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HARNESSING MARKETS FOR WATER QUALITY

Clay Landry, Associate Editor
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This issue of *IMPACT* is devoted to exploring and understanding the opportunities and challenges of harnessing markets to improve water quality. It looks at how markets could be implemented to address the growing concern of nonpoint source pollution as well as point sources. Recently, the EPA proposed a water quality trading proposal, which is summarized, reviewed, and critiqued.

Overview

Feature Articles

WATER RESOURCES
IMPACT

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[Cover Photo: Great Smoky Mountains National Park
by Raymond Herrmann, Fort Collins, Colorado)

WATER RESOURCES
IMPACT

OVERVIEW
HARNESSING MARKETS FOR WATER QUALITY

Clay Landry

According to a recent U.S. Environmental Protection Agency (EPA) study, more than a third or our rivers and about half of all estuaries monitored by the agency face serious water quality problems. And these numbers are on the rise. That grim report was released just weeks ago on September 30, 2002, and was a part of EPA's biennial national water inventory assessment.

The report showed that from 1998 to 2000 the percentage of polluted streams rose from 35 to 39 percent. Likewise the percentage of polluted estuaries, the nation's natural water filters, increased from 44 percent to a whopping 51 percent.

The culprit, says the EPA, is increasing levels of nonpoint source pollution from cities, farms, and forests. In fact, the July edition of *IMPACT* (Vol. 4, No. 4), entitled *Assessing the Quality of our Nation's Water Resources*, touched on this very issue. In this review of the first decade of USGS's National Water Quality Assessment Program, nearly every article addressed the rising concern of controlling nonpoint pollution. Several articles also pointed out the difficulty in identifying and quantifying nonpoint source pollution. Even more difficult is developing cost effective methods for controlling this diffuse pollution source.

The same day the water quality inventory was released, the EPA released a second report, a so-called gap analysis of water infrastructure funding needs. The findings of that report were equally staggering. The EPA estimates that at current rates, a $500 billion gap in water quality infrastructure will occur within the next 20 years. In other words, the nation will need $500 billion in infrastructure improvements simply to maintain its current level of water quality. The report may paint a bleaker picture than we really face due to its focus on technological fixes. However, the point remains that significant amounts of cash will be necessary to address the nation's growing water quality concerns.

Clearly our nation's water quality is at a crossroads. Water quality problems are rising as is the deficit needed to fix these problems. Yet, funding sources for fixes are dwindling at best. So what is the solution?

One approach is to enlist the help of the private sector by developing policies that make water quality protection an asset rather than a liability. Meaningful gains in the battle to protect our nation's water quality will only be achieved by harnessing and channeling the power of markets so that they deliver both economic prosperity and foster sound environmental practices.

Indeed, the EPA is eyeing up policies that enlist the private sector through market incentives. On May 15, 2002, the agency announced a comprehensive water quality permit trading policy proposal. The basic idea is to allow polluters, or anyone for that matter, to create tradable credits or permits by implementing measures that reduce pollution levels. These permits can then be sold to polluters with higher treatment costs or new development projects that will impact water quality.

The benefits of permit trading are numerous. To name a few, the program allows the EPA to focus on monitoring outcomes rather than regulating and worrying about the most appropriate technology standards. Second, the ability to improve water quality and sell it creates an incentive to discover better low costs for pollution controls. In effect, it encourages market participation and discovery by all types of polluters, including nonpoint sources. Finally, trading provides opportunities for local control and input on how pollution controls are achieved.

This issue of *IMPACT* is devoted to exploring and understanding the opportunities and challenges of harnessing markets to improve water quality. Dr. Suzie Greenhalgh and Amanda Sauers of the World Resources Institute kick off the issue with an illuminating article describing the nuts and bolts of water quality trading. The article also addresses the challenging issue of ensuring these new markets fulfill environmental objectives.

Rachel Cardone of Environmental Resource Management explores the possible obstacles water quality trading markets may face as they develop. The article focuses on the mechanics of creating new environmental markets. Cardone looks to the air quality market to identify basic requirements for any new environmental market.

The next article summarizes EPA's recently proposed policies on water quality trading. Please note that the article does not represent the views of the EPA. It is a summary of information edited by *IMPACT*. *IMPACT* invited the EPA to contribute to this issue, but the agency was unable to finalize internal review and approval of an article within the five-month period that we gave them. (Hopefully, approval of water quality trades won't take quite as long.) The EPA regretfully withdrew its contribution at the last minute.

The next two articles critique EPA's water quality trading proposal. Dr. Bruce Yandle, Professor Emeritus of Clemson University and Senior Associate at the Political Economy Research Center, provides a thorough review of the EPA proposal. He sees the permit trading proposal as an excellent opportunity for the agency to venture forward, but outlines some changes that are critical to make the program truly successful. Dr. Marty Matlock and associates from the University of Arkansas examine the challenges and limitations of EPA's *Fairness Principle*. The *Fairness Principle* requires that costs and benefits in any trading proposal be distributed proportional to dischargers and those benefiting from the improvements.

Finally, we are pleased to announce the launch of a new regular feature – *Water on Wall Street* – which will attempt to keep *IMPACT* readers up-to-date on the new economy of water by covering new and changing trends of the water industry. I would like to welcome Rachel Cardone, *IMPACT*'s new Business Correspondent, who will be assisting me with the column.

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SUBMITTING ARTICLES FOR IMPACT

Contact the Associate Editor who is working on an issue that addresses a topic about which you wish to write. Associate Editors and their e-mail addresses are listed on pg. 1. You may also contact the Editor-In-Chief Earl Spangenberg and let him know your interests and he can connect you with an appropriate Associate Editor. Our target market is the "water resources professional" – primarily water resources managers and such people as planning and management staffers in local, state, and federal government and those in private practice. We don't pay for articles or departments. Our only recompense is "the rewards of a job well done."

WATER RESOURCES IMPACT

ENVIRONMENTAL BENEFITS AND CHALLENGES OF TRADING WATER QUALITY

Suzie Greenhalgh and Amanda Sauer

A number of mechanisms are being used to address water quality problems around the world. As the extent and nature of water quality impairment has become more prevalent, the set of potential solutions has also grown.

The earliest efforts at controlling water quality took a regulatory command-and-control approach. This was either in the form of technology-based or performance-based standards placed on point sources like municipal wastewater treatment plants and industrial facilities. Technology standards specified the type of equipment or processes that each industry needed to adopt to meet a water quality target. A performance standard, on the other hand, specified the target and gave industries and treatment plants greater flexibility in the methods they could employ to meet that target.

Even though this regulatory approach achieved initial success, it does place heavy financial burdens on facilities to continually upgrade their equipment, and regulators must keep abreast of new technological advances. It provides little opportunity or incentive for facilities to be innovative.

Nonpoint source pollution such as agriculture, whose source is more difficult to identify than point source discharges, cannot be as easily controlled by regulation. Moreover, the cheaper, easier-to-achieve point source reductions in pollution have already occurred, and costs are escalating for them to meet the tougher water quality standards imposed on them. These factors have led to an evolution of various economic policies aimed at water quality improvements.

INNOVATIVE SOLUTIONS THROUGH TRADING

Nutrient trading is perhaps the most exciting and innovative mechanism being discussed. This concept revolves around the fact that each industrial facility or municipal wastewater treatment plant face different regulatory compliance costs depending upon size, scale, age and overall efficiency. Therefore, the cost of meeting tighter water quality standards may be cheaper for one facility than another. This provides an opportunity for those facilities whose upgrade costs are lower to make additional reductions beyond their obligation, and selling these additional reductions to facilities whose costs are higher. As an adjunct to regulation the whole concept of trading increases the flexibility facilities have to meet a water quality standard, thereby lowering the overall cost of compliance.

Many studies have illustrated that the inclusion of trading as part of a water quality improvement strategy achieves significant water quality improvements at a much lower cost than is achieved by other mechanisms. In a study of nutrient reduction options in three watersheds in the Upper Midwest, for instance, trading was by far the most cost-effective option. The study compared the costs of meeting tighter nutrient standards by requiring point sources to meet 100 percent of the obligation, by implementing best management practices through agricultural conservation subsidies, by a combination of point-source performance requirements and point-source/nonpoint-source trading, and by a joint trading and targeted performance-based conservation subsidy program.

For the Saginaw Bay watershed in Michigan, the joint trading/targeted conservation subsidy scenario reduced the costs of meeting tighter water quality standards by 82 percent compared to traditional command-and-control regulation on point sources. Similar, but smaller, cost reductions were seen for the Minnesota River watershed in Minnesota and the Rock River watershed in Wisconsin (Faeth, 2000).

HOW DOES TRADING WORK?

One of the first steps for developing a trading program is the establishment of a pollution cap for a body of water to reflect the maximum amount of pollution it can safely absorb while still meeting the federal and state water quality standards. In the U.S., the Clean Water Act has a process for waterways designated as impaired, that identifies and allocates load reductions. This allocation is called a TMDL, for Total Maximum Daily Load. The TMDL could be considered a cap. Unfortunately, the TMDL regulations have been extraordinarily controversial. On the environmental side, people legitimately claim that the water quality goals set forth in the Clean Water Act have not been achieved, and it even appears that the U.S. may be backsliding. Cities and businesses often object to TMDL implementation because the costs of meeting new water quality goals can be quite expensive. The real question is how to meet clean water goals at the least cost, thus the need for flexibility mechanisms. Because the TMDL is a type of cap, one logical step is to allow sources to meet new requirements through trading.

... one of the first steps for developing a trading program is the establishment of a pollution cap . . .

Trading can occur between two point sources, between a point source and nonpoint source, or between two nonpoint sources. Point source facilities are generally controlled by a discharge permit while nonpoint sources are not controlled by regulatory limits. The inclusion of nonpoint sources into trading programs has raised the question of uncertainty in the amount of reduction actually achieved by these sources. For nonpoint

sources to reduce their nutrient contribution to water bodies, some kind of best management practice (BMP) would be implemented. These practices may include changing tillage practices, excluding livestock from water bodies, or creating filter strips to trap sediment. To address this reduction uncertainty, a trading ratio or discount factor is commonly applied to nonpoint source reductions.

HISTORY OF TRADING PROGRAMS

Water quality trading programs have been in existence since the 1980s but have not enjoyed the successes of some other trading programs like the Acid Rain Trading Program. The first trading program for water quality in the United States was established for the Dillon Reservoir, a source of drinking water for Denver, Colorado, 70 miles to the east. Rapid urban growth, decreasing water quality, and increasing reliance on the reservoir for Denver's drinking water led to the creation of the Dillon Bubble, the watershed area that feeds into the Reservoir.

Under the trading program, point sources within the bubble could purchase phosphorus reduction credits from existing urban nonpoint sources like lawn and road runoff and septic tank seepage. In practice, however the upgrading of the municipal wastewater facilities achieved such high phosphorus reductions that no trades were made between point and nonpoint sources. The only trades to occur were two nonpoint source trades.

The Cherry Creek Reservoir, also a source of drinking water for Denver, has a similar program. As the areas around these reservoirs further develop, more trades are expected to occur within these programs.

The Tar-Pamlico program in North Carolina is probably the best known water quality trading program in the United States. This program was established to avoid tighter point-source permit limits and to reduce the cost of meeting nutrient load reduction requirements. When the North Carolina Division of Environmental Management designated the Tar-Pamlico basin as nutrient sensitive waters, in response to increasing numbers of fish kills and algal blooms, a coalition of municipal and industrial dischargers formed the Tar-Pamlico Association.

The Association agreed to reduce its nutrient discharges into the basin and to share a single nitrogen discharge limit in lieu of individual nitrogen limits being assigned to each discharger. The Association enforces the limit and internally allocates discharge limits among its members. If the Association exceeds the annual limit, it pays into an agricultural fund that farmers draw from to pay for best management practices, which reduce the amount of nonpoint-source nutrients they discharge into the basin.

The Tar-Pamlico program can be considered a hybrid between a trading program and an effluent tax. The credits are purchased for a fixed price, and there is no direct connection between the credits point-source dischargers use to meet nutrient limits and the credits generated through the best management practices fund.

In Australia, a salinity trading scheme along the Hunter River uses real-time trading of salinity credits to ensure that salinity levels in the river do not exceed a regulatory limit. Salinity levels, which have increased from coal mining activities, electricity generation, and land clearing, were starting to harm irrigated agriculture in the region. The solution was to develop a trading scheme that allocated salt credits to participants.

During times of high river flows, participants are able to discharge salty water according to the number of salt credits they hold. Credit holders can use their credits for their own discharges or they can trade credits to other dischargers. This scheme not only provides a cost-effective mechanism for reducing salinity levels in the Hunter River, it also provides a mechanism that allows new mines or industries to enter the region without compromising water quality.

CHALLENGES AND OPPORTUNITIES

The lack of success of water quality trading programs has been due to a variety of factors including poor design, difficulties in estimating nonpoint loads, and the high transaction costs of finding trading partners where there may typically be a few large point sources but hundreds of small point and nonpoint sources in a watershed. The enforceability and monitoring of nonpoint source controls present difficult and costly obstacles that must be overcome before trading can be undertaken at a large scale. There is also concern about the equity and environmental justice impacts of trading programs, especially those that allow an increase in discharges in one location. Furthermore a trading-program, if designed poorly, may lead to the formation of highly degraded localized areas in the watershed. To avoid these problems, trading programs must consider the location of potential partners within the watershed, size of the watershed where trading can occur, the compliance records of trading participants, and enforcement and monitoring issues (National Wildlife Federation, 1999).

To try to address these issues and help create nutrient reduction markets, the World Resources Institute (WRI) has created and is testing a website to support pilot nutrient trading programs in Michigan and the Chesapeake Bay. NutrientNet (www.nutrientnet.org) is designed to give agricultural nonpoint sources a first cut estimate of their nutrient contribution to watershed, the likely reductions they can achieve through adopting a variety of mitigation options and the cost of generating credits. The site uses the latest Geographic Information Systems (GIS) based tools to provide location-specific information, such as soil type, slope, and distance to the nearest stream, that is normally difficult to come by, but is critical to creating accurate nonpoint load estimates.

Similarly, point sources can make an initial estimate of the costs associated with reducing their nutrient emissions. In addition, buyers and sellers of nutrient credits can post their offers on the website, providing a centralized market place where buyers and sellers can connect and complete deals. WRI is also developing a registry so

that trades can be legally registered with the appropriate regulatory agency.

EXPANDING MARKET AREAS

To date, most trading programs have concentrated on phosphorus, which affects freshwater ecosystems and necessarily raises concerns over local water quality problems. Consequently, trading areas have been limited to small geographic areas. The development of nutrient trading markets could be enhanced by effectively incorporating larger market areas.

As the extent and cause of water quality problems are clarified, there appears to be greater and greater potential for trading to be an integral part of the solution over a larger market area. For example, now that nitrogen coming from the Mississippi Basin has been identified as the major component in the formation of the Dead Zone in the Gulf of Mexico, who is to say that trading could not play a key role in alleviating the problem? Freshwater ecosystems are not greatly impacted by nitrogen and it is only when these excess nitrogen loads reach the oceans that problems arise. This opens up the possibility for trading within considerably larger geographic areas than present trading schemes. To date, most trading programs have concentrated on phosphorus, which affects freshwater ecosystems and necessarily raises concerns over local water quality problems. Thus, these trading programs operate at relatively small watershed scales.

WATER QUALITY AND CLIMATE CHANGE

Water quality improvements have also been tied to other environmental benefits. In a WRI analysis of climate change strategies for U.S. agriculture, nutrient trading provided significant reductions in greenhouse gas emissions (GHG), a major contributor to climate change (Faeth and Greenhalgh, 2000). Overuse of nitrogenous fertilizers not only contributes to water quality problems, but some of the surplus ends up as nitrous oxide emissions, the single largest source of GHGs from U.S. agriculture. The analysis by WRI suggests that there is about an order of magnitude greater opportunity for GHG offsets from better nitrogen management than from carbon sequestration in agricultural soils. Nutrient trading offers a low cost way of achieving those management changes. In addition, environmental groups are more supportive of this approach to GHG offsets than to others such as soil sequestration. Furthermore, best management practices, such as riparian buffers and wetlands, also provide flood control and benefits to wildlife that should be considered. This illustrates the synergies between environmental goods and services and highlights the importance of developing comprehensive strategies to address environmental problems.

A climate change commitment in the U.S. would likely include a market for GHG emissions reduction credits that would create additional incentives for nutrient trading. This is especially true because the carbon sequestration potential of other agricultural practices is constrained by physical and economic considerations. Programs to cost-effectively reduce agriculture's emissions could help reduce the nation's total emissions of greenhouse gases, thus providing some additional room under the cap for other emissions. This could help the U.S. maintain a healthy economy while still honoring a commitment to reduce GHG emissions.

A FINAL WORD

With environmental policy moving away from the traditional command and control approaches of the past toward more market-based incentives, trading can provide a unique cost-effective solution to many water quality problems. It has the potential to reduce the cost of compliance by industrial and municipal facilities to meet increasingly more stringent water quality standards, it allows unregulated source of pollutants such as agriculture and urban nonpoint sources to be part of the solution, and it improves water quality. For all intents and purposes it can provide a win-win solution for regulators, industrial and municipal facilities, agriculture, and society as a whole.

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WATER RESOURCES IMPACT

TAKING WATER QUALITY TO THE MARKET

Rachel Cardone

A NEW COMMODITY

They said it could never be done. They said price would run into the hundreds if not thousands of dollars, driving factories and whole industries to bankruptcy. They said the creation of an SO_2 market (sulphur dioxide) to reduce the occurrence of acid rain in the U.S. Northeast would prove devastating to the economy.

They were wrong . . .

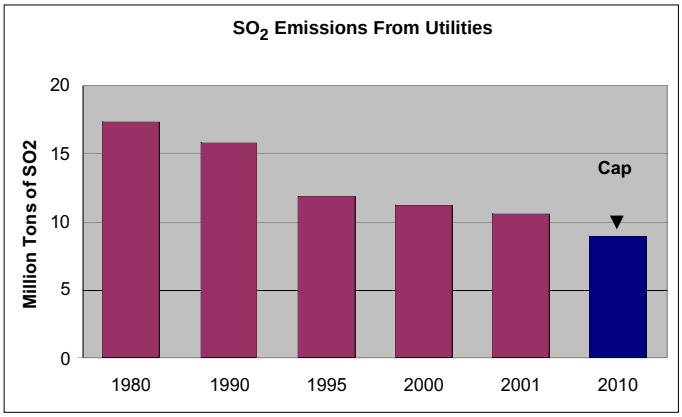
Since the early 1990s, when the first national environmental trading market was created in the United States, a variety of market-based mechanisms have been developed to address environmental issues, including local, regional, and even international markets for NO_x, lead, smog, renewable energy, greenhouse gases, wetlands, and even weather derivatives. Each market has succeeded in its goals to reduce pollution at a fraction of the cost of command and control: the SO_2 market alone has reduced four million tons of SO_2 every year from participating utilities. Each has gained from the lessons learned through creating the previous market – reducing the amount of time to bring the idea to reality. Now, plans are underway to scale up pilot programs for trading water quality, in the form of industrial pollution, urban storm water, and agricultural runoff. Looking at this new market's predecessors may provide clues and perhaps even solutions to the possible obstacles water quality trading markets may face as they develop.

WHY MARKETS?

Market mechanisms are a relatively new policy approach to addressing environmental quality issues, in contrast with command and control policies. With markets, governments can reduce costs by regulating the market as a whole and enabling businesses to take individual initiatives towards innovation, while giving business the flexibility to make choices that best suit their unique growth and production strategies. Further, trading markets generally cost less than remediation and top-down regulatory measures. This has proven the case with environmental markets, especially those based on cap and trade principles, which set strict limits to allowable emissions, creating demand for emissions allowances. "Cap and trade is a very economic approach to addressing an environmental issue," commented David Oppenheimer, a broker with Natsource, one of the nation's leading emissions traders.

Under a cap and trade scheme, the EPA determines a maximum level of pollution allowed, and then allocates allowances to polluters that provide them with the legal basis for releasing pollution and also for trading. For example, in the federal SO_2 market, established in 1990, the EPA set the initial cap at 90 percent of the 1980 level for the largest 110 emitters, and then provided these utilities with emission allowances proportional to their historic releases. Setting the cap below actual emissions created demand, and the participating utilities had the option of either investing in new technologies to reduce pollution emissions, or to trade with other utilities that had the technologies or were better able to finance the upgrade. The third alternative – to ignore the new regulations and the fledgling market – was not an appealing one, as an automatic $2,000/ton penalty (indexed to inflation) was imposed for each ton of SO_2 produced in excess of the cap. The remaining 2000+ utilities were mandated to join the SO_2 market in 2000. [Note: Under the federal SO_2 trading program, an automatic $2,000/ton penalty (indexed to inflation) is imposed for every excess ton of SO_2 produced. Initially, costs for SO_2 credits were projected to fall between a range of $500 to $1,500 each. As a result of the penalty for noncompliance, which took effect in 1995, the EPA did not take any enforcement action in the policy's first effective year.]

The following figure shows how SO_2 emissions have been reduced under the trading market scheme. While the first cap was set at 1980 levels, market entry by nonprofits, along with annual reviews by the EPA, "retire" allowances to reduce the total amount of SO_2 released every year. By 2010, the EPA projects emissions from utilities to be about half of 1980 levels.



Source: EPA.

As trading helped to address SO_2 pollution and reduce acid rain through innovation and entrepreneurship, so too could water quality trading work to reduce the pollution that, among other things, has caused a dead zone the size of New Jersey off the Gulf of Mexico. By capping nitrogen and phosphorus emissions (among other pollutants) coupled with a progressive schedule for retiring allowances, the government may succeed in improving environmental quality through the markets while fostering new business.

BASIC REQUIREMENTS FOR NEW MARKETS

The basic requirements for any environmental market are generally similar. First and foremost, environmental regulation must drive the market, and the framework must be clear and consistent, spelling out the rules without being overly constrictive. In the existing markets, the EPA created frameworks for the markets and then let the markets develop on their own. "Government needs to set rules and then let the private sector do what it does best, operating under a flexible environment with regulatory parameters," said Corrine Boone, Managing Director at CO_2E.com, a leading greenhouse gas consulting and brokerage firm.

The regulatory hinge for the proposed water quality trading market is the Clean Water Act, which prohibits releasing toxic levels of contaminants into water bodies in the United States, and at a local level, with the mandate to determine Total Maximum Daily Loads (TMDLs) for impaired watersheds. Determining TMDLs requires identifying what pollutants are present in a specific, affected watercourse, and then establishing a limit for how much of each pollutant is acceptable without adversely impacting the watercourse's health. The EPA's track record with existing markets has been positive, allowing the markets to grow and develop organically.

While EPA takes a hands-off approach to market operation, the market must also create environmental benefits. Monitoring and enforcement of transactions – with harsh penalties for noncompliance – is important to achieve this end. Within the SO_2 market, for example, the costs of noncompliance are several times the cost of purchasing credits: participants currently face a $2,000 fine per ton of excess SO_2 released, rather than purchasing a credit (for a ton of SO_2) at less than $200 per ton.

Another important component of a successful environmental market is the legal association of a given amount of pollution (or abatement) with an owner. For the SO_2 and NO_x markets, this occurs at the tail end of a smokestack, and is monitored by Continuous Emissions Monitoring Systems (CEMS). This legal parameter forms the basis of determining compliance and establishing credibility within the market.

Associating the supply of nonpoint source pollution to a specific owner may prove daunting, and may be better compared with the property-rights challenges faced by the greenhouse gas (GHG) market. Some of the questions being asked, but have not yet been resolved in the GHG market, include: how does one set boundaries for production? and how does one address the inequities between developed and developing countries? While the latter is not necessarily relevant for nonpoint source pollution, the former is worth pursuing. In the GHG case, if a company owns a fleet of trucks, who is legally responsible for the emissions – the company that owns the fleet, or the truck maker? Likewise, in the nutrient trading market, are farmers responsible for their phosphorus and nitrate runoff, or should the fertilizer producers be considered the owners? This question is best answered by determining the balance between what is technically and politically feasible.

There are also risks associated with assigning a value to (and quantifying) the effects of conservation activities to reduce non-point source pollution in the water quality market: variable factors such as precipitation levels and the difficulty in quantifying benefits. To reduce the risks, a mechanism called a trading ratio is generally used. A trading ratio addresses inequities in the market by making a point source pollution credit (say, 1 tonne of phosphorus, equivalent to say, 3 tonnes of phosphorus in nonpoint source pollution). Here the trading ratio is 3:1.

In the NO_x market, as in any large market, a trading ratio helps to create balance so that, for example, Los Angeles doesn't buy all the allowances from Oregon, leaving Oregon with no operating power plants and Los Angeles with increased license to pollute. Ultimately, the value of environmental markets is their value is creating positive environmental benefits, and so mechanisms like trading ratios have been created, to ensure that environmental quality improves in a fair and equitable manner.

Then, there is a question of scale: how big does a market need to be to be considered a market? Existing environmental markets in the United States can range from as small as ten participants in an individual state, for example renewable energy markets in Indiana, to a fully liquid market with secondary trading, as occurs within the SO_2 market, implying that size doesn't matter, as long as there is demand and supply.

The existence of brokers in the water quality trading markets will likely aid the overall market's growth & maturity, as has happened in other environmental markets

Of course, the fewer players in the market, the less likely a market will be efficient. For example, if only one abater operates within a watershed, it might set the price artificially high because the polluters have no alternative option. "There has to be leverage," said Benedikt von Butler, a broker at Evolution Markets, a leading environmental brokerage company at Wall Street. "To create liquid and efficient markets, you need a large number of competitive participants with very different incentives and costs. Transparency, standardization, and a strong compliance regime will lower transaction costs. If everyone needs the same thing and has similar costs, then the market won't work well."

The proposed water quality trading market players will vary based on a watershed basis. The EPA initiative calls for trading among industrial, mining, municipal, agricultural, conservation, and other parties (depending on who's in the watershed) to meet the supply capped by TMDL mandates. Complying with regulation will create the demand, with participants either investing in technology to reduce point source pollution, or investing in conservation methods to reduce nonpoint source pollution.

Finally, there is the question of price. In the SO_2 market, despite earlier concerns that a ton of emissions

would cost thousands of dollars if not more, the price has never exceeded $260 per ton. Setting the price was difficult at first, due to the unknown costs associated with the market. Initially, the transaction costs of making a trade were high due to the lack of information and history within the market. With the help of time, and brokers who facilitate the majority of trades in environmental markets, the transaction costs have been considerably reduced. According to von Butler, "In the early stages of the market, brokers took a higher commission from both buyers and sellers because trading was slow, information about prices scarce, and finding counter-parties was more time consuming. As the volume of the market increased, however, the commission per transaction has declined. Brokers 'grease' the market and lower transaction costs by enabling participants to quickly find counter-parties and information on prices – a work that would otherwise cost market participants substantial time and money."

NOT ALL MARKETS ARE CREATED EQUAL

Imagine: Due to predicted hurricane patterns in late July, New York City is expecting a rainy autumn. Anticipating excess sewerage outflows from its wastewater treatment plants, the New York Municipal Water Finance Authority decides to forego millions of dollars of investments to upgrade all 14 plants in favor of trading with other cities. It considers forecasts showing the Chicago expects a dry autumn, and, through a broker, reserves a certain amount (called a put) of water quality trading credits from Chicago's Department of Water at a set price for the month of August that will allow the NYMWF to discharges its expected overflows.

Under this scenario, Chicago is betting that they will not have excessive rain, which will keep the price of pollution allowances low. The credits reserved by the NYMWF are higher than the expected price, so that Chicago will earn a profit. However, if the predictions are incorrect and Chicago receives excessive precipitation in August, Chicago won't have enough allowances to match its own sewerage overflows, making it noncompliant with the Clean Water Act.

To avoid the possibility of high fines for noncompliance, the Chicago Department of Water also reserves credits, this time with the Sewerage and Water Board of New Orleans, on the probability that New Orleans will have excessive allowances for the month of August. These hedges cost billions less than upgrading the facilities, and both accomplish the same goal – to meet the quality standards mandated by regulations. As a result, taxpayers are happy, and the market flourishes.

Could this actually happen? Not under the current framework of the proposed water quality market, which specifically constrains trading to within watersheds. It could be possible, as experience with water quality trading increases and the issues of environmental markets, such as clearly defined legal status, monitoring and compliance, and ensuring environmental benefits from each trade are developed at a national level.

Water quality trading has existed for several years on a localized basis in states such as Colorado and North Carolina, although the number of trades and the size of the market has remained very small. As the numbers of water quality trading markets to address pollution grow, the role for brokers will also grow. Brokers help to match buyers and sellers in a market, to provide current and reliable information about the market and its value, and to

facilitate trades for a commission on each trade. The existence of brokers in the water quality trading markets will likely aid the overall market's growth and maturity, as has happened in other environmental markets.

As of yet, none of the major brokerage houses have dedicated staff to pursue market development for water quality (see table below). This is largely because at this early stage of the market, policy makers are more relevant to establish a trading structure than brokers for brokering trades. The brokering happens once the regulatory structure is in place and the stage is set for buyers and sellers to look for each other and gain knowledge to best inform their decisions.

So, less than 10 years after the first environmental market was created to reduce acid rain, are we ready to start trading water quality? With a developing regulatory framework and interest from the public, private, and nonprofit sectors, it appears the answer is yes, and soon.

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LEADING ENVIRONMENTAL BROKERAGE HOUSES

Company	Emissions Trading Market	Contact Information
Natsource LLC	SO_2, NO_x, GHG, Emissions allowance markets, Renewable energy markets, Emission Reduction Credits (ERCs), RECLAIM Trading Credits (RTCs)	Natsource 140 Broadway, 30th Floor New York, NY 10005 (212) 232-5300 doppenheimer@natsource.com www.natsource.com
Evolution Markets	SO_2, NO_x, GHG, Emission Reduction Credits (ERCs), RECLAIM Trading Credits (RTCs), Discrete Emission Reductions (DER), Renewable Energy Credits (REC), OTC coal, weather derivatives	Evolution Markets 65 Broadway, Suite 504 New York, NY 10006 (212) 430-6475 pzabo@evomarkets.com www.evomarkets.com
CO2e.com	B2B for GHG	CO2e.com Canada 181 University Ave., Suite 1500 Toronto ON M5H 3M7, Canada (416) 350 2177 Fax: (416) 350-2985 http://www.co2e.com/
Cantor Fitzgerald Environmental Brokerage Services	Emissions trading, RECLAIM Trading Credits (RTCs), SO_2, NOx, GHG, Renewable Energy Credits (RECs), Wastewater Credits (Los AngelesSewerage Facility Charge Credits)	Cantor Fitzgerald Environmental Brokerage Services 345 California St., Suite 1260 San Francisco, CA 94104 http://www.emissionstrading.com/
Prebon Energy	Emissions trading, Discrete Emissions Reduction Credits, Emissions Reductions Credits, NO_x, Particulate Matter, Vocs, VOMs, and ROGs	Prebon Energy, Inc. 5847 San Filipe, Suite 1715 Houston, TX 77059 (713) 821-1480 Fax: (713) 821-1401 www.prebonenergy.com

EPA'S PROPOSED WATER QUALITY TRADING POLICY

On May 15, 2002, U.S. Environmental Protection Agency Administrator Christie Whitman proposed a Water Quality Trading Policy to increase the pace and success of cleaning up impaired rivers, streams and lakes throughout the country. EPA officials believe this policy could save the public hundreds of millions of dollars by advancing more effective, efficient partnerships to clean up and protect watersheds. The policy encourages incentives to maintain high water quality where it exists as well as restoring impaired waters. In addition, the policy sets forth what EPA believes is necessary for state and tribal water quality trading programs to be successful and identifies provisions of acceptable trading programs that are consistent with the Clean Water Act and federal regulations.

"Many of us remember when some of our country's rivers were so heavily polluted that they were catching fire in the 1960s," said Whitman. "As a result of the Clean Water Act, signed into law in 1972, the discharge of pollutants by industry was greatly reduced. However, there is more to be done and the policy we are proposing today will help enhance the efforts that are already underway. This policy will lead to greater efficiency and better results, while being responsive, as we meet our clean water goals."

Despite the accomplishments of the Clean Water Act, many of America's waterways are still polluted by urban stormwater, sanitary sewer overflows, agricultural runoff, and pollutants from the air that fall into our waters. What this policy seeks to encourage is more innovative approaches to meeting clean water standards and does not change any of the current regulations or standards that are in place.

"We've made a lot of progress controlling pollution from industrial and municipal sources," Whitman explained. "Now we must look to innovative strategies that complement our current programs, to help us address the remaining challenges. Our Water Quality Trading Policy keeps existing controls and safeguards in place, but offers greater flexibility and incentives to states, tribes, and companies to comply with the Clean Water Act. Trading provides incentives for voluntary reductions from all sources to improve and maintain the quality of the nation's waters."

The trading policy seeks to support and encourage states and tribes in developing and implementing water quality trading programs that implement the requirements of the Clean Water Act and federal regulations in more flexible ways and reduce the cost of improving and maintaining the quality of the nation's waters.

Under the proposed policy, industrial and municipal facilities would first meet technology control requirements and then could use pollution reduction credits to make further progress towards water quality goals. In order for a water quality trade to take place, a pollution reduction "credit" should first be created. EPA's water quality trading policy states that sources should reduce pollution loads beyond the level required by the most stringent technology requirements in order to create a pollution reduction "credit" that can be traded. For example, a landowner or a farmer could create credits by changing cropping practices and planting shrubs and trees next to a stream. A municipal wastewater treatment plant then could use these credits to meet water quality limits in its permit.

DEVELOPING RULES FOR TRADING

The rules for trading are still being developed. Yet there are some key elements and considerations the EPA sees as essential to developing a successful water quality trading program. In general, the EPA believes that the elements of any sound trading policy should include:

- Clear authority for, and use of transparent processes/public participation to develop trading.
- Defined, equivalent units of trade (e.g., pounds of phosphorous).
- Standard protocols for quantifying units of trade (i.e. pollution reductions).
- Manageable transaction and administrative costs.
- Accurate recording and public availability of trading information.
- Monitoring of water quality effects, and program evaluation with a correction/feedback loop.

For the purposes of defining the trading policy, EPA uses the following: an exchange of pollution reduction units ("credits") among and between regulated and/or unregulated sources of pollution to achieve a water quality goal more cost-effectively.

EPA officials believe that most trading will occur as states, tribes, and sources implement programs to restore polluted waters

WHAT ARE EPA'S PRIMARY GOALS IN WATER TRADING?

Despite hundreds of billions of dollars of public and private investment in water quality programs to meet the goals of the Clean Water Act, fully 40 percent of America's waters remained impaired. Most of this impairment is driven by nonpoint source contributions to America's continuing water pollution problems. EPA believes that, while not a panacea to our water quality problems, water

quality trading offers significant promise to restore our waters to meet the statutory goals.

The precursor to the 2002 proposed policy was EPA's final policy issued in 1996, as well as the *Draft Framework for Watershed Based Trading*. That policy was not fully utilized, since significant questions of how EPA would view and respond to numerous issues of design and implementation were left unresolved. The intent of the 2002 policy is to clarify these and other questions so that states and other interested parties can move forward and use water quality trading to address remaining/emerging water quality problems.

PURPOSE AND INTENDED USE OF EPA's UPDATED POLICY

In updating EPA's water quality trading policy, the intent is to: (a) signal clear EPA support for environmentally sound trading programs; (b) offer some guidance on essential and important features these programs should contain; and (c) align trading programs with key provisions of the Clean Water Act. The policy also notes ancillary benefits that can accompany trading programs involving nonpoint source reductions, such as wetlands and habitat restoration.

Neither the proposed nor final trading policies will be legally binding documents – nor exert the force and effect of a regulation, but rather exist to provide sufficient guidance to interested parties to allow trading to proceed and grow over time. EPA intends to encourage trading in situations where the environmental and economic benefits of doing so are clear. At the same time, no one should be made "worse off" by trading, hence some of the restrictions on the locational and cross-pollutant aspects of trades which are described below.

KEY PROVISIONS OF THE PROPOSED POLICY

The proposed policy addresses trading in unimpaired waters, trading in impaired waters before development of a TMDL, and trading to meet TMDL requirements. The policy recognizes that TMDLs may well be the driving force for most trading activity and that nutrients (nitrogen and phosphorus in various forms) will be the pollutant most often traded. However, because trading can also be useful in reducing other pollutants (e.g., metals and toxic pollutants) in some situations, the proposed policy allows that pollutants other than nutrients may be traded subject to case-by-case approvals by the regulatory agency. The proposed policy also recommends that trades for pollutants other than nutrients ensure a net reduction of the pollutant rather than a straight offset.

Trading in Unimpaired Waters

For unimpaired waters, the policy recognizes trading as one way to maintain high water quality and offset the impacts of growth. These trades may result in a straight offset for the increased loads, or a net reduction in pollutant loadings, as consistent with state antidegradation requirements.

Trading in Impaired Waters Prior to TMDL Development

For impaired waters where a TMDL has not yet been developed, the policy permits trading and recommends a net load reduction for trades both to improve water quality (pending TMDL development) and to hedge against uncertainty in the final load reductions that will eventually be needed to meet the TMDL. Two possible scenarios for pre-TMDL trading are: (1) trading limited to one or a few NPDES-permitted sources intended to offset the impact of a new or increased discharge pending TMDL development; and (2) a water body (or watershed) scale program involving most dischargers that proceeds on a voluntary basis before the scheduled due date for the TMDL. To be most successful, the latter effort would be designed to achieve the applicable water quality standard and would be supported by load and wasteload analyses, modeling, and monitoring activities to enable sound allocations and implementation of the trading program.

Trading to Meet a TMDL

Trading to meet TMDL requirements is likely to be much more common than pre-TMDL trading. TMDL trading may occur among point sources, as in Connecticut's Long Island Sound Nitrogen Credit Exchange Program, or primarily among point and nonpoint sources. Provisions in EPA's final policy will be coordinated with provisions in the planned Watershed/TMDL Proposed Rule, so that TMDLs may be developed to allow for subsequent reallocation (e.g., trading) among waste load allocations and nonpoint source load allocations to the degree indicated by technical feasibility. In shifting pollution reductions from point sources to nonpoint sources, programs will need to estimate and offset the greater uncertainty associated with nonpoint source load reductions.

Estimating Nonpoint Source Load Reductions

Estimating load reductions from agricultural and other diffuse pollution sources is one of the most challenging aspects of a trading program involving nonpoint sources. The proposed policy discusses the necessity of 'discounting,' to ensure that pollution reduction credits recognize the uncertainty in the performance of land management practices, and to account for other factors like distance from the point of impairment. State agricultural agencies and the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) may be able to provide valuable assistance and expertise to trading programs in deriving sound estimates of nutrient and sediment reductions from land management practices.

Accountability for Trading Partners

Accountability is a prerequisite for all participants in a trading program. For NPDES dischargers, all existing regulatory and enforcement provisions continue to apply and a discharger is always responsible for meeting its permit requirements. In terms of permit mechanisms, larger scale trading programs may want to consider the

use of general or watershed permits to facilitate the exchange of pollution reduction credits and reduce paperwork while retaining federally enforceable permits for all NPDES participants. For federally unregulated nonpoint sources, various accountability mechanisms are available for states to adopt. These include private contracts between point and nonpoint sources, third-party certifications of performance, and state-imposed accountability provisions.

MOVING FORWARD

EPA officials believe that most trading will occur as states, tribes, and sources implement programs to restore polluted waters. The policy supports trading among and between regulated and unregulated sources through watershed partnerships and programs developed by states and tribes. In response to the revised 2002 policy, EPA has received approximately 80 comments which we are currently fully considering and preparing responses to, in order to issue a final policy in November 2002.

FOR MORE INFORMATION regarding EPA's proposed water quality trading policy, please contact http://www.epa.gov/owow/watershed/trading.htm.

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A NEW WATER QUALITY TOOL AVAILABLE

On the 30th Anniversary of the Clean Water Act, the U.S. Geological Survey (USGS) announced a new standardized web-searchable database of environmental methods that will allow scientists and managers monitoring water quality to compare data collection methods at a glance and find the method that best meets their needs. The tool also allows monitoring data to be shared among different agencies and organizations that use different methods at different times. This database was developed in conjunction with the U.S. Environmental Protection Agency (USEPA), and other partners in the federal, state, and private sectors.

Called NEMI (National Environmental Methods Index), the tool is a free, web-based online clearinghouse of environmental monitoring methods. The NEMI database contains chemical, micro-biological and radiochemical method summaries of lab and field protocols for regulatory and non-regulatory water quality analyses. It is searchable over the World Wide Web, providing up-to-date methods information through a standard Internet connection and browser. By visiting www.nemi.gov, users can directly access current methods information. In the future, NEMI will be expanded to meet the needs of the monitoring community. For example, biological methods will be added to NEMI, along with additional field and laboratory methods of importance to the monitoring community.

NEMI provides a summary of the procedures and performance data needed to assess methods. Critical data on sensitivity, accuracy, precision, instrumentation, source and relative cost are produced as tabular reports, and full methods are linked to the summaries. Often, formats for gathering information on various methods involve a time consuming search through lengthy methods to distill bits of necessary information (e.g., What is the holding time? Is the precision and accuracy of the selected method adequate?). A few minutes with NEMI will provide answers to these questions, and more.

"NEMI represents a successful interagency effort that helps everyone (citizen groups, academics, industry, and government agencies) share information on the methods they use to do environmental monitoring," said Dr. Robert Hirsch, USGS Associate Director for Water. "This will save a lot of time and effort for everyone, offering a single place on the Internet where people can search for information about suitable, well-documented methods of monitoring. This will help to ensure that future monitoring efforts use appropriate methods and it will add to everyone's ability to share the results of their monitoring programs."

Happy 30th Birthday
CLEAN WATER ACT
October 18, 2002

WATER RESOURCES
IMPACT

HAVE MARKETS FOR WATER QUALITY CONTROL REALLY EMERGED FROM THE POLICY BASEMENT?

Bruce Yandle

In 1969 when the U.S. Senate was considering the first fundamental piece of water pollution control legislation, Senator William Proxmire of Wisconsin sponsored a bill that required the use of economic incentives for achieving cleaner water (see Hite *et al.,* 1972). He had heard Resources for the Future economist Allen Kneese testify about the system of charges used for decades in the much-celebrated Ruhr River basin. Senator Proxmire was persuaded that anything as precious water quality should be treated accordingly. People should pay when they chose to consume or degrade the quality of a stream. There should be markets for water quality. As explained by Kneese and other witnesses at the dawning of U.S. water quality policy, paying for the right to discharge not only rationed the use of water quality, doing so set in motion a process that caused polluters to search for alternative ways to produce more and pollute less. The long experience in the Ruhr proved this.

Even then, advocates of command-and-control argued that effluent fees might be helpful, but only after technology-based controls were in place. As stated in a 1971 Joint Economic Committee report on the matter:

> [Effluent charges] should be coupled with a requirement that the polluter take steps, according to a fixed timetable, to control his pollution by the best available technology. If he fails to comply, he should be subject to enforcement procedures, effluent charge or no effluent charge (U.S. Senate, 1971).

The use of economic incentives and market forces died in committee. The advocates of command-and-control regulation brought overwhelming support to the notion that water quality consumption should be free, provided the polluter installed the specified technology for reducing the concentration of wastes entering rivers and streams and held a U.S. government pollution permit. Once permits were issued and the engineering controls installed and operated, the polluter was home free. The system was based on inputs, not outcomes. This, at least, was a theory of the federal statute that emerged in 1972. It is completely understandable that many of the nation's major polluting industries supported command-and-control and rejected the use of property rights and charges.

After the 1972 Federal Water Pollution Control Act became law, later with amendments to be called the Clean Water Act, advocates of market approaches continued to promote the benefits of using prices and marketable permits for controlling water pollution. Each time the organic statute was up for reauthorization (in 1977 and again in 1987) the water marketers would sally forth with their stories. And each time, command-and-control would prevail.

Periodically, an administration in power would throw a few market-process crumbs to the advocates for change, setting up special EPA offices for considering incentives or for taking watershed approaches for controlling water quality, even including the prospects for trading discharge rights. Gradually, Senator Proxmire's idea of using effluent charges was replaced with marketable permits. Understandably, few polluters wanted to pay fees and taxes, but many saw the benefits of paying less for water quality control. A potentially meaningful crack in the command-and-control concrete arrived in 1995, when the Clinton Administration ventured forth with project XL, based on the idea that the one-suit-fits-all technology standards might be escaped and replaced with common-sense pollution control approaches. However, even the much vaunted XL became hampered by the requirement that technology-based standards were to be met before innovation could be tried. Anyone who did otherwise was left themselves open for suit for violating the federal statute. As with other experiments beyond the limits of the statute, XL made good public relations copy but did little to change the U.S. commitment to command-and-control, a policy that has now prevailed for 30 years.

... this may be just the right time, for fundamental changes in the nation's Clean Water Act

MAKING ADAM SMITH PROUD

In keeping with the pattern of the past, on May 15, 2002, the Bush Administration's EPA announced a new Water Quality Trading Policy. The proposed permit trading policy allows dischargers in the same water quality constrained watershed, for example, to buy or sell water treatment services, if doing so, in their eyes, reduces costs or improve profits. Emerging neatly with an evolving Total Maximum Daily Load policy, now coming to grips with the need to focus on water quality outcomes, the proposed trading policy offers the prospects of reducing the cost of improving the quality of vast amounts of substandard lakes, streams, and shores. In fact, breaking away the concrete of command-and-control may be necessary if meaningful water quality improvements are to be forthcoming. Though the idea has been around for a while, the EPA announcement referred to trading as "an innovative approach that offers greater efficiency in achieving water quality goals on a watershed basis." Adam Smith would be proud.

But let us not be too critical. EPA's new trading policy suggests that water quality trading is coming out of

the policy basement and entering the main floor of the shop where fundamental action occurs. The policy addresses critical national goals and explains how trading may accelerate achieving those goals. The statement also mentions a number of trading experiments now in place across the nation. Indeed, some 34 are listed by the EPA Office of Water. As might be expected, given the difficulties posed by the federal statute, of the 34, only 10 have had more than one trade, even though some have been in business for 20 years. Before trade can occur, all federal regulations must be met, which is to say the gains from trade are sharply reduced.

While the new policy is encouraging to those who favor markets and seek lower cost water quality, it is still constrained by the now 30-year old command-and-control requirements of the water quality statute. Again, the new trading policy still requires that before trades can occur, all permit conditions must be met, including the application of appropriate control technologies. Unfortunately, life on the main floor of EPA's policy shop may be frustrating for the new trading policy.

ESCAPING THE POLICY BASEMENT

Fortunately, however, the timing of the policy coincides closely with Senate hearings now taking place for reauthorizing the Clean Water Act. In testimony to the Senate Environment and Public Works Committee on October 8, 2002, EPA Assistant Administrator for Water Tracy Mehan indicated that "it is time, not so much for a change in course as a shift in focus: from a point source-oriented program to a nonpoint centered one; from relying largely on technology-based standards to complementing past progress by a water quality-based approach, and from emphasizing inputs to focusing on environmental outcomes" (as quoted in Franz, 2002). Of course, there will be other witnesses who will challenge Mehan's statement, suggesting that more command-and-control, not less, is the answer.

But this may be just the right time for fundamental change in the nation's Clean Water Act. Ground is being lost in the effort to improve water quality. At the same times, the cost of measuring and monitoring water quality outcomes has fallen. This may be the time to introduce waivers, not a complete revamping of the Act, even though that might be desirable.

Waivers for relieving command-and-control could be provided to states or groupings of states that will take alternate ways for achieving water quality improvements. Watersheds and river basins would be the natural unit of control. With the water quality control district and its management unit identified, federal waivers would remove the focus on inputs and technology but require continuous monitoring of outcomes and demonstration of effectiveness. In short, the door could be opened completely for the use of market incentives and any other approaches for improving water quality.

Unless the door is opened fully, water quality markets will continue to provide some good content for convention speeches and scholarly dissertations, but little in the way of fundamental policy change.

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[*Editor's Note:* This article draws from a more comprehensive review and public interest on the EPA's proposed water quality trading policy comment by Bruce Yandle and Brian Manix, which is available online at the Mercatus Center, George Mason Univ. (www.mercatus.org).]

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ERRATA

IMPACT, Vol. 4, No. 5, Pg. 17
"Watershed Academy Web: Five Lessons Learned About Online Training"
by Douglas J. Norton

The caption for Figure 6 on pg. 17 of this article was inadvertently left off. The caption should read as follows:

An Interactive 'hub' Design for Training in Forestry Best Management Practices (BMPs). What might have been 40+ pages of straight text has been organized into eight BMP submodules, each delivering its message in half-page segments paired with visuals. Self-tests after each submodule reinforce learning.

AWRA apologizes for any inconvenience this may have caused Mr. Norton and all IMPACT subscribers.

WATER RESOURCES IMPACT

IS THE FAIRNESS PRINCIPLE FAIR?

Marty D. Matlock

INTRODUCTION

Our greatest opportunity for improving water quality in the almost 3,500 water bodies listed as impaired by nutrient (predominantly phosphorus) enrichment is through trading between point sources and nonpoint sources (Faeth, 2000). To help realize this potential, the U.S. Environmental Protection Agency (USEPA) developed the first national policy statement on water quality trading in 1996 (USEPA, 1996). Some states, notably Michigan and Wisconsin, have enacted public laws and implemented policies to promote water quality trading yet in 1999 there were only 25 water quality trading programs in various stages of development (Fossett *et al.*, 1999). The complexities and uncertainties associated with water quality trading, as well as the threat of lawsuits and court-mandated water quality restoration schedules under the Total Maximum Daily Load (TMDL) process, often limit implementation of water quality trading programs.

USEPA has proposed general criteria and recommended six elements for water quality trading in an attempt to obviate and reduce these uncertainties (Table 1). Although these six elements are useful in determining the feasibility of a water quality trade, the proposed USEPA water quality trading structure underestimates the critical role of the *Fairness Principle*. The fairness principle requires that costs and benefits in any trading proposal be distributed proportional to cause and benefits. However, we suggest that the fairness principle could limit opportunities. Two case studies of phosphorus management conflicts in adjacent, interstate watersheds in Arkansas and Oklahoma are presented to illustrate that the fairness principle can a primary limitation in the development water quality trading strategies.

CASE STUDY ONE: THE EUCHA BASIN

The Eucha Basin is facing serious water quality problems due to increasing phosphorus levels from urban development and an expanding agricultural industry. A unique aspect is that the basin is located in the Ozark Plateaus which cuts across the Oklahoma and Arkansas borders (Figure 1). With two states involved, the management of the phosphorus problem has been particularly challenging.

The narrow definition of the fairness principal is limiting practical and cost effective solutions to solving water quality problems

Land use is primarily forest and pasture, with much (~50 percent) in agricultural production. Water in the Eucha Basin drains to Lakes Eucha and Spavinaw, which are the municipal water supplies for Jay and Tulsa, Oklahoma. These municipal water supplies are being degraded by algal blooms, resulting in taste and odor problems in drinking water. The algae growth is accelerated by phosphorus runoff from agricultural fields and wastewater from neighboring Decatur, Arkansas. The primary source of the phosphorus is from the community wastewater treatment plant and agricultural runoff.

TABLE 1. Proposed USEPA Criteria and Elements for Water Quality Trading

CRITERIA	1. Water quality trading must be consistent with the CWA. 2. Water quality trading should generally be limited to nutrients (N and P) and sediment. Other pollutants can be traded where net water quality or environmental benefits are improved, or where adequate information exists to establish improvement of water quality through the trade. 3. The purposes for implementing water quality trading programs should be to improve water quality at reduced costs, achieve TMDL objectives, establish economic incentives for voluntary reductions, and bundle ecological services to achieve multiple environmental benefits.
CRITICAL ELEMENTS	1. Clear legal authority for trading to occur. 2. A fungible, clearly defined, unit of trade. 3. Standardized protocols to quantify pollutant loads and load reductions. 4. Mechanisms for determining compliance and ensuring enforcement. 5. Public participation and access to information. 6. Program evaluations, including periodic assessment of environmental and economic effectiveness of trading programs.

From FR 67:94, pp. 34709-34710, May 15, 2002.

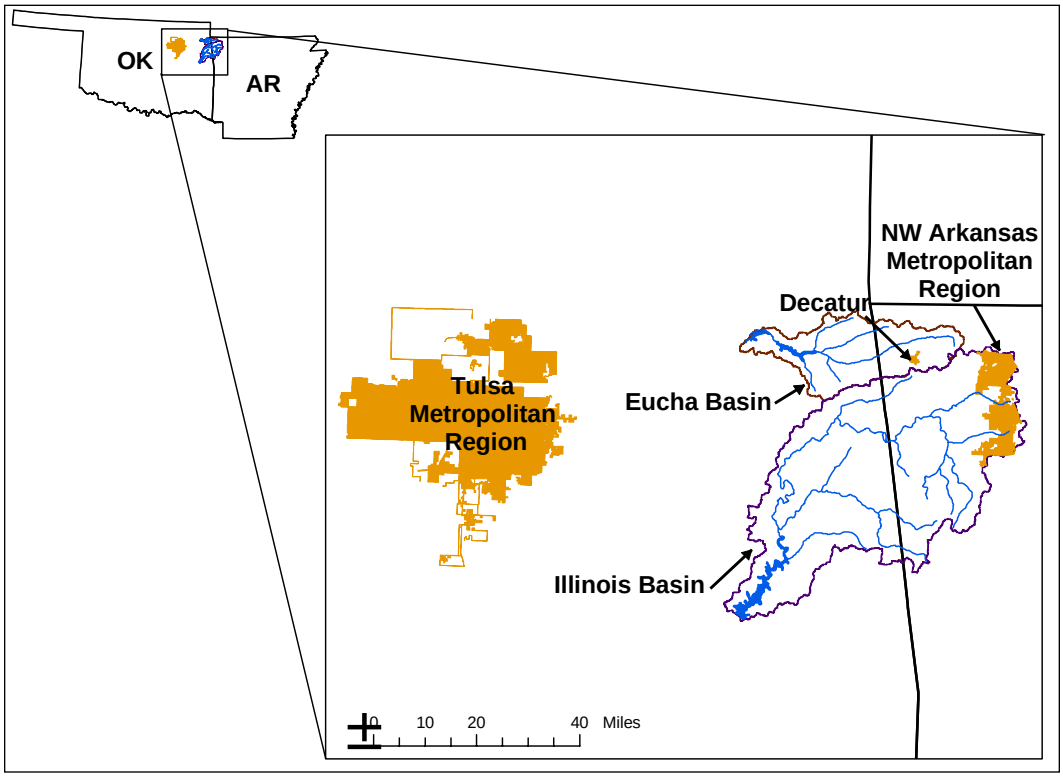

Figure 1. Locations of the Eucha and Illinois River Basins in Oklahoma and Arkansas.

Animal production, particularly poultry, has grown significantly in the Eucha Basin over the past ten years. About 430 active poultry farms with over 1,100 houses are located in the basin, producing over 300,000 metric tons of litter and 3,000 metric tons of phosphorus annually. Phosphorus from the poultry litter enters the watershed when it is applied to fields adjacent to poultry houses as a soil amendment and fertilizer.

The Decatur wastewater treatment plant was estimated to contribute about 25 percent of the annual phosphorus load into Lake Eucha (Storm *et al.,* 2002). In addition phosphorus concentrations as high as 9.9 parts per million were measured in Columbia Hollow, a small stream located directly below the Decatur wastewater plant discharge point (Haggard, 2000). This is almost 50 times higher than the maximum level of total phosphorus considered a pollutant in small streams. Columbia Hollow, the Decatur wastewater treatment plant receiving stream, is a significant source of phosphorus in the main channel of Spavinaw Creek.

The city of Tulsa, Oklahoma, has incurred over $4 million in increased water treatment costs directly related to increasing phosphorus levels in its municipal water supply. However, the primary sources of the problem, the city of Decatur's water treatment plant and a growing poultry industry, are located across the state line in Arkansas. The growing phosphorus problem has resulted in intense conflict between state agencies, with no clear legal authority to mediate a resolution.

While phosphorus is linked to algal blooms and taste and odor problems, no threshold loads have been well documented when algae levels become problematic for municipal water supplies. In other words, there are no absolute phosphorus management criteria for protecting drinking water supplies. In addition Arkansas has not established phosphorus limits for reservoirs, lakes, or streams. Consequently, no explicit management endpoint for phosphorus loading into Lakes Eucha and Spavinaw is determinable. Enforcement and management becomes difficult without a specific target level. Enforcing a water quality standard requires some numeric criteria.

In December 2001, the city of Tulsa and the Tulsa Metropolitan Utility Authority filed a lawsuit in U.S. District Court against the city of Decatur and six poultry companies based in Northwest Arkansas seeking monetary damages for past and future costs to treat taste and odor problems in the drinking water supply. Tulsa and the Tulsa Metropolitan Utility Authority also requested an injunction from further polluting of the Eucha Basin. If successful, the lawsuit would pose significant cost on the city of Decatur and the poultry industry.

In an attempt to avoid those costs the city of Tulsa and the Arkansas-based poultry companies recently entered negotiations to explore settling this lawsuit with the goal of mitigating water-quality concerns and providing sustainable animal agriculture in the basin. However, water quality trading is not likely to be an option in these

negotiations because of the inability to satisfactorily distribute the cost and benefits between the two parties. The city of Decatur does not have the economic resources to engage in point-nonpoint source trading and will not be required by the Arkansas Department of Environmental Quality (as of August 2002) to include a phosphorus limit in Decatur's wastewater discharge permit.

The citizens in Tulsa do not perceive a benefit from the poultry industry in NW Arkansas, and thus do not perceive self-interest in preserving the industry. While the citizens of Tulsa are generally supportive of landowner rights issues, the direct costs to their quality of life caused by the actions of a relatively few landowners in Arkansas are perceived to be disproportionate, thus unfair. Finally, there is no perceived culpability by Tulsa citizens, as the city does not discharge wastewater to the Eucha Basin.

Water quality trading in this scenario is not feasible because the proposition that the city of Tulsa provide resources to assist poultry producers in reducing phosphorus loads is not perceived as fair. The citizens of Tulsa benefit greatly from clean water in Lake Eucha; the citizens of Decatur and local poultry producers do not. This narrow view of the fairness principle prohibits participants in the conflict from evaluating alternative remedial strategies that would be economically more efficient than litigation. The fairness principle in water quality trading suggests that proportionality be distributed not only to the sources of pollution, but also to the benefits received through clean water.

CASE STUDY 2: THE ILLINOIS RIVER

The Illinois River Basin adjoins the Eucha Basin to the south and covers 4,300 km^2 with approximately half the basin located in Oklahoma and half in Arkansas. The Illinois River Basin is similar to the Eucha Basin in that it is a predominately rural landscape. The dominant uses of land in the basin are forestry, which makes up 42 percent of the total area, and agricultural pasture, which comprises 48 percent. Urban development covers only 3 percent of the basin's total land area. Water flows from Arkansas to Oklahoma and animal agriculture is the primary income source in the basin. The Arkansas portion of the basin is experiencing rapid economic growth through an expanding urban population and a growing animal industry.

▲ Employment Opportunity

RESEARCH/TEACHING ASSISTANTSHIPS
Graduate Program of Hydrologic Sciences
University of Nevada, Reno

Applications are encouraged for graduate teaching/research assistantships beginning July 1, 2003. Positions carry an annual stipend of approximately $14,000 including tuition and fees. Students interested in the area of ground water, surface water, and aqueous geochemistry are encouraged to apply.

Additionally, funded research assistantships are available in paleohydrology, contaminant transport, watershed hydrology and numerical simulation, as well as scholarships and doctoral fellowships offered through UNR and the Desert Research Institute.

Completed application packages are due **January 10, 2003,** and should be mailed to:

Graduate Program of Hydrologic Sciences
Mail Stop 175
LMR 267
Reno, NV 89557-0180

Information on assistantships and fellowships in the Hydrologic Sciences Graduate Program can be found at www.hydro.unr.edu or by calling (775) 784-6250.

The Arkansas portion of the basin is comprised of the Flint Creek, Illinois River, Baron Fork, and Caney Creek Drainage areas. An average of 208 metric tons of phosphorus annually enters Oklahoma from the Arkansas portion of the Illinois River Basin. Even though urban land use is relatively small (only 6 percent of the Arkansas portion), the combined annual phosphorus load from four municipal wastewater treatment plants is approximately 43 percent (90 metric tons) of total annual load entering into Oklahoma (Green and Haggard, 2001). The remaining phosphorus is from agricultural sources, including poultry litter runoff.

The impact of nutrient loading into Arkansas streams on downstream waters in Oklahoma including Lake Tenkiller has been a source of historic conflict. The U.S. Supreme Court in 1992 decided in an Oklahoma lawsuit filed against Arkansas that the upstream state of Arkansas could not violate water quality standards of downstream Oklahoma (USSC503 90-1262). At that time, however, Oklahoma only had ambiguous narrative criteria, rather than a numeric standard, for phosphorus.

In July 2002, Oklahoma implemented a numeric standard of 0.037 mg L^{-1} of total phosphorus in the Illinois River and five other streams designated as scenic rivers. Phosphorus measurements at 30 sites located on the Arkansas side of the Illinois River Basin found that levels exceeded the new water quality standard (Haggard *et al.,* 2002). The Oklahoma Attorney General has indicated that he intends to take whatever measures are necessary to enforce the water quality standard at the Oklahoma and Arkansas border.

Action by the Okalahoma Attorney General's office could limit the growth and development of five booming communities located in the in the northwest region of Arkansas. One city is already exceeding the capacity of its municipal sewer system. Faced with an oversubscribed municipal sewer system and no immediate alternative treatment option, this municipality restricted all new building permits in August 2002. In addition, several other cities are currently planning expansions to the local wastewater treatment plants in anticipation of future growth. Expanding the plants would increase wastewater discharge into tributaries of the Illinois River. Permitting of these wastewater treatment plants will require compliance with the anti-degradation clause of the Clean Water Act, and thus will require some strategy for managing phosphorus.

The fairness principle in this scenario clearly supports subsidies to municipal governments of northwest Arkansas to reduce the impact of nonpoint source pollution from poultry production in the Illinois River Basin. In fact, Arkansas municipal leaders have initiated a watershed-based strategy to reduce phosphorus loads in the Illinois River at the Oklahoma and Arkansas border. Their strategy includes, among other things, voluntarily reducing phosphorus concentrations at all existing wastewater treatment plants to one part per million, and exporting poultry litter from the basin. The municipalities are negotiating with the poultry industry to develop phosphorus export strategies, including converting poultry litter into commercial fertilizer. One of the challenges of implementing this approach is that there is no clear legal authority to establish nutrient trading. However, local authorities recognize that point and nonpoint nutrient trading strategies offer a cost-effective method to meet the Oklahoma water quality standard for phosphorus in the Illinois River. Thus, even though the critical elements identified by EPA are not present, a form of point-nonpoint water quality trading is being developed to reduce the total load of phosphorus to the Illinois River Basin.

ANALYSIS

The two case studies illustrate that the fairness principle is a critical element in determining if water quality trading is feasible. Conflict between the value placed on common resources and demands for those resources is central to this issue of fairness. The citizens of northwest Arkansas recognize that the poultry industry represents approximately $2 billion annually to the Arkansas economy. Oklahoma citizens recognize the economic value of nondegraded water for drinking water supply and recreation. Arkansans are not directly affected by the quality of drinking water in Oklahoma, and Oklahomans do not benefit directly from the poultry industry in Arkansas.

Those who would bear the costs do not perceive spending public funds to treat water degraded by phosphorus loads in the Eucha Basin as fair to citizens of Tulsa, since the costs associated with a trade do not result in an equitable gain. In the Eucha Basin, the only alternative water quality trading option would be between the Decatur, Arkansas, wastewater treatment plant and the nonpoint sources of phosphorus in the basin. However, the city has about 1,000 people in about 600 households, and poultry processing plant that is the major employer in the community, as well as a major contributor of phosphorus in the wastewater treatment plant effluent. The absence of a clearly defined endpoint – a permit limit – undermines the motivation for the establishment of a trade. Furthermore, point sources of phosphorus contribute approximately 25 percent of the total phosphorus load in the Illinois River. Consequently, the popular perception is that nonpoint source polluters should bear more of the responsibility and cost of reducing phosphorus levels. Thus the narrow definition of fairness often found in the public debate prohibits seeking the economically optimum solution to a common resource management problem.

In contrast to the Eucha Basin, having point sources in northwest Arkansas bear the costs of reducing phosphorus in the Arkansas portion of the Illinois River Basin is perceived as fair, since those citizens also benefit directly from the poultry industry. In the Illinois River Basin there is a clearly defined water quality standard for phosphorus (0.037 mg L^{-1} total phosphorus, 30-day geometric mean, at the Oklahoma/Arkansas border).

The narrow definition of the fairness principle is limiting practical and cost effective solutions to solving water quality problems. Some have suggested that fairness exists in tension – that is, that the welfare of some will be sacrificed in any strategy designed to enhance the well-being of all (Kaplow and Shavell, 1999). This

argument suggests fairness requires equal rather that equitable distribution of costs/benefits during implementation of a policy. Water quality trading between point source and nonpoint source requires municipalities and industries to see beyond immediate economic costs of water quality trade transactions. The benefits of those transactions must be included in the balance to evaluate the efficacy of the trade, as both short and long-term costs. The six elements proposed by USEPA are critical for reducing uncertainty in assessing these costs, and in shifting some transaction costs to the agencies responsible for protecting water quality. However, the fairness principal rather than an administrative infrastructure often dictates the efficacy of a water quality trading strategy.

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Indrajeet Chaubey and **Kati White** of the Department of Biological and Agricultural Engineering, University of Arkansas, and **Brian E. Haggard**, USDA-ARS Poultry Production and Product Safety Research Unit, Fayetteville, Arkansas, contributed to this article.

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USGS CIRCULAR 1223: CONCEPTS FOR NATIONAL ASSESSMENT OF WATER AVAILABILITY AND USE – IS NOW AVAILABLE

On September 12, 2002, The U.S. Geological Survey (USGS) released Circular 1223 "Concepts for National Assessment of Water Availability and Use." The report was prepared in response to a directive from Congress as part of their Fiscal Year 2002 Appropriations, to describe the scope and magnitude of the efforts needed to provide periodic assessments of the status and trends in the availability and use of freshwater resources of the United States.

The report describes concepts for a national assessment of freshwater availability and use that would develop and report on indicators of the status and trends in storage volumes, flow rates, and uses of water nationwide. This information currently is not available in an up-to-date, nationally comprehensive and integrated form. The assessment also would provide regional information on recharge, evapotranspiration, interbasin transfers and other components of the water cycle.

The assessment should be highly collaborative, involving many federal and state agencies, universities, and non-governmental interests. This will ensure that the indicators that are produced can be aggregated with other types of water-availability and socioeconomic information to provide a comprehensive picture of the Nation's freshwater availability. The design and development of these efforts should be coordinated through the Federal Advisory Committee on Water Information.

USGS welcomes comments and feedback on the plans outlined in the report. The report is available in PDF format on the USGS Website at http://pubs.water.usgs.gov/circ1223/.

WATER ON WALL STREET

Clay Landry and Rachel Cardone

Met Board Delivers Final Blow to Cadiz

Cadiz's controversial $150 million water storage project suffered another major setback on October 8, when the Metropolitan Water District Board rejected it. Met's decision may be the final blow for the project, and possibly Cadiz.

Cancellation of the project comes at an exceptionally perilous moment for Santa Monica-based Cadiz. An interest payment of $7 million to bondholders is due within a week. A bank loan of about $35 million is due in January. That loan from ING Baring Bank has customarily been rolled over annually on the expectation that it would eventually be paid off from water project revenue.

The project was once considered a key part of California's strategy to reducing the state's dependency on the over-allocated Colorado River. Under the project, Cadiz would be paid to store water from the Colorado River in an aquifer underneath their 35,000-acre ranch in the Mojave Desert.

Metropolitan was a critical partner in the proposal and was expected to be Cadiz's biggest customer. The project was estimated to generate $500-$1 billion in revenues over 50 years. It also was to be Cadiz' crown jewel, launching the modest agricultural producer into an international water company. When news of the vote hit Wall Street, Cadiz's stock price plummeted 92.6% to $0.27 – its lowest point ever.

French Water Utilities Hammered by Markets

The U.S. market hammered French utility conglomerates Suez and Vivendi Environnment recently, which both have major holdings in the US. Suez dropped 33 percent on the New York market. Suez – still reeling from losses in Argentina – announced sell-offs of major energy assets. None of the company's water holdings are scheduled for the auction block.

Suez's great rival Vivendi Environnment (VE) also suffered major losses this month with share prices dropping 11.7 percent on the New York market. The drop was precipitated by news that first half net profits fell 23 percent from the same period a year earlier.

VE continue pursuing major asset sell offs to service its looming debt load of 15 billion euros, which the company says will be cut in half by year's end. So far, the company has raised more than 1.3 billion euros though the sale of noncore assets.

VE raised $200 million this month from the sale of share in Philadelphia Suburban. VE sold 9.9 million shares at $18.25 a share in a secondary offering. Philadelphia Suburban's stock rose to $19.75, a 4.6 percent gain. In another deal, VE's U.S. Filter unit finalized the sale of its waterworks-distribution business for $620 million to a company jointly owned by J.P. Morgan Partners and Thomas H. Lee Partners.

U.S. Filter Bids for New Orleans

U.S. Filter Operating Services presented the New Orleans Sewerage and Water Board a proposal that it claims will save customers $600 million over 20 years, create 350 new jobs, and provide both salary increases and guaranteed employment for current staff.

U.S. Filter proposes to commit to invest $57 million per year to improve the city's inefficient infrastructure of decaying pipes, valves, and hydrants, along with providing the New Orleans water system with a new computer system that would provide updates on repairs in real-time.

New Orleans is currently reviewing this proposal, along with proposals from United Water and a company comprised of city employees to operate and manage its water and sewer systems. A preferred bidder will be announced after comments from the New Orleans Sewerage and Water Board of Directors and the public.

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▲ Proposed AWRA Bylaw Change – October 17, 2002

Current Bylaw: Section 6 F 6 – The Secretary/Treasurer will: "Review the budget prepared annually by the Executive Vice President and transmit it to the Finance Committee (with an information copy to the Board) a month before the Association's Annual Business Meeting."

Proposed Bylaw: The Secretary/Treasurer will: "Review the budget prepared annually by the Executive Vice President and transmit it to the Finance Committee (with an information copy to the Board) before the Association's Annual Business Meeting."

Proposed Change: Delete the words **"a month".**

Rationale: To comply with the current practice which is to have a draft budget for review by the Board and discussion by the Finance Committee at the Annual Meeting with final approval occurring by the Board at its January meeting.

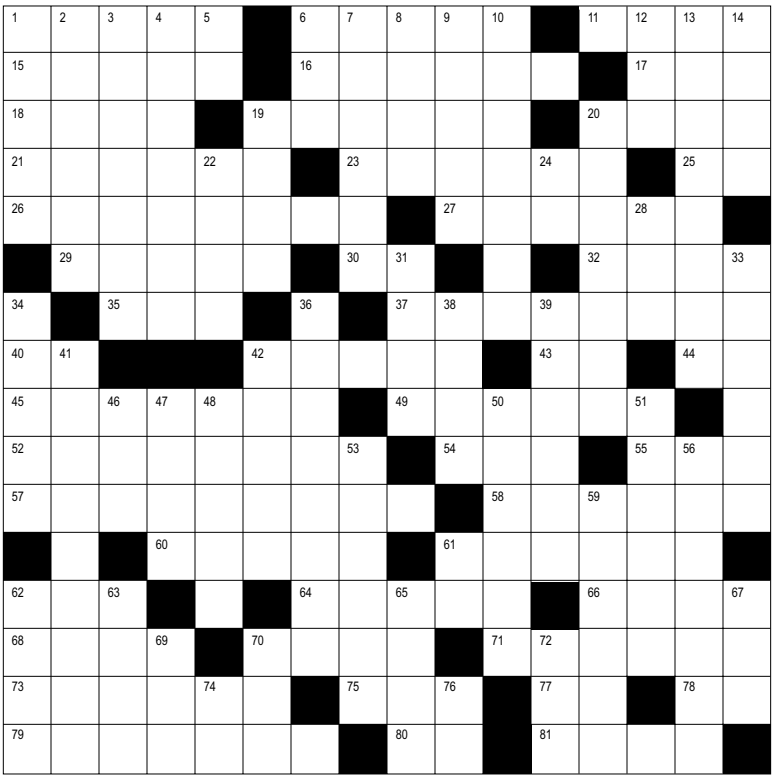
Proposed Date of Action: January 24, 2003, Monterey, California.

Water Industry Market Watch

Company	Ticker	Share Price: Oct. 9 Close	% Change	Exchange	52-Week High	52-Week Low	Yield	P/E	Revenues*: Last Reported	Revenues*: Year Ago	Aug. Close
Water *Utility Sector*											
American States Water	AWR	$24.20	-5.5%	NYSE	29.01	20.25	5.95	16.8	197.5	184.0	25.60
American Water Works	AWK	$44.88	1.1%	NYSE	45.00	39.95	3.79	26.39	809	680	44.37
Artesian Resources	ARTNA	$28.76	3.9%	NASDAQ	34.60	24.75	5.98	16.72	16.4	14.9	27.68
Birmingham Utilities	BIW	$17.80	-2.5%	American	20.75	15.00	9.78	10.22	3.5	3.4	18.25
California Water Services	CWT	$24.42	-3.5%	NYSE	27.75	20.45	4.63	24.76	120.8	114.0	25.30
Connecticut Water	CTWS	$24.27	-8.4%	NASDAQ	32.21	20.35	4.04	17.92	21.0	21.2	26.49
Consolidated Water	CWCO	$12.37	-8.7%	NASDAQ	15.45	9.95	5.58	17.92	6.3	5.9	13.55
Middlesex Water Co.	MSEX	$21.65	-5.6%	NASDAQ	26.72	18.30	4.30	23.27	29.8	27.9	22.94
Pennichuck Corp.	PNNW	$27.21	4.1%	NASDAQ	32.40	19.50	3.27	30.57	11.9	9.9	26.14
Philadelphia Suburban	PSC	$19.75	4.6%	NYSE	25.00	16.02	4.20	23.79	148.3	147.4	18.89
Suez	SZE	$14.28	-33.0%	NYSE	34.40	15.00	4.65	15.12	4669.0	4801.0	21.30
Southwest Water	SWWC	$14.06	-9.2%	NASDAQ	19.10	11.80	5.27	18.99	60.9	51.1	15.49
York Water Co.	YORW	$13.70	-19.8%	NASDAQ	20.17	11.50	4.82	20.75	9.5	9.3	17.09
Vivendi Environnement	VE	$20.40	-11.7%	NYSE	39.50	17.52	9.32	19.63	849.7	786.7	23.10
Water *Filtration and Technology Sector*											
Calgon Carbon Corp	CCC	$5.41	-11.2%	NYSE	9.89	5.22	2.22	45.08	131	142	6.09
Ionics Inc.	ION	$19.53	-13.9%	NYSE	33.90	18.90	-	8.13	159.7	236.6	22.68
Millipore Corp.	MIL	$31.44	-9.2%	NYSE	63.36	27.25	-	19.52	176.0	168.0	34.64
Osmonics Inc.	OSM	$10.57	-22.6%	NYSE	17.50	10.40	-	21.13	105.7	105.0	13.65
Pall Corp.	PLL	$14.90	-12.1%	NYSE	25.00	14.99	3.96	25.25	1290.0	1235.0	16.96
Water *Resource Development Sector*											
Cadiz Inc.	CLCI	$0.27	-92.6%	NASDAQ	11.00	3.00	-	-	30.8	27.7	3.65
Intergrated Water Resources	IWRI	$0.15	0.0%	OTC	-	-	-	-	-	-	0.15
Layne Christensen Co.	LAYN	$7.30	-21.1%	NASDAQ	10.8	7.11	1.37	72.99	40.7	42.5	9.25
Pico Holdings Inc.	PICO	$8.55	-33.6%	NASDAQ	17.86	8.50	-	10.86	3.1	-4.7	12.88
Southwestern Water Exploration	SWWE	$0.85	-43.3%	OTC	-	-	12.14	-	-	-	1.5
Western Water Co.	WWTR	$0.25	-16.7%	OTC	1.26	0.20	-	-	1.7	1.9	0.3

* Revenues presented are in $ millions and reflect second half revenes ended June 30 (except BIW and WWTR which report 1Q revenues)
PLL reports full year end Aug 1, 2002. Suez reflects Ondeo cumulative revenues, VE reflects Vivendi Water cumulative revenues.

▲ Water Resources Puzzler (answers on pg. 30)



ACROSS
1 Watt's power
6 white trash?
11 Cleo's river
15 Prince Charles' TV
16 followed by number or clock
17 indicates not
18 sight at Winter Olympics
19 pallid
20 first part of hero or freeze
21 a beef stew
23 poise
25 AKQJ10?
26 grasps hastily
27 Y_2O_3
29 fisherman's monofilament
30 Mister _____
32 weird
35 followed by Act or biscuit
37 a Saint?
40 a monetary unit of Laos
42 sheeplike
43 the Oakland 9
44 symbol for osmium
45 god of the sea
49 entices
52 visionaries
54 38 DOWN, e.g.
55 opposite SSW
57 Golden Fleece hunters
58 to hire a lawyer
60 hot sauce
61 affirm
62 part of EST
64 encourage
66 the fiddling arsonist?
68 _____ de force
70 Nebr. neighbor
71 TV pooch
73 Spanish _____, 1588
75 tonic's friend?
77 river in Italy
78 26th Pres.
79 Pacific Ocean cyclone
80 neighbor of VA
81 one of HOMES

DOWN
1 Julie and Tom
2 residents of Dawn and Sunset
3 excellent
4 receiver of a portion
5 Oh, _____!
6 Peter _____
7 DI's command
8 splendor
9 Dickinson, poet
10 an Italian cheese
12 Danube tributary
13 a seducer
14 OK city
19 an NFL player
20 aware of
22 Calif. bruins
24 neighbor of 70 ACROSS
28 noun suffix
31 result of teenage driver?
33 sycophants
34 bamboo eater
36 hackneyed
38 Al or Dick
39 sugar and gum
41 Yukon or Northeast
42 Ryan or Tatum
46 wooden pin
47 NM art colony
48 Aleutian island
50 small bite of food
51 entraps
53 POW camp
56 ester of nitrous acid
59 a vector
61 symbol for astatine
62 ERA or RBI
63 drop heavily
65 aunt to niece
67 over (poet.)
69 college cheer
70 Tome or Paulo
72 Tarzan's friend
74 water qual. indicator
76 location of Neuse R.

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▲ Employment Opportunities

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc. (DBS&A) is a progressive environmental science and engineering consulting firm, serving a broad spectrum of government and private sector clients, providing comprehensive services in groundwater and surface water hydrology, investigation and remediation of soil and groundwater, and water resource management.

VICE PRESIDENT, WATER RESOURCES DIVISION (Job #245)

This position may be based in either our Albuquerque, NM, or Austin, TX, location. We are seeking a highly skilled professional with at least 15 years of relevant surface water and/or groundwater experience, such as planning, feasibility, design and/or implementation of water resource management plans/projects. An MS degree in water resources, hydrology, hydrogeology, civil engineering or closely related field is preferred. PE or other professional licensure is a plus. VP is responsible for the profitability of the division; new business development; project management oversight; and mentoring and development of division staff.

The successful candidate will have proven ability to develop and execute work in the Southwest water resources market (NM, TX, CA, AZ), in areas such as municipal water supply development, groundwater modeling, and/or local or regional water supply planning. Proven expertise in business decision making, including development and implementation of strategic and tactical business plans; risk avoidance; interpretation and application of financial data to business decisions; and management of cost control are required.

DBS&A offers challenging work, opportunities for professional development, and a competitive compensation and benefits package. For immediate consideration, please e-mail (MSWord) resume with cover letter specifying Job #245, references and salary history to: hr@dbstephens.com. Mail to HR Director DBS&A, 6020 Academy Road NE, Albuquerque, NM 87109.

SENIOR WATER RESOURCES SPECIALIST (Job #246)

DBS&A is seeking an experienced water resources professional for our Austin, TX, office with proven ability to develop and execute work in the Texas water resources market. Candidates must have at least 10 years of relevant surface water and/or groundwater experience including planning, feasibility, design and/or implementation of water resource management plans/projects. BS degree in water resources, hydrology, hydrogeology, civil engineering or closely related area is required; MS degree is preferred. PE or other professional licensure is a plus. Responsibilities include successfully managing project budgets and schedules, and providing technical assistance to teams involved in water resource investigations, feasibility studies, modeling, report preparation, litigation support activities, sampling, and data analysis for water resource and other projects. This position requires travel to DBS&A offices and short-term field assignments. This is an opportunity for a professional with a proven track record to play a key role in leading the growth of the firm's water resources program throughout the Southwest.

DBS&A offers challenging work, opportunities for professional development, and a competitive compensation and benefits package. For immediate consideration, please e-mail (MSWord) resume with cover letter specifying Job #246, references and salary history to: hr@dbstephens.com. Mail to HR Director DBS&A, 6020 Academy Road NE, Albuquerque, NM 87109.

CALIFORNIA BRANCH OFFICE MANAGER (Job #247)

We are seeking a gifted manager and business developer, with proven client development capabilities in California, to lead our growth in the California marketplace. The individual in this position must have a 10-year track record combining relevant technical experience, client development, and staff and operations management. This position requires a BS degree, MS degree preferred, in geology, hydrology, or closely related area. Desirable areas of experience include vadose zone and groundwater hydrology, multiphase contaminant transport, water resources analysis, including artificial recharge and groundwater resource management.

A high-energy individual with proven ability to handle multiple tasks and produce results in a fast-paced, competitive environment is required. Demonstrated success in developing strategies, establishing contacts, motivating teams, leading proposals and presenting solutions to clients are critical. Experience in strategic planning, development and execution of annual business plans, and budgeting and cost control is strongly preferred.

DBS&A offers challenging work, opportunities for professional development, and a competitive compensation and benefits package. For immediate consideration, please email (MS Word) resume with cover letter specifying Job #247, references, and salary history to: hr@dbstephens.com. Mail to: HR Director, Daniel B. Stephens & Associates, Inc., 6020 Academy Rd. NE Suite 100, Albuquerque, NM 87109.

EEO/AA Employer • www.dbstephens.com

▲ Water Resources Continuing Education Opportunities

MEETINGS, WORKSHOPS, SHORT COURSES

2003

DECEMBER 2002

11-13/Engineering & Planning Approaches/Tools for Conservation Design. Madison, WI. **Contact** Engr. Registration, The Pyle Ctr., 702 langdon St., Dept. 107, Madison, WI 53706 (800/462-0876; f: 800/442-4214; w: http://epdweb.engr.wisc.edu/brochures/E912.html)

FEBRUARY 2003

17-19/USEPA, SWMM, and PCSWMM 2002 – Stormwater Modeling Workshops. Toronto, Ontario. **Contact** Lyn James at CHI, 36 Stuart St., Guelph, ON, Canada N1E 4S5 (519/767-0197; f: 519/767-2770; e: info@chi.on.ca; w: www.chi.on.ca) (see Feb. 20-21 for Conference)

18-21/Aquaculture America 2003: New Frontiers in Aquaculture. Louisville, KY. **Contact** (760/432-4270; e: woldaqua@aol.com; w: www.was.org)

20-21/Conf. on Stormwater & Urban Water Systems Modeling. Toronto, Ontario. **Contact** Lyn James at CHI, 36 Stuart St., Guelph, ON, Canada N1E 4S5 (519/767-0197; f: 519/767-2770; e: info@chi.on.ca; w: www.chi.on.ca) (see Feb. 17-29 for Workshops)

APRIL 2003

28-30/River Basin Management 2003 - 2nd International Conf. on River Basin Mgmt. Las Palmas, Garn Canaria. **Contact** Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK. (+44 (0) 238 029 3223; f: +44 (0) 238 029 2853; w: http://www.wessex.ac.uk/conferences/2003/riverbasin2003/4.html)

MAY 2003

12-14/AWRA's Spring Specialty Conf. "Agricultural Hydrology and Water Quality." Kansas City, MO. Contact AWRA, 4 West Federal St., P.O. Box 1626, Middleburg, VA 20118-1626 (540/687-8390; f: 540/687-8395; e: info@awra.org)

JUNE 2003

18-20/Water Pollution 2003 - 7th Intn'l. Conf. on Modelling, Monitoring and Prediction of Water Pollution. Cadiz, Spain. **Contact** Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK. (+44 (0) 238 029 3223; f: +44 (0) 238 029 2853; w: http://www.wessex.ac.uk/conferences/2003/water2003/2.html)

23-25/Coastal Engineering 2003 - 6th Intn'l. Conf. on Computer Modeling and Experimental Measurements of Seas and Coastal Regions. Cadiz, Spain. **Contact** Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK. (+44 (0) 238 029 3223; f: +44 (0) 238 029 2853; w: http://www.wessex.ac.uk/conferences/2003/coastal03/)

29-July 2/AWRA's Summer Specialty Conf. "Second Intn'l Congress on Watershed Mgmt. for Water Supply Systems. New York, NY. Contact AWRA, 4 West Federal St., P.O. Box 1626, Middleburg, VA 20118-1626 (540/687-8390; f: 540/687-8395; e: info@awra.org)

JULY 2003

28-31/StormCon '03. San Antonio, TX. **Contact** Janice Kaspersen (www.stormcon.com)

AUGUST 2003

10-14/American Fisheries Society 133rd Annual Meeting. Quebec City, Quebec, Canada. **Contact** Betsy Fritz (301/897-8616, x212; e: bfritz@fisheries.org)

SEPTEMBER 2003

16-19/Internat'l. Conf. on GIS & Remote Sensing in Hydrology. Three Gorges Dam Construction Site, China. **Contact** Chairman LOC of ICGRHWE, c/o Prof. Yangbo Chen, Inst. of Water Resources & Environ. Engr., College of Earth & Environ. Sciences, Sun Yat-Sen Univ., 135 Xingangxi, Guangzhou, China 510275 (f: +86-20-3402-2397; e: eescyb@zsu.edu.cn

OCTOBER 2003

19-22/2003 AIH Annual Meeting & Conf. Atlanta, GA. **Contact** AIH, 2499 Rice St., Ste. 135, St. Paul, MN 55113 (651/484-8169; f: 651/484-8357; e: AIHydro@aol.com

NOVEMBER 2003

2-5/AWRA's Annual Water Resources Conf. San Diego, CA. Contact AWRA, 4 West Federal St., P.O. Box 1626, Middleburg, VA 20118-1626 (540/687-8390; f: 540/687-8395; e: info@awra.org)

2004

MAY 2004

2-6/4th World Fisheries Congress-Reconciling Fisheries With Conservation: The Challenge of Managing Aquatic Ecosystems. Vancouver, BC, Canada. **Contact** (800/555-1099; e: FISH2004@advance-group.com)

AUGUST 2004

21-26/American Fisheries Society 134th Annual Meeting. Madison, WI. **Contact** Betsy Fritz (301/897-8616 x212; e: bfritz@fisheries.org)

CALLS FOR ABSTRACTS

January 30, 2003 (Abstracts Due) – Conf. on Stormwater & Urban Water Systems Modeling. February 20-21, 2003. Toronto, Ontario. **Contact** Lyn James at CHI, 36 Stuart St., Guelph, ON, Canada N1E 4S5 (519/767-0197; f: 519/767-2770; e: info@chi.on.ca; w: www.chi.on.ca)

February 15, 2003 (Abstracts Due) – 10th Nat'l. Sym. on Individual & Small Community Sewage Systems & 8th Internat'l. Drainage Sym. April 14-17, 2004. Sacramento, CA. **Contact** Adel Shirmohammadi, Program Chr. (301/405-1185; f: 301/314-9023; e: AS31@umail.umd.edu or ashirmo@umd.edu)

February 28, 2003 (Abstracts Due) – 2003 AIH Annual Meeting & Conf. October 19-22, 2003. Atlanta, GA. **Contact** AIH, 2499 Rice St., Ste. 135, St. Paul, MN 55113 (651/484-8169; f: 651/484-8357; e: AIHydro@aol.com)

December 13, 2002 (Abstracts Due) – StormCon '03. July 28-31, 2003. San Antonio, TX. **Contact** (www.stormcon.com)

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▲ A Retrospective of AWRA's National Water Resources Policy Dialogue

Richard A. Engberg • Technical Specialist
American Water Resources Association

Great approach ... the most participatory and group discussion event I have attended. This and other italicized comments represent feedback from the attendees of the American Water Resources Association's (AWRA) recently concluded National Water Resources Policy Dialogue (Dialogue). A total of 267 persons registered for the Dialogue which was held September 17-18, 2002, in Washington, DC, at Loew's L'Enfant Plaza Hotel. Attendees represented a good mix of federal, state, and local employees, academics, nongovernmental organization (NGO) representatives, and private citizens. The Dialogue was sponsored by 10 federal water resources agencies and cosponsored by 24 NGOs. On pg. 29 you will find a montage of photographs from the Dialogue by Cynthia Fenton of AWRA.

The Dialogue featured keynote speakers and panel discussions on six key water resources policy issues. Most importantly, however, it included over four hours of facilitated discussions in which all attendees were given the opportunity to express personal opinions or the positions of their agencies, organizations, or associations, on the key issues. Finally, following the keynote addresses, the panel discussions, and the facilitated discussion sessions, it featured a session of three rapporteur/provocateurs representing the business community, the environmental community, and a state agency who provided their unique perspectives and feed back on issue discussions of the previous 1.5 days.

Great choice of keynote speakers. The Dialogue featured three prominent keynote speakers. The Honorable Parris N. Glendening, Governor of Maryland, addressed water resource policy issues from the state and local perspective at the luncheon on Day 1. The Honorable Harry Reid, U. S. Senator from Nevada, and Assistant Majority Leader, addressed water resources policy issues from the congressional perspective as the first speaker on Day 2 of the Dialogue. Finally, the Honorable James L. Connaughton, Chair of the Council on Environmental Quality, Washington, DC, addressed water resource policy issues from the administration perspective at the luncheon on Day 2.

Best conference/dialogue (I) have ever been to. The Dialogue opened with brief remarks by Ken Lanfear, AWRA President, Gerry Galloway, Dialogue General Chair, and Jerome Delli Priscoli, Dialogue Facilitator. This was followed by the first key issue panel, "Restoring and Protecting the Environment." The panelists included G. Tracy Mehan III, Assistant Administrator, Office of Water, U.S. Environmental Protection Agency (EPA), Washington, DC, leader; LTG Robert Flowers, Chief of Engineers, U.S. Army Corps of Engineers, Washington, DC; Rebecca R. Wodder, President, American Rivers, Washington, DC; Donald R. Wharton, Senior Attorney, Native American Rights Fund, Boulder, CO; and John R. Wehle, Assistant Executive Director, St. Johns River Water Management District, Palatka, FL. Panelists based their presentations on the following charge: "Current water uses affect the environment through impacts on water quality and quantity and on biological and physical resources. As uses increase so will the impacts. How can we best manage and meet current and future water needs while still restoring and protecting the environment?"

Yes, the key issues were appropriate. The second key issue panel was "Water Resources Infrastructure." The panel was led by the Honorable John Linder, member of Congress from Georgia. Other panelists were Benjamin R. Grumbles, Deputy Assistant Administrator, Office of Water, EPA, Washington, DC; Christopher O. Ward, Commissioner, New York City Department of Environmental Protection, Flushing, NY; Ken Kirk, Executive Director, Association of Metropolitan Sewerage Agencies, Washington, DC; and Christopher Brescia, President, Midwest Area Rivers Coalition (MARC-2000), St. Louis, MO. These panelists based their remarks on the following charge: "Water supply and treatment systems, multipurpose dams, flood protection works, and water transportation channels and harbors constitute a generally aging water infrastructure in the United States. These systems are largely not in the public's consciousness; yet they are fundamental contributors to the nation's prosperity and quality of life. Investment choices and tradeoffs about the rehabilitation, replacement and upgrading of this vital water resources infrastructure must be considered. What are the alternatives, how are they accomplished, and who pays?"

Very appropriate and conducive to brainstorming. The third key issue panel was "Safety and Security of Water Resources." Panelists included Joan B. Rose, University of South Florida, St. Petersburg, FL, leader; John W. Keys, Commissioner, U.S. Bureau of Reclamation, Washington, DC; Ray E. Finley, Sandia National Laboratories, Albuquerque, NM; Michael S. Marcotte, Deputy General Manager, District of Columbia Water and Sewer Authority, Washington, DC; and Diane Regas, Deputy Assistant Administrator, Office of Water, EPA, Washington, DC. These panelists based their remarks on the following charge: "Terrorism and natural disasters threaten the safety and security of the nation's water supplies and water storage facilities. It is essential that water resources policies address detection of terrorist activities related to physical facilities and water supplies, monitoring of water supplies, appropriate contingency and response plans for both terrorist events or natural disasters, and recovery plans for terrorist events or natural disasters. How can water resource policies best address this?"

The format and scope were excellent. The fourth key issue panel was "Managing Watersheds Holistically." The panel was led by R. Mack Gray, Deputy Undersecretary for Natural Resources and the Environment, USDA, Washington, DC. Other panelists included Billy R.

Wilson, Vice Chair, National Association of Conservation Districts, Kinta, OK; Robert M. Hirsch, Associate Director for Water, U.S. Geological Survey, Reston, VA; Christine Olsenius, Executive Director, Southeast Watershed Forum, Duluth, GA; and Henry J. Vaux, Jr., Associate Vice President for Agriculture and Natural Resources, University of California. These panelists based their remarks on the following charge: "Watersheds provide water for terrestrial and aquatic species and their habitat and meet human needs for municipal, industrial, agricultural, recreational and other water uses. Rapid population growth, loss of aquatic native diversity, and a general decline in the health of landscapes and ecosystems have led to increased conflicts among water users. A holistic approach can provide information on the physical, biological, and social systems of watersheds and to understand the interactions within and between these systems at different hydrologic scales. How can a holistic approach help resolve these conflicts?"

Great work by the organizers, support staff and facilitators to keep the program on time and in focus. The fifth key issue panel, "Sustainable Water Use and Drought Management" was led by Judge H. Craig Manson, Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior, Washington, DC. Other panelists included Shaun McGrath, Program Manager for Water Policy, Western Governor's Association, Denver, CO; Joseph K. Hoffman, Executive Director, Interstate Commission on the Potomac River Basin, Rockville, MD; and Denise D. Fort, University of New Mexico, School of Law, Albuquerque, NM. These panelists based their remarks on the following charge: "Sustaining and managing groundwater and surface water resources of the U.S. for future generations is becoming more difficult given increasing water demands, especially during droughts. Managing water use for the long run to sustain all needs including instream, offstream and habitat will require difficult tradeoffs and careful policy making. How can future policy decisions mitigate potential losses of life and property?"

Good job putting all this together. The final key issue panel was "Flood Plain and Coastal Zone Management". It was led by Margaret Davidson, Acting Assistant Administrator for Ocean Services and Coastal Zone Management, National Ocean Service, NOAA, Silver Spring, MD. Other panelists were Alfred H. Vang, Deputy Director, South Carolina Department of Natural Resources, Columbia, SC; Michael F. Rippey, Napa County Supervisor, Napa, CA; David H. Graham, Bonita Bay Group, Bonita Springs, FL; and Michael Buckley, Federal Emergency Management Agency, Washington, DC. These panelists based their remarks on the following charge: "Planning and management of flood plains and coastal zones have been underway for many years. Yet relatively few U.S. communities have adequate protection measures in place. Continuing development of floodplains and shorelines may increase the potential for harming natural resources and putting residents and their property at risk. How can future policy decisions mitigate potential losses of life and property?

I liked the format and was amazed at how well it worked with the number of people there. At the conclusion of the second, fourth, and sixth key issue panels, facilitated discussion sessions were held to allow all participants to discuss the two issues presented just previously. Participants were organized into tables of up to10 persons. Facilitators asked each table to discuss among themselves the most significant subissues of each key issue. Each table reported one significant subissue to the facilitators. Following the discussion, the subissues were posted and participants were asked to vote on the subissues using dots. Results of the voting were made available to participants. In the afternoon of day 2, three rapporteur/provocateurs presented feedback from the discussion sessions, each providing their own spin. Provocateurs were G. Edward Dickey, Baltimore, MD, representing Dawson and Associates, a water resources development group; Mark Van Putten, President of the National Wildlife Federation, Reston, VA, representing the environmental community; and Brian Griffin, Secretary of Environment, State of Oklahoma, representing the state perspective. This was followed by an open discussion moderated by Gerry Galloway that provided views from both the floor and the dais and featured several of the key issue panelists. The Dialogue concluded with closing remarks by Gerry Galloway.

I would like to be on a planning committee for such a conference. The Dialogue generated great energy and calls for future action. The results of the subissue voting identified three consensus issues that crosscut the key issues and could form the basis for future actions. First, a National Water Vision should be developed that will assist the nation in dealing with competing water resources objectives. Under the Vision, issues such as infrastructure, drought, and flooding could be addressed collectively rather than individually. Second, a National Water Policy is needed to define the shared responsibilities for water issues at all levels from local to federal. The Policy could translate the National Water Vision from talk to action. Finally, there is need for greater collaboration among water-related organizations at all levels that could build on successful fledgling incentive programs such as water trading. The Dialogue Steering Committee will continue to meet to determine the timing and scope of future activities based on these consensus issues.

Dialogues could alternate among national, international, and regional issues. The Dialogue was a huge success! One panelist who only was present for the panel on which he served, was heard to say that "If I had known in advance the quality of the presentations and attendees I would have cleared my calendar for both days." AWRA invites comments on the Dialogue and on thoughts regarding future Dialogues. Please convey your comments to Richard Engberg, Technical Specialist, AWRA at dick@ awra.org.

Richard A. Engberg is AWRA's Technical Specialist, A former federal employee, he was Manager of the National Irrigation Water Quality Program for the Department of the Interior from 1990 to 1999, and before that was USGS-WRD, District Chief, Iowa District, Iowa City, Iowa.

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American Water Resources Association
NATIONAL WATER RESOURCES POLICY DIALOGUE
(A PICTORIAL REVIEW)

AWRA Announces the Launch of E-Learning Courses

AWRA is pleased to announce its entry into the field of distance learning with the launch on October 15, 2002, of seven individual e-learning courses. These are the first seven of a nine-course program entitled "Introduction to Modeling of Hydrologic Systems." Courses 8 and 9 are undergoing review and will be available in 2 to 3 weeks.

Eric Lappala, President of Eagle Resources, LLC, Raleigh, NC, has created the courses for AWRA and is the instructor for all courses. Eric has over 30 years experience in the modeling of hydrologic systems, first with the U.S. Geological Survey and more recently as a consultant. Eric has taught a similar two-day short course in the past for AWRA.

The purpose of the nine-course program is to enable water resources professionals an opportunity through self-study to become familiar with the concepts of hydrologic systems modeling, and to understand the utilities and pitfalls of hydrologic modeling.

Students can expect that each course will take about 1.5 to 2 hours of on-line time to complete. The entire sequence of nine courses is expected to require about 15 hours of on-line time. Each course will be a prerequisite for the succeeding course.

Learning objectives are listed at the beginning of each course and exam questions based on the learning objectives are located at strategic points during the course to test the students' comprehension of the course material. E-mail contact with the instructor and chat rooms are available to students on a near real time basis.

Continuing Education Units (CEUs) are available for the entire nine course sequence. A total of 1.5 CEUs will be awarded to students completing all nine courses. CEUs will not be available for students who do not complete the nine course sequence.

The cost of each course is $40 for AWRA members and $50 for non-members. Registration may be accomplished on line by visiting the AWRA website www.awra.org and using the Distance Learning link. Alternatively, students may visit the AWRA learning portal www.waterlearn.org and register directly. For more information, please contact Richard Engberg, AWRA Technical Specialist at dick@awra.org.

The names of the nine courses comprising "Introduction to Modeling of Hydrologic Systems" are listed below:

Course No.	Course Name
1	The Modeling Process
2	Selection of Fluid Flow Processes
3	Conceptual Fluid Flow Processes – Groundwater
4	Properties that Determine Groundwater Flow
5	Transport Processes
6	Developing the Site-Specific Conceptual Model
7	Developing the Simulation Model
8	Solution Methods for the Simulation Model
9	Model Calibration, Sensitivity, and Modeling Resources

Reported by Richard A. Engberg
AWRA Technical Specialist

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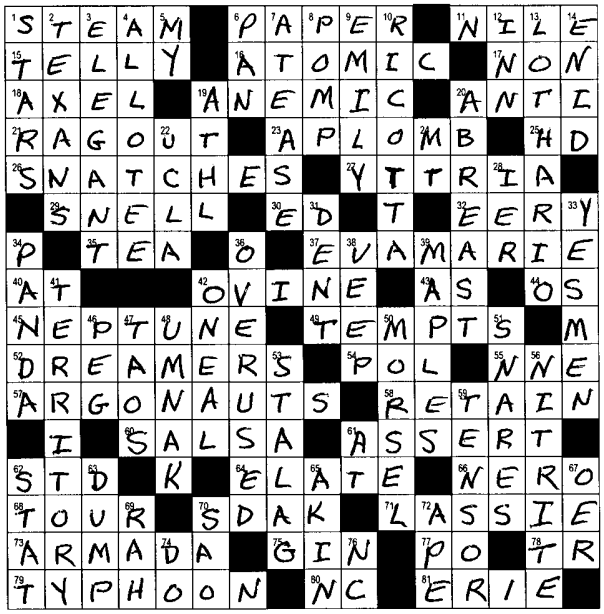
AWRA Awards Herbert Scholarship for 2002-2003

TESS WYNN has been selected as the recipient for the 2002-2003 Richard A. Herbert Memorial Educational Scholarship.

Ms. Wynn is currently a PhD candidate in Biological Systems Engineering at Virginia Tech. She received her BS in Agricultural Engineering from Virginia Tech where she was named 1992 University Woman of the Year. In 1995 Ms. Wynn received an MS in Civil Engineering from North Carolina State University. She has professional experience with state government and private consulting. Her current research is on the effects of vegetation on stream bank erosion. Following the completion of her PhD, Ms. Wynn plans to pursue a career in research and teaching.

Solution to Puzzle on pg. 24



Future Issues of IMPACT

JANUARY 2003
Failures In Water Management: Lessons Learned
John H. Herring (JHERRING@dos.state.ny.us)

MARCH 2003
Water Rights And Wrongs In Transition
Clay J. Landry (landry@perc.org)
Laurel E. Phoenix (phoenix@uwgb.edu)

MAY 2003
Water Management At The Extremes
Charles W. Slaughter (macwslaugh@icehouse.net)

JULY 2003
Power Shifts In Water Management
Faye Anderson (fayeanderson2@aol.com)

SEPTEMBER 2003
Framework For Monitoring
Robert C. Ward (rcw@lamar.colostate.edu)

NOVEMBER 2003
Social Foundations of Water Management
Eric J. Fitch (fitche@marietta.edu)

All of the topics listed above are subject to change. For information concerning submitting an article to be included in the above issues, contact the designated Associate Editor or the Editor-In-Chief N. Earl Spangenberg (espangen@uwsp.edu).

AWRA Future Meetings

2003 MEETINGS

May 12-14, 2003 • Kansas City, Missouri
AWRA'S SPRING SPECIALTY CONFERENCE
"Agricultural Hydrology and Water Quality"

June 30-July 2, 2003 • New York, New York
AWRA'S SUMMER SPECIALTY CONFERENCE
"Second International Congress on Watershed Management for Water Supply Systems"

November 3-6, 2003 • San Diego, California
AWRA's ANNUAL WATER RESOURCES CONFERENCE

2004 MEETINGS

May 15-19, 2004 • Nashville, Tennessee
AWRA'S SPRING SPECIALTY CONFERENCE
"GIS AND Water Resources-III"

June 28-30, 2004 • Olympic Valley, California
AWRA'S SUMMER SPECIALTY CONFERENCE
"Riparian Ecology–Buffer Zone"

November 1-4, 2004 • Orlando, Florida
AWRA's ANNUAL WATER RESOURCES CONFERENCE

August 2002 JAWRA Papers (Vol. 38, No. 5)

WATER ON RESOURCES DIALOGUE

- Devolution of Bureau of Reclamation Constructed Water Facilities
- Rates, Rights, and Regional Planning in the Metropolitan Water District of Southern California

TECHNICAL PAPERS

- Sustaining Local Watershed Initiatives: Lessons From Landcare and Watershed Councils
- Estimating the Benefits of Phosphorus Pollution Reductions: An Application in the Minnesota River
- Multiscale River Environment Classification for Water Resources Management
- Precipitation Retention and Soil Erosion Under Varying Climate, Land Use, and Tillage and Cropping Systems
- Integrated Assessment of Uses of Woody Draws in Agricultural Landscapes
- Evapotranspiration Measurement and Estimation of Three Wetland Environments in the Upper St. Johns River Basin, Florida
- New England Drought and Relations With Large Scale Atmospheric Circulation Patterns
- Health Risks Associated With Consumption of Untreated Water From Household Roof Catchment Systems
- Assessing Sedimentation Issues Within Aging Flood Control Reservoirs in Oklahoma
- Modeling the Hydrochemistry of the Cannonsville Watershed With Generalized Watershed Loading Functions (GWLF)
- NWSRFS Calibration Parameter Selection and Geologic Reasoning: Pacific Northwest Cases
- A Strip Model Approach to Parameterize a Coupled Green-Ampt Kinematic Wave Model
- Multiscale Influences on Physical and Chemical Stream Conditions Across Blue Ridge Landscapes
- Raingage Network Design Using NEXRAD Precipitation Estimates
- Short Term Benthic Colonization Dynamics in an Agricultural Stream Recovering From Slaughterhouse Effluents
- Calibration of Storm Loads in the South Prong Watershed, Florida, Using BASINS/HSPF
- Climatic and Hydrologic Variability in a Coastal Watershed of Southwestern British Columbia
- Suspensoids in New York City's Drinking Water Reservoirs: Turbidity Apportionment
- Heavy Rainstorms in Chicago: Increasing Frequency, Altered Impacts, and Future Implications
- Erodibility of Urban Bedrock and Alluvial Channels, North Texas

JAWRA

Employment Opportunity

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EPA is seeking three highly qualified scientific leaders who are currently engaged in bench-level work and research and development in the physical, biological, medical, or engineering sciences. Further rounds of hires are possible. The incumbent should be a nationally recognized authority and leader in an area of widespread scientific interest and investigation. He/she will typically have received honors and awards from major national organizations for his/her accomplishments. His/her reputation as a scientific leader is such that he/she serves as a recruiting attraction for recent graduates who seek opportunities to work under his/her inspiration and guidance in one of the fields of study listed below. To meet the requirements of these positions, applicants must have a PhD or equivalent experience.

These are Scientific/Technical (ST) Professional positions located in the Office of Research and Development (ORD). The ST shall be based in one of ORD's many laboratories or centers, dependent on field of study.

The minimum rate of basic pay for an ST position shall equal 120 percent of the GS-15 step 1 rate of basic pay.

The incumbent will be responsible for one of the following fields of study: (1) Surface Water Hydrology, (2) Systems Ecology, (3) Human Exposure, (4) GIS/Spatial Analysis, (5) Atmospheric Sciences, (6) Environmental-Epidemiology, (7) Risk Assessment Modeling, (8) Genomics/Proteomics, or (9) Bioinformatics

Interested applicants may submit a short resume, a vision statement, and 2-3 representative publications to Jayne Ramsey at U.S. EPA/ORD (8101R), 1200 Pennsylvania Avenue, NW, Washington, DC 20460.

For more information, please go to http://www.epa.gov/ORD/htm/jobs_ord.htm, or contact Jayne Ramsey at (202) 564-6736 or ramsey.jayne@epa.gov.

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SEND US YOUR FEEDBACK ON THIS ISSUE
(comments on previous issues are also welcome)

Water Resources IMPACT has been in business for almost four years and we have explored a lot of ideas. We hope we've raised some questions for you to contemplate. "Feedback" is your opportunity to reflect and respond. We want to give you an opportunity to let your colleagues know your opinions . . . we want to moderate a debate . . . we want to know how we're doing. Send your letters by land-mail or e-mail to Clay Landry (for this issue); or to Earl Spangenberg (Editor-In-Chief). Either way, please share your opinions and ideas. Please limit your comments to approximately 350 to 400 words. Your comments may be edited for length or space requirements.

Feedback

Vol. 4, No. 3, May 2002: Article on "What If ... The United States of America Were Based on Watersheds"

I just got around to reviewing the May issue of IMPACT to use one of the articles for my Watershed Management course this semester, specifically the one by Gerald Kauffman "What If ...". I have a couple of comments that should be addressed.

1. The Water Resources Council was created by the Water Resources Planning Act of 1965, not the implied "Water Resources Council [Act] of 1965."

2. The 1970 Susquehanna River Basin Commission was created by the Susquehanna River Basin Compact that was approved by Congress and includes the three states and a federal representative that is, I believe, the Corps of Engineers, not the Congress as stated.

3. The Colorado River "Agreement" is properly known as the Colorado River Compact, which created both Divisions (for use) and Basins (for supply). Since not much can be done about the supply (other than some transbasin diversions which, although they do exist, don't make much of a dent in the total annual flow of the Colorado River), the Divisions are uniquely divided to have equal clout, which is not easy with seven states. The solution was to have Colorado and Wyoming represented only in the Upper Division along with parts of Arizona, Utah, and New Mexico; while California and Nevada are represented only in the Lower Division along with parts of Arizona, Utah, and New Mexico again. This provides the necessary balance, and is certainly an interesting as well as ingenious arrangement that would be worthy of pointing out in an article such as this.

4. And, finally, in the article itself, which raises interesting and valid concerns, ideas, and suggestions, the discussion of the original boundary-setting in the U.S. omits identification of the metes and bounds system that did, indeed, use ridges as boundaries along with streams and rivers, as pointed out. It also omits discussion of the role of the General Land Office Township System that was used outside the original 13 Colonies in the federally-acquired (by treaty, war, or purchase) lands.

Peter Black, SUNY

Response by Gerald J. Kauffman:

All are points well taken.

1. The Water Resources Council was indeed created by the Water Resources Planning Act of 1965.

2. The Susquehanna River Basin Commission Compact was signed into law on December 24, 1970, and was adopted by the Congress of the U.S., and the legislatures of New York State, Pennsylvania, and Maryland. The SRBC commissioners are the governors of the three states and a federally appointed designee, appointed by the President.

3. The formal name is the Colorado River Compact but many references also refer to it less formally as the Colorado River Agreement.

4. Metes and bounds surveying did incorporate boundary determinations based on ridge tops as well as other natural features. However as discussed in the article, very few of the state political boundaries were surveyed based on ridge line or watershed-based boundaries.

AMERICAN WATER RESOURCES ASSOCIATION MEMBERSHIP APPLICATION – 2003

MAIL THIS FORM TO . . . AWRA • 4 West Federal St. • P.O. Box 1626 • Middleburg, VA 20118-1626
FOR FASTEST SERVICE . . . FAX this form (credit card or P.O. orders only) to (540) 687-8395
QUESTIONS? . . . CALL AWRA HQ at (540) 687-8390 or E-MAIL at info@awra.org

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PROC. – 1 copy of AWRA's annual symposium proceedings

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AWRA
Community, Conversation, Connections

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(PLEASE LIMIT YOUR CHOICE TO ONE IN EACH CATEGORY)

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JT1 Management (Pres., VP, Div. Head, Section Head, Manager, Chief Engineer)
JT2 Engineering (non-mgmt.; i.e., civil, mechanical, planning, systems designer)
JT3 Scientific (non-mgmt.; i.e., chemist, biologist, hydrologist, analyst, geologist, hydrogeologist)
JT4 Marketing/Sales (non-mgmt.)
JT5 Faculty
JT6 Student
JT7 Attorney
JT8 Retired
JT9 Computer Scientist (GIS, modeling, data mgmt., etc.)
JT10 Elected/Appointed Official
JT11 Volunteer/Interested Citizen
JT12 Non-Profit
JT13 Other _____

EMPLOYER CODES

CF Consulting Firm
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ES Educational Institution (student)
LR Local/Regional Gov't. Agency
SI State/Interstate Gov't. Agency
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FG Federal Government
RE Retired
NP Non-Profit Organization
TG Tribal Government
OT Other _____

EDUCATION CODES

HS High School
AA Associates
BA Bachelor of Arts
BS Bachelor of Science
MA Master of Arts
MS Master of Science
JD Juris Doctor
PhD Doctorate
OT Other _____

WATER RESOURCES DISCIPLINE CODES

AG Agronomy
BI Biology
CH Chemistry
EY Ecology
EC Economics
ED Education
EG Engineering
FO Forestry
GR Geography
GE Geology
GI Geographic Information Systems
HY Hydrology
LA Law
LM Limnology
OE Oceanography
PS Political Science
OT Other _____

PLEASE NOTE YOUR SELECTED CODE NUMBERS FROM ABOVE

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EMPLOYER CODE .....
WATER RESOURCES DISCIPLINE CODE.....
EDUCATION CODE .....

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