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MUNICIPAL WATER RIGHTS IN NEW MEXICO

VARIOUS APPROACHES - VARIOUS DEVELOPMENT IMPACTS

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INTRODUCTION

Municipalities in New Mexico today are in the position of balancing economic development and smart growth. The most important element of smart growth is water supply.

Each municipality in New Mexico has its own unique set of circumstances that its governing body must consider in determining what policy it should set in terms of new development and water supply. These factors include: whether the municipality wants to encourage economic growth and development; the make-up of its existing portfolio of water rights (whether it has surface water, groundwater, imported water, and/or storage); the location and availability of water rights; staff time; expense; local politics; risk assignment; and the local business atmosphere.

Many municipalities up and down the Rio Grande are growing at a significant rate. The list includes Taos, Santa Fe, Bernalillo, Rio Rancho, Albuquerque, Los Lunas, Belen, Truth or Consequences, Las Cruces, and Santa Teresa. For these entities, the challenge lies in having sufficient water rights to support their existing populations and new development.

Other municipalities across the state face similar challenges related to growth. For many municipalities, their present water supply is also stretched by drought. Almost all municipalities want to accommodate growth and economic development. Thus, the issue they face is who will bear the risk and pay the associated costs of acquiring and transferring water rights to serve new development – the municipality, the builder, or some combination of the two.

The first step for most municipalities across New Mexico is water conservation programs. Most municipalities have been able to stretch their water supplies through: public education; water use restrictions; and pricing structures that discourage the use of large volumes of water — thereby decreasing per capita water consumption. Conservation, however, can only "create" so much water, and additional water rights must be brought into the municipality to accommodate growth.

Accordingly, while acquiring and transferring additional water rights is the primary focus after conservation, additional issues that must be addressed with new development and new water demand include the infrastructure that must be constructed to serve new areas and annexation.

To examine these issues more thoroughly, ordinances and regulations from 20 New Mexico municipalities were obtained and reviewed. The list includes Alamogordo, Albuquerque, Angel Fire, Artesia, Bloomfield, Carlsbad, Deming, El Prado Water and Sanitation District, Española, Farmington, Hatch, Las Cruces, Los Lunas, Mesilla, Raton, Rio Rancho, Ruidoso, Santa Fe, Taos, and Tucumcari. [An electronic summary of each municipality's requirements for water rights for new development, infrastructure, and annexation is available upon request, email: thewaterreport@hotmail.com]

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Approaches

Connection Fee

Predictability

Cities' Risks

The Water Report
(ISSN pending) is published monthly by Envirotech Publications, Incorporated
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Editors: David Light & David Moon
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email: thewaterreport@hotmail.com
website: www.TheWaterReport.com
Subscription Rates: $249 per year
Multiple subscription rates available.
Postmaster: Please send address corrections to The Water Report, 260 North Polk Street, Eugene, OR 97402

WATER RIGHTS FOR NEW DEVELOPMENT

In general, the municipalities surveyed take one of three approaches to new water requirements necessitated by the extension of water service. First, one group of municipalities has no specific ordinances or regulations that require developers to acquire or transfer water rights when extending water service to a new development. The cost of providing new water service is offset to some degree by hookup fees that can vary by meter size. A second group of municipalities requires new water users to convey sufficient water rights to offset their new demand on the system or pay a fee in lieu of providing water rights at a price set by the municipality. Finally, a third small group of municipalities requires developers to convey water rights to offset their new water demand, but does not allow a fee in lieu of water rights. In other words, there is an absolute requirement that water rights be conveyed to the municipality. Each of these three categories is described in more detail below.

No Water Rights or Fee in Lieu of Requirement

At one end of the spectrum are the cities and towns which essentially have no requirements with respect to water rights when there is new demand on an existing system. In some cases, communities charge a standard connection fee. In other cases, fee schedules vary depending on the size of the meter. This latter approach shifts more of the costs to those builders who use more water.

Two entities that use this approach are the Albuquerque-Bernalillo County Water Utility Authority and the City of Gallup. With respect to the Albuquerque-Bernalillo County Water Utility Authority, there is a Utility Expansion Charge for each new connection within the Authority's service area. The Utility Expansion Charge varies according to a number of factors, including the amount of water that will be consumed by the new water user. Outside of the service area, the Authority's policy is that there should be no net expense to the Authority. With respect to the City of Gallup, there are no specific water rights or fee requirements for developers. The City has not been stretched to the point that it has had to create a specific policy to address the issue of water rights for new growth. Gallup's policy accommodates growth.

One advantage of this system is that it is easy to administer and provides predictability of cost and scheduling to developers. Another advantage is that the cost of water rights is not artificially inflated by competition among developers. By keeping builders out of the water rights market, there are fewer competitors to drive up the cost of water rights.

The disadvantage to a no-water-rights or fee-in-lieu-of policy is that the municipal entity bears most of the burden and risk in obtaining additional water rights. In cases where there is one standard hook-up fee, a city cannot distinguish between small and large projects, regardless of their potential impact on the city's water resources. Variable hook-up fees that bear a relationship to meter size help alleviate this problem. Under this approach, the municipality bears the responsibility for ensuring an adequate water supply, as well as the risk of escalating costs over time to acquire and transfer additional water rights.

This approach works well for large municipalities in New Mexico that have adequate professional staff who work on large-scale projects and who are ahead of the curve in terms of acquiring water rights. It also works well for New Mexico municipalities who want to encourage economic growth and development.

Conveyance of Water Rights or a Fee in Lieu of Water Rights

This category of programs provides options — either the conveyance of water rights to compensate for the new demand placed on the system that will result from the extension of municipal water service, or payment of a set fee per acre-foot per year needed in lieu of conveying water rights. The price per acre-foot for the fee in lieu of water rights is set by each municipality based upon the local price of water rights. [Editor's note: An acre-foot is the volume of water required to cover one acre of land to a depth of one foot, equivalent to 325,851 gallons]

Several determinations must be made when using this approach, each of which varies by municipality. These factors include: the threshold for the applicability of the ordinance; the quantity of water that will be required; the price for the fee in lieu of water rights; whether the municipality has the discretion to reject water rights that are being tendered; and whether a conveyance is simply the act of legally conveying the water rights to the municipality or whether it also includes completing a transfer of the water rights (approval from the State Engineer).

One of the initial policy decisions that a municipality must make is at what level of new water use does its ordinance apply. Some require the conveyance of water rights or a fee in lieu of for the addition of single family residences. Other municipalities set higher residential and commercial thresholds that must be exceeded before the ordinance becomes effective.

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Fee-in-Lieu Pricing

Rejection of Tender

Transfer Approval

Appurtenant Rights

Some municipalities quantify the water rights that must be conveyed or set the fee in lieu of based upon a site-specific water budget. In other cases, municipalities quantify the water rights required or set the fee in lieu of based upon the size of the meter requested by the new development. Often, these municipal ordinances and regulations have clauses allowing a reduction in the pre-determined quantities if the property owner can persuade the governing body that the project will use less water than the pre-determined amount.

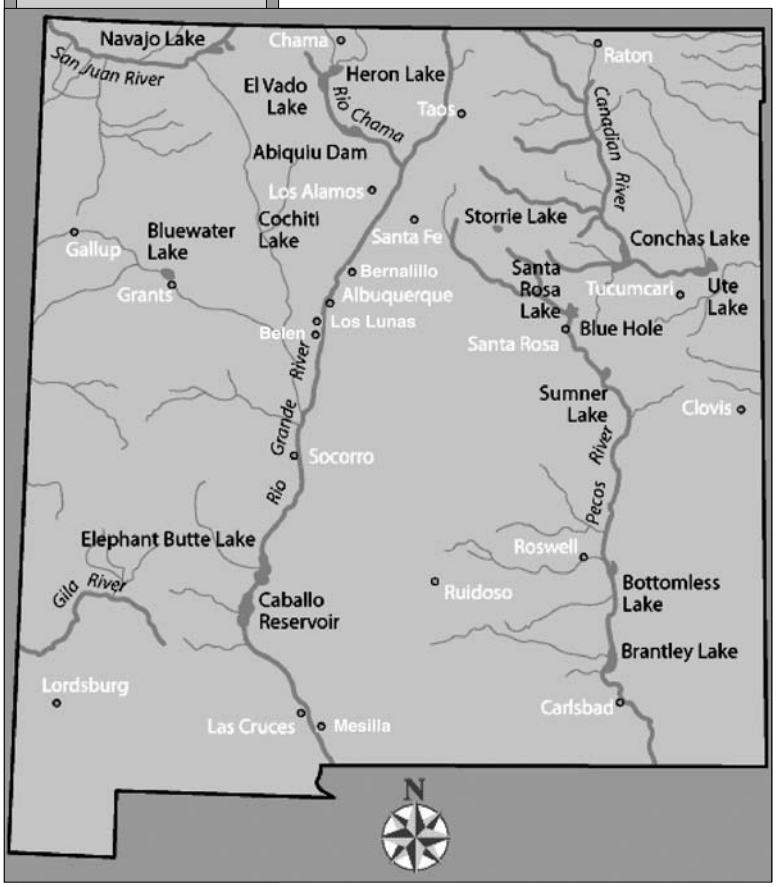
With respect to the price for a fee in lieu of conveying water rights, each municipality sets its own price. In some cases, the price is set by ordinance. In other cases, the price is set by regulation. In yet other cases, the municipality's price is set by something less formal than a regulation. Prices set by ordinance are difficult to change and may not reflect current market conditions.

In almost all instances, municipalities reserve the right, either explicitly or implicitly, to accept or reject water rights that are tendered. For example, the Town of Mesilla explicitly reserves the discretion to determine the acceptability of the water rights being conveyed. In other instances, such as the Town of Taos, the municipality accomplishes the same objective by holding new water users to their full water rights demand, whether or not the full transfer is approved by the State Engineer.

None of the ordinances in this second category provide specific information about what constitutes a conveyance of the water rights to the municipality. In other words, it is not clear whether conveyance simply means executing a deed conveying the water rights to the municipality or whether it also includes completing a transfer of the water rights as required by the Water Code. It appears that making a conveyance to the municipality has historically been sufficient and that each municipality then takes the responsibility for the completion of a transfer. This is an area that should be clarified in most of the municipal ordinances and regulations.

Many of the ordinances are based on the assumption that the water rights being conveyed are those appurtenant to the land being developed. This is emphasized by the fact that the fee in lieu of provisions are generally written to apply primarily to the owners of "non-water right land."

Examples of entities that use this approach are Las Cruces, Taos, and El Prado Water and Sanitation District located just north of Taos. Taos and El Prado Water and Sanitation District both require set amounts of water rights for each new single family residential home or a set fee in lieu of water rights. Both entities also review the site water budget for each new commercial water user. The fee in lieu of water rights is higher for new commercial water users than it is for new residential users. Rather than reviewing site-specific water budgets for each new water user, the City of Las Cruces determines each developer's water rights requirements by meter size. The varying scale is set forth in a resolution of the Las Cruces City Council.



The advantage of a conveyance of water rights or alternatively, a fee in lieu of water rights program is that it recognizes and seeks to address the need for additional water rights for development, while allowing builders the option of paying money if they need certainty of time or money. Presumably, the fees paid are used by the municipality to acquire and transfer water rights to offset the new demand. This approach helps control inflation of water rights costs due to competition among builders in the marketplace. A key component of a successful fee in lieu of program is keeping the fee tied to the cost of acquiring and transferring water rights (which means not setting the price by ordinance).

As would be expected, there are also some disadvantages of a conveyance of water rights or a fee in lieu of program. Initially, a municipality must be vigilant to update its fee in lieu of so that it can cover the costs of acquisition and transfer of water rights. Given the rapidly escalating price of water rights in some areas, this can be very difficult to anticipate given the time lag that can happen between the payment of the fee in lieu of and the actual acquisition and transfer of water rights. Next, to actually compensate for the water demands of new

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Transfer Issues

development, the city should set its water rights requirements slightly higher than anticipated or require site-specific water budgets for each new home or project. City staff or a consultant's time will be needed to review site-specific water budgets. To ensure that homeowners or developers convey only valid and existing water rights, the city should maintain the discretion to reject tendered water rights, or at least make sure the developer is liable for the site water budget even if the State Engineer denies or reduces the transferred amount. Finally, if the city only requires the conveyance of the water rights, it will have the time, expense, and risk of obtaining a final and non-appealable transfer of the subject water rights.

This approach works well for municipalities who want to encourage economic growth and development and want builders to pay their fair share of the costs associated with acquiring the necessary water rights to support the new use. It requires a commitment of staff time or the hiring of attorneys and consultants to acquire and transfer water rights if a municipality is collecting fees rather than water rights. This approach does not discourage new development, but does make new development pay its fair share.

Conveyance of Water Rights Only

Fee Option Unavailable

There are a small number of municipalities in New Mexico that require the conveyance of water rights to offset new water use without providing the option of a fee in lieu of water rights.

Policy Factors

Like the municipalities that allow either a conveyance of water rights or a fee in lieu of water rights, municipalities that only allow the conveyance of water rights must make several policy decisions about this approach. Each entity must decide at what threshold its ordinance will apply, establish a formula for determining the quantity of water that will be required, decide whether the municipality has the discretion to reject water rights that are being offered, and set policy on whether a conveyance is simply the act of legally conveying the water rights or whether it also includes completing a transfer. Because each of these factors was addressed in the section immediately above, the discussion is not repeated here.

The only New Mexico municipalities that use this third approach among the group surveyed were Santa Fe, Los Lunas, Belen, and Bernalillo. The ordinances in Los Lunas, Belen, and Bernalillo actually allow a fee in lieu of conveying water rights, but none of the three are presently accepting a fee in lieu of water rights.

Threshold Quantity

Los Lunas, Belen, and Bernalillo have a minimum threshold quantity for commercial and residential development before the ordinance becomes effective. Once the threshold is exceeded, the presumption for residential development is .336 acre-feet per year consumptive use, unless the builder can prove the amount will be less. Local builders will typically try to reduce the requirement. Developers are finding water through severances of water rights from the land, but increasingly, are purchasing both the land and the appurtenant water rights. In these three municipalities, the builders are paying for the cost of preparing an application to transfer the water rights, the filing fees, and the cost of advertisement. There have not yet been protested applications in Los Lunas, Belen, or Bernalillo so the issue has not been raised about whether the municipality or the builder would pay the costs associated with a protested application. administrative hearing and any potential appeals.

Protest Costs

Santa Fe's Approach and Amendments: Transfer Only

Developer Burden

The City of Santa Fe (City) has the most extensive and explicit ordinance in New Mexico to offset the demand for new growth in terms of requirements on builders who need water service. Recognizing that development in the area is expanding while Santa Fe's water resources are limited, the City Council decided to place the full burden and risk of meeting new water needs on the developers of the projects creating the needs. This water rights transfer ordinance was originally adopted by the City Council on July 27, 2005, and after a year of heated debate and threatened litigation, it was amended on July 26, 2006. It is informative to describe the ordinance as originally passed, the criticisms that the ordinance generated, and the recent amendments that addressed some of the concerns.

Recent Amendments

Santa Fe's ordinance requires developers to acquire and transfer water rights to the City. There is no fee in lieu of provision. To begin the process, each builder must acquire sufficient water rights to meet 110% of his site water budget. The builder then "tenders" these water rights to the City. The City conducts a due diligence review of water rights offered by the builder to determine whether they are good and valid water rights in the City's view and whether they are the type of water rights that the City can use within its existing system. The builders pay the City $1,000 per acre-foot to review the water rights and the City has the sole discretion to accept or reject the water rights that have been tendered. If the City rejects the tendered water rights, the builder must find different water rights to tender to the City. If the City accepts the water rights, the City becomes a co-applicant with the water rights owner on an application to transfer those rights to a point of diversion designated by the City for its use. The ordinance states that the City has the sole discretion to make decisions in the application process. The

City Discretion

New Mexico Municipal Water Rights

Ordinance Effects

Cost Uncertainty

Bidding War

Project Limbo

Transfer Process

Water Bank

Escrow Account

City shares the cost of the application with the water rights owner. As the ordinance was originally adopted, builders were not allowed to obtain building permits until there was a final and non-appealable order transferring the water rights to the City by the State Engineer.

Soon after the ordinance was adopted in Santa Fe, local builders began to experience the effects. The primary objections by builders to Santa Fe's ordinance included: cost uncertainties; the high overall cost to acquire and transfer water rights in what had quickly become a very competitive market; and the uncertainty of time to process an application. Another concern of builders relates to the City of Santa Fe's sole discretion over the application process once they seek to transfer their water rights to the City.

With the structure of Santa Fe's ordinance, builders have no means of accurately predicting project cost when they are required to acquire and complete the transfer of water rights. Until an application to change the place of use, purpose of use, and point of diversion is filed and notice is published, a developer cannot anticipate whether the application will be protested. The quantity and quality of protests can significantly affect the costs to complete a transfer of water rights. While an unprotested application could be approved for minimal cost, the costs of litigating a protested application can easily climb into the tens or hundreds of thousands of dollars. Trying to anticipate overall project costs when the water rights component varies so widely makes business decisions very difficult.

Coupled with the uncertainty of costs is the constantly rising cost of water rights that is fueled by the existing ordinance. As a direct result of the ordinance, a significant number of developers are now in the local water rights market bidding against each other to acquire water rights. There is fierce competition among developers who need water rights immediately. This demand has caused the cost of water rights to increase dramatically, with the price per acre-foot quadrupling in the last year. The negative impact of the high market value of water rights will necessarily be experienced by the City if it purchases water rights for its own needs.

Another complaint about the ordinance as originally adopted was that it created an unworkable uncertainty in terms of time and scheduling new projects. Because builders could not obtain building permits until they had received a final and non-appealable order transferring the necessary water rights to the City, new projects could remain in limbo for years. The process of acquiring, tendering, and transferring water rights can take anywhere from one year to five years, depending on the water rights market, the work load of City staff and its consultants to review tendered water rights, the State Engineer's application process, and potential appeals. This uncertainty in time created an extreme hardship on builders who had business and financial commitments that are time dependant. This matter was recently addressed by amendments to the water rights transfer ordinance which are discussed below.

Another component of Santa Fe's ordinance creates a significant risk for builders who purchase water rights to convey to the City. The ordinance gives the City sole decision-making authority over the application process to transfer water rights. When the application phase begins, many builders will have invested millions of dollars buying water rights. The City ordinance provides the City with sole discretion over the transfer process on water rights that it does not own and in which it has no vested interest. Ultimately, many builders will have millions of dollars worth of their projects and millions of dollars of their water rights that are dependent on the City's decision-making ability in the application process. What happens if the builder and the City disagree on witnesses at hearings, on motions and briefs, or litigation strategy? What if some or all of the water rights are not approved for transfer, arguably because of how the application process was pursued? The City has no vested interest in the outcome and the builder will likely have millions of dollars at stake. This risk can be mitigated if the builders initially obtain an option to purchase the water rights as opposed to the outright purchase of a water right. Because it is a seller's market, though, such a provision may be difficult or impossible to obtain without a significant increase in the price.

While several local builders sought a repeal of the City's water rights transfer ordinance or at least the addition of a fee in lieu of water rights, the City chose to retain the basic structure of the ordinance and address some of the concerns with the two recent amendments to the ordinance. One amendment creates an escrow account which allows builders to obtain building permits while their water rights transfer application is pending and the second creates a water rights bank. While neither amendment shifts the ultimate burden or cost of acquiring and transferring water rights from the builders, both will help builders with the timing issue, i.e. it will allow them to obtain building permits and proceed with construction while their water rights transfers are pending.

The amendment to the water rights transfer ordinance relating to escrow allows developers to place 150% of the market value of their water rights into an escrow account after their water rights have been tendered to and accepted by the City. The establishment of an escrow account then allows a builder to obtain building permits while the transfer process is proceeding. If the transfer of water rights is not

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Escrow Process

Earlier Permit

Water Bank

Developer Risk

Water Budget Fee

ultimately approved, the escrow monies are forfeited. If some portion of the water right is not transferred, the escrow account is drawn upon proportionate to the quantity of water not transferred. An escrow account is different from a fee in lieu of water rights. With the escrow provision in the Santa Fe ordinance, a builder must find and tender sufficient water rights to pass the City's due diligence review. Builders do not have the option of paying a fee instead of acquiring and transferring water rights. The escrow account is only accepted if water rights that the City has reviewed and accepted are not transferred. The escrow account at least allows a builder to proceed with his project while an application to transfer water rights is pending. If a builder uses the escrow account to obtain building permits prior to issuance of a final and non-appealable order transferring the water rights, it is not in his financial interest to default to the escrow. At this stage, the builder has already paid for the water rights, paid the City to review the tendered water rights, paid the cost of the application process, and has had to escrow 150% of the purchase price of the water rights. It makes no financial sense for a builder to ever want to actually draw upon his escrow account. Instead, it is a tool to acquire a building permit earlier in the process.

An example should help to illustrate the point. Assume a builder buys 20 acre-feet per year of consumptive use water rights for $30,000 per acre-feet per year, for a total purchase price of $600,000. In addition, the builder will have to pay the City $20,000 to review the water rights. Also assume that the builder paid his own consultants and attorneys $20,000 for the transactional work, due diligence review, and to work with the City to get the water rights accepted. To obtain building permits while the transfer is pending, the builder will have to escrow $900,000 (150% of $600,000). Continuing with this example, assume that the builder has had to pay $100,000 in expenses related to the administrative water rights transfer. If the transfer is denied, the builder will forfeit the escrowed amount of $900,000 to the City, lose the $140,000 he paid to the City and to his own consultants and attorneys, and likely have no water rights if the transfer was denied. Under this scenario, the builder paid $1.64 million to be credited for 20 acre-feet per year of water for his project, or $82,000 per acre-foot per year of consumptive use rights. This being the case, builders will never want to default to an escrow account, but they will use it as a mechanism to obtain building permits earlier in the process.

The second amendment that was recently adopted by the Santa Fe City Council creates a water rights bank. Santa Fe's original ordinance requires that any water rights transfer be tied to a site water budget. The newly created water rights bank allows anyone to acquire and transfer water rights into points of diversion designated by the City independent of a specific project. A depositor can use water rights he has transferred into the water rights bank for his own future project or sell or assign his water rights at a negotiated price. A depositor must still tender water rights to the City, obtain an acceptance by the City, and pay the City its actual costs to review the water rights. The depositor is solely responsible for transfer costs. Title to the water rights will be transferred to the City when the rights are committed to a particular project. In time, the water rights bank will provide a portfolio of unused water rights that will be readily available for purchase by builders without having to spend the time and money acquiring and transferring water rights. While it is likely the price of water rights banked with the City will be high, the water rights bank will allow a builder the option of choosing certainty of time and price through purchase of banked water rights for his project.

Even with the two recent amendments, Santa Fe's ordinance still places nearly all of the risk of acquiring and transferring water rights for new growth solely on the builders. The approach of only allowing the conveyance of water rights, but not a fee in lieu of, is a good approach for municipalities who want to discourage growth. It also ensures that a municipality will not have to commit staff time and expense to acquire and transfer water rights to accommodate new growth. Even with the existing amendments, Santa Fe's ordinance is at the far end of the spectrum of municipalities in New Mexico in terms of assigning risk and cost to builders to acquire and transfer water rights to accommodate new growth and economic development.

Potential Fourth Approach: Emphasize Fees for Water Rights

It is impractical for any municipality to ignore the growing demand for water resources and not seek assistance from builders. After reviewing the various approaches, a fourth approach might be considered by municipalities. It combines aspects of all three approaches but it would be based upon a site water budget fee paid to the municipality, as the preferred alternative, with an option for water rights in lieu of the fee.

The fee should be calculated based upon the site water budget and anticipated market costs of water rights necessary to meet the budget. The municipality should also consider whether it wants builders to be responsible for their incremental share of unaccounted water, *i.e.*, system loss. In some municipalities, the problem is significant enough that it is a component of their ordinances. All fees collected should be

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earmarked for a permanent water rights purchase fund which the municipality would actively manage to continuously expand its water rights in order to meet future needs. Thus, the intent would be for the developers to bear the cost burden associated with expanding water rights. However, with the municipality controlling the market for water rights, the costs should not be forced into artificial escalation by bidding wars between developers (as described above). This would also remove uncertainty about the quantity or quality of water rights being tendered. This approach should appeal to developers because they can more accurately project building costs and because it provides more scheduling certainty for their project developments. It is the certainty they acquire under this type of scheme that would appeal to them.

Acquisition Program

The drawback to the municipality is that it must undertake a water rights acquisition program. However, every New Mexico municipality should already be actively engaged in such a program for its own 40-year water demands such that this ordinance would simply involve an expansion of those duties. The benefits of market and quality control provided through this type of program should offset any downside.

40-Year Plan

New Mexico municipalities were given a 40-year planning period by statute (N.M.S.A. 1978, § 72-1-9). Legislators didn't want cities to tie up water rights for an unlimited amount of time. In accordance with the "use it or lose it" principle of water law, the statute established a reasonable period of time for municipalities to hold unused water rights without fear of forfeiture due to non-use. Most cities in New Mexico are putting together 40-year plans for their water supplies.

Rather than a fee in lieu of water rights, this approach might be considered a water rights in lieu of approach that would allow a builder who has valid water rights to tender them to the municipality in lieu of the fee. This would offer another option to developers. If a municipality does want to consider the water rights in lieu of fee, it should thoroughly consider whether to build into its ordinance the discretion to review and not accept tendered water rights and who pays the cost of transfer.

Benefits

An ordinance based upon a fee to offset new water users is far friendlier than an ordinance requiring the acquisition and transfer of water rights by the developer. This type of ordinance should encourage development while acknowledging the growing need for, and cost of, water rights.

This approach is slightly different than the no water rights or fee in lieu of requirement approach because it is expressly tied to a site water budget and the cost is directly related to the cost of acquisition and transfer of the water rights. It is different from the conveyance of water rights only approach in that the ordinance would be structured so that the clear preference is for the municipality to obtain a fee tied to the site water budget and that the conveyance of water rights in lieu of fee is less desirable.

True Costs

A critical component to the success of any new ordinance or regulation is education and participation by the community in the development of the ordinance or regulation. Builders and new homeowners must understand the true cost of water. Water has historically been one of the most subsidized services provided by municipalities. To obtain full understanding of and support for a new ordinance, public meetings and workshops should be held with those who will be affected. There is the greatest opportunity for acceptance of the new ordinance if the people who will be affected are given the opportunity to assist in its formulation.

Large Projects

This fourth approach might work best in communities that are in need of large public works projects related to water supplies and/or water rights that can best be planned and implemented by the municipality. It would not be as advantageous where a municipality needs small quantities of water rights transferred to offset new development. Examples of the fourth approach might include a pipeline that could be considered by the Town of Silver City to move water into the Town, or a Santa Fe project to construct a pipeline that would return waste water directly to the Rio Grande and thereby increase diversion rights.

MARKET LIMITATIONS

Market Constraints

From a developer's standpoint, there are several constraints on the market that are affecting water rights availability and price. Some argue that they are artificial constraints. One constraint relates to the longstanding State Engineer policy to not allow transfers from above the Otowi gage on the Rio Grande River to points below the Otowi gage. A second relates to a Middle Rio Grande Conservancy District (MRGCD) policy that post-1907 rights cannot be transferred out of irrigation. A third relates to a recent State Engineer policy that post-1939 groundwater rights cannot be transferred to offset surface water depletion effects on the Middle Rio Grande.

Groundwater Test Case

With respect to the MRGCD policy, Los Lunas presently has an outstanding offer that may test the policy. Los Lunas has made a one-time offer to builders requesting 30 to 50 acre-feet per year of post-1907 water rights with a strong history of irrigation since 1935. The water rights must also be clean in every other respect, so there are no other issues that might prevent transfer approval. In exchange, Los

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Lunas will provide the builder with a like amount of San Juan-Chama Project water to ensure that he has water rights for his development. Los Lunas then wants to file an application to transfer the post-1907 water rights out of MRGCD for municipal purposes. This could squarely frame the issue and provide a test case for whether post-1907 water rights can be transferred out of MRGCD.

UNIFORM INFRASTRUCTURE TO ENSURE COMPATIBILITY

Most municipalities' ordinances recognize the need to control the type and quality of infrastructure built to service new areas. Once a city commits to providing water service, it is not uncommon that at some time in the future, if not immediately, it will assume the operation, maintenance, and repair of the infrastructure. Accordingly, compatibility and uniformity with the municipality's existing water supply system is critical. Even where the City is providing only bulk water to extra-territorial areas, quality and type of infrastructure should be addressed to avoid potential negative impacts on the City's delivery system and to minimize future problems that might arise in the event of annexation.

Different communities have taken different approaches to new infrastructure, although all tend to place the cost on the builder. Some find it sufficient to provide the specifications to which a builder must build and provide the infrastructure. Others are more cautious and require that they have supervisory authority over construction of infrastructure. The most conservative retain complete control over the bidding and building of infrastructure, simply passing on the actual costs to the builder. The rationale behind this approach is that the builders' motivation in letting the bids and overseeing construction is to minimize costs on projects for which they will have no future responsibility. On the other hand, the municipality that will have operation, maintenance, and repair responsibility for years into the future has a vested interest in ensuring that the new infrastructure is of good quality and is compatible with its existing infrastructure.

SERVICE AREA CONSIDERATIONS

Different approaches are taken to requests to provide water service outside the geographical limits of municipalities. Some municipalities agree to extend water service, but with the proviso that in-town needs will be met first. Other municipalities have taken a similar approach and provided water through contract. Still others are more demanding. They require a finding by the governing body that such service is needed and appropriate. Some cities require that the owner of the land to be served sign a contract agreeing to the annexation of their property at such time as the municipality determines it appropriate. Las Cruces and Los Ranchos Mesilla require that the owner of the lands to be served convey to the City any water rights that are appurtenant to the land prior to annexation.

There may be the potential for two or more municipalities or political subdivisions to compete for service area. This must always be considered when planning for new developments.

For example, in and around Taos, New Mexico, water service is provided by 15 separate entities, including twelve mutual domestic water consumers associations organized and operating under the Sanitary Projects Act, NMSA 1978, § 3-29-1 *et al.* (1953), two water and sanitation districts operating as special districts under NMSA 1978, § 73-21-1 *et al.* (1953), and the Town of Taos, operating as a municipality under the Municipal Code. In some cases, service areas of these 15 entities are distinct. In other cases, service areas are adjacent to one another. There are also cases in which an entity's service area has been completely surrounded by the service area of another entity. Each water service organization has its own autonomy, but in the long run, there is a fair amount of inefficiency in such a patchwork system. These intertwined service areas can cause posturing, political debate, and litigation.

There is pending litigation in the Third Judicial District Court between the City of Las Cruces and Moongate Water Company, Inc. over service areas. The debate stems from whether Moongate has the right to an exclusive service area even though it serves areas within Las Cruces' greater service area.

CONCLUSION

Every New Mexico municipality has its own unique set of circumstances that must be considered in formulating a policy relating the water rights and new development. Whether it wants to encourage economic growth and development, its existing portfolio of water rights, the availability of water rights, staff time, expense, local politics, and business atmosphere are all considerations that must go into each decision. Given the increasing demand for water in New Mexico and its diminishing supply, it is an issue that nearly every New Mexico municipality will continue to struggle with in the future.

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Mercury

Increased Levels

Different Forms

Natural Sources

Human Contributions

Fossil Fuels

MERCURY CONTAMINATION

A WEST COAST PERSPECTIVE

by Katherine Futornick, Gary Bigham, and Betsy Henry
(Exponent, Inc. - Lake Oswego, OR; Bellevue, WA Offices)

INTRODUCTION

Over the past 150 years, since the beginning of the industrial era, there has been an increase in background levels of mercury in the environment. Evidence for the increase has been found in remote as well as industrialized areas and the amount of the increase varies from two- to five-fold and as high as 10-fold in some areas. Although most of the mercury in the environment is inorganic and non-toxic, some is converted to the toxic form, methylmercury, which is typically produced in an aquatic environment and bioaccumulates in fish. Fish serve as a crucial component in the food chain and consumption of contaminated fish can lead to health impairments for both humans and wildlife that consume fish.

The majority of studies on mercury have been conducted on the East Coast where there are more anthropogenic (human) sources of mercury. However, the West Coast states have high concentrations of mercury in precipitation as well, but with fewer sources and lower deposition rates. In part, the concentrations of mercury in precipitation are attributed to a significant contribution from Asian countries, adding to the complexity of controlling mercury from anthropogenic sources.

This article explores the complexities of mercury in the water environment and provides a backdrop for the debate on how much to regulate anthropogenic sources of mercury, and to what extent reductions of inorganic mercury will correlate with reduced mercury concentrations in fish tissues.

A MERCURY PRIMER

Mercury is a naturally occurring element found in rocks, oceans, and the atmosphere. It ranks about 67th in abundance among the elements naturally found in rocks and accounts for about 0.5 **p**arts **p**er **m**illion (ppm) of the earth's crust. It is found in very concentrated deposits, mostly as cinnabar, a mineral composed of mercury sulfide. Under normal weather conditions, mercury is released slowly from rocks and minerals as they erode. Other natural sources of mercury include volcanoes and hot springs.

Mercury is commonly called liquid silver or quicksilver because, in its elemental form Hg[0], it is liquid at room temperature and metallic silver in color. It can be easily separated through the use of heat from its parent mineral and be recovered in a pure state. Due to its high surface tension, it forms small, stable droplets. However, it can easily vaporize into air, especially when heated, and be carried long distances in the atmosphere. Mercury has the highest solubility of any metal and can bond to other elements to form inorganic compounds that are even more soluble. Mercury can also form organic compounds, with methylmercury being the most frequently encountered in nature.

Human-related activities such as coal combustion and some manufacturing processes release more mercury than do natural processes. Based on 2004 data, the Swedish Environmental Research Institute estimated global anthropogenic mercury emission to be approximately 2,269 tonnes (tonne is metric ton, 1,000 kg, about 2,200 lbs). Asia was found to be contributing more than half of the emissions (Table 1). Stationary combustion processes account for 67% of the total worldwide mercury emissions with about 51% due to the burning of fossil fuels. Combustion processes emit Hg[0], oxidized divalent mercury (**r**eactive **g**aseous **m**ercury or RGM) and small fractions of particulate mercury (HgP). RGM and HgP are deposited on local to regional scales whereas Hg[0] may disperse globally.

Table 1. Global Mercury Emissions

Category	Percentage of Global Mercury Emissions
Stationary Combustion	67
Gold Production	10
Non-ferrous Metal Production	7
Cement Production	5
Waste Disposal	5
Caustic Soda Production	3
Mercury Production	1
Pig Iron and Steel Production	1
Other	1

Source: John Munthe, Swedish Environmental Research Institute

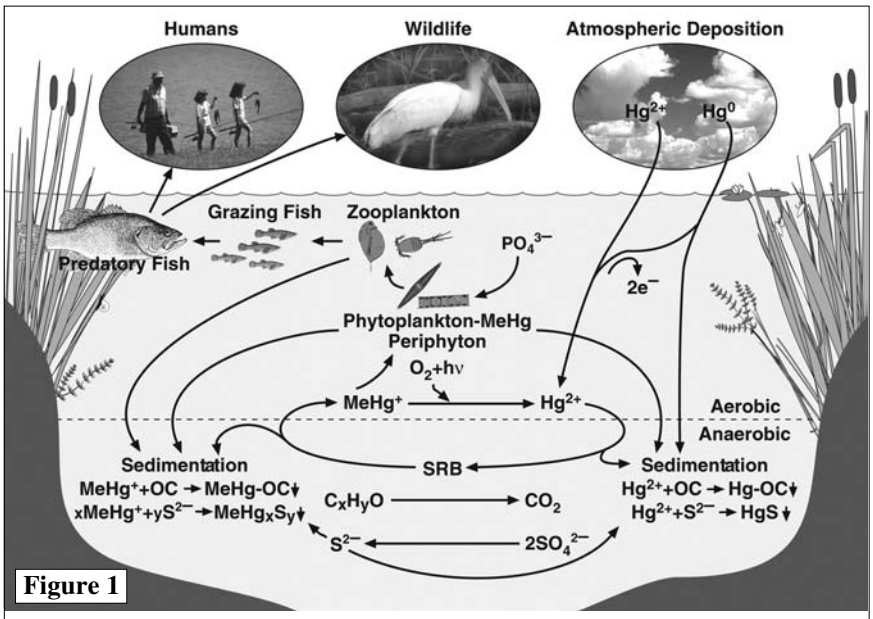

Figure 1

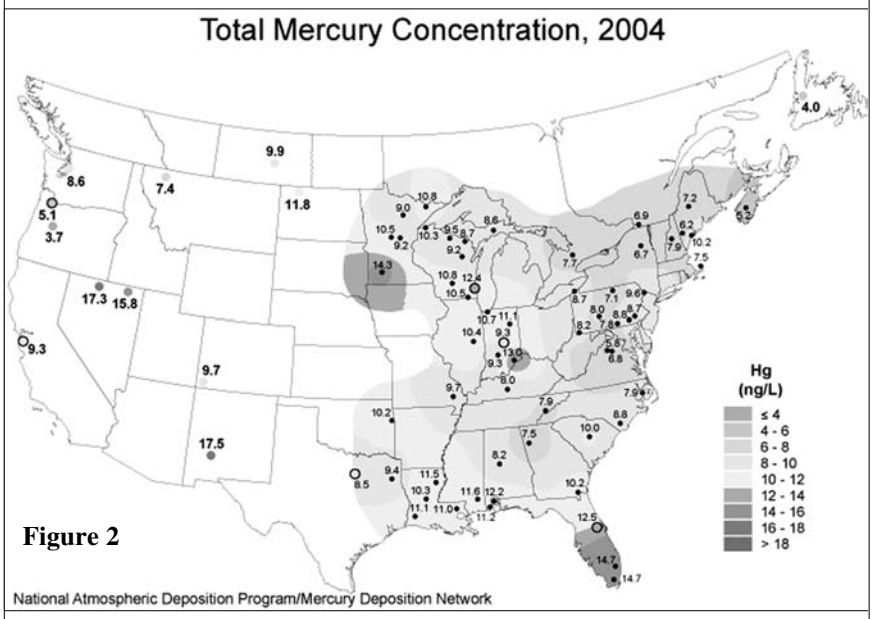

Figure 2

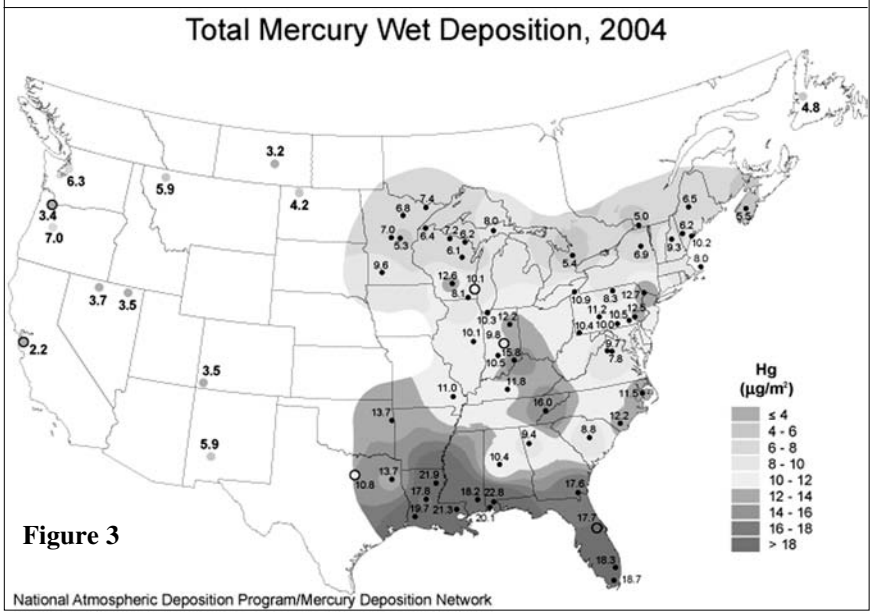

Figure 3

Fifty years ago, mercury was thought to be relatively stable and inactive in the environment. It is now universally accepted that mercury exhibits complex behavior with a variety of chemical forms, global-scale atmospheric transport, and poorly understood linkage between multiple sources of mercury and bioavailability in aquatic and terrestrial species. The global cycle for mercury involves local deposition near the source as well as long-range transport, presence in all media (soil, water, air, biota), and chemical transformation (Figure 1).

In areas where there are no direct sources of mercury pollution, mercury comes from elsewhere. The Midwest United States has more anthropogenic sources of mercury than other parts of the country. In the Northeast, much of the mercury comes from the Midwest because prevailing winds are generally from west to east. Vermont, with virtually no local mercury sources, has issued statewide fish consumption advisories due to mercury contamination. Although the West Coast states have fewer coal-fired power plants, they have anthropogenic sources such as gold mines and mercury mines, and natural sources, such as volcanoes and geothermal systems, and trans-Pacific mercury sources from Asia. In addition, forest fires in the West are known to re-emit mercury to the atmosphere and subsequent changes to the landscape can increase soil erosion and runoff to aquatic systems. Mercury is also transported globally with the movement of high altitude air masses.

Mercury from the atmosphere reaches the earth's surface in rain, snow, and other forms of precipitation, as well as in dust and other particulates in the air (i.e., wet or dry deposition). Once on the land or in water, some of the mercury may be chemically altered to a form that evaporates back into the air where it may be carried long distances and re-deposited elsewhere. Figures 2 and 3 illustrate the annual average mercury atmospheric concentrations and wet deposition rates for 2004 (source: National Atmospheric Deposition Program, Mercury Deposition Network, http://nadp.sws.uiuc.edu/mdn/). It can be seen from the maps that while mercury concentrations can be high in the West, mercury wet deposition rates are generally lower (due to lower precipitation rates). Both mercury precipitation concentration and wet deposition data are sparse in the West compared to the East.

Mercury methylation is primarily the result of anaerobic microbial activity in sediments. Once methylated, mercury can be absorbed by bacteria and algae and can biomagnify (increase in concentration) in the food chain by a factor of 1 million or more (see Figure 4). [Hope, B. *A Mass*

Mercury

Food Chain Accumulation

Budget for Mercury in the Willamette River Basin, Oregon, USA. Water, Air and Soil Pollution 161, 2005] Consumption of fish is the primary route for humans and wildlife to be exposed to harmful quantities of methylmercury. The primary concern is that methylmercury, which is a neurotoxin, can impair the neurological development of fetuses.

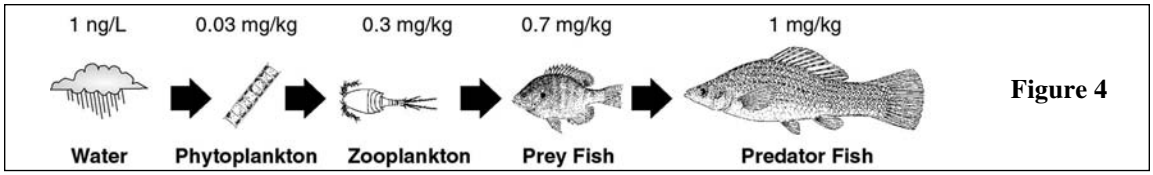

Figure 4

Formation of Methylmercury in the Environment

On-Going Processes

As soil particles wash into streams, wetlands, or other aquatic systems and accumulate on stream bottoms, mercury associated with these particles can be transformed by microbial activity in the sediments into methylmercury. Research has shown that the concentration of methylmercury in sediment or water is a result of two opposing reactions, methylation and demethylation. Because of demethylation, methylmercury is short-lived in the environment. However, because methylmercury is continually formed, concentrations remain high enough to be of concern. Even so, methylmercury rarely accounts for more than a few percent of the total mercury concentration in water, soil, and sediment.

Methylmercury production predominantly occurs in the absence of oxygen as a result of the activity of sulfate-reducing bacteria, organisms that are ubiquitous in sediment and water. Formation of methylmercury in the aquatic environment requires Hg+2, availability of sulfate, and carbon. In aquatic environments, sulfate is highly available, whereas in the terrestrial environment it is limited. However, very high sediment sulfide concentrations such as in marine environments reduce the rate of mercury methylation. In contrast, low sulfide concentrations in sediments promote mercury methylation through the formation of Hg-S complexes that are available for methylation by sulfate-reducing bacteria. Estuarine environments, warm temperatures, and availability of organic substrates may provide optimal conditions for the production of methylmercury. A study by Lambertson evaluated the temporal and spatial variations of organic matter, sulfide concentrations, and mercury methylation in an estuarine environment. [Lambertson, L. and M. Nilsson. *Organic Material: The Primary Control on Mercury Methylation and Ambient Methyl Mercury Concentrations in Estuarine Sediments*. Environmental Science & Technology, Volume 40, No. 6, 2006] Results indicated that the accumulation of organic matter in sediment was the main factor affecting net methylmercury production, while the total amount of mercury had little or no influence on the amount of methylmercury in the sediment.

Uncertainty

Figure 1 illustrates the basic understanding of methylmercury production as we know it today. Several factors make it difficult to say with certainty how much of the inorganic mercury exposed to aquatic environments will be transformed to its more toxic methylated form. Ecosystems have differing capabilities to transform inorganic mercury into methylmercury. During mercury cycling and bioaccumulation, hydrology, water quality, trophic (food chain) structure, topography, size of watershed, and temperature, to name a few factors, influence mercury methylation. Even within the same ecosystem, the varying landscape and land cover, soils, and erosion factors that affect the timing and mobility of inorganic mercury entering surface water can create differences in the amount of methylmercury.

MERCURY IN FISH

Concentrations as Indicator

The concentration of mercury in fish is a much-used indicator of the level of mercury in the environment. Methylmercury is accumulated and concentrated in the tissues of aquatic organisms from contaminated water and, predominantly, the food chain. Fish that feed on other aquatic organisms therefore typically accumulate higher concentrations of mercury than do fish whose diet is limited to plants. As fish age, mercury concentrations typically increase because they ingest mercury faster then they release it. Methylmercury is the predominant form of mercury found in fish.

Mercury Cycling

Methylmercury first enters the aquatic food chain after being sorbed (bonded) to phytoplankton or other organic matter and consumed by fishes or benthic macroinvertebrates (sediment-dwelling organisms such as mudworms or crayfish). Once accumulated, methylmercury is only slowly released from organisms. Methylmercury tends to concentrate in the muscle tissue, where it binds with sulfur in sulfhydryl groups of protein, rather than in fatty tissue, where other bioaccumulative compounds such as **p**oly**c**hlorinated **b**iphenyls (PCBs) are stored. Further information on mercury cycling in the environment can be found in the EPA Mercury Report to Congress (available at www.epa.gov/oar/mercury.html) and the United Nations Environmental Programme's Global Mercury Assessment (available at www.chem.unep.ch/mercury/default.html).

Mercury

The question of how much mercury is in fish, and more importantly, where it is coming from, has implications in the debate about how much to regulate anthropogenic sources of mercury. An equally important question is, "To what extent should efforts to reduce inorganic mercury inputs into the environment correlate with reduced mercury fish concentrations?"

MERCURY REGULATIONS

WQ Criteria

Effluent discharges to water bodies are regulated under the authority of the US Environmental Protection Agency (EPA). The federal Clean Water Act (CWA) gives EPA the authority to impose restrictions on mercury concentrations in water. EPA is required to publish ambient water quality criteria protective of aquatic life and human health from the presence of mercury. Criteria developed under Section 304 of the CWA are considered "non-regulatory" and unenforceable; they provide a scientific assessment of ecological effects. However, when a state incorporates these criteria into its water quality standards, they become enforceable maximum acceptable levels.

WQ Standards

New RfD

EPA first published ambient water quality criteria for mercury in 1980, expressed as total mercury concentration. In 2001, EPA updated its ambient water quality criteria and established a new **r**e**f**erence **d**ose (RfD) for human health at 0.0001 mg methylmercury per kg body weight per day. The resulting water quality criterion is now 0.3 mg methylmercury/kg fish (or shellfish), expressed as a concentration in freshwater and estuarine fishes.

When a water body is out of compliance with water quality standards, a Total Maximum Daily Load (TMDL) is developed for the impaired water body. The TMDL quantifies the maximum allowable loading of the pollutant that will still allow the water body to meet designated uses and water quality standards. The loading is allocated to all contributing point and non-point sources (including natural background levels).

Atmospheric Transport

Studies in western states have indicated that mercury is present in many locations. A study conducted at Oregon State University indicated that atmospheric transport in western states is an important factor in mercury distribution. Fish were analyzed in twelve western states from 410 randomly selected stream sites to assess the spatial extent of mercury contamination in whole fish. Sample results yielded a narrow range in fish tissue mercury, suggesting that atmospheric deposition played a significant role in the presence of mercury. [Hughes, R.M., A.T. Herlihy, Spencer Peterson. *Mercury Concentration in Lotic Fish Tissue Across the Western United States*. ASLO, 2005]

TMDL Challenge

All western states are subject to the CWA and, therefore, certain impaired water bodies under the 303(d) listing are subject to TMDLs for mercury. While anthropogenic mercury loading and emissions can affect fish tissue concentrations, the change in mercury fish tissue concentration is not always proportional to the change in the loading. The challenge for regulators will be to appropriately address mercury deposition from sources outside their respective states and to provide an adaptive management approach based on new information as they develop TMDLs for water bodies with mercury impairments.

MERCURY ISSUES IN WESTERN STATES

The following sections briefly describe selected issues relating to mercury in aquatic environments in certain West Coast states.

California

As with many of the West Coast states, the sources of mercury in California are both naturally occurring and anthropogenic. Many of California's water bodies have impaired uses due to mercury contamination. In the Sacramento Valley, water bodies are enriched in mercury and fish tissue concentrations exceed regulatory target levels. The Sacramento Valley is a historical freshwater marsh and its wetlands provide sites for methylation as do the historical mining sites in the Sierra Nevada. The TMDL approach to allocating loading for mercury in an attempt to control mercury in fish tissue has come under criticism as unattainable because sediment continues to serve as a reservoir of mercury methylation. With regulatory target levels in fish believed to be unachievable, offset projects have been suggested to remediate abandoned mercury mines and control streambank erosion. This approach is part of an overall adaptive management program to emphasize risk reduction and attainable fish tissue targets based on historic and future conditions.

Offset Projects

Legacy Mining

The San Francisco Bay area also has elevated mercury concentrations in fish. All segments of the Bay are listed as impaired and, therefore, subject to TMDLs. As with the Sacramento Valley, legacy mining is a key contributor to the mercury contamination in the Bay. Residual mercury from gold and mercury mining was transported downstream into the Sacramento/San Francisco Bay estuary, where it is believed to have contributed to elevated mercury contents in fish, resulting in consumption advisories. Mercury also came from the New Almaden mercury mines in the Guadalupe River watershed, which

Mercury

Adaptive Management

discharges into South San Francisco Bay. These were the largest mercury mines in North America.

Other sources of mercury in the Bay come from industrial, municipal, non-urban stormwater and direct atmospheric deposition including re-emission from forest fires. Inflow from the Guadalupe River and Central Valley watersheds, urban stormwater runoff, and sediment bed erosion account for more than 50% of the mercury in the Bay. As with the Sacramento Valley, an adaptive management approach has been undertaken for the mercury TMDL, which means that immediate actions will be based on current information. As new information becomes available, the approach may be altered following review by the State's regional water board every five years.

Idaho

Sources of mercury in Idaho also include both natural and anthropogenic sources. Idaho, as with other western states, has its share of legacy mines. Atmospheric mercury deposition (including deposition from trans-Pacific and regional sources) is similar to what is seen in other western states. Because of elevated mercury concentrations in fish, consumption advisories have been issued in Idaho. EPA Region 10 identified potential sources of mercury such as legacy mining, past agricultural practices, current gold mining, and other thermal processes that use fossil fuels (e.g., coal-fired power plants).

Recent Study

Through a recent study, researchers evaluated mercury-affected streams, fish tissue, and air sources in Idaho and surrounding areas. Salmon Falls Creek Reservoir, located in a remote area in south-central Idaho, was the area of study. More than 60% of the watershed in which the reservoir is located lies in Northeastern Nevada. Prevailing winds generally blow from the west or southwest out of northern Nevada. During 2005, EPA Region 10 conducted air sampling for the Idaho Department of Environmental Quality near the reservoir as part of a multi-media sampling project including water, sediments, and precipitation to study the potential sources of mercury. The primary purpose of the air sampling was to determine whether atmospheric mercury was causing high mercury concentrations in fish and to quantify background atmospheric inputs of mercury in the region. Both elemental gaseous mercury (Hg[0]) and RGM were measured.

Air Sampling

Transport

Results showed that Hg[0] accounted for most (more than 95%) of the mercury in the air. Hg[0] does not deposit readily and can be transported in the atmosphere for long distances. Hg[0] is of concern because a portion of it may be converted to RGM by atmospheric oxidation. RGM, mostly Hg[II+], is highly reactive and soluble; it may be deposited within a short distance of its source (e.g., tens to hundreds of miles). The results of the air sampling showed episodic elevated mercury concentrations and that mines in northern Nevada could be the source of the high concentrations. [Presentation by EPA Region 10, *Gold Mines and Mercury Emissions—Region 10 Experience*]

Oregon

China Impact

Monitoring of mercury in the environment in remote areas of Oregon suggests that a significant contribution of mercury contamination is coming from non-local sources through atmospheric deposition. Although there are local sources of mercury, the majority of mercury deposition comes from China via trans-Pacific air currents. [Peterson, S., A. Herlihy, R. Hughes, K. Motter, and J. Robbins. *Level and Extent of Mercury Contamination in Oregon, USA, Lotic Fish*. Environmental Toxicology and Chemistry, Vol 21, No. 10, 2002]

Patterns Study

Mercury bioaccumulation in remote, non-industrial locations, however, had not been comprehensively evaluated in Oregon until 1997 when Spencer Peterson of the EPA National Health and Ecological Effects Research Laboratory in Corvallis, Oregon and others conducted a survey to better understand temporal and spatial patterns of elevated mercury in biological populations throughout the state. The study divided the state into two sections, with each section bounded by the Cascade Mountain range. The western section consists of the Willamette Valley, the coastal mountains, forest, and farmland. The northern half of the western section is characterized by more rainfall than eastern Oregon and larger numbers of flowing streams. The southwestern half experiences less rain than northwest Oregon, but more than eastern Oregon. Eastern Oregon is sparsely populated, semi-arid, and has fewer flowing waters, particularly in southeastern Oregon.

Atmospheric Pathway

Peterson et al. focused their survey on lotic fish (i.e., fish that inhabit flowing water such as a stream, creek, or river) and looked at fish groupings rather than individual fish. They compared mercury levels in large versus small fish and evaluated large rivers versus small streams. Their survey included 154 stream and river sites, representative of approximately 60,000 kilometers of Oregon streams and rivers. The findings indicate that mercury is present in fish in both eastern and western regions of Oregon and suggest that atmospheric transport is an important pathway in Oregon for mercury distribution. [Peterson et al. (2002)]

Mercury

Consumption Advisory

Although the Oregon Department of Human Services (ODHS) uses a level of 0.35 mg/kg to trigger fish consumption advisories, the Oregon Department of Environmental Quality (ODEQ) uses the EPA water quality criterion of 0.3 mg methylmercury/kg fish. In the Willamette River Basin, consumption of fish with high levels of methylmercury is a potential health risk for both humans and wildlife. As far back as 1979, ODHS issued a mercury health advisory warning for consumption of fish from Cottage Grove Reservoir (located on the Coast Fork Willamette River). Mercury contamination to the Coast Fork comes principally from the abandoned Black Butte mercury mine. In 1997, ODHS issued a mercury advisory for the entire main stem of the Willamette River, including the Coast Fork to Cottage Grove Reservoir, for consumption of largemouth bass, smallmouth bass, and northern pikeminnow. A separate advisory was issued for Dorena Reservoir, also located on the Coast Fork. In 2001, ODHS issued a consolidated (all species) fish consumption advisory for the entire Willamette River Basin.

Oregon TMDLs

As a result of these advisories, a legal requirement is triggered to limit the loading of the pollutant, in this case mercury, to the affected water body. Trans-Pacific atmospheric deposition of mercury is and will continue to be a major challenge for Oregon's TMDLs. The development of the Willamette River Basin TMDL is an example of that challenge.

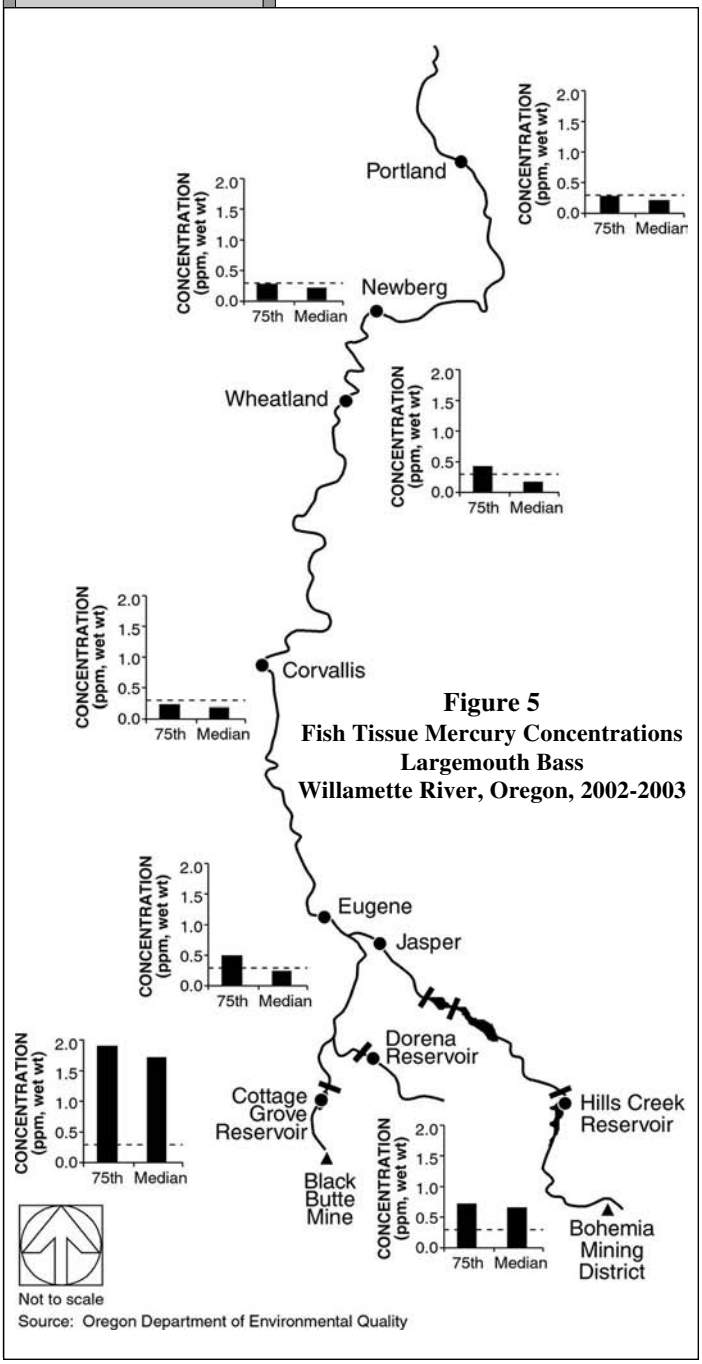

Figure 5
Fish Tissue Mercury Concentrations
Largemouth Bass
Willamette River, Oregon, 2002-2003

ODEQ began development of the Willamette River Basin mercury TMDL in 2002 following a review of information on basin-specific mercury and methylmercury concentrations. One of the objectives of the study was to examine spatial, seasonal, and other relationships between mercury and methylated mercury and accumulation in fish tissue. The majority of data in the basin was confined to known sources such as specific mining-affected reservoirs and streams and was scarce in other basin areas. An example of site-specific variability in the rates of methylmercury formation and bioaccumulation is found in the Willamette River.

Figure 5 shows fish tissue mercury concentrations in largemouth bass from 2002-2003 DEQ sampling events (DEQ 2003). As evidenced from the plot, the relative degree of impairment in the Coast Fork of the Willamette River is higher than in other river segments. In fact, fish tissue mercury concentrations are below 0.30 mg/kg for much of the Willamette River, even when data from the 75th percentile are considered. Although not shown on the plot, a similar trend is exhibited when the data are normalized by fish length. This strongly suggests that the Willamette River watershed is not homogeneous, but spatially variable with regards to mercury bioaccumulation.

Although ODEQ's study did not identify a reliable predictor of mercury concentration in fish, it is possible that the mercury levels in the mainstem could be attributed to the methylmercury generated in wetlands. [Hope, B. *An Assessment of Anthropogenic Source Impacts on Mercury Cycling in the Willamette Basin, Oregon, USA*. Science of the Total Environment, 356, 2006] Other plausible contributors may be the degree of soil cover, the release of mercury to surface water through erosion, and biogeochemical controls relating the bioavailability of mercury and methylated mercury to the activity of methylating and demethylating bacteria.

MERCURY ANALYTICAL TECHNIQUES

Methylmercury bioaccumulation in the food chain was recognized following the development in the early 1980s of analytical techniques capable of detecting mercury in water at concentrations below one part per billion. With the low detection limits, it was determined that much of the mercury reported for surface water samples prior to the early 1970s reflected gross contamination of the sample during the sampling and analysis process. Research into concentrations of trace metals in the oceans at about this time indicated that very particular sampling

Mercury

Sampling Techniques

techniques, often called "ultraclean" techniques, were necessary to avoid contaminating samples. As sampling and analysis protocols became more rigorous, the concentration of mercury reported in surface water samples dropped to about 1 to 10 parts per trillion. These concentrations are significantly less than the enrichment in fish tissue, which at 1 part per million in fish represents an enrichment factor of 1 million. More recent advances in sampling and analytical techniques to detect very low concentrations of mercury and to differentiate inorganic mercury and methylmercury in surface water have begun to fill some of the data gaps. An article further describing analytic methods used to assess mercury in a water environment will appear in ºThe Water Report's October issue.

SUMMARY

The primary human health and ecological concern regarding methylmercury is consumption of fish, yet the ability to quantify the relationship between total mercury concentrations in water and sediment and methylmercury concentrations in fish continues to challenge researchers and regulators. Despite years of effort in developing models, predictions of methylmercury concentrations in fish remain highly uncertain. Data on mercury concentrations in the environment suggest that there is a connection between total mercury concentrations in the environment and methylmercury concentrations in fish. However, the relationship is not consistent from site to site or over a range of total mercury concentrations. This discrepancy is generally attributed to site-specific variability in the rates of methylmercury formation and bioaccumulation. Although our understanding of the mercury cycle has improved and analytical advances have allowed us to differentiate between mercury and methylmercury, it remains an open question how to regulate mercury emissions, mercury discharges, and mercury concentrations in water and sediment to reduce methylmercury concentrations in fish tissue and thus, risk to humans and wildlife.

Fish Consumption

Regulatory Issues

Given the variety of sources of mercury and uncertainty in their relative contribution to methylmercury bioaccumulation, future challenges will include developing regulatory policies that improve efficiencies while reducing risks. Other challenges will be to recognize potential increases in atmospheric loading and deposition from new sources of mercury; increased atmospheric deposition due to increased industrial activity in Asian countries; and impacts from global climate change where methylmercury may be released from once-frozen bogs and tundra.

Increasing Study

Over the next several years, studies will be conducted and technologies will be developed that will improve our understanding of methylmercury bioaccumulation mechanisms, and our understanding of how mercury regulations may lead to reduced risks to humans and wildlife. At the same time, we may experience greater impact from non-anthropogenic sources. National and international efforts will be needed to significantly reduce worldwide mercury sources.

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EPA Mercury website: www.epa.gov/mercury/index.htm

Editor's Note: EPA's recently issued *Draft Implementation Guidance for the Methylmercury Fish Tissue Criterion* is available from the above website. The document provides technical guidance to states and authorized tribes on how to use the January 2001 criterion. Comments are due by October 10, 2006.

Katherine Futornick is a managing scientist with Exponent and specializes in strategic planning and management of complex environmental projects. She completed her undergraduate degree at the Massachusetts Institute of Technology and graduate studies at the University of Oregon and Oregon State University where she conducted research into the environmental stressors on internal opiates in mammalian reproductive systems. During the past 10 years, she has managed projects investigating mercury contamination from legacy mining sites and managed several watershed assessment and stormwater projects. Katherine serves as Chair of the Oregon Chapter of the Air & Waste Management Association (A&WMA) and is on the board for the Pacific Northwest International Section of A&WMA.

Gary Bigham is a Principal with Exponent in Bellevue, WA and specializes in the evaluation of contaminant and sediment transport and fate in the environment. He received his BS is geology from Oregon State University and his MS in geophysical sciences from Georgia Tech University. Gary has undertaken numerous investigations of mercury in the environment and in indoor air over the past 15 years. The largest has been the comprehensive investigation of mercury cycling and bioaccumulation in a lake contaminated by two mercury-cell chlor- alkali plants, in Onondaga Lake, NY. He also recently participated in a natural resource damage assessment of the Guadalupe River, CA that drains the New Almaden Mining District, the largest mercury mining area in the US. Over the past ten years, he has been involved with litigation regarding the influence of nutrients on mercury cycling and bioaccumulation in the Florida Everglades. Gary has participated in investigations at many other mercury-contaminated sites and published numerous papers and presentation abstracts. He also led an extensive evaluation of the behavior of mercury spilled from gas pressure regulators and mercury vapor in indoor air, and served as an expert witness in litigation involving mercury spilled in buildings and homes.

Betsy Henry is a managing scientist from Exponent and has been working in the field of mercury fate and transport for 15 years. She earned a Ph.D. from Harvard University in 1992 with a dissertation on mercury methylation in the environment. Since joining Exponent in 1991, she has focused on mercury-contaminated sites including Onondaga Lake, NY. She stays current with mercury research, most recently attending the 8th International Conference on Mercury as a Global Pollutant in August 2006.

Instream Flow

Allocation Trade-Offs

Historic Views

State Primacy

Varied Flow-Coverage

Tools

QUANTIFYING INSTREAM FLOW NEEDS

by Tom Annear, Wyoming Fish & Game Department (Cheyenne)

There is no dynamic more crucial to the quality of life on earth than the amount of water flowing in streams and rivers. The timing, quantity, and quality of water flowing in streams are critical environmental factors which profoundly effect both where and how well we (and most other organisms) live. At the same time, the way in which water is used is among our most contentious issues.

A variety of tools and strategies have evolved to address the water-use controversy. Significant strides continue to be made concerning how to quantify some of the trade-offs associated with water allocation decisions. However, scientific advances in the field of quantifying instream flow needs are still far short of eliminating controversy. As the demand for water increases the arguments become evermore heated. This dependable dynamic underscores the need for further improvement to the ways in which we assess and quantify instream flow needs.

This article provides an overview of the basic nature of instream flow issues, the evolution of flow quantification needs assessments, and offers insights on ways to better address disagreements.

BACKGROUND

Throughout much of history, many people have looked at water as a simple, extractable resource like coal, oil, or timber. Many people still hold this view. However, the fact is that flowing water affects our lives in ways that are much more complex than your garden-variety single-use resource. No other natural resource is more essential for our survival or provides so many important functions for society. Allowing water to be used principally for one purpose to the detriment of all others is still a common occurrence. This practice and mind-set has led to many of our current conflicts.

The notion that water was an extractive resource of limitless proportions was common in the sparsely populated world of North America's European settlers. It was this belief that, among other things, led to the demise of many wildlife species, degradation of water quality, and loss of nearly 60% of the wetlands in the US (www.epa.gov/owow/wetlands/vital/toc.html).

In the early years of settlement there seemed to be plenty of water to go around for both in-channel and out-of-channel uses and users. Controversy did arise, however, when water was taken out of the channel. This led to development of laws to regulate its allocation among the various consumptive users. It wasn't until most of the water was allocated to out-of-channel uses that in-channel users realized they'd been unwittingly left out of the equation. The desire to use water for in-channel purposes is not the "new" Johnny-come-lately interest that some describe. On the contrary, the public has always had an abiding and significant interest in the values of flowing rivers. This interest simply wasn't adequately expressed until the after those values had become compromised. Current efforts to protect the benefits of functional instream flow are a reflection of the move to remedy this oversight. Unfortunately, with most of the water already legally allocated, rectification is very difficult. It usually means an existing water user has to do something different, which often results in conflict.

REGULATORY BACKGROUND

In the United States, the legal authority for allocating water within the boundaries of each state rests with state governments. Each state has devised their own strategies for administering water among the various interests competing for its use. While the precise administrative mechanisms vary according to the needs and culture of each state, most states rely on their fish and wildlife agency or equivalent to help quantify the amount of water needed to protect the public interest in fishery and wildlife resources of flowing waters and lakes. Predictably, not all states developed their instream flow programs at the same pace. In fact, many states still do not have a formal instream flow / water management program for fisheries.

Tools to estimate minimum flow needs for streams have existed for some time, but the formal science of quantifying instream flow needs for streams and lakes did not take shape until the early 1970's when a proliferation of instream flow methods were developed. Many of these strategies were showcased at a conference held in Boise, Idaho (Orsborn and Allman 1976). In the 30 years since this historic conference, there has been tremendous growth in the number and type of strategies used to quantify flow needs. Almost all of these new methods are effective at some level. However, the variety of technique choices generates its own brand of controversy. This has been especially true when the results and recommendations of any one particular method provided a flow level that didn't match the expectations of one or more stakeholders.

Instream Flow

IFC Organization

Standard Protocol

Published Critiques

Concepts

Legal Protection

"Wet Water"

"Fishery" Meanings

THE INSTREAM FLOW COUNCIL

State fish and wildlife agencies have often found themselves in the middle of controversies over methods and data interpretation. As a consequence, they felt a need for some standard strategy to credibly quantify flow needs. Within this environment, an organization of state and provincial (Canada) fishery and wildlife agencies formed in 1998, known as the Instream Flow Council (IFC). Membership on the IFC is provided to each state or provincial fish and wildlife agency, which is represented by their lead instream flow or water management coordinator.

One of the purposes of the IFC was to develop a network whereby those charged with the responsibility of protecting public fishery and wildlife interests could share ideas and strategies. Careers are simply too short and the issues too serious for each state and provincial agency to make the same mistakes their counterparts had dealt with in other states and provinces. Networking and sharing both successful and unsuccessful strategies has proven highly valuable in the few short years since formation of the IFC.

The IFC also sought to develop a standardized protocol or approach of what they considered were accepted concepts and practices for quantifying instream flow needs for public trust fishery resources in rivers and lakes of North America. To address this need, 16 IFC members from throughout the US and Canada authored a book, *Instream Flows for Riverine Resource Stewardship.* that defines the science, law and role of the public in setting instream flow needs (Annear et al. 2002, 2004). The book provided 46 policies the authors felt were important when making instream flow decisions. In addition, the authors provided critical opinions of 34 of the most commonly used instream flow methods in the US and Canada. This assessment is uniquely different from other instream flow method summaries in that the authors went beyond mere descriptions of methods and offered their specific critiques of the shortcomings, strengths and applications for each method. With over 600 references and the insights of many front-line instream flow experts, the book has become a primary reference source for instream flow practitioners in the US and Canada. The book is also an important tool for helping IFC members and others understand the complexities of the instream flow arena and develop better instream flow needs assessments. The concepts presented in this article are drawn largely from the IFC book.

INSTREAM FLOW STUDIES

BASIC TERMS, INTERRELATIONS & POLITICAL MILIEU

Quantifying the instream flow needs of a river is not a simple matter. One must begin with an understanding of some of the terms and concepts associated with the process. Primary among these is the concept of instream flow itself. At its most basic level, "instream flow" simply means water flowing in a stream or river. Streams in flood stage as well as streams where the only water in the channel is flowing through shallow sands just beneath the surface both have instream flow. The flow-amount at any particular time may or may not be adequate for creating, maintaining, or improving ecological functions. Instream flow can refer to a single flow or it can be a range of seasonally adjusted flows.

In other situations, when people talk about an "instream flow" they're actually talking about a water right, permit or operating agreement. In many of these situations, just because you have an instream flow right, permit, or agreement there's no guarantee you'll always have the amount of water identified on the certificate. That's especially true of unregulated, free-flowing systems where natural precipitation and runoff patterns cause widely variable flows. An instream flow water right or permit doesn't necessarily put water in the channel, but it can protect it from diversion by other users when it is available in the stream. Many disagreements about instream flow can be avoided at the outset by making clear whether we're talking about: 1) water in the creek but no legal protection; 2) legal protection but no guaranteed flow; or 3) "wet water" in the creek with legal protection to go with it.

The majority of instream flow prescriptions are often made to create, maintain, or restore a fishery. As a consequence, the term "fishery" must also be defined at the outset of a study. Although fish are definitely a part of a fishery, the latter term actually relates more broadly to the community of organisms (including forage fish species and macroinvertebrates), aquatic habitat (including water quality, channel form and function, and riparian habitat), and human users. When state and provincial agencies manage fisheries, they typically address all three of these components via stocking, managing in-channel habitat and surrounding lands, and setting regulations for utilization of fish (harvest). Instream flow studies designed to create, maintain or restore a *fishery* should be much broader than setting a single minimum flow to protect a single species of fish – even if that's the target species for the study.

Inadequate laws and policies can prevent the best science and informed public support from playing their legitimate role. While many western states now have instream flow laws, their mere existence all too often leads people to think that the legal component is no longer an issue. A close look at instream

Instream Flow

Inter-Related Components

flow laws, however, often reveals more limitations than opportunities. Even the seemingly beneficial laws are all too often interpreted or implemented in a fashion which limits their usefulness for the purpose of managing fishery resources.

One aspect of achieving a successful outcome in an instream flow study is the importance of recognizing the interrelated nature of science, legal/institutional, and public involvement components of water management. All too often scientists wonder why their most compelling research doesn't stimulate action. The public often has strong opinions — sometimes based on fact, sometimes not. Public stakeholders also often feel ignored when their requests or demands are not recognized or accepted. When not properly addressed, public opinion can stop a project just as surely as the lack of credible data.

Although laws and policies are often the trump card, as a practical matter each of these interrelated components should be addressed with equal diligence. Stakeholders who are intent on working effectively need to recognize the legitimacy of each of these components, identify potential bottlenecks, and then work cooperatively with other stakeholders to address those stumbling blocks within their ability to control. Ignoring or failing to address the need for appropriate scientific studies, the role of the public, and legal and institutional limitations up front simply sets the stage for frustration or major confrontation.

Location Potential

Where you are located on the landscape can also make a difference in how instream flow problems are best addressed. If the focus of the study is on public lands, unallocated water is often available to protect everything from base flows to flushing flows to flood flows. Securing needed flows can still be a significant challenge requiring detailed scientific justification, development of public support and the ability to legally protect needed flows. However, the opportunity to do good things often does exist. Situations where adequate water is available are sometimes described as "top-down" strategies where the focus is on identifying how much water can be depleted from existing flows without affecting the existing aquatic community.

Public Lands

Private Lands

If the focus of the study is on private lands, much of the natural flow is often already allocated to out-of-channel uses. In these situations, it may be a considerable challenge to find enough water (either by reallocation of existing rights, water conservation, or construction of new dams) to restore a fishery. Legal issues and public involvement will often be significant factors here. These types of efforts are described as "bottom-up" strategies in terms of trying to put enough water back in the stream to accomplish a desired effect.

Public Interests

It is important to be clear about the reasons for establishing adequate instream flow. One public perception is that protecting sufficient quantities of water for instream flow is a matter of providing water for fish at the expense of people. Though emotionally compelling, this is incorrect. Water in the United States and Canada is typically held in trust and managed by the state or province, which means it is the property of all citizens. Determining the amount of water to dedicate to instream use is almost always the product of a public process that reflects public choice to use water for maintaining fisheries. Thus, it is not the fish that hold an instream flow water right or permit. Rather, instream flow rights are owned and shared by all the citizens of the state or province. By virtue of this public ownership, claims by water right or permit holders that they are being discriminated against by fish or wildlife have a certain emotional appeal, but no basis in law. The bottom line is that using water for instream flow is matter of people choosing to use water for that purpose. Many disagreements can be headed off by agreeing up front that instream flow is a legitimate use of water — for people — that just happens to grow fish.

THE STATE OF THE SCIENCE

Ecosystem Complexity

River managers today need a level of ecosystem understanding that is unprecedented. They are no longer afforded the luxury of focusing solely on fish. Today's issues require knowledge of the life history requirements of organisms living in and adjacent to streams, habitat and the processes that form habitat, the effect of land alterations in the watershed on hydrology, the inter-relationship of organisms in the system, and much more.

Early Tools

Through the early part of the last century, natural resource managers were aware that some level of flow was needed to sustain the natural functions of streams, but they lacked defensible methods to quantify those needs. The earliest tools to fill this need were relatively simple ones that identified single-level minimum flows. Unfortunately, for many folks who are not fisheries scientists this "minimum flow mentality" became established as an acceptable strategy in all situations and this view persists today. A wide range of other methods followed this first suite (Morhardt 1986 and Reiser et al. 1989). Most were designed to address the habitat needs of a single species of fish.

Increased access to computers in the 1970s and 1980s coupled with increased knowledge of aquatic systems and organisms resulted in the ability to do more sophisticated, incremental studies that could evaluate the trade-offs between flow and physical habitat over a range of flows. However, even when

Instream Flow

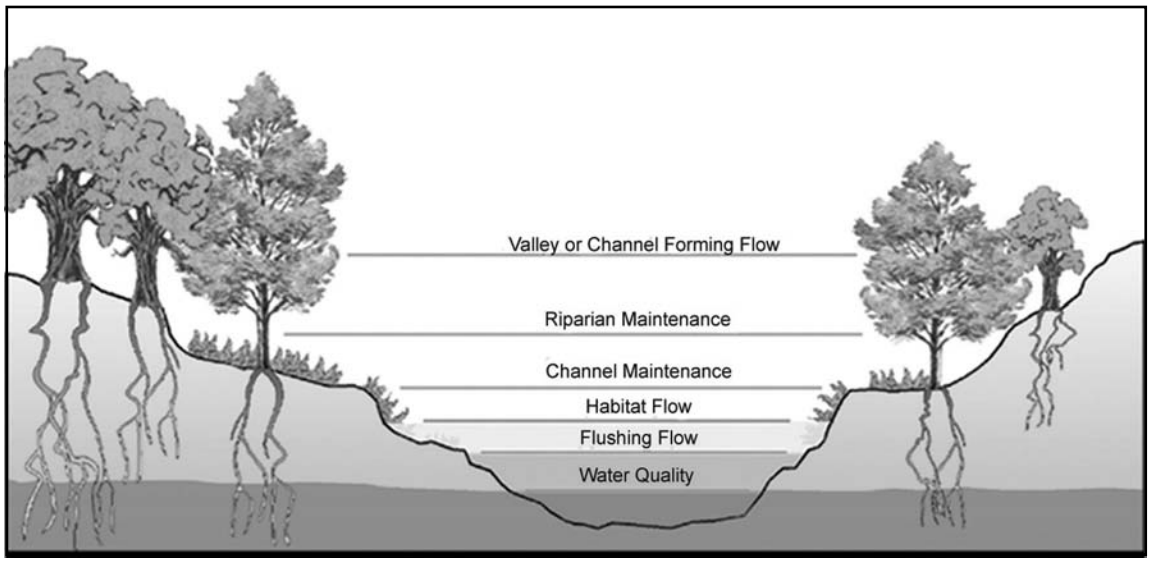
Primary Elements

approaches such as the widely-used Instream Flow Incremental Methodology (IFIM) were employed, the tendency was to focus on only one or a few species (usually sport fish), life stages, or habitat needs (Stalnaker 1993).

Scientific advances have also occurred in areas other than fisheries, such as how the timing, frequency and duration of flows affect the character of rivers and some of the organisms that live there. Studies today take more of a holistic approach that reflects this growing body of knowledge. Based on these advances, the IFC endorses the philosophy that rivers are defined by the interaction of five primary riverine elements that include hydrology, biology, geomorphology, connectivity and water quality (Annear et al. 2004).

Hydrology

Each of these disciplines entails its own level of complexity and each is intricately interrelated to the other four in even more complex ways that we only partially understand. Hydrology is the driving force and central variable for all rivers. In short, river systems are defined by the timing, duration and magnitude of flows that pass through their channels over long periods of time. Addressing the hydrologic component of an instream flow involves more than keeping a minimum amount of water in the stream to maintain fish survival. A range of river flows is needed to provide specific, important ecological functions, which are associated with the other four riverine components. Natural droughts can be as important as natural floods – though neither should be prescribed on a permanent basis. Management of intra- and inter-annual flow variability, properly timed, is essential to protect, restore, enhance and manage riverine structure and function.



Ecological Functions: *A range of river flows provides specific, important ecological functions that can be related generally to the five riverine components. Providing a single, minimum amount of water in the stream to maintain fish survival will not maintain long-term habitat features to perpetuate an existing fishery or restore a degraded one.*

Biology

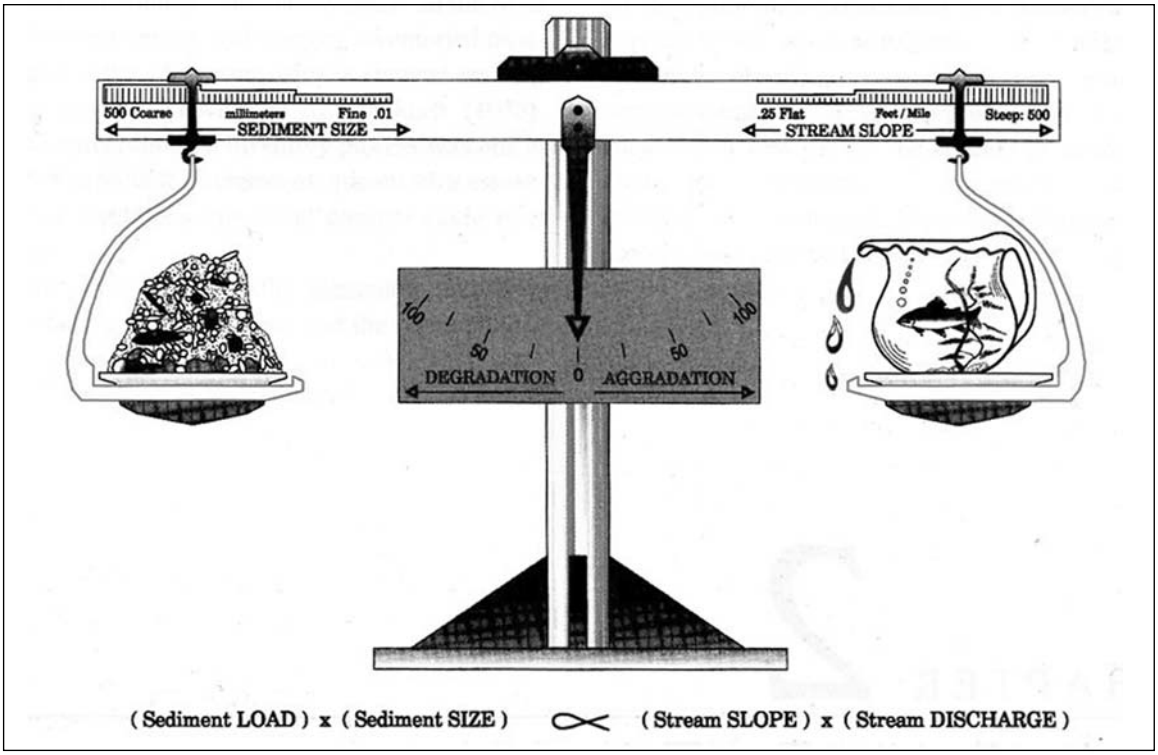
Biology relates to all of the organisms that are associated with and help define a river (fish, aquatic insects, and vegetation along the banks). Traditionally, biologists considered only the dominant sport fish or endangered species. However, when we talk about how much water is needed for the biology component of an instream flow we need to talk about the entire community of organisms that live in the stream as well as the vegetation in the stream and the riparian community through which it flows. The fish we are often focused on are just one part of the energy web that is intimately tied to and affected by the structure and function of the entire riverine community. Looking at just fish is a gross oversimplification of what's going on in most rivers.

Geomorphology

Fluvial geomorphology pertains to the way water affects sediment and bed particle conveyance capacity and patterns, and the subsequent effects on stream channel shape. Typically an overall goal is to maintain a stable stream channel by keeping the stream in a condition of sediment equilibrium where sediment import equals export over time (years). The timing, duration and magnitude of flow, as well as the amount of sediment entering the system, determines whether down-cutting, deposition, or channel migration will occur. Managing both flow and sediment is important in terms of maintaining the number of pools, the cleanliness of riffles and the overall width and depth of the river. Changing any of these elements can and often will change the kind and number of organisms that live in the river.

Instream Flow

Stable Channel Balance



Lane's Balance Equation

Lane's Balance Equation has been used to show the concept of "stable channel balance," depicting the relationship of sediment load and sediment size to slope and discharge graphically. A change in any one of the parameters will set up a series of adjustments in companion variables and ultimately result in changing the river channel and the organisms that live there.

Water Quality

Water quality is also affected by water availability and flow patterns, which in turn elicit a biological response. In some situations, managing this riverine element is as simple as dilution being the solution to pollution. But sometimes dilution isn't a good thing – especially for organisms that prefer turbid or warm water. Adding water with less sediment than occurs naturally, such as sediment-free, cooler water coming from a dam to a formerly warm water river with higher sediment loads can have drastic ecological effects on organisms that are adapted to an environment with different natural water quality characteristics. One element related to water quality that is rarely considered is the effect of a project on icing processes (as a function of water temperature) and winter habitat. This is an area of science that has yet to receive much attention but studies done to date suggest that the effect of altered icing processes on populations of fish and their habitat can be among the most significant of all factors affecting a fishery in ice-prone regions (Prowse 2001a, 2001b; Annear et al. 2002).

Connectivity

Connectivity consists of four dimensions, each with their own range of considerations related to hydrology, biology, geomorphology, water quality and energy. Understanding the importance and function of these four dimensions can be critically important for crafting effective flow regimes.

THE FOUR DIMENSIONS OF CONNECTIVITY INCLUDE:

Longitudinal Connectivity pertains to the presence of physical, chemical, or hydrological (e.g. lack of water) barriers on the mainstem of the river. However, it also relates to connectivity of the mainstem to its tributaries and a downstream terminus (e.g. a lake or ocean).

Lateral Connectivity references the ability of the river to spill onto the associated flood plain as well as for nutrients and woody materials on the floodplain to reach the river. Many fish species spawn during floods in flood plains or juveniles rear in seasonally connected wetlands. Construction of dikes and berms typically are designed to disconnect these components of a river and often have significant unintended consequences to the energy flow, habitat use, productivity, and persistence of aquatic organisms found in the river.

Groundwater Influence

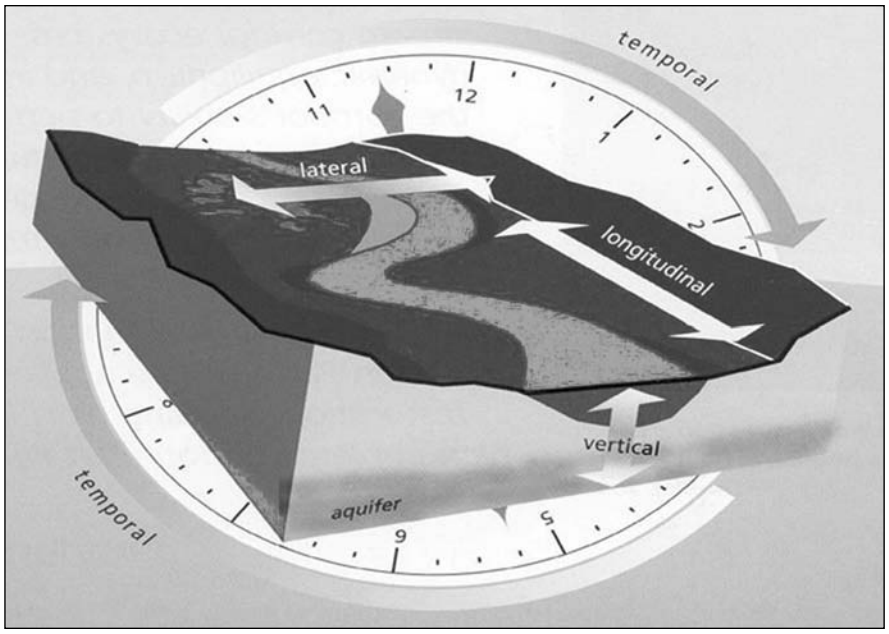
Vertical Connectivity relates to the connection of surface flow in the river to shallow groundwater. Wells located in riparian areas that draw from shallow groundwater can influence flow in the river just as directly as a diversion taking the water right off the top. Vertical connectivity patterns can be highly variable over both time and space as a function of changing geologic patterns and other factors, making

Instream Flow

Natural Dry Patterns

it necessary to do site specific studies to define the relationship between and potential effects associated with the use of shallow groundwater adjacent to flowing rivers.

Temporal Connectivity pertains to the pattern in which flow passes through a channel over time. In many situations riverine organisms are dependent on continuous, adequate flow in a section of river at all times of year. In other situations, healthy community assemblages have evolved and are defined by some manner of disconnectivity. Many stream segments cease flowing but still have isolated pools that provide refugia for native fishes to the exclusion or disfavor of non-native organisms. Though we sometimes call these "dry streams," there's a major distinction between when a stream goes dry and when it simply ceases flowing for some organisms. These natural flow patterns can be essential for excluding non-native fishes. Increasing year-round flows may look good to people, but can have drastic unintended consequences to certain assemblages of fish and other aquatic organisms.



Four Dimensions: *Rivers are connected in four dimensions—from headwaters to their mouth, from channel to floodplain and valley, vertically from their bed to the groundwater, and through time. Rivers are shaped and characterized by movements of water through the longitudinal, lateral, and vertical dimensions, which transfer materials, energy, and organisms. The time dimension (duration and rate of change) is also a critically important consideration in establishing instream flow prescriptions because of the dynamic nature of the riverine components (From Ward 1989).*

Flow Purpose

In consideration of the five riverine components and sub-parts, it's more important than ever that we ask the question "instream flow for what purpose" early in the project planning process.

Riverine Modeling

Regardless of how fast or far scientific advances occur or the level of sophistication contained in an ecological model, it seems more is always expected. It's crucial to recognize some of the basic tenets of riverine modeling.

BASIC TENETS OF RIVERINE MODELING INCLUDE:

- There is not a straight-line relationship between water and habitat. More water does not always mean more habitat.
- There is no best method or approach for quantifying flow needs.
- The ecological processes in every stream are unique and different from other streams, though there may be some similarities in some characteristics and functions.
- The ecological characteristics of streams change longitudinally and temporally – every stream segment is different. A flow that maximizes habitat in one part of the stream may not provide the same benefit in another part.
- A flow or flow regime that is beneficial to one life stage or species may be detrimental to other life stages or species.
- No single flow is best for an ecosystem or a full suite of organisms. Managers typically must manage for flow regimes.
- Modeling output must be evaluated to determine if there are any inconsistent or alarming results. Professional judgment is an essential part of all instream flow prescriptions.

Instream Flow

Illusion of Technique

Manage Uncertainty

Precise Numbers Unattainable

Flexibility Needed

Framework

Dealing With Uncertainty

Although there are many cases where the relationship between flow and an ecological response have been documented, some effects are not readily apparent. Ecological systems are complex. Their short and long-term interrelations are not completely understood. Dasman (1973) noted, "Today natural diversity still baffles us. Even the simplest natural communities escape our comprehension. We abstract and simplify them intellectually with energy flow charts or system diagrams. When we understand the pictures and formulae, we delude ourselves into believing we understand reality." Dasman's realization remains one of the most important things to keep in mind when analyzing data. The illusion of technique is a dangerous lure of all models. Stakeholders must be vigilant to not blindly follow outputs. In many cases professional judgment of experienced scientists, or strategies as simple as taking a series of photos at a range of flows, can be as or more pertinent than the output from some models (Mike Belchick, personal communication).

One attribute of all models is that they require users to accept some level of uncertainty. The statistician George Box summed this characteristic up succinctly in his oft-used quote "all models are wrong, but some models are useful" (Box 1979). Managing uncertainty is one of the most important parts of the assessment process, which of course is what science is designed to address. Regardless, uncertainty associated with instream flow quantification can and is often used by all stakeholders to delay a project and, if great enough, can just as easily kill a project or compromise a valuable aquatic resource.

Accuracy versus Precision

In science there is a very clear, and often significant, difference between providing an accurate answer and a precise one. Environmental responses based on trends or patterns measured over time (years) can be determined with a relatively high degree of accuracy. The science has evolved sufficiently that it is quite feasible to determine if the fishery (including habitat) will be better, worse, or about the same under one flow regime compared to another. In many situations, these kinds of accurate predictions of trends are acceptable.

The same cannot be said of the ability of methodological tools to predict a precise number of fish at any given place or point in time – especially with highly mobile populations. Fish populations are naturally dynamic from year-to-year, season-to-season, and segment-to-segment as a function of many variables of which water is only one (albeit an important one). There are very few studies to date that document a strong, consistent relationship between a particular flow level or regime and a precise fishery response.

Regardless of this fact, fishery scientists are often all too willing to come up with precise answers. This is often a formula for failure. The likelihood is that their prediction will be unacceptably high or low and lead to the claim that the answer is "wrong." In some cases where the measured response doesn't match up with the predicted one, "failing" to show a strong relationship between flow and fish is used to discredit both the science and the scientist.

In brief, scientific tools today are quite capable of providing relatively accurate answers (e.g. more fish) but they will most certainly always have difficulty providing precise determinations of fish numbers. Thus, it is often important that stakeholders consciously note whether the standard for studies is one of precision or accuracy.

Adaptive Management

The need for reducing uncertainty is directly proportional to the value of the investment being proposed and the value of the fishery in question. In situations where the value of both components is critically high, the best scientific studies and coordinated efforts with the public may fail to reduce uncertainty to acceptable levels for all parties. With many projects, neither party dare be wrong by much because once an agreement is reached, the outcome is a one-shot deal that's locked in place for a long time (decades or more). When parties reach an impasse and where flexibility exists in time, water and money, an adaptive strategy is often appropriate.

The term adaptive management is popular and shows up in many situations, not all of which are truly adaptive management. Hilborn and Walters (1992) describe several types of this strategy ranging from passive to experimental to active. In situations with high risk and potential controversy, active adaptive management is often the most useful. This framework involves developing a structured experimental process in which parties design a strategy, gauge the response over a defined time period, compare the response to a quantified pre-project condition, and implement new planned experiments until agreement of both parties is reached or the desired outcome is achieved.

Instream Flow

Critical Points

Adaptive management is a process to resolve critical uncertainties. It is not a compromise strategy nor is it an excuse to postpone decisions or to allow decisions to be based on inadequate or limited information (Walters and Holling 1990). If adaptive management is to be part of an instream flow decision, all parties must agree in advance on several points.

Critical adaptive management agreements include:

- What the objectives for the process are and what success will look like (are you managing for static or dynamic conditions; is the goal habitat or population oriented);
- Any future adjustments in the flow regime will be based on credible monitoring information. Monitoring should include adequate pre-project quantification (several years) as well as post-implementation of the experimental flow;
- The need to increase or decrease stream flow are both viable outcomes;
- The nature and adequacy of legal or regulatory mechanisms should be documented; one should determine whether they will allow for future changes to be made and enforced;
- Adequate funding and other resources (including water supplies) are provided in advance in an independently managed account; and
- Who will manage the account, how interest on the account will be managed, and under what circumstances escrow funds, water, and other resources may be used.

The method, which can be extremely flexible and responsive to system changes, allows a range of solutions to be examined that will probably capture the variation inherent in most stream systems and reduce the overall uncertainty about a system. If monitoring is properly conducted, practitioners can gain useful information and insights on how systems function.

Adaptive Management Limitations

The technique is unlikely to be implemented in quasi-legal proceedings, such as Federal Energy Regulatory Commission (FERC) hydropower licensing, because the parties need certainty as an immediate outcome, not additional studies and other potential license or permit conditions or limitations. This is equally true for proceedings involving other economic interests — such as lending institutions — because they require certainty and minimal risk prior to providing any type of financial assistance to a development project. The technique can be expensive because effective, long-term monitoring is required throughout the life of the process to allow adequate testing of hypotheses.

CONCLUSION

"no silver bullet"

Models' Limits

The majority of instream flow studies still rely largely on one-dimensional or two-dimensional physical habitat assessments that are designed to predict habitat suitability and trade-offs for sport fish. The level of accuracy of most of those studies is reasonably good as long as practitioners restrict their interpretations to the limits of the model they're using. Still, when we consider that these models usually address only one of the five riverine elements that define rivers (e.g. biology) and provide little information about the other four (hydrologic processes, fluvial geomorphology, water quality and spatial/temporal connectivity), there is much uncertainty associated with recommendations from these studies.

Documenting Design Decisions

Though not widespread, it is increasingly common to see studies include more of the five riverine elements in their assessments than in the past — though few if any include the entire suite. It isn't always necessary to quantify outcomes based on all five elements. It is, however, very important to document whether or not those designing instream flow studies have considered things like geomorphology and water quality in their study design and to document the reasoning behind any exclusions. In practice, the design of each instream flow study should be based on the unique set of issues and questions relevant to the particular situation.

Integrating Elements

Developing and using ecological models to describe riverine reactions to changes in flow is an imprecise process. To date, research has done a reasonably good job of quantifying the response of individual elements to changes in flow. But much remains to be done in the area of integrating multiple components. Perhaps the greatest research need is to better understand the inter-relationships between the five riverine components and develop predictive models that can further increase the accuracy of the decisions we make with water management for our rivers, streams, and lakes. New strategies such as Bayesian probability models show some promise for integrating multiple riverine elements and assessing potential outcomes by modifying elements individually or as groups. One such study is being undertaken by the US Geological Survey on the Flint River, Georgia (Peterson et al. 2006). Development of other large-scale river ecosystem models such as a Virtual River Network are also being proposed or conducted by others (Piotr Parasiewicz, UMass Amherst, personal communication).

Almost all people share the common tendency to want to boil things down to a simple level ("what's the one thing I need to know?"). As concerns fisheries, this can boil down to: "what's the minimum flow

Instream Flow

Personal Values & Ecological Principles

necessary to protect this fishery?" The world we live in, however, is not as simple to understand as some might prefer. Instream flow and water management decisions will always be imprecise regardless of the sophistication of models we develop. They may be accurate in the sense that we are capable of detecting and modeling some cause-and-effect relationships. But the complexity of natural processes is so great that precise predictions are simply beyond our level to fully comprehend — let alone describe in detail with mathematical models.

Some of us would like to think that a single, highly sophisticated model to quantify instream flow needs would make the decision-making process easier. The fact is that there is no silver bullet. Science serves a useful purpose in helping reduce uncertainty and will continue to evolve. However, the controversy associated with water is most often based more on personal values than on an understanding of ecological principles.

Einstein commented that "Science can ascertain what is, but not what should be, and outside of its domain value judgments of all kinds remain." Thus, instream flow decisions will always be a combination of science, public involvement, and the laws and policies under which we function as a society.

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FERC Decision

HYDROELECTRIC RELICENSING DECISION

***SKOKOMISH* CASE LIMITS FERC AUTHORITY**

by David Moon, Editor

In a case involving terms and conditions imposed by the Federal Energy Regulatory Commission (FERC) on a hydroelectric project as part of its relicensing proceeding, the DC Circuit Court issued a decision that strongly supports the restoration of flow to a river and the authority of federal agencies to protect natural resources. *City of Tacoma v. FERC, et al.,* No. 05-1054 (D.C.Cir. Aug. 22, 2006). The Skokomish Indian Tribe (Tribe) and Tacoma Power (Tacoma) had filed separate challenges to the FERC license issued for the Cushman Hydroelectric Project on the North Fork of the Skokomish River.

De Facto Decommission

Tacoma historically diverted virtually all the water from the North Fork riverbed into a pipeline, thereby maximizing the generating power of the river. Some water continued to flow into the North Fork riverbed from a tributary, and recently Tacoma released into the riverbed an additional flow of 60 cubic feet per second (cfs). Nonetheless, the court recognized that "the Cushman Project sharply reduced water levels, thereby affecting fish populations and increasing silt deposits." Slip Op. at 3-4. Tacoma asserted that, as conditioned, the Cushman Project (Project) would cost more to operate than the value of the power it generated — the license, therefore, would amount to a *de facto* decommissioning of the project, in violation of sections 14 and 15 of the Federal Power Act (FPA), 16 U.S.C. § 797(e).

Tribe's Position

The Tribe maintained that the license didn't adequately protect the environment or the Tribe's reservation and should have included all of the Department of the Interior's (Interior) section 4(e) conditions of the FPA. The section 4(e) conditions had been rejected by FERC for being filed after a strict 60-day deadline FERC ruled was applicable to Interior's submission. The Tribe also contested whether requirements of the Clean Water Act, the Coastal Zone Management Act, and the National Historic Preservation Act had been satisfied in the proceeding.

FERC Authority Restricted

The DC Circuit significantly reigned in FERC's power as part of the decision. "We conclude FERC exceeded its statutory authority by placing a strict time restriction on responsibilities Congress delegated to other federal agencies." *Id*. at 14. "Though FERC makes the final decision as to *whether* to issue a license, FERC *shares* its authority to impose license conditions with other federal agencies. *See Escondido Mut. Water Co. v. La Jolla Band of Mission Indian*s, 466 U.S. 765, 772-79 (1984). To the extent Congress has delegated licensing authority to agencies other than FERC, those agencies, and not FERC, determine how to exercise that authority, subject of course to judicial review. FERC can no more dictate to Interior when Interior should complete its work than Interior can dictate to FERC when FERC should do so. Here, FERC took all the time it needed—a full 24 years—to issue a license to Tacoma. Interior, in contrast, produced its license conditions within about three years of receiving notice on August 1, 1994." *Id*. at 15 (court emphasis).

Off-Reservation Facilities

The scope of conditions FERC is required to accept, even when the dams at issue were located *off* the Skokomish Indian reservation, also played an important role in the court's decision. The court noted that only the transmission line and the access road are "within" the reservation for purposes of the FPA. "FERC concluded that Interior's authority to impose section 4(e) conditions was limited to mitigating the relatively small impact the transmission line and access road had (and would have) on the reservation, and it did not extend to the much greater impact the dams and water diversion had (and would have) on the reservation." *Id*. at 16. FERC relied on one of its previous decisions, *Minnesota Power & Light Co*., 75 FERC ¶ 61,131, at 61,447-48 (1996), and the Supreme Court decision in *Escondido* to arrive at this conclusion.

Interior's Conditions

The DC Circuit, however, interpreted *Escondido* as providing an expansive view of FERC's authority under section 4(e), rather than a restrictive one. The court found that the "implication" of the Supreme Court's statements in *Escondido* is that Interior can provide section 4(e) conditions "provided that at least 'some' or 'any' part of the licensed facilities is on reservation land." *Id*. at 17. The court also found that such an interpretation was consistent with the plain meaning of the statutory language. "All the parties agree Tacoma's Cushman Project is 'within [a] reservation' at least to the extent of the access road and transmission line, and section 4(e) provides that licenses issued 'within [a] reservation' 'shall be subject to and contain such conditions as the Secretary [of the Interior] . . .shall deem necessary for the adequate protection and *utilization* of such reservation.' 16 U.S.C. § 797(e) (emphasis added)." *Id*. at 17.

Project Effect

> "We conclude, therefore, that the Secretary of the Interior is not limited in this proceeding to mitigating the impact the access road and the transmission line will have on the reservation. Instead, he may impose license conditions that are designed to mitigate the effect of the project on the Skokomish River to the extent doing so is reasonably related to protecting the reservation and the Tribe. Moreover, the

FERC Decision

No § 4(e) Discretion

Shift in Priorities

Potential Shut-Down

Minimum Flows

Additional Issues

FERC Mandate Changed

Tribal Protections Expanded

FPA gives FERC no discretion to reject Interior's section 4(e) conditions, *Escondido*, 466 U.S. at 777-79, though FERC is 'free to express its disagreement' with the conditions 'in connection with the issuance of the license' or 'on [judicial] review,' and it also has the option of not issuing the license, *id.* at 778 n.20." *Id* at 18.

Tacoma's arguments that the relicensing conditions adopted by FERC amounted to an illegal *de facto* decommissioning of the project were soundly rejected. The court first cited a FERC decision, *Mead Corp., Publishing Paper Divisio*n, 72 FERC ¶ 61,027 (1995), and stated that "FERC expressly noted the possibility that, under this new approach, it might license projects that had 'negative economic benefits.' *Id.* at 61,069." *Id*. at 29. The court then went on to discuss the fact that FERC "cannot guarantee license renewal when Congress has greatly altered the regulatory landscape during the course of the prior license term. 60 Fed. Reg. at 341-43." *Id*. The court pointed out that one of the "major shifts in national priorities since the 1920s has been from a near-exclusive focus on development to an increasing focus on environmental protection, and this shift is reflected in amendments to the FPA." *Id*. at 30. The court specifically mentioned considerations that must be made due to the Clean Water Act and the Endangered Species Act that have added to the "sweeping changes in FERC's statutory mandate." *Id*. at 31.

The court's conclusion regarding the FPA provision that requires FERC to grant new licenses "upon reasonable terms" (16 U.S.C. § 808(a)(1)) left no doubt about the potential impact of license conditions. "Therefore, the question we must decide is whether 'reasonable terms' can, in some cases, be terms that may have the effect of shutting a project down or occasioning a change of ownership. We think the answer is yes, especially here where, according to FERC's factual finding, Tacoma has recouped its initial investment plus a significant annual return on that investment. The obligation to give 'equal consideration' to wildlife protection and the environment, *id.* § 797(e), implies that, at least in some cases, these environmental concerns will prevail. At the very least, the Act is ambiguous, and FERC's interpretation of its statutory authority is reasonable and entitled to deference under *Chevron*, 467 U.S. at 842-43." *Id*. at 31.

Finally, the court vacated its stay of the minimum flow requirements that were contained in the license based on its conclusion that FERC is obligated to include Interior's section 4(e) conditions. With the stay no longer in effect, Tacoma will be required to immediately release a minimum flow of 240 cfs into the North Fork of the Skokomish River. The court noted further that Interior's section 4(e) conditions included several conditions imposing minimum flow requirements in excess of those presently incorporated in the FERC license. The case was remanded to FERC to include Interior's section 4(e) conditions and then determine if it will issue a license, or not issue a license, for the Project.

This opinion should be reviewed thoroughly due to other parts of the decision not discussed here. The court dealt with other tribal issues, including *Chevron* deference when Tribes are involved. The decision also addresses section 401 water quality certifications under the Clean Water Act (CWA) and FERC's responsibility to ensure that a state has complied, at least facially, with requirements for a proper 401 certification. Section 401 of the CWA requires a water quality "certification" from the appropriate state agency before FERC can license a hydroelectric project. 33 U.S.C. § 1341(a)(1); see also Glick, TWR #28 regarding the recent Supreme Court affirmation of state's authority under section 401 of the CWA. The court also rejected Tacoma's challenge to the validity of Biological Opinions in its discussion of review standards.

Conclusion

It is not known if Tacoma will appeal the decision. As it stands, the decision significantly checks the power FERC has historically exercised while making relicensing decisions. The court's holding relies on the "sweeping changes" in FERC's mandate due to the "major shifts in national priorities since the 1920s…to an increasing focus on environmental protection." With vast numbers of hydroelectric projects coming up for relicensing in the next decade this decision is of great consequence — both for the rejection of the argument that FERC cannot impose conditions if they result in shutting down a project and for its recognition that FERC is required to impose conditions Interior recommends (and cannot arbitrarily impose deadlines that thwart other agencies' concerns). The decision has also greatly expanded the scope of protection for Indian tribes by holding that licenses should be conditioned to protect not only direct impacts caused by the parts of a project located on a reservation, but to also protect against the *effects* of a project on a reservation and its utilization. Finally, what has been viewed as FERC's near absolute power in relicensing proceedings has been substantially altered, while the authority of other state and federal agencies has subsequently increased.

For Additional Information: Brett Swift, American Rivers, 503/ 827-8648 or website: www.americanrivers.org; full opinion available at: http://caselaw.lp.findlaw.com/data2/circs/dc/051054a.pdf

WATER BRIEFS

WETLANDS CASE US

9TH CIRCUIT ISSUES POST-*RAPANOS* DECISION

On August 10, the 9th Circuit Court of Appeals issued the first federal appellate court decision concerning wetlands and federal Clean Water Act (CWA) jurisdiction since the landmark Supreme Court decision in *Rapanos v. United States* and *Carabell v. U.S. Army Corps of Engineers*, 126 S.Ct. 2208 (2006). The 9th Circuit upheld the lower court's summary judgment, which required the City of Healdsburg to obtain a National Pollutant Discharge Elimination System (NPDES) permit under the CWA in *Northern California River Watch v. City of Healdsburg*, No. 04-15442 (9th Cir. Aug. 10, 2006). The court's decision was based on its conclusion that the wetlands at issue were within the CWA's definition of "navigable waters" because a "significant nexus" existed between the Russian River and the pond (with surrounding wetlands) that receives wastewater discharges from Healdsburg's waste treatment plant.

Commentators on the *Rapanos* decision have noted how that 4-1-4 split decision left the scope of the CWA in doubt, subject to a case-by-case factual analysis by federal courts to determine whether jurisdiction existed in various wetland settings. See Bricker, TWR #29 and Walston, TWR #30. In *Healdsburg*, the plaintiff alleged that the city violated the CWA by discharging sewage from its waste treatment plant into waters covered by the CWA since the city had not obtained an NPDES permit to do so. Healdsburg discharged the sewage into a body of water known as "Basalt Pond," which is a rock quarry pit measuring one half mile in length and a quarter mile in width, with 58 acres of surface water. The pond is located next to the Russian River (from 50 to several hundred feet horizontally), and is separated from the river by a levee.

The 9th Circuit noted that the lower court had based its decision on *United States v. Riverside Bayview Homes, Inc*., 474 U.S. 121 (1985) and that the Supreme Court had "narrowed the scope" of the earlier decision with its ruling in *Rapanos*. Stating its view of *Rapanos*, the 9th Circuit found that "the controlling opinion is that of Justice Kennedy who said that to qualify as a navigable water under the CWA the body of water itself need not be continuously flowing, but that there must be a 'significant nexus' to a waterway that is in fact navigable. Adjacency of wetlands to navigable waters alone is not sufficient." Slip Op. at 9302. This last sentence of the quote is particularly interesting since Justice Kennedy's opinion in *Rapanos* stated that, "As applied to wetlands adjacent to navigable-in-fact waters, the Corps' conclusive standard for jurisdiction rests upon a reasonable inference of ecological interconnection, and the assertion of jurisdiction for those wetlands is sustainable under the Act by showing adjacency alone." *Rapanos*, 126 S.Ct. at 2248.

"In light of *Rapano*s, we conclude that Basalt Pond and its wetlands possess such a 'significant nexus' to waters that are navigable in fact, because the Pond waters seep directly into the navigable Russian River." *Healdsburg* at 9302. In addition to finding that Basalt Pond was subject to the CWA, the court also affirmed the district court's ruling that neither the waste treatment system nor the excavation operation exceptions in the CWA applied to Healdsburg's discharges.

The 9th Circuit explained its rationale at page 9311: "Applying these [*Rapanos*] principles in this case, it is apparent that the mere adjacency of Basalt Pond and its wetlands to the Russian River is not sufficient for CWA protection. The critical fact is that the Pond and navigable Russian River are separated only by a man-made levee so that water from the Pond seeps directly into the adjacent River. This is a significant nexus between the wetlands and the Russian River and justifies CWA protection under the ACOE regulations and current Supreme Court jurisprudence. The district court's findings of fact support the conclusion that Basalt Pond and its wetlands 'significantly affect the chemical, physical, and biological integrity of other covered waters understood as navigable in the traditional sense.' *Id*. at 2248." (Slip Op. at 9311).

The opinion went on to discuss other hydrological and ecological connections between Basalt Pond and the Russian River, and the fact that the "district court also found that Basalt Pond significantly affects the chemical integrity of the Russian River by increasing its chloride levels." *Id*. at 9312. "In sum, the district court made substantial findings of fact to support the conclusion that the adjacent wetland of Basalt Pond has a significant nexus to the Russian River. The Pond's effects on the Russian River are not speculative or insubstantial. Rather, the Pond significantly affects the physical, biological and chemical integrity of the Russian River, and ultimately warrants protection as a 'navigable water' under the CWA." *Id*. at 9312-9213.

For info: Opinion available at http://caselaw.lp.findlaw.com/data2/circs/9th/0415442p.pdf

GOLF COURSE RECEIVES CONSERVATION FINES AZ

The Arizona Department of Water Resources (ADWR) announced recently that two Tucson area golf courses settled violations of ADWR's mandatory conservation requirements that occurred between 2002 and 2005. Investigation found that the golf facilities — the Stone Canyon Club and the Golf Club at Vistoso — exceeded the annual groundwater use limits established in ADWR's Third Management Plan for the Tucson Active Management Area (AMA). In reaching the settlement, ADWR agreed to waive half of the $173,025 in civil penalties accrued between 2002-2005. Efforts to improve course efficiency and the facilities' recent switch from groundwater to reclaimed effluent played a big part in the agency's decision to reduce the penalties, ADWR Director Herb Guenther said. To identify conservation potential, the facilities' management must submit the results of a professional irrigation audit to ADWR by the end of 2006. Owners of Stone Canyon and Vistoso may choose to reduce the amount of the fine further if they replenish the aquifer through artificial recharge. No reductions will be allowed for any violations that may occur in 2006 or 2007.

For info: Kenneth Seasholes, ADWR Tucson AMA area director, 520/ 770-3814 or website: www.azwater.gov/TAMA

WATER BRIEFS

CANAL LINING HALTED CA
ALL-AMERICAN CANAL

On August 25, the 9th Circuit Court of Appeals issued an emergency injunction ordering an immediate halt to the All-American Canal Lining Project. The project is designed to prevent leakage from the canal that conveys water from the Colorado River to farms in California's Imperial Valley. The $210 million project is for construction of a parallel canal along a 23-mile segment of the existing earthen canal to recapture an estimated 67,000 acre-feet of seepage water per year from the 78-year old canal. As a result of the injunction, all work on the canal-lining project, which has been in the works for over 20 years and was set to begin in the next two weeks, has stopped and will not resume until a final ruling is issued on the merits of the original appeal.

A lawsuit was brought against the US government and the Imperial Irrigation District (IID) in 2005 by environmentalists and agricultural interests in Mexico, asserting that farms and wildlife south of the border have come to depend on leakage from the canal, including an important wetland located in Mexico. The project is a US government project funded by the state of California and the San Diego County Water Authority; the All-American Canal is owned by the US and IID is serving as lead agency because it has a contract with the Bureau of Reclamation to manage the facility.

A judge in US District Court in Las Vegas ruled in July that the canal project should be allowed to go forward. The judge found that the plaintiffs in the case failed to prove any material changes had occurred after the issuance of a final environmental impact statement in 1994 and therefore a supplemental EIS wasn't needed. He further held that the law did not require the United States to address "speculative " or "extraterritorial " environmental impacts in Mexico and that the plaintiffs had failed to demonstrate that such impacts would cause environmental or socioeconomic impacts in the US.

The motion for an emergency injunction pending appeal was brought against the US and the Imperial Irrigation District by Consejo de Desarrollo Economica de Mexicali and the Cty of Calexico. The practical effect of the injunction, according to IID General Manager Charles Hosken, will be to delay the project indefinitely and thus drive up the cost of construction. A press release from IID noted that the "fugitive water" leaking from the canal, which is flowing across the international border into the Mexicali Valley, is considered key to ensuring that California continues to live within its legal entitlement to 4.4 million acre-feet annually from the Colorado River, in accordance with the Colorado River Compact.

For info: Bureau of Reclamation website: www.usbr.gov/LC/region/programs/aac.html;
Kevin Kelley, IID, 760/ 427-1593 or website: www.iid.com

TRIBAL WATER QUALITY US
PROGRAM CASE STUDIES

Four case studies have been published highlighting the accomplishments of four tribes that have adopted EPA-approved water quality standards: the Hoopa Valley Tribe, the Sokaogon Chippewa Community, the Hualapai Tribe, and the Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation. These case studies provide background information on the tribes, describe the steps the tribes took to develop EPA-approved water quality standards, and discuss how water quality standards have benefited the tribes.

For info: Case studies on EPA website: www.epa.gov/waterscience/tribes/video.htm

DAM REMOVAL OR
SAVAGE RAPIDS (ROGUE)

The Bureau of Reclamation (Reclamation) awarded the first part of a contract for construction of the Savage Rapids pumping plant and subsequent removal of a major portion of the Grants Pass Irrigation District's (GPID) Savage Rapids Dam located on the Rogue River near Grants Pass, Oregon on August 9. The entire project, including dam removal, is scheduled to be completed by December 19, 2009.

The first phase of the contract covers construction of a pumping plant capable of handling flows up to 150 cubic feet per second to ensure that GPID can continue service to its patrons on both sides of the river once Savage Rapids Dam is breached. A second phase of the contract, which will be awarded once the remaining construction easement is acquired, will cover construction of a pipe bridge designed to carry a portion of the district's water across the river. This will be followed by removal of a major portion of the dam.

The President's fiscal year 2007 budget request included $13 million in funding for the project. The funding has been approved by the House of Representatives and the U.S. Senate Appropriations Committee. Action in the Senate is pending.

For info: Robert Hamilton, Reclamation, 208/ 378-5087 or website: www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=13181

PERCHLORATE REGS CA
DRINKING WATER STANDARD

On August 28, the California Department of Health Services (DHS) released the long-awaited drinking water standard for perchlorate. The standard of six parts per billion (ppb) is the same as the public health goal that was finalized in 2004. The public comment period will close on November 3, 2006. DHS will also host a public hearing on the regulation on October 30, 2006.

For info: DHS website: www.dhs.ca.gov/ps/ddwem/chemicals/perchl/perchloratemcl.htm

WATER BRIEFS

PUNITIVES REDUCED CA
GROUNDWATER POLLUTION

In our July 15th issue (TWR #29), we reported on a groundwater pollution case that resulted in a substantial verdict against the manufacturer of the dry-cleaning chemicals which contaminated the groundwater aquifer. *City of Modesto et al. v. TDCC et al.* (No. 999345; see also 999643).

The jury awarded $3.2 million in compensatory damages, and then granted punitive damages of more than $175 million. The judge in the case recently reduced the punitive damages to a total of $12.7 million. Following the trial, Judge Munter reduced Dow Chemical's punitive damages to $5,441,221 and Vulcan Materials' punitive damages to $7,254,115. R.R Street's punitive damages were not reduced. Modesto was given the option by the judge to accept the decreased award or go forward with a new trial.

For info: Michael Axline, Miller, Axline & Sawyer (Attys. for Modesto), 916/ 927-8600 or email: toxictorts@toxictorts.org; Scot Wheeler, Dow Chemical, 989/ 636-2205 or website: http://news.dow.com/dow_news/corporate/2006/20060614c.htm

WATERSHED GRANTS US
EPA PROGRAM

EPA plans to award up to $19 million in grants to help clean up and restore the nation's waterways. Proposals must reach EPA by October 16, 2006, for capacity-building grants and November 15, 2006, for project-implementation grants. Capacity-building grants provide for education and training, whereas implementation grants involve actions such as protection and preservation.

State governors and tribal leaders nominate potential recipients for implementation grants. EPA will evaluate and rank submissions based on criteria outlined in each notice. Watershed organizations receive the awards based on how likely they are to achieve environmental results in a relatively short time. Selection of the grantees will be announced in the fall.

Under the Targeted Watersheds Grant Program, EPA has awarded nearly $40 million to 46 watershed organizations since 2003. In excess of $2 million has gone to five watershed capacity-building organizations to further the activities of more than 3,000 local watershed groups. For this grant cycle, the focus will be on supporting community-based approaches and strengthening local capacity to protect and clean up water resources.

Watersheds currently in the program cover more than 142,000 square miles of the nation's landscape draining into lakes, rivers, and streams.

In August, EPA released its 2005 Targeted Watersheds Grant Annual Report. It provides examples of how grant funding helps watershed partnerships advance the goals of the Clean Water Act through sound watershed plans. Comprised of informative fact sheets and maps, the report highlights 34 community efforts to reach measurable clean-water goals. The report also includes summaries of grantees focused on capacity-building efforts.

For info: Carol Peterson, EPA, 202/ 566-1304 or email: peterson.carol@epa.gov
EPA WEBSITES:
Targeted Watershed Grants: www.epa.gov/twg
Grant process: www.grants.gov
2005 Annual Report: www.epa.gov/twg/2005annualreport

WETLANDS INITIATIVE US
NEW USDA PROGRAM

The US Department of Agriculture's (USDA's) Farm Service Agency recently announced a new Conservation Reserve Program (CRP) "Duck Nesting Habitat Initiative" to restore 100,000 wetland acres in aid of increasing duck populations by an estimated 60,000 birds annually.

Enrollment is limited to land in the Prairie Pothole Region encompassing parts of Iowa, Minnesota, Montana, North Dakota and South Dakota. The acreage is allocated in the amounts of 40,000 acres to North Dakota, 40,000 acres to South Dakota, 8,000 acres to Minnesota, 8,000 acres to Montana and 4,000 acres to Iowa. Land must be located outside the 100-year floodplain. Land eligible for the program must be capable of being restored to CRP wetland standards. Wetlands must include a buffer that will protect water quality and provide quality nesting habitat.

For land with fewer than 25 duck pairs per square mile, participants can enroll acreage at a 4-to-1 upland-to-wetland ratio. This means for every one acre of wetlands, there must be four acres of surrounding upland habitat. For land with 25 or more duck pairs per square mile, participants may enroll acreage up to a 10-to-1 upland-to-wetland ratio.

USDA's Commodity Credit Corporation will offer participants an incentive payment equal to 25 percent of the cost to restore the site's hydrology, an annual rental payment and cost-share assistance of up to 50 percent of eligible practice installation costs.

Sign-up for the initiative will begin Oct. 1, 2006, at local FSA offices and will run on a continuous basis until enrollment goals are met, or Dec. 31, 2007, whichever comes first.

CRP is the nation's largest private-lands conservation program, with more than 36 million acres enrolled. Through CRP, farmers and ranchers plant grasses and trees in crop fields and along streams. The plantings stop soil and nutrients from running into regional waterways and impacting water quality.

CRP offers additional wetlands restoration initiatives targeting 500,000 acres inside the 100-year floodplain, 250,000 acres outside the 100-year floodplain and one million acres of previously converted wetlands of less than 40 acres per tract.

For info: Jillene Johnson, USDA, 202/ 720-9733 or email: jillene.johnson@wdc.usda.gov
USDA WEBSITE: www.fsa.usda.gov/pas/publications/facts/html/crpduck06.htm.

WATER BRIEFS

WASTEWATER VIOLATION ID

EPA ENFORCEMENT SETTLEMENT

The City of Kooskia, ID, has reached a $3,500 settlement with EPA for Clean Water Act violations related to the City's municipal wastewater discharge.

According to the discharge monitoring reports provided by the City, the City has been exceeding both the chlorine and E.Coli bacteria effluent limits in its National Pollutant Discharge Elimination System (NPDES) permit. The City discharges its treated wastewater to the South Fork of the Clearwater River. Between January, 2003, and October, 2005, the City accumulated roughly 2,000 violations. The chlorine and E.Coli bacteria effluent limits are water quality based effluent limits established using the State's water quality standards for local water quality conditions.

According to EPA, City officials have made significant strides in addressing this discharge problem. The planned plant upgrades are expected to achieve measurable progress improving overall water quality in the South Fork of the Clearwater River.

For info: Margo Young, EPA Reg X, 206/ 553-1603 or email: young.margo@epa.gov
EPA NPDES WEBSITE: http://cfpub.epa.gov/npdes/index.cfm

CLIMATE & WATER NM

STATE CLIMATE CHANGE REPORT

Climate change will have a significant impact on the availability of, and demand for, New Mexico's water during the next century according to a recently titled, "The Impact of Climate Change on New Mexico's Water Supply and Ability to Manage Water Resources," which was produced by the New Mexico Office of the State Engineer.

The report warns that the impacts to New Mexico are expected to be significant for water managers and users in future years, with changes to both supply and demand. The report discusses how little modeling is available that is specific to New Mexico with respect to global warming and climate change. Governor Bill Richardson directed the Office of the State Engineer to work with other state agencies, with local and federal agencies, and with the state's research institutions to prepare an analysis of the impact of climate change on the state's water supply.

THE REPORTS KEY POINTS INCLUDE:

- Temperatures have already risen in New Mexico and are predicted to continue to increase.
- There have been changes in snowpack elevations in recent years.
- There have been changes in available water volumes and in the timing of water availability.
- Precipitation has increased in the form of rain rather than snow due to increasing temperatures.
- Smaller spring runoff volumes and/or earlier runoff will impact water availability for irrigation and for ecological and species needs.
- Milder winters and hotter summers will result in longer growing seasons and increased plant and human water use.
- Increased evaporative losses from reservoirs, streamflows and soils due to hotter, drier conditions.
- An increase in extreme events, including both droughts and floods.

A copy of the report, can be downloaded from New Mexico's Office of the State Engineer website: www.ose.state.nm.us ["Hot Topics" >> "Current Drought Status" >> "Water Levels and Climate Conditions"]

For info: Karin Stangl, NMOSE Planning and Communications, 505/ 827-6139

STORMWATER VIOLATIONS ID

EPA FINES DEVELOPERS

EPA has reached settlements with Primeland Development Company, LLP, and GM Development, LLC, for violations of the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP).

Primeland Development Company, LLP settled for a penalty in the amount of $2,550 for violations at its construction site in Meridian, Idaho. The violations consisted of deficiencies in the Storm Water Pollution Prevention Plan (SWPPP).

EPA also settled with GM Development, LLC for a penalty in the amount of $12,900. The violations included operating without coverage under the CGP, deficiencies in the SWPPP, failure to conduct all required inspections and failure to maintain Best Management Practices for stabilizing its construction site in Post Falls, Idaho.

For info: Tony Brown, EPA Reg X, 206/ 553-1465 or email: brown.anthony@epa.gov
EPA STORMWATER DISCHARGE WEBSITE: http://cfpub1.epa.gov/npdes/home.cfm?program_id=6

DISCHARGE VIOLATION AK

EPA ENFORCEMENT

EPA has reached a $30,000 settlement with Inlet Fish Producers, an Alaskan seafood processor based in Kenai, Alaska. Following an inspection at their facility, the company was cited for discharge of seafood processing waste without authorization from a National Pollutant Discharge Elimination System (NPDES) permit.

Although the previous operator of the facility, Inlet Fisheries, Inc. was authorized under the General Permit for Seafood Processors in Alaska, the new operators did not obtain permit coverage in accordance with the requirements of the permit. Inlet Fish Producers, Inc. discharged without permit coverage from 2002-2004. Furthermore, EPA and Alaska Department of Environmental Conservation inspectors observed deficiencies in the facility's seafood waste treatment process during inspections on July 31, 2002 and July 26, 2004.

In response to this action, Inlet Fish Producers, Inc. applied for and received authorization to discharge from its Kenai facility on June 3, 2005.

For info: Mark MacIntyre, EPA Reg X, 206/ 553-7302 or email: macintyre.mark@epa.gov
EPA Discharge Permitting website: http://cfpub.epa.gov/npdes/index.cfm

CALENDAR

Please Note: An extended Calendar containing ongoing updates is available on The Water Report's website: www.thewaterreport.com. Subscribers are encouraged to submit calendar entries, email: thewaterrepot@hotmail.com

September 15 OR
Property Transactions & Real Estate Development, Portland. For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220, email: hduncan@elecenter.com, or website: www.elecenter.com

September 15 GA
Environmental Law, Atlanta. For info: The Seminar Group, 800/ 574-4852, email: registrar@theseminargroup.net, or website: www.TheSeminarGroup.net

September 19-20 CO
Colorado Water Conservation Board Meeting, Vail, Evergreen Lodge. For info: CWCB, 303/ 866-3441, or website: www.cwcb.state.co.us/Board/meetingschedule.htm

September 17-20 CA
California and the World Ocean Conference (CWO '06), Long Beach, Hyatt Regency. Agenda Includes Discussion of Implementing the California Ocean Protection Council's Strategic Plan. For info: Conf Organizers, 916/ 922-7032 or email: cwo02@completeconference.com or website: http://resources.ca.gov/ocean/cwo06/

September 18-20 MT
Northwest Water Policy and Law Symposium, Bozeman, Holiday Inn. RE: Infrastructure Matters, Surface Water/Groundwater: Relation in Nature and Policy, Water Regulation v. Land-Use Regulation, Challenges of Natural Resource Policy & More. For info: Susan Higgins, Montana Water Center, 406/ 994-6690, email: water@montana.edu, or website: water.montana.edu/policy/default.htm

September 19 OR
Mercury: Global Problem, Local Solutions, Northwest Environmental Business Council & Air and Waste Management Association Event, Portland, OMSI. RE: Assessment, Substitution, Responsible Management; Bioaccumulation Risks & Case Studies; Reducing Sources of Mercury: Mercury in Wastewater; Mercury Amalgam; Mercury from Coal Fired Power Plants; Mercury in Steel Mini-mills; Legacy Sources; Municipal Incinerators. Remediation and Treatment of Mercury - Success Stories. For info: Sue Moir, NEBC, 503/ 227-6361 or email: sue@nebc.org

September 19-20 UT
The Managing for Excellence Project, Salt Lake City, Marriott University Park. RE: Bureau of Reclamation's Challenges to Manage, Develop & Protect Water Resources in an Environmentally & Economically Sound Manner. For info: Reclamation, 308/ 445-2808 or website: www.usbr.gov/excellence

September 21 CA
CEQA & NEPA, Los Angeles. For info: Law Seminars International, 800/ 854-8009, website: www.lawseminars.com/

September 21-22 CA
"Assessment, Use, and Management of Groundwater in Areas of Limited Supply," Groundwater Resources Association of California Annual Meeting, San Diego. For info: Bill Pipes, 559/ 264-2535, or email: wpipes@geomatrix.com

September 25-26 NV
Western Water Law: A Comparison Among States, Las Vegas, Rio All-Suite Hotel & Casino. RE: CWA Cases, Judicial/Administrative Comparison of States, The Colorado River, Groundwater Regimes, Case Law Update, ESA Water Right, Water Supply & Land Use Planning. For info: CLE Int'l, 800/ 873-7130 , email: register@cle.com, or website: www.cle.com

September 25-26 CA
California Energy 2006, San Francisco, San Francisco Marriott. RE: Shifts in Energy Policy, Local Control, Global Warming Concerns, Future Sources & Environmental Impact, Power Markets & Regulation. For info: Law Seminars Int'l, 800/ 854-8009, website: www.lawseminars.com/frame_seminars.htm

September 25-27 MT
Public Land Law Conference: "The Law of Ecosystem Restoration," Missoula. RE: Policy Implications of the Clark Fork Basin Natural Resource Damage Program. For info: University of Montana website: www.umt.edu/publicland/Conference

September 25-27 CA
CASQA 2006 Conference, Sacramento, Radisson Hotel. Sponsored by the California Stormwater Quality Association. RE: Stormwater Technologies, Regulations, Programs & Community Impacts. For info: CASQA, 650/ 366-1042, email: info@casqa.org, or website: www.casqa.org

September 25-27 WA
An Introduction to Ground Water Course, Seattle. For info: National Ground Water Association, website: https://info.ngwa.org/servicecenter/Meetings/Index.cfm#MT2

September 27 CA
Groundwater Wells: Use & Shared Use Agreements, Rohnert Park. For info: Lorman Education Services, 866/ 352-9539 or website: www.lorman.com/seminars/

September 28 OR
Northwest Environmental Business Council's Stormwater Solutions Showcase, Portland, Oregon Museum of Science & Industry, 1945 SE Water Ave. Target Audience Includes DEQ 1200 C, 1200 Z, 1200 COL Permit Holders and Other Environmental Professionals. For info: Sue Moir, NEBC, 503/ 227-6361 or email: sue@nebc.org

September 28-29 TX
Texas Water Law, Austin, Omni Hotel at Southpark. RE: Water Law Fundamentals, Groundwater Districts, Bed & Banks, TCEQ's Protection Role, Lower Colorado River Authority Supply, Land Development, Water Markets, Environmental Flows, Water Quality & Wetlands, Water Planning, Rampant Development, & Regulatory Takings. For info: CLE International, 800/ 873-7130, email: register@cle.com, or website: www.cle.com

September 29 WA
Clean Water Act and Stormwater Management, Seattle. For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220, email: hduncan@elecenter.com, or website: www.elecenter.com

October 3-4 CO
2006 Tamarisk Research Conference: Current Status and Future Directions, Fort Collins, Fort Collins Hilton. Sponsored by the Tamarisk Coalition, the Center for Invasive Plant Management, and Colorado State University. RE: Management Efforts, Future Research Needs, Effective Policy & Management Decisions. For info: Conference website: www.tamarisk.colostate.edu/

October 4-6 CO
Sustaining Colorado Watersheds: Science & Restoration Through Collaboration, Breckenridge. Joint conference of Central Rockies Chapter Society of Ecological Restoration, Colorado Riparian Association & Colorado Watershed Assembly. For info: website: www.ser.org/cerser/2006Conference.asp

October 6 CO
Colorado's Future 2006 Conference: Taking the Plunge - Research as a Tool for Water Stakeholders, Copper Mountain Resort. RE: Interactive Workshops Focused on Research, Data Collection & Decision Making. For info: Lyn Kathlene, Colorado Institute of Public Policy, 970/ 491-2544, email: lyn.kathlene@colostate.edu, or website: www.cipp.colostate.edu/conferences

October 6 AK
Permitting Strategies, Anchorage. For info: The Seminar Group, 800/ 574-4852, email: registrar@theseminargroup.net, or website: www.TheSeminarGroup.net

October 10-20 CA
Watershed Partnership Seminar 2006, Riverside, Mission Inn. Sponsored by the California Bay-Delta Authority. For info: CBDA website: www.baydeltawatershed.org/

October 11-13 CA
2006 Water Quality/Regulatory Conference, Ontario, Doubletree Hotel. Sponsored by the East Valley Water District. For info: Jo McAndrews, EVWD, 951/ 787-9267, or website: www.evwd.com

October 12-13 IL
Endangered Species, Chicago. For info: Law Seminars International, 800/ 854-8009, or website: www.lawseminars.com/

October 12-13 MT
AWRA Montana Section Annual Meeting, Polson. For info: AWRA website: http://awra.org/state/Montana/events/conference.htm

October 12-13 CA
21st Century Groundwater Systems Conference, Costa Mesa, Hilton Costa Mesa. RE: Regulatory Requirements, Aging Infrastructure, Climate Change, Security Risks, Available Technologies, Water Resource Management & Planning, Strategies to Optimize Resources, Emerging Water Sources, Treatment & Monitoring Options & Future Needs, & Technology Innovations. For info: NGWA, 800/ 551-7379, or website: www.ngwa.org/e/conf/0610125075.cfm#location

October 16-20 WA
Community Action and Innovation for Watershed Sustainability, 2006 Biennial Conference, Walla Walla, Marcus Whitman Hotel & Conference Center. Collaboration with the Walla Walla Watershed Alliance, Water & Environmental Center & Walla Walla Community College. For info: www.watershed.org

October 18-20 NV
Water Quality, Drought, Human Health & Engineering Conference, Las Vegas, Desert Research Institute. RE: Solutions-Based Forum, Improving Water Quantity & Quality, Impact on Human Health & Engineering, State/Federal Policies. For info: American Society of Mechanical Engineers' website: www.asmeconferences.org/water06/

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October 19-20 MT
Water Law Conference, Helena. RE: Legislative Issues, Water Adjudication, Surface/Groundwater Interaction, Coalbed Methane, Emerging Issues, Groundwater Augmentation Plans, DNRC Hearings, Water Leasing, Tribal Reserved Water Rights, Interstate Issues (Columbia River) & More. For info: The Seminar Group, 800/ 574-4852, email: registrar@theseminargroup.net, or website: www.TheSeminarGroup.net

October 19-20 CA
Artificial Recharge of Ground Water , San Diego. For info: National Ground Water Association, website: https://info.ngwa.org/servicecenter/Meetings/Index.cfm#MT2

October 21-25 TX
WEFTEC 2006 - 79th Annual Conference and Exhibition, Dallas, Dallas Convention Center. Sponsored by the Water Environment Federation. RE: Water & Wastewater Practices, Solutions & Regulations. For info: WEF, 800/ 666-0206, email: csc@wef.org, or website: www.weftec.org/home.htm

October 23-24 UT
Utah Water Law, Salt Lake City, Marriott Downtown. For info: CLE International, 800/ 873-7130, email: register@cle.com, or website: www.cle.com

October 25-27 OR
Communities Working for Healthy Watershed: OWEB 9th Biennial Conference, Seaside, Seaside Convention Center. For info: Oregon Watershed Enhancement Board website: www.oregon.gov/OWEB

October 25-28 ID
Groundwater & Surface Water Under Stress: Competition, Interactions, Solutions, Boise. For info: www.uscid.org

October 26-27 CA
California Water Law Conference, Irvine, Hilton Hotel. RE: Water Supply Demonstrations, Groundwater Banking, Integrated Water Resource Planning, Reliability & Storage, & Desalinization. For info: CLE International, 800/ 873-7130, email: register@cle.com, or website: www.cle.com

October 26-27 OR
"Beyond Conflict: Tribal Water Rights, Settlement Strategies, and Environmental Justice," Tribal Water Rights Conference Northwest 2006, Eugene, University of Oregon School of Law. RE: Global Indigenous Perspectives & Resolving Water Disputes. For info: Jill Forcier, 541/ 346-3845, email: enr@uoregon.edu, or website: www.law.uoregon.edu/org/nwtwc

October 26-27 WA
Wetlands in Washington, Seattle. RE: Supreme Court: Rapanos & Carabell Decision, Implementing New Mitigation Guidelines, Mitigation Banking Developments, ESA Update, Stormwater Runoff, Enforcement Issues, Tribal Archaeological Issues, Nationwide & Individual Permits, Implementation of Critical Areas & Ethics. For info: Law Seminars International, 800/ 854-8009, or website: www.lawseminars.com/

October 27-28 AZ
"Looking Ahead: Managing Stormwater & Harvesting Rainwater for Conservation," Tucson. RE: Federal Stromwater Management Requirements, BMPs, Techniques for Beneficial Use of Rain & Stormwater. Sponsors: US Bureau of Reclamation, ARCADIS, U. of Arizona & the Water Resources Research Center. For info: Cado Daily, email: cdaily@ag.Arizona.edu, or website: www.rcsa-usa.org

October 28-November 2 AZ
6th International Symposium on Managed Aquifer Recharge, Phoenix. For info: ISMAR website: www.ismar2007.org

October 30 HI
Natural Resources Damages Litigation, Honolulu. For info: Law Seminars International, 800/ 854-8009, or website: www.lawseminars.com/

November 1-3 WY
Wyoming Water Association 2006 Annual Meeting and Education Seminar, Casper, Ramkota Hotel. For info: Wyoming Water Association, 307/ 631-0898, or e-mail: wwa@wyoming.com

November 2-3 OR
Oregon Water Law 15th Annual Conference, Portland. RE: Municipal Water Supplies, Urbanization Pressures on Agriculture, Resolving Conflicts, Permitting & Legal Disputes for Storage and Delivery of Water. For info: The Seminar Group, 800/ 574-4852, email: registrar@theseminargroup.net, or website: www.TheSeminarGroup.net

November 6-9 MD
Annual Water Resources Conference, Baltimore, Sheraton Inner Harbor Hotel. Sponsored by the American Water Resources Association. RE: Infrastructure Asset Management, Water (Homeland) Security, Watershed Management, Dam Rehabilitation/ Removal, Sustainability of Drinking Water Supplies, Impacts/Solutions of Urbanization, Drought & Flood Management, Ecological Restoration of Wetlands & Stream Corridors. For info: Patricia Reid, AWRA, 540/ 687-8390, email: pat@awra.org, or website: http://awra.org/meetings/Baltimore2006/

November 8 WA
Regulatory Requirements, Seattle. For info: The Seminar Group, 800/ 574-4852, email: registrar@theseminargroup.net, or website: www.TheSeminarGroup.net

November 8-9 TX
Environmental Forensics: Methods & Applications, Houston. For info: National Ground Water Association, website: https://info.ngwa.org/servicecenter/Meetings/Index.cfm#MT2

November 8-10 TX
Water Systems Council Fall 2006 Members Meeting, Dallas, Gaylord Texan Resort & Convention Center on Lake Grapevine. For info: member_services@watersystemscouncil.org, or website: www.watersystemscouncil.org/calendar/index.cfm

November 13-15 MA
Brownfields 2006 Conference, Boston. RE: Phoenix Awards for Excellence in Brownfield Redevelopment. For info: Denise Chamberlain, 717/ 761-0554, EPA website: www.epa.gov/brownfields/bfconf.htm

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