSS and BOD_5 contents of septic tank effluent, and
- evaluated whether bacterial additives increase microbial levels in treated septic tanks versus untreated septic tanks.

Methods, Materials, and Design

Clark chose mobile home parks in which to conduct the study so that researchers could access numerous septic systems located in close proximity, reducing travel costs and sampling time and enabling researchers to replicate tests.

Clark's study spanned one year (January 1997 to December 1997) and targeted 48 septic tanks serving homes in two mobile home parks in North Carolina's Chatham and Orange counties. These 48 septic tanks were chosen from a pool of 80 septic tanks because they were easily accessible, fell within the maintenance range being studied (well-maintained, poorly maintained, or maintained at an intermediate level), and were free of major maintenance problems.

The well-maintained septic tanks had been pumped just two to three years before the study began. The poorly maintained septic tanks had rarely if ever been pumped out during their 15 to 20 years of operation. Septic tanks identified as having had an intermediate level of maintenance fell within these two ranges.

Twelve of the 48 septic tanks had inlet risers added so that the sludge depth and scum thickness could be measured. Of the remaining 36 septic tanks, 16 had existing risers over the inlet end of the septic tanks and 20 tanks had risers over both the inlet and outlet ends of the septic tanks. All of the tanks were two-compartment septic tanks.

The 48 septic tanks were grouped into 12 blocks of four tanks based on each tank's existing level of maintenance and initial readings prior to adding the additive.

Initial readings included sludge depth and scum thickness for all 48 tanks and TSS and BOD_5 contents for 20 of the 48 tanks. These initial readings were later used to

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statistically evaluate the effects of additives after the first two sampling periods.

After the tanks were grouped, the three additives and control were randomly assigned within each block. To preserve the integrity of the study, Clark used a single-blind study design. This meant the primary researcher collected and analyzed data without knowing which treatments or controls each tank had received until it was necessary to compare the collected data from the treated tanks to the collected data from the control tanks. In addition, no research funding for the project was either solicited from or accepted by additive manufacturers or distributors.

Treatments for the study consisted of three liquid bacterial septic tank additives and a control (no additive). The additives were purchased from a local retail store in the same manner as a consumer would purchase them. Additionally, subsamples from additive bottles were evaluated during each four-week sampling period to ensure that they contained a viable population of microorganisms.

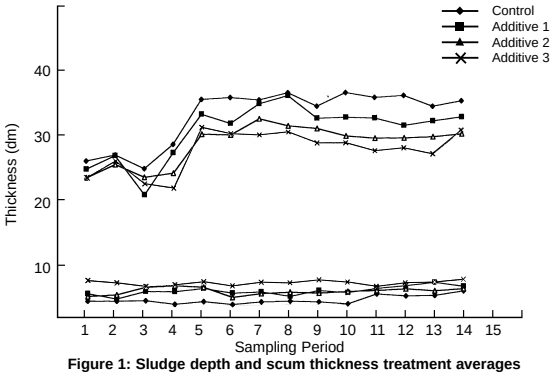

Figure 1: Sludge depth and scum thickness treatment averages

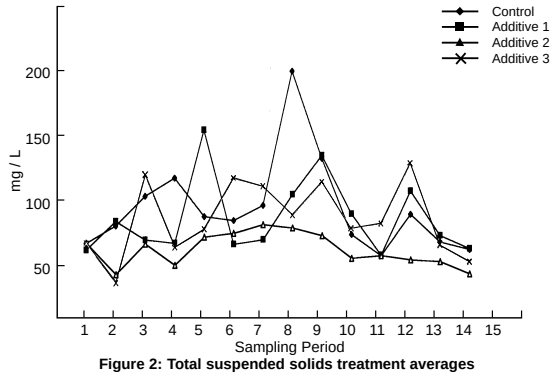

Figure 2: Total suspended solids treatment averages

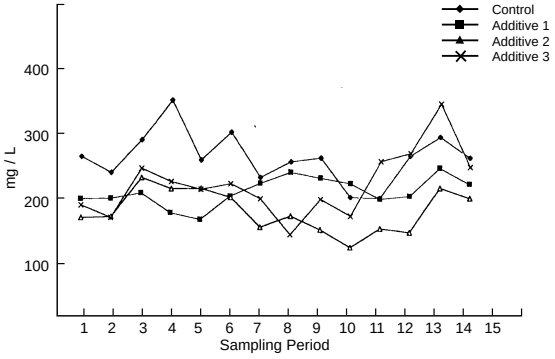

Figure 3: Five-day biochemical oxygen demand treatment averages

Monitoring the Septic Tanks

Sludge Depth: Sludge depth was monitored in all 48 tanks once every four weeks. Sludge depth was measured in three locations on the inlet side of the septic tank: in each of the two corners of the inlet opening that were farthest from the inlet pipe, and at the center of the inlet opening beneath the inlet pipe discharge. The two-compartment septic tanks that were used in this study have a sanitary tee at the outlet but not at the inlet where the home's pipeline enters the tank.

Sludge depth measurements were used to determine if bacterial additives reduced the thickness of the sludge layer in the septic tanks or the rate of sludge accumulation, which in turn would reduce the frequency with which septic tanks needed to be pumped.

Scum Thickness: Scum thickness was monitored in all 48 tanks once every four weeks using a scum judge. Scum thickness was measured in as many locations throughout the inlet opening as needed to find a range of scum thickness. These readings were then used to determine an average scum thickness.

BOD_5 Content: This measurement was done once every four weeks on grab samples collected from the outlet sanitary tee on a subset of 20 tanks. The grab samples were collected using a weighted sampling head and a hand-held vacuum pump. The subset of tanks included tanks from each of the three treatment groups and from the control group.

TSS Content: This measurement was done once every four weeks on the same tanks that were used to measure the BOD_5 content. (Clesceri's 17th edition of *Standard Methods for the Examination of Water and Wastewater*, published by the American Public Health Association in Washington D.C., was used to analyze the BOD_5 and TSS samples.) The purpose of the TSS measurement was to determine if the additive treatments affected the solids exiting the tank.

Organism Count: Beginning with the 12th week of the study, researchers did a total organism count on all 48 tanks every 12 weeks. The sample for the total organism count was taken from the supernatant that was collected for the center sludge measurement. A subsample was then collected from the supernatant, diluted, and plated onto Tryptic Soy Agar using a Spiral Plater. (See Wollum II, A.G., 1982. *Cultural Methods for Soil Microorganisms. Methods of Soil Analysis, Part 2, Chemical and Microbiological Properties.* Second Edition, Chapter 37, American Society of Agronomy, Inc. and Soil Science Society of America, Inc.)

A countable population of colony-forming units usually appeared within two to three days. Two counts were made of each plate after growth appeared.

When Clark used treatment averages to compare the control and treatments, he found no general pattern and no effect due to use of the additives.

Conclusions

Clark concluded the following from his research:

- Dunnett's test analysis (x = 0.05) indicated no difference in sludge depth related to treatment between the three additives and the control. The additives tested did not reduce the thickness of sludge depth in the septic tanks nor reduce the rate of sludge accumulation when compared to the control. Clark concluded that the observed differences in sludge depth were related to the initial sludge depth that was present at the beginning of the study. (See Figure 1.) For example, at the beginning of the study, before adding any treatments to the tank, the control had the highest average sludge depth and maintained the highest average sludge depth through out the study.

- Initial scum thickness appeared to be the main factor that controlled the scum thickness. Clark found that the scum thickness initially present before use of the additives was the primary factor controlling scum thickness once the additives were applied to the tanks. (See Figure 1.) He also found that some of the additives reduced the scum levels across all levels of maintenance. Clark, however, points out that his analysis is inconclusive; it does appear that two of the three

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profile

Maine Wastewater Treatment Plant Designated Nation's Most Improved

by Natalie Eddy
NSFC Staff Writer

Operators at the Mars Hill Wastewater Treatment Plant in Maine used to call themselves "the silent service." Silent because they felt the public didn't know they existed with the high quality of service they provided.

But a recent national award to the plant by the U.S. Environmental Protection Agency (EPA) speaks volumes about its operation and maintenance, and word about the tiny New England wastewater plant isn't mum anymore.

Mars Hill, located along the Canadian border in Northeastern Maine, was flushed out of the crowd when it was named "Most Improved Plant" in the 13th Annual U.S. EPA National Wastewater Management Excellence Awards.

Jeff Saucier, superintendent of the plant, commented, "Everybody knows about us now, and most everybody around here is very proud of us. They're proud that this facility has put Mars Hill on the national map.

"People should take their wastewater treatment service for granted. That means we're doing a good job."

How the Awards Work

Since 1986, the EPA has presented the awards through its annual National Operations and Maintenance (O&M) Excellence Awards Program, which recognizes outstanding O&M practices at publicly owned wastewater treatment facilities.

Jeff Saucier (left), superintendent of the Mars Hill, Maine, wastewater treatment plant, and John Peavey, operator, ride on a pontoon boat to inspect and clean the aerators in the lagoon system after five years of operation. (Photo courtesy of Jeff Saucer.)

Awards are presented in nine O&M categories to honor plant personnel and local officials for their commitment to clean water.

Traditionally, the Assistant Administrator for Water presents a plaque to first and second place award winners at the Water Environment Federation's Technical Conference (WEFTEC), held last year in Orlando, Florida. First place winners also receive a plant flag.

Maria Campbell, coordinator for the awards program, said the state, EPA regions, the Water Environment Federation, or other environmental organizations nominate award winners.

The nominees undergo extensive review and compliance screenings. A panel of judges reviews the applications and selects the best of the best wastewater treatment plants as national winners.

Secret to Their Success

Saucier attributes the secret of Mars Hill's success, for the most part, to being proactive rather than reactive. "Good maintenance is our chief asset. If you have a well–maintained facility, you're less likely to have problems later and better equipped to solve problems as they arise," he said.

The plant was constructed in 1963, originally consisting of traditional gravity sewer lines feeding into a clarifier with an anaerobic digester for sludge.

In 1993, it was upgraded from primary to secondary treatment, the result of an administrative order from the EPA. Today, the plant consists of a gravity collection system with three aerated lagoons for treatment and a storage lagoon to accommodate flows when discharge is prohibited because of weather.

Saucier commented, "Before the change, the plant was discharging into a small stream and really needed to be upgraded."

DEP Involvement

During the planning and construction of the Mars Hill facility, problems regarding the plant involved inflow and infiltration, low stream flows, combined sewer overflow issues, and treatment level flows.

Saucier credits the EPA's Wastewater Treatment Plant Operator On-Site Technical Assistance and Training Program–104(g)(1) and Maine Department of Environmental Protection (DEP) 104(g)(1) Program trainers Nick Archer and Don Albert with providing a lot of guidance and assistance in getting the plant into shape. The Maine

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additives might have reduced scum thickness over time for a limited number of tanks at the low-maintenance site.

- The situation concerning the high scum thickness and low sludge depths and vice versa seems to indicate that use of inlet tees in septic tanks may need to be added to the On-Site Sewage Rules in North Carolina. This will control situations where significant scum accumulations capture incoming solids and prevent them from settling to the bottom of the tank in septic tanks that receive less than ideal maintenance.

- No treatment effect was noticed for TSS. The high variability observed within tanks over the course of the project made it difficult to draw any conclusions about the additive's effect on TSS levels. Only three of the 48 experimental units showed a slight decrease in suspended solids. (See Figure 2.) "The decrease in suspended solids for one of these three experimental units was because the tank was no longer being used," said Clark. "This lack of incoming water allowed the solids that normally exit the tank as TSS to settle out. There is no explanation for the slight decrease in the other two experimental units."

- A very limited, transitory treatment effect was noticed for BOD_5. Initial BOD_5, however, appeared to be the controlling factor on subsequent BOD_5 concentrations after the addition of additives to the tanks. (See Figure 3.)

- All additives tested during the study contained live, viable organisms.

- All 48 tanks, including the control tanks, maintained very high populations of organisms over the course of the study.

- The additives tested did not provide any substantial or long-term statistically significant benefits compared to the control (no additive) for the parameters and conditions tested during this research project. It was concluded that this study does not demonstrate any practical value from using bacterial septic tank additives.

- More research is needed under many different circumstances before definitive conclusions can be drawn about the practical benefits of using bacterial additives in septic tanks.

For more information about Clark's thesis, "The Effect of Bacterial Additives on Septic Tank Performance," write to North Carolina State University, Department of Soil Science, Box 7619, Raleigh, North Carolina 27695-7619 or telephone Hoover at (914) 515-7305, or e-mail to mike_hoover@ncsu.edu.

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Maine Wastewater Treatment Plant Designated Nation's Most Improved

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DEP organized the Maine Lagoon Task Force.

"Some of the ideas we are using today were generated by the task force, and the engineer who designed our plant was part of this task force," Saucier said.

"We've also had input from other plants. All of this has really helped us tweak our process."

In addition to plant changes, Saucier said the EPA's 104(g)(1) Program, which is implemented by the Maine DEP, helped the plant's operators train for and complete their certification. Saucier holds a Class IV license, while the other two plant operators are working toward their Class III certification.

"We promote education here. We want everybody to go as far as they can. It helps us better understand the reason we're here; it enables us to do the job better," he said.

Saucier said the plant continues working with the DEP today to ensure proper maintenance and to optimize plant performance. "We work very closely with regulators. Just this month, we negotiated a new license with the DEP. It mainly addresses the issues of toxicity and frequency of sampling," he said.

This ongoing relationship has turned the malfunctioning plant into a plant with a compliance record that exceeds all other aerated lagoon plants in the state.

Lagoons

When the plant was upgraded in 1993, a variety of different systems was considered, according to Saucier. But ultimately, aerated lagoons were chosen as the preferred method of treatment because of the large area of land available in northern Maine.

The operators have the ability to use the three aerated lagoons and storage lagoon in a series or parallel. He added, "We can go from July to February on a storage unit. We are able to discharge intermittently when the stream level reaches above 174 cubic feet per second.

"The storage lagoon allows us to discharge the majority of our flow during periods when no pH adjustment is necessary."

Another benefit of lagoons was the expense of the operation. "We are a poor community," Saucier said. "The median household income is $18,114."

And premium service does not come cheap. Although the cost of sewerage runs the average customer $332 per year, doubled when you consider the cost of water, Saucier believes the service is worth every penny. "Those who have wastewater service don't want to pay the price, but those who don't have the service know the price of not having it."

Cold Weather

The plant, which services approximately 600 people, has special challenges due to the extreme temperatures of the area.

Winter temperatures in Mars Hill commonly reach 30 degrees Farenheit below zero. Summer highs reach approximately 75 degrees Farenheit. The area averages 115 inches of snow a year. Saucier said the snow helps to insulate the lagoon. "Once the top ice has formed, the snow helps to prohibit more ice formation," he said.

"We pay close attention to changes in the environment—climactic changes are key.

"We have to monitor the air in our treatment lagoons more closely because of our cold weather climate," he explained. "We also watch our water levels and many other parameters closely. At one degree Celsius, the biological activity of our water virtually ceases. To make up for that, we have to increase the volume of the lagoon by raising the levels. Winter is an especially difficult time of year for treatment, but we still get adequate treatment.

"In the summertime, we run our lagoons much differently with less volume. To be proactive, this summer we plan to take one of the lagoons offline and see how treatment works with just two lagoons. Then, we will remove sludge from the one we have drained. If this works, we might alternate and drain another lagoon the next year."

Ice towers in the Mars Hill treatment lagoon formed during the winter of 1998-99. The air tends to keep a small hole in the ice above the aerators where bubbles are formed and freeze. The bubbles pile up and form a volcano-like structure with a hollow core. These bubbles only tend to form on days with low atmospheric pressure, according to Jeff Saucier, plant superintendent. (Photo courtesy of Jeff Saucier.)

Saucier said they are taking these steps as a precautionary measure, not because of any sludge build-up problems.

Extension Line

Under construction is a $1.55 million collection system extension that will service an additional 70 customers in the town of Blaine.

A poor agricultural area, Blaine's median income is $13,500. With funding from a Community Development Block Grant, EPA, DEP, and Rural Development funds, as well as some funding from the community of Blaine, the utility was able to offer the service to the low-income residents with no residential hook-up fees.

"With the grants, we only had to borrow $300,000. It allows us to stay within our rate structure. Payoff on the project is within 10 years," he said.

"We're known to be a very cooperative district. We do anything we can within the rate structure to help those who need it."

The project has been in the planning stages since 1994. Saucier said they have tried every year since then to get the Community Development Block Grant. "We were finally successful in 1998. That's what helped us leverage the other funds. It's a whole community effort—two communities coming together," he added.

Operators Continue Changes

Saucier said they continue to make changes and try new things to keep the plant functioning at the optimum level of efficiency. He explained, "Last year our metal levels were a little high for lead and copper. We needed to reduce our end-of-pipe levels. We discovered it was mainly due to our drinking water system, so we installed corrosion control, which has brought our levels down at the wastewater treatment end."

Another change is a customer newsletter they just initiated. "We wanted to be able to communicate with the customers to let them know what we're doing and establish a rapport," he said.

To plan for the future, Saucier said the plant sets aside $4,000 a year. He explained, "Our engineers encouraged us to buy land close to the facility to make land disposal easier. The DEP has worked with us to permit a small site behind the lagoons.

"We try to dispose of sludge intermittently. A small amount every year may be sufficient. Should the need arise, we have the money to lease or purchase the necessary land and finance the delivery trucks."

Saucier concluded, "It's best to insulate your users from possible future expenses by putting the funds away yearly. You have to plan for the future."

For additional information about Mars Hill, contact Saucier at (207) 425-2620. To learn more about the EPA National O&M Excellence Awards Program, contact Campbell at the EPA Office of Wastewater Management Small Underserved Communities Team, 401 M. St., SW, Mail Code 4204, Washington, DC 20460 or call (202) 260-5815.

Year 2000: Is Your Computer System Ready?

by Kathy Jesperson
NSFC Contributing Writer

Are you ready for the next millennium? If you're asking, "Millennium? What millennium?" then maybe you won't be surprised to learn that your computer system may not know that it's coming either.

How can this be? Well, after December 31, 1999, many computer systems are not going to know what year it is. This happens because certain systems only store the last two digits of a given year. So, on January 1, 2000, when these computers try to calculate date-specific information, they may crash, simply shut down, or possibly corrupt data.

And this could happen because date calculations usually involve subtracting one date from another. Many computer systems and embedded chips may tally negative numbers or simply translate the wrong date, such as 1900 for 2000. This problem is often referred to as Y2K. And it could affect billing and even automated wastewater system operations.

"In the past five to 10 years, there has been an increase in the use of computer systems in the water and wastewater industry," noted James A. Bell, associate with Smith & Loveless, Inc., a water and wastewater treatment equipment supplier.

Besides being used for many office functions such as billing, computers are now being used in many other areas. "In the pump station market, programmable logic controllers (PLCs) are often being used in place of conventional control systems," Bell continued. "Also, many water and wastewater plants have automated their operations with central computerized monitoring systems."

Two Digits Are Missing

"The key problem concerning the impending millennial change is whether or not the PLC or computer monitoring system contains what is referred to as a 'real-time clock' function," Bell said. "It's this function that tells the computer when to activate certain treatment system operations."

How can a simple function like the date cause a computer system to fail? "In the year 2000, a real-time clock functioning with a two-digit data field may treat '00' data as the year 1900 and not 2000, causing possible system malfunctions," said Bell. Not knowing what year it is can affect whether or not bills are sent out on time and due dates are properly calculated. And many monitoring systems within drinking water and wastewater plants that alert operators to equipment malfunctions and breakdowns may fail. Computers are also used to record and transmit data from remote locations, which could cause date-sensitive problems to arise.

It All Started a Few Years Ago

So how did we get into this mess? Would you believe that we did it on purpose? "Back in the 1960s and 1970s when computers first entered the business world, they were extremely expensive," noted Peter de Jager, an industry consultant, in his article, "You've Got To Be Kidding."

"Most of this expense was tied directly to two aspects of computing: how much data a computer could store and how fast it could process that data," de Jager wrote. "One way to store data was on a piece of stiff cardboard known as a Hollerith card. Each of these cards had enough space to hold only 80 characters of information, which is not a lot of information."

Since these cards were not big enough to store all the data they needed to store, programmers had to compromise, de Jager continued. Rather than writing dates like 28/09/1958, they wrote 280958, saving themselves four precious characters. Unfortunately, two of those characters were the now crucial "19."

Now, some 30 years later, even though computers changed, the standard did not, de Jager said. And the problem is not that easy to fix. "When someone says, 'Put the dates back in,' they're making an assumption," he continued. "They're assuming that we know where the dates are within the programming."

Where's the date?

According to de Jager, it is not unusual for a company to have more than one million lines of programming within their computing systems. And if we had labeled dates by some kind of standard, such as prefacing them with the word DATE, then finding them within programs would be easy, he explained. But we did not create such a standard.

"Dates have been labeled everything under the sun—from 'bdate' for birthdate to 'snowball' for reasons known only to the programmer," he wrote. "So the advice that we should just put the dates back in, while well intentioned, is, to put it mildly, useless."

Is there anything that can be done? "Create another bit of data known as the 'century' indicator," de Jager explained. "If the indicator is 0, then the year 55 refers to 1955. If it's set to 1, then it refers to 2055."

Another solution would be to use "date logic," which is a bit more difficult to explain and once again relies on assumptions, he noted. There are other solutions, but nothing that's going to be simple. That, combined with the fact that December 31, 1999, is an inevitable deadline ensures high stress levels well into the next century.

Can we find solutions?

What can you do to prepare for the 21st century? First, you need to be aware that the problem exists. Don't panic, but do become aware that there are solutions, and then start working on them immediately. Also find out what your suppliers are doing to address their Y2K problems. If they don't have a plan, you may be at risk.

The U.S. Environmental Protection Agency recommends a checklist to prepare for the millennium. "No single checklist fits everyone's needs, since businesses have a wide variety of services and technologies," notes the Small Business Administration's Web site. But you can use these steps

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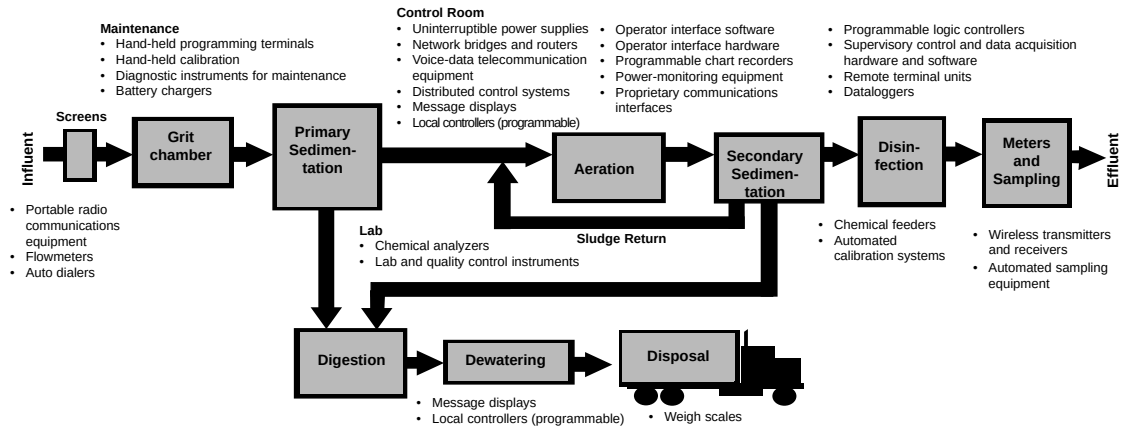
Possible Y2K Troublespots



research

Project Monitors Alternative Systems in Florida's Keys

by Jeremy Canody
NSFC Contributing Writer

Imagine a 150-mile chain of tiny, sun-drenched islands surrounded by ocean water, teeming with marine wildlife and home of the only living and federally protected coral reef in the continental United States—sounds great.

Now imagine trying to find an effective method for treating the wastewater produced by that same chain of islands inhabited by more than 80,000 annual residents and host to nearly five million visitors each year. Add to that over 20,000 conventional onsite wastewater treatment systems (OWTS) installed in this area that has a geological make-up of mostly porous limestone covered by just a few inches of top soil—welcome to the Florida Keys.

For years, contributing factors such as those mentioned above (inadequate soils, population, and tourism) have served as the suspect catalysts behind increasing water quality degradation from nutrient overloading in the Florida Keys.

To protect this region from further degradation, the federal government in 1990 established the Florida Keys National Marine Sanctuary (FKNMS). In 1993, the U.S. Environmental Protection Agency (EPA) identified effluent from the high number of conventional OWTS in the area as a major source of nutrient loading to FKNMS waters.

Because of these findings, the Florida Keys Onsite Wastewater Nutrient Reduction System (OWNRS) Demonstration Project was created in 1995 by the Florida Department of Health and Rehabilitative Services (now the Florida Department of Health) to demonstrate the effect alternative OWTS had in reducing nutrient loading in the Keys.

The OWNRS Demonstration Project was initially set up for monitoring to take place over a period of one year with testing to begin in October 1996. Preliminary test results, however, showed that continued monitoring of OWNRS should be conducted to further quantify phosphorous removal capacities and treatment performance longevity, as well as long-term maintenance requirements for each technology. Therefore, the project continues today.

"We're testing wastewater treatment processes that provide a level of treatment superior to conventional OWTS to evaluate their potential to reduce organic, solids, and nutrient loading to the near-shore waters of the Keys," said Damann Anderson, an environmental engineer and vice president for applied technologies at Ayres Associates in Tampa, Florida. The Florida Department of Health selected the company (Ayres) to conduct the demonstration project initially funded by a $500,000 EPA grant.

Visitors at the Florida Keys Onsite Wastewater Nutrient Reduction Systems Demonstration Project tour the systems being tested at the Big Pine Key Road Prison in the lower Florida Keys.

More specifically, the goal of this on-going project is to determine if the Florida advanced wastewater treatment (AWT) standards of 5 milligrams per liter (mg/L) for carbonaceous biochemical oxygen demand (CBOD) and total suspended solids (TSS), 3 mg/L for total nitrogen (TN), and 1 mg/L for total phosphorous (TP) are feasible for OWTS.

Anderson said that the overall purpose of the project is to evaluate the nutrient removal efficiency, reliability, consistency, operation and maintenance requirements, and costs associated with OWTS being tested at the central test facility.

The Prison Project

The last place one would expect to find the central test facility for a project like this is at a prison; however, that is exactly where the project's test facility was constructed—at Big Pine Key's minimum security correctional institution in the lower Florida Keys.

What prompted project officials to construct the facility at the prison was the fact that the institution provides a reliable and constant wastewater source in an environment consistent with the rest of the Keys. The central test facility was designed to allow comparative testing of five wastewater treatment process streams, simultaneously, under controlled conditions that shared a common wastewater source. It was also designed to allow effluent from any one of the five process streams to be routed to various additional processes for further treatment and evaluation.

Electronically activated dose systems provide each of the process streams with influent wastewater that is diverted from the prison's wastewater collection system. The dosing schedule mimics a typical household flow, with peaks in the morning and evening. Under normal

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to help you prepare:

- Awareness—which includes educating and involving all levels of your organization in solving the pending problem. "There are numerous articles, newsletters, trade conferences, and Web sites devoted to this issue," noted EPA. Get the basic information and then get started.
- Inventory—identify and list all of the different computer-based systems, components, service providers, and hardware that contain microchips that support your utility. Refer to owners' manuals and equipment manufacturers. Also, meet with representatives from your suppliers to determine if they are ready for the year 2000.
- Assessment—examine how severe and widespread the problem is in your utility and what needs to be fixed. Analyze the risk as well as the impact when date-dependent equipment is found. Doing this first will help determine the best course of action.
- Correction and testing—implementing the readiness strategy you have chosen and testing what has been fixed. This might include hiring a consultant to help fix the problems. It may also include replacing equipment. And then after the equipment is "fixed," it includes running tests to be certain that it really is. Independent verification may also be a good idea.
- Implementation—using your repaired or replaced system, which means putting the system back into full operation. Document all Y2K compliance efforts. Notify customers of Y2K compliance readiness, using bill stuffers, newspaper ads, etc.
- Contingency plans—be ready for unforeseen problems. "Despite the best efforts to repair the Y2K problem and prepare for its impact, problems may still arise," noted EPA. Prepare a contingency plan as though some natural disaster is expected. Order back-up chemicals and materials just in case. Have additional personnel on hand to manage any problems that may occur in the plant as well as to handle possible customer service complaints. Also, have two-way radios available for staff in case telephone systems go down.

For more information about year 2000 compliance, the following Web sites offer detailed material:

- http://www.year2000.com—*Peter de Jager's Web site and a good source of links to other year 2000 Web sites.*
- http://www.compinfo.co.uk/y2k/manufpos.htm—*contains links to computer manufacturers' home pages where you can find year 2000 compliance information.*
- http://www.epa.gov/year2000/—*provides information about EPA's year 2000 strategy.*

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operating conditions, each of the process streams received 200 gallons of wastewater a day. The facility is designed so that this level can be adjusted for stress testing and other similar tests. Effluent from each of the process streams is discharged to a sump tank after water quality sampling and returned to the prison's wastewater treatment plant.

In addition to the central test facility, subsurface drip irrigation systems were installed at three individual homes in the Lower Keys and monitored for operation, maintenance, and user acceptance. Drip irrigation system performance is currently being evaluated at the central test facility where results can be directly compared to the other treatment technologies.

Construction costs for the facility amounted to $120,000, and Ayres Associates completed the construction of the facility in October 1996. Anderson said that the construction and operating costs of the OWNRS are considerably more than conventional OWTS. He pointed out that the installed costs for the OWNRS tested ranged from $7,500 for a subsurface drip irrigation system to $17,000 for a 500-gallon-per-day recirculating sand filter with an anoxic biofilter. The installed costs for a conventional, mounded OWTS in the Florida Keys is approximately $6,500. (All figures are 1998 dollars).

The Treatment Processes Used

Several technologies that demonstrate advanced treatment and nutrient removal capabilities were selected for the project. Some of the criteria that project officials used in selecting the technologies included documented advanced treatment capabilities, reliable and consistent performance, minimal operator intervention, available treatment capacities for individual home use, and reasonable equipment, construction, and operating costs.

Anderson explained that the systems and the technologies involved in this project are very foreign to most people because they involve a greater level of complexity than traditional treatment systems.

Each of the technologies being tested uses physical, chemical, and biological treatment processes. Both passive and active systems were tested.

The following is a limited description of each technology and its treatment process(es). For a more detailed description, contact the Florida Department of Health to obtain a copy of Ayres's final report from their initial monitoring study that became available in March 1998.

Process Stream #1 (see diagram) consists of a septic tank, which is followed by a recirculating sand filter (RSF) and an anoxic biofilter (ABF). Effluent from the system is discharged to an unlined drip irrigation bed. The treatment of the effluent occurs through digestion and settling in the septic tank and physical, chemical, and attached growth aerobic biological processes in the recirculating sand filter. The sand filter removes limited quantities of phosphorous through adsorption. Then the nitrified sand filter effluent is mixed with septic tank effluent in the recirculation chamber to encourage denitrification. The sand filter effluent undergoes additional nutrient reduction in an anoxic biofilter and by contact with the drip bed media and vegetation (Saint Augustine grass).

Process Stream #2 (see diagram) is considered the most "low-tech" of the systems in that it uses a relatively passive technology consisting of a septic tank with effluent discharged to a lined drip irrigation field. A commercially available subsurface drip irrigation system by AZTEX™ Products is used for effluent distribution to the root zone. Reduction of nutrients and other parameters is accomplished by preliminary digestion and settling in the septic tank, with additional physical, chemical, and biological treatment processes occurring in the drip field media and by vegetation uptake (Saint Augustine grass).

The lined field contains one foot of saturated media under 1.5 feet of unsaturated media. The effluent should undergo nitrification in the upper unsaturated portion of the drip bed and limited denitrification in the saturated lower portion of the drip bed. Three treatment media (consisting of crushed red brick, silica sand, and an expanded clay aggregate) underlie distinct zones of the drip field. The brick and the clay aggregate media were chosen for their phosphorous adsorption potential. Because the media field was built over an impermeable liner, an assessment can be done of the effectiveness of evapotranspiration in reducing effluent volumes.

A commercially available treatment unit known as the Bio-Microbics FAST™ aerobic unit is the primary treatment for Process Stream #3 (see diagram). The unit uses fixed-film activated sludge (FAS) treatment, a combination suspended-growth and attached-growth aerobic biological process to provide nitrification of the effluent before discharge, as well as provide denitrification by mixing activated sludge biomass through aerobic zones. The mixing causes alternating aerobic and anaerobic conditions that favor growth of denitrifying microorganisms and conversion of nitrate to nitrous oxide or nitrogen gas. Additional processes, such as an engineered media drip irrigation system, would be required for phosphorous removal following this system.

Process Stream #4 (see diagram) uses a proprietary treatment unit known as the AES BESTEP-IDEA™ system, an aerobic/anaerobic, suspended-growth biological

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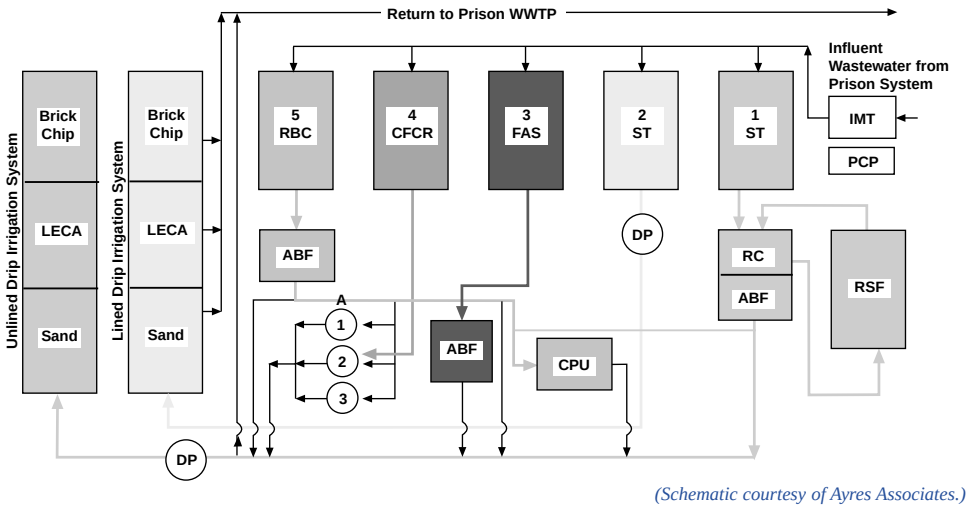
Central Test Facility



(Schematic courtesy of Ayres Associates.)

LEGEND	
ABF	Anoxic Bio-filter
AC	Adsorption Cell
AC-1	Brick Chips
AC-2	Aluminum Silicate
AC-3	LECA
CFCR	Continuos Feed Cyclic Reactor
CPU	Chemical Precipitation Unit
DP	Drip Irrigation Pump System
FAS	Fixed-Film Activated Sludge
IMT	Influent Mix Tank
PCP	Process Control Panels
RBC	Rotating Biological Contactor
RC	Recirculation Chamber
RSF	Recirculating Sand Filter
ST	Septic Tank

research

Project Monitors Alternative Systems in Florida's Keys

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treatment process that operates as a continuous-feed cyclic reactor (CFCR). The process is similar to a sequencing batch reactor, but is unique in that it allows continuous flow while using only one process tank. Aeration to the tank is cyclical, which causes alternating aerobic and anaerobic conditions. The fluctuating environment results in nitrification followed by denitrification and also uptake of phosphorous by the activated sludge biomass.

Process Stream #5 (see diagram) uses a proprietary treatment unit known as the Klargester Biodisc™, which is a rotating biological contactor (RBC), followed by an anoxic biofilter (ABF). The contactor is an attached-growth, aerobic treatment process that provides internal recycling for nitrification and denitrification. It produces a nitrified effluent that then undergoes denitrification in the anoxic biofilter. Anderson notes that additional processes, such as an engineered media drip irrigation system, would be required for phosphorous removal following the treatment process of this system.

Testing Parameters

The primary testing period for wastewater and effluent sampling occurred between October 1996 and October 1997, with weather monitoring, water level elevation monitoring, evapotranspiration monitoring, and other field tests occurring at various times during the course of the first year of testing.

During the primary testing phase, 24-hour composited samples were collected from the influent mix tank and from each of the five process streams from November 1996 through August 1997. Samples were analyzed for biochemical oxygen demand (BOD), CBOD, TSS, total kjeldahl nitrogen (TKN), (nitrite + nitrate)-nitrogen (NO_2NO_3-N), and TP. TN was obtained by summation.

Additional processes are available for testing at the facility. These include chemical precipitation, supplemental carbon addition (for denitrification), and additional phosphorous adsorption media. The test facility was designed so that the effluent for the treatment process streams can be routed to any of these additional processes for further treatment and evaluation. Anderson said the additional processes are currently under evaluation.

The Results

Results indicated that the systems provided excellent treatment performance for CBOD and TSS. However, none of the systems met all of Florida's AWT effluent standards, although the subsurface drip irrigation system with the engineered media (Process Stream #2) did meet three of the four standards: CBOD, TSS, and TP.

The submerged biofilter (Process Stream #3) provided the greatest amount of nitrogen removal. Although no system met the AWT requirements for TN removal, the submerged biofilter (Process Stream #3) and the rotating biological contactor (Process Stream #5) achieved 40 to 70 percent reduction with a mean effluent TN value of 11.0 and 12.5 mg/L, respectively.

Summary of Effluent Water Quality Data

Parameter	Statistic	Influent	Process Stream 1 (RSF-ABF)	Process Stream 2 (crushed brick)	Process Stream 3 (FAS)	Process Stream 4 (CFCR)	Process Stream 5 (RBC-ABF)
BOD_5 (mg/L)	mean	170.90	2.18	3.98	5.58	4.16	2.42
	Std. Dev.	73.85	2.53	6.36	3.90	5.45	1.38
	min	62.00	1.00	1.00	1.00	1.00	1.00
	max	299.00	9.70	21.30	14.00	17.20	5.00
	n	10	12	11	11	8	11
$CBOD_5$ (mg/L)	mean	137.80	1.50	2.81	2.63	3.19	1.68
	Std. Dev.	60.13	0.90	4.04	3.15	5.18	1.24
	min	59.00	1.00	1.00	1.00	1.00	1.00
	max	220.00	4.00	14.40	9.01	15.90	5.00
	n	10	12	11	11	8	11
TSS (mg/L)	mean	117.50	2.25	4.09	4.63	6.85	5.75
	Std. Dev.	92.09	1.76	3.83	3.93	6.62	4.47
	min	17.00	1.00	1.00	1.00	2.00	1.00
	max	345.00	6.00	11.00	14.00	20.00	16.00
	n	12	12	11	12	10	12
TKN (mg/L)	mean	38.42	1.01	1.75	1.55	1.16	2.75
	Std. Dev.	10.67	1.44	2.10	0.82	0.52	2.62
	min	19.20	0.26	0.34	0.49	0.56	0.42
	max	62.50	5.30	8.19	3.40	2.20	7.40
	n	12	11	12	12	9	11
NO_2 NO_3-N (mg/L)	mean	0.03	21.09	19.27	9.42	14.30	9.77
	Std. Dev.	0.02	6.76	10.09	4.06	6.49	3.69
	min	0.01	14.00	1.60	3.90	2.54	3.60
	max	0.05	35.20	36.60	19.70	23.00	17.00
	n	10	11	11	12	9	11
TN (mg/L)	mean	38.45	20.76	21.15	10.97	15.46	12.52
	Std. Dev.	10.67	5.61	11.27	4.05	6.60	5.98
	min	19.25	14.46	3.00	4.55	3.53	4.05
	max	62.55	30.23	44.79	20.19	24.20	23.00
	n	12	10	11	12	9	11
TP (mg/L)	mean	8.39	1.76	0.60	5.38	6.24	4.67
	Std. Dev.	5.79	0.48	0.23	1.44	1.59	1.05
	min	4.32	0.92	0.34	3.22	4.80	2.50
	max	26.00	2.40	1.20	8.70	9.90	5.90
	n	12	10	11	12	10	12

(Table courtesy of Ayres Associates.)

Anderson said these results are excellent considering they were obtained without carbon addition to enhance denitrification. He added that supplemental carbon addition is currently being evaluated at the prison's test facility and early results show that an effluent TN value of 5 mg/L may be achievable by adding carbon to an anoxic biofilter unit following the fixed-film activated sludge or rotating biological contactor treatments.

As mentioned above, the lined drip irrigation system with the crushed brick media (Process Stream #2) was the only system to meet the AWT standard for TP (mean TP value of 0.60). However, Process Stream #1 did provide good TP removal with a mean effluent of 1.8 mg/L. Anderson said that these results suggest that adsorption of phosphorous on the sand and crushed brick media were among the most stable TP removal mechanisms tested, but warned that once the media adsorption sites reach capacity, the breakthrough of phosphorous at higher concentrations could occur.

Process Stream #1 also produced the best CBOD and TSS effluent levels achieved.

When asked if there was any feasible way to meet or exceed Florida's AWT standards in the Keys, Anderson suggested that a combination of these processes, such as an aerobic biological treatment unit, followed by an anoxic biofilter with supplemental carbon addition, discharging (via drip irrigation) onto an engineered media bed could meet the standards for CBOD, TSS, and TP and come very close to the standard for TN (approximately 85 percent removal of TN).

For a complete summary of the effluent water quality data collected during the OWNRS primary monitoring stage, refer to the chart on this page.

Monitoring Continues

Anderson said they will now continue monitoring at the site to quantify phosphorous removal duration and treatment performance longevity, solids handling requirements, and maintenance requirements.

Based on these results from the Florida Keys OWNRS Project and its continued research, the standards and regulations concerning onsite wastewater treatment, technology design, operation, and maintenance will continue to change and be challenged in the Florida Keys.

With continued funding for this project and others like it, and with the coordinated efforts of local, state, and national governmental groups and agencies, the performance of OWTS could be improved such that they could provide a permanent, reliable alternative for wastewater treatment in sensitive environments like the Florida Keys, Anderson said. He added that projects like this are not only beneficial to the Florida Keys, but to any region throughout the world where conventional OWTS do not effectively treat effluent before dispersal to the ground.

For more information about the project, contact Anderson at (813) 978-8688.

Arcata, California . . . The Rest of the Story

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operated fairly reliably, releasing only an occasional discharge of raw sewage or non-disinfected wastewater into the bay. Nevertheless, the combined releases, leaks, seepage, and inadequate systems of these communities produced, according to the North Coast Regional Water Quality Control Board (RWQCB), an estimated 3.5 million gallons of inadequately treated wastewater daily that was discharged into the bay.

In overseeing protection of the enclosed waters of Humboldt Bay, the North Coast RWQCB considered the communities' treatment systems "ground-zero" to cleaning up the bay. In 1969, with the passing of the Porter-Cologne Act, both stringent water quality standards and the power to enforce them provided just the impetus that the board needed. State legislators made it clear with Porter-Cologne that no community or business had "a right to pollute."

By 1975, restrictions on bacterial levels in municipal wastewater discharge, developed and adopted within a Comprehensive Basin Plan by the SWQCB, imposed severe limitations on municipalities discharging into enclosed bays and estuaries. Water pollution laws were consolidated, and 16 statewide planning basins, of which the North Coast RWQCB was one, geared up to aggressively implement water quality standards advanced in the state's Bays and Estuaries Policy.

The Final Blow

The overarching, stated intent of the SWQCB was to phase out all discharges into Humboldt Bay at the earliest practicable date. At the same time, however, the obvious impracticality of a cessation of all discharges required the SWQCB to provide an "exception met by enhancement" provision. In those cases where discharge was shown to be at a consistent level of treatment and released "in such a manner that it would enhance the quality of the receiving waters," discharge permits would be allowed.

Arcata was told that in addition to cleaning up its wastewater treatment, its municipal landfill located on the edge of the bay would have to close. Other Humboldt Bay communities were similarly notified and warned of restrictive measures until compliance was made.

Many towns became noncompliant and unresponsive to SWQCB mandates for improved sewage service. In response, the SWQCB implemented enforcement procedures and measures: denial of future hook-ups, placement of construction moratoriums upon several towns, and the imposition of fines (up to $10,000 per day). A series of cease-and-desist orders as well as years of public hearings ensued. In describing the battle to upgrade and improve the towns' sewage treatment systems, a process that took nearly 14 years, John Hannum, a district engineer with the North Coast WQCB during this time, called these communities his "recalcitrant teenagers."

Salmon, Wastewater, and Wetlands

An experiment critical to the conceptualization and creation of the wetland treatment facility was quietly taking place on the sidelines throughout the beginning of the conflict and was at first only indirectly influential. The work and research of fisheries biologist and professor at Humboldt State University, George Allen, Ph.D., would ultimately provide the ways and means of making the facility a reality.

Since 1971, Allen had been conducting a salmon ranching study, mixing wastewater with seawater. He had shown that salmon raised in this mixture could be healthfully and successfully reared and even triggered to return to the site to spawn. Through Allen's initial aquaculture findings, coupled with his dilemma in developing a sufficient excess water storage capacity in the aquaculture project, the idea of marshes as a viable treatment option was born.

In an anecdotal telling of how the notion of the marshes arose, Allen described a class on fish culture in which he was presenting this water storage problem. A student he characterized as a "C+ student" raised his hand and asked, "Why don't you just run the water around and make some marshes?" Suddenly, according to Allen, his project transformed from a fisheries project and system into a wetlands project and system.

The Wastewater Wars Heat Up

It was 1977, and Arcata had many battles to fight before developing a credible marsh system and convincing regulatory authorities that

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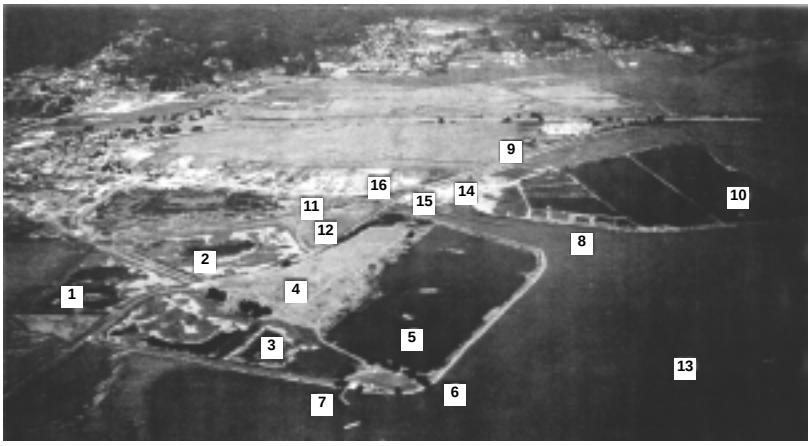
Arcadia Marsh and Wildlife Sanctuary: Points of Interest



1 **Robert Gearheart Marsh:** Completed in 1981, this marsh was built from pastureland and now uses treated wastewater as the sole water source.

2 **George Allen Marsh:** Also completed in 1981, this marsh was built on an abandoned log deck and is enhanced with wastewater.

3 **Dan Hauser Marsh:** This is the final marsh to be fed with treated wastewater before returning to the treatment plant for disinfection and release into the bay. This marsh was a barrow pit for the closure of the adjacent landfill.

4 **Mount Trashmore:** This grassy hill has been reclaimed from a sealed sanitary landfill that operated during the 1960s and '70s.

5 **Frank Klopp Lake:** This brackish lake was also a barrow pit for the closure of the landfill and is now a popular loafing area for shorebirds, a feeding area for diving birds and river otters, and a place for artificial-bait-only sport fishing.

6 **Old Arcada Wharf:** California's first railroad, the Union Plankwalk Railtrack and Wharf Company, was in operation from January 1855 until the depression period.

7 **Arcata Boat Ramp:** The only concrete boat ramp maintained in Arcata Bay, this serves as an access point for sport boating, duck hunting, and sport shellfish harvesting.

8 **Wastewater Aquaculture Projec**t: Fish hatchery and ponds where salmon, trout and other fish are raised in a mixture of wastewater and seawater.

9 **Marsh Pilot Project:** These ten 20' x 200' marsh cells have been used since 1980 to demonstrate the effectiveness of constructed wetlands to achieve water quality and habitat goals.

10 **Oxidation Ponds:** These 45 acres of ponds, built in the late 1950s, treat Arcata's wastewater to secondary standard.

11 **Butcher's Slough:** Butcher's Slough is a restored estuary receiving feed from Jolly Giant Creek, the principal watershed in Arcata. A California Coastal Conservancy project returned the estuary to its original alignment and ecological value. This slough serves as home to the Coastal Cutthroat Trout.

12 **Butcher's Slough Marsh:** An old log pond restored to provide swamp-like habitat in the Arcata Marsh and Wildlife Sanctuary.

13 **Arcata Bay:** This bay produces more than half of the oysters grown in California and is home to a variety of other aquatic animals.

14 **Headworks Facility:** This is the place where the influent to the treatment system is received.

15 **Discharge Point:** This is the point where a mixture of treatment of marsh effluent and enhancement marsh effluent is discharged into the Arcata Bay side of Humbolt Bay.

16 **AMWS Interpretive Center:** This is the site where the AMWS Interpretive Center is built. This center will attempt to meet the educational demands of the treatment system.

management

Arcata, California . . . The Rest of the Story

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such a low-tech facility would work, while providing "enhancement" to Humboldt Bay. Opposition came primarily from state and federal authorities who were leaning heavily toward the development of a regional wastewater treatment system in order to bring the entire Humboldt Bay region into compliance. These authorities were also adamantly opposed to any bay discharge plan. Among several facility proposals and designs batted around during this period, the foremost was an activated sludge facility built on a peninsula called Samoa Spit.

Meanwhile, the communities of Arcata, Manila, Eureka, and McKinleyville, along with unincorporated towns of the area, eventually responded to the SWQCB's greater restrictions on discharges and the subsequent need to develop treatment options and formed the Humboldt Bay Waste Authority (HBWA). The members of HBWA were charged with the responsibility of overseeing and approving the state's treatment proposal.

The treatment proposal was for a regional collection system with an activated sludge treatment plant located at Samoa Spit. The plant would have large interceptors circling the bay with a pipeline crossing the bay under an area of active bay navigation. The effluent would be discharged into the Pacific Ocean in an area of shifting sea bottom and heavy seas during the winter storms.

Put forth by the SWQCB and funded in part by federal grant moneys, the regional "activated sludge" project was considered state-of-the-art in sewage engineering. It had EPA approval as well as funding, and many communities nationwide were constructing just such facilities.

When the Samoa Spit facility was made public, a considerable uproar in opposition ensued, particularly over the estimated expense. Headlines of "Shocking Sewer Rates" began to appear in the *Eureka Times-Standard* in November 1977. The Concerned Citizens for the Development of Humboldt Bay released data showing that 400 percent increases resulting from operational and developmental costs of the regional facility could occur.

Citizen groups claimed that the facility was too energy-intensive, with unpredictable development and operational costs. The price tag for Arcata's participation fluctuated between $56 and $65 million in 1975 dollars. Arcata's Public Works Director, Frank Klopp, argued that these estimates were low and could escalate as the project was implemented, with unknown yet potentially prohibitive costs to the ratepayers.

Additionally, the possible environmental risk generated community anxiety and prompted the filing of several lawsuits. Jackie Kasun, an economics professor at Humboldt State University and Dan Ihara, a member of the Manila Community Services District Board, filed first with a suit contending that the "regional project was a great big boondoggle." Through their Committee for a Sewer Referendum, Kasun and Ihara were instrumental in putting forth a petition drive demanding voter approval on bonds for the facility and educating the communities about the total impact such a project would have.

The Humboldt Bay's harbor pilots sued the Harbor Commission, claiming it was irresponsibly granting a construction permit for the facility. The pilots' contention was that the submarine pipeline that would be buried three feet beneath the bay in an area of active navigation would be at risk from shipping operations, particularly the large transport ships' anchors. The anchors, when dropped, dig up to five feet into the bay's mud and sand. The question was raised of who would be held liable if, indeed, an anchor tore open the pipeline, releasing thousands of gallons of raw sewage into the bay.

The Harbor District subsequently revoked HBWA's permit, indicating that future pipe designs would have to be buried deeper. Further concerns articulated whether the pipeline, designed to run along a submerged faultline, would be sufficiently earthquake proof to withstand a quake without rupture.

The Search for an Alternative

While the Wastewater Wars were raging, Arcata was looking at alternatives, forming a Task Force on Wastewater Treatment to search for an independent treatment system for the city. Allen and a colleague, Robert Gearhart, Ph.D., an environmental resources professor and sanitation engineer, were members of the task force. Together they designed a plan that would upgrade Arcata's current oxidation facility and provide enhanced secondary treatment. They envisioned it as a "hybrid park-sewage works." Allen and Gearhart proposed a marsh pilot project that was fundamentally an expansion of Allen's original aquaculture project. The marsh project would test the efficacy of marshes in the full treatment of municipal wastewater.

Arcata withdrew from HBWA and further discussions about a regional treatment facility collapsed. Arcata acted partly in response to the citizen lawsuits and referendums; in 1978 the townspeople of Arcata voted by 76 percent to approve an independent treatment facility. Their decision was also in response to the concerns raised by Public Works Director Klopp, especially to his characterization of the cost as a "doubling of a doubling within five years," and principally, according to Sam Pennisi, former city councilman, in response to their own ethos. "We had an outlook that values consistency in policy and innovation. We believed in experimentation, in the value of research. We believed in risk taking."

Answering to its own maverick inclinations, the City of Arcata funded and launched in 1979 the Marsh Pilot Project, with the Task Force overseeing the testing of marsh ecology. The strategy was developed in the eventual hopes of satisfying the "enhancement" criteria of the state law for a bay discharge. The Marsh Pilot Project would expand the scope of Allen's aquaculture research and run wastewater through constructed wetlands to measure if "enhanced" conditions could be established.

Out of the Ashes of the Wastewater Wars . . .

The other communities fared well in eventually implementing treatment facilities. Grant Ramey of McKinleyville's community services board observed, "We were relieved when the state board decided that we could each take care of our own treatment." At that time, according to one participant, there was "a lot of teeth-gnashing over the [Arcata's] decision."

While McKinleyville had already designed and completed a collection system in anticipation of a regional line, the smaller communities such as Manila and Fieldbrook were left without plans of action

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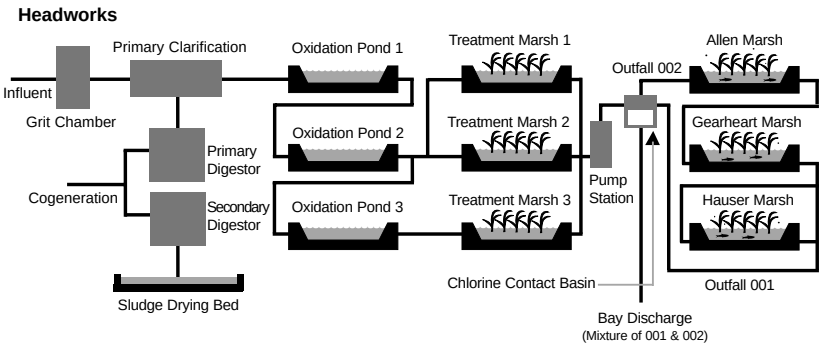
Arcata's Treatment Components



Marsh water levels at Arcata are checked using wet wells. (Photo by Deborah Carol.)

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for their own decentralized treatment solutions, which meant scrambling to establish contingency facilities. However, the communities moved forward and put together an oversight committee, which culled dozens of treatment options.

From 1978 to 1983, McKinleyville was allowed to send its sewage to Arcata to be treated until its own system was completed. The town now uses infiltration basins alongside the Mad River and discharges into the river from October to May—high-flow months. Manila and Fieldbrook developed wetland treatment systems with degrees of success based upon the towns' own particular landscapes, soil, and hydraulic conditions.

Eureka, the largest city of the initial HBWA group, continued with plans for a scaled-down version of a centralized facility, bringing into treatment the unincorporated towns of the Humboldt County Service Area. Its facility has been in operation since 1984 and releases into a swift-moving channel in the bay on the outgoing tide and has a record of perfect compliance.

Development of the Marsh and Wildlife Sanctuary

In May of 1983, based on the Marsh Pilot Project findings, the SWQCB approved the diversion of disinfected, partially treated wastewater to the 30 acres of enhancement marshes of the AMWS and allowing a bay discharge. The board wrote, "Sufficient evidence was presented . . . to find that there is a reasonable probability that the discharge of secondary, disinfected and dechlorinated effluent into Humboldt Bay, together with a treatment process which either creates new beneficial uses or results in a fuller realization of existing beneficial uses . . . could enhance the receiving water quality."

Arcata combined the construction of the marshes with an urban redevelopment plan, returning an abandoned lumber mill and its log pond to former wetland habitat and reestablishing an historical creek channel of the Jolly Giant Creek, as well as its estuary and slough. A capped landfill that Arcata was ordered to shut down in the 1970s (and which subsequently became a derelict site called Mt. Trashmore), was incorporated into the marsh, restored with native upland grasses and laced with walking trails. This expanded still further the notable public open space feature of the facility.

Concurrent to a protected bays policy action, coastal zoning reform was implemented by the California Coastal Zone Act restricting projects that did not enhance shore resources. The California Coastal Conservancy (CCC), overseeing coastal zoning permitting, viewed the AMWS project as a way to increase severely diminished freshwater resource habitat and as a way to provide coastal open space opportunities.

The CCC was not averse to the use of wastewater for wildlife habitat if it proved to be an effective resource, and subsequently the AMWS (a sewage treatment facility) was developed for its "resource and recreational" value. In 1981, the CCC, having provided funding and guidance, assisted in the construction of the three enhancement marshes: Gearhart, Allen, and Hauser, named after the two professors and a former HBWA member of Arcata instrumental in seeing the AMWS created.

Walking around the marshes with its plethora of snowy egrets, a scene of serene and quiet efficiency, one can only imagine how things could have been so different. The project that eventually was built added coastal wetland habitat to severely diminished wetlands, provided a rest stop on the Pacific flyway for migratory birds, and became a municipal open space site. The Audubon Society provided design standards for the marshes to ensure high quality avian use, with the result that the marsh sanctuary is an extremely populated, multi-species, and world-class bird habitat.

The AMWS is a hybrid combining the natural cleansing system of wetlands with the rigors of municipal treatment standards and functions. The resultant system makes for a dynamic exchange between the sublime and the mundane.

The facility is not without its problems, but in the 17 years it has been cleaning wastewater, it has performed exceptionally well. In 1990 and 1991, coliform levels in the flow returning from enhancement marsh Hauser were alarmingly high, with elevated readings of as much as 1600 most probable number (MPN). Levels going into the AMWS must meet a 23 MPN requirement, and discharge into Humboldt Bay is consistently measured at <2 MPN. Operational staff determined that these levels were a result of naturally occurring loading from the active use of the enhancement marshes by the plentiful bird population and traced the surging patterns to seasonal use by migratory birds.

In addition, spikes and surges reflective of community events of this college town can also contribute to uneven readings. For example, a surge pattern or extra loading occurred during May every year. It was a mystery until someone realized it occurred at the same time as graduation ceremonies at Humboldt State University, which meant an increase of up to seven thousand visitors to Arcata availing themselves of the toilet facilities. Anticipating the influx and adding a clarifier to accommodate the increased demand solved this problem.

Jill Geist, Arcata's water quality specialist, warns however, that this form of wastewater treatment is not a "cookie-cutter" model. It is, rather, a successful concept, and communities need to determine whether it can work for them given their specific land and water conditions and population demands.

In a blending of environmental concerns and the need for an efficient, clean, and cost-effective treatment facility, Arcata developed a unique and all-purpose open space, wildlife habitat, and educational resource sewage treatment operation.

History of Arcata's Wastewater Treatment System

Prior to 1949—Raw sewage was directly discharged into the bay through a pipe outfall.

1949—A primary treatment plant was constructed including a pumping station, pre-aeration unit, primary clarifier, digester, and sludge drying beds. Clarified effluent was discharged directly into the bay.

1956–1957—Arcata had outgrown the primary treatment plant and plans were made to upgrade and expand the plant. The expansion included a headworks structure, storm pumps, aerator, a digester control building, and a 55-acre oxidation pond.

1966—A chlorination facility and contact basin were added to the treatment plant.

1971—Improvements were made to the collection system, and additional headworks capacity, another clarifier, and an aeration pond in the first unit of the oxidation pond were added to the treatment plant.

1974—The chlorine contact basin and chlorination facility were enlarged, and a dechlorination unit was added.

1986—Treatment and enhancement wetlands were added to the treatment plant in addition to improvements and modifications to the rest of the plant.

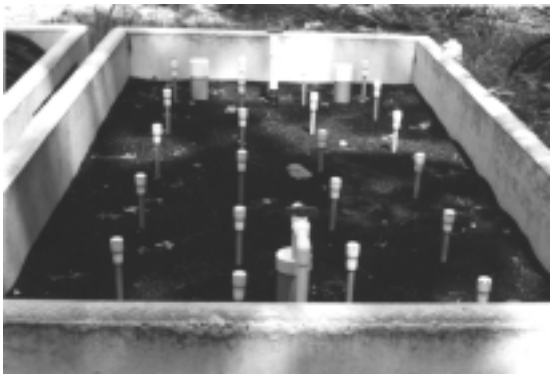
research

Monongalia County, West Virginia, NODP Phase I Completed

The National Onsite Demonstration Project (NODP) has concluded its Phase I demonstration project in Monongalia County, West Virginia. The project area is the Chestnut Ridge Park located in the eastern part of the county, east of Morgantown, home of the National Small Flows Clearinghouse (NSFC).

The NODP is funded by the U.S. Environmental Protection Agency and managed by the NSFC to assist small communities in funding, installing, monitoring, and managing model onsite systems as cost-effective, viable alternatives to centralized sewage systems.

The 75-acre park, besides being conveniently near the NSFC and located on county land (avoiding problems with access, installation times, and technology selection that seemed to arise at each privately owned site considered), is representative of much of this Appalachian region. The area has many steep slopes, exposed bedrock, and shallow soils, often with low permeability.



Recirculating sand filter utilizing Black Beauty filtration media at the Monongalia County, WV, NODP I site, Chestnut Ridge Park.

Monongalia County is also typical of many of the communities within the region that have a serious need for viable alternatives to conventional wastewater management methods. Most widely dispersed rural areas have no access to central sewage treatment and have failing wastewater systems or direct discharges. Some of the clusters of homes have no suitable areas for subsurface absorption fields.

The Monongalia County Health Department (MCHD), located in Morgantown, was funded by the NSFC to provide leadership for the project. A local contractor provided design and installation support for part of the project. Technical assistance staff at the NSFC provided sampling and design support. In addition, Chestnut Ridge Park staff assisted with the installation and educational aspects of the project.

The Board of Health for the state of West Virginia permits landowners and certified septic system installers to conduct their own soil percolation tests. The health department issues construction permits for onsite systems based upon the submitted percolation test results and the number of bedrooms listed on the site. Overall, the state and county realize the need for and are supportive of testing alternative systems for widespread use in the state.

Site Selection

In 1995, part of the site selection criteria, aside from being an area not well suited for conventional systems, included varying uses and need. Facilities at the park include a residence, shower house, dining hall, lodge, park office, and cabins, each presenting different demands for wastewater treatment.

The park has vault privies and tanks that require routine pumping. Some holding tanks and privies, constructed of concrete blocks, are suspected of leaking wastewater. A common concern of those visiting the park is the availability of sanitary facilities.

"Before this project," said Park Ranger Brian Flaherty, "the park was served mainly by pit-vault type toilets. In one instance, during heavy rains, graywater from the showers was flowing directly into the lake."

Monitoring of the sites occurred from April 1997 to June 1998.

System 1. Septic Tank with Recirculating Sand Filter/ Gravelless Trench and Sand-Lined Trench

This system was installed at the new public restrooms for the park office. The area is low-lying and extremely wet year-round, with clay-type subsoils and minimal topsoil cover.

The treatment objectives were to demonstrate the nutrient and pathogen reduction capabilities of a recirculating media filter and to compare the effectiveness of two alternative soil absorption trenches.

The treatment and disposal system consists of a 2,400-gallon precast concrete septic tank, an effluent filter screen, a recirculation tank, two proprietary recirculating sand filter cells, and two alternative soil absorption systems (sand-lined trench and shallow, gravelless trench).

This system has consistently shown a 75 percent reduction in nitrogen compounds and 95 percent reduction in fecal coliforms. Soil samples three feet downslope from the active trench indicate an effluent plume, but fecal coliforms are below detection levels. No noticeable differences in the performance of the two soil absorption systems have been shown to date.

System 2: Septic Tank with Constructed Wetlands and Gravelless Trenches

This system serves the two restrooms at the park's dining hall. The structure is in a rocky, wooded area in close proximity to bedrock, with clay-like subsoils with minimal topsoil cover.

The treatment objectives were to demonstrate the performance of the sequence of grease trap, septic tanks, constructed wetland, and contour shallow trench in dealing with high-strength waste from the dining hall facility.

The treatment and disposal system consists of a 1,000-gallon septic tank, an 800-gallon septic tank as grease trap to the dining hall kitchen, two constructed wetland cells connected in series, and two 100-foot, 10-inch-deep gravelless trenches located downslope of the cells.

The high-strength effluent from the septic tank shows 95 percent nitrification and 99.9 percent reduction in fecal coliforms. The biochemical oxygen demand (BOD—organic material) is reduced by 75 percent to 78 mg/L. Fecal coliforms were not detected three feet downslope from the soil absorption trenches.

System 3: Home Aeration Unit/Contour Chamber Trench

This system is installed at the park ranger's residential unit serving two occupants. The area is rocky and wooded and in close proximity to bedrock.

The treatment objective was to demonstrate the effectiveness of a proprietary extended aeration treatment system in reducing the nutrient and pathogen load to a soil absorption system.

The treatment and dispersal system consists of a home aeration unit and polyethylene leaching chambers in a trench 100 feet long, 36 inches wide, and 18 inches deep.

This extended aeration system shows some nitrification and denitrification, but the effluent indicates a relatively high BOD of 174 ppm and fecal coliform count of 160,000/100 ml. This system is not appropriate for this location (high bedrock) without tertiary treatment such as an intermittent sand filter or a sand mound. The noise level of the aerator was found to be intrusive in this rural location. An acceptable silence baffle reduced the noise to acceptable levels.

"This system is very efficient," said Flaherty. "We have seen only a 10 to 15 percent increase in our electric bill."

System 4: Septic Tank with Disk Filter and Drip Irrigation System

The system serves the main shower house at the park. The area has a gentle slope and is somewhat wet throughout the year, surrounded by stumps, surface boulders, and dead trees, with clay-type subsoils with minimal topsoil cover.

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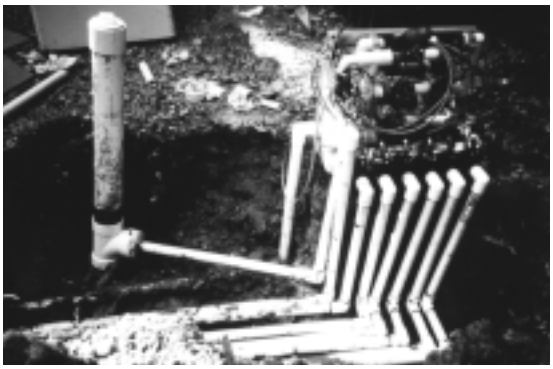
The treatment objective was to demonstrate that a proprietary drip irrigation system with only mechanical filtration of septic tank effluent can effectively deal with a substantial flow of wastewater without a significant rise in the water table and also provide effective treatment of BOD and pathogens in the soil horizons.



Filtration and valve manifold unit for a drip irrigation system at Chestnut Ridge Park, Monongalia County, WV, shown during installation. This unit receives septic tank effluent from the pump chamber, mechanically filters the effluent, and directs it to one of six irrigation zones.

The treatment and disposal system is made up of a 2,400-gallon, dual-compartment, concrete septic tank; a 2,400-gallon effluent pump chamber with a submersible pump; a central processing unit containing zone valves, three filters, and heater (for frost protection); and six drip irrigation zones covering 0.6 acres containing 8,000 feet of drip irrigation tubing.

Observation wells at this site have not shown any evidence of ponding of effluent in the soil or rise in the water table. Limited soil sampling appears to show that treatment in the soil is effective, with very low fecal coliform counts. This mechanical system has an alarm that has made several calls. Regular preventive maintenance is a requirement for this system.

"If a drip irrigation system can be installed at this site, it can be installed almost anywhere," said MCHD Director of Environmental Health Art Adams.

System 5: Septic Tank and Contour Systems

This unit, Casey Cabin, is a two-bedroom rental facility located in a rocky, wooded site with characteristics typical of the area: clay-type subsoils with minimal top soil cover limiting permeability and evapotranspiration.

The treatment objective was to demonstrate a low-cost, simple, basic septic tank and contour soil absorption system shown to be effective in similar terrain in Nova Scotia, Canada.

The treatment and disposal system consists of a 1,000-gallon precast concrete septic tank with effluent filter, a 300-square-foot absorption trench 100 feet long and three feet wide laid along a contour, and four-inch diameter PVC gravity distribution pipes.

A pan lysimeter only six inches beneath the contour trench shows a 75 percent reduction in total nitrogen and fecal coliform count at a time of low precipitation. A soil sample three feet downslope from the trench shows fecal coliform as not detected.

Said Sanitarian Supervisor Cliff Livengood of the MCHD, "Many visitors to the park have been impressed by the contour system for its simplicity, low installation costs, low maintenance requirements, and the fact that an absorption system of only three hundred square feet is serving an installation equivalent to a single-family home that would normally require a minimum of six hundred square feet of absorption field."

System 6: Septic Tank with Low-Pressure Dosing Pipe System

This unit, Klaer Lodge, is a rental unit at the park. The lodge had an old septic tank and clay tile drainfield between the lodge and cliff serving the kitchen. Two washrooms have been added to the facility, which is located in an area of clay-type subsoils with minimal top soil cover and a depth to bedrock of 16 inches in some spots.

The treatment objective was to demonstrate that a low-pressure pipe distribution system is an effective alternative to serial distribution by gravity on a sloping site.

The treatment and disposal system includes two 1,000-gallon single-compartment septic tanks connected in series. The first tank contains an effluent filter, and the second tank is a pump tank. The rest of the system is made up of a grease trap and seven contour trenches with an average depth of 16 inches with valves on the pressure lines.

Monitoring of septic tank effluent shows that the grease trap is functioning with BOD of average levels and little evidence of oil and grease breakthrough. Most of the trenches were cut into loose bedrock and the effluent is unlikely to achieve adequate soil treatment. It was not possible to retrieve soil samples for analysis. The low-pressure dosing system should have been constructed on a sandy loam fill, given these site conditions.

Educational and Technology Transfer Program

The educational program for this project was focused on state regulatory personnel, area installers and contractors, and the general public. According to the Monongalia County Health Department staff, the public education program had the widest coverage. On average, 500 people visit the park each day, and the bright signs describing the systems and their operation are situated at strategic locations in the park. The goal of the public education efforts was to provide end-users with an awareness of alternative wastewater systems and their maintenance.

In March 1997, NSFC's sister organization, the National Environmental Training Center for Small Communities (NETC-SC), hosted an onsite wastewater training program for operators. Eighteen area contractors, regulators, and university staff members attended the session where the operating systems were demonstrated.

In the fall of 1997, more than 75 sewage enforcement officers from Pennsylvania participated in a guided tour of the site hosted by the MCHD and local contractor Paul Ashburn of Ashco-A-Corporation. In Pennsylvania, sewage enforcement officers are the closest parallel to county sanitarians in other states.

In addition, MCHD staff, the park ranger's office, and NSFC staff hosted several tours of the park systems.

Lessons Learned

"The biggest challenge to installation of the alternative systems was the need for training local installers about alternative systems," said Livengood. Some system installations involved several contractors and required several phone calls and meetings to coordinate the construction of each system.

According to MCHD staff, all systems installed will work effectively in West Virginia. Long-term operation and maintenance requirements, however, are even more important for alternative systems than they are for conventional systems.

Development of a local maintenance industry or management program for the community and training for local maintenance professionals are essential to ensure the successful long-term use of onsite and cluster systems.

"These systems are a valuable resource that can help regulators, installers, students, and the general public to learn more about alternative systems," said Max Fisher, assistant director of the West Virginia Board of Public Health. "It's the one-stop-site for a variety of systems that are operational and effective."

For more information about the Monongalia County demonstration project or other NODP sites, call the NSFC at (800) 624-8301 or (304) 293-4191.

opinion

Onsite Wastewater Management in the 21st Century: the "Utility System" Concept

by Anish R. Jantrania, Ph.D., P.E., M.B.A.
NSFC Contributing Writer

Editor's Note: This is the second in a series of three articles dealing with the future of onsite wastewater treatment, management, and regulation. It focuses on management issues dealing with the use of onsite systems. The next article will focus on regulations. Anish Jantrania is an environmental engineering consultant specializing in addressing onsite wastewater issues. His opinions do not reflect those of the NSFC, and we welcome other viewpoints.

Technically, the onsite wastewater treatment industry is already into the 21st century; however, technology is just one of many different areas of any industry. Other areas need to progress in order for the industry as a whole to progress and be effective and competitive. The establishment of a utility infrastructure is one of the most important areas that we need to address in order to be successful in the next century.

Today, most homes that use onsite systems have conventional septic tank drainfield systems. These systems are generally installed and forgotten about unless they start showing problems such as sewage surfacing on the ground or backing up into the house. These systems are not operated or maintained by any utility company, and most problems can be avoided by regularly pumping out the septic tank or occasionally by installing additional drainfields. However, a wastewater system really needs a bit more oversight.

Also, in the 21st century, a wastewater system, no matter how small, ought to treat wastewater to secondary or better quality before discharging it into ground or surface water. Depending on soil for treatment of raw or primary quality wastewater is not environmentally sound and is not a sustainable concept.

Centralized versus Onsite Wastewater Systems

Centralized wastewater treatment plants are operated by a utility where trained and licensed operators monitor and maintain the plant so that the discharge from the plant meets the necessary performance standards. Basically, the homeowner pays a hook-up fee to connect to a centralized system and then pays a regular user charge and transfers all the responsibility for sewage to the utility. Today, most of the people who live with an onsite system are responsible for their system.

Public acceptance of onsite systems can be enhanced only when onsite systems offer the same wastewater services as a centralized sewage system. When an onsite system can offer such operational comfort to people and offer an environmental protection guarantee to the regulators, their use can be considered as equivalent to a centralized sewage system. We now have the technologies that can achieve both of these requirements in a cost-effective manner. However, we are still in an infancy stage regarding the development of an infrastructure similar to a utility that can make these technologies available to people.

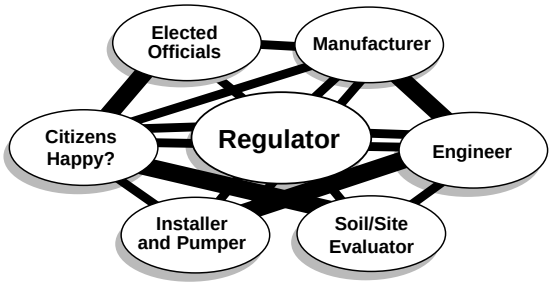
Utility System Concept

It is time for all of us to seriously consider the use of onsite systems under a utility concept. There are a few management entities present today in the country that offer wastewater services to people who use onsite systems; however, most people still have no access to such services. As we get ready to enter the new century, we need to seriously consider how to develop a regulatory system that will allow people to get wastewater services from a utility the way they get other services such as telephone, cable, gas, or electric. We also need to discuss what kind of services a utility should offer and what role such a company could play in the onsite industry.

When a utility is responsible for permanent operation and maintenance of an onsite system, simple issues such as access to the system's components for maintenance and inspection can be addressed in a timely manner. I believe that such a qualified utility should be licensed to do all the pre-installation work such as engineering, site/soil evaluation, selecting a wastewater system, and be allowed to install and operate onsite systems on a permanent basis. Such a utility should be allowed to use the best available technology for wastewater treatment and dispersal, and be regulated based on the performance of the onsite systems, both in terms of operational services to the customers and the protection of the environment and public health.

Figure 1: Onsite Systems Without a Utility Model

Heavier lines indicate stronger bond



Under the utility model for onsite systems, the role of manufacturers, engineers, soil/site evaluators, and installers can be defined in a manner that would result in the most efficient use of their services. Today, I believe that the requirements of a soil/site evaluation and engineering design quite often do not add any real value to the operation of individual home and small commercial onsite systems. Most of the current regulations for onsite systems still require soil/site evaluation to determine if the proposed site is suitable for an onsite system. Such pass/fail criteria for a site are not necessary because now it is possible to have a wastewater system for any site.

Once the decision is made for development in an area that is not served by a centralized wastewater system, an onsite system utility can offer all the services necessary for adequate treatment and dispersal of wastewater. The environmental and the public health regulators can then make sure that the services provided by the utility offer safe, adequate, and proper protection to the environment and public health.

Value-Added Services

Under the current regulatory system (Fig. 1), a homeowner has to deal with an engineer, a soil/site evaluator, an installer, a manufacturer, and a regulator and spend a lot of money, especially when the lot is not suitable for a conventional septic tank drainfield system. Soil and site evaluations are sometimes done by both public and private sector soil scientists; similarly engineering is done by both public and private sector engineers for a single-family home onsite wastewater system. This approach typically leads to a slow and expensive duplication of work.

In contrast, under the utility model (Fig. 2), the necessary pre-installation work can be done by the utility in a most efficient manner. Adequate installation of any onsite system is very important for the long-term use of such systems. Under the utility model, well-trained installers can adequately install systems, and soil/site evaluators and engineers

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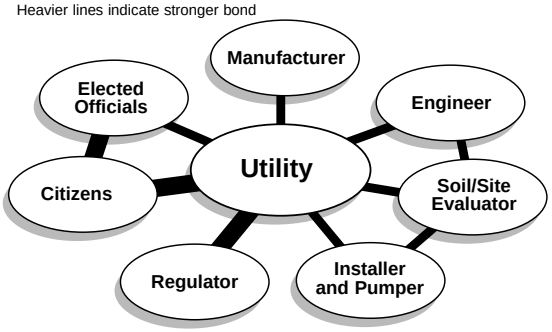
Figure 2: Onsite Systems Under a Utility Model

Heavier lines indicate stronger bond



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can offer value-added services when needed. Manufacturers of onsite systems can also be assured that their products will be installed and operated in a professional manner on a permanent basis.

Redefining the Roles

Only a utility company (public, private, or some combination) can correct the situation we currently face with onsite systems. Today, a regulatory agency is in the middle of everything we do in the onsite industry (Fig. 1). In most states, a health department, state or local, is given the task of regulating the installation of onsite systems, mainly septic systems. Most of the resources of the regulatory program are allocated to pre-installation issues such as soil/site evaluation and review of engineering work submitted by the private sector. The performance of the system is taken for granted and there is no monitoring of the system's performance or the system's impact on the environment.

With the advancement in technologies for individual home wastewater treatment and disposal systems, it is time for the regulatory programs to shift their emphasis from pre-installation to post-installation issues. It is time for the regulatory programs to move away from dictating where people can live, how many bedrooms they can have in their house, how many seats they can have in a restaurant, or what kind of wastewater system they need. We need instead to put a utility in the middle (Fig. 2) that is licensed to offer wastewater services in a cost-effective and environmentally sound manner.

Pre-installation work needs to be handled by a utility that is licensed by the appropriate regulatory agencies to offer wastewater services to the citizens who do not have access to a centralized sewage system. Such a utility must consider an onsite system that discharges at least secondary or better than secondary quality effluent into the environment, and move away from using a conventional septic tank drainfield system. The regulatory agency then can focus on monitoring the performance of the wastewater systems and the environmental impact of the systems.

If and when needed, the utility may be asked to upgrade the systems that are operating in its service area to meet higher environmental standards. I don't see this happening, however, if the utility starts with an onsite system that uses a media filter or an aerobic treatment unit to achieve advanced treatment and a shallow trench, drip, spray, filterbed, or evapotranspiration type system for adequate dispersal of treated effluent.

Helping the Onsite Industry

A utility company can also help the onsite industry to adequately "weed out" wastewater technologies that are poorly designed or manufactured. At present, there is no mechanism that can measure the long-term performance of small wastewater treatment and disposal systems. A utility company that is responsible for acquiring, installing, and operating a wastewater system in a manner that will meet the necessary performance standards in a cost-effective way will always strive for the best possible technology. Such a company will have an interest in looking at a system's ability to meet performance standards and achieve customer satisfaction and at its long-term cost. Only with such a company can the onsite industry really judge the true potential of the variety of systems manufactured by different companies at present.

Serving the People and the Environment

A utility company can also educate people about the environmental impacts of wastewater and about the importance of reuse or recycling of adequately treated wastewater. There is tremendous interest in the use of environmentally friendly systems and the reuse of treated wastewater. One must, however, realize that improperly managed wastewater systems can create environmental and public health problems. Only under a proper management frame- work can people have access to environmentally friendly, advanced wastewater systems.

A utility company can also help people get the best possible wastewater system at the least possible cost by acquiring products and services in quantity. Today, most people who apply for an onsite system permit (typically to a health department) get most of the pre-installation services such as soil evaluation and design from the health department employee, a sanitarian. These employees are trained on only one type of onsite system—a septic tank drainfield system.

When it is determined, however, that the soil and site conditions are not suitable for septic tank drainfield systems, the homeowners are asked to retain the services of the private sector for the use of alternative systems and are asked to purchase the products and services necessary to install those systems. Thus, the current regulatory system is the main reason why there are so many septic tank drainfield systems in the country and so few alternative systems that treat wastewater to secondary standards or better before discharge.

The onsite industry needs to get serious with the current approach in which regulators can "sell" one type of onsite system—a conventional septic tank drainfield system. This approach creates a situation where companies that manufacture packaged treatment and dispersal systems have to compete with government employees who are authorized to sell a generic system. At the same time, the regulatory agency is not held responsible for the long-term consequences on the environment or public health from the operation of the systems that it asks to be used. As one can see, this is not a good approach by any means.

If, however, a utility is allowed to offer wastewater services to people, I believe the onsite industry will definitely benefit in terms of offering well engineered, advanced wastewater treatment and disposal systems that can protect public and environmental health on a permanent basis in a cost-effective manner.

Long-Term Cost

As I indicated in my previous article (see Spring 1999 *Small Flows*), there are a number of companies in the market offering a variety of onsite treatment and disposal technologies. It is hard, however, for the public to really evaluate which system may be suitable for their situation. A wastewater system has two types of costs: capital cost (the cost of getting a system installed), and operating cost (the cost of power to operate the system and the cost to maintain it). Some systems may be less expensive from a capital cost point of view but may require high operation costs, whereas some may be the other way around. It is important for the homeowner to consider the long-term cost of the system.

Typically, however, homeowners or developers are not interested in the long-term cost of a wastewater system because they may not use the system on a long-term basis. Thus, only the utility that is required to operate the system on a permanent basis can really judge the true cost of a wastewater system. An onsite wastewater system, just like a centralized system, must be for a structure that it serves and not for the people who live in that structure or use the structure for commercial purposes.

I believe that under a utility model, the cost of offering wastewater services using onsite systems will be no different than what is typically charged to people who have access to a central sewer system; it may be even less. It is important however, to keep in mind the fact that most centralized systems are subsidized by public funds. During the Construction Grants Program in the 1980s, billions of dollars were spent to subsidize the construction of centralized collection and treatment systems. Therefore, one must look at the real cost of connecting to a centralized system and not the subsidized cost.

Under a utility model, I believe that a residential onsite system could be made available to individual homeowners for less than $20,000 in construction cost with an operating cost of less than $8 per thousand gallons of usage.

Regulatory Changes Needed

The process that could establish such a utility model in a state must start with changes in legislation. Most importantly, we need legislation that sets a time frame to phase in the use of appropriate onsite systems under the utility model and to phase out the use of conventional septic tank systems.

technology

Bag Dewatering: Technology for Small Treatment Plants

by M. Caigan McKenzie
NSFC Staff Writer

Editor's Note: Part of the mission of Small Flows *is to report on new or innovative technologies. The National Small Flows Clearinghouse (NSFC) does not recommend specific manufacturers, and recommendation is not implied by mention in a* Small Flows *article. We would like to hear from manufacturers not already in our Manufacturers and Consultants Database as future sources of data.*

If your water or wastewater treatment plant is small (e.g., average daily wastewater flow less than 200,000 gallons), a bag dewatering and disposal system could save you maintenance, energy, and money.

Available through Envirodyne Systems, Inc., in Camp Hill, Pennsylvania (a developer of the bag dewatering and disposal system), this system uses gravity to dewater biosolids and has only three moving parts—the sludge pump, polymer pump, and polymer mixer. With the assistance of Mother Nature, the bagger achieves high performance without the auxiliary vacuum or pressure devices needed with other dewatering systems. Envirodyne offers three models: a six-bag, eight-bag, or 10-bag unit.

According to Robert Sheker, a systems engineer with Envirodyne, operator time for this system is minimal. Sheker says, "All the operator needs to do is take off the previous day's bag, tie it with a steel tie just like you would tie a garbage bag, and stack it outside. Every other day, the operator makes a new batch of polymer and pushes the start button. The system is designed to be semi- automatic and does not require continuous operator attention during the dewatering operation."

How the Dewatering and Disposal System Works

After polymer conditioning, biosolids are placed in a gravity drainage unit that is open at the top to simplify cleaning and maintaining the system. The slurry is then continuously dewatered as it falls into one of the bag chambers. Water drains through the woven material from which the 23-gallon bags are made and is collected and returned to the head of the plant.

Each automatic operating cycle typically includes a one- to two-hour fill period followed by a one- to four-hour additional gravity drainage period and produces approximately 22.5 pounds of dry biosolids per bag.

Using a modified-fork dolly, only one person is needed to disconnect the bags and stack them on pallets for further dewatering. Once the bags are stacked outdoors, natural evaporation from within the bags increases the solids content to as high as 40 to 60 percent.

Water is collected in woven, 23-gallon bags. Each bag holds approximately 22.5 pounds of dry biosolids. (Photo courtesy of Envirodyne Systems, Inc.)

Bagger System Calculations

Sheker's design basis is: aerobically digested sludge type, production rate of 50 pounds of dry solids a day, and concentration of one percent.

The design calculations include the monthly solids loading rate, the monthly bag processing requirement, the dewatering cycles required per month, and the cost comparison.

Sheker provides the following calculations for a typical sludge bagger system for a small wastewater treatment plant:

Monthly Solids Loading Rate Calculation

50 lb. d.s./d x 30 days/mo
= 1,500 lb. d.s./mo.

1,500 lb. d.s./mo ÷ 0.01 ÷ 8.34 lb/gal
= 17,986 gal./mo.

Monthly Bag Processing Requirement Calculation

1,500 lb. d.s./mo. ÷ 22.5 lb. d.s./bag
= 67 bags a month

Dewatering Cycles Required per Month

- Model SBS-6 All-American™ Sludge Bagging System
  67 bags a month ÷ 6 bags a cycle
  = 12 cycles a month
- Model SBS-8 All-American™ Sludge Bagging System
  67 bags a month ÷ 8 bags a cycle
  = 9 cycles a month
- Model SBS-10 All-American™ Sludge Bagging System
  67 bags a month ÷ 10 bags a cycle
  = 7 cycles a month

Cost Comparison

Model SBS-6 All-American™ Sludge Bagging System
Budget Monthly Operating Costs

- Labor: 13 hrs./mo. x $15/hr.
  = $195
- Polymer: $4.50/lb. x 8 lb. poly/ton d.s. x 1,500 lb. d.s./2,000 lb.
  = $27
- Bags: 12 cycles/mo. x 6 bags/cycle x $1.50/bag
  = $108
- Electricity
  = $10
- Hauling: 12 cycles/mo. x 6 bags/cycle x 50 lb./bag x $50/2,000 lb.
  =$90
- Total Budget Monthly Operating Cost: **$430**

Budget Annual Operating Cost:
$430 x 12
= $5,160
Budget Capital Cost
= $30,000 (plus $24,000 for optional trailer-mounted system)

Model SBS-8 All-American™ Sludge Bagging System
Budget Monthly Operating Costs:

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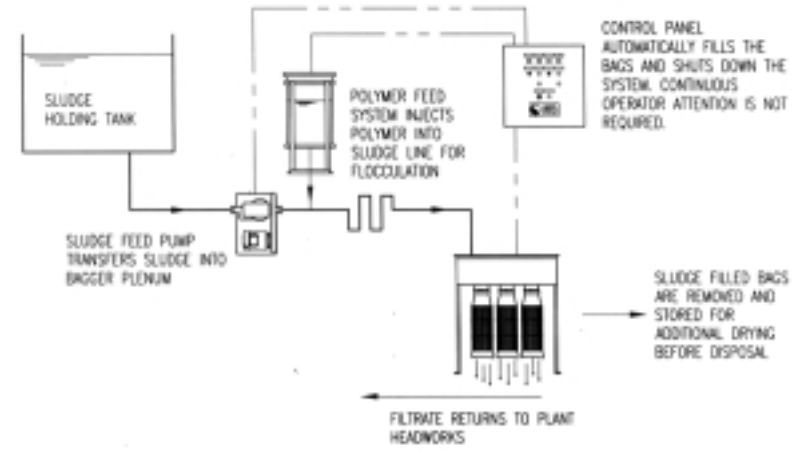
Sludge Bagger System



Overview schematic of Envirodyne's sludge bagger system, tracing the dewatering process from the holding tank to the bag chambers. (Schematic courtesy of Envirodyne Systems, Inc.)

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- Labor: 10.5 hrs./mo. x $15/hr. = **$158**
- Polymer: $4.50/lb. x 8 lb. poly/ton d.s. x 1500 lb. d.s./2,000 lb. = **$27**
- Bags: 9 cycles/mo. x 8 bags/cycle x $1.50/bag = **$108**
- Electricity = **$8**
- Hauling: 9 cycles/mo. x 8 bags/cycle x 50 lb./bag x $50/2,000 lb. = **$90**
- Total Budget Monthly Operating Cost: **$391**

Budget Annual Operating Cost: $391 x 12 = **$4,692**

Budget Capital Cost = **$32,000** (plus $24,000 for optional trailer-mounted system)

Model SBS-10 All-American™ Sludge Bagging System

Budget Monthly Operating Costs:

- Labor[1] : 9 hr./mo. x $15/hr. = **$135**
- Polymer: $4.50/lb. x 8 lb. poly/ton d.s. x 1,500 lb. d.s./2,000 lb. = **$27**
- Bags: 7 cycles/mo. x 10 bags/cycle x $1.50 bag = **$105**
- Electricity = **$7**
- Hauling: 7 cycles/mo. x 10 bags/cycle x 50 lb./bag[2] x $50/2,000 lb. = **$88**
- Total Budget Monthly Operating Cost: **$362**

Budget Annual Operating Cost: $362 x 12 = **$4,344**

Budget Capital Cost = **$34,000** (plus $24,000 for optional trailer-mounted system)

Sheker says that for the above example, Envirodyne would recommend the SBS-10 since in this case it would have the lowest life-cycle cost and the most reserve capacity.

Additional Cost Savings with Mobile System

For an even greater cost savings, the sludge bag dewatering and disposal system can also be purchased as a trailer-mounted unit. The portability of this unit enables plants with a common owner in close proximity to each other to share the costs of the unit. Or, if a plant chooses, it can rent the unit out as a source of revenue.

A trailer-mounted unit is a good choice for a plant in a flood plain, since the unit could be easily moved to protect the equipment when water rises.

What Plant Operators Say About the Bag Dewatering and Disposal System

Steve Fletcher, plant superintendent at BCI Municipal Authority in Coalport, Pennsylvania, has used the sludge bag dewatering system since 1995. "The bag dewatering system is perfect for our flow of 100,000 gallons a day," said Fletcher. "When we used the small sludge press, we bagged by hand eight hours a day. With the bagger system, we have reduced that to two and one-half hours a day. And the bagger system doesn't require the operator to be there to babysit it like the sludge press did. With the bagger, you just check the texture of the sludge to see if it's a good mix. If it's not, just adjust the polymer or pump setting. It's simple."

The sludge bag dewatering and disposal system is also available as a trailer-mounted unit for easy portability. (Photo courtesy of Envirodyne Systems, Inc.)

When asked why the bag dewatering system was chosen over other systems, Fletcher said, "We looked at the simplicity of maintenance. It has fewer moving parts, so the chance of a breakdown is reduced. It's virtually maintenance free, economical, and compact. Plus, if we ever increase our flow to 300,000 gallons a day, all we need to do is to add another bagger. It's easy."

Mick Plumley, chief operator at Culloden PSD in Culloden, West Virginia, shares many of Fletcher's views about the bag dewatering system. Culloden handles a 200,000-gallons-a-day flow. Before converting to the bag dewatering system, Culloden used drying beds.

When asked about the difference between drying beds and the bag dewatering system, Plumley enthusiastically endorsed the bag dewatering system. "The drying beds were too much work to clean and maintain," Plumley said. "We've cut our time in this area by at least 30 percent. As for operator time needed to monitor the system, we've cut that by 60 to 70 percent using the bag dewatering system. This system is priced reasonably, and customer support for this system is superb."

For more information on sludge dewatering systems, contact the NSFC at (800) 624-8301 or (304) 293-4191 and ask for a search of companies in the Manufacturers and Consultants Database. If you would like to list your company with the NSFC, contact the Manufacturers and Consultants Database manager.

For more information on the bag dewatering and disposal system, write to Robert Sheker, P.E., Envirodyne Systems, Inc., 50 Utley Drive, Camp Hill, Pennsylvania 17011; call (717) 763-0500; or fax (717) 763-9308.

[1] Labor estimate includes bag handling, polymer make-up, general maintenance and cleanup. Operator performance will impact actual time.

[2] Bag weight is based on 45 percent cake solids after bag storage. Typical cake solids after 120-day storage is 40 to 50 percent.

The inside of a trailer-mounted unit. The chemical feed is in the background and the bag units are on either side. (Photo courtesy of Envirodyne Systems, Inc.)

Abbreviations

lb.	*pound(s)*
hr.	*hour(s)*
d.s.	*dry solids*
d.	*day(s)*
mo.	*month(s)*
gal.	*gallon(s)*
0.01	*one percent solids*

events

1999 Calendar of Events

If your organization is sponsoring an event that you would like to have promoted in this calendar, please send information to the Small Flows *editor at the address printed in the staff box on this page.*

July

Southern Illinois University Rivers Project
by National Science Foundation
July 18–23
Chicago, Illinois
(618) 650-3788

Texas Water Quality Association Annual Meeting
by Texas Water Quality Association
July 22–24
Kerrville, Texas
(512) 479-0425

The FEMA National Flood Insurance Program
by American Society of Civil Engineers
July 23
Anaheim, California
(800) 548-2723

ASCE-CSCE Conference on Environmental Engineering
by American Society of Civil Engineers and Canadian Society of Civil Engineers
July 25–28
Norfolk, Virginia
(800) 548-2723

Intermountain States On-Site Wastewater Treatment Symposium
by Utah On-Site Wastewater Treatment Training Center, Utah Water Research Laboratory, and Utah State University
July 27–29
Utah State University in Logan
(435) 797-3159 Fax:(435) 797-3663
siverson@cc.usu.edu

August

South Atlantic Well Driller's Jubilee
by South Atlantic Well Drillers
August 1–3
Myrtle Beach, South Carolina
(540) 740-3329

Southern Illinois University Rivers Project
by National Science Foundation
August 1–6
Edwardsville, Illinois
(618) 650-3788

1999 Adirondack Waterfest
by Washington County Soil and Water Conservation District (SWCD), Saratoga County SWCD, and the Greater Adirondack Resource Conservation and Development (RC&D) Council
August 3
Fort Hardy Park, Schuylerville, NY
(518) 623-3090—Marc Usher of the Greater Adirondack RC&D Council
(518) 885-6900—Doreen S. Clemens at Saratoga County SWCD
(518) 692-9940—Laurie Deyoe at Washington County SWCD

Southern Illinois University Rivers Project
by National Science Foundation
August 8–13
Tremont, Tennessee
(618) 650-3788

Florida Septic Tank Association's 26th Annual Convention
by Florida Septic Tank Association
August 19–21
Daytona Beach, Florida
(904) 454-4030

AIM/New York Onsite Wastewater Association Conference
by Association for Installers and Manufacturers
August 26–28
Binghamton, New York
(502) 369-9836

September

AIM Regulators Training Conference
by Association for Installers and Manufacturers
September 9–11
Ft. Wayne, Indiana
(502) 369-9836

"Tools for Productivity"
by The Indiana Association of Realtors
September 15–16
Indianapolis, Indiana
(317) 571-5600—Jon Hiler
jhiler@in.net

89th Annual Convention and Trade Show
by Ohio Association of Realtors
September 16–18
Columbus, Ohio
(614) 228-6675 ext. 116

International Public Works Congress and Exposition
by American Public Works Association
September 19–22
Denver, Colorado
(800) 988-9218

10th Northwest Onsite Wastewater Treatment Short Course and Equipment Exhibition
by University of Washington Department of Civil and Environmental Engineering and Washington State Health Department
September 20–21
Seattle, Washington
(206) 543-5539 Fax:(206) 543-2352
uw-epp@engr.washington.edu

1999 Water Resources Conference
by American Water Works Association
September 26–29
Norfolk, Virginia
(303) 347-6203

The FEMA National Flood Insurance Program
by American Society of Civil Engineers
September 29–October 1
Ft. Meyers/Sarasota, Florida
(800) 548-2723

AIM/Mississippi Onsite Wastewater Association Conference
by Association for Installers and Manufacturers
September 30–October 2
Vicksburg, Mississippi
(502) 369-9836

October

WEFTEC '99: 72nd Annual Conference and Exposition
by Water Environment Federation
October 9–13
New Orleans, Louisiana
(800) 666-0206

15th Annual On-Site Wastewater Treatment Conference
by North Carolina State University and North Carolina Department of Environment and Natural Resources
October 19–21
Raleigh, North Carolina
(919) 513-1678-Joni Tanner

Construction Business and Technology Conference and Expo/JLCLive West '99
by Journal of Light Construction
October 22–23
Las Vegas, Nevada
(802) 456-7470

Wisconsin Wastewater Treatment Plant Conference
by Wisconsin Wastewater Operator's Association, Inc.
October 27–29
Stevens, Wisconsin
(414) 524-3630

The National Small Flows Clearinghouse, established by the U.S. Environmental Protection Agency under the federal Clean Water Act (CWA) in 1977 and located at West Virginia University, gathers and distributes information about small community wastewater systems. *Small Flows* is published quarterly.

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WestVirginia University

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Oregon Seeks Improved Onsite Septic Systems

The Oregon Department of Environmental Quality (DEQ) and Deschutes County, Oregon, will purchase up to 40 innovative onsite septic systems in La Pine, Oregon.

The Oregon DEQ, in partnership with Deschutes County, is the recipient of a major U.S. Environmental Protection Agency (EPA) grant ($5.5 million) to implement a National Decentralized Community Wastewater Demonstration Project.

A total of $10 million in federal funding has been appropriated for planning and construction of innovative, advanced onsite and community or cluster wastewater treatment systems, creation of management and maintenance programs, and monitoring and evaluation of impacts.

Two other sites included in the project are Warren, Vermont ($1.5 million) and Block Island/Green Hill Pond, Rhode Island ($3 million). The Capacity Development Project will assist in coordinating and providing technical assistance to these and other national demonstration projects.

The Congressional intent is "to help 'jump start' the process of technology transfer of various decentralized wastewater treatment options." The proposed project in La Pine focuses on reduction of nitrate pollution from septic systems.

A major objective is to field-test the performance of various promising technologies for removing nitrates from septic systems and monitor operation and maintenance of these systems. Successful systems will be recommended for statewide and national adoption as effective preventive measures to protect water quality.

La Pine is a community of approximately 12,000 people located 25 miles south of Bend in central Oregon. The region has a cold, high-desert climate with prolonged freezing periods. Within the area, there are approximately 13,000 lots that may be served by septic systems. Of these, 6,000 are developed and 7,000 are vacant. At least 1,800 lots have water tables two feet or less below surface. Many lots with individual septic systems and domestic wells have highly permeable soils overlying a shallow aquifer that is used as the drinking water source. These lots are seen as increasing threats to the water quality in the La Pine area.

What They Are Looking For

Systems need to be proposed that have advanced denitrification capability and meet certain performance standards. Sites in the area of La Pine will be selected by the county and state that meet minimum requirements for installation of onsite septic systems as specified under Chapter 340—Divisions 71 and 73 Oregon Administrative Rules.

Systems will be constructed and installed by the manufacturer or designer according to documented specifications and procedures. Moreover, each vendor will be required to provide an operation and maintenance manual that can be followed by the home or facility owner.

Expected System Performance

Experimental systems will be selected for field testing that meet or exceed the following effluent quality at discharge to the soil absorption system:

- Total nitrogen concentration ≤ 10 mg/L
- BOD_5 ≤ 10 mg/L
- TSS ≤ 10 mg/L
- Fecal coliform and *E. coli* levels ≤ 2 orders of magnitude organisms/100 ml

Claims for achieving the above performance standards need to be substantiated by relevant laboratory/field data, specification of localities and use conditions under which such data were obtained, and identification of the testing entity. Preference will be given to existing independent, third-party evaluation. Systems will be monitored up to a period of three years before any final recommendations are made to EPA.

Proposals Sought

A complete proposal must include the following documents:

- letter of intent to participate in the experimental system trials,
- explanation of system design with emphasis on scientific or engineering principles,
- field and laboratory data documenting performance of the system,
- identification of the party responsible for providing the materials, labor, and supervision of the installation at each site representing the manufacturer or designer,
- engineering plan(s) ready for review,
- material and labor costs,
- retail price,
- operation and maintenance costs,
- delivery and installation time from purchase order,
- operation and maintenance manual or instructions,
- the responsible person accessible locally or on short notice for trouble-shooting, and
- manufacturer warranty for the system.

Evaluation of Proposals

In addition to system performance, other criteria for system selection will include, but not be limited to, initial material and labor costs, ease of maintenance and related costs, and operational track record at each site. DEQ and Deschutes County will review complete proposals, make the final selections, and reserve any and all rights to make the final determination. Vendors not chosen to participate will not be given opportunity for further review or appeal.

Istallations Sought in Summer 1999

DEQ and Deschutes County intend to purchase up to 15 systems to be installed during the current construction season, which normally runs from June to October. Additional systems will be purchased and installed in the summer of 2000. Complete applications will be processed in the order received. This year, the project is dependent upon receiving EPA funding necessary for implementation. Upon receipt of funding, some systems will be installed this construction season. Interested parties need to apply as soon as possible to be included in the 1999 phase of the project.

The DEQ representative of the Technical Review Committee can be reached at (503) 229-5858 for further inquiries.

Complete proposals should be furnished to Onsite Program, Attention: Technical Review Committee, La Pine National Demonstration Project, DEQ, Water Quality, 811 SW 6th Avenue, Portland, OR 97204.

NETCSC Sponsors Installer Training in West Virginia

The National Environmental Training Center for Small Communities (NETCSC) is teaming with the West Virginia Bureau for Public Health to provide sewage system installer training in West Virginia.

"NETCSC and West Virginia University's National Onsite Demonstration Project are helping West Virginia increase its capabilities in onsite wastewater management by assisting the state Bureau for Public Health in making improvements in its installer training," said John Hoornbeek, NETCSC training research associate. "There is a need for improved installer training materials, and we hope to take what we are learning in West Virginia and apply it nationally."

NETCSC is assisting the Bureau for Public Health in upgrading its Class II Installer Study Materials and providing support for training deliveries in the state.

Nineteen onsite wastewater professionals attended the first training session offered March 17 and 18, 1999, in Martinsburg. An additional session tentatively is scheduled for September in Morgantown. The two-day training course prepares sewage system installers to obtain their Class II installer certificate.

The training provides information on home aeration units, sand filters, low-pressure dosing systems, mound systems, constructed wetlands, pumps and dosing, as well as other systems and requirements. The Class II Installer Certification Examination is offered at the conclusion of the course.

For more information, call Craig Mains at NETCSC at (800) 624-8301 or (304) 293-4191, extension 5583.

news

First State Regulators Conference Is Well Received

by Colleen Mackne
NSFC Contributing Writer

The National Small Flows Clearinghouse (NSFC) recently hosted the first National Onsite Wastewater Regulators Conference in Saint Louis, Missouri. This is the first time an attempt has been made to bring together the regulators of onsite wastewater systems from all 50 states. The primary purpose was to create a network among regulators for technology transfer and information sharing and to provide an opportunity for regional groups to get together.

Forty-five regulators along with NSFC representatives attended the conference, which began with an "ice-breaker" reception in the evening of April 29, followed by two full-day sessions and a half-day session on May 2. The conference included the following general topics:

- basis of current standards and implementation of performance-based codes;
- alternative technologies and the approval process;
- certification and training;
- the role of advisory boards and the public in rule making;
- onsite management issues and inspection programs;
- data on performance of treatment systems; and
- state updates and future approach.

In preparation for the conference, the NSFC developed a survey in collaboration with Paul Chase from Chase Environmental Services, Inc. These questionnaires were mailed out to all state regulators to seek information about each state's program. Information gathered from the returned questionnaires was used to guide the conference agenda, which included a series of presentations followed by breakout sessions to discuss issues raised by the presentations in a small group format.

This conference was designed with input from regulators to promote an exchange of information and ideas regarding onsite treatment and management. Therefore, the agenda was structured to allow a lot of time for informal discussion. The conference started with a reception to provide a casual atmosphere for regulators to socialize and make contacts with each other.

At the beginning of the first full-day session, Chase presented the results of the questionnaires, stating some of the challenges regulators reported having such as the process for getting technologies approved, political problems and public perception, and dealing with difficult site conditions. The first breakout session then took place to give regulators the opportunity to discuss issues brought out by Chase's presentation.

Forty-five state regulators, along with National Small Flows Clearinghouse representatives, attended the National Onsite Wastewater Regulators Conference, an unprecedented event held in St. Louis, Missouri.

The next presenter was Paul Booher from the Florida Bureau of Water and Onsite Sewage Programs, who gave an illustrated talk on the implementation of performance-based codes. Booher stated that a performance-based approach allows designers great flexibility in onsite system components so long as operational performance parameters are met by the system. Rather than focusing on permit details through a prescriptive process, a performance-based process focuses on results. Florida officials admit that their program is but a first step toward a more comprehensive program that could be developed in the future.

Kevin Sherman from the Bureau of Water and Onsite Sewage Programs for the state of Florida gave a presentation explaining the Capacity Development Project—Incorporating Risk Assessment in Onsite Wastewater Regulations. This program is an effort to address some of the barriers to implementing onsite systems that were mentioned in the U.S. Environmental Protection Agency (EPA) Response to Congress on Decentralized Wastewater Systems.

Three national forum meetings are being conducted by the Steering Committee of the National Decentralized Water Resources Capacity Development Project sponsored by the EPA. The Steering Committee is charged with helping to set a national agenda for funding onsite wastewater research and demonstration projects.

The second breakout session followed this presentation to allow regulators to discuss issues surrounding performance-based codes and the Capacity Development Project.

The second full day of the conference began with a case study on alternative technologies and the approval process. Duke Price presented along with Allen Knapp from the Virginia Office of Environmental Health Services where, in partnership with a private company, they have developed a testing protocol for experimental systems. The protocol would allow systems to be installed in site conditions where conventional systems could not be used. In addition, the pass/fail criteria included in the protocol are fairly stringent in terms of protecting public health and the environment. Data have been collected for approximately three years to determine whether or not to approve a technology called the Puraflo™ peat filter system.

Ken Graber from the Texas Natural Resource Conservation Commission presented a case study on certification and training, noting that one highlight of the program in Texas is that they have tried to educate and regulate all points of the industry. Graber said that there needs to be certification of everyone involved, including the installers, site evaluators, designers, sanitarians, and operators.

The morning of the second full day also included a panel discussion about how state regulators can work together and with what groups they are involved. Some of these groups included EPA Region 1; a workgroup called the "On-Site Wastewater Task Force" made up of the regulatory directors of the onsite wastewater programs in each of the New England states and New York; and the Southeastern Coastal States Onsite Managers Program, which includes a group of regulators from Virginia, Louisiana, Mississippi, Alabama, Georgia, South Carolina, North Carolina, and Florida. Moderated by NSFC Program Coordinator Peter Casey, the panel included Price from Virginia, Doug Ebelherr from Illinois, Tom Groves of Massachusetts representing the New England Interstate Water Pollution Control Commission, and Sherman from Florida.

In addition, Doug Ebelherr from the Illinois Department of Public Health presented a case study on the role of advisory boards and the public in rule making. Using the Advisory Commission on Private Sewage Disposal that has been implemented in Illinois as an example, Ebelherr noted that there is strength in advisory boards for developing regulations because they allow input from a broad base of interest groups such as environmental councils, industry, manufacturers, contractors, regulators, academia, legislators, and the public. In advisory boards, these different groups come together as a cohesive assembly to reach a consensus.

Before and during lunch, two case studies on onsite wastewater management issues and inspection programs were presented by Bob Uebler and Bill Jeter from the North Carolina Department of Environment, Health, and Natural Resources, and Ed Corriveau and Richard Kaintz from the Pennsylvania Department of Environmental Protection.

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Uebler and Jeter discussed one key feature of North Carolina's program, which is that the operators of the systems are all certified. They discussed why management is so crucial, stating that it would not only improve system performance but would allow the use of much more diverse technologies than are being used presently. Proper management would open up possibilities that may not have been previously considered because of the very risky nature of some technologies. If there was the assurance that the alternative systems were being managed and operated properly, regulators would be more willing to consider them, they said.

Corriveau and Kaintz discussed sewage facility management entities for small onsite systems. Kaintz talked about the Pennsylvania Rural Electric Association (PREA), a group that represents customer-owned electric co-op companies who are advocates of rural living and onsite systems. The PREA is interested in being the management entity for inspections of onsite systems.

Kaintz said, "In Pennsylvania, it is hoped that many local governments will create management programs; however, for some municipalities, that may not be feasible. Therefore, a citizen with a system that requires inspections will need to seek out an independent service provider, and we believe that co-ops like the PREA will fill that need."

Using a case study in Carroll Valley as an example, Corriveau discussed how to advance management systems through the use of electric co-ops and other entities. He stated that trust must be developed among all the participants—the regulators, local government, management agency, and homeowner—so they all have confidence that the sewage systems are going to be there as a long-term solution to the wastewater problem.

In the afternoon of the second full-day session, an overview of EPA activities in the decentralized field was presented by Bob Lee from the EPA Office of Wastewater Management Municipal Technology Branch, and Bob Rubin, a professor at North Carolina State University, who is on an inter-agency personnel agreement working part-time with the EPA.

The two discussed the Clean Water Action Plan, EPA's plans to develop voluntary national standards for onsite management programs, and EPA's commitment to technology development and to the long-term operation and maintenance of onsite systems.

Breakout sessions followed presentations on the second day to give regulators the opportunity to discuss issued raised by the presentations.

The third day, which was a half-day session, began with a presentation on the Environmental Technology Verification (ETV) Project and gaining confidence in onsite wastewater technology performance, given by Sherman. The ETV Project is a three-year project that EPA awarded to National Sanitation Foundation International. Their partners include the NSFC, the National Onsite Wastewater Recycling Association, the National Environmental Health Association, and a group of other stakeholders such as Ron Lindsay of the National Ground Water Association and William Anderson of the American Academy of Environmental Engineers.

The conference included breakout sessions such as this one to give regulators the opportunity to discuss in a small group format the issues raised by presentations. Facilitated by Duke Price from Virginia, members of this session were (clockwise from left to right) John Higgins from Massachusetts, David Johnson from Alaska, Allen Knapp from Virginia, Debra Baker from Kansas, Brent Parker from Iowa, Sarah Wells from Kentucky, Roman Kaminski from Wisconsin, Russ Chateauneuf from Rhode Island, Bill Jeter from North Carolina, and Scott Golden from Ohio.

According to Sherman, "Another barrier to implementing advanced technologies in states is uncertainty among regulators as to whether the treatment products can perform as claimed. The ETV Project is a third-party verification process that involves developing a protocol to test a particular product against the claims set for it."

The conference ended with a "parting thoughts" presentation that focused on the question, "Where do we go from here?" Peter Casey, NSFC program coordinator and Andrew Lake, NSFC technical assistance specialist discussed NSFC's role in disseminating information about onsite wastewater systems and how the NSFC can serve as a resource for regulators.

The main highlight of this conference was the networking and discussions that occurred among the regulators during breakout sessions. One point made during the large group discussion was that it can be difficult for regulators to get local people who are actually managing the systems to follow uniform codes because each county does things their own way. There was discussion about the role of the homeowner and the different management entities that are available.

Discussion at the conference also centered on the issue of public acceptance. According to Uebler, "The technologies are there, but we need public acceptance, which boils down to an education issue—educate the homeowner who is ultimately managing the system."

There was also some general discussion among attendees about developing national standards for regulations, but most felt that was not realistic due to regional differences. When asked what could be done on a national level that would have the most positive impact, Uebler said, "It would improve the industry if there was a common standard for licensure of all individuals involved—contractors, installers, etc."

Overall responses to the conference were very positive. Fred Bowers from the New Jersey Bureau of Nonpoint Pollution Control said, "This conference exceeded my expectations. It was great to be here with other regulators from all over the country. I was looking for ideas on how to deal with performance-based systems and got several. I'm leaving with a better understanding of how various states are dealing with these and other issues."

Graber stated, "This was a much-needed conference. I think it's given us a direction on what we need to do next—to see how others' ideas can fit into our program. We as regulators have many things in common, but there are some problems politically that we know we can't solve."

The NSFC is already working to develop a state regulators conference for next year based on feedback from this conference.

Following the conference, a separate stakeholder workshop, sponsored and conducted by the EPA, was held on May 3–4 to discuss the development of voluntary national management standards for onsite/decentralized wastewater treatment systems. These voluntary standards are intended to provide a comprehensive framework for developing local management programs for onsite and decentralized wastewater treatment systems.

Proceedings from the National Onsite Wastewater Regulators Conference are currently being developed and more details will be available in the next issue of Small Flows. To find out more about state regulations for onsite wastewater systems, call the NSFC at (800) 624-8301 or (304) 293-4191.

news

Intermountain States Onsite Symposium Set

An "Intermountain States On-Site Wastewater Treatment Symposium" will be held July 27 to 29, 1999, at Utah State University in Logan.

The symposium will bring together people from Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming to address onsite wastewater treatment issues in these states. The symposium will focus on:

- identifying resources and needs for onsite education, research, regulatory goals, and technology transfer;
- establishing a database of regulations, criteria, use, and performance of onsite treatment technologies in the region; and
- establishing a communication network among interested parties and developing opportunities for sharing information within these states.

The symposium will address areas of needs, opportunities for sharing information, identification of research areas, discussion of outreach activities in each state, and identification of regulatory status and regulatory goals of each state.

Mike Hoover, Ph.D., director of the National Training Center for Land-Based Technology and Watershed Protection and extension specialist at North Carolina State University, will be the keynote speaker. Representatives from the National Small Flows Clearinghouse, the National Environmental Training Center for Small Communities, the National Onsite Wastewater Recycling Association, the Consortium of Institutes for Decentralized Wastewater Treatment, and the Northwest Onsite Wastewater Training Center will make presentations on their supporting roles in the onsite wastewater industry.

The symposium will use roundtable discussion panels with facilitative moderators to summarize onsite needs, issues, and proposals. It is anticipated that the symposium will result in a network of individuals throughout the targeted states for exchange of information and development of collaborative opportunities. A document is planned to be produced that will summarize issues, needs, and potential roles of the interested parties and the status of onsite wastewater treatment in the region.

For more information about the symposium, write to Steve Iverson, Manager, Utah On-Site Wastewater Treatment Training Center, Utah Water Research Laboratory, Utah State University, Logan, Utah 84322-8200; call (435) 797-3159; fax (435) 797-3663; or send e-mail to siverson@cc.usu.edu.

Special Training Center Workshop Scheduled

"An Insider's View of On-site Wastewater Training" will be held August 30 at the National Training Center for Land-Based Technology and Watershed Protection at North Carolina State University in Raleigh, North Carolina.

This special train-the-trainer workshop is designed to help training centers deliver improved onsite system training, enhance their training centers, and make their programs financially self-sufficient.

"This workshop will focus on training program development, marketing, and management. It will provide training materials for onsite wastewater professionals from North Carolina's Soils and On-Site Wastewater Training Academy and serve as a training center 'How-To' primer," said Mike Hoover, Ph.D., training center director.

The workshop will include a special insider's tour of the North Carolina training center and is being held in conjunction with the annual Subsurface System Operator Training School.

The National Environmental Training Center for Small Communities (NETCSC) and the Consortium of Institutes for Decentralized Wastewater Treatment are co-sponsoring the workshop.

NETCSC has developed an operator's manual, trainer's guide, and trainer's resource package, which includes more than 400 slides and overhead transparencies, for operator training that will be available to workshop participants at a special reduced price.

For more information, contact Joni Tanner at (919) 513-1678 or e-mail joni_tanner@ncsu.edu.

Drip Distribution Workshop Planned at National Onsite Conference

The National Onsite Wastewater Recycling Association (NOWRA) will hold a pre-conference workshop on drip distribution on Wednesday, November 2, 1999, at Jekyll Island, Georgia. The limited-attendance workshop will precede NOWRA's 8th Annual Conference and Exhibit on November 3–6. The conference theme, "NOWRA: New Ideas for the New Millennium," will include 46 hours of educational sessions presented by leaders from academia and regulatory and private sector areas of the onsite wastewater recycling industry.

The workshop will be limited to 50 attendees in order to maximize opportunities for discussion. Proceedings of the workshop, including discussion notes, will be available following the conference.

Exhibitor registration and information is available, and conference registration materials will be available in July. Both can be accessed on NOWRA's Web site at *http://www.nowra.org.*

For conference information, phone (800) 966-2942, fax (847) 559-9235, or e-mail 103061.1063 @compuserve.com.

CWA Section 106 Grant Allotment Revision

The U.S. Environmental Protection Agency (EPA) recently announced changes to the formula for allotting funds appropriated under section 106 of the Clean Water Act (CWA) to states and to interstate agencies for administering water quality programs. The section 106 allotment formula was previously based on data more than 25 years old, including population data from the 1960s and data on pollution sources from the early 1970s. Reports of current water quality conditions around the country, provided by states under section 305(b) of the CWA, indicate that the location and nature of the sources of water pollution have changed significantly since the early 1970s. Utilizing the more recent data, EPA revised the section 106 state and interstate allotment formula.

These revised section 106 state and interstate allotment formulas will be effective for Fiscal Year 2000 and beyond. For a copy of the Federal Register Notice, visit *http://www.epa.gov/fedrgstr/EPA-WATER* on the Internet.

North Carolina Launches Soils and On-Site Wastewater Training Academy

The Soils and On-Site Wastewater Training Academy is a comprehensive, coordinated program of professional courses related to soil evaluation and wastewater treatment. It went into operation this May as a program of the National Training Center for Land-Based Technology and Watershed Protection at North Carolina State University (NCSU).

"This is the first time we've tried this," said Mike Hoover, Ph.D., professor of soil science and extension specialist at NCSU and the center's director. "We've done many short courses, but never put them together into a coordinated curriculum. It's a really big undertaking."

The courses are divided into six distinct categories (Septic System Basics; On-Site Wastewater; Soil and Site Evaluation; System Design; Installation and Inspection; and Operation and Maintenance) and are numbered like college courses to indicate the required experience level.

The courses started in May and will continue in 1999 through September. Others will be offered in 2000 and 2001. Most courses include hands-on demonstrations at one of the four onsite wastewater training centers in North Carolina (Raleigh, Greensboro, Plymouth, and Bolivia).

All courses are taught by a skilled team of two to four instructors from NCSU, the North Carolina Cooperative Extension Service, the North Carolina Department of Environment and Natural Resources, local health departments, and/or private industry. All instructors are seasoned professionals.

For more information on courses and registration, contact Joni Tanner by phone at (919) 513-1678, fax (919) 515-7494, or e-mail joni_tanner@ncsu.edu.

Wastewater Information Available on the Web

Editor's Note: There is an ample supply of wastewater-related sites on the World Wide Web. The following sites are only a sample of information that is available. At the time of publication, these sites were current, but due to the dynamic nature of the Web, they may have changed, moved, or disappeared.

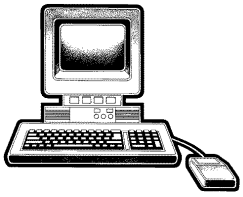
U.S. Geological Survey—Water Resources of the United States
http://water.usgs.gov/
This site is dedicated to providing the hydrologic information needed to best use and manage the nation's water resources. The water data section of this site includes Real Time, Geographical Information Survey data, historical records from the National Water Information System, water use maps, and searchable data by county and watershed. The technical review section includes links to state and local Web sites and United States Geographical Survey contacts. Also featured in this Web site are the Digital Water Resources Investigations Report and the National Water Conditions page.

Ground Water Protection Council (GWPC)
http://gwpc.site.net/
GWPC's mission is to protect water resources for all beneficial uses and to provide independent research about potential sources of groundwater contamination and pollution prevention practices. Various state and federal agencies that deal with groundwater issues, environmentalists, industry, and concerned citizens are included in GWPC. This site lists recent news headlines about groundwater, an ongoing groundwater issues section, and specific topics related to groundwater and underground injection, legislation, and other relevant Web sites.

Spanish Reading Room
http://www.epa.gov/espanol
The Environmental Protection Agency has designed a reading room for Spanish-speaking people and has divided this room into technical and non-technical sections. Each of these two sections is organized by subject, including air, water, solid waste (both hazardous and non-hazardous) pollution prevention, pesticides, and environmental emergencies. This site also provides links to outside organizations that have made treaties and laws available online in Spanish.

Border EcoWeb
http://www.borderecoweb.sdsu.edu
The Border EcoWeb provides public access to environmental information for the U.S.-Mexican border region. A collaborative effort between several educational institutions and the U.S. Environmental Protection Agency, this site contains information on such issues as water resources, the environment, watershed management, and sustainable development along the U.S.-Mexican border region.

Water Online
http://www.wateronline.com
This site is a resource for professionals in the water and wastewater industry. Water Online provides current information on water and wastewater regulations, technology, basic operational elements of the water and wastewater industries, the collection, treatment, and disposal of wastewater, stormwater management, and sludge conditioning and disposal.



Science Traveler International
http://www.scitrav.com/wwater
This site offers a comprehensive listing of activated sludge information. Science Traveler International provides information for the novice as well as for the seasoned professional. The site defines wastewater terms, gives process and modeling information, profiles various municipal treatment plants, provides numerous publications about hazardous wastes and safety issues, sedimentation, sludge dewatering and waste disposal, waste management, nitrification and denitrification, and lists professional wastewater organizations and upcoming events.

Cornell Offers Video on Managing Stormwater Runoff in Constructed Wetlands

America's water continues to be adversely impacted by many sources of pollution.

Modern-day impermeable surfaces, such as roads and parking lots, increase stormwater runoff that accelerates erosion and downstream flooding. This runoff transports contaminants such as sediments, nutrients, road salts, oils, and pathogens to rivers and lakes. According to the U.S. Environmental Protection Agency (EPA), silt and nutrients were the top two pollutants in their last "Assessment of U.S. Rivers."

A new Cornell Cooperative Extension video, *Use of Constructed Wetlands for Stormwater Runoff*, shows developers, natural resource managers, community planners, educators, and the general public how properly constructed wetlands moderate flow extremes and improve water quality. Added benefits include enhanced groundwater recharge, aesthetic appeal, and the creation of wildlife habitat. The 20-minute program shows how wetlands function to reduce pollution, explains appropriate design elements, highlights success stories, and suggests sources of assistance for planning and constructing a wetland.

Funding was provided by the U.S. EPA Section 319 Nonpoint Source Program administered by the New York State Department of Environmental Conservation and the U.S. Department of Agriculture's Renewable Resources Extension Act.

Copies of the video may be obtained from the Cornell University Resource Center, 7 BTP, Ithaca, NY 14850 for $19.95, which includes handling and mailing. New York state residents must add applicable sales tax or provide exempt status.

1999 Training Resources Catalog Now Available from NETCSC

More than 100 helpful training resources are detailed in the *1999 Training Resources Catalog* now available from the National Environmental Training Center for Small Communities (NETCSC).

This new 24-page catalog provides detailed descriptions of the current training packages, training aids, and training-related information available from NETCSC. Topic areas include training packages, NETCSC database searches, environmental management, drinking water, wastewater, solid waste, training, and adult education. Information is also provided on the organization that developed the resource, year of publication, number of pages, type of product, item number, and price for each resource.

To request a free copy of the 1999 Training Resources Catalog, *contact NETCSC at (800) 624-8301 or (304) 293-4191.*

List of Small System Technologies Available from EPA

The U.S. Environmental Protection Agency (EPA) recently released its *Small System Compliance Technology List for the Surface Water Treatment Rule*. The listing provides greater detail than earlier listings on the capabilities, applicability ranges, water quality concerns, and operational and maintenance requirements for compliance technologies.

The listing also includes details on issues identified by EPA and its stakeholders in their review of draft materials.

The list includes information on compliance technologies listed in the original *Surface Water Treatment Rule* and newer technologies that have been approved in the last few years. Newer disinfection technologies include UV radiation and onsite generation. Newer filtration systems include membrane and bag filtration technologies.

The guidance also includes a discussion of emerging technologies and issues for further consideration. Copies of the technologies list may be downloaded from the Internet at EPA's Web site at *http://www.epa.gov/safewater.*

Small Flows

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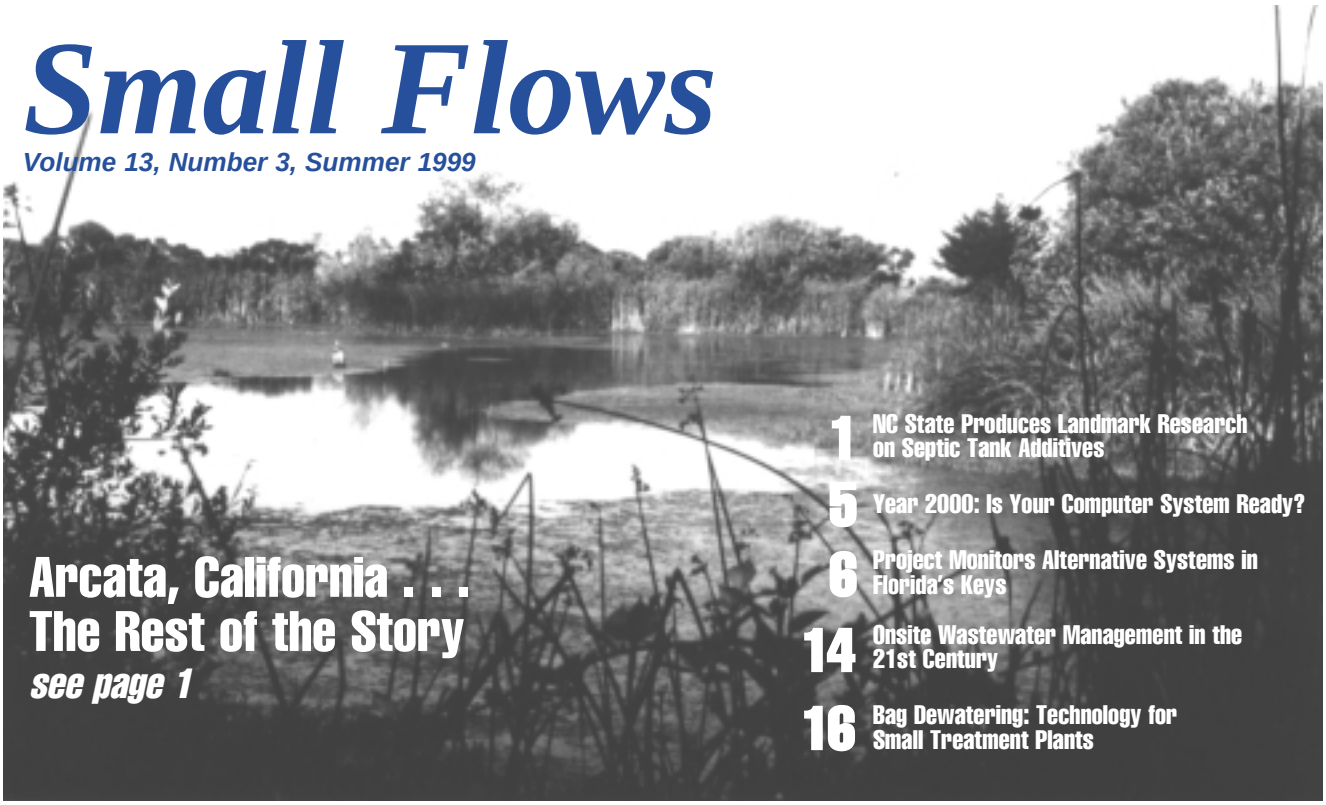

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16 Bag Dewatering: Technology for Small Treatment Plants

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