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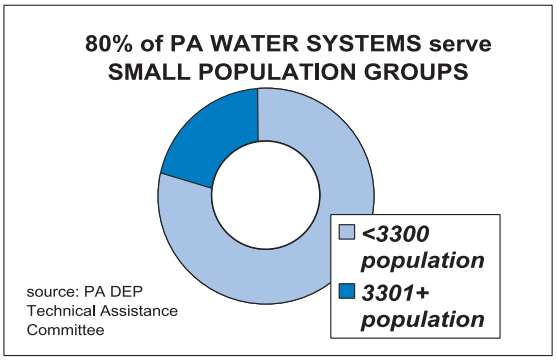
Coaldale Six-Mile Run: Capacity Development Realized

By Thomas W. Essig, Jr., Water Resources Specialist

The author Tom Essig with Vivian Foster, Corporation Secretary/ Treasurer and Judy Wright, Board President

The Challenge

Pennsylvania has 1,941 small drinking water systems serving communities with populations of less than 3,300 people. This represents approximately 80% of all drinking water systems in the state. Their small size is a major obstacle to providing quality drinking water now and in the future. Roughly 25% do not have a licensed operator. Many do not have a capital improvement or equipment replacement fund. Infrastructure is often inadequate to meet new regulations. Often, there is a scarcity of environmental expertise among local leaders and a lack of ability in dealing with complex problems. Moreover, many systems exist in economically depressed areas and have a high number of retired customers living on fixed incomes.



Project Background

Coaldale Six-Mile Run was organized as a municipal corporation in 1969. Each customer is required to pay an initial membership fee of $150.00 and receives a certificate. This entitles the holder to connect to the system and gives them voting rights at the annual organization meeting to select board members. Board members appoint staff positions, set pay scales and enact policy.

Located in the Appalachian Mountain Region of western Pennsylvania, Coaldale has 127 customers and an annual budget of approximately $35,000. Historically, this was a region

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Director's Notes . . .

John McCarthy

It seems like everyone in the water business is talking about Capacity Development these days. It has become the buzz-word for regulators, technical assistance providers and water infrastructure funders. Small community leaders seem to be the target group. Have you ever wondered what this "capacity development" is all about and why everyone wants small town leaders to have it?

We are in the midst of a long-term environmental revolution in America:

- We aim to purify our water and protect it far into the future. Over the past thirty years, changes in wastewater and drinking water laws have increased the standards for clean, safe water. These changes have caused just about every community water and sewer system in America to conduct more extensive water testing, improve technology and increase the quality of water.
- These increased treatment standards require more manpower for oversight and maintenance.
- New source development is growing in cost at an alarming rate and new available sources are becoming harder to find. New source or other infrastructure development for a very small rural community can be the biggest thing affecting them. If done without careful planning and thought, it can cause economic disruption and cause the community to be even more stressed than before.
- Conservation has become a primary focus, from reducing infiltration and inflow (I&I) throughout water and sewer systems to attending to household water management practices.

These steps have come at a cost, especially for the smallest communities across this nation. To install a new or upgrade a replacement water system/waste infrastructure, users have had to increase what they pay for each gallon of drinking water and treated wastewater (which is why conservation and I&I management are so attractive). *These considerations have made it more important than ever for local decision-makers, most of them volunteers, to make wise decisions when committing their communities to new infrastructure spending.* The emphasis on capacity development is at least partly to make sure these leaders understand the value of the infrastructure they oversee and to help prepare them to wisely manage these valuable assets.

Of course it would be one thing if all of this was just a one-time expense and we could look to prices leveling off in the future, but they may not. For one thing, the revolution in water standards isn't over and more regulations and tighter standards may still lie ahead. For another thing, it is already too expensive for many communities to replace environmental infrastructure without financial assistance from federal and state government. All across the country water and sewer systems are currently overdue for replacement.

Federal and state legislators face a kind of double whammy. They know they will have to help these communities pay for today's water and waste system replacements; they also realize that the government is likely to have to pay the tab again thirty years from now when the new systems built today are due for rehabilitation or replacement. This is looking like a real dilemma to many financial people in government. One goal of capacity development is to establish a practice of long term planning among the owners and managers of small community water and waste systems. The hope is to encourage local infrastructure managers to plan for the future by setting adequate user rates and establishing capital replacement funds.

For Rural Community Assistance Program (RCAP) technical assistance providers, the answer may lie in helping communities to achieve a whole range of development goals. As Bill Webb points out in his interview in this issue, RCAPers are finding that community leaders seek to balance water, sewer and solid waste needs with other community goals, including economic development, good schools, affordable housing, transportation and other community facilities. Perhaps, in the long run, building strong communities may be the best way to help rural communities care for their environmental infrastructure.

John McCarthy
Program Director

Coaldale Six-Mile Run: Capacity Development Realized

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where coal was "King", providing employment opportunities in the deep cut coal mines. The bituminous or soft coal was used for home heating and in coke ovens.

Coke is a hard, porous residue left after the destructive distillation of coal; it is used as a reducing agent in the smelting of pig iron and as a fuel. The growth of the steel industry, however, produced a rising demand for metallurgical coke, making it inevitable that coke should be manufactured as a chief product rather than as a by-product. Later, the decline of both the steel and coal industries caused an economic downturn in the region. A year 2000 income survey indicated a 54% low/moderate income level in the Borough. Current employment opportunities exist mainly in the manufacturing sector, and often require a lengthy commute.

The Coaldale water system was designed, constructed, and funded through a Farmers Home Administration (now the Rural Utility Service, RUS) grant/loan package. Coaldale is served by two water sources. One is a well and the other is a creek filtration system. Initially a sand filtration process removes sediment from the raw water. Next the filtered water goes to the chemical building where it is further processed with green sand filters and for turbidity. Finally, it is chlorinated and pumped to a 50,000-gallon storage tank that provides gravity distribution to customers. The high amount of iron sediment that plagues the source water is of major concern. This causes maintenance problems in that the sand filter's upper layers become clogged with sediment and require regular removal of the upper three to six inches of sand. This is very labor intensive, and the specialized sand is costly to replace. The processing equipment and distribution systems are over 30 years old.

Capacity Development helps drinking water systems to analyze their current operations and implement changes to develop into a more viable entity for the future. Technical, managerial, and financial capacity are three broad, highly interrelated components of the water system evaluation.

1. **Technical capacity** *refers to the physical infrastructure of the water system including the quality of water sources, infrastructure (treatment, storage, and distribution) and the technical ability of the operator to keep the system within requirements of the Safe Water Drinking Act.*
2. **Management capacity** *includes ownership, policy formation, staffing, and organization.*
3. **Financial capacity** *involves the financial resources of the water system including budget formation, establishing customer rate structures, fiscal controls and funding debt service obligations.*

Coaldale had to replace filters: Green sand filters remove iron and manganese from drinking water. This filtration is commonly used throughout PA in areas previously subjected to coal mining.

Overcoming Obstacles

RCAP technical assistance in Pennsylvania for RUS projects is primarily financial in scope. Services include budget preparation, assisting with quarterly RUS report preparation, rate tests, and RUS end-of-year reports. With the decline in the coal industry and in the regional economy, delinquent accounts began to encumber the Water Company. The Corporation withdrew from the RUS debt service reserve account, and an additional RUS loan was secured to finance system improvements. Coaldale was heavily leveraged, and it stood essentially one major emergency repair away from a major rate increase or insolvency.

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Coaldale Six-Mile Run: Capacity Development Realized

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Jason Banco, Water System Operator with Tom Essig, Water Resources Specialist

Additional technical assistance is provided on operational and managerial issues that are requested by the project during the financial site visits. A high member turnover, long unproductive board meetings, and a general lack of knowledge in finance, water rules and regulations hampered the board. Certified operators were difficult to find and keep. System leaks were frequent in the distribution system and in customer service connections. The cause of many of the leaks was due to backfilling the trench around the pipe with stone and other materials that were unsuitable for pipe bedding. Often large rocks are found in the immediate area of the leaks. Being a small town, rumors about the water company's finances and water quality issues were often exaggerated within the community. Treatment plant equipment replacement and distribution system upkeep, including meter upgrades, were generally put off due to a lack of money. Annually, the metered water produced was about 6,751,000 gallons while the metered water sold was only 4,486, 000 gallons. This amounts to approximately a 34% water loss rate.

The Solutions

It quickly became apparent that additional revenues were needed to improve Coaldale's financial position. RCAP water resources specialist Shane Bickel recommended a rate re-structuring that enabled Coaldale to bill their customers on a more equitable basis of actual water usage. Expenditures were divided into categories of fixed and variable costs based on an annual basis. Fixed costs included debt service payments, postage, 50% of wages, quarterly reports, leases, dues, consultant fees, analytical testing, insurance, meter reading, printing and miscellaneous items. A 7% cushion for delinquent accounts was factored into the calculation. All customers shared equally in the fixed costs that were established at a flat rate of $15 per month. Variable costs included equipment parts, 50% of wages, chemicals, and utilities. Those customers that used more water would pay more in their monthly bills because a charge of $3.00 per 1,000 gallons of water usage was deemed sufficient to cover variable expenses. This new rate made Coaldale more self-sufficient in their finances, but even greater stability for *future* viability still needed to be addressed. The fire company was not charged for water in the past. However, since they have a banquet facility that they charge a fee to use, it was determined that they should pay for their water. This increased revenue flow and will lower the percentage of unaccounted-for water. Future water needs for fire-training purposes can be drawn from "Dry Hydrants" which are standpipes in ponds or creeks.

During the 2001 budget preparation the author presented a budget with three rate proposals to enable Coaldale to strengthen their fiscal and operational status. The board approved the higher of the proposals, a 33% rate increase raising the flat rate charge to $20 per month, after an RCAP presentation aimed at encouraging capacity development. The additional revenues were to be used to pay off the second loan and are being applied to fully fund the reserve account. Next, a capital improvement fund for system maintenance was established and is being funded by $500 a month. System improvements that year included installing a new chlorinator and turbidity meter, along with the replacement of the filtration sand. Customer meters are being replaced making for more accurate billing.

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RCAP staff have provided technical assistance in developing management capacity by developing job descriptions and by helping to advertise for a licensed operator. The RCAP representative forwards information on Department of Environmental Protection rules and regulations as needed. An RUS requirement for advertising the Equal Rights Notification was solved by stamping the disclaimer on all customer bills and posting it at the Post Office. A local newsletter was even created. "The Water Drops" provides information on recent activities, policy notifications, conservation tips, and makes for overall good public relations. A delinquent account policy was adopted establishing aggressive water shut-offs. This greatly reduced long-term delinquencies. Board meetings were made more action-oriented by developing a minutes packet with pertinent information that is sent out to board members several days in advance of the meetings. This prepared the board better to discuss issues at the next meeting. The former policy of reading the minutes to the board, which usually side tracked the meeting, was eliminated. The agenda is more strictly adhered to.

According to Pennsylvania's RUS Program Director Korah Abraham, *"No-cost technical assistance provided by RCAP and other such sources is very important and can be a lifesaver to many communities similar to Coaldale Six-mile Run. RCAP is not a substitute for the professional engineer or legal counsel. However, an experienced specialist from RCAP can help a community to navigate probably the most expensive project they will ever have through uncharted waters."*

On the Horizon

The more one works with capacity development, the more one realizes that the process is ongoing. A system with true *capacity* is continuously improving its financial and managerial operations as well as improving its performance in providing safe water.

Future technical assistance will be provided in converting the hand ledgers currently used to a computerized program currently being developed by RCAP. System improvements such as expanding the current stream source, new meter installation, control devices, painting the storage tank, and a new chemical treatment building will hopefully be funded by a CDBG grant from the 2000 income survey. A sewer is projected to be developed in the Borough in the next few years.

Coaldale is a close-knit and proud community. This is demonstrated by the large amount of work that is done by community volunteers. Board members went door-to-door for the CDBG income survey. Community members operated the plant when they were without an operator. Over 2,347 pounds of new filtration sand was installed, and an equal amount of old sand removed. A five-man bucket brigade was utilized to shovel out the old filtration sand, wheel barrow it away, and replace it—a very challenging project!

Ms. Vivian Foster, Coaldale Secretary/Treasurer observes, *"I remember, as a young wife and mother, dealing with the difficulties of having little or no water every summer. When our new system was developed, we were all thankful. We are proud of what we have achieved and the fact that our lives are so much better. On behalf of the board and the customers of Coaldale, we are very grateful for the assistance in financial reporting, helpful suggestions and actions of the RCAP staff over the years."*

Capacity Development: Prepare for the Future

by Larry Stepenuck, Senior Water Resource Specialist and Barry Woods, Water Resources Specialist

Larry Stepenuck

Barry Woods

Capacity Development is a simple and effective tool to help public water systems maintain the necessary ***financial, technical*** and ***managerial*** elements that will enable them to comply with the provisions of the Safe Drinking Water Act. These three key elements of system capacity are discussed at length in the companion article appearing in this issue, Tom Essig's *"Coaldale Six-Mile Run Capacity Development Realized."*

If one or more of these key elements is missing, one may end up with a dysfunctional system that fails to meet the requirements of current and future drinking water regulations.

Capacity Development Tools

Many small community systems lack capacity in one or more of these areas. The tools used to address specific impairments of local capacity may include (but not be limited to) self-assessment surveys, operator certification, source water assessment, rate structure reviews, capital improvements, administrative restructuring, water conservation, systematic review of external linkages—and, importantly, the use of qualified technical assistance providers.

Our advice to operators and local officials always begins with this: ***Operate and deal from a self-interest perspective!*** Be proactive and protect your investment. Be prepared and plan for today, tomorrow and the future. Understand and implement the various Drinking Water Regulations. Learn to communicate and cooperate effectively with the respective boards and regulatory agencies. Adopt strategic planning techniques, and take the initiative to identify potential compliance issues and resolve them effectively.

Levels of Capacity

Inadequate capacity is an indicator of a lack of ability to assure compliance with drinking water standards. Operating a system with inadequate capacity may pose a threat to the continuous supply of safe drinking water.

Conditional capacity means that compliance with the majority of drinking water standards may be met, but that deficiencies are present which must be addressed.

Adequate capacity means that the system currently complies with all drinking water standards and regulations, and is expected to continue to do so well into the future. The owners of a system with adequate capacity have clearly demonstrated their willingness and ability to plan for future impacts.

Capacity Development

...simply stated is the planning and implementation that is needed to meet the immediate and long-term challenges facing your community water system.

A SAMPLE MANAGERIAL SELF-ASSESSMENT WORKSHEET

Review, identify and make a self-assessment of the following conditions:

1: Identity and ownership
2: Governing and accountability
3: Staffing and training levels
4: Ethics, moral & legal issues
5: Mission statement or goals
6: Regulations, rules, policies or guidelines
7: Insurance coverage
8: Master plan & contingency planning
9: Management info. system
10: Internal relationships
11: Operating policies
12: Financial resources
13: External linkages
14: Technical assistance providers

Making Project Co-Funding Happen

An Interview with Bill Webb, The Northeast RCAP's Regional Manager in the Great State of New York

We caught up with Bill one morning in the hotel lobby just before a quarterly meeting of Northeast RCAP technical assistance providers. Representing our newsletter From Watershed to Well *is our correspondent and technical editor, Chris Nill (CN).*

Chris Nill

Bill Webb

(CN) We're talking this morning about how to make project co-funding happen, with some pointers from an RCAP master. Bill, I want to ask you, for starters, what do we mean by project co-funding? Why is co-funding sometimes necessary?

(BW) It seems as though there is a trend that has been building over the last 10 years or so. Projects have become more complex in their scope of activities, and much more expensive. It seems now in the current climate for these projects that one funder simply can't provide the necessary funding package to get it done. I think that's basically why we're aiming here to draw more funders in, to get the best possible funding package we can: one agency just can't handle the project alone.

(CN) So it's a way to make complex projects happen.

(BW) It's also interesting that I and most of my colleagues tend to look at a funding [source] with the idea of aiming their funds at a particular aspect of the project. Let's take an example: the village of New Berlin.

Their wastewater project is in excess of $7 million. There's a small residential area surrounding a core business area. We're approaching two funders: USDA through their Rural Development program to help us with funding for the residential area; we hope also to get additional funding from the newly established Governor's Office for Small Cities. Specifically we're going to approach them with the need for the business community in terms of how their funds will help the business community remain viable and in some instances actually grow because there will be a community sewer system in place. So, that's one example of how we try to meld the funds together.

The co-funding initiative actually has a long history in New York. I started working with Diane Perley of the Environmental Facilities Corporation. It was kind of a vision we and other technical assistance providers had probably about seven years ago. We began to see the need for more than one funding source in order to get a project off the ground. And it evolved slowly. In the beginning, I don't think funders were very receptive to the idea. As the years went on and TA providers mainly were able to give more evidence and information that this was a viable activity, they began to warm to the idea and to see that it was to their advantage to mingle their funds with other agencies...to make [the money] spread, if you will, over that many more projects. This appealed to them, at least that's my perception; I don't want to speak for them. They saw that as a reasonable end.

Today in New York we actually have a co-funding committee that consists of representatives of the Environmental Facilities Corporation (representing the clean water revolving fund and the drinking water fund), and USDA through their Rural Development fund. It also involves staff from the Appalachian Regional Commission [ARC] and the Governor's Office for Small Cities, both through their competitive [grant] program and their economic development program.

Some of these funders meet on a regular basis. It's a little more difficult for the Governor's Office and the ARC because of their own rules and regulations and criteria—it's not quite as easy for them to participate. But I'm sensing that there's more give and take lately, and more information being shared in this arena.

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Making Project Co-Funding Happen
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Chris and Bill sharing ideas

*(**CN**) Bill, you've mentioned a couple of major agencies that are out there, but in general what types of funding sources are we dealing with? You mentioned Rural Development, the Governor's Office of Small Cities [in New York]....What others?*

(BW) I think the two major funders involved with water and sewer projects are USDA through their Rural Development fund and then the State Revolving Loan Funds that New York (and most other states) offer for water and for sewer. In New York these are administered mainly through the Environmental Facilities Corporation. There's also the Governor's Office for Small Cities—that is very competitive. That's HUD money. Occasionally we are able to get the Appalachian Regional Commission involved, more in the southern tier of New York and Pennsylvania. It's a small source but it can be the money that makes or breaks a project.

There's also some private funding that we occasionally get from foundations. I'm thinking mostly of the O'Connor Foundation, based in Delaware County. They ordinarily provide funding for the construction phase, but they are also a valuable source for the planning phase, for studies that might be necessary such as engineering studies or hydro-geologic studies.

*(**CN**) I would imagine they would have a priority of funding projects in their geographic area?*

(BW) Yes, they tend to be very geographically specific, but there are other organizations in other areas. Also, we have had considerable success in applying to individual state legislators through their individual member process. Again, [these are] small items: ten or fifteen thousand dollars. It is necessary to get the preliminary studies started, without which you can't make the applications to get the projects going through USDA or state revolving funds…the agencies that will provide construction funds.

I should also mention the US Dept. of Commerce's Economic Development Administration (EDA), which tends to fund one or two large projects a year in New York [and elsewhere]—strictly on the criteria of jobs-created, jobs-retained. Their money is scarce, but if you're doing a big project that's going to bring in an employer, you wouldn't want to overlook that.

*(**CN**) To what extent do these different agencies have different application deadlines and different application requirements?*

(BW) Indeed, they do. In general, we can categorize them as once-a-year activities or "open-window." Once-a-year activities are mainly related to the Appalachian Commission and the Small Cities program. The economic development [money] seems to be an open window, until the money is gone. USDA and the state revolving loan funds are pretty much "apply any time during the year," but that doesn't necessarily mean your application will be acted on [immediately]. They have some of their own internal dates that they have to be aware of.

*(**CN**) Each agency has slightly different documentation requirements as well, don't they?*

(BW) Yes and no. You gather similar demographic information. They want to get an idea of typical household income, whether it be low to moderate…They are required to have environmental assessments, and some legal aspects in place. The problem is that each agency has their own intake forms. For years the TA providers, as well as funders themselves, have been struggling, trying to develop some single intake document that will provide sufficient information for all of the agencies that might be involved in the project. And then they can cull the information and do what they want with it. This would save the community from the frustration of having to make single applications to

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each of the agencies they want to have involved in their project—and waiting what seems like an interminable time for some kind of an answer. That can be very frustrating and this can be a hard one to crack.

We're continuing to work with all the funding agencies. Sometimes in my frustration, I'd like to just lock them in a room and say: "Here's the project; don't come out until you've got an answer!" Obviously that won't work; in my dreams it does, though. It would save the communities time and frustration. It would also save money because each application can be anywhere from three to seven thousand dollars, depending on what the situation is. While that doesn't sound like a lot of money, and in many instances it is a reimbursable item if the project comes to fruition, it's more of a psychological barrier. Each mayor or town board has to face arguments like, what if the project doesn't go through? Then it comes out of every taxpayer's wallet.

*(**CN**) Technical assistance providers from the Northeast RCAP can play a vital role as catalysts to help make co-funding happen. How exactly can RCAP's TA providers help a community in this connection?*

(BW) I think it's important for the communities, at some point in the planning phase, to seek outside assistance. I try to get a meeting together with representatives from each of the funding sources where it seems most appropriate to fund this project. They can sit down from the very beginning and take a hard look at what the project is going to be like and what it's going to cost. We just lay out the project before any applications are in progress. It gives everybody a chance to get on the same page: *Is this a fundable project?* It's an informal meeting. You draw your stakeholders closer together. This is where the TA providers can greatly assist the community, not only at that initial meeting, but in gathering together information and sharing it through a series of meetings. We also contribute by helping prepare the applications.

*(**CN**) What is the most important challenge we'll be facing in infrastructure development in rural America?*

(BW) My current feeling is that communities up to this point have been more reactive than pro-active in their infrastructure thinking. By that I mean they are [often] under a consent order. So they say, "Lets get it done and get out from under this consent order." Instead of saying: "For some reason we're in this pickle, but once we get this particular infrastructure fixed, what might we do with it?" It may be the town's largest asset; people need to look at it as an asset, not as a liability. It is something to build upon through better quality of water—to attract people, or even a small industry.

We had a recent meeting involving communities, regulatory agencies, TA providers, funders—and one of the ideas coming out of that was the message to funders that what they ought to really be thinking about is a fund that would encompass their ability to provide funding not only for infrastructure but for other types of rural development. I see this as the wave of the future: having a community look at their assets and think about their future in terms of 'How can I best use these resources?' and 'What are my community development assets?' We're talking *integrated community development*. This is something we're talking about not only in New York but in other parts of the Northeast. We are giving a lot of thought to outreach to our network of providers, and our experience working the smallest and poorest of the rural communities in our areas. How can we increase activities to serve these needs?

*(**CN**) Bill, I think your insights will help a lot of communities think through their project co-funding strategy in a more rational way. I want to thank you for sharing your ideas with us.*

The Natural History of Your Drinking Water

by Robert E. Morency, Jr., Ph.D., Water Resources Specialist

Robert Morency

Where does your drinking water come from? The simple answer is that all of the water that we use originates as rain, which is trapped temporarily in reservoirs, and then put to use as technology allows. During various times of the year, some of the rain or snow that falls is made available for storage. Storage can take place naturally in either surface impoundments (ponds, lakes, rivers) or underground permeable material, known as aquifers. In addition, storage can take place in the man-made structures, such as reservoirs, cisterns, or tanks of various design. How rain water arrives at the place of storage, and how it moves throughout the natural environment, are the subject of this article.

Water that evaporates to the atmosphere from either the land surface or from bodies of open water, will only stay in the atmosphere for about 10 days, until it falls as precipitation (either rain, hail, sleet, or snow). When air heats up, it has an increased capacity to hold water vapor. As air warms, the molecules spread out, allowing water vapor to fill in the larger space between the gas molecules. Warm air masses, such as those that develop in low latitudes, absorb water vapor, due to the ability of the air to hold the water vapor. When air masses of different origin (tropical vs. polar regions) meet, the warm air is cooled, and thus cannot hold the water vapor as the gas molecules begin to squeeze together. The molecules of water vapor condense, bonding together as they are coalescing into water droplets large enough to fall to the ground.

When rain falls to the ground, a number of things can happen to it. Depending on the condition of the earth's surface where the rain falls, the water will either soak into the soil and then downward to recharge aquifers, or it will flow on or near the surface to rivers and lakes and thus enter the evaporation/precipitation cycle all over again. Strange as it may seem, the driest conditions will inhibit the water from soaking in, promoting runoff, which results in the flash floods that are common in arid or semi-arid regions. Only where there is established vegetation will the ground be able to soak up water into soils that have been conditioned by the vegetation to be soft and absorbent. When the soils have reached their soaking limit, they will either begin to allow further soaking to lower layers (where it is stored as ground water in aquifers), or to allow excess water to begin to run off to rivers and lakes. Sloped surfaces allow runoff, whereas flatter areas (where underlain by sandy soils) allow aquifers to be recharged.

During the journey of a drop of water from a distant body of water through the atmosphere, back to the earth's surface, eventually to an aquifer, and ultimately to your faucet, there are many things that may slow down or stop its progress. In summer, wells and reservoirs become lower despite the rains that occur in a normal year, and especially during drought times. Chief among the factors that cause wells and reservoirs to experience a net loss from storage in the spring and summer is **evapotranspiration**. This refers to the use, by vegetation, of the water that soaks into the soil during rains. The plants make use of soil water in the process of photosynthesis, and a substantial amount (sometimes virtually all) of the precipitation during the growing season goes into supporting plant life. Plants don't use ground water stored in aquifers, except for some desert plants that send long tap roots deep enough to reach the water table. Wells in summer are lowered as ground water moves downhill to either lakes or streams, and they cannot be adequately replenished because of the uptake and use by plants.

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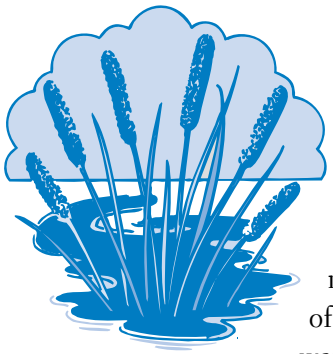

In the autumn when, due to colder weather and diminished daylight, vegetation dies off and plants go dormant, the water that falls can now make its way to layers below the soil, where it collects underground, either in fractures in bedrock, or in pore spaces between sand, gravel, or more tightly-packed material. The degree of permeability of the material in which the water is collecting will help determine its suitability for becoming a source of drinking water, i.e., whether or not it is an aquifer. The thickness of the aquifer, together with the permeability, determine it's **transmissivity**, which is the true measure of how the material will behave when pumped to supply a given amount of water. A source that is adequate for a small water system may not be considered an aquifer for a large municipal system.

In the winter, precipitation falls as snow, ice, or rain. In any case, the recharge of aquifers is slowed due to two factors: the frozen ground and the suspension of the precipitation as snow. The aquifers tend to stabilize, or recharge slowly because any water melting and passing through to lower layers can do so because vegetation isn't using water trapped in the soil. In the Northeastern U.S., the amount of snowpack, and the rate at which it melts is one of the chief factors determining how much water will be available for well withdrawals during the next summer. Higher water levels in the spring increase the flow out of aquifers during the spring. In times of drought, levels can be lowered rapidly in the early season, and may not be replenished as vegetation resumes its demands during the growing season.

How our drinking water is cycled throughout the environment is part of a much longer hydrogeologic cycle, which includes long-term (10,000 years) storage in the oceans, and even longer-term storage (millions of years) in glaciers. The next time you turn on the tap, ponder the fact that what you are drinking may have come directly to you from storage of ten thousand, or even a million years. Then realize that you are about to recycle it again soon, as you release it to the environment again after it has nurtured your life-processes, and carried away your wastes, only to begin the long journey anew.

Maps

By Arthur Astarita, Water Resources Specialist

Arthur Astarita

Source water protection maps have been distributed to water systems by state environmental protection agencies over the past few years. These maps show potential contamination sources within your watershed and source water locations. They can be of great help when performing various types of vulnerability assessment in a community. The recent and ongoing state re-mapping efforts for emergency response 911 are also creating a useful product for public health and safety.

"One picture is worth more than ten thousand words."
Chinese Proverb

These two major projects are having an impact on the way towns and utility systems understand relationships within their borders as well as on how their respective borders interrelate. However, ***these maps are worthless if those within the map borders do not verify the information.*** Remember, people who do not live in the communities are producing these maps with dated information. A map can indeed be worth a thousand words—but *let not the words speak with forked tongue.*

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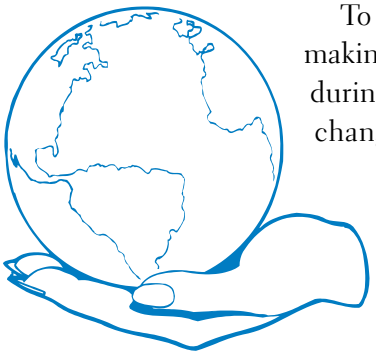
Maps
(cont'd from pg. 11)



To be truly useful, the data used in map-making requires quality checking. Especially during the 911 project, road names are being changed and house numbers are being required. Are these changes actually being incorporated? The town should gather to verify and update the maps. Maps can be useful to trace the town's history: how the residential, business centers and utilities grew, and how the open space was utilized. Maps can preserve the knowledge of employees and supervisors who know where the pipes are buried. Maps can also document the story telling of long-time residents.

Drafting tables and large map storage cabinets are starting to disappear. Replacing them are computer terminals and CD-ROM's. Geographical Information System (or GIS) is a term coined for mapping with the aid of computers. Draftsmen have basically put down their drafting pens and picked up a keyboard and mouse. Instead of using a drafted, cumbersome and somewhat inaccurate, transparent film overlay, GIS can use unlimited digital overlays. The accuracy of these digital overlays can range from a few inches to a few feet depending upon the source of information. Manipulation of various informational layers may reveal relationships not previously contemplated. Hypothetical questions can easily create new maps to visualize and discuss.

Looking at Data: Art Astarita, Mike Pattavina and Hatsy Cutshall, RCAP, Inc.

Requests for a drafted map that once took days or maybe weeks to fulfill now take hours. This new way of mapping provides a way to quickly resolve debate on various levels for decision-makers. It enables documentation of growth patterns and evaluation of emergency response. It also helps with integrated planning and development. Answers to questions can be visualized. The "what if" game can be played quickly, and repeatedly.

A picture is worth more than ten thousand words. In this case, "the picture" is really many pictures transparently overlaid. Once citizens and public officials can stop debating facts, they can begin (virtually) to see the impacts of their thoughts and dreams. Questions can be "tested" prior to public debate. It is a valuable, time-saving technique to visually investigate the financial and managerial impacts of such questions as:

- ? What is the relationship between existing municipal services and future growth?
- ? How do expanding public services impact the tax burden of homeowners in different areas of the community? What is the projected ratio of income versus tax distributed throughout town?
- ? What is the distribution of wastewater disposal fields, private wells, population density, and soils versus lot sizes?
- ? What is the build-out scenario in rural areas with and without public services?
- ? What areas are properly suited for what development types, with respect to existing public services, topography and watersheds? How does that compare to the existing build-out scheme?

Utilities can obtain zoning maps as well as a tax assessor listing of map and lot numbers that includes physical addresses. These can then be related to water, wastewater, and other utility account numbers. Being able to understand where a call originates is part of the emergency response program. In the future, utilities will be able to call addresses in particular areas to notify their customers of problems; this is the so-called "reversed 911" response.

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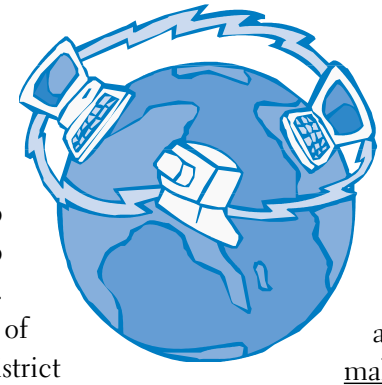

For instance, if a water main breaks, the fastest way for the water district to notify users to boil their water would be to have the computer call them. In the future, with the aid of GIS computers, the water district may be able to take advantage of such efficiencies; so will public safety.

The most difficult parts of using this new technology are 1) gathering the data, 2) verifying the data is correct, 3) purchasing the hardware and software, 4) entering the data into the computer and, 5) training. As with all new routines there is a learning curve, but that should not prevent the data organization or the data verification. If you have accomplished these first two tasks, congratulations!

A good website for general digital mapping information is www.gis.com. Freeware is available to download on this site. Different data viewers are available that allow one to construct maps, print and email them. Certain internet websites provide interactive mapping where you can do the mapping on the website. Sites such as http://factfinder.census.gov/ can map census data; wetland maps can be made on http://www.nwi.fws.gov/, and FEMA's www.esri.com/hazards/makemap.html can help visualize flood hazard areas. All states have websites for their GIS data; some have interactive mapping ability. Although access to some areas on these sites is currently being restricted, registration and password security will become the normal gateway to such areas in the future.

The incorporation of technology in the workplace is being brought to a higher plain; those that have it will pave the way for others to follow. Workers should be trusted and challenged by management to utilize technology to produce a better service. Utilizing computer-generated maps can help with better decisions with a clearer understanding of the impacts. Such tools may help everyone to visualize improvements with a greater public consensus.

Mercury Pollution: How Serious Is It?

By Michael Pattavina, Solid Waste Specialist

Michael Pattavina

Mercury pollution is a serious problem. Many bodies of water throughout the Northeast have fish that are unsafe to eat due to high levels of mercury. Mercury can cause damage to the human brain, spinal chord, kidneys and liver. It affects the ability to learn, speak, feel, taste and move. Mercury in the diets of wildlife can cause early death and the inability to reproduce. In light of these dire health impacts, it is important that we understand how such a toxic substance has become so prevalent in our environment and what we can do about decreasing its impact.

Today, mercury is used in the manufacture of products such as thermometers, thermostats, fluorescent light bulbs, appliances, dental fillings, and pharmaceuticals. Mercury is also present in certain industrial processes, combustion of fossil fuels (primarily coal), production of cement, and medical and municipal waste incineration. But even though it has many useful qualities, mercury is extremely toxic to our health and we must find ways to minimize it in our environment.

When products that contain mercury are discarded, they end up at landfills, incinerators or wastewater treatment plants where the mer-

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Mercury Pollution: How Serious is it?

(cont'd from pg. 13)

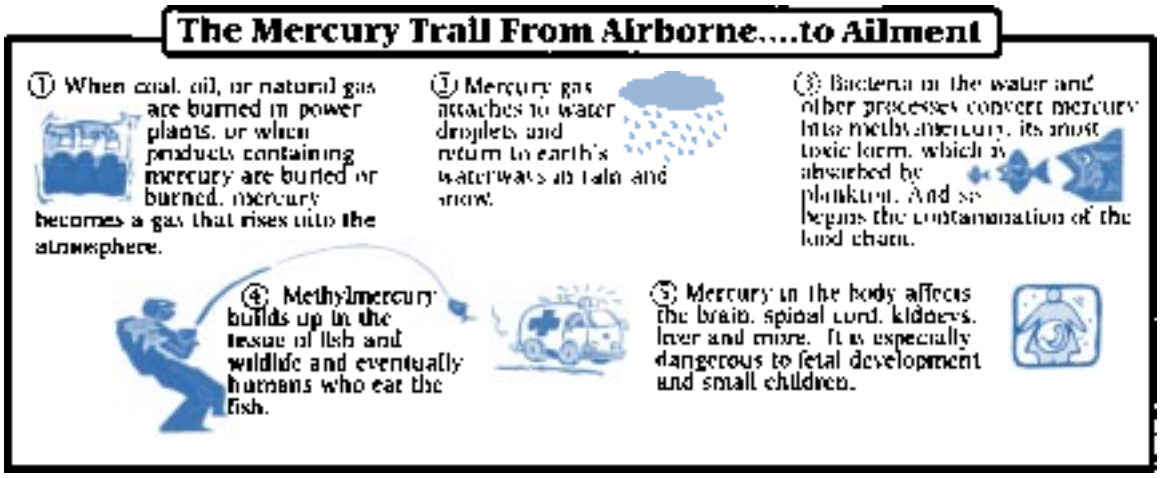
Mercury (Hg, atomic # 80 in the Table of Elements) is a naturally occurring element that is mined from the earth's crust in the form of cinnabar. In a low-tech, simple process, cinnabar has been refined for mercury since the 15th century. It has many properties that are unique: liquid metal at room temperature, expands and contracts evenly with temperature change, exhibits high surface tension, conducts electricity extremely well and kills bacteria and fungi. The hazards of mercury are historical: criminals were sent to the quicksilver mines by the Romans where life expectancy was only three years. "Mad as a hatter" reflected the strange and unpredictable behavior of workers with mercury poisoning who used mercury nitrate in the felting process for the hat making industry.

cury can enter the environment. Not all forms of mercury are toxic, but once released into the environment all types of mercury pollution can lead to the formation of the extremely toxic methyl mercury. It is this form of mercury that can harm humans and wildlife. Once released into the environment, mercury persists for long periods of time and does not degrade into harmless chemicals. Mercury can have local impact or be carried across whole continents by the wind. Even remote ponds and lakes may be polluted with mercury. This problem has prompted the New England Governors and Eastern Canadian Premiers to adopt a regional mercury action plan that has spurred many aggressive actions to reduce mercury pollution. Massachusetts is implementing its Regional Mercury Reduction Plan by reducing mercury in hospitals, establishing mercury-bearing products collection programs, pursuing mercury labeling and mercury-bearing product "take back" legislation. In addition, Massachusetts has a goal of reducing mercury received at combustion facilities by 50 percent through source separation efforts by the end of 2003. (Percent reductions will be calculated from baseline inlet tests conducted in 1999.)

Northeast RCAP solid waste specialists are assisting rural communities in implementing their own municipal mercury collection programs. The Franklin County Solid Waste Management District in Massachusetts has pioneered the collection of mercury from household appliances at small municipal transfer stations. Municipal training programs now exist to identify and capture mercury from household sources. The Town of Greenfield, MA has enacted a mercury bylaw and, with technical assistance from RCAP, has conducted a mercury thermometer swap program that collected hundreds of mercury thermometers.

Summary of Approaches for Decreasing Mercury Impacts

- Mercury must be managed at regional levels to eliminate damaging releases into the atmosphere;
- Knowledge of the presence of mercury is key to success in capturing the toxic material via pollution prevention programs;
- Labeling of mercury-bearing products is important in order to identify the material for proper disposal;
- Risk education concerning potential exposure of workers to mercury must become part of worker health and safety programs;
- Education to consumers and producers of mercury-containing products is essential.



Source: Center for Ecological Technology

Common Mercury Containing Items

Household Products

- Variety of household cleaners and products
- Medical products
- Skin creams
- Thermometers
- Religious objects
- Ice fishing tip up lamps
- Electric organs
- Pesticides (crab grass killers, fungicides)
- All fluorescent light bulbs
- High intensity discharge (HID) lamps
- Old toys
- Grandfather clock weights

Appliances

- Flame sensors, safety valves for gas ranges, gas wall ovens, gas dryers, gas refrigerators
- Tilt switch for spin cycle shut-off in washing machines
- Tilt switch for light in lid of chest freezers
- Relay switch in some refrigerators, freezers, and humidifiers

Automotive and Marine

- Tilt switch in hood and trunk lights
- Anti-lock brake systems in some vehicles
- HID headlights
- Automotive security systems
- Tilt switch in some bilge pumps
- Safety shut off switch in some outboard motors

Batteries

- Mercuric oxide batteries (used primarily in hearing aids, cameras, light meters, and watches

Gauges

- Blood pressure gauge
- Farm manometers
- Old gas light systems

Heating and Cooling Systems

- Flame sensor/safety valves (gas: space heaters, boilers, furnaces, air conditioners)
- Thermostats for heating and air conditioning
- Heat pumps and evaporative coolers

Tilt Switches

- In silent wall switches
- In heating/cooling thermostats
- In automatic shut-off steam irons
- In some cellular/portable phones
- In cover of some laptop computers
- In gas gauge of some riding lawn mowers and tractors

Article Sources:

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3. *Mass. Dept. of Environmental Protection, "Mercury In Common Household Products." Fact Sheet. (617) 252-5500.*
4. *Franklin County Solid Waste Management District (MA), "Mercury In Appliances Workshop," (413)772-2438.*

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