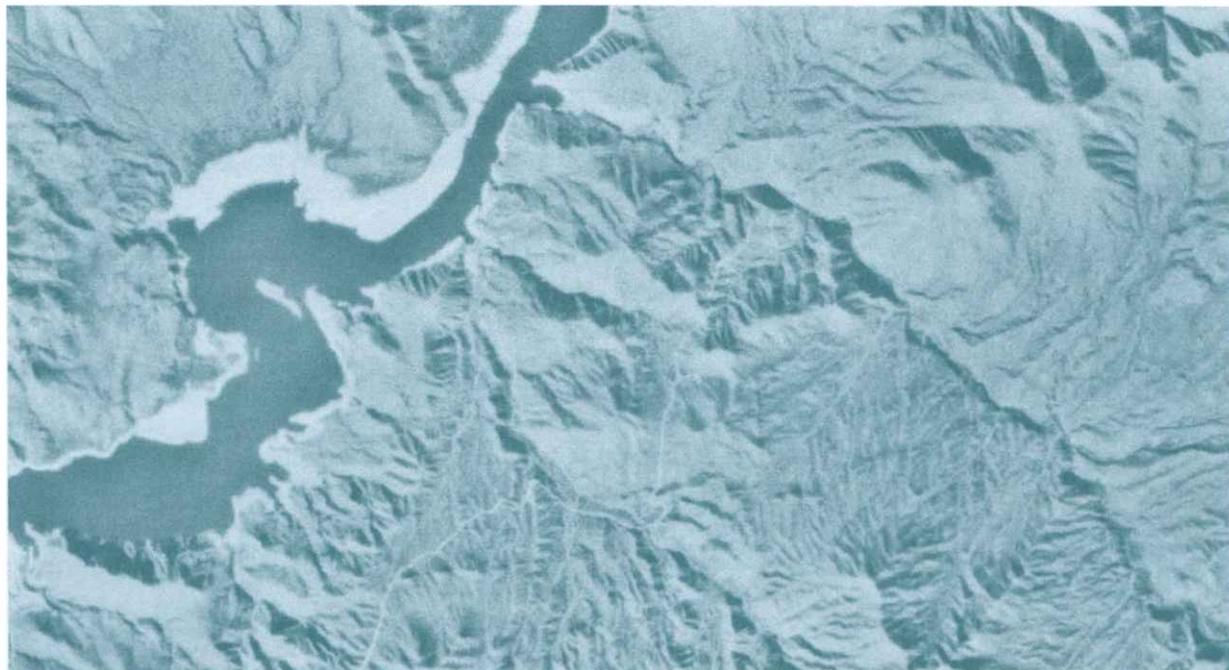


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The ridges, slopes and contours that direct flow and define a watershed can create a beautiful pattern as is shown in this aerial view. Human effects on the watershed also are apparent. Most noticeable is Apache Lake, formed by Horse Mesa Dam on the Salt River. Roads also can be seen.

Managing Watersheds to Improve Land and Water

by Joe Gelt

At first glance, the term watershed management appears to be self-explanatory, its meaning apparent in its very wording. Watershed management is the managing of a watershed. At best, however, this definition is merely the starting point and might appropriately be compared to the initial upland flow of a watershed itself, before becoming part of a complex system covering a broad area. Various interpretations and ap-

plied, watershed management, as public policy or field of study, also covers a broad area, to include consideration of social, cultural, and economic affairs as well as natural resource and environmental issues.

A concept well known to natural resource managers, watershed management is gaining wider recognition, with references to it now appearing in the popular press. Its recent and wide application ensures that

thoughtful coverage of environmental issues having to do with water will likely refer to watersheds and watershed management. For example, a front-page article in the Sunday "New York Times" on March 1 discusses an environmental strategy to ensure the overall quality of watersheds. Also, President Clinton's Clean Water Initiative, announced in his 1998 State of the Union Address, relies on watershed management

ideals to achieve its goals. An understanding of watershed management is key to comprehending much developing water-related public policy.

Watershed management's relatively recent rise to prominence is due to the interest and support of researchers, policy makers, politicians at various levels of government, community groups and the private sector. Many people from these groups believe that watershed management, with its coordinated, voluntary and consensus-based solutions, helps them first recognize and then address problems and areas of mutual concern.

Several watershed management initiatives are underway in Arizona. Projects along the Verde and Gila rivers have attracted national attention, and the San Pedro River is the site of varied watershed activities. Meanwhile the Arizona Department of Environmental Quality (ADEQ) is in the process of adopting a statewide watershed management framework, to expand the application of watershed principles and to institutionalize the approach in state government. A review of watershed management, its meaning and application, would be timely and help promote a better understanding of its potential to resolve present and future natural resource problems within the state. An understanding of watershed management begins with an understanding of a watershed.

Watersheds as Geography

In watershed management, a watershed is an administrative unit as well as a geographic designation. Considered either way, administratively or geographically, watershed needs defining. What is this structure or natural feature that conveniently serves this dual purpose?

A watershed is a geographic area defined by the flow and movement of

surface water. In a watershed, because of the elevation and contours of the land, all water flows to the same location or water body, such as a stream, pond, lake, wetland or — although not in landlocked Arizona — estuary. In its flow to a common destination, water sets the boundaries of a watershed. Hydrologists sometimes refer to watersheds as catchments or drainage basins. The term river basin sometimes is used synonymously with watershed.

Some watershed-related terminology — e.g., catchments or drainage basins — conveys an image of plumbing, as if human intent were involved. Watersheds, however, are natural systems of flowing water. Much of the water coursing through a riverbed is the result of runoff and spring flow from the surrounding land, its hills, mountains, mesas and other surfaces that slope toward the river. In higher elevations snow falls, accumulates and melts. Rain also occurs. The runoff from melting snow and rain flows over the land, guided by its varied forms and surfaces, possibly through canyons and arroyos, into a system of tributary streams. Streams merge and in turn merge again, until the cumulative flow enters a larger body of water.

The above describes a watershed in a state of nature. To understand the conditions of a watershed, however, more than a natural flow of water needs to be examined. Various human activities also may occur within a watershed, and these may affect its natural conditions. For example, cattle may graze in certain areas. Waters within a watershed may be used for irrigation, and the return flow may carry fertilizers and salts. Lands may be set aside for various other human activities, from logging to recreational uses, each with a possible effect on water quality. Also the watershed may include urban areas. Centers of diverse and varied human activities, urban centers may be the

source of runoff with varied kinds of pollutants that enters the watershed.

Watersheds exist at different scales or levels, depending upon a particular point of reference. For example, if the Colorado River is the point of reference then almost the entire state of Arizona consists of a single watershed. This is because almost all of Arizona's land eventually drains to the Colorado River. The only exceptions are certain areas draining through Mexico into the Gulf of California and a few closed basins such as the Wilcox Playa.

(Arizona shares the Colorado River watershed with six other states. The Seven Colorado Basin states' cooperative effort at negotiating and then signing the 1922 Colorado River Compact might be viewed as an early example of watershed or river basin management. The compact apportioned Colorado River water between Upper and Lower Basin states. Basin-side agreements were not common at that time.)

On its way to the Colorado River, water in Arizona flows through

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various other drainage systems that are in themselves watersheds. In other words, there are watersheds within watersheds, with smaller watersheds nested within larger ones. For example, in Arizona, the Gila and Little Colorado rivers, each fed by their own watersheds, both eventually drain into the Colorado River. Their watersheds in turn are fed by others watersheds. Watersheds, therefore, range widely in size and scale, from the local to statewide.

(If flow along the Continental Divide is considered then water also divides the continent. Also known as the Great Divide, the Continental Divide is located at the watershed formed by the Rocky Mountain ranges or tablelands. This watershed marks the dividing of the waters in the United States. On one side water drains eastward into the Atlantic Ocean and on the other side water drains west, into the Pacific Ocean. Most water flowing east drains into the Gulf of Mexico before entering the Atlantic Ocean. Most of the western flows enters the Columbia or Colorado rivers before reaching the Pacific Ocean.)

Watersheds as Administrative Units

That watersheds can be subdivided into various sized segments enhances their value as an appropriate and workable management unit. A hydrologic system unto itself, a watershed provides a more comprehensive and rational setting to resolve water or natural resource problems than areas defined by political boundaries, whether national, state, tribal or local. For example, problems having to do with water quality or quantity or wildlife habitat are not likely to be confined to areas enclosed within political boundaries. Watersheds are more likely to match the geographic scale of such problems.

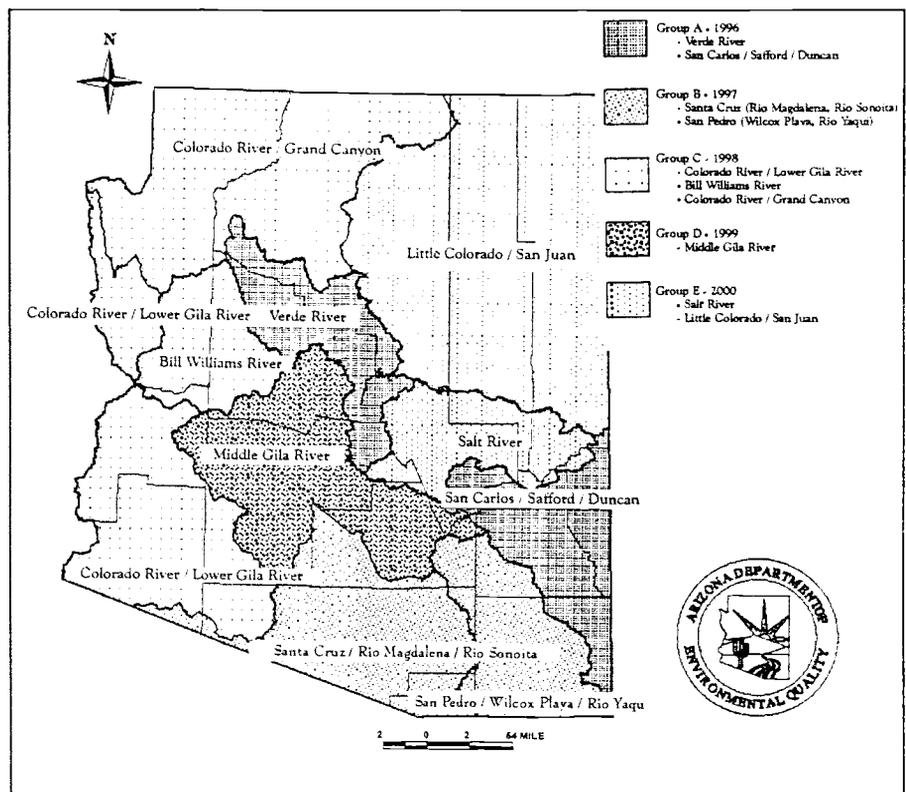


Figure 1. Arizona's ten watershed management zones

In developing its statewide watershed framework, ADEQ has identified ten watersheds as management units (See Figure 1). The watersheds are ten interlocking sections that together cover the entire state.

The flow of water can determine borders between states and nations as well as the shape and extent of a watershed. The Colorado River is the border between the states of California and Arizona, and the Rio Grande divides Texas and Mexico. The use of rivers to define political borders, however, is profoundly different than their use as watershed boundaries. Water and its flow is the internal logic of a watershed, its prescribed area determined by the movement of water within it. When used as political boundaries, a river is merely a convenient point of reference. The watersheds of the Colorado River and the Rio Grande extend far beyond the political boundaries set by those two rivers.

Watershed management is not the only strategy for defining an area or

spatial unit for the purpose of managing its natural resources. Ecosystem management also considers the broad regional context as the appropriate framework for addressing natural resource issues. Definitions of ecosystem management vary, but the approach generally is based on the occurrence of biota in an area.

The focus of ecosystem management ranges from specific sites to global regions. Debate is ongoing about whether watershed or ecosystem management better provides a framework for managing natural resources. Both, however, share a commitment to move beyond single-issue problems viewed on a micro scale to a holistic consideration of broader regional patterns, along with a consideration of the complex interaction of humans with the environment.

More is involved in a watershed management approach, however, than establishing administrative or organizational units along watershed

John Wesley Powell's Watershed Governance Plan

Powell is a figure that stands tall in the history of the West, mainly for his journey down the Colorado River, a river of almost mythical stature. Those who know Powell only as an early explorer of the Colorado River, however, overlook his other major contribution to western history. Not attracting the attention of his hazardous river run, Powell's proposal for western settlement to be based on the natural conditions of the area, its land, water and climate, is bold and adventuresome in its own right. Powell was a man ahead of his time, looking to the natural limitations of an arid and semi-arid region to determine the pattern of human settlement.

Powell envisioned relying on the topography of the West, especially its natural drainage network, to determine a rational plan for human settlement. His plan was to divide the western region into 200 or 300 "hydrographic basins" or watershed units, to be the pattern of settlement, rather than the townships and counties established in other parts of the country. Regional water management as the principle for the sociopolitical organization of society was not a new concept. Early practitioners include the ancient fluvial societies of Mesopotamia, Egypt and China. Spain brought the concept to the New World.

Powell admired the community spirit evident within Hispanic and Mormon communities and suggested that other settlements in the arid and semi-arid West follow their example and jointly control their own water and land resources. Early Hispanic and Mormon settlers finding scarce water resources in the region realized cooperation among water users was essential. They therefore organized their societies to ensure community management and control of scarce water resources. Land and water resources became community resources.

With such examples in mind, Powell recommended that western institutions be organized into "hydrographic" districts. Powell wrote in "The Century" in 1890 that those living in such a district would include "a body of interdependent and unified interests and values,

all collected in one hydrographic basin, and all segregated by well-defined boundary lines from the rest of the world." He proposed that "the entire arid region be organized into natural hydrographic districts, each one to be a commonwealth

within itself for the purpose of controlling and using the great values which have been pointed out... The plan is to establish self-government by hydrologic basins."

Further, to Powell, federal involvement in western water development was a dastardly intrusion, on a par with the machinations of monopolists and speculators to control water. In ringing tones Powell wrote, "that the enterprise shall be controlled by the men who have the genius to organize, and whose homes are in the lands developed" and concluded with a dramatic flourish "and I say to the Government : Hands off! Furnish the people with institutions of justice, and let them do the work for themselves."

In Powell's feisty and brave new plan watershed boundaries not only define areas of natural resource management and use, specifically of water, but they also define sociopolitical units. What he in effect proposed goes beyond watershed management to watershed governance, with natural hydrologic districts becoming self-governing commonwealths. At the time — and even now — Powell's proposal of "watershed democracy" was revolutionary. Coordinating the management of land and water resources went against the grain of western politics at that time. The West developed along much different lines.



lines. Topographical ridge lines may define the physical boundaries of a watershed, but the application of various principles, practices and theories within those boundaries determines whether a watershed management approach is in fact in place.

Watersheds in History

The historic roots of watershed management are evident in the Depression Era, from 1929-1942. This was a crisis time that called forth new institutional arrangements to meet

the ongoing economic emergency. In response to these perilous times, the Tennessee Valley Authority was established, its creation an effort to improve regional water development and management. The TVA reflects the premise that river basins should be managed as a unit and that institutional arrangements are needed for in-

tegrating the management of land and water resources.

Also at this time, the establishment of conservation districts, part of a national program administered by the U.S. Soil Conservation Service (renamed in 1994 the Natural Resources Conservation Service), encouraged land-water integration at the regional level. Partnerships among public, private and government interests to control erosion at the watershed level gained prominence during the depression. The influence of these developments is evident in the modern watershed movement.

In serving various needs, watershed management evolved over time, absorbing new ideas and concepts and reflecting shifts in thinking. In Arizona and the West, a version of watershed management that prevailed at one time has colored perceptions of its meaning even into the present. Watershed management was once viewed as primarily a means of increasing water supplies. It thus served the land use ethic that was dominant in the 1950s. Watersheds were valued as sources of various commodities – water, timber, minerals, etc. – and management practices were adapted to increase the supply of those prized commodities. Thus, a watershed was best managed that delivered a maximum amount of water.

A 1940 government publication on dam construction stresses managing watersheds as a water augmentation strategy. The author complains that dam builders often concentrate on the dam site itself, paying slight, if any attention, to the watershed. In this context the watershed is defined as the surface and subsurface flow that occurs upstream of the dam. The aim of watershed management is to maximize the amount of water available for storage behind the dam while minimizing the amount of sediment carried to the impoundment.

A prime strategy for increasing the supply of water, whether to a dam or to water users, was to manage the vegetation within a watershed. What this in effect meant was destroying or severely reducing vegetative growth within the watershed. This strategy was based on the fact that vegetation, to survive, uses water that otherwise could be put to human uses. Removing the vegetation is a way of redressing this perceived imbalance. Thin out or remove water-using vegetation within a watershed or replace it with a less consumptive species, and a net gain will result; i.e. more water for humans. Chains, cables and chemicals were the means of removing chaparral and pinon-juniper forests; ponderosa and mixed conifer forests were harvested.

In the mid-1950s, studies were done that showed if mixed conifer and ponderosa pine were cleared or thinned in certain areas grasses that use less water than would grow. Clearing of chaparral shrubs also was seen to have water augmentation promise. Since these shrubs readily reseed, however, burning and chemical treatment was the prescribed method of eliminating them. Additional water savings were anticipated by replacing vegetation along riparian areas with more shallow rooted types.

As might be expected this strategy did not go over well with some people. Environmentalists called it “tin roof watershed.” Although some experiments were conducted in Arizona, managing vegetation within watersheds for water augmentation was not done to any great extent within the state for a variety of reasons – political, logistical and environmental.

This version of watershed management, which was common in the semi-arid West at that time, still lingers in some people’s minds as its dominant rationale. To them water augmentation is so closely linked to watershed management that the terms are more

or less synonymous. This at times has worked to discourage a wider acceptance of today’s much different watershed management practices.

Contemporary Watershed Management

Defining watershed management as preached and practiced today is not an easy task. Increased references to watershed management in the natural resource field, in contexts ranging from environmental to regulatory, do not ensure a common understanding of the term. Even among those who advocate its use, who believe watershed management is the wave of the future, may not totally agree on its meaning and application.

Watershed management has been described as a “catchall phrase,” in its accommodation of different activities. EPA literature refers to it in a more positive light as “an evolving approach with many variations.” Some people take comfort from this lack of precision, claiming that it is an advantage that watershed management does not fit a particular cubbyhole and instead can be creatively applied to serve different needs. Yet, sufficient agreement exists among many watershed management advocates to provide a description of some basic working premises that underlie the concept and its application today.

More than just a policy-making strategy, watershed management also advocates a particular way of thinking, an integrated and holistic view of the world that also is influencing thought in a range of other fields. We now tend to be suspicious of any single cause-and-effect explanation for phenomena, especially natural phenomena. We urge taking the wider perspective, to look at various contributing factors and the way they interact, rather than focusing on a single component. Examples of this

thinking are evident in various areas, from interdisciplinary studies to integrated pest management. Environmentalists lay special claim to the wisdom of such an approach, often citing John Muir's remark, "When we try to pick out anything by itself, we find it hitched to everything else in the Universe."

Today's understanding of watershed management reflects this view. For example, its literature includes such polysyllabic words as interconnectedness, integrated, interrelationship, multi-disciplinary and multi-jurisdictional. What these words have in common, besides an abundance of syllables, is that they go beyond single categories. The phenomena they refer to are not cut from a single piece, but consist of several pieces that fit together creating a more complex whole.

More specifically, watershed management involves recognizing the complex workings of a watershed, its principles based on an awareness that land use, soil and water are all connected, and this land-water connection is an essential factor to consider when managing watersheds. Further, the strategy acknowledges that issues overlap, that streams are to be studied along with lakes and wetlands; that land uses and community activities are tied to water quality; that groundwater is connected to surface water; that wildlife habitats depend on the condition of water and land; that upstream is linked to downstream; etc.

Recognizing the complexity of the natural world begets awareness that human affairs are not conducted in isolation, nor do they play out as separate and independent acts, but often have implications beyond the immediate situation, to affect other actions and in turn to be affected by them. Human involvement in a watershed, therefore, can have far-reaching implications. As a result, watershed management is concerned with such

human-related activities as agricultural practices, urban runoff, private property interests, beneficial uses, sustained economic vitality, net environmental benefit and water quality concerns, especially nonpoint source pollution.



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In sum, managing a watershed is a strategy to promote its cooperative use among various, even competing interests, while at the same time protecting the watershed's natural or environmental values as well as public health. Despite the ambitious goal, practicing watershed management principles should not be viewed as a daunting task. Successful application is really based on a simple premise. Clayton Creager of the CADMUS Group describes the process: "By acknowledging a need to work together, problems are addressed more directly. So what we are basically talking about with watershed management is people cooperating — like in kindergarten."

People Working Together

Watershed management involves the participation of stakeholders. As defined in Arizona's watershed framework document, stakeholders are "individuals, organizations, and agencies that are involved in or affected by water resource management decisions for a watershed management zone." Stakeholders' interests in watersheds involve political, social and economic considerations. Assembling a watershed management team to speak to these varied interests can involve rep-

resentatives of all levels of government, public interest groups, industry, academic institutions, private landowners and concerned citizens.

Broad stakeholder involvement has various implications. With power shared at different levels, new types of governance can be established. The previous reliance on specialized agencies too often resulted in inconsistent and fragmented efforts that often conflicted, overlapped or otherwise were insufficient. The result frequently was a form of institutional paralysis known as decision-making gridlock.

By working together and sharing information, stakeholders agree on ground rules to guide their participation in management activities. They come to an understanding about their particular roles and mutually agree on adopted priorities and shared responsibilities. With such broad and varied participation, the focus on environmental issues is thus broadened to also include consideration of social and cultural goals such as economic stability and quality of life issues.

Watershed management often partakes of the tenets of conflict resolution. The consequences of personal confrontations and legal entanglements have been shown to be damaging and costly. Collaboration now is generally viewed as the best way to resolve conflict, especially with regards to environmental issues.

Further, watershed management accommodates the interest of local stakeholders who often have complained of being left out of the policymaking process. The involvement of local and even community interests, however, should not be interpreted to mean that watershed management is a bottom-up approach in contrast to the federal top-down strategy. Instead, all stakeholders are partners in adopting watershed management goals.

Watershed Conference and Publications

The following upcoming conference and new and revised publications are evidence of growing interest in watershed management:

Conference Call for Papers

A conference titled *Land Stewardship in the 21st Century: The Contribution of Watershed Management* is scheduled for March 13-16, 2000 in Tucson. Conference sponsors include the University of Arizona's School of Renewable Natural Resources, U.S. Forest Service and the Rocky Mountain Research Station. The conference is to raise awareness about the contributions watershed management will make to land stewardship in the 21st century. Conference information is available at <http://www.srn.arizona.edu/> and <http://www.fs.fed.ws/fs/>

A call for poster papers has been issued. Submit a title and a 250-word abstract by October 15, 1998 to: Leonard F. DeBano, Poster Session Chair, School of Renewable Natural Resources, University of Arizona, Tucson, Arizona 85721; phone 520-621-2543; fax 520-621-8801; email debano@ag.arizona.edu

Publications

In 1996, the Natural Resources Law Center, School of Law, University of Colorado, Boulder published *The Watershed Source Book* (\$25). The publication describes 76 initiatives in seven western water regions. The Center is in the process of revising the source book, systemati-

cally updating old case studies and adding new case studies to its database. The Center also published *An Assessment of the Changing Federal Role in the Emerging Era of Community-Based Watershed Management* (\$15) and *State's Role in the Western Watershed Initiative* (\$15). Contact the Center for publication information. Phone: 303-492-1286; FAX 303-492-1297.

The National Research Council's Committee on Watershed Management completed a report, *New Strategies for America's Watersheds*, to be published in late summer. The committee was charged to explore the opportunities and constraints associated with watershed-scale management and consider how to better integrate the ecological, social and economic dimensions of such approaches. For information about the publication contact the National Academy Press, 2101 Constitution Avenue, Washington, D.C. 20418; 1-800-624-6242.

The Western States Water Council is currently working on a publication, *State Watershed Strategy Guidebook*. Directed primarily at state water managers and other state officials and written from a western perspective, the handbook is a resource for states interested in encouraging local watershed initiatives to help resolve water resource problems. Contact the Western States Water Council for additional information: Western States Water Council, Suite A-201, 942 East 7145 South, Midvale Utah 84047; 801-561-5300.

Arizona Considers Watershed Management

Watershed programs are being worked out at the state level throughout the United States, with mixed results. Such efforts are often undertaken with federal support. About one-third of the states either have adopted a statewide watershed management program or are in the process of adopting such a program.

ADEQ's official commitment to watershed management began in 1994 when Brian Munson, then head of the agency's Water Quality Division, directed staff to explore what implications watershed management would have on ADEQ operations. At the time, watershed management was at-

tracting national attention as an effective strategy for managing water quality.

Supported by EPA funding and technical assistance, an ADEQ work group was formed to look into watershed management possibilities for the state. Membership was limited to ADEQ staff, specifically those involved in water division programs. The intent was first to work out within the agency an understanding of watershed management and its implications, before involving other individuals and groups. A central task of the work group was to develop a statewide watershed framework to guide the state in adopting watershed concepts. In preparing this document, the work group consulted with various outside agencies such as the

U.S. Environmental Protection Agency, U.S. Corps of Engineers, U.S. Bureau of Reclamation, Arizona Department of Water Resources and especially local councils of government.

In May 1997, the ADEQ work group issued a draft version of a document titled, *The Arizona Statewide Watershed Framework*. The document is a blueprint, the theoretical underpinnings, of an Arizona watershed management program. It is intended to be an adaptive management document, to be adjusted and modified to best meet Arizona conditions and situations.

Along with defining watershed management, both as philosophy and public policy, the document also provides a specific work plan. As pre-

viously noted, the document organizes the state into ten management zones (Shown in Figure 1). A six-step method is identified for developing and implementing a successful regional watershed plan within the management zones.

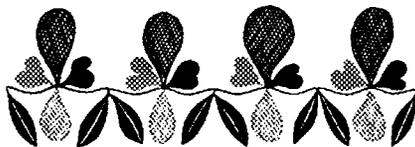
- Initiate stakeholder outreach and involvement
- Collect and evaluate watershed data
- List and target environmental concerns
- Develop management strategies and measures of success
- Compile the watershed plan
- Implement and evaluate watershed plan

Along with identifying six essential steps the document also lists various ADEQ operations or activities that are to be performed as part of the watershed framework. Including these activities as part of the framework is consistent with the document's directive that "ADEQ will use the watershed approach as a practical means to consolidate and fulfill many of the department's objectives and activities."

In many ways the framework is a strategy for managing ADEQ programs. For example, the document outlines a schedule of when ADEQ programs and activities will occur within particular watersheds. They are scheduled as part of a sequenced and iterative pattern. For example, detailed monitoring would be scheduled during a particular year at an individual watershed, to be performed at different watersheds in future years. Other ADEQ programs would be worked out in a similar fashion. As a result, ADEQ operations would be taking place on a rotating basis in different regions of the state. The intent of this cyclical watershed approach is to better budget and allocate ADEQ resources and to enable the agency to perform its duties in a more thorough and consistent manner.

The framework represents the state's most far-reaching and organized effort to adopt watershed management concepts. Related issues that lend momentum to Arizona's consideration of watershed management are control of nonpoint source pollution and determining total maximum daily loads (TMDLs). Both are addressed by the state's watershed framework document.

Nonpoint Source Pollution Program Watershed management, as generally understood and practiced today, is linked to efforts to control nonpoint source pollution (NPS). Background to the NPS issue therefore sheds light on the current inter-



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est in watershed management. More specifically, examining Arizona's operation of a NPS program shows how experience in managing such a program has benefitted the state in efforts to apply watershed management principles.

At one time, the control of point source pollution was a water quality priority. Point source pollution comes from an identifiable source; e.g., a factory or a mine. Controlling point source pollution involves identifying the source, whether mine, factory or other, with state or federal agencies then enforcing specific requirements. This is considered a "top-down" approach, with a source of authority enforcing directives on those subject to, or under its authority.

Efforts at controlling point source pollution eventually paid off, with sufficient progress demonstrated to enable regulators to focus on other sources of pollution. Officials then

turned their attention to the control of nonpoint source pollution.

Controlling non-point source pollution presents regulators with a different set of circumstances than point sources of pollution. Unlike point source pollution, NPS is less readily identified with a particular source or a single source of pollution. Frequently associated with urban or agricultural runoff, NPS pollution develops from many human activities, usually related to land uses. Relatively diffuse in its points of entry into the environment, NPS pollution can originate anywhere on the land surface or within a watershed. NPS pollution might then flow with runoff to streams, rivers lakes, and aquifers.

Managing NPS pollution usually involves identifying a land area with a common drainage system and joining forces with other interested and concerned parties within the area to develop a strategy for solving problems. Many different interests need to work together, from the various levels of government – local, state, and federal – to the private sector and individual members of the public. The community needs to be involved because nonpoint source solutions often are voluntary.

In response to the rising concern about NPS pollution, ADEQ's Division of Water Quality adopted an NPS control program. The stated object of the program is: "To improve the health of the watershed through the development of community-based programs that minimize pollution from nonpoint sources to surface waters." Central to this effort is the Nonpoint Source Management Zone Program (NPSMZ) which divides Arizona into 15 Nonpoint Source Management Areas. These represent areas with certain community and hydrologic consistencies.

ADEQ's later efforts to establish a statewide watershed framework benefitted from the agency's experience in administering its nonpoint

source pollution program. Through its involvement with the NPS program, ADEQ gained familiarity with watershed-based environmental management. Further, managing the NPS program involved working with community groups since NPSMZ was instrumental in establishing local advisory groups in the Verde River Valley and the Upper Gila River Valley.

A task when designing the current state watershed framework was to broaden the focus beyond traditional NPS program concerns, such as impacts of farming, ranching, and urban runoff, to include a greater array of water quality programs. As previously discussed, watershed management is intended as a more comprehensive natural resource strategy.

Determining Total Maximum Daily Load TMDLs have attracted wide attention lately, even featured on a front-page article in the Sunday, March 1, "New York Times." TMDLs represent a new approach for evaluating water quality and protecting waters, with EPA heralding their use as "a defining moment." Enforcement of TMDLs earned EPA's accolade because it represents a commitment to control water quality on a watershed basis, rather than relying on technological strategies.

In brief, a TMDL is a measure or "budget" of the amount of a specific pollutant that a body of water can receive before it exceeds water quality standards for a designated use. TMDLs generally are set for individual pollutants within specific watersheds. TMDLs owe their prominence to the Clean Water Act and its requirement that loading estimates be set for those watersheds with water quality insufficient to meet designated uses. For example, TMDLs would need to be established for a stream segment that is designated for contact recreation but has high levels of fecal coliform bacteria.

Setting TMDL standards means

considering both nonpoint sources and point sources of pollution. As a result, efforts to set TMDL standards require coordination among various regulatory agencies on a watershed basis. ADEQ is planning to establish about 92 TMDLs during the next eight to 13 years.

TMDLs have taken on a special importance lately for several reasons. EPA is viewing the process as an effective tool to improve water quality on a watershed basis. Also, the TMDL issue—or more specifically various states' failure to develop TMDLs—is providing an opportunity for environmental groups and others to sue EPA for its failure to enforce Clean Water Act directives in some states. In effect, TMDL is an issue for rethinking water quality on a watershed basis.

Critics Question Arizona's Commitment

Arizona has undoubtedly made a start in adopting a watershed approach for managing various state water quality programs. The work that went into developing *The Arizona Statewide Watershed Framework* demonstrates a commitment to applying watershed principles within the state. Many observers, however, view progress accomplished thus far as only the beginning, faulting ADEQ for not more actively promoting watershed management initiatives. Critics often refer to watershed work being done in other western states, especially Utah, California, Oregon and Washington, to demonstrate that Arizona could and should be making greater progress.

For example, Utah appears to be making strides in adopting watershed management. The state is divided into ten watershed management units. A coordinator is assigned to each unit, and each unit also has a local steering committee and a technical advisory

group. Unit coordinators act as a liaison between state government and local communities. At the state level, the statewide watershed management coordinator is part of a team consisting of representatives from various sections within the Utah water quality division. Chaired by the water quality division director, the team works to align various operations with watershed principles.

Critics claim that part of the problem in Arizona has been the administrative instability within ADEQ. An excessive number of personnel changes, especially at senior management levels, has left the state without effective leadership to promote watershed management initiatives. For example, in the last four years, four different directors have headed the Water Quality Division within ADEQ. This is a key position to ensure state commitment to watershed policy. This rapid turnover does not bode well for consistent and long-term attention to watershed affairs—not to mention other water quality matters.

Some critics identify various characteristics of what they call the state's political culture as working against statewide watershed management. For example, they claim Arizona has an inordinate devotion to control at the local level, to the extent that it is the defining political philosophy of the state. This position often is interpreted to mean that not only is federal involvement resented, but even directives from state government are unwelcome. Applying such principles to efforts at cooperative governance, such as watershed management, can present problems.

For example, locals who grapple with complex watershed issues likely lack the scientific and technical expertise to make appropriate decisions. If government, which can be a source of such expertise, is suspect, where can local community members turn for help? If even state officials are reluc-

tant to take action lest they impose upon local communities, citizen groups may be left to their own limited resources. Some critics fault ADEQ for not having worked out suitable procedures for building bridges to local communities to enable the agency to better work with advisory groups and respond to their needs.

(Legislative action this past session demonstrated Arizona's belief in local control of water and watershed matters, in the face of proffered federal assistance. The Arizona House passed a memorial urging President Clinton and the White House Council on Environmental Quality to refrain from including any Arizona rivers, watersheds or river segments in the American Heritage River Designation launched last year. Representative Jean McGrath feared for local control: "We couldn't think of what benefits the program offered. We don't need the federal government's control of our waters or watershed. We think we do a good job of that locally.")

Some people view Arizona's commitment to the property rights movement as hampering efforts to work out watershed initiatives. Property rights is an expression of local control, with individual property owners claiming certain inviolable rights to determine the use of their land, regardless of government policies. Whether viewed as a social, cultural or political movement, a property rights position often is at odds with the collective planning and negotiating of watershed management.

Finally some people claim that Arizona is lukewarm in its commitment to watershed management for hydrological or water supply reasons. Tucson, which is Arizona's second largest city, relies on groundwater, with the Central Arizona Project supplying the city's only surface water supply. Without a direct vested interest, Tucson officials may not be overly

UA Has Watershed Resources Program

The University of Arizona's Watershed Resources Program, located within the School of Renewable Natural Resources, College of Agriculture, offers bachelor, master and doctorate degrees. Watershed management courses consider the management needs of whole watersheds and their multiple uses, with special attention to water relationships. At the graduate level, students study, through a quantitative, multi-disciplinary approach, the role of water in the management of natural resources. For additional program information contact: Program Chair, Watershed Resources Program, School of Renewable Natural Resources, the University of Arizona, Tucson, Arizona 85721; 520-621-7255; Richard Hawkins, rhawkins@ag.arizona.edu.

concerned with the condition of adjacent watersheds. In Phoenix, the Salt River Project claims the watersheds of the Salt and Verde rivers. Its involvement with these watersheds, which are managed by the U.S. Forest Service, is said to discourage extensive watershed management activity.

If Arizona has in fact been slow to adopt principles of watershed management, the situation may be changing. Arizona, along with other western states, is confronting change — some say it faces a transformation — the effects of which will become more evident in the future. Ranching, mining, agriculture and timber, once the economic mainstays of the West, are being replaced by recreation, exploitation of scenic resources and a concern for urban affairs. The effects of this shift undoubtedly will be evident in debates about the best strategy to deal with publicly owned land and water. Watershed organizations may be the pressure point to deal with these issues and as result may gain in importance in the future.

Federal Watershed Support

Various federal agencies are committed to watershed management as a strategy to further U.S. natural resource management objectives. Agencies such as the U.S. Army Corps of Engineers, the U.S. Department of Interior and especially the

U.S. Environmental Protection Agency provide both financial and technical support to encourage watershed management planning and implementation.

Other federal agencies have adopted various aspects of the watershed approach, but often without the community involvement component. For example, the U.S. Bureau of Land Management and the U.S. Forest Service are using watershed analysis, but often without community participation. (The question then arises whether this in fact is watershed management. The watershed approach is multifaceted, involving a range of activities. Some proponents feel sufficiently protective about watershed management principles to be wary of agencies claiming to use the strategy, but without adopting what they consider to be a key component; i.e., community involvement. They are quick to point out that more is involved in watershed management than organizing activities within watershed boundaries.)

When considering the federal role in watershed management, the Natural Resources Conservation Service merits special mention. Founded in 1935 as the U.S. Soil and Conservation District, this agency actively promoted regional federal-state-local partnerships. It was instrumental in establishing about 3,000 soil conservation districts that almost cover the en-

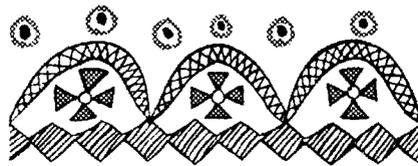
fire nation. The agency's adoption of a "small watershed program" and its development of a "natural resource management" framework promoted regional cooperation in erosion and flood control issues. The NRCS is a lead agency in the promotion of watershed management, its conservation districts providing the framework for many current watershed initiatives.

Various pieces of federal legislation refer to watershed management. For example, the Clean Water Act (CWA) mentions watershed management and includes options for watershed-based activities. The 1996 amendments to the Safe Drinking Water Act include new requirements for source water protection activities; in effect, this means watershed and associated groundwater basin protection. Also, in 1991, EPA released plans for a new watershed protection approach to confront nonpoint pollution problems. In 1994, EPA Region 9 came up with a watershed strategy plan, with various goals including setting clear watershed target priorities, supporting local, state, and federal watershed efforts, and tracking and evaluating the success of watershed management initiatives.

More recent federal action further promoted watershed management. On October 18, 1997, the 25th anniversary of the passage of the CWA, Vice President Al Gore issued a directive to various federal administrators in honor of the special occasion. He directed EPA administrator Carol Browner and Secretary of the Department of Agriculture Dan Glickman to work with other federal agencies and the public to develop a plan toward fulfilling the CWA's original goal of "fishable and swimmable" waters. A Clean Water Action Plan was duly prepared and forms the core of President Clinton's Clean Water Initiative which he announced in his 1998 State of the Union Address.

The plan relies heavily on the watershed approach, referring to it as

the "key to the future." Watershed assessments are to be used to identify watersheds to be targeted for FY99 funding, and watershed restoration action strategies will identify causes of water pollution and the actions needed to remedy those problems. In brief, the watershed approach is to be the guiding light for setting priorities and taking action to clean up the nation's rivers, lakes and coastal waters.



San Ildefonso pottery design

As part of the Clean Water Action Plan state environmental agencies and conservationists are directed to take the lead in conducting unified watershed assessments, to be developed by October 1998. The process also is to involve federal and local agencies, watershed-based organizations and the public. The assessment is to define watershed priorities for those watersheds most in need of restoration. These watersheds would be eligible for priority funding from the FY 1999 budget.

The assessment also calls for developing and implementing watershed restoration action strategies to restore those watersheds most in need of attention. Further, a preliminary schedule is to be set for working on the remaining watersheds. In Arizona, the U.S. Natural Resource Conservation Service and ADEQ are working together to assess and prioritize the state's watersheds.

The President's FY 99 budget proposes \$500 million to implement the action plan. Further, the President said that over the next five years

he will set aside \$2.3 billion, in addition to current spending levels. Among other objectives, the federal money is to be spent to "increase direct support to the states and tribes to carry out a watershed approach to clean water, and fund watershed assistance and partnership programs and grants to help local communities and citizens take leadership roles in restoring watersheds."

Some people are skeptical of the initiative, claiming it is politically motivated, its goal to promote Vice President Gore's presidential aspirations. They say much of the funding of the initiative is uncertain, with some of the support depending upon future congressional appropriations. Not taking any chances, the Western Governors Association is actively promoting federal funding for watershed improvement and restoration.

Conclusion

That watersheds provide a framework for managing natural resources seems appropriate for a number of reasons. The most obvious reason is that watersheds are naturally defined surface areas and provide a focus for observing the effects of human activities on land and water. Managing a watershed often means managing human activities to lessen any damaging effects on natural processes.

Also, however, an acceptance of watersheds as managing units implies less reliance on bureaucratic techniques; instead, the workings of a watershed determine what decisions are made and what actions are taken, at least in theory. Natural watershed processes, rather than bureaucratic structures, provide the rationale for management plans. This is an appealing concept at a time when many people profess belief in an environmental ethic.

This mode of thinking also might

lead us to consider what is basic to watersheds: i.e., water – the flow, drip, swirl and rush of water. Although obvious, this still might bear mentioning. Too often theory rules, its interpretation and application of primary importance. Even watershed management, although striving to be user-friendly, can at times seem rather abstract. Those wary of theories and abstractions can derive some comfort knowing that their involvement with watershed management is essentially an involvement with water, in its various states and conditions.

Watershed management therefore is more than just an effective management plan, to be studied, interpreted and applied. Part of its appeal extends beyond its use as policy to an awareness that watersheds are in fact systems of flowing water, and that an effective application of watershed management principles begins with an appreciation of river flow. In a memoir of his boyhood Richard Selzer describes the effect rivers have on him, "From each river, there is given off a personal drift that is the confusion of its numberless currents, the curves and recurves of its long traipse, the strew of its bed." In his

feel for rivers, Selzer is effectively expressing one of the first principles of watershed management.

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