

The Ahwahnee Water Principles

A Blueprint for
Regional Sustainability



Acknowledgements

The Local Government Commission extends its deepest gratitude to the authors of the Ahwhanee Water Principles. This dedicated group of individuals also served as a special advisory committee to this project and gave generously of their time and expertise to help develop this guidebook.

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The authors are grateful for the helpful review and contributions of Steve Lipman to the guidebook's introduction and those of Oliver Ibrien to the section on stretching our water supplies, as well as editing assistance from Erin Hauge and Nancy Mathison.

We are also indebted to many other individuals and organizations who provided resources and information for this guidebook. A special thanks to Ahmad Kashkoli with the State Water Board; Steve Lipman; Ken Kay and KenKay Associates; Oscar Balaguer, Chief, Certification and Wetlands Unit, Division of Water Quality, State Water Board; Vicki Musgrove and Richard Bradley with the City of Ventura; Maria Wong of the Yolo County Natural Community Conservation Plan Joint Powers Authority; Lisa Nisenson; Lynn Richards with the U.S. EPA; Maureen Middlebrook of the Sonoma County Agricultural Preservation and Open Space District; the Nonpoint Education for Municipal Officials; California Water and Land Use Partnership; the Inland Empire Utilities Agency; Sacramento Area Council of Governments; the Water Education Foundation; the City of San Jose; the Irvine Ranch Water District; the California Urban Water Conservation Council; and Darren Greenwood with the City of Livermore. Finally, we would like to thank the State Water Board for project funding and guidance.

Also, we would like to thank those who graciously provided images for use in the guidebook, including Nonpoint Education for Municipal Officials, KenKay Associates, Steven Joseph, the Department of Water Resources, the City of San Jose, the City of Portland, Inland Empire Utilities Agency, Sonoma County Agricultural Preservation and Open Space District, the San Francisco Chronicle and the Water Education Foundation.



The

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July 2006

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“Watersheds not only connect our land and water, they connect our communities. We cannot sustain vibrant, livable communities if we cannot sustain clean and reliable water supplies.”

— Mary Jane Griego, Yuba County Board of Supervisors

Introduction

While in California in the later part of the 19th century, Mark Twain observed, “Whiskey is for drinking... water is for fighting.” The tensions and concerns over sufficient water to meet the needs of California reflected in Twain’s humorous comment are as true today as they were over 100 years ago.

Safe, clean water is essential to California, its nearly 37 million residents, its vibrant and diverse economy, and its cherished quality of life. However, accessible quantities of clean water adequate to meet California’s current and projected future

needs are limited and relatively finite. It is becoming increasingly evident to policy-makers that to accommodate the often competing needs of various end-users, while providing for continued demographic and economic growth, requires careful, forward-thinking management of California’s water resources.

Responsibility for balanced, effective water management in California is increasingly borne by government at the local level. In 2001, state legislators recognized the need to tie future development to the availability of water in enacting Senate Bills 221 and 610. This legislation, sometimes referred to as the “show me the water laws,” requires that before local

jurisdictions can approve new, large residential and commercial projects, the project must receive written verification from the local water agency that there are sufficient water resources to sustain the growth projected by the project.

However, the reverse is also true. The loss of water resources forces the loss of population and businesses. For example, in west Fresno County where several towns are now facing diminishing water resources, a lack of water is causing some residents to move out of the area. This population loss is presenting formidable economic challenges for these communities. [1]



New responsibilities for managing California's water supplies

In addressing the state's population growth, predicted to jump another 12 million people by 2030, community and regional land use decision-making by local jurisdictions will directly impact the distribution of California's water resources. [2]

Competition for adequate supplies of water has long-produced tensions between rural and agricultural California and rapidly growing urban, suburban and exurban California. This competition and the resulting tensions will almost certainly intensify unless local governments mitigate these competing interests by looking to cost-effective, long-term policies that efficiently manage and distribute available water resources.

Furthermore, responsibility for the safety and protection of California's water is now increasingly placed with local and regional government agencies. Federal and state laws mandate regulatory oversight at the local level, including water supply and safety, stormwater management, pollution mitigation and flood control.

However, the responsibility for meeting these requirements is accompanied by growing concerns over legal and financial liabilities that city and county governments may face.

Taken together, the requirements of the new water supply laws and regulatory programs are pushing California's local governments to see the need to coordinate their planning and development processes with water management efforts.

Local governments' increasing concern about adequately managing water resources also extends to protecting and preserving California's precious quality of life. The demands of increasing population, agricultural and commercial operations, changing land use and expanding urbanization affect and, in some cases, threaten California's ecology, natural places and resources. Shortsighted land use planning threatens the state's natural treasures, including aquifers, lakes, rivers, streams and watersheds.

Sound, thoughtful management of our water resources — how water is captured and controlled, how it is treated, used and released — is an issue that local governments cannot afford to ignore. Around the United States, local officials are embracing new land use policies that protect and maximize local water resources, reduce the cost of stormwater permits,

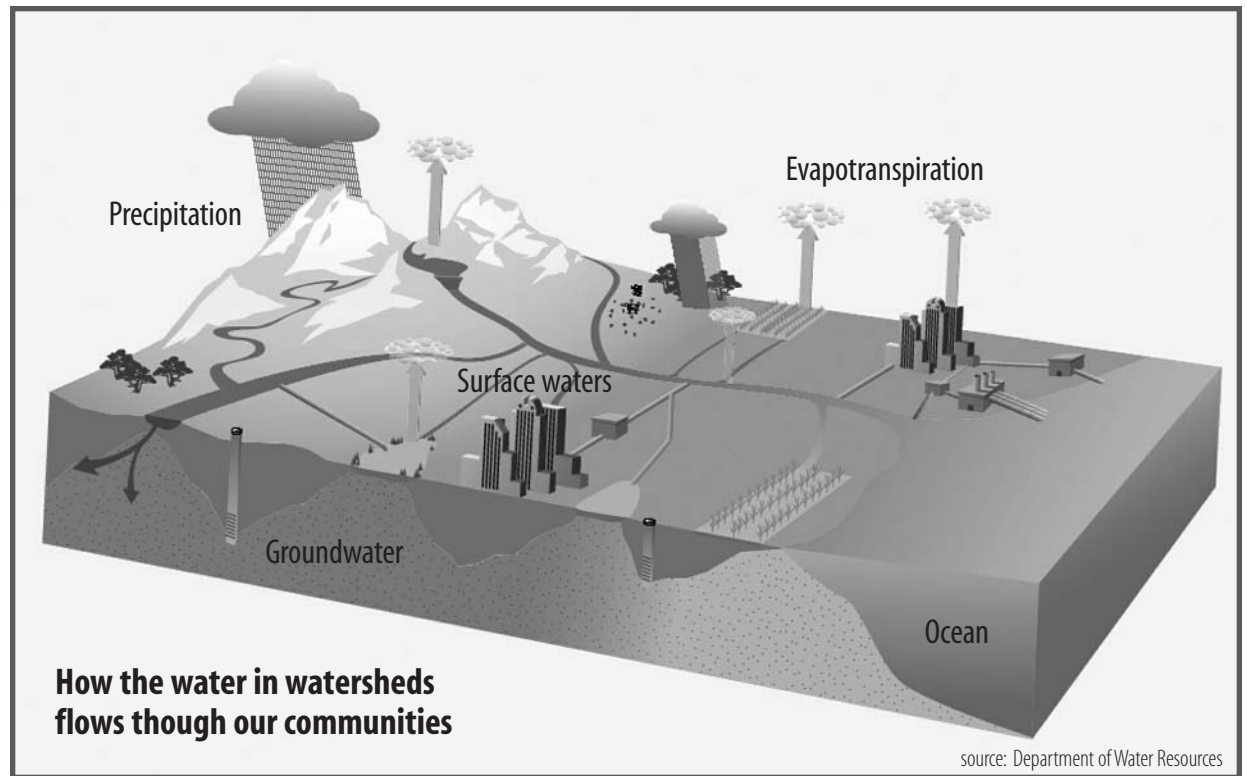
lessen the possibility of fines for violating water quality standards, and limit the impacts of flooding on rapidly developing floodplains. Communities are looking ahead, and planning and investing to meet current and projected future demands for water supply, quality and the environmental health needed to sustain them. They understand that their land use decisions seriously impact those water resources. This guidebook is intended to help officials at the local and regional level become active partners in protecting local water resources and watersheds.

Thinking regionally – The watershed

Every river we see is part of an area of land – a watershed – that catches and drains the water that falls within it. A watershed is a network of water, a geographic area in which water, solids, sediments and dissolved materials drain and flow to a common outlet – a point on a larger stream, a lake, an underlying aquifer, an enclosed bay, an estuary or, in California, the Pacific Ocean.

All land, developed or not, is part of a watershed. When rain falls, it becomes a part of the watershed it falls in. The water in a watershed is connected by the streams, lakes and wetlands we see on the surface, which are also tied to groundwater basins below the ground.

Watersheds are critical to the health and welfare of our communities. They are the source of our water; they maintain our forests, agriculture and fisheries; they feed our rivers, lakes, groundwater and estuaries; and they provide essential wildlife habitat and innumerable natural services we depend on.



In addition to providing our drinking water, California's watersheds sustain economic and recreational activities throughout the state, including tourism, commercial and recreational fishing, boating and rafting.

Of course, the natural boundaries that define watersheds are not the same as the political boundaries of cities and counties. Watersheds may span multiple jurisdictions, which means separate communities and their water supplies are connected by the watershed they share.

In hydrologic terms, California can be broken into 10 watershed regions – North Coast, San Francisco, Central Coast, South Coast, Sacramento River, San Joaquin River, Tulare Lake, North Lahontan, South Lahontan and Colorado River – each with its own climate, ecology and geographic characteristics. From a regulatory perspective, California's watersheds are arranged into nine Regional Water Quality Control Boards.

Meeting our future water needs

Because watersheds are dynamic and fragile systems, the challenges to maintaining and sustaining vital watersheds are becoming increasingly complex.

Population increases and economic growth will be accompanied by more housing and commercial development. This means that previously open land will be covered by asphalt, concrete and similar impervious surfaces, impairing water from percolating into the ground and replenishing underground aquifers. This will reduce available water supplies at a time when the demand for water will be increasing.

To make matters worse, as it flows across parking lots and streets, runoff water will gather up refuse, oil and other contaminants and pollute our local water supplies.

Unless the relationships between water supply, growth and development are better managed, California's watersheds will become increasingly polluted. Their vital natural functions to collect and cleanse our water supplies, provide commercial and recreational opportunities and wildlife habitat will be impaired and possibly permanently destroyed.

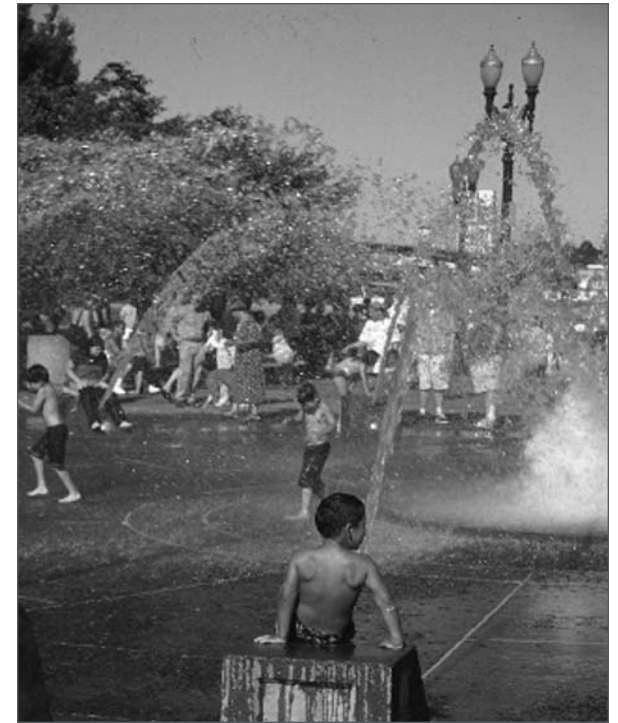
Global warming represents yet another challenge to California's future water supplies. Warmer temperatures will produce a smaller snowpack and more winter runoff. This means more floodwaters to manage in the winter followed by less snow melt to bank in reservoirs for drinking water, summer lawns and crop irrigation.

It cannot be stressed enough that California's available water resources are limited and unpredictable. Much of California is arid and prone to drought; in the past 75 years, in fact,



California has experienced three major droughts – from 1929-34, 1976-77 and, most recently, 1987-92.

The way most California communities supplement local supplies is by importing water. Unfortunately, the principal sources of imported water are becoming increasingly unavailable. Today, most of Central and Southern California's water comes from the San Francisco Bay-San Joaquin River Delta, which provides water for two-thirds of California residents. This water also irrigates a substantial portion of California's farms, is the state's most important fishery habitat, and is home to more than 10,000 species of migratory fowl. But the Delta itself is under severe strains.



Nor can California, especially the southern part of the state, continue to rely so heavily on water imported from the Colorado River. Currently, it is California's other major source of imported water. But regulatory requirements limit California's claim on water from the Colorado River. The needs of other states in the Colorado Basin, the impact of severe, prolonged drought, and questions of water quality limit the Colorado River as a reliable source of water for California's future needs.

Still, the picture of water resource management in California is not entirely bleak. There are practical actions that cities and counties can take that will ensure a future water supply for their communities.

The Ahwahnee Water Principles for Resource-Efficient Land Use



In 2004, the Local Government Commission set out to identify effective, least-cost economically and politically viable options for sustainable water resources management at the local level. The LGC invited respected water resource policy, management and planning professionals – with experience at the federal, state and local levels – to craft a set of land use principles which would provide guidance to local officials and communities concerned about sustaining future water supplies.

The process of developing the Ahwahnee Water Principles mirrored the LGC's earlier Ahwahnee Principles for Resource-Efficient Communities, which were released in 1991. The Ahwahnee Principles presented a blueprint for elected officials to create compact, mixed-use, walkable, transit-oriented developments in their local communities, and have since paved the way for growing acceptance and inclusion of “smart growth” and the “New Urbanism” in local and regional land-use policies and practices.

In March 2005, the Ahwahnee Water Principles for Resource-Efficient Land Use, in a format that could be incorporated into a community's general plan, were presented to an audience of more than 100 mayors, city councilmembers and county supervisors at the Ahwahnee Hotel in Yosemite, where they were enthusiastically received.

The Ahwahnee Water Principles – comprised of nine community principles and five precepts to implement these community objectives – provide a practical blueprint for sustainable land-use practices that can improve the reliability and quality of water resources and reduce some of the financial liabilities that new development places on local government.

These principles are practical actions that cities and counties can take as good stewards of California's water resources by ensuring that new development and redevelopment minimize the risks and impacts of stormwater runoff, ground and surface water contamination and flooding.

At the same time, these steps can help ensure that communities will have water resources adequate to serve existing and new businesses and residents. These strategies are efficient, effective, least-cost options, which can help avoid communities being dependent on expensive and potentially unreliable imported supplies of water from outside their area, or undertaking costly cleanup or water treatment measures. Implementation rests with county boards of supervisors and city councils exercising their planning and land use authorities.

The Ahwahnee Water Principles

■ Preamble

Cities and counties are facing major challenges with water contamination, stormwater runoff, flood damage liability, and concerns about whether there will be enough reliable water for current residents as well as for new development.

These issues impact city and county budgets and taxpayers. Fortunately there are a number of stewardship actions that cities and counties can take that reduce costs and improve the reliability and quality of our water resources.

The Water Principles complement the Ahwahnee Principles for Resource-Efficient Communities that were developed in 1991. Many cities and counties are already using them to improve the vitality and prosperity of their communities.

■ Community Principles

- 1 Community design should be compact, mixed use, walkable and transit-oriented so that automobile-generated urban runoff pollutants are minimized and the open lands that absorb water are preserved to the maximum extent possible. *[See the Ahwahnee Principles for Resource-Efficient Communities]*
- 2 Natural resources such as wetlands, floodplains, recharge zones, riparian areas, open space and native habitats should be identified, preserved and restored as valued assets for flood protection, water quality improvement, groundwater recharge, habitat and overall long-term water resources sustainability.
- 3 Water holding areas such as creek beds, recessed athletic fields, ponds, cisterns and other features that serve to

recharge groundwater, reduce runoff, improve water quality and decrease flooding should be incorporated into the urban landscape.

- 4 All aspects of landscaping from the selection of plants to soil preparation and the installation of irrigation systems should be designed to reduce water demand, retain runoff, decrease flooding, and recharge groundwater.
- 5 Permeable surfaces should be used for hardscape. Impervious surfaces such as driveways, streets and parking lots should be minimized so that land is available to absorb stormwater, reduce polluted urban runoff, recharge groundwater and reduce flooding.
- 6 Dual plumbing that allows graywater from showers, sinks and washers to be reused for landscape irrigation should be included in the infrastructure of new development.
- 7 Community design should maximize the use of recycled water for appropriate applications including outdoor irrigation, toilet flushing, and commercial and industrial processes. Purple pipe should be installed in all new construction and remodeled buildings in anticipation of the future availability of recycled water.
- 8 Urban water conservation technologies such as low-flow toilets, efficient clothes washers and more efficient water-using industrial equipment should be incorporated in all new construction and retrofitted in remodeled buildings.
- 9 Groundwater treatment and brackish water desalination should be pursued when necessary to maximize locally available, drought-proof water supplies.

■ Implementation Principles

- 1 Water supply agencies should be consulted early in the land use decision-making process regarding technology, demographics and growth projections.
- 2 City and county officials, the watershed council, LAFCO, special districts and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a watershed level.
- 3 The best, multi-benefit and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.
- 4 From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information. The participatory process should focus on ensuring that all residents have access to clean, reliable and affordable water for drinking and recreation.
- 5 Plans, programs, projects and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices.

Authors: Celeste Cantú, Martha Davis, Jennifer Hosterman, Susan Lien Longville, Jeff Loux, Jake Mackenzie, Jonas Minton, Mary Nichols, Virginia Porter, Al Wanger, Robert Wilkinson and Kevin Wolf. Editor: Judy Corbett.

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Model Water Element for General Plans

In conjunction with the Ahwahnee Water Principles, a Model Water Element has been drafted. A compilation of some of the best general-plan language available, drawn from existing city and county general plans, this model element can be tailored to fit any community plan once the individual characteristics of the watershed have assembled (see Appendix A). This model element can also help cities and counties examine the interconnections within watersheds, in the hope that it will guide the way for new partnerships with other entities for their mutual benefit.



■ The Ahwahnee Water Principles can be grouped into four categories:

I. Growing in a water-wise manner [Principles 1-2]: Forms that new development should, and should not, take to accommodate population growth and accompanying development and transportation needs without destroying watersheds — including the natural infrastructure of wetlands, floodplains, recharge zones, riparian areas, open space and native habitats that supply our water.

II. Water-friendly site design [Principles 3-5]: Neighborhood and site-scale planning and design strategies that can be used to protect water quality, maximize existing supplies, reduce flood risks, and handle runoff more wisely.

III. Stretching our water supplies [Principles 6-9]: To ensure reliable water supplies in the future, communities need to make the most efficient use of existing supplies. This includes graywater for reuse in the home, office or land-

scaping, use of water-efficient technologies and designs, and stretching groundwater supplies through treatment and desalinization.

IV. Implementation principles:

These five precepts can help local governments put the Ahwahnee Water Principles into action through strategies for implementing compact growth patterns, water-friendly site design and water conservation. They provide practical steps to make the physical changes necessary to ensure water sustainability.

As a follow-up to the Ahwahnee Water Principles, the State Water Board is developing a model letter that regional water boards can use in commenting on general plan Environmental Impact Reports. The letter asks cities and counties to fully consider how their general plan updates will affect water quality, encourages planning to avoid adverse effects, and cites the Ahwahnee Water Principles as a source of policy

level principles to address water supply/quality problems stemming from urban development.

The League of California Cities and the California State Association of Counties have adopted resolutions that encourage their members to consider the Ahwahnee Water Principles, and individual jurisdictions have begun to adopt them as local policy.



I. Growing in a Water-Wise Manner

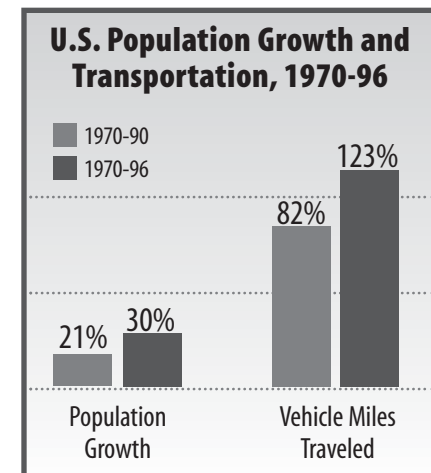
To accommodate growth and maintain strong economic vitality, California communities need to provide adequate housing, opportunities for commerce and good services. But communities also need water, and because land development can degrade water resources, communities must also ensure that they grow in ways that do not jeopardize the very water that will be needed to accommodate growth.

Local government decisions – neighborhood and city-/county-wide planning strategies that specify how and where development occurs – affect future water supplies.

Water for our increasing population

The U.S. population is projected to grow by 18%, or 50 million people, between 2000 and 2020. California will absorb a large portion of that growth – adding some 12 million people by 2030. [3]

Where will this growth be located? Where will water come from for this growth? The answers to these questions are linked because the water we need for future growth depends upon how we develop the land to accommodate it.



...and the rate of car travel has increased even faster than the population growth.



Ninety-one percent of California's original five million acres of wetland have been drained or filled. It is estimated that the state is currently losing 5,000 acres of wetlands per year.



Today's growth patterns

■ How we are growing

Between 1982 and 1997, developed land in the U.S. grew by 34%, far outpacing the 15% population growth that occurred over the same period. [4] This pattern is the result of land use patterns that are spread out, resulting in what many refer to as "sprawl."

The root cause of sprawl is zoning and development that encourage large lots and the separation of land uses. Since the end of World War II, we have been separating housing, work places, retail, government services and even schools. The assumption that everyone wants to live in a large-lot, residential-only subdivision has led to near-complete dependence on the auto as a method of travel.

The result is that urbanizing communities are mostly covered in pavement, which effectively rules out walking and biking as transportation options. Wide roads and acres of parking lots make for unappealing, hot, polluted and unsafe places for pedestrians and bicyclists. Anyone not in a car is viewed as out-of-place. Furthermore, low densities make transit infeasible. It takes a density of at least seven units per acre to make frequent bus service viable and 16 units per acre to accommodate rail. In urban sprawl, densities are generally far below these minimums. [5]

Pollutants from automobiles are deposited on parking lots and roads. Stormwater collects those pollutants and deposits them in our streams, rivers, lakes, beaches and other bodies of water. Urban runoff is a chief cause of nonpoint source pollution that, according to the U.S. EPA, is the most significant threat to water quality.

In its 2000 National Water Quality Inventory, the U.S. EPA reported that the leading sources of impairments across all water body types – including streams and rivers, lakes, ponds and estuaries – are nonpoint sources such as agriculture and land-based activities in urban areas. [6]

■ Where we are growing

A related issue is that most new growth is occurring on undeveloped natural areas called "greenfield" sites. A recent analysis showed that 95% of all building permits in 22 metropolitan areas were for development on previously undisturbed lands. [7] Urban areas are expanding onto forests, wetlands, agriculture and rangeland, floodplains, riparian zones and other natural areas. These development patterns tend to consume valuable farm, range, recreational and forest land that drive important economic sectors.

The water supply impact of growing on greenfields

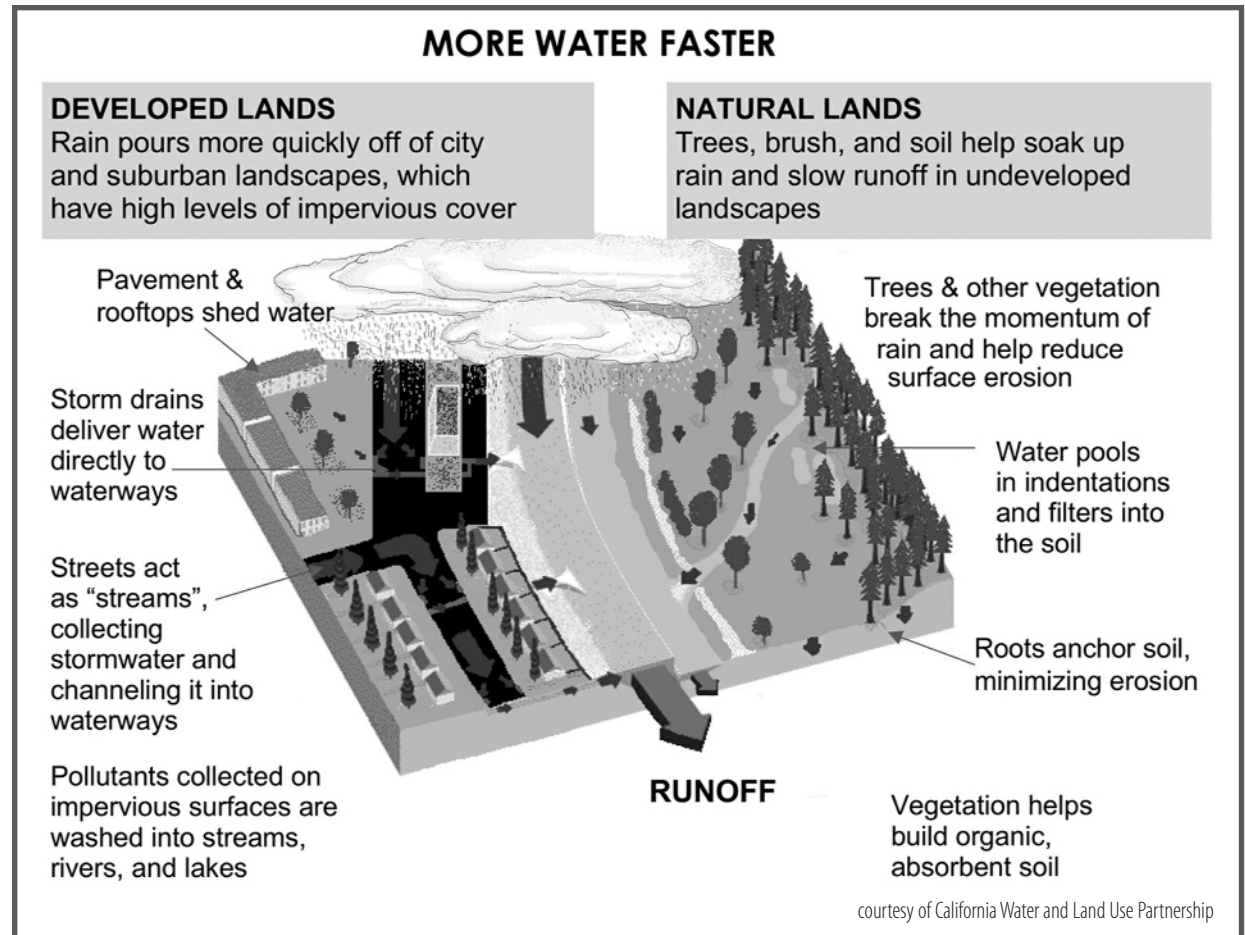
Today's growth patterns are troubling to water management professionals because they are reducing the amount of land that filters, transports and stores our water. Activities associated with increased development on greenfield sites such as construction, increased traffic and the use of chemical treatments in lawns, impair the quality of water resources as well.

As the diagram shows, developing land in undisturbed areas interferes with natural drainage processes and impairs water quality through:

- The loss of undeveloped natural areas that absorb runoff and filter pollutants;
- The expansion of impervious surfaces that prevent natural infiltration of runoff;
- The subsequent alterations to flow regimes that result in the loss of groundwater recharge, and increased localized flooding and nonpoint source pollutant loads carried by urban runoff.

It has long been understood that impervious surfaces affect water quantity by diverting groundwater flow to surface runoff, but the impacts to watersheds and water quality have become clear as well. Numerous studies show that by virtually every measure of ecosystem health, the streams, creeks, marshes and rivers in watersheds where over 10% of the land has been paved over are less diverse, stable and productive than those in natural watersheds. [8]

As the amount of impervious cover increases, the magnitude and velocity of runoff from urban areas increase resulting in



erosion and instability of stream banks, changes to channel structure, loss of natural vegetation and increased sedimentation. These effects damage habitat and property, and often require expensive structural fixes to prevent damage to roads, bridges and property, which cause further degradation and compounded effects down stream.

Recent research indicates that in California, many rivers and streams appear to be even more susceptible to the effects of

impervious cover than experts initially thought. These studies indicate that initial impairment actually occurs at levels as low as 3% to 5% impervious cover. [9]

Water management professionals have responded with stronger regulatory controls intended to reduce the impacts of development on water quality, water supplies and the natural environment.

Understanding water quality regulations in California

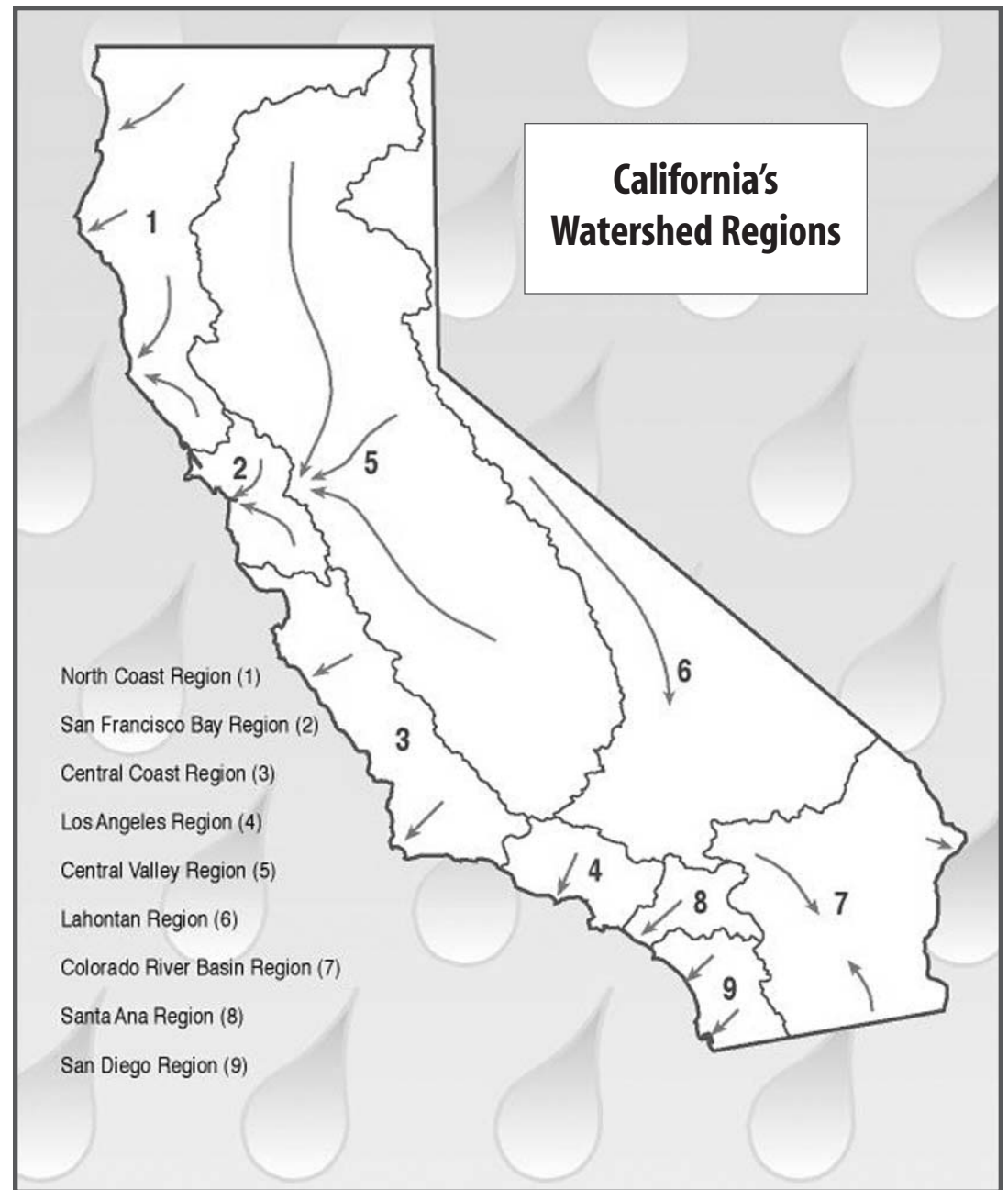
The Clean Water Act gives the U.S. EPA authority to set water quality standards for all contaminants in surface waters. The act makes it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions.

In California, the Porter-Cologne Water Quality Control Act gives the State Water Board ultimate authority over State water rights and water quality policy, and establishes the nine Regional Water Quality Control Boards to oversee water quality on a day-to-day basis at the local/regional level.

In 1972, the federal government established the National Pollutant Discharge Elimination System program (NPDES) to regulate point sources of pollution (attributable to specific outflows) from municipal sanitary sewers and industries. The program was effective but significant water quality problems, stemming from “nonpoint source” pollution, remained. Nonpoint source pollution results when contaminants from many diffuse sources are carried to water bodies.

In 1987, amendments to the Clean Water Act expanded the NPDES program to address nonpoint source pollution in urban runoff by determining that discharges from stormwater systems were point sources of pollution.

This change brought cities and counties, as operators of municipal separate storm sewer systems (MS4s), under the regulatory provisions of the NPDES Municipal Stormwater Program. Compliance with municipal stormwater permits



required by the NPDES can be costly and burdensome to local governments.

The NPDES MS4 permit program was instated in two phases. Phase I regulations were directed at MS4s serving a population of 100,000 or more, including interconnected systems and stormwater discharges associated with industrial operation and construction activities.

Phase II regulations were issued in 1999 to expand permit coverage to MS4 dischargers not covered in Phase I, including small MS4s (those serving a population of less than 100,000). In general, municipalities of over 10,000 residents require a permit, but the regional water boards have ultimate authority to designate who needs a permit. Smaller communities with exorbitant discharges may also be regulated.

NPDES permits are issued every five years to allow for changing conditions, evolving pollution control practices, and modifications to discharge/performance standards and regulations. The water-quality protection strategies in this guidebook apply to both phases.

Regulators want to see that the practices that communities select for their stormwater programs will lead to measurable water quality improvements, but they do not yet set specific numeric standards. Instead, they use performance standards that establish minimum levels of execution in each of six required program areas of the permit.

The standards are evolving, however, and becoming more stringent and explicit. Specific water quality requirements are not used yet, but water quality benchmarks are expected in upcoming permits, which suggests the shift toward numeric standards will continue.



NPDES permits require regulated MS4 operators to develop a Storm Water Management Program that implements appropriate best management practices to reduce the discharge of pollutants to the maximum extent practicable. Small MS4s permits prescribe a set of six minimum control measures that must be implemented along with evaluation and assessment efforts:

- 1 Public education and outreach
- 2 Public participation
- 3 Illicit discharge detection and elimination
- 4 Construction site runoff
- 5 Post-construction runoff control
- 6 Pollution prevention and good housekeeping

For more details on the NPDES program, please visit www.waterboards.ca.gov for links to more information and your regional water board's web site.

Water supply legislation

Legislation requiring adequate water supplies prior to development approval was passed in 2001. The so-called “show me the water laws” are Senate Bills 221 and 610. SB 221 requires a city or county to provide written verification of sufficient water supplies by the water agency for proposed development projects of 500 units or more.

A sufficient supply is defined as enough to meet the needs of the proposed development project in normal years as well as during a drought. Approval of the subdivision map or parcel map is prohibited unless and until such supplies are documented. Meeting the terms of this legislation is solely the responsibility of the city or county, even though it is the water agency that documents the availability of water for the new project.



Old stormwater solutions like these did not address water quality, but now they must.



SB 610 provides the process for implementing SB 221. This measure requires that a water supply assessment be included in the Environmental Impact Report of any large development project that exceeds certain specified thresholds.

Both the NPDES program and new water supply laws are pushing local governments to coordinate their planning and development processes with water management efforts.

Economic implications

The costs related to water issues, from managing stormwater to securing supplies, is great. To reduce serious impacts to their budgets, communities should address the basic land use practices that create those costs.

A study of 27 diverse watershed types revealed that in areas where less than 40% of the land in a watershed was devel-

oped, the treatment cost of water was about \$30 per million gallons. Where the land was completely paved over or dedicated to intensive agriculture, the cost to supply drinking water to the community was \$140 per million gallons. [10]

California's economy also depends on clean water and beaches – coastal employment represents more than 80% of employment in California, and 58% of the state's ocean economy is from tourism and recreation – watershed protection is not only a water quality issue, it is an economic imperative.

The solution is to grow in the form of compact, walkable communities that concentrate growth and preserve watersheds. Doing so may also increase property tax revenues. Investors expect that real estate values over the next 25 years will rise fastest in communities that have a "pedestrian-friendly configuration." [11]

“Local land use decisions have a significant impact on our water resources. We must work to develop our communities in ways that protect and enhance, rather than degrade, those natural and precious resources.”

– Kathy Long, Ventura County Board of Supervisors

Ahwahnee

Water Principle 1 –

How we grow

Community design should be compact, mixed use, walkable and transit-oriented so that automobile-generated urban runoff pollutants are minimized and the open lands that absorb water are preserved to the maximum extent possible.

(see the Ahwahnee Principles for Resource-Efficient Communities)

“The biggest influence on future water supplies and water quality in California is local land use planning.”

– Celeste Cantú, Executive Director, California State Water Resources Control Board




Planning that assures compact, walkable and transit-oriented communities while preserving important open lands is touted by both the U.S. EPA and the state as one of the most effective steps that can be taken to minimize the water pollution created by urban runoff and assure future water supplies.

In 2002, the U.S. EPA modeled the impacts of stormwater from new development at densities of one, four and eight residential units per acre. The results revealed that, assuming

that our communities will continue to grow, it is better to concentrate the development in a smaller land area using higher densities.

“Lower-density development always requires more land than higher densities to accommodate the same amount of growth.” When more land is disturbed, more of the watershed is damaged, according to the U.S. EPA’s “Protecting Water Resources with Higher Density Development.”

■ **Figure 1 – One-acre scenarios**

Scenario A 1 house per acre	Scenario B 4 houses per acre	Scenario C 8 houses per acre
		
Impervious cover = 20% Runoff/acre = 18,700 ft ³ /yr Runoff/unit = 18,700 ft ³ /yr	Impervious cover = 38% Runoff/acre = 24,800 ft ³ /yr Runoff/unit = 6,200 ft ³ /yr	Impervious cover = 65% Runoff/acre = 39,600 ft ³ /yr Runoff/unit = 4,950 ft ³ /yr

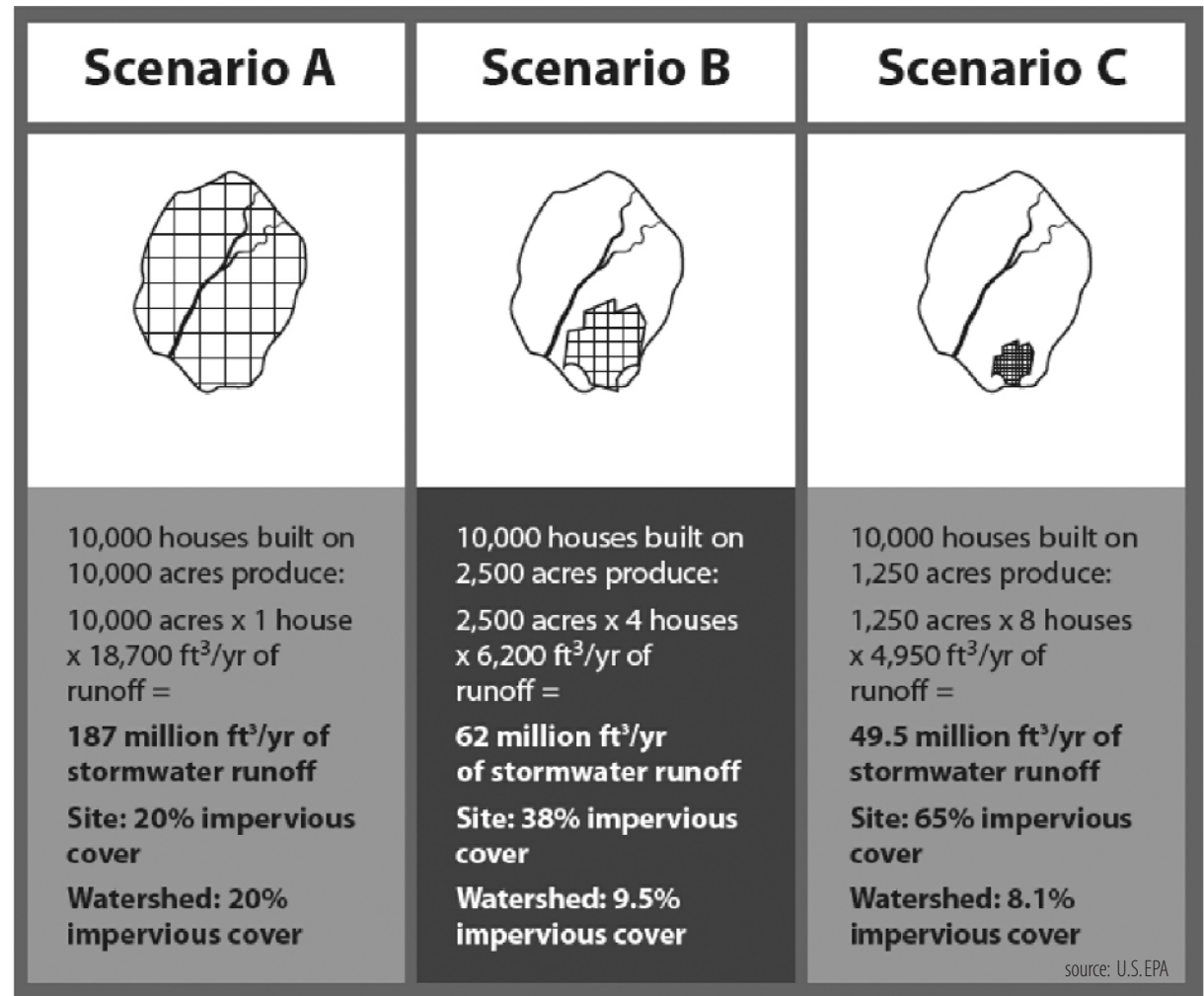
source: U.S. EPA

Figure 1 demonstrates that the amount of runoff – per housing unit – is higher at lower densities, and lessens as more units are accommodated per acre.

In Figure 2, overall impervious cover for the watershed decreases as site density increases. The lowest-density scenario (Scenario A) covers the entire watershed and generates 187 million cubic feet per year of stormwater runoff. At four houses per acre, Scenario B consumes less land and generates less than half as much stormwater runoff as Scenario A. At the highest density, Scenario C consumes the least land and produces just 49.5 million cubic feet per year of stormwater runoff. Scenario A generates approximately three times the runoff of Scenario B and four times as much as in Scenario C.

Purdue University researchers came to the same conclusion when they examined two potential project sites in the Chicago area – one in the city, the other on the urban fringe. Their study revealed that placing low-density development on the urban fringe would produce 10 times more runoff than a higher-density development in the urban core. These results are consistent with other studies completed in the past decade. [12]

Today, a significant number of developers are interested in developing and redeveloping vibrant downtowns that include townhouses, lofts and apartments in addition to retail, entertainment and government services. Others are attempting to develop New Urbanist, sustainable or smart-growth compact, mixed-use and mixed-income neighborhoods. The market is responding very positively to these walkable, bikeable and transit-friendly developments.



source: U.S. EPA

■ **Figure 2 – A 10,000-acre watershed accommodating 10,000 houses**

Redevelopment and infill development

Infill can reduce the impact of development on water resources by focusing growth into already developed areas instead of on more sensitive lands at the urban fringe. Infill also takes advantage of existing infrastructure and transportation options.

One of the best ways to protect natural areas and prevent the spread of impervious cover is to maximize the use of land that is already paved. Using land that is already developed conserves greenfields by absorbing growth that would otherwise be sited in undeveloped areas. This means growth is accommodated without increasing impervious cover and urban runoff.

These strategies can also lead to a greater mix of uses and higher densities, which create other benefits including increased transportation options and vibrant neighborhoods.

For example, if an old shopping center is replaced by mixed-use development, growth is accommodated with no net increase in impervious surface cover.

Many stormwater management strategies focus on new development. Redevelopment projects also provide opportunities to incorporate on-site stormwater strategies, such as swales, green roofs and permeable hardscapes that can readily be retrofitted into urban areas (see Section II). Cities can partner with the private sector to encourage redevelopment and identify ways to retrofit stormwater management practices into projects.

Strip mall transformed into pedestrian-oriented community

The Crossings is a transit-oriented redevelopment project in Mountain View that transformed a 1960s auto-oriented strip mall into a mixed-use and pedestrian-oriented community. Located adjacent to a new CalTrain commuter station, The Crossings provides a range of housing and retail opportunities (359 housing units at about 21 units per acre) located within a short walk of shopping and transit. An interconnected network of tree-lined streets and paths encourages pedestrian mobility and provides easy access to an existing grocery store.



The project's multi-story design reduces its footprint and provides sufficient density to support transit. The project also incorporates on-site stormwater management with permeable "turf-blocks" used for fire lanes and roof spouts that drain into landscaped areas to infiltrate rooftop runoff. Community parks and open spaces are distributed throughout the 18-acre site to provide an amenity as well as areas that can absorb stormwater.

For more information: Eric Anderson, City of Mountain View, (650) 903-6225 or eric.anderson@ci.mountainview.ca.us

To make use of infill and redevelopment as water protection strategies, communities may need to revise local zoning ordinances to allow for greater density and mixed uses. Both infill and redevelopment tend to be more complex and pose more barriers to developers than greenfield development. Communities should consider incentives that facilitate redevelopment and infill projects.

Density bonuses provide incentives for developers who agree to incorporate certain desired features into their projects. For

example, a developer could be allowed to develop at higher densities if they integrate on-site stormwater practices. The City of Portland provides density bonuses for the use of green roofs.

The EPA's model Phase II stormwater permit provides language on the use of infill, redevelopment, and other specific smart growth strategies as stormwater best management practices (www.epa.gov/npdes/pubs/modpermit.pdf).

Walkable, well-connected streets and paths

Land use patterns that create a network of well-connected streets and paths that support walking, biking and transit have many water resource benefits. Reducing auto use minimizes auto-related pollutants in urban runoff.

Narrower streets translate into water resource benefits as well because they reduce the amount of pavement covering a community. The fifth Ahwahnee Water Principle offers more information on the benefits of narrow street designs.

Need for improved zoning

Sadly, the vast array of codes and ordinances that we have produced over the past 50 years are holding up the progress of better land use patterns. Existing zoning codes and ordinances, focused on density and use, often make more water-friendly developments difficult or impossible to do.

Fortunately, tools and strategies are available to local governments to level the playing field or even provide advantages to those developers attempting to build less auto-oriented places to live, work and play.

Form-based codes

Form-based codes are increasingly being used by cities and counties across the country to achieve the walkable, aesthetically pleasing neighborhoods that residents and policy-makers have envisioned for their general plans. Rather than zoning by use and density, the form-based code allows the community to specify exactly what they want new development and redevelopment to look like — including public spaces and streetscapes. There is less emphasis on use and more on form — thus the name, “form-based” code.

This zoning tool involves community residents in design charrettes very early in the process. It provides accurate graphics so that residents can see exactly what they are going to get. It also lets developers know exactly what the community wants. It speeds up the development approval process, gives certainty to developers, and saves them money.

A form-based code can be incorporated into a specific plan, a Planned Unit Development or other planning document. The Local Government Commission’s web site (www.lgc.org) has more information on this tool and the communities that have implemented it.

Green stormwater design improves redevelopment

The City of Emeryville is combining extensive redevelopment and on-site stormwater best management practices for an integrated water protection strategy. Long a pioneer in reclaiming and redeveloping industrial areas, Emeryville is now incorporating stormwater management strategies to comply with NPDES permit requirements.

Strategies range from shared structured parking to green roofs and landscaped areas designed to capture stormwater. The City’s “Guidelines for Green, Dense Redevelopment” provides developers and designers with a vision for integrating green stormwater treatment into site planning and building design.

The guidelines show how such techniques can be designed to match Emeryville’s unique, densely urbanized development context. Using “green dense redevelopment,” Emeryville’s urban infill projects maximize existing impervious surfaces and direct growth away from the undeveloped portions of the watershed.

For more information: Peter Schultze-Allen, Emeryville Public Works Department, (510) 596-3728



“Resource-efficient land use means approving the kind of new commercial, industrial and housing developments that works with natural processes – not against them. Water resource-efficient land use means we understand how the watershed works and we work with it.”

– Susan Lien Longville, Director, Water Resources Institute, CSU-San Bernardino

Transit-oriented developments add water management

■ City of Villages demonstrated in San Diego

The City of San Diego is encouraging smart growth development through its City of Villages pilot demonstration project, a strategy encourages development that mixes housing, retail, jobs, schools and civic uses within walkable communities that have easy access to transit.

The San Diego City Council approved five innovative projects to become pilot villages by a unanimous vote in February 2004. The projects are meant to inspire developers and communities to create similar neighborhood centers throughout the city.

Notably, the City of Villages plan coordinates infill and redevelopment with stormwater management; and the stormwater plan identifies the City of Villages infill plan as a water protection strategy.

For more information: San Diego Planning Department, (619) 235-5200 or planning@saniego.gov



■ Rooftop runoff in San Jose

The Ryland Mews transit-oriented development in San Jose provides high-density housing on an existing light rail line within walking distance of downtown. Its multi-story buildings reduce the footprint of the development, while its setting facilitates pedestrian mobility to reduce transportation-related pollution and hardscape. The project also directs rooftop runoff to landscaping, allowing infiltration to control stormwater on-site.

For more information: Jenny Nusbaum, City of San Jose, (408) 277-4576 or jenny.nusbaum@sanjoseca.gov



Ahwahnee Water Principle 2 — Where we grow

Natural resources such as wetlands, floodplains, recharge zones, riparian areas, open space and native habitats should be identified, preserved and restored as valued assets for flood protection, water quality improvement, groundwater recharge, habitat and overall long-term water resource sustainability.



“The water in a watershed is essential for supporting all life.”

— Mary Nichols, Director, UCLA Institute of the Environment

Natural resources, such as our drinking water supplies, riparian habitat and aquatic ecosystems, are linked together and function as an integrated whole in a watershed. The water within watersheds — above and below ground — is connected. This means the quality of both surface and groundwater supplies is dependent upon the land cover within a watershed.

Watersheds act as the plumbing system that ultimately delivers rainwater from the place it lands in the watershed to our kitchen sinks. “Undisturbed” areas are important to this natural plumbing system because they filter, transport and store our water; provide natural flood control; and maintain fisheries, timber, agriculture and other natural resources.

Preserving the watershed

The U.S. EPA has been advocating the use of watershed protection approaches since 1991. Watershed protection, which emphasizes preservation of valuable natural areas to protect water resources, is an approach that is recognized for providing long-term benefits to water quality and supplies.

Local government can align development with long-term water resource goals by making wise land use decisions that protect watershed functions rather than degrade them. The second Ahwahnee Water Principle is designed to:

- Protect and restore large, continuous natural areas as open space;
- Preserve important and sensitive ecological areas such as wetlands, floodplains and riparian corridors;
- Preserve and enhance the value of these natural areas as community assets.

Preserving open space and farm land in the watershed

■ Livermore Specific Plan curbs sprawl

The City of Livermore's South Livermore Valley Specific Plan received the 2006 Outstanding Planning Award for Implementation from the American Planning Association. For each acre of land developed in the plan area, one acre of agricultural land is placed into a conservation easement. This helps curb sprawl while preventing the loss of prime agricultural land. For more information: Livermore Community Development Office, (925) 960-4400

■ Conservation easements create balance

In Placer County, one of California's fastest-growing areas, the Placer Land Trust is using collaboration and conservation easements to balance rapid growth and land conservation.

The trust crafted the West Placer Habitat Protection Program with developers, conservation groups, and local, state and federal agencies, to protect 3,500 acres of critical habitat in western Placer County over 25 years. Real-estate transaction fees in the West Roseville Specific Plan area fund the program. To date, 2,000 acres of valuable land have been protected. For more information: (530) 887-9222 or info@placerlandtrust.org



Efforts to preserve valuable natural areas work best when coordinated with the strategies outlined in the first Ahwahnee Water Principle that create compact forms of development, encourage a mix of uses and maximize the utility of existing infrastructure. The combination of compact community forms and preservation of critical environmental areas is a powerful tool that communities can leverage to protect the water resources needed to sustain future growth.

Identify and prioritize

Many tools are available to local officials ready to initiate, or improve upon, efforts to protect and restore natural areas. Not all land is of equal value for water resources and watershed protection. Taking inventory of areas that remain undeveloped and assessing their value allows communities to prioritize and protect those areas that are the most valuable and vulnerable.



To get started, communities must:

- Identify – Determine areas that are still undeveloped.
- Prioritize – Rank areas according to their natural resource value.
- Protect – Use local and regional planning, incentive and acquisition programs, and land use regulations to protect valuable areas and direct future growth.

Geographic Information Systems (GIS) mapping can help communities with these steps. Mapping existing land uses, open space areas and key natural resources can help communities know what they have to work with, and how these areas relate to each other spatially. Mapping can also help communities rank sites in terms of their conservation priority, and target areas most suitable for growth. Communities can use this information to create and compare different development scenarios as well. These methods can combine good data and expert analysis with public participation.



Once identified, the community(s) involved must determine ways to protect and restore those areas that are the most important, and then implement them through local and regional planning policies and plans. Ways to do this include conservation easements, transfers of development rights, buffer zones and greenbelts, urban growth boundaries, open space districts and habitat conservation districts.

Conservation easements

A conservation easement is a legal agreement that permanently limits uses of a piece of land to protect its conservation value. Local land trusts work with landowners to create conservation easements as an alternative to subdividing or selling the land for development. The easement spells out the rights retained by the landowner and the restrictions on use of the property.

In return for putting their land under easement, landowners typically receive monetary compensation, can stay on their land, and can receive significant tax benefits. To be eligible for federal tax deductions, conservation easements must be dedicated in perpetuity so that the easement remains in force forever and “runs with the land,” meaning that all subsequent landowners are also bound by the easement.

Easements on private lands have become an effective means of protecting large expanses of natural and working landscape without having to purchase the land outright or needing to manage it over the long term. Cities and counties can partner with local land trusts as funding partners and integrate easements into local planning efforts.

Transfer of development rights

In a Transfer of Development Rights program, landowners living on valuable land worthy of protection are able to trade their rights to develop that land for the right to develop in designated growth areas.

This allows a community to shift development away from land it wants to protect but cannot afford to purchase. At the same time, development is focused in designated growth areas. The result benefits both the landowner, who receives just compensation, and the community, which can protect important natural areas, agricultural lands or open space.

Development rights credits help to direct good growth

The County of San Luis Obispo passed an ordinance to allow the Land Conservancy of San Luis Obispo County to sell development credits in areas that the County has designated for growth.

A \$200,000 State Coastal Conservancy grant was used to establish a revolving fund for purchasing environmentally sensitive properties, record deed restrictions on those properties, and sell the resulting Transfer of Development Rights credits to people wishing to develop at higher densities or add square footage above allowed levels within designated “receiving” areas.

The proceeds from these sales provide capital for the acquisition of additional property from willing sellers to be preserved as open space. The program costs the county nothing since the sale of credits is administered by the State Coastal Conservancy. The Land Conservancy of San Luis Obispo County has preserved more than 230 properties to date and doubled the amount of money in the revolving fund.

For more information: Land Conservancy of San Luis Obispo County, (805) 544-9096 or lc@special-places.org



Buffer zones and greenbelts

Buffer zones create a transition or barrier of open space between potentially conflicting land uses. Placing buffers between development and sensitive natural resource areas is a key water-protection strategy. These water-specific buffers are commonly used along rivers and streams, around wetlands or lakes, or to protect known groundwater recharge zones. They provide flood protection, reduce erosion, protect water quality, and create/protect habitat. Studies have shown that forested buffers are highly effective in removing particulate pollutants from runoff. [13]

Communities can establish setback requirements that create buffers by specifying how far a development must be built from a stream, wetland or other water body. The U.S. EPA recommends a minimum of 100 feet to protect water quality and at least 300 feet if a habitat corridor is also needed.

Regional greenbelts protect some of world's best farmland

The cities of Yolo and Solano Counties are working together to protect some of the world's most productive farmland by creating a regional greenbelt to distinguish each city, focus development into built areas, and preserve natural and working lands.

For example, the City of Davis' Farmland Preservation Ordinance is helping to create a greenbelt around the city. It requires mitigation for development that alters zoning from agricultural to any other use. The mitigation can come in the form of conservation easements or other land-protection practices, or developers can pay into a farmland preservation fund established by the City.

The City of Davis' Right to Farm Ordinance is another tool for developing greenbelts. It requires that developers create a buffer of at least 150 feet between existing agricultural land and new development. A portion of the buffer can be used for native landscaping, trails, stormwater drainage swales or retention basins, and other natural or recreational amenities. For more information: (530) 757-5610 or pbweb@ci.davis.ca.us

In Solano County, the Cities of Dixon and Vacaville are working hand-in-hand to create an agricultural greenbelt to separate the two cities and protect the cultural, natural and economic values of the land between them. They jointly purchased the land that now creates a greenbelt between the two cities. It is leased to local farmers and is under an easement that ensures the land will never be developed. (www.ci.dixon.ca.us)

And in 2002, the Cities of Davis and Woodland, in conjunction with Yolo County, signed a memorandum of understanding establishing a greenbelt between the cities. The MOU makes official the intent of all three jurisdictions to provide a permanent area of open space and agriculture between Davis and Woodland. (pbweb@ci.davis.ca.us)



Urban growth boundaries

Urban growth boundaries confine growth to a designated zone by creating a boundary around a municipality or developed area outside of which urban development is prohibited. These boundaries are not meant to stop or restrict the amount of growth, but to contain outward urban expansion.

Typically, the area inside the boundary – the growth zone – provides enough land and infill/redevelopment potential to accommodate projected growth over a 20-year period. Zoning ordinances usually need to be changed to allow and encourage higher densities inside the boundary.

A similar approach is to limit the extension of infrastructure, thereby forcing development to occur in areas that are already served by existing public services and facilities. These controls are meant to limit “leapfrog” development patterns.

More and more localities are employing urban growth boundaries to protect open space and encourage development in already developed areas. These programs can be highly effective in ensuring that growth does not occur in natural areas, but they must be coordinated with regional efforts to ensure that growth is accommodated in a fair manner, and that uncontrolled forms of development do not simply end up in nearby communities.



Urban boundaries “curb” growth so open space can “soar”

Ventura County and eight of the county’s municipal jurisdictions have passed Save Open-Space and Agricultural Resources (SOAR) ordinances that share the goal of preventing development outside of designated areas. For the cities, the ordinances establish a boundary called a “City Urban Restriction Boundary” (CURB). Development outside a city’s CURB lines requires city voter approval. At the county level, a countywide vote is required to approve any change to existing open space, agricultural or rural designations or to change any element of the general plan related to those designations. Most of the SOAR ordinances were passed by initiative. For a copy of Ventura County’s ordinance: www.ventura.org/planning/ordinances_regs/ords_regs.htm



Open space districts

Open space districts are independent special districts within local governments with the role of protecting and acquiring open space in and around the community. They are often established by local ballot measures through which local voters decide to tax themselves for the purpose of protecting open space.

Since 1994, voters around the nation have approved more than 1,200 local conservation measures generating more than \$30 billion in new public funds for land conservation. In 2005, 80% of such measures passed, as voters approved another \$1.7 billion for open space protection. Cities and counties can take the lead in establishing or increasing funds for local open space districts.

Voters support preservation measures, fund land acquisition

■ Marin County creates open space district to protect wetlands and natural habitats

In 1972, Marin County voters approved the creation of the Marin County Open Space District. Since then, the district has worked to protect more than 14,000 acres in 33 preserves, including native habitats, important natural resource areas and sensitive wetlands.

The district has worked with local partners to purchase land, obtain conservation easements, and establish transfer of development rights programs. The protected acreage – ranging from wetlands to oak woodlands and redwood groves – provides a host of public benefits including recreation, water resource protection and habitat protection.

For more information: parksandopenspace@co.marin.ca.us



■ Sonoma County voters approve sales tax to fund conservation efforts

Sonoma County voters created the Sonoma County Agricultural Preservation and Open Space District in November 1990 and funded it with a quarter-cent sales tax. The tax currently generates more than \$17 million annually.

The district works with local government, landowners and public agencies to acquire land for each of four program areas: agriculture, greenbelts, natural resources and recreation. Employing several methods of land acquisition, this program is using public-private partnerships to protect valuable natural resources, working lands and community amenities.

The program has protected nearly 70,000 acres of land by conservation easement or fee title purchase, at a cost of \$168.7 million for land worth \$221.6 million – a net savings to the district of nearly \$53 million.

For more information: Sonoma County Open Space District, (707) 565-7360 or openspace@sonoma-county.org

Conservation plans – local opportunities for regional planning

Habitat Conservation Plans (HCP) and Natural Community Conservation Plans (NCCP) are locally developed plans that are completed to satisfy federal and state species protection laws. The plans are developed under California's Natural Community Conservation Planning Program Act and the federal Endangered Species Act for the protection of species and habitat. The California Department of Fish and Game administers the NCCP program.

The program is not focused on single species, instead the goal is to conserve natural communities at the ecosystem scale while accommodating compatible land uses. This helps reduce conflict between conservation efforts and reasonable uses of natural resources. The U.S. Fish and Wildlife Service administers the HCP program that works hand-in-hand with the state program resulting in joint NCCP/HCPs.

The state program is generally more expansive than the federal equivalent because it focuses on protecting whole ecosystems rather than single species. All NCCPs are completed in concert with HCPs, which are funded under the Endangered Species Act. An adequate NCCP/HCP will likely receive implementation funding from state and federal sources.

NCCP/HCP plans allow local governments to coordinate their natural resource planning at a regional level and to determine how and where growth should occur over a longer timeframe. Developers benefit through streamlined permitting processes that clarify allowable types and locations of development in the plan area.

Regional planning balances growth and habitat conservation

■ Yolo County's regional agency secures largest HCP planning grant in California

In 2004, Yolo County and the Cities of Davis, Winters, Woodland and West Sacramento entered into a collaborative planning agreement with the California Department of Fish and Game to develop a countywide NCCP/HCP. A joint powers agency was established to act as the lead agency on the project.

The conservation planning process coincides perfectly with other local/regional planning efforts including Yolo County's General Plan update and Integrated Regional Water Management Plan, according to Maria Wong, the agency's executive director. She believes that this provides an opportunity to develop plans with mutually supportive goals and solutions that can help Yolo County communities to balance conservation with working landscapes and regional growth before remaining habitat is lost or degraded.

The project is supported by grant funding from state and federal sources. Last year, it received the largest HCP planning grant awarded in California. For more information: Maria Wong, (530) 666-8834.

■ San Diego County's regional plan provides large-scale ecosystem and habitat protection

In 1997, San Diego County adopted a Multiple Species Conservation Program to provide large-scale ecosystem and habitat protection, as opposed to individual species preservation. The regional plan covers 900 square miles that designates areas suitable for development and those that must be preserved. Large areas of continuous habitat and natural lands are protected under the plan, which has assisted landowners and developers with a simpler, more streamlined development process. Under the program, developers and local agencies benefit from the localized permit process, pre-established mitigation requirements based on development area, and cost sharing with state and federal agencies.

The program is a 50-year plan that was developed by species advocates, developers and local/state agencies. Though the plan does not place a moratorium on development, it requires County review of all projects within the plan area to determine compliance with mitigation and regulations of the program. The County also negotiates with property owners in the plan area to acquire more land for preservation.

Since its inception, thousands of acres have been acquired for protection. The program's goal is to acquire or permanently protect a total of 172,000 acres, 98,379 of which are in unincorporated areas. For more information: www.sandiego.gov/planning/mscp or Betsy Miller, City of San Diego Planning Department's MSCP Section, (619) 533-4543 or bmiller@sandiego.gov.



West's largest restoration

The Vic Fazio Wildlife Area, dedicated in 1997, created a wetland preserve of more than 16,000 acres – the largest public/private restoration project west of the Florida Everglades. The area provides protection from seasonal floods, the most significant natural hazard in Yolo County. The wetlands also provide natural habitat and agricultural use during the summer and fall.

The Vic Fazio Wildlife Area is considered a model of public-private partnership that illustrates the potential for communities to meet shared goals through regional collaboration. The project's stakeholders included landowners, conservation organizations, recreation groups, farmers and representatives of local, state and federal resource and planning agencies.

The plans reduce risk and conflict because all parties know what to expect and what is required. The plans must specify a strategy for achieving the required objectives of natural community conservation and compatible land use and economic activity. The strategy might include such techniques as land acquisition, developing wildlife reserves or watershed management.

For more information: California Department of Fish and Game, www.dfg.ca.gov/nccp; and "A Local Official's Guide to Habitat Conservation Laws," www.ilsf.org/habitat

Restoration strategies

Restoration is to natural resource management what re-development is to community planning; it takes damaged "natural" infrastructure and turns it into a community asset.

Restoration practices re-establish the "working parts" of a site's ecology, so it can function properly again. Restored

areas such as wetlands, floodplains and riparian areas can provide water storage, purification and infiltration to reduce flood risks, improve water quality and enhance supplies.

Local watershed councils and resource conservation districts are often engaged in restoration work and can be valuable partners for local government. Resource conservation districts also provide important links to local landowners, which is especially valuable since agricultural and pasture lands often contain sites that can be restored and maintained to serve double-duty as working lands and water protection areas. (Section IV provides more information on entities with whom local government can partner.)

Wetland restoration is especially important. Wetlands are the workhorses of our watersheds. They filter water, detain flood flows, recharge aquifers, feed surface waters, provide prime habitat and aesthetic and recreational value for people.



The Arcata Marsh and Wildlife Refuge (above) takes partially treated wastewater and finishes the process.

In recent decades, urbanization and development of roadways have caused the loss of significant amounts of wetland areas. Ninety-one percent of the five million acres that once made up California's wetlands have been drained or filled. It is estimated that California is currently losing 5,000 acres of wetlands per year. [14]

This creates a serious shortage of land areas that can recharge groundwater, absorb excess flood flows, filter pollutants and deliver the array of ecosystem services — including purifying water supplies — that wetlands provide.

One way to recoup the essential work that wetlands perform is to restore or create wetland areas in and around a community. This practice has been used successfully for flood protection, stormwater control, wastewater treatment and habitat creation.

Man-made wetlands remove pollutants from urban runoff

The San Diego Creek Watershed Natural Treatment System (NTS), developed by the Irvine Ranch Water District, is a watershed-based approach to solving regional water quality problems. It strategically places man-made wetlands throughout the watershed to remove pollutants from urban runoff — particularly from chemical lawn treatments that wash off people's yards.

The project is expected to remove 126,000 pounds of nitrogen and 21,000 pounds of phosphorus annually, and reduce fecal coliform levels by 26%. It also provides wildlife habitat and open space, and is expected to cost significantly less than new or existing wastewater and stormwater infrastructure systems.

Project Manager Norris Brandt says the project is cost-effective, and notes that it has been well received because "it uses existing public lands and natural processes to clean the creek water instead of expensive man-made structures like treatment plants."

The natural treatment system will use plants and soils including bulrush, cattails and peat to eliminate pollutants in urban runoff. Sediments, nutrients and pathogens



that would otherwise enter Upper Newport Bay — and eventually flow into the ocean — are instead settled out and assimilated through natural processes.

While its primary goal is to improve water quality, other benefits include creating habitat and providing an aesthetic and educational amenity. The natural treatment system is a model for the way wetland restoration can solve multiple problems, create community assets, and cut costs.

For more information on this and other Irvine Ranch Water District Urban Runoff projects: www.irwd.com

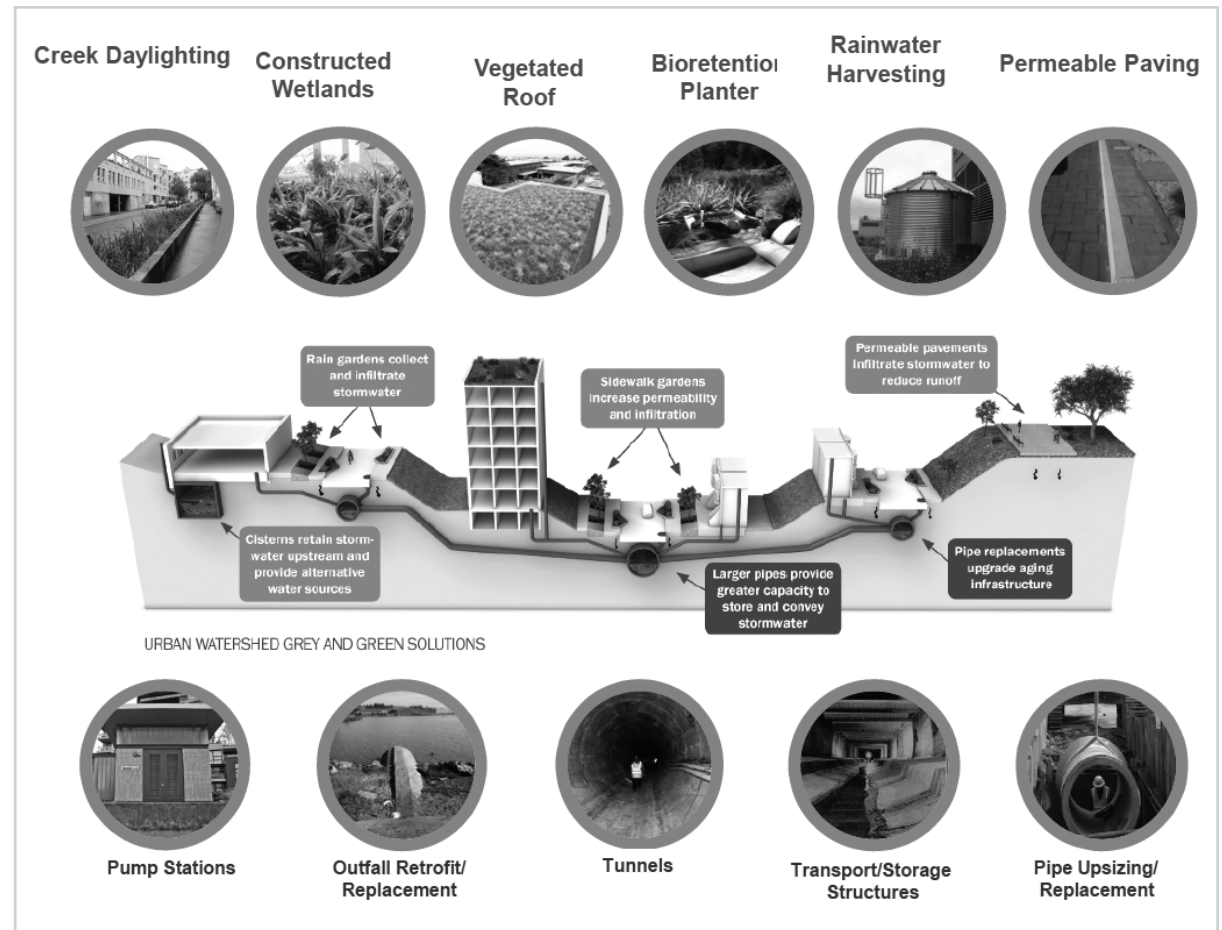
II. Water-Friendly Site Design

“In the past, Low Impact Development was only encouraged; now it’s a requirement.”

— Fernando Duenas, Sacramento County Stormwater Quality Partnership

Natural systems filter and cleanse water, then collect it in lakes, rivers and underground aquifers. Leaving much of our watershed undeveloped is best for our water supplies, but many of our lands are already developed for living, farming, working and playing. We must accommodate our growing population, which will inevitably result in continued development of our watershed lands.

A community’s water resources are only as healthy as the areas the water flows through. Preserving or restoring natural drainage and landscape systems within development creates “green” infrastructure that filters, stores and distributes water resources. We can also create systems to naturally manage stormwater generated by development. This approach, called “low impact development” (LID) is good for water quality and water supply.



3 Principles of LID Stormwater Management

Low impact development promotes the integration of stormwater best management practices that mimic natural hydrology into all aspects of development and community design, including streets and parking, homes and buildings, and parks, public spaces and landscaped areas.

The three key principles of LID are “slow it, spread it, sink it.”

- Slow stormwater flows down, to allow pollutants to settle out of the water.
- Spread stormwater out over a larger area, so plants and soil can filter out pollutants.
- Sink stormwater into the soil, to provide water for plants or to infiltrate into the groundwater system.

LID technologies

A wide range of LID implementation strategies or “green technologies” are now available. The most common, and often most preferred by developers, are vegetated swales and flow-through planters. The diagram below outlines other popular LID treatments.

“Climate change adds new vulnerabilities and exacerbates historical challenges to California water management. Adapting California’s water sector to the impacts of climate change will require a coordinated effort between federal, state, and local governments, businesses, and California’s residents.”

– Safeguarding California 2014

Ahwahnee Water Principles 3, 4 and 5 are design strategies that reduce impacts by minimizing impervious surface cover and integrating natural runoff controls into new and existing development. The strategies aim to emulate predevelopment conditions in the built environment. These three principles call for incorporating green infrastructure into the urban environment in order to: (a) temporarily hold water during periods of heavy rain, (b) reduce water demand from landscapes, and (c) allow water to penetrate the soil and flow to groundwater systems. Implementing these design strategies into new development and redevelopment projects will help communities adapt to a changing climate and ensure greater resilience in local water systems.



recharge and enhancing local water supplies are all important climate resilience strategies supported by watershed-friendly site design.

A significant amount of energy is used for water extraction, treatment, conveyance, heating & cooling, and treatment & disposal of wastewater & stormwater. We can cut back on our greenhouse gas emissions (GHGs) by reducing this “imbedded energy” through water use efficiency. LID reduces the amount of energy needed to treat stormwater, and thus has significant GHGs savings compared with conventional treatment methods. This also lowers the cost of meeting water quality requirements – both for environmental discharge and recycling for municipal purposes.

Climate Change Resilience

Water friendly site design facilitates climate change resilience by protecting water resources and using available water supplies more efficiently. Climate change will have a significant impact on California’s water system. Higher temperatures result in loss of snow pack storage, changes in runoff timing and increased water demand. We also expect more frequent and intense extreme weather events, like floods and droughts, too. These changes have consequences for our water infrastructure, water supply, and water quality. [15] Water use efficiency, water reuse, groundwater

“Water Quality, Supply and Infrastructure Improvement Act of 2014”

In 2014, California voters passed Proposition 1—a \$7.5 billion general obligation bond measure—to fund water projects and programs in support of the Governor’s Water Action Plan. The measure included funding for groundwater management planning and cleanup, storage projects, stormwater, habitat restoration, and other water management objectives. While only a small percentage of funding needs, the bond will jumpstart local projects and bring us closer to integrated, sustainable water management. For more information: <http://awpw.assembly.ca.gov/water-bond>





Economic implications

LID is economical; it often costs less than conventional systems to install and maintain because of fewer pipes and belowground infrastructure. Landscaped areas create “quality of life” benefits that contribute to livability, property values, community vitality and aesthetics.

The City of Los Angeles passed a comprehensive LID ordinance in 2011, requiring on-site capture of 100% of all stormwater runoff from a 3/4 inch storm. The City estimates that recharging this stormwater into the aquifer will offset imported water needs, with an imbedded energy cost savings of over \$23 million a year. [16]

In 2013, the City of Modesto installed a new 164-space parking lot for Woodward Community Park, using all LID design features. Their team gained a 20% savings on installation costs, as well as a long-term operations cost savings because there are no storm filters to maintain.

Many municipalities are now requiring developers to use these solutions in order to meet state permitting requirements. As long as the rules are clear and projects can be completed without excessive delay, developers are finding cost savings and environmental-permitting benefits from LID practices. Coordinating local development codes and stormwater management creates a more streamlined process and ensures that low-cost stormwater controls are both effective and long-lasting.

MS4 Permitting & LID

The State Water Resources Control Board, via their nine Regional Water Quality Control Boards, implements the federal Clean Water Act by issuing “municipal separate storm sewer” (MS4) permits. The State Board encourages augmenting water supplies through multi-benefit, green infrastructure-based stormwater projects. Runoff can be infiltrated for groundwater recharge or captured for onsite reuse. California’s Recycled Water Policy [17]

goal is to increase stormwater capture by two million acre-feet/year by 2030. Stormwater is an important resource—critical for California’s ability to provide safe, reliable water supply for current and future generations.

LID techniques are not merely encouraged, but are now required by the State and Regional Water Boards. Since 1999, larger cities (municipalities > 100,000 people) covered under Phase I MS4 permits must treat or infiltrate runoff with LID since 1999. Since 2012, the State Water Board’s Phase II Permit (municipalities < 100,000 people) now includes LID standards for new and re-development. These standards emphasize landscape-based site design features and porous pavement treatment systems. Each Regional Permit is unique, and includes varying LID requirements, depending on the region’s identified priorities for watershed health and function. Regardless, all projects are required to implement the (LID) standards, with the goal of reducing runoff and improving water quality.

Ahwahnee Water Principle 3 —

Maximize
permeability in
developed areas

Water holding areas such as creek beds, recessed athletic fields, ponds, cisterns and other features that serve to recharge groundwater, reduce runoff, improve water quality and decrease flooding should be incorporated into the urban landscape.

We can improve the land's capacity to handle the water it receives when it rains. The third Ahwahnee Water Principle emphasizes mimicking natural systems to hold and drain water in a more effective and efficient manner. These water holding & draining areas can take many forms: curb cuts, swales, rain gardens, ponds and depressed turf areas, and can be used in parking areas and street medians. These features should be incorporated into the urban landscape along roadsides, in traffic islands, below roof gutter downspouts, and in public areas, parks, greenbelts and residential landscaping to help recharge groundwater, reduce runoff, improve water quality and decrease flooding.

Infiltrate stormwater into groundwater wherever it is safe, clean, and possible.

Infiltration is the natural drainage process through which water is absorbed into the ground. It allows physical, chemical and biological processes to occur that purify water as it travels through soils into groundwater basins. Retention is an important component of this process, controlling rates of drainage by temporarily holding runoff in place to evaporate or infiltrate into the ground at a slower, more natural pace. Enhancing infiltration capacity can effectively attenuate flood flows and replenish our rivers, lakes and groundwater. When designed into stormwater management systems, retention and infiltration controls drainage and captures pollutants suspended in runoff.

Groundwater Recharge

California's groundwater is critical to achieving climate change resilience and long-term sustainability for our communities. This flexible water source helps buffer impacts from drought and flood, filling the gap when surface supplies are insufficient and storing excess water for later use. [18] Until the Sustainable



Groundwater Management Act was passed in 2014, California did not regulate groundwater at a statewide level (adjudicated basins are an exception). The SGMA will help California rebound from its history of excessive pumping, overdraft, and collapse of our underground water storage capacity by requiring regional agencies to balance their basin's water budget. [19] Stormwater capture and retention, coupled with LID or green infrastructure for water quality treatment, is key to replenishing groundwater. As part of their Sustainable Communities Strategies (SCS) under SB 375, municipalities should identify their key aquifer recharge areas and limit development in those areas.

Communities taking steps toward groundwater sustainability are an example for others:

- The Sierra Valley Groundwater Management District (SVGMD) "Assured Water Supply Rules" (Ordinance 83-01) requires anyone seeking approval from a local land use agency for a groundwater-dependent development to file water source documents with the SVGMD. The local agency cannot approve the development permit until SVGMD ensures there is sufficient groundwater availability. [20]

Colgan Creek restoration: Stormwater quality, flood management, and safe routes to school.

The City of Santa Rosa and Trout Unlimited restored over 2,000 feet of Colgan Creek, connecting a local high school to a neighborhood that previously lacked sidewalks. Widening the stream width and improving riparian forest health will increase stormwater quality and flow attenuation, and increase flood holding. For more information: <http://colgancreek.org/>

- The GWMP for the Modesto Sub-Basin directs its implementing agencies to identify priority recharge areas, and encourages land use planning entities to protect these lands from development. [21]

Leveraging Multi-Benefits projects for larger-scale treatment areas

IRWM

Since the 2002 Integrated Regional Water Management (IRWM) Act, seeking multiple benefits in all projects is a statewide priority. IRWM—a collaborative approach to managing water on a regional scale—increases local self-reliance, reduces conflict, and achieves social, environmental, and economic goals. [22] Stormwater management is one priority of IRWM, which can be a useful avenue for project funding and support. Many state funding sources [23] require inclusion of local projects in a region's IRWM Plan. IRWM is also a practical venue for coordinating local and regional planning efforts. For more information: <http://www.water.ca.gov/irwm/stratplan/>

Co-Management

Effective water management requires integration of both surface

water and groundwater supply, with conservation, water quality, reuse, environmental stewardship, wastewater recycling, flood plain management, stormwater capture, and other water management strategies. [24] Cooperation saves agencies time and money:

- reducing duplication in management efforts,
- increasing economies of scale when contracting for similar goods and services, and
- avoiding counter-productivity when actions by one jurisdiction inadvertently negate those of their neighbor. [25]

Land use decisions at the local level have significant implications for groundwater and surface water resources. Cities, counties and special districts can be more effective by collaborating on regional or watershed-scale management across jurisdictional boundaries through coordinated planning:

- Groundwater Sustainability Plans
- Sustainable Community Strategies
- General Plan updates
- Zoning ordinances
- Evaluation of groundwater-intensive land use proposals
- Well permitting [26]

Elk Grove tests dry wells for stormwater infiltration, groundwater recharge, climate adaptation.

Drywells are an effective method for capturing and storing stormwater runoff when used in conjunction with other LID treatments. Dry wells help recharge the groundwater, a pressing need during drought. The City of Elk Grove constructed two dry wells, one in a suburban neighborhood, and another in an industrial parking lot, and is monitoring stormwater and groundwater quality during and after rain events. They hope to dispel concerns about stormwater contaminating their water supply. Because of the Central Valley's clay soil, LID is especially challenging. Drywells can help overcome this common obstacle and provide valuable water storage — an important strategy for climate change adaptation. For more information: http://www.elkgrovecity.org/city_hall/departments_divisions/public_works/dry_wells





Stormwater “Alternative Compliance”

Local municipalities are charged with ensuring water quality standards are met while maximizing multi-benefit opportunities through LID. However, LID is not appropriate for all projects. Sites with shallow groundwater, poor soils, or contamination are poor choices for LID. Space and funding constraints with infill development and redevelopment are particularly onerous for on-site LID.

Alternative compliance is a potential solution for some Phase II MS4s: identifying larger treatment areas downstream of a redevelopment or infill project site where stormwater can be more effectively collected and treated. This is especially important as state regulations (such as SB 375—the Sustainable Communities and Climate Protection Act of 2008) and funding sources (such as the Affordable Housing Sustainable Communities Cap and Trade funding) focus on infill and transit-oriented development.

Some Phase I and Phase II MS4 Permits (e.g., Central Coast Regional Water Board (3), L.A. Regional Water Board (4), and San Diego Regional Water Board (9)) are revising their permit structures to require watershed-scale planning in stormwater management options. This will help identify appropriate sites for



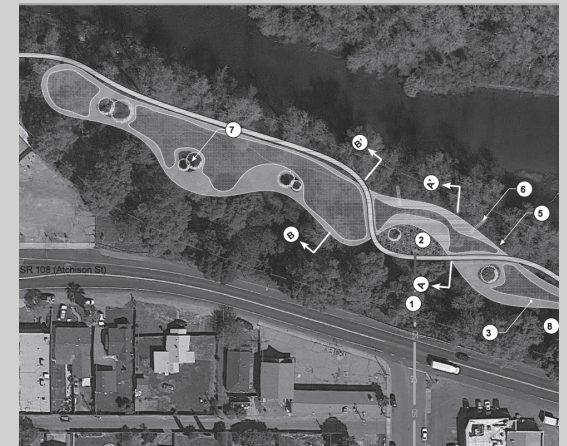
LID, and provide alternative solutions for project sites not conducive to LID. However, low cost, low-tech LID retrofits, such as curb cuts, can be implemented virtually anywhere. With estimates that 60% of our built environment will be redeveloped by 2050, huge opportunities for LID retrofits still exist.

- Under the 2012 Los Angeles County MS4 Permit, [27] permittees can seek “Alternative Compliance” by participating in an “Enhanced Watershed Management Program” (EWMP). Permittees can propose regional projects to replenish groundwater supplies at offsite locations that have a designated beneficial use in the Basin Plan. Municipalities implementing an EWMP will develop larger-scale, regional stormwater capture projects to meet permit conditions.

Unlike the expansive retention and detention ponds of the 1990s, “alternative compliance” seeks to provide multiple community benefits, while meeting stormwater quality requirements. A number of communities have created recessed parks, baseball fields, neighborhood rain gardens, and similar features that temporarily hold water during excessively rainy periods. Some are even daylighting urban creeks and creating or restoring ponds.

LID a Tough Sell for Small Communities Seeking Infill Development

The City of Riverbank sought an alternative compliance strategy to support downtown revitalization through infill and redevelopment, while also protecting and improving the water quality of the Stanislaus River. Projected in-fill development is not significant enough to finance neighborhood-scale LID features without placing too high a cost burden on existing property-owners and developers. Alternative Compliance projects would need to be partially financed by federal and state grants. Municipalities should urge the State Board to provide additional options or flexibility for situations where LID is particularly onerous if they are to achieve both water quality and infill development goals. For more information: www.lgc.org/lid-alternative-compliance





Daylighting Streams

The rivers and streams that flow through our communities are a valued resource. They add community character, recreational opportunities, economic stimulus, habitat, and environmental benefits. Since the early 20th century, though, many of our rivers and streams have been buried in culverts under pavement or encased in concrete channels, providing little benefit for human or natural communities. Restoring urban creeks is important to watershed-based stormwater management; they effectively filter pollutants from urban runoff, including as much as 50% of nitrogen from lawn fertilizers. [28]

“Sustainable groundwater management balances groundwater resources in a manner that ensures basin resiliency and benefits for present and future generations.”

— California Department of Water Resources (DWR)

Daylighting Urban Creeks

■ Strawberry Creek – an early Daylighting success story

Strawberry Creek is one of the earliest documented daylighting projects, and a testament to the benefit of restoring creeks in our urban communities. The creek was reopened and restored to its original course in 1984. The focal point of Strawberry Creek Park—a 200-foot section converted back to its natural state—received the highest Environmental Planning Award from the California Parks and Recreation Society. The City of Berkeley funded the project, recognizing its positive community impact: property values near Strawberry Creek have gone up, and crime rates have gone down. Efforts continue to daylight the rest of Strawberry Creek’s natural course. For more information: <http://www.sustainable-city.org/articles/creeks.htm> [29]

■ A multi-stakeholder planning effort restores Lincoln Creek

Efforts began in 2005 to restore 600 feet of Lincoln Creek’s reach through downtown Auburn. The creek was backfilled and diverted through underground culverts to construct school playing fields, which are no longer used. Auburn School Park Preserve opened to the public in 2008, and is now a focal point of the downtown area. The park provides access to intact riparian habitat and “ensures that nature’s filtration system remains intact, reducing erosion and keeping watersheds healthy and clean.” For more information: www.placerlandtrust.org [30]

Ahwahnee
Water Principle 4 —

Water-wise landscaping:
The “Watershed Approach”

All aspects of landscaping from the selection of plants to soil preparation and the installation of irrigation systems should be designed to reduce water demand, retain runoff, decrease flooding, and recharge groundwater.

Russian River Watershed Association Helps Landscapers be “River Friendly”

In partnership with Alameda County’s StopWaste.org, the RRWA created the Russian River-Friendly Landscape Guidelines — a comprehensive toolbox for landscape professionals, providing guidelines and resources to protect and conserve Russian River waterways through landscape design and maintenance. The Guidelines support an integrated approach to earth-friendly landscaping, including plant debris reuse and reduction. For more information: <http://www.rrwatershed.org/programs/RRFLG>



The fourth Ahwahnee Water Principle addresses how communities can use landscape design to improve stormwater management and maximize existing water supply. From the scale of an entire subdivision to an individual property, we can develop a natural “green” infrastructure to protect our water resources.



Until recently, water agencies encouraged water-efficient landscaping, such as “xeriscaping.” [31] This approach focused all aspects of landscaping—from plant selection to soil preparation and irrigation systems—on reducing irrigation, with little attention to other potential benefits. Water providers are now shifting to a “watershed approach,” [32] highlighting the value of a full range of benefits from sustainable landscaping practices. The watershed approach treats each landscape as a miniature watershed; this greatly reduces the need for supplemental irrigation while providing multiple community benefits. The “watershed approach” to landscaping reduces:

- Average daily water demand,
- Seasonal peak water demand,
- Taking water from environmental uses,
- Runoff and soil erosion,
- Chemical treatments,
- Green waste,
- Air pollution from turf maintenance,
- Greenhouse gas emissions, and
- Costs of energy use, stormwater controls, water treatment and wastewater treatment.



Slow stormwater flows down and treat with bioretention before discharging

Bioretention is a common LID practice that directs runoff from impervious areas into a highly permeable area to treat and control on-site runoff close to its source. Bioretention not only provides water storage and facilitates infiltration, but also improves water quality. A study of six bioretention systems showed greater than 99% removal efficiency for oil and grease. Removal of total suspended solids — a measure of the amount of pollutants in an amount of water — ranged from 72% to 99%. Lead removal ranged from 80% to 100%. [33]

Swales—the most common form of bioretention—are drainage areas that slowly transport runoff through a vegetation-lined channel. Plants slow the flow of runoff, allowing pollutants to settle out and promoting filtration. Biophysical interactions between the vegetation, soils and soil organisms, digest most contaminants.



Green infrastructure for new development and redevelopment

In contrast with traditional site-by-site post-construction landscaping, the watershed approach to landscape design starts at the subdivision, planned unit development, or specific plan scale. Early on in the construction process, natural features (plants, trees, streams, water holding areas, small ponds, soils, and natural drainage patterns) should be cataloged before land is cleared or graded. These features play an important role in the natural watershed, and should be incorporated in the new development landscape as much as possible.

Local governments can encourage watershed-based landscaping through ordinances that either require these key landscape features to be preserved or incentivizing their protection. When disturbing a landscape is unavoidable, proper grading and soil preparation can reduce run-off and evaporation while increasing soil moisture and groundwater recharge.



Stormwater Retrofit at Meiners Oaks, CA

The Ventura River is contaminated by excessive nitrogen and bacteria from the Meiners Oaks residential community's stormwater runoff. But as of 2015, the Ojai Valley Land Conservancy and the County of Ventura will be remedying this by divert 40% of their runoff into the Ojai Meadows Preserve. Slowing the flows down through an enhanced vegetated bioswale treatment system removes bacteria and nitrogen. The site's clay soils don't allow enough infiltration, so water is discharged back into the storm drain system at lower volumes. Regular flow and water quality testing provides useful data on the effectiveness of the system. For more information: <http://uninc.vcstormwater.org/>



Appropriate Plant Selection

On average, more than half the water consumed by single-family and multi-family homes is for landscape maintenance. Californians use about 977 billion gallons of water for landscape irrigation each year. Improved landscaping techniques can reduce this amount up to 75%. [34]

Appropriate plant selection is critical to reducing water use, and is a main component of the “watershed approach” to landscaping. At a minimum, “appropriate plants” are water-efficient and non-invasive. Water-hungry turf grass [35] is limited or eliminated. California native or other climate-appropriate plants are preferred for the additional habitat benefits they provide. Plants with similar water needs should be grouped together (and spaced for growth) in “hydro-zones” to increase irrigation efficiencies. LGC, in partnership with the City of Riverbank and AECOM, created the Lower Stanislaus LID Design Manual, which includes a plant guide appropriate for communities across California’s Central Valley. For more information: <http://www.lgc.org/model-lid-standards-specifications-for-riverbank>

To further reduce potable water use, the watershed approach promotes rainwater capture and use of household graywater reuse. Daily Acts provides resources to help residents install simple gray-

water systems at home: <http://dailyacts.org/laundry-landscape-system-overview>. The most obvious benefit of the watershed approach for property owners is lower water and energy bills. A study of condos and townhouse complexes in Marin County found traditional landscaping used 126 to 216 gallons daily per dwelling unit. Water-conserving landscapes at similar complexes reduced water use by more than 50%. [36] Since the passage of SB 375—and subsequent adoption of Sustainable Community Strategies—the state has been placing greater emphasis on reducing greenhouse gas emissions and leveraging multi-benefit projects with both water and energy reductions. Cap and trade funds provide additional resources for communities to implement such projects.

Turf Removal

Especially since Governor Brown’s 2015 Drought Executive Order (B-29-15) and the state’s commitment to removing 50 million square feet of turf, rebate programs for turf removal and replacement are proliferating across the state. In general, rebate programs offer customers a dollar amount per square foot of turf removed; individual programs require compliance with various specifications (e.g., inspections, irrigation systems, plant selection, etc.). Local and regional agencies are adopting these turf removal programs in hopes that the upfront investment will yield long-term outdoor water savings. Water savings vary by local climate, program requirements, and end-use behavior, but estimates range from 13 to 70+ gallons/ft. Southern California agencies report an average of about 45 gallons saved per square foot turf removed each year. Turf conversions can capitalize on other landscape and maintenance savings as well. For more information: California Water Conservation’s Turf Removal & Replacement report.

Santa Monica offers Cash for Grass

The City of Santa Monica provides residents \$3.50 per square foot of turf removed—up to \$4,500 per property—in response to the California 2013–2015 drought and the 2015 Drought Executive Order. The removed turf must be replaced with low water-use plants or permeable landscape surfaces, and drip irrigation must be used for new plant material. Customers can also have a landscape consultation, for only \$50. For more information: http://www.smgov.net/Departments/OSE/Rebates/Landscape_Rebate.aspx



Operations & Maintenance

■ The watershed approach to landscaping reduces landscaping inputs, costs, and maintenance.

A nine-year Santa Monica case study on water use, waste production, and maintenance time contrasted a conventional landscape (turf yard) with a native garden, and found that the native garden reduced water use by 83%, green waste by 56%, and maintenance time by 68%. Even though it initially cost 35% more to install than the conventional yard (partly due to removing cement paths and installing rain gutters), the native garden paid back dividends in water cost savings and maintenance time. This study demonstrates the potential O&M savings from water-efficient and sustainable landscaping practices. These benefits can be scaled up from the individual home to a neighborhood or even an entire municipality. For more information: <http://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Landscape/garden-garden-2013.pdf>

■ Palm Desert cut water use by one-seventh using drought-tolerant plants.

Water-efficient plants grow slower than conventional types, so maintenance requirements are reduced. The City of Palm Desert replaced street medians lawns in with drought-tolerant plants. In doing so, the City reduced their water use to only one-seventh of their previous usage. Maintenance costs are now two-thirds lower, as well. Water-efficient landscaping also reduces pests, weeds and disease, so less money is spent on fertilizer and pesticides. Cutting back on these substances also reduces water pollution. More information: www.cityofpalmdesert.org/PublicWorks.asp

Water-wise Irrigation

The amount of water applied to the landscape depends on multiple factors: the water needs, management practices, and irrigation efficiency. Experts estimate that as much as 50% of residential water used outdoors is wasted from overwatering, because of inefficient irrigation methods and systems. But irrigation control technologies—properly installed, operated, and maintained—can significantly reduce this waste by applying only as much water as needed, when it's needed.

There are plenty of affordable, simple to use irrigation controllers on the market, functioning like a thermostat for your sprinkler system. Weather-based irrigation controllers use local weather data and onsite sensors to tailor watering schedules to actual landscape conditions. Soil moisture-based control technologies adjust the irrigation schedule based on the amount of moisture in the soil. Rain sensors ensure the sprinklers don't go off during or after it rains. The US EPA has a WaterSense labeling program for irrigation products on the market, just like their EnergyStar appliance labeling. In one California study, 'Smart' irrigation systems reduced water use more than 25%.



Urban Greening

Creating and maintaining urban forests—trees in yards, public spaces, and along streets—is a cost-effective way for cities to improve environmental quality; increase the economic, physical, and social health of their communities; and foster civic pride. Studies show that every dollar invested in trees yields \$2 to \$4 in benefits—such as cleaner air, lower energy costs, better water quality and stormwater control, increased aesthetics, and higher property values.

Trees and Stormwater Management

Trees play an important role in urban stormwater management. Leaves and bark slow and reduce runoff during rainstorms, allowing some rainfall to evaporate, some to infiltrate, and the remainder to run off in a slower, more controlled fashion. For every

1,000 trees, estimated stormwater runoff is reduced by nearly one million gallons. Cost savings from these reductions total about \$7,000 per year. [37]

As a tree's roots grow, they break up and loosen soils, which enables the ground to absorb more water, more quickly. Increased infiltration reduces flooding and helps replenish groundwater. Tree roots also help reduce pollutants in the runoff they capture, and prevent erosion because their roots hold soil in place. [38]

Economics Benefits of Trees

Urban forests effectively mitigate the urban heat island effect—the increase in temperatures from urban development. Regions that are naturally hot and dry during the summer, like the San Joaquin Valley, have greater potential cooling opportunities from urban greening than anywhere else in the nation. Urban trees can

reduce temperatures by 5-10° Fahrenheit!

Trees also increase residential property values; according to a recent study, people are willing to pay 3% to 7% more for homes with trees than those with fewer or no trees. Each large front-yard tree adds about 1% to a home's value. Consumers also prefer trees: more frequent and longer shopping trips occur in centers with trees; shoppers are willing to pay more for parking and spending up to 12% more on goods and services when trees are abundant.

The tree industry is injecting hundreds of millions of dollars into the state's economy, and urban forestry is a fast expanding job market. The City of Visalia has been working with the Sequoia Community Corps to hire disadvantaged community members for citywide urban forestry projects. Together, they have successfully planted and maintained urban trees while creating jobs for the community.

Ahwahnee Water Principle 5 —

Minimize impervious surface cover

Permeable surfaces should be used for hardscape. Impervious surfaces such as driveways, streets, and parking lots should be minimized so that land is available to absorb storm water, reduce polluted urban runoff, recharge groundwater and reduce flooding.

Impervious surfaces inflict more damage to the watershed than any other aspect of development. When rainwater cannot infiltrate, it runs off the surface and carries with it whatever has accumulated there. Ahwahnee Water Principle 5 addresses how communities can reduce their impervious surface cover to reduce these impacts.

Permeable surfaces should be used for hardscape, wherever possible. Impervious surfaces such as driveways, streets, and parking lots should be minimized so that land is available to absorb stormwater, reduce polluted urban runoff, recharge groundwater and reduce flooding. When impervious surfaces are linked via a network of streets, parking areas, storm drains and drainage channels, they create an “expressway” for runoff that leads to higher concentrations of pollutants and fast moving “bursts” of polluted water that is damaging and erosive to local streams and habitat.

Automobile-related hardscapes account for more than 60% of the total imperviousness in suburban areas. Streets account for the lion’s share of this — about 40% to 50% in residential areas alone. [39] Parking lots take up around 10% of the land in U.S. cities and can occupy as much as 20% to 30% of downtown core areas. [40] Normal auto use and wear releases harmful chemicals from brakes, tires, and engines: nickel, chromium, lead, copper, zinc, chromium, and manganese. All of these toxins accumulate on paved surfaces and are carried into storm drains and water bodies by urban runoff. [41]

For most local governments, increasingly strict NPDES urban runoff regulations will be sufficient to motivate a serious look at the way impervious surfaces are used and designed into the built environment. An even greater incentive may be the improved quality of life achieved by reducing the dominance of streets and parking lots in a downtown or neighborhood. Cities that narrow their streets and put cars in smaller lots or parking structures are far more attractive, safe and pleasant places to be.

Complete & Green Streets

■ 21st Street receives APWA Project of the Year Award

The City of Paso Robles used to suffer from frequent flooding, poor pavement, and inadequate facilities for bicycles and pedestrian traffic. The City adopted a Bike Master Plan in 2009, to improve cycling safety, and with support from the California Natural Resources Agency Urban Greening Grant Program, they were able to turn 21st Street into the first “Green and Complete Street” in San Luis Obispo County. Project successes include improved stormwater filtration and recharge to the Salinas River, sediment removal, reduced street flooding, pedestrian safety improvements, traffic calming, new cycling infrastructure, more shade, aesthetics, public education, and promoting infill and redevelopment. For more information: <http://www.prcity.com/government/departments/publicworks/engineering/pdf/10-17A-beforeafter.pdf> [42]



■ Integrated Rainwater Harvesting

The UC Davis Department of Environmental Horticulture and the Center for Urban Forest Research integrated a rainwater harvesting system that: captures water into cisterns and rain barrels; treats surface runoff via a vegetated filter strip; enhances infiltration into soils through a swale; and strategically shades smaller drought-tolerant landscaping with climate-appropriate trees. Landscaping is irrigated with the water stored in the rain harvesting. For more information: www.fs.fed.us/psw/programs/cufr

Street & Parking Diets

Urban designers and health professionals agree that most residential streets are too wide. Communities are now reducing street widths in newer developments and redesigning existing streets to devote less space to cars. This technique, known as a street-diet, successfully accommodates the same amount of traffic while creating a more pleasant urban environment. Arterials are also coming under scrutiny. The Institute of Transportation Engineers and the Congress for the New Urbanism released a guide that changes arterial street design. Rather than the traditional focus on capacity, speed, and topography alone, the new guide changes widths and street design to accommodate pedestrians. For more information: www.cnu.org

Local governments tend to require more parking spaces than necessary. One study of 10 California cities revealed that lots were filled to only 56% of their capacity, even at peak times. But the practice remains of setting minimum parking requirements to satisfy maximum parking demand. Parking needs are influenced by development density, design, and use. As residential density doubles, car ownership falls 32% to 40%. Where transit is available, neighborhood stores are close by, and streets are walkable, even less parking is necessary. If daytime use leaves spaces unfilled in the evening, they can be shared. Thoughtful planners

assess all these factors, rather than simply following outdated, “off the shelf” standards.[43]

Capture and treat stormwater for water supply wherever feasible

“Rainwater harvesting” practices help manage stormwater, turning it from a nuisance into a resource. Rain barrels and cisterns are low-cost, effective, and easily maintained water storage systems that can manage rooftop runoff from residential, commercial and industrial sites. Catching runoff from buildings reduces stormwater flows and provides an alternative water supply for landscaping or other uses.

Rainfall that runs off developed lands is as precious and as useful a water supply as our surface streams that originate in the mountains. Parcel-specific tools like cisterns are an important component for capturing this supply, but much larger opportunities exist as well. For example, almost half of the water used in the San Gabriel Valley is from collected runoff, which is sent to spreading basins that infiltrate into the aquifer, and then pumped back up as groundwater. Development and redevelopment can play a larger role in catching rainfall and infiltrating it into groundwater, wherever feasible.

Reducing parking pays off

■ The City of Palo Alto

The City of Palo Alto defers up to 50% of required parking spaces to a landscape reserve wherever parking needs are unclear. One apartment development deferred 22 of the 95 parking spaces required by the city code, turning the land into a family play lot, a barbeque area, and picnic benches. After 15 years, the landscaped area remains—no new parking proved necessary. For more information: cityofpaloalto.org/planning-community

■ The City of Santa Clara

The City of Santa Clara reduced parking at NASA research park—a mixed-use development with housing, retail and office space connected by a network of bicycle and pedestrian paths. Cutting 7,542 parking spaces down to 5,200 saved \$3 million a year. The design of the Los Padres and Homestead Condominiums in Santa Clara minimizes impervious surfaces via higher-density housing and narrow streets. The design incorporated pervious areas to allow stormwater absorption and groundwater recharge. The 20-foot wide streets are supplemented with permeable concrete (turf block) fire lanes, which allow natural filtration of stormwater while providing space for children to play and enabling emergency vehicle access. For more information: Judith.Silva@ci.santa-clara.ca.us



Pervious materials & techniques

Pervious pavement materials have been on the market for more than a decade. These products are designed to let water flow through, reducing the water-related problems with impervious hardscapes. Porous asphalt and pervious concrete surfaces available today look just like conventional asphalt or concrete, but have tiny spaces that allow water to percolate through. Materials have improved over the years, becoming more durable and less costly. Still, permeable pavement is a better fit for parking lots, driveways, access roads, public plazas and sidewalks, rather than high-traffic roadways.

Other pervious hardscape products for landscaping and public spaces are more popular:

- Paving stones or unit pavers: brick, stone, or concrete blocks on top of a prepared sand base allow water to travel through gaps between the blocks.
- Grass pavers or turf blocks: gaps between blocks allow grass or other appropriate plants to grow through, not only allowing water to percolate into the ground, but also slowing runoff and filtering out pollutants.

“Disconnect” impervious area

Some parts of our developed land—an airport runway, for instance—must be impervious. You cannot land a Boeing 747 on pervious concrete. An easy solution for spaces where the tools above are not appropriate is “disconnected impervious area.”

Impervious surfaces, which cause runoff, are usually linked into an ever-expanding stormwater management system. Think of a house: the peak of the impervious roof is the top of a watershed that includes gutters, and downspout, a driveway, a curb line, a storm drain and so on to the ocean. Disconnecting that system of impervious area can be as simple as directing your downspout into a rain barrel or rain garden instead of a driveway. More sophisticated disconnections include recessed tree wells and planters in a parking lot. In each case, some of the necessary impervious area is disconnected from the system carrying the water away.

■ Rose Bowl disconnects its parking lot

The Rose Bowl Aquatic Center in Pasadena got serious about LID. Their parking lot is made with pervious concrete parking stalls and sunken planters. The parking area was even re-graded to make sure water flows to the right spot! For occasional heavy rains, excess stormwater flows into their traditional overflow capacity system.

■ More creeks mean less runoff

Davis’ acclaimed Village Homes uses natural drainage—creeks and ponds—that act as temporary holding areas and recharge basins. Abundant trees not only provide shade, but reduce runoff and enhance infiltration. Lawns are eliminated (except playfields), and drought-tolerant plants and edible vegetation are used extensively. Conservation site design was used to plan the development, which allowed developers to make use of existing natural features and incorporate multi-functional open space throughout. Village Homes not only manages its own runoff, but also that of the surrounding area. [44]

III. Stretching Our Water Supplies

“Every time water is wasted, money and a precious resource go down the drain.”

– California Water Plan Update 2005

Based on current per-capita use, the water demand generated by California’s future residents will require a 40% increase in supplies. While our population is growing rapidly, our water supplies are limited, and there is no way to make “new water” to meet increasing demand.

Communities need to look to under-utilized local resources to fill future needs. They also need to develop a portfolio of water supplies, rather than relying on a single conventional source. Conservation, reclamation, the reuse of graywater and recycled water, and the treatment of contaminated groundwater supplies are all potentially viable “supply” options available to local communities.

By employing water conservation, recycling water and treating contaminated groundwater, California could make another four million acre-feet available to meet future needs. [45]

Reduced reliability of future water supplies

In the past, many communities have looked to far away sources to provide the water they needed. In the future, it is likely that those sources will be increasingly difficult to secure and less reliable, and bear heavy economic, social and environmental costs. Communities that now have excess

water are likely to need it to supply their own growing populations. Water supplies to Southern California coming from the Colorado River are already being reduced, as other states are using their full-supply rights to serve their own growing populations. This provides a forecast of what is likely to pass in California as our own communities grow in population.

While some interests still support new surface water reservoirs, none of the proposals in the CALFED Record of Decision has been found to be cost-effective or environmentally acceptable. [46]

The conventional water supply systems – dams, aqueducts and pumping stations that move water around the state – are also dependent upon an aging infrastructure. As the financial costs of maintaining and updating the extensive infrastructure required by these systems – and the environmental costs they create – become increasingly apparent, damming rivers and building aqueducts to move water wherever it is needed will no longer be viable strategies.

Global warming may also play into this scenario. California depends on the Sierra snow pack as a massive natural storage system. Global warming experts warn that snow levels will rise and winters become shorter, effectively shrinking our largest storage system.

Community self-reliance

When a gallon of water is conserved, it’s as good as a gallon of water supplied. In fact, it can be better. Conserving that gallon not only makes it available for other uses, it means less wastewater is generated. The potential of water conservation is immense and offers the greatest and most-affordable single source for meeting future needs.

We can design infrastructure and buildings to greatly increase the efficiency with which we use our water supplies. Requiring dual plumbing in all new development – even if recycled water is not yet locally available – will make future use of recycled supplies a viable option. Enabling expanded use of household graywater systems will give consumers an opportunity to reduce their water costs and play a role in decreasing demand on potable supplies. Low-flow and dual-flush toilets, water efficient appliances and “smart” water-saving irrigation technology are practical and available.

Developing these strategies can provide local and reliable sources of water that communities will need to meet California’s “show me the water” laws. Conservation, recycling and groundwater treatment meet the criteria of “no regrets actions.” They are sustainable strategies that make sense whatever the impacts of global climate change.

Ahwahnee Water Principle 6 — Graywater reuse

Dual plumbing that allows graywater from showers, sinks and washers to be reused for landscape irrigation should be included in the infrastructure of new development.



Water inside, reused outside: Dual drains installed in a second-story shower allow water to be diverted to the garden.

Reuse of domestic graywater is a simple and affordable practice that individual families or entire communities can employ to use water more wisely. Any water that has been used in the home — except water from toilets — is called “graywater.” Shower, sink and laundry water comprise 50% to 80% of residential “waste” water, which may be reused for other purposes, especially landscape irrigation. [47]

During droughts, some people resorted to using buckets to transfer bath water to the garden. This practice can be made more convenient by putting two drains in a bathtub or sink — one drains to the garden, the other to the sewer.

Key facts about water reuse

More than half of the water used within the home, typically 60 gallons a day per person, is suitable for reuse. [48]

Using graywater instead of drinking quality water for landscape irrigation can keep lawns and gardens green — even in times of drought — and alleviate water demand in areas prone to water shortages.

Graywater can also be better for a garden than using treated drinking water. Soap and other products in wastewater are rich in compounds that can pollute waterways, wear out septic systems, and overburden wastewater facilities. However, these same pollutants — phosphorus, nitrogen, potassium and proteins — are sources of nutrients for fruit trees, landscaping and gardens. [49]

State law (California Water Code, Section 14875-14877.3) permits cities and counties to allow the sanitary reuse of graywater.

Graywater systems are affordable and simple to install, especially if done at the time of construction. A workable, code-compliant, graywater irrigation system sends water from showers, sinks and other graywater sources away from blackwater before they mix and go to a sewage system.

Economic implications

Graywater reuse allows water suppliers to purchase less water for their customers. This water will become even more expensive as California's population increases.

Reusing graywater for irrigation means wastewater treatment facilities will have less volume to treat, and can delay expansion of those facilities. It can also extend the life of residential septic systems.

Individual customers save money on their metered water bills when water is used more than once.

Environmental benefits

Reusing water may allow communities to leave fresh water in rivers and streams to protect fish and wildlife. This can be critical during times of drought when river and stream flows can become low and warm, leading to fish-kills.

What local government can do

Cities and counties can require that dual drains be installed in new construction for the purpose of reusing water. As an incentive, the water saved can be counted as a source of water to meet the requirements of new state "show me the water" laws that require developers to prove that enough water is available to serve proposed new housing.

Taking steps to require and encourage graywater

■ Malibu adds graywater to its General Plan, develops guidebook to aid installation

The City of Malibu inserted graywater installation requirements in its general plan: "New development shall include a separate graywater treatment system where feasible" (Policy 3.123). As a result, numerous sites have graywater systems in use. Malibu also developed a "Graywater Handbook" to complement the City's policy. The handbook provides guidelines, resources and techniques to help homeowners and developers integrate graywater systems into their projects.

The handbook is available at www.ci.malibu.ca.us. For more information about Malibu's graywater law and permit process: Deputy Building Official Craig George, (310) 456-2489 x229

■ Santa Monica uses financial incentives to promote graywater projects

The City of Santa Monica has an incentive-based program to encourage graywater projects. The City provides discounts on sewage bills for installing graywater systems and has implemented a grant program to provide partial funding for innovative landscaping projects that incorporate graywater systems and other innovative water-saving features.

The City also provides fact sheets about graywater regulations and additional resources about constructing graywater systems, requesting rebates or receiving general assistance. For more information: Kim O'Cain or Bob Galbreath, Santa Monica Water Resources Management Office, (310) 458-5408

■ LA County recycled water manual provides wide range of tips and resources

The Los Angeles County Recycled Water Advisory Committee has developed an extensive 48-page "Recycled Water Manual" that provides information on goals, general provisions, design and construction, operations and maintenance, marking and equipment, agency contacts and resources for users and site providers. (www.watereuse.org/ca)

■ Los Angeles military base serves as graywater model for others to follow

The Los Angeles Air Force Base in El Segundo uses graywater in toilets and urinals in seven buildings and irrigates their five-acre landscape with graywater. The Los Angeles Air Force Base is serving as a template for bases throughout the world through its innovative use of recycled water. For more information: Office of Public Affairs, (310) 653-1132

Ahwahnee
Water Principle 7 —
Water recycling

Community design should maximize the use of recycled water for appropriate applications including outdoor irrigation, toilet flushing, and commercial and industrial processes. Purple pipe should be installed in all new construction and remodeled buildings in anticipation of the future availability of recycled water.



“California has the potential to recycle enough water to meet 30-50% of the household water needs of our projected population growth.”

— California Recycled Water Task Force

Water recycling is an umbrella term that encompasses the treatment, storage, distribution and reuse of municipal wastewater. Recycling wastewater provides communities an opportunity to develop and diversify their water portfolios with a reliable source of water to meet a range of needs.

Recycled water is municipal and/or industrial wastewater that is treated for reuse. The recycled wastewater generally

used in urban settings has undergone biological, physical and chemical treatment processes to bring it up to a standard appropriate for use in fire fighting, toilets, sprinkler systems, landscape irrigation, agriculture, cooling towers, commercial laundries, car washes and artificial snow making. Recycled water is the fastest-growing water supply in California. [50]

Potential contribution to our water supplies

California generates about five million-acre feet of municipal wastewater per year. Currently, 500,000 acre-feet of recycled water is being used around the state. An acre-foot is roughly enough to cover a football field with one foot of water or the amount needed by one or two families for one year.

According to the California Recycled Water Task Force, California has the potential to recycle up to 1.5 million acre-feet per year, saving potable water to satisfy the needs of 1.5 million homes annually. [51]

Safety

The safety of recycled water is well-established: it has been used by California communities since 1929 without any reported health problems. California's regulations governing



Many golf courses are using recycled water for irrigation.

the production, distribution and use of recycled water are some of the most stringent in the world. The California State Department of Health Services sanctions the use of recycled water for a variety of uses. These include, but are not limited to landscape irrigation, agricultural irrigation, construction water, water for industrial purposes, fountains, and indoor toilet and urinal flushing. Recycled water may also be used in cooling systems for buildings.

Working with non-potable recycled water is safe if common sense is used and appropriate regulations are followed. There has never been a documented case of disease or other public health effect in the United States related to the use of recycled water that meets established standards, according to the Department of Health Services.

Purple pipes to assure safety

Recycled water, although highly treated, is considered non-potable. A dual-plumbing system is used, with the recycled water carried in purple-colored pipes to prevent the unintentional misuse of recycled water or cross-connection with the potable water system.

Regulations and guidelines have been developed to address public-health concerns with such misuse. State law prohibits a connection between the recycled water and the potable water systems. Tests are conducted before connecting new sites to recycled water supplies to ensure this does not happen.

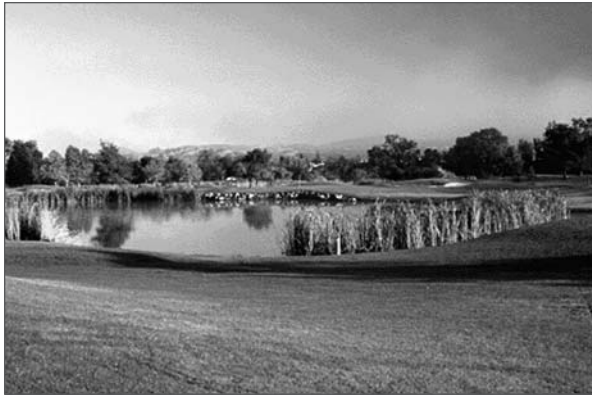
Look for the purple pipes

To avoid confusion, pipes, valves and other equipment carrying recycled water are colored purple to make sure that recycled water does not get mixed with potable water.

Purple pipe is just like other PVC piping, except that it carries reclaimed rather than fresh water.

The pipe usually has a continuous banding of lettering on both sides reading, "RECYCLED WATER – DO NOT DRINK."





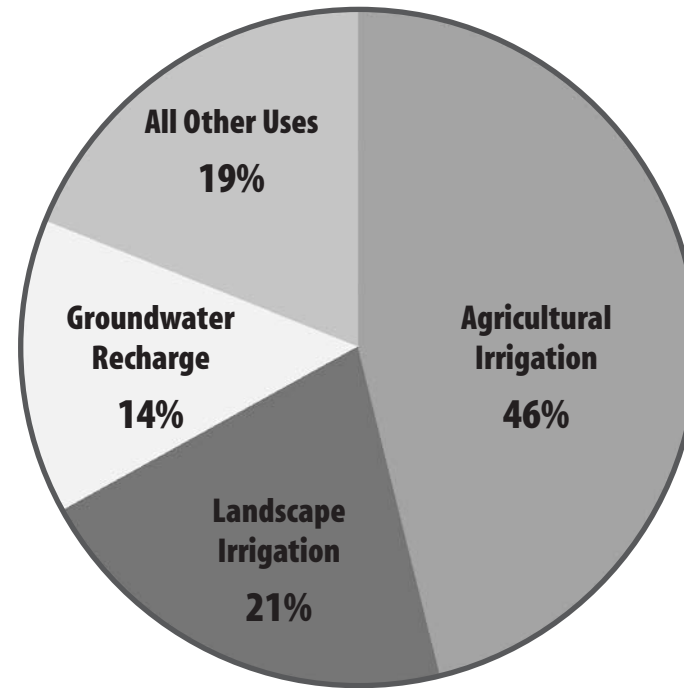
Matching the quality with the use

Industrial and commercial users of recycled water are sometimes served by their own pipeline from a wastewater treatment plant. Uses for recycled water cleaned to a lower-quality standard include aquaculture, concrete manufacture and cooling tower operation. Urban irrigation uses include wildlife-habitat maintenance, irrigation of cemeteries and highway landscaping, and nursery irrigation.

In some cases, wastewater from a building's sinks and toilets may also be carried to a separate holding tank in the basement, where it undergoes multi-stage processing similar to that of large-scale wastewater treatment plants. Many of these systems are currently on the market. The resulting water is then recycled through the building's toilet system via the purple pipes. These systems require permits both as providers and users of recycled water.

Large quantities of recycled water are used in California for agricultural purposes. The quality of that water varies based

How recycled water is used in California



on the degree to which the water may come in contact with food crops or dairy cows. Recycled water supplies can also be used as a part of groundwater storage projects.

California has more than 300 water recycling plants in operation. The Department of Water Resources reports that, as of 2004, California communities were using recycled water at 4,800 sites. [52]

Notable recycled water venues

- The San Francisco 49ers' practice field in Santa Clara
- The Pebble Beach and Spyglass golf courses
- Ernest and Julio Gallo Winery's vineyards

State law about recycled water

State law indirectly requires the use of recycled water. California Water Code Section 13550-13556 states that the use of potable domestic water for non-potable uses, including cemeteries, golf courses, parks, industrial and residential irrigation uses, and toilet flushing, is an unreasonable use of water if recycled water is available.

California regulates the use of recycled water as directed under Title 22. Each use of recycled water must have a permit from the local authority administering the recycled water program, which has the responsibility of enforcing the rules and regulations. The local authority is usually the retailer of recycled water to the site. Permit requirements typically include construction, inspection, cross-connection certification, site-supervisor training and a schedule of the hours that recycled water can be used. These local authorities can specify what sites and/or uses of recycled water are to be used in their service area, as long as they comply with state requirements.

The Regional Water Quality Control Boards require that recycled water customers conduct an inspection at least once a year while the recycled water system is in use. The results of this inspection must be documented and submitted in a written report. According to Department of Health Services regulations, at dual-plumbed use sites the customer is responsible for conducting a periodic cross-connection test every four years, unless visual inspections reveal a requirement for more frequent testing. The agency operating the recycled water program also promulgates rules and regulations determining the way recycled water systems are implemented and operated, and how records are to be kept.

Plans for projects using recycled water should indicate all water sources and the locations and specifications of all pipes and devices. Design standards must be set to protect public health and the integrity of the overall water supply, setting minimum separations for recycled and potable water pipes, minimum standards to protect drinking fountains and eating areas from overspray, and restrictions on runoff and ponding to protect domestic well water.

Recycled water systems also require regular preventative maintenance, including inspections, making certain that pipe markings remain level, monitoring of spray patterns and runoff from irrigation, and accurate recordkeeping of maintenance.

Economic implications

While the economics of recycled water depend upon the place and the use, recycled water can be less expensive than purchasing new supplies. As water supplies grow more scarce, the economic advantages of recycled water will continue to increase.

In Southern California in particular, recycling water reduces the enormous cost of energy required to import water.



Orange County's Groundwater Replenishment System treats water so that it can be safely pumped into potable groundwater supplies, creating water for 144,000 families annually. Despite \$486.9 million in construction costs, studies found that the system produced greater benefits for its cost than any of the alternatives. It will also use 50% less energy than importing water, resulting in additional savings. [53]

Environmental benefits

Recycled water can be used to enhance or restore wetlands that provide wildlife habitat, flood protection, improved water quality and recreational amenities. It also reduces the volume of potable water that must be withdrawn from rivers, lakes and groundwater to maintain the natural ecology of those bodies of water.

Recycled water projects and programs make a difference in communities across California

■ Recycled water saves supply and money in Rohnert Park

The City of Rohnert Park has been using recycled water to reduce demand on potable water supplies since 1988. Approximately 510 acres of land are irrigated with recycled water, saving more than three million gallons per day of potable city water. An extensive distribution system distributes recycled water to golf courses, city parks, school grounds and commercial properties.

The lead developer of 1,610 homes planned along Rohnert Park's eastern border has requested approval from the Santa Rosa Board of Public Utilities to build three wastewater storage ponds capable of storing up to 10 million gallons of recycled water. If the \$18 million project is built, it will be the largest reuse project in Sonoma County since the \$205 million Geysers' wastewater-to-electricity project went operational in December 2003. The ponds, which would be filled during the winter, would be drained during the spring and summer to irrigate the front yards of 880 homes, the front and back yards of 730 multifamily units, and several acres of commercial development planned within the nearly 300-acre area. For more information: Brookfield Homes, (925) 743-8000

■ Marin water district expanded recycled water for new uses

The Marin Municipal Water District was the first water supplier in California to use recycled water for car washes, air conditioning cooling towers and commercial laundries. Since the early 1980s, the district has pioneered the use of recycled water for non-agricultural purposes in northern California. Up to two million gallons a day are recycled and distributed in a separate pipeline system to more than 250 customers in northern San Rafael. Recycled water is used for irrigation, toilet flushing and other non-drinking purposes.

The water that the district recycles is wastewater that has been treated by the Las Gallinas Valley Sanitary District. To recycle this water, the district filters it and treats it

further at its recycled water treatment plant, meeting the most stringent standards in the country. The finished recycled water is crystal clear, odorless and free of harmful bacteria. It is similar in quality to water in swimming pools. The district also manages the demand for water by encouraging efficient water use through various conservation programs. For more information: Marin Water District Conservation Department, www.marinwater.org or (415) 945-1520

■ Downtown Oakland high-rise incorporates dual plumbing

In 2001, the Shorenstein Company altered its plans for 555 City Center – a premier office building in an infill, redevelopment area of downtown Oakland – to include dual plumbing for recycled water for toilet and urinal flushing. It has become the first dual-plumbed high-rise building in Northern California, with a savings of 11.2-acre feet of drinking water per year. For more information: Shorenstein Company, www.shorenstein.com or (415) 772-7000

■ Recycled water a big part of Irvine Ranch Water District's supply

Recycled water now makes up about 20% of the Irvine Ranch Water District's total water supply: 18 million gallons a day are treated, providing water for 80% of all business and community landscaping needs including parks, golf courses, school grounds and gardens.

In 2000, the Lakeshore Towers' dual-plumbed office complex became the 15th building within the Irvine Ranch Water District's service area to convert to recycled water for toilet flushing. The conversion is the second one at Lakeshore Towers and one other building is slated for future conversion to recycled water for toilets. For more information: Lakeshore Towers, www.lakeshoretower.com/pages/Profile.html or (949) 955-5253

What local government can do

- Amend the local building code to require the installation of dual-purpose pipes (purple pipes) in new construction. Where recycled water is available, this step will implement state law. Where it is not, communities will be building the infrastructure for when recycled water is available in the future.
- Amend the building code to require the installation of purple pipes in remodeled buildings.
- Adopt a water recycling ordinance. The California section of the WaterReuse Association web site provides a model water recycling ordinance (www.watereuse.org/ca/modelwword.htm). The ordinance's intent is to maximize resource conservation and streamline implementation of water recycling projects in conformance with state law. The ordinance can also be tailored to conform with local rules and regulations.
- Work with wastewater management authorities to develop the necessary reclamation and treatment facilities.
- Work with local water suppliers to add water recycling to their Urban Water Management Plan and consider sharing resources for a joint public-private venture.
- Work with developers to create incentives or otherwise streamline the deployment of dual-plumbing systems.
- Initiate or join a public outreach and education program to educate the community about the benefits of using recycled water and address their concerns.

Recycled water works in many different settings

■ Recycled watering part of master-planned community in Placer County

The Serrano development in Placer County is one of the first master-planned communities to use recycled water for large-scale residential lawn watering. Recycled water is used to water common areas, golf courses, an elementary school's landscaping and the front and back lawns of more than 3,400 homes.

Due to the success of Serrano, the El Dorado Irrigation District – which is now saving millions in treatment costs and reduced discharges – is asking that new developments adopt programs similar to Serrano's whenever feasible. Home-owners reap savings in their water bills as well.

For more information: Parker Development Company, www.serranoeldorado.com/about-1b.html or (916) 939-3333

■ Windsor finds big irrigation savings in recycled water

The Town of Windsor is saving approximately 275 million gallons of drinking water a year by irrigating 400 acres of golf course, vineyard, parks, pasture and fodder croplands with recycled water. A new housing development uses recycled water to irrigate front yards and offers residents the option of using reduced-cost water that is recycled to irrigate backyards.

For more information: Windsor Water Department, www.windsorgov.com/towwater.html (970) 686-7476

“It is not a question of whether or not we grow, but how. This is about the future of our communities; the decisions we make need to reflect our commitment to protecting the water resources we depend on.”

– Jennifer Hosterman, City of Pleasanton Mayor

Ahwahnee Water Principle 8 — Water conservation

Urban water conservation technologies such as low-flow toilets, efficient clothes washers, and more efficient water-using industrial equipment should be incorporated in all new construction and retrofitted in remodeled buildings.



Projections by the California Department of Water Resources indicate that urban water conservation will be the leading source of water for California's growing population. Water conservation is one of the main reasons that urban areas have been able to accommodate the last 20 years of growth with approximately the same amount of water that they consumed in the 1990s. [54]

Existing conservation technologies include low-flow toilets and showerheads, efficient clothes washers, weather-based irrigation controllers, and more efficient commercial and industrial cooling equipment.

To meet the supply demands of California's growing population at the lowest cost and protect against droughts, local governments should expand the use of water conservation. The urban sector, and residential use in particular, provide the greatest opportunities for cost-effective water savings through conservation.

Potential contribution to water supply

It is estimated that urban water conservation can contribute 2.0 to 2.3 million-acre feet a year to our water supplies — enough to supply the current household demands of more than two million new families. (One acre-foot is roughly the amount needed by two families for one year.) [55]

State laws that encourage or require conservation

Article X of the California Constitution prohibits waste and unreasonable use of water.

California's Water Code Section 375 allows any public entity that supplies water to adopt and enforce a water conservation program that requires installation of water-saving devices.

The Urban Water Management Planning Act (Water Code Section 10620-10621 and 10644) requires urban water suppliers with more than 3,000 customers to adopt water management and conservation plans in five-year increments. These plans must be filed with local land-use planning agencies and are a key resource for water planning and coordination between water agencies and local government.

In 2001, SB 221 (Government Code Section 66473.7) and SB 610 (Water Code Section 10910-10915) were enacted to ensure adequate supplies prior to approval of development projects with 500 homes or more, and encourage better coordination between water suppliers and local land use agencies. Water conservation is a low-cost way to meet the water needs of new development.

Economic implications

Conservation is the least expensive strategy available to us. According to the Pacific Institute, more than half of the urban water conservation strategies can be achieved at \$200 per acre-foot or less. By comparison, the Metropolitan Water District of Southern California currently charges its members over \$400 per acre-foot. [56]

Approximately 33% of the energy budget of city governments in California is used for pumping water and 23% is used for treating wastewater. [57] Water conservation has the potential to significantly reduce local government energy costs because it reduces the need to pump water and to treat wastewater.

The State Water Project is the largest single user of energy in California, consuming an average of 5 billion kWh of electricity each year. [58] Assuming a relatively low rate of 8 cents/kWh, the electricity cost to move this water is \$400 million per year.

Investing in improved water efficiency creates local jobs and local benefits. By contrast, investment in distant supplies sends money out of the community.

Environmental benefits

Water-conserving activities are key to sustainable development because they help protect water as a natural resource, minimize the use of chemicals needed to treat water and wastewater, and reduce energy use and pollution associated with pumping and transporting water.

Water conservation reduces demand, which in turn reduces the need to expand water storage projects and allows more water to remain in our rivers and streams for recreation, fisheries and natural habitat.

Conventional methods of increasing supplies, building more or larger dams, transporting water long distances, and excessive pumping, have harmed the state's aquatic resources. Using conservation, we can supply enough water to meet our needs without further damaging the natural heritage of California.

Reducing water use, and consequently wastewater generation, lessens environmental damage resulting from withdrawals, wastewater discharge and overuse of surface or groundwater.

Working with others at a regional level to improve water-use efficiency

Although many conservation efforts are local in scope, their effects are regional because the supplies that communities depend on are shared at the regional, state and inter-state levels. There is enormous potential for cities, counties, water districts, state and regional agencies, and developers to work together under the current regulatory context.

The recent "show me the water" laws and Urban Water Management Plans raise the bar for developing locally reliable supplies because without proof of adequate supplies, communities and developers are unable to engage in growth needed to accommodate future residents.



Because the supply of housing is also a regional issue, improving regionally based sources of water will give communities in the region greater self-sufficiency and more control over how they develop.

What local government can do

- Local building codes can be amended to require the use of low-flow toilets, showerheads and efficient irrigation technologies."
- Local retrofit ordinances can require the retrofit of water-conserving technologies in both residential and industrial facilities upon resale.
- Local governments can work with water suppliers to develop incentives, rebates and outreach programs to help residents, property managers and developers incorporate more efficient technologies into their homes and projects.

California communities find innovative ways to encourage the public to conserve water

■ **New fee structure has rewards for Irvine Ranch Water District**

When rapid population growth led to dwindling supplies and increased wholesale water charges, the Irvine Ranch Water District implemented a new fee structure that rewards water efficiency and identifies waste when it occurs. The long-term goal was to develop a water-wise conservation ethic within the community while maintaining stable utility revenues. Within a year, water use declined by 19%. Over the next six years, the district saved an estimated \$33 million in water purchases. For more information: Irvine Water District Conservation Office, (949) 453-5325 or www.irwd.com/Conservation

■ **Santa Monica uses outreach, loans in its conservation program**

Groundwater contamination and rapid growth created a dual threat to the City of Santa Monica's water supplies. The City was forced to increase water purchases and decided to take a multi-faceted approach. It developed a conservation program that includes education and outreach, water-use surveys, landscaping measures, toilet retrofits and a loan program. The result was a 14% reduction in water use, a 21% reduction wastewater flow and a net savings of \$9.5 million between 1990 and 1995. For more information: City of Santa Monica Environmental Programs Division, www.santa-monica.org/epd or (310) 458-2213

■ **Metropolitan Water District offers free conservation workshops**

The Metropolitan Water District of Southern California – a consortium of 26 cities and water districts that provides drinking water to nearly 17 million people – works with local communities to provide free water conservation workshops to community members

as well as landscaping firms. The workshops cover topics including how to detect wastewater, maintain sprinkler systems properly, and develop landscape designs appropriate to the climate. The workshops are offered in both English and Spanish. For more information: www.bewaterwise.com/pda.html or Diane Harrelson, (213) 217-6167 or dharrelson@mwdh2o.com

■ **Santa Barbara County water suppliers launch media campaign**

Cities and counties can be involved in educating the community on water conservation practices. The water suppliers of Santa Barbara County joined forces to launch the Santa Barbara County Be Water Wise Media Campaign. Campaign sponsors included the Santa Barbara County Water Agency, the Cities of Buellton, Santa Barbara, Santa Maria and Solvang, the Carpinteria Valley, Goleta and Montecito water districts, and the Cuyama Los Alamos and Vandenberg Village community services districts.

The campaign used materials developed and shared by the Metropolitan Water District of Southern California to run ads in local media outlets. To view ads and materials from the campaign: sbwater.org/Programs.htm#Media. For more information: Helena Wiley, Santa Barbara County Water Agency, (805) 568-3451 or hwiley@cosbpw.net

The City of Santa Barbara also offers residents a free “water-checkup” on how to read their water meters and use water efficiently, check for indoor and outdoor leaks, measure the efficiency of irrigation systems, and develop an irrigation schedule. City water customers can call the Water Conservation Hotline for assistance. For more information: www.santabarbaraca.gov/Government/Departments/PW/WCHome.htm

Ahwahnee Water Principle 9 — Cleaning up groundwater supplies

Groundwater treatment and brackish water desalination should be pursued when necessary to maximize locally available, drought-proof water supplies.

In rural areas and along the state’s central coast, 90% of the drinking water is supplied by groundwater. Nearly one in three Californians — more than 9 million people — rely solely on groundwater for their water needs. In fact, California’s groundwater supply is 20 times greater than the amount of water stored behind all our dams. [59]

Groundwater resources are particularly valuable in California because — unlike surface supplies — they are widely distributed throughout the state. Groundwater also has the benefit of year-round reliability, unlike surface supplies that are available from rain in the winter and snow melt in the spring but can be scarce in the summer and fall when they are most needed.

Sadly, in many areas, groundwater is already over tapped and/or contaminated. In some cases, desalination can treat these supplies to meet local needs.

Threats to groundwater

Groundwater is being contaminated by a number of sources, but salts, stemming from urban, agricultural, wastewater and seawater intrusion, have become one of the greatest threats to California’s groundwater resource.

Seawater intrusion is a growing problem due to the over-drafting of coastal groundwater basins. As groundwater is pumped from the aquifer, seawater flows inland through permeable ground. Under normal conditions, the fresh water acts as a buffer by leaving no space in the aquifer. When too much fresh water is drawn, the sponge-like aquifer can soak up the seawater.



In the Salinas Valley, for instance, 50 years of overdraft has allowed seawater to move five miles inland, contaminating local groundwater aquifers that provide water for the region’s \$3-billion agricultural economy and the public water supply for local communities.

Saltwater contamination of groundwater is not only a coastal phenomenon. In the Central Valley, ancient pockets of isolated saltwater have been drawn into nearby freshwater aquifers as a result of overdraft.

Since management of groundwater is primarily a local responsibility, cities and counties are positioned to make important decisions that protect groundwater as a long-term, sustainable supply for local water needs. The first step is to protect these resources with land use practices based on the first five Ahwahnee Water Principles that help protect surface waters and recharge groundwater supplies. When that fails, the more costly step of desalination is an option.

Groundwater desalination

Desalination is a process that removes salt from brackish (low-salinity) water or seawater so it is available for beneficial use. Reverse osmosis, the principal method used for desalination in California, can be used to remove salt as well as specific contaminants in water such as chemicals, volatile organic carbons, nitrates and pathogens.

Groundwater desalination has been used in California since 1965. Dramatic improvement in the treatment technology has resulted in a significant rise in desalination capacity. Currently, 17 groundwater desalination plants operate in California, with six new plants in the design and construction phase.

Desalination is an important component of water recycling (Awhahnee Water Principle 7). Desalting wastewater expands the range of beneficial uses of recycled municipal wastewater. Roughly 150,000 acre-feet of the 1.2 million acre-feet per year of the recycled water expected by 2030 will be desalinated.

Potential contribution and economics

The State of California Desalination Task Force found that there is a potential for 290,000 acre-feet of additional groundwater desalination at costs ranging from \$130 to \$1,250 per acre-foot. The benefits of desalination include:

- Increased water supply.
- Decreased diversion from environmental uses.
- Increased water supply reliability during drought periods.

Chino Basin desalination project serves fast-growing region

The Chino Desalter Authority was formed as a joint powers authority in February 2002 to manage the production, treatment and distribution of highly treated potable water to cities and water agencies throughout its service area. The authority and the Inland Empire Utilities Agency are advancing groundwater desalination as part of their Optimum Basin Management Plan. They have installed pumps and filters to remove nitrates from groundwater supplies in the Chino Basin, one of the fastest-growing areas in the nation. About 27,000 acre-feet has been restored so far, with the goal of reducing dependence on expensive imported water supplies and providing a local drought-proof supply of new water for local communities.

The desalination project is also linked to other efforts to maximize local supplies. The Chino Basin Recycled Water Groundwater Project is part of the comprehensive Water Supply Enhancement Program jointly sponsored by the Inland Empire Utilities Agency, Chino Basin Watermaster, the Chino Basin Water Conservation District and the San Bernardino County Flood Control District. Combined, these efforts aim to improve the quality of local drinking water wells, enhance water supply reliability and lower the cost of water to residents throughout the Chino Basin. For more information: Chino Basin Watermaster, www.cbwm.org, or Inland Empire Utilities Agency, www.ieua.org

- Reclamation and beneficial use of waters of impaired quality.
- Diversification of water supply sources.
- Improved water quality.
- Protection of public health.

Desalination has historically been prohibitively expensive. However, recent technological advances have made it more efficient, less energy-demanding and less expensive. These advances have reduced desalination costs to levels that are comparable to, and in some instances, competitive with the cost of purchasing outside water supplies. [60]

What local government can do

- Allow developers to fund groundwater cleanup as a condition of approval as a way of meeting California's "show me the water" laws.
- Work with water suppliers to include groundwater treatment in Urban Water Conservation Plans.

IV. Implementing the Ahwahnee Water Principles



The five implementation principles are designed to provide guidance to local leaders and their staff members to ensure the most effective application of the measures suggested by the nine community principles.

In brief, these implementation principles suggest involving key watershed stakeholders in the decision-making process, and they point out that the best projects have more than one benefit and that evaluating the effectiveness of our policies once they are implemented is a very good idea.

Implementation Principle 1 – Coordination is key

Water supply agencies should be consulted early in the land use decision-making process regarding technology, demographics, and growth projections.



The Ahwahnee Water Principles are suitable for implementation by individual cities or counties through their land use processes. However, to maximize their effectiveness, local jurisdictions need to engage water suppliers as partners. Recent legislation has made this even more important.

Lack of coordination between water agencies and land use agencies can lead to the approval of development projects that lack water to meet projected needs. This problem led to legislation in 2001 that encourages greater coordination between water suppliers and local government planning agencies.

“Show me the water laws”

Senate Bills 221 and 610 are the so-called “show me the water laws.” SB 221 requires a city or county to obtain written verification that sufficient water supplies are available



before approving proposed development projects of larger than 500 residential units, retail projects larger than 500,000 square feet, and office projects larger than 250,000 square feet. The water agency must provide verification of a sufficient supply – defined as enough water to meet the needs of the proposed development project in normal years as well as during a drought.

SB 610 provides the process for implementing SB 221. This measure requires that a water supply assessment be included in any environmental documentation for projects subject to the California Environmental Quality Act, that also meet the size thresholds above.

The SB 610 supply assessment does not preclude development, SB 221 prohibits approval of a proposed subdivision map or parcel map unless and until sufficient supplies are documented.

Responsibility for meeting the requirements of this legislation lies solely with the city or county, even though it is the water agency that documents the availability of water for the new project.

Urban Water Management Plans

Municipal water agencies are required to prepare an Urban Water Management Plan every five years. The plan must evaluate supplies and demands over a 20-year horizon, including wet, dry and normal years, and specify measures for ensuring future water supplies. Urban Water Management Plans provide a foundation for satisfying the specific requirements of the “show me the water” laws.

Cities, counties, developers and water agencies share an interest in the information these planning documents provide. They should work in concert to ensure that plans are complete and to identify water management options that make the most of existing water supplies. That way the plan can be used in development planning and approval to ensure that statutory requirements are met.

The community’s future water needs will be a function of population growth and the location and design of new development. Water agencies and planning departments will both benefit if plans reflect input from the cities and counties supplied by the water agencies.

The land use agency must provide an accurate picture of planned land uses to forecast and plan for future water needs. Water agencies must provide a clear picture of available sources of water supply and the various costs and benefits of

those sources so that local land use agencies can plan for future growth in a manner that includes a careful evaluation of the water supplies available to meet future needs.

Once completed, water agencies are required by state law to provide copies of their Urban Water Management Plans to the cities and counties they serve. Planning staff should review the plans of water suppliers in their jurisdiction to see if they contain sufficient supply and demand analysis to meet the provisions of the “show me the water” laws.

Coordinating the analyses needed for land use and water planning facilitates sustainable development practices, such as the following:

- To advance the use of recycled water, a community needs to ensure that the water agency identifies and analyzes recycled water as a source in their Urban Water Management Plan. The water agency will also need to be certain that the city or county will be requiring purple pipes in new development.
- To be certain that conservation measures will maximize the efficient use of existing water supplies, the water agency can work with the cities or county in its service area to develop programs that require or incentivise the installation of water-efficient technologies such as low-flow toilets, shower heads and smart irrigation systems.
- To count on groundwater supplies as a source, water agencies need to know that land use policies are in place to protect groundwater supplies from contamination and loss of infiltration for recharge.



All of the above measures can be included in development agreements.

General Plans

It is also advisable for local governments to perform a water supply and demand analysis when preparing a general plan update. This should be done in cooperation with the water agency to ensure that the general plan does not designate properties for future growth where there is no available water supply.



Conserving water makes more of it available for agriculture and environmental uses.

“Improved efficiency and increased conservation are the cheapest, easiest and least destructive ways to meet California’s future water needs.”

— Peter Gleick, President, The Pacific Institute

Water coordination is crucial for regional self-sufficiency

■ Sonoma County thinks regionally to implement water conservation programs

Acting regionally, the Sonoma County Water Agency – which includes the County, the Cities of Santa Rosa, Petaluma, Sonoma, Cotati and Rohnert Park, and the water districts of Forestville, North Marin and Valley of the Moon – is the first water wholesaler in the state to make a 100% commitment to water conservation and recycling as supply sources on behalf of all of its retailers.

Notably, the agency is requiring that all of its retailers join the California Urban Water Conservation Council and commit to implementing the 14 best management practices of urban water conservation. The agency oversees planning and implementation of regional water conservation programs for its eight retail water contractors and has developed a self-sustaining funding mechanism to support those programs.

Collaboration between the eight-member Water Advisory Committee brings together city council and county board members, city and district managers, and senior-level staff. The North Coast Water Conservation Group has also been established as an clearinghouse for information on current issues and coordination of regional programs and events.

Sonoma’s regional goal is to achieve a combined yearly water savings of 6,600 acre-feet by 2015. The agency developed a Water Conservation Plan as a guide to achieve this goal and has reduced the contractual water entitlements of each contractor to reflect these savings, further demonstrating their commitment to water efficiency. For more information: Cristina Goulart, Sonoma County Water Agency, (707) 523-1010 or www.scwa.ca.gov

■ East Bay Municipal Utility District coordinates with local planners

The East Bay Municipal Utility District (EBMUD) worked with 22 local land use agencies in its service area to complete “District Wide Update of Demand Projections.” EBMUD developed a geographic information system to complete the analysis, which calculated demand based on land uses in the service area. Accurate land use-based analysis required coordination with local planning departments to identify the phasing of future growth and accommodate for the variation in water demand from different land uses. For more information: www.ebmud.com



Implementation Principle 2 – Regional collaboration

City and County officials, the watershed council, LAFCO, special districts, and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a regional level.

“Regional efforts are needed to effectively coordinate local approaches to development and achieve better watershed-wide results.”

– U.S. Environmental Protection Agency

Successful integration of water into land use planning is achieved through a watershed-wide perspective. A single community within a watershed can enact measures to protect water quality or prevent flooding but they won't be as effective as when neighboring communities enact similar measures. Coordination is needed because watersheds do not tend to follow jurisdictional boundaries.

Fortunately, there are numerous venues for city and county elected officials to affect planning on a watershed level.

Important opportunities are also available to local representatives who serve on a LAFCO or Council of Government.

Local elected officials as conveners

Mayors, city councilmembers and county supervisors are in an excellent position to bring together key players within a watershed to focus on its preservation.

Water collaboration produces more fish for North counties

In 1997, Del Norte, Humboldt, Mendocino, Siskiyou and Trinity Counties agreed to work collaboratively to boost declining salmon and steelhead populations in Northern California. This commitment led to the development of the Five Counties Salmonid Conservation Program (www.5counties.org), which seeks to protect the region's economic and social resources through the conservation and restoration of salmonid populations to healthy, sustainable levels. Through this effort, they agreed to base decisions on watershed rather than county boundaries. The partnership has led to on-the-ground restoration projects, the development of regional policy guidelines and ongoing collaborative resource management.

The program is also becoming more involved in land use planning. Water quality and quantity can be drastically improved by providing incentives to private landowners to maintain riparian setbacks, as well as working with county planning departments to integrate specific ordinances into their general plans that combine a watershed-based approach with private land development.



Teaming up to buy land

San Diego County and the Southern California Cities of Escondido, Encinitas and Solana Beach formed a partnership to preserve the watershed in collaboration with the Encinitas-based San Elijo Lagoon Conservancy and the Escondido-based Escondido Creek Conservancy.

The partnership is facilitating the purchase of the land. The local communities are working to maintain it by clearing creek debris, grappling with non-native plant species that crowd out native plants and restoring native shoreline habitats that filter pollution before it enters receiving waters.

For more information: Doug Gibson, (760) 436-3944 or www.scwrp.org/taskforce_sandiego.htm

Local Agency Formation Commission

Local Agency Formation Commissions (LAFCOs) review proposals for the formation of new local governmental agencies and for changes in the organization of existing agencies (such as annexations). There are 58 LAFCOs working with nearly 3,500 governmental agencies. LAFCO decisions strive to balance the competing needs for efficient services, affordable housing, economic opportunity and conservation of natural resources.

The composition of LAFCOs varies from county to county, but nearly all have two members from the board of supervisors and two members from city councils within the county. Many LAFCOs also have two members from independent special districts in the county and a representative from the public.

A 1995 law added section 10910 to the California Water Code that permits LAFCOs to require cities, when applying to expand their sphere of influence, to provide information for determining whether existing and planned water supplies are sufficient to meet current and new demands.

LAFCOs cannot demand conditions for their approval of a project – they can only say “yes” or “no” to an expansion request. However, LAFCO boardmembers can base their decision on the impact of the proposed expansion on the watershed. For instance, a LAFCO denied an annexation request by the City of Folsom because the local water agency maintained that there were not adequate water supplies to serve the new development.

LAFCOs can also offer guidelines such as the Ahwahnee Water Principles to potential applicants.

Councils of Government

A Council of Government (COG) has responsibility for producing transportation plans within its region. A COG in a region with poor air quality must also address air pollution or be threatened with the loss of its transportation funds.

COGs representing 80% of California residents have recently undertaken visioning exercises that address where and how their communities should grow. All have adopted a growth strategy that includes preservation of existing open space and a vision for compact, walkable, mixed-use communities.

Their legal mandate does not include water in the visioning process, but these processes offer an ideal opportunity to apply a regional approach to managing water resources.

Metropolitan Planning Organizations

Metropolitan Planning Organizations (MPOs) are the entities that administer federal transportation dollars. COGs often serve as the regional MPO. The Metropolitan Transportation Commission in the San Francisco Bay Area and the Sacramento Area Council of Governments (which serves as that region's MPO) provide financial incentives to cities and counties in their regions for concentrating growth around transit and for planning and building compact, mixed-use development. These same strategies are found in the first Ahwahnee Water Principle.

Resource conservation districts

Resource conservation districts are formed as independent local liaisons between local, state and federal government and landowners. California has more than 100 resource conservation districts, funded largely through grants and occasionally through county property tax revenues.

California's resource conservation districts are "special districts" organized under the state Public Resources Code, Division 9. Each district has a locally elected or appointed volunteer board of directors composed of landowners in the district. The districts address a wide variety of conservation issues, including watershed protection and water management.

Resource conservation districts can facilitate cooperation between local government and farmers, ranchers and other landowners. They have an expanding role in linking land use planning and water management. Several are extending their focus on agricultural issues in primarily rural areas to address a growing slate of concerns related to urban areas.

Many are also engaged in local land-use planning activities and watershed management. Many watershed coordinators are housed in local resource conservation districts, which make them a valuable resource for getting stakeholders to the table in planning and management processes.

Regional visions help planning for growth and water needs

■ Sacramento region uses visioning process to create a water-demand "blueprint"

The Sacramento Area Council of Governments (SACOG) has completed water-demand projections for the areas covered in the Sacramento Blueprint visioning process. SACOG planners worked with local water agencies to model water demand projections for each of the different scenarios that were envisioned.

The results indicate that the SACOG-preferred Blueprint Scenario, which advocates smart growth for the region, would generate less water demand than the status quo. In fact, analysis found that implementing smart-growth land use practices in the Sacramento region would net a 31% reduction in needs for the increment of anticipated growth. For more information: sacregionblueprint.org/sacregionblueprint

■ Northwest Colorado uses "natural" boundaries for regional water quality plan

Other COGs in the West are explicitly integrating water into their work. For example, the Northwest Colorado Council of Governments (NWCCOG), whose planning region includes portions of the Colorado River and the North Platte River watersheds, is taking a regional approach to developing a regional water quality plan. It became involved because the natural and planning boundaries of the region's watersheds "do not neatly correspond to the planning regions with respect to the Water Quality Management Plans." [61] For more information: www.nwc.cog.co.us/Programs/Water/water_quality_quantity_committee.htm

“California’s regions cannot meet all of their objectives with a single water strategy. Integrated regional water management is the future for California because it will help regions diversify their water portfolio strategies and get the most from local, state and federal resources and funding.”

— Lester Snow, Director, California Department of Water Resources

Many benefits grow out of watershed partnerships

■ Sun Valley watershed group creates flood protection and water supply solutions

The Sun Valley Watershed Stakeholders Group began meeting in 1998 under the leadership of the Los Angeles County Department of Public Works' Watershed Management Division, which was formed to create integrated solutions for flood protection, water supply and stormwater quality in the county.

The Sun Valley Watershed Management Plan was initiated "to solve the local flooding problem while retaining all stormwater runoff from the watershed, increasing water conservation, recreational opportunities, wildlife habitat and reducing stormwater pollution."

The planning process developed a set of alternatives that were evaluated according to the costs and benefits they provided for flood control, water quality, water conservation and total cost. The plan provides data and analysis to take a watershed-based approach to solving water management problems in one of California's most urbanized watersheds. For more information: www.sunvalleywatershed.org

■ San Diego County groups band together for collaborative watershed management plan

In 1998, a group including foundations, two conservancies and a resource conservation district signed a formal agreement to protect and improve the Carlsbad Hydrologic Unit through a collaborative watershed management plan. San Diego County and seven cities joined the effort, along with federal, state and regional government entities and nonprofit organizations. The project has been working to restore habitat and raising funds to acquire watersheds to protect them from development.



Watershed partnerships

Watershed partnerships, often called watershed councils, are formed when local watershed stakeholders come together to protect their watershed. These groups are engaged in a wide range of efforts to protect and restore the state's water resources and the watersheds that sustain them. These include local restoration efforts, data collection and monitoring, local education and outreach efforts, and providing a conduit between local government, landowners and citizens interested in protecting the watershed. Many are also involved in long-range planning and assessment projects to provide information that can affect policy and management decisions.

Not every community has an active watershed group, but there are currently more than 300 watershed groups in California.

Watershed groups are funded through local, state and federal sources. Most depend on state and federal grants matched by local funds. Recent state funding to promote community-based watershed efforts has come through CALFED's Watershed Program.

Propositions 40 and 50 (administered by the State Water Boards and the Department of Water Resources), the Non-

Point Source program 319 funds (as part of the Clean Water Act's Section 319) and the State Water Boards' revolving fund and community assistance grants are the primary funding sources supporting local watershed management efforts.

Many watershed councils and state officials are worried about future support for watershed projects as these funding sources end.

Federal funding has been available through the Department of Conservation's Watershed Coordinator Grant Program, which funds watershed coordinators through local resource conservation districts.

Watershed management plans have been developed over the years by watershed partnerships.

Integrated water management efforts

The State of California has developed an Integrated Regional Water Management Grant program, which has encouraged integrated regional strategies for managing water resources and provided grant funding for projects that protect communities from drought, protect and improve water quality, and reduce dependence on imported water. Several impressive regional projects have grown out of this effort.

Integrated Regional Watershed Management Plans

■ Southern California region eyes making its watershed drought-proof

The Santa Ana Watershed Project Authority covers a Southern California region projected to grow by 5-10 million residents in the next 50 years. The agency developed the Southern California Integrated Watershed Program as a series of projects that would be needed to achieve its goal of making the watershed drought-proof (by requiring no imported water during drought years). The intent is to complete this program within 10 years, providing that sufficient funding is acquired. The program includes a message to the planning community to "integrate watershed thinking into the everyday planning process." For more information www.sawpa.org

■ North Coast develops comprehensive plan to meet the region's shared water goals

The North Coast Integrated Regional Water Management Program is developing a comprehensive plan to increase cooperation between regional stakeholders in meeting shared water management goals. The program encourages projects that offer multiple benefits; are integrated with other regional efforts; and address water supply, water quality, wastewater, stormwater, flood control, watershed planning and aquatic habitat protection and restoration.



Improving coordination and collaboration among agencies responsible for managing water-related issues, including local land use agencies, is a key to achieving greater efficiencies. Additional benefits include the enhancement of public services and building of public support. The joint effort will also help to improve regional competitiveness for state and federal grant funding.

"The North Coast IRWMP's unique, multi-jurisdictional approach has brought together agencies dealing with water supply, water quality and land use planning," said Rohnert Park Councilmember Jake Mackenzie, the North Coast program's vice chair. "The process relies heavily on the leadership of local elected officials, as well as extensive critical review by an advisory board representing all seven counties. It has brought about an amazing amount of communication between the counties and water management agencies." For more information: www.northcoastirwmp.net

Implementation Principle 3 – Integrated solutions achieve multiple benefits

The best, multi-benefit and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.

Many of the strategies outlined in the Ahwahnee Water Principles have more than one benefit. Whenever possible, strategies should be chosen that provide two-fers, or better.

For example, putting up a levee will help prevent flooding, but it is not effective as an Ahwahnee Principle strategy that both prevents flooding and replenishes groundwater supplies.

The first community water principle suggests that we develop our cities in a compact manner so that automobile-generated urban runoff pollutants are minimized and open lands are

preserved. This strategy is not only better for the community water supply, it also reduces air pollution and provides the walking and biking opportunities that help our populations incorporate healthy physical activity into their daily lives.

Ideally, planners and developers will apply all the Ahwahnee Water Principles, including natural drainage systems, the use of permeable surfaces, water-conserving landscapes, and water-conserving toilets. Integrating these measures achieves the maximum benefit.

Less expensive recycled water reduces threat of floods



Communities whose treated sewage empties into the Russian River – a Northern California river that is very prone to flooding – have accomplished two community benefits by using recycled water to irrigate landscapes. First, recycled water is less expensive than potable water, so the community and its residents save money. Second, by keeping wastewater out of the river, the threat of flooding during heavy periods of rain is reduced. While beefing up the area's levees may be effective in an emergency, diverting water from the area for productive uses also has more benefits in the long term.

Combining smart growth and low-impact development

The City of Ventura uses an infill-first strategy to avoid urban sprawl and minimize the impacts of development on local watersheds. Mixed-use, multi-story buildings replace small, dilapidated buildings currently surrounded by large parking lots. Underground parking lots, retail on street level and residences or offices on the upper floors now serve to reduce the development's impervious footprint. New developments are also conditioned with the goal of mimicking a site's pre-development hydrology. Design techniques manage runoff throughout the development. These structures retain, infiltrate, filter, store and evaporate, and detain runoff close to its source. Preferred conditions emphasize the use of grassy swales and depressed landscape areas. The result provides a range of benefits to the community and the environment. Landscaped areas help capture runoff and recharge groundwater, open space and agriculture remain intact, and pedestrian activity increases while fewer car trips are made. For more information: Vicki Musgrove, City of Ventura, (805) 652-4518

Inland Empire headquarters combines a variety of water- and energy-efficient measures

The Inland Empire Utilities Agency's LEED Platinum headquarters, located in Chino, integrates components of all of the community Ahwahnee Water Principles. The 22-acre Chino Creek Park, which abuts the agency's headquarters, serves as a regional community park dedicated to reestablishing the river's ecological function and native wildlife ecosystem.

The centerpiece is the restoration of approximately 16 acres of riparian habitat and wetlands, which will improve runoff water quality and benefit endangered species. Minimal grading during the construction of the building also helped preserve natural landscape features and promote natural drainage capacity. The two-acre headquarters site was planted with native, drought-tolerant trees and shrubs to create a natural setting for songbirds and other species.

Designed to manage a 25-year storm on-site, the project integrates sustainable stormwater solutions including permeable paving, bioretention basins, swales and disconnected roof spouts. Using these low-impact development techniques instead of conventional stormwater infrastructure netted a savings of more than \$1.4 million in capital costs.

Combining several water-conservation strategies has reduced potable water demand by 73%. Native and drought-tolerant landscaping is irrigated with highly efficient 'smart' irrigation controllers using reclaimed graywater. Inside the building, dual-flush toilets and ultra-low-flow urinals use 100% recycled water from the agency's treatment facilities and use 27% less water than conventional toilets and urinals. Faucet aerators reduce limit flow to 0.5 gallons per minute.

Wastewater treated at the processing plant not only irrigates all landscaped areas, it will soon supply water to neighboring farms and industry where potable water is not needed. Water from the treatment process is also reclaimed and used for industry and for recharging regional aquifers.



Integrated groundwater program reduces Chino Basin's dependence on imported water

The Chino Basin Recycled Water Groundwater Project integrates stormwater management and water supply enhancement strategies to solve multiple problems. The project is part of the comprehensive Water Supply Enhancement Program sponsored by the Inland Empire Utilities Agency, Chino Basin Watermaster, Chino Basin Water Conservation District and the San Bernardino County Flood Control District.

It aims to reduce dependence on expensive imported water supplies and provide a local drought-proof supply of new water for the Chino Basin. The project will blend high-quality stormwater and recycled water to recharge the groundwater basin. It offsets the need for approximately 16,000 acre-feet of imported water, saving about \$4 million per year in imported water purchases, and provides reliable water supplies to meet future growth without any significant increase in water and sewer rates. For more information: (909) 993-1600 or www.ieua.org/RecycledGroundwater.html

Implementation

Principle 4 – Public involvement and stakeholder collaboration

From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information.

The participatory process should focus on ensuring that all residents have access to clean, reliable and affordable water for drinking and recreation.

Planning professionals, with their training and experience, are invaluable to the planning process. They cannot, however, be expected to foresee and understand every variable that may affect a project's outcome. On the other hand, residents may lack a thorough understanding of the principles and processes of planning, but they do bring valuable information and perspectives to the table.

The Public Policy Institute of California found that the quality of Urban Water Management Plans created by municipal water suppliers was significantly improved when the planning process included broad-based public participation and outreach. [62]

A proactive planning process, which includes a well-designed public involvement component, encourages individuals to consider the big-picture question of whether or not a proposed plan will enhance or damage the quality of life in the neighborhood and region in which it is built. It allows the community to make decisions based on shared goals and values.

Such a process allows participants to understand exactly what they are getting, assuring better public approval at build-out. Projects that develop strong public buy-in through participation are less likely to experience delays due to public opposition.

By involving residents in the planning process, a planning team can ensure that plans will have a long-lasting and stable constituency. Finally, a well-designed public process can renew the diminishing faith in government.

“Out of our effort in Pasadena to have thousands of residents in the community participate, came the seventh principle of the new general plan: Public participation will be a perma-

nent part of achieving a greater city,” according to Rick Cole, Pasadena's former mayor. “(Pasadena's) Seventh Principle has changed government, making it more open, responsive and effective. It has also raised the level of trust among residents – not trusting in City Hall, but trusting that they own City Hall.”

New public participation tools

Many advances in technology are making it easier to involve the public in complex decisions, including computer simulation and geographic information systems.

Computer simulations allow the designer to produce a fairly accurate image of a proposed project. They help the public feel comfortable that they understand what they are going to get in the end.

Geographic Information Systems (GIS) allow complex spatial information to be displayed in the form of colored maps. They allow the users to envision various land use alternatives and understand their potential economic, social and environmental impacts. The result is a far more information decision-making process.

The Local Government Commission has also successfully employed a more low-tech approach called the Community Image Survey. This tool helps participants in a planning process understand their choices: Would they prefer a wide residential street or a narrow one? A mall or a town center? Contrasting photographs give participants the chance to choose what they would prefer. Results are tallied and the group's preferences are announced and incorporated in the proposed plan.

Implementation

Principle 5 – Evaluate and adapt

Plans, programs and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices.

Too often, plans end up on the shelf, programs are implemented and yet not completed, and policies don't achieve their intended outcomes. Monitoring and evaluation are important aspects of planning and implementation that ensure plans are effective, and that policies and programs are implemented and achieve results.

Because resources are required to evaluate the effects of public policy, this crucial task is not often undertaken. However, to assure that community policies are effective, evaluation is important. Evaluation also allows for adaptation so that policies and programs can evolve with the times.

Evaluation and monitoring should be based on good data and an open, ongoing dialogue between staff, elected leaders and the public. Natural resource managers call this "adaptive management," an approach that allows on-going refinement of policies so that decisions will reflect lessons learned and address current needs and issues.

Evaluation can take many forms. It can involve the collection of monitoring data, such as water quality indicators, to determine the effectiveness of a given program. It can also involve community surveys, public meetings and focus groups to gauge the public's view of a particular policy or program. The specific form and methodology depends on the situation, but it is always advisable to apply the resources needed to evaluate city or county programs.

A well-designed evaluation and monitoring program will:

- Establish measurable goals and objectives.
- Provide a framework for assessing project performance.



- Identify measures that can be used to monitor progress toward achieving project goals.
- Provide information to help improve current and future projects.
- Maximize the value of public expenditures to achieve environmental results.

Levels of evaluation

A project can be evaluated on a number of levels, and a range of evaluation models have been developed for different needs. One key of all of these strategies is that evaluation needs to be conducted from start to finish in any project.

It is best to start evaluation before a project is developed or implemented. Often called a "needs assessment," this form of evaluation allows decision-makers to see what problems need to be addressed before they try to solve them. This

seems obvious, but assessing the needs that a given policy solution is meant to address is rarely done.

Once it is clear what needs to be done and a policy solution is developed, goals can be set. Setting goals and milestones for meeting those goals is a vital step in developing and implementing effective policies and programs. Goals clarify the intention of the program, policy or project being implemented, and help the community know what to expect.

The next level of evaluation should occur throughout the development of the policy or program being implemented. Identifying baseline data – whether it is quantitative or qualitative – provides a gauge for measurement. As the policy is implemented, progress can be checked against baseline information to see if it is working.

This level of evaluation is critical because it allows us to identify problems and adapt solutions to stay on course to reaching the intended goal.

Finally, evaluation should occur at the conclusion of a project. Once the project, program or policy has been implemented or built, it is important to measure its effectiveness. This helps to determine whether the desired outcome was met and what lessons were learned that could be applied to future decisions.

It also allows elected leaders to gauge the return on investment – whether the benefits are worth the costs. This is hard to determine if measurable goals have not been set.

Southern California studies demonstrate cost and water savings from weather-based irrigation controllers

In 2001, the Irvine Ranch Water District, the Municipal Water District of Orange County and the Metropolitan Water District of Southern California completed a small-scale study of weather-based evapotranspiration (ET) irrigation controllers. Water demand and runoff from 40 controllers installed in Irvine's Westpark residential neighborhood were measured. Water savings averaged 37 gallons per day, or 7% of total household water use.

Based on these findings, the Irvine Ranch and Orange County districts partnered on another project, the Residential Runoff Reduction (R3) Study. The study had four primary purposes:

- Test the use of weather-based irrigation technology, also known as ET controllers, to manage irrigation water for residential homes and large landscape areas.
- Evaluate the effectiveness of a targeted education program on residential homeowners.
- Determine the correlation between proper water application in landscape irrigation and the quantity and quality of urban dry-season runoff.
- Gauge the acceptance of water management via the controller technology.

For more information: www.irwd.com/Conservation/water_conservation_research.php

Selected Resources

■ Principle 1: How we grow

The Local Government Commission (www.lgc.org) has developed several resources to help communities encourage compact growth through redevelopment, infill and other design strategies:

- Building Livable Communities: A Policymaker's Guide
- Street Design Guidelines for Healthy Neighborhoods
- Smart Growth Zoning Codes: A Resource Guide
- Compact Development Compact Disc: A Toolkit to Build Support for Higher Density
- Creating Great Neighborhoods: Density in Your Community

The Greenbelt Alliance, "Smarter Infill" (www.greenbelt.org)

U.S. EPA guides for using smart growth as a water management strategy (www.epa.gov/smartgrowth):

- Protecting Water Resources with Smart Growth
- Using Smart Growth Techniques as Stormwater Best Management Practices
- Protecting Water Resources with Higher Density Development
- National Management Measures to Control Nonpoint Source Pollution from Urban Areas
- Growing toward More Efficient Water Use: Linking Development, Infrastructure, and Drinking Water Policies



The EPA's model Phase II stormwater permit with language for smart growth strategies as stormwater best management practices: www.epa.gov/npdes/pubs/modpermit.pdf

■ Principle 2: Where we grow

The Center for Watershed Protection (www.cwp.org) hosts many articles and online tools.

The EPA's many resources on watershed protection practices include build-out tools (www.epa.gov/greenkit/2tools.htm) and source water protection plans (www.epa.gov/safewater/protect.html).

The Trust for Public Land published "Protecting the Source" on regional source water protection efforts: www.tpl.org/tier3_cd.cfm?content_item_id=1337&folder_id=195

Nonpoint Education for Municipal Officials (NEMO) has developed resources on "Natural Resource Based Planning:" www.nemonet.uconn.edu



■ Stormwater management

The EPA's National Menu of Stormwater Best Management Practices provides guidance for all six minimum control measures required for municipal (MS4) NPDES permits: <http://cfpub.epa.gov/npdes/stormwater/menuofbmps>

California's State Water Board (www.swrcb.ca.gov) is an important resource for current regulatory information and links to regional board web sites. Its stormwater program's Post Construction Runoff Control web page has links to low-impact development documents: www.swrcb.ca.gov/stormwtr/post_construction.html

The State Water Board's Nonpoint Source Pollution Control Program (www.swrcb.ca.gov/nps) has produced the California Nonpoint Source Encyclopedia: www.swrcb.ca.gov/nps/encyclopedia.html

■ Principles 3-4-5: Low-impact development

The California Stormwater Quality Association (www.casqa.org) assists the State Water Board and communities to implement the National Pollutant Discharge Elimination System (NPDES) stormwater mandates.

The LID Center has information and technical tools on the selection and use of low impact development best management practices: www.lowimpactdevelopment.org/epa03/biospec.htm

The Bay Area Stormwater Management Agencies Association developed “Start at the Source – Design Guidance Manual for Stormwater Quality Protection.” For this and other documents: www.basmaa.org/documents/index.cfm?fuseaction=documents&doctypeID=3

■ Principle 4: Water-wise landscaping

StopWaste.Org has a good example of a guide – “Bay Friendly Landscape Guidelines” – that cities and counties can develop with local water suppliers to educate the public about water-efficient landscaping.

The California Urban Water Conservation Council works to integrate water conservation’s best management practices into the planning and management of California’s water resources. Its web site (www.cuwcc.org) contains technical resources and a standard set of best management practices that the Council regularly updates as new practices evolve.

The Department of Water Resources’ Landscape Water Use web site includes California’s Model Water Efficient Landscape Ordinance and the “Water Use Classifications of Landscape Species” guide for selecting plants and planting

materials, and developing irrigation schedules for existing landscapes: www.owue.water.ca.gov/landscape/faq/faq.cfm

■ Principle 4: Trees and urban forestry

Many resources on tree selection and benefits are available:

- The Local Government Commission’s fact sheet on “Livable Communities and Urban Forests” highlights the economic, public health and environmental benefits provided by trees: www.lgc.org/environment/trees.html
- American Forests’ City GREEN software is a useful tool for analyzing cost savings: www.americanforests.org
- The U.S. Forest Service’s Center for Urban Forest Research (CUFR) at UC Davis hosts a web site with up-to-date research and technical guidance: www.fs.fed.us/psw/programs/cufr
- The LGC and CUFR have developed tree guidelines for California’s San Joaquin Valley, Southern Coast and the Inland Empire regions: www2.lgc.org/bookstore/list.cfm?categoryID=2

■ Principle 5: Minimize impervious surface cover

The Congress for New Urbanism and the Institute of Transportation Engineers have produced an arterial-street design guide to accommodate pedestrians: www.cnu.org

U.S. EPA’s Parking Spaces/Community Spaces: www.epa.gov/smartgrowth

Portland’s Metro developed a regional street design manual, specifying stream treatments, street width and associated water quality benefits: www.metro-region.org



Many of the resources listed in the low impact development section offer solutions for minimizing paved surfaces and using permeable alternatives.

The Local Government Commission (www.lgc.org/freepub) has developed several useful resources, including two related to reducing impervious surfaces through street design:

- Emergency Response and Narrow Streets
- New Thinking for a New Transportation Age

■ Principle 6: Graywater

Graywater Central web site (hosted by Oasis Designs): www.graywater.net

California’s graywater standards: www.owue.water.ca.gov/docs/Revised_Graywater_Standards.pdf

City of Santa Monica’s Graywater Guidelines: santa-monica.org/epd/residents/Water/graywater.htm

City of Malibu’s Graywater Handbook: www.ci.malibu.ca.us/index.cfm?fuseaction=detailgroup&navid=274&cid=2949

WateReuse Association: www.watereuse.org/ca/index.html

■ Principle 7: Recycled Water

WaterReuse Association model recycled water ordinance (California): www.watereuse.org/ca/modelwrord.htm

Department of Water Resources' 2005 Water Plan Update Sections 12—Matching Water Quality to Use and 16—Recycled Municipal Water: www.waterplan.water.ca.gov/cwpu2005/index.cfm#vol2

The State Water Board's Office of Water Recycling has important information about the use and development of recycled water as well as information on funding programs to help communities get recycling: www.swrcb.ca.gov/recycling

California Recycled Water Task Force documents and findings: www.owue.water.ca.gov/recycle/taskforce/taskforce.cfm

South Bay Water Recycling Rules and Regulations: www.sanjoseca.gov/sbwr/rulesandregulations.htmf

WaterReuse.org: www.watereuse.org

WaterReuse Technical Resources: www.watereuse.org/techres.htm

Department of Water Resources' Water Recycling and Desalination Program: www.owue.water.ca.gov/recycle/index.cfm

U.S. EPA Guidelines for Water Reuse: www.epa.gov/ORD/NRMRL/pubs/625r04108/625r04108.htm

West Basin Municipal Water District's Recycled Water User Manual: www.westbasin.org/pdf/Recycled_Water_User_Manual.pdf



■ Principle 8: Water conservation

The California Urban Water Conservation Council is a 350-plus member partnership of urban water agencies, public interest organizations and private entities working to increase efficient water use through integration of urban water efficiency Best Management Practices into the planning and management of California's water resources. These BMPS are regularly updated to reflect the most effective and current practices: www.cuwcc.org

Bewaterwise.com provides a range of water conservation information from the family of Southern California regional water agencies, including information on landscaping, native plant use and a watering index.

The Association of California Water Agencies has abundant information on current and pending legislation, and several resources on a range of water issues: www.acwa.com



The Department of Water Resources' Office of Water Use Efficiency provides support for the stewardship of California's water resources and energy-efficient use of water: www.owue.water.ca.gov

www.h2ouse.org provides a virtual home tour of a model water-saving home.

The Pacific Institute has research publications on the use and potential of urban water conservation: www.pacinst.org

■ Principle 9: Cleaning up groundwater supplies

The Water Education Foundation has resources on groundwater and many other topics: www.water-ed.org

The Department of Water Resources (www.water.ca.gov) has information on desalination in the 2005 Water Plan Update: www.waterplan.water.ca.gov/cwpu2005/#vol2

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Appendix A. The Model Water Element

Communities often have water-related policies interspersed throughout various elements of their General Plan because many aspects of the community's development and well-being are linked to water. Including a separate water element in the General Plan will help communities coordinate land use practices with the protection and management of water resources.

A stand-alone water element indicates a community's commitment to protecting local and regional water resources. Combining water-related policies and information in one place also allows for more integrated solutions and makes that information more accessible to the public. Once established, water element policies can be interspersed throughout other General Plan elements and planning documents.

Having water information and policies in a single place can also streamline compliance with requirements for National Pollutant Discharge Elimination System (NPDES) permits, SB 610 supply assessments and SB 221 supply verification.

This Model Water Element provides a policy framework to address the links between water and land use, and builds upon the watershed-based approach of the Ahwahnee Water Principles and the rest of this guidebook.

Watershed-based policy solutions provide the opportunity to build on the connectivity between the hydrological, ecological and social elements of watersheds. Surface water and

groundwater are connected; water quality and supply are connected. Increasingly, our ability to grow as a community is a function of how the use and quality of water is managed. These policies, like the Ahwahnee Water Principles, strive to protect or restore the health and function of watersheds.

Sample Policy Language

The policy language provided in the Model Water Element has been taken from existing General Plans and other planning documents from around the state. Some local governments already have developed — or are developing — water elements for their General Plans. The State Office of Planning and Research also provides a chapter on developing a water element in its 2003 General Plan Guidelines (www.opr.ca.gov/publications/#pubs-G).

In addition to precise policy language, the Model Water Element provides “ideas for data and analysis” about integrating water into planning documents. It is also a helpful resource for communities that are not developing a stand-alone water element, but are looking to address water resource issues within their land use decision-making processes.

Each section of the Model Water Element also provides a set of policies and actions to support implementation. These are primarily program measures that address coordination and

collaboration, public involvement, education and outreach, incentives, and monitoring and assessment.

These measures can make the difference between plans that are left on the shelf and those that are put into action. They build local and regional capacity to respond to needs with effective and adaptive policy solutions, and will help earn the trust and support of local residents and neighboring communities.

The following sample policies in the Model Water Element are arranged in three sections:

- 1 Watershed protection and management**
- 2 Protecting and improving water quality**
- 3 Managing supply and demand of water resources**

While each section contains policies to address particular subjects, most water issues (and policies) are interrelated — and therefore difficult to limit to one category.

Watershed-based policy solutions take advantage of these linkages, and are especially effective when used in a coordinated manner to address several water quality, supply and flood management concerns. Similarly, policies intended to protect water quality can also augment water supplies, and help maintain essential watershed processes.

Watershed protection and management

These policies address how and where development occurs within a watershed. Many of them encourage community design that minimizes the impact and overall footprint of a community or a development project using smart growth techniques to create a compact, walkable design with mixed uses, a range of transportation options and a well-connected street network.

Other policies outlined in this appendix seek to protect natural areas and ecological systems to better maintain watershed processes. Taken together, these approaches are geared toward minimizing impacts from development and preserving watershed health to ensure sustainable water supplies, reduce flood risks and protect natural values.

Ideas for data and analysis

Compiling pertinent information about local natural resource conditions — such as floodplain maps, soils, local water bodies and important habitat or ecological areas — is typical in General Plans. This information is also useful for analyzing watershed conditions and can be supplemented with other data about local watersheds, including watershed boundaries, aquifer recharge areas, soil permeability and existing land uses related to the watershed(s).

In many places, local watershed councils or other groups have completed a watershed assessment that can provide a foundation for watershed-based policy solutions. These assessments typically include:

- A delineation of watershed boundaries.
- An inventory of important hydrologic features, such as rivers, lakes, groundwater basins, floodplains, riparian zones and estuaries.
- A discussion of the basic water resources and services that these features provide, including sufficient clean water, aquifer recharge, pollutant filtering and flood protection.
- A discussion of related resources such as fisheries, forestry, agriculture and recreation that are sustained by the watershed.

A water resource inventory should link water-related information to existing land uses and infrastructure. It should identify existing and projected water supply sources and analysis of projected demands. It may be possible to obtain this information from Urban Water Management Plans prepared by water suppliers. Local government can partner with water agencies and/or watershed groups to develop this information as part of a comprehensive watershed assessment that links data about water supply, demand, quality and land uses in the watershed.

Geographic Information Systems (GIS) is a very useful format for collecting and analyzing watershed data. GIS maps and data can be coordinated with other planning maps. Many communities already have many of the data layers needed, while others are available through state sources. A GIS's visual format allows planners, developers and the public to “see” the relationship between watershed features and functions, and zoned land uses. It also enables analysis of policy solutions using more sophisticated modeling techniques.

A. Compact development

These policies encourage compact development that mixes uses and supports multi-modal transportation options. Compact development can minimize the impact of new growth on water resources by reducing the community's footprint and allowing preservation of the watershed. Multi-modal transportation can reduce water pollution from cars, minimize the need for transportation-related impervious surfaces, and support compact development.

■ County of Los Angeles General Plan

Promote infill development to take full advantage of the existing capacities of public services and facilities.

Promote development of vacant infill sites at higher intensity, recycle underutilized sites, and advocate the cleanup, redevelopment and reuse of brownfield (potentially polluted) sites.

Promote compact, walkable, well-designed mixed-use development in and adjacent to employment and transit centers and commercial corridors to provide convenient access to jobs, shopping and services.

Promote ordinances that initiate transit-oriented development along bus and rail transit corridors.

Promote land use that encourages multi-modal transit nodes in unincorporated areas.

■ County of Riverside General Plan

Re-plan existing urban cores and specific plans for higher - density, compact development as appropriate to achieve the Riverside County Integrated Project Vision.

Concentrate growth near community centers that provide a mixture of commercial, employment, entertainment, recreation, civic and cultural uses to the greatest extent possible.

Concentrate growth near or within existing urban and suburban areas to maintain Riverside County's rural and open space character to the greatest extent possible.

Site development to capitalize upon multi-modal transportation opportunities and promote compatible land use arrangements that reduce reliance on cars.

■ City of Livermore Land Use Element

Encourage the clustering of development to minimize its overall footprint in areas of ecological sensitivity, such as hillsides, alkali springs, creek corridors and watersheds.

■ Santa Monica Sustainable City Plan

Implement land use and transportation planning and policies to create compact, mixed-use projects, forming urban villages designed to maximize affordable housing and encourage walking, bicycling and the use of existing and future public transit systems.

■ City of Chico General Plan

Maintain and enhance a strong pedestrian scale and orientation within the downtown through the design of buildings and streets.

■ City of Windsor General Plan

Streets, paths and greenways connect the town and constitute the most basic civic open space. Their design should consider the needs of pedestrians and bicyclists, as well as cars, and contribute positively to the town's identity.

■ City of San Diego General Plan

Design an interconnected street network within and between communities, which includes pedestrian and bicycle access, while minimizing landform impacts.

B. Natural resource protection and watershed management

Protection of important natural areas, which is critical to watershed protection, is facilitated by compact land-use patterns that compact development policies create, but it also requires policies that ensure key areas are sufficiently protected and managed. This includes policies for wetland and stream protection, buffer and setback standards, and the acquisition and protection of open space to serve these purposes.

■ City of Thousand Oaks

Protect remaining floodplains to help retain stormwater runoff from tributary watersheds and reduce the potential for periodic flooding within downstream reaches of the Arroyo Conejo and Calleguas Creek.

■ City of Arcata General Plan

Ecological systems and natural processes are not to be disrupted by land use activities to a significant degree (e.g., a culvert or other drainage device that blocks fish passage).

An "adaptive management" approach shall be used to maintain ecological and biological integrity, including monitoring the status of ecological systems in the city and adjusting City implementation of the plan, to more closely approximate the conditions provided in the planning area's least-disturbed natural ecosystems.

Streamside Protection Areas (SPA) are established along both sides of the streams identified on the City Watercourse Map. These areas shall remain in a natural state to protect the streams' ecosystems and their associated riparian habitat areas. The SPA shall include:

- 1 In areas where existing development, as defined in the Land Use Code, is adjacent to the stream, the SPA shall be not less than 25 feet outward on both sides of the stream, measured from the top of bank.
- 2 In all other locations within the city, the SPA shall be not less than 100 feet outward on both sides of the stream, measured from the top of bank.
- 3 In locations within the city having significant areas of riparian vegetation exceeding 100 feet in width measured from the top of bank, the SPA shall be expanded to encompass all of the riparian vegetation, except in no case shall the SPA exceed 250 feet in width from the top of bank on either side of the stream.

Maintenance of streams as natural drainage systems: Arcata's creeks carry a significant amount of the city's stormwater. Drainage controls shall be enforced through implementation of the Drainage Master Plan, to protect water quality, and minimize erosion, sedimentation and flood impacts to city creeks. A comprehensive stream maintenance program shall be prepared to augment stormwater utility rehabilitation projects designed to improve flow capacity, minimize channel erosion, and enhance riparian habitat.

■ City of San Luis Obispo

Wetlands and associated wetland buffers are to be preserved as open space, and maintained in a natural state to protect the community's water quality, wildlife diversity, aesthetic values and recreation opportunities.

Wetlands are to be protected from development impacts by requiring a wetland buffer around these areas. The wetland buffer should: (1) be located between the wetland and proposed, existing or potential development; (2) be of a sufficient width and size to protect the species most sensitive to development disturbances and to compensate for project impacts as determined by a qualified biologist during the initial planning phase of development; and (3) be designed to complement the habitat value of the wetland resource.

■ County of Los Angeles General Plan

The goal is effective management of watersheds, which balances growth and development with resource conservation, flood hazard mitigation, habitat preservation and water quality protection.

Support the preparation and implementation of Watershed and River Master Plans to enhance aquatic habitats, promote recreational opportunities, and restore natural features.

Conserve, restore and monitor wetlands and other riparian habitats to preserve the natural hydrologic conditions and associated biotic habitats that support the wetland function.

Support the preservation, restoration and strategic acquisition of open space to preserve natural streams and drainage channels, which are necessary for the healthy function of watersheds.

■ City of San Diego General Plan

Apply the appropriate zoning and environmentally sensitive lands regulations to limit development of floodplains, wetlands, steep hillsides, canyons and coastal and waterfront lands.

■ City of Ventura General Plan

Require that sensitive wetland and coastal areas be preserved as undeveloped open space wherever feasible and that future developments result in no net loss of wetlands or "natural" coastal areas.

■ City of Livermore General Plan

Conserve the value and function of Livermore's open space as a biological resource.

Require appropriate setbacks, to be determined in coordination with resource agencies, LARPD, EBRPD and other responsible agencies, adjacent to natural streams to provide adequate buffer areas that ensure the protection of plant and animal communities.

■ City of Santa Cruz General Plan

Minimize the impact of development upon riparian and wetland areas through setback requirements of at least 100 feet from the center of a watercourse for riparian areas and 100 feet from a wetland. Include all riparian vegetation within the setback requirements, even if it extends more than 100 feet from the watercourse or if there is no defined watercourse present.

■ City of Fresno General Plan

The city will continue to support the concept of a regional river parkway system in the river bottom, in coordination

with Fresno County, Madera County, public interest groups, property owners and the State of California.

■ City of Grass Valley General Plan

Establish open space easements along riparian corridors.

C. Vegetation protection and management

These policies address the use and protection of trees or natural vegetation for maintaining watershed processes, and the management of landscaping and urban forests in developed parts of the watershed. These policies overlap with those in other sections, including policies about construction practices and water quality.

■ City of Chico General Plan

Protect and enhance the urban forest that reinforces the image and identity of the community and its older neighborhoods.

■ City of San Luis Obispo Draft General Plan

Protect, preserve and create the conditions that will promote the preservation of significant trees and other vegetation, particularly native California species.

■ City of Livermore General Plan

Conserve Livermore's native trees and vegetation, which are important biological resources within the planning area.

Require new developments to incorporate native vegetation into their landscape plans, and prohibit the use of invasive non-native plant species. Propagules (seeds or plants) of native plants shall be from native sources.

■ City of Woodland General Plan

The City shall require that new development preserve natural woodlands to the maximum extent possible.

D. Sustainable site preparation practices

The site preparation phases of development can be among the most detrimental to water resources. It is also during these phases that on-site environmental features – soils, topography and vegetation – can either be protected for their value as “green infrastructure” or degraded. The dredging and filling of wetlands and streams, and intensive grading and vegetation removal, alters site hydrology and creates downstream impacts on water resources.

The following policies are designed to minimize the impacts of site preparation practices and promote the protection of on-site environmental features as natural water resource infrastructure for their benefit to the new development.

■ City of Livermore General Plan

Grading and excavation in woodland areas shall avoid disturbances to subsurface soil, water or rooting patterns for natural vegetation.

The use of “green construction” and land development techniques shall be encouraged as a means to reduce the environmental impacts of construction activity.

Encourage all additions and new development to follow green building practices for design, construction, and operation and to incorporate as many LEED prerequisites and credits as feasible.

■ City of Rohnert Park General Plan

Require new construction to utilize site preparation, grading, and foundation designs for erosion control to prevent sedimentation and contamination of streams.

■ City of Malibu Local Coastal Program Land Use Plan

New development shall protect the absorption, purifying and retentive functions of natural systems that exist on the site. Where feasible, drainage plans shall be designed to complement and utilize existing drainage patterns and systems, conveying drainage from the developed area of the site in a non-erosive manner. Disturbed or degraded natural drainage systems shall be restored, where feasible, except where there are geologic or public safety concerns.

■ City of Santa Cruz General Plan

Require site design and erosion control measures in areas subject to erosion hazards or adjacent to streams and wetland areas to minimize grading activities and vegetation removal.

E. Policies and programs to support implementation

■ County of Sonoma Draft General Plan – Water Resources Element

Correlate the quality and quantity of water captured, stored and contained within each unique watershed to the needs of beneficial water uses by all county residents, local industry, agriculture and the natural environment.

Encourage and support research on and monitoring of local groundwater conditions, aquifer recharge, watersheds and streams.

Where a problem has been identified, promote and seek funding to evaluate and remediate it through a watershed management approach.

Work with the Regional Water Quality Control Boards, watershed groups and stakeholders in the collection, evaluation and use of watershed-specific water resource information.

■ Riverside County General Plan

Allow techniques, such as incentives, transfer of development credit programs or other mechanisms, to achieve more efficient use of land.

Allow development clustering and/or density transfers in order to preserve open space, natural resources and/or biologically sensitive resources.

■ County of Los Angeles General Plan

Promote improved inter-jurisdictional coordination of land use and transportation policy matters between the county, cities, adjacent counties, special districts and regional and subregional agencies.

■ County of Inyo General Plan

Work with federal and state agencies, local districts, utilities (LADWP) and Native American tribes to ensure that the County and the public are involved early in any planning process and that routine feedback and public input is requested.

Water quality

Land use development significantly impacts water quality. These water quality policies aim to mitigate development impacts and protect and improve the quality of water for domestic, environmental, agricultural and other uses.

The growing need for high-quality drinking water supplies, new water quality regulations, public health risks and environmental values are just a few of the reasons to institute local policies to ensure water quality.

Full-scale water quality protection is linked to the watershed protection policies in the preceding section as well as the water supply policies in the subsequent section.

Ideas for data and analysis

Any existing water-quality monitoring data from water purveyors, watershed councils or government agencies can be included and may be useful to provide baselines for evaluating the effectiveness of programs and policies.

Specific local water quality impairments (TMDLS) and threats, such as specific discharge points, should also be identified and related to the supply sources they might impact (for example, MTBE as a threat to groundwater supplies).

An increasing number of communities are analyzing development patterns to manage stormwater quality by mapping impervious surface areas and using modeling to project water-quality impacts likely to occur from different development decisions.

A. Stormwater management

Municipal stormwater permits under the National Pollutant Discharge Elimination System (NPDES) program require communities to address the impacts of development on stormwater quality.

The planning and design stages of development offer some of the best opportunities for incorporating effective stormwater best management practices. Regulated communities need to develop Stormwater Management Programs that include measures for addressing the post-development impacts of stormwater runoff.

Addressing stormwater in the General Plan and other planning documents also assures that land use planning and stormwater management efforts are coordinated and not contradictory.

Stormwater management requires regional and site-scale policies. The following policies are therefore linked to watershed protection policies as well as water-supply policies for treating stormwater as a local supply source.

■ Santa Monica Municipal Code

The following urban runoff reduction requirements shall apply to all persons submitting applications for new development within the city.

When an application is submitted for a new development project, the applicant shall be required to submit an Urban Runoff Mitigation Plan to the Department of Environmental and Public Works Management.

In developing an Urban Runoff Mitigation Plan, the applicant shall infiltrate or treat projected runoff for the new development by an amount equal to or greater than the volume of runoff produced from a storm event through the incorporation of design elements.

The design elements used by an applicant may, but are not required to, include the following:

- 1) Maximize permeable areas to allow more percolation of runoff into the ground through such means as:
 - a) Biofilters;
 - b) Green strips;
 - c) Swales.

The use of permeable materials in lieu of or to replace hardscapes will increase the amount of runoff seepage into the ground.

- 2) Maximize the amount of runoff directed to permeable areas and/or maximize stormwater storage for reuse or infiltration by such means as:
 - a) Orienting roof runoff towards permeable surfaces, drywells, French drains or other structural best management practices (BMPs) rather than directly to driveways or non-permeable surfaces so that runoff will penetrate into the ground instead of flowing off-site.
 - b) Grading the site to divert flow to permeable areas.
 - c) Using cisterns, retention structures or green rooftops to store precipitation or runoff for reuse.
 - d) Removing or designing curbs, berms or the like so as to avoid isolation of permeable or landscaped areas.

- 3) Remove pollutants through the installation of treatment control BMPs.
- 4) For purposes of compliance with this [Santa Monica] Section, pools, hot tubs and spas shall be considered impermeable surfaces.
- 5) The Urban Runoff Mitigation Plan must also include the applicant's plan for the maintenance of all BMP's requiring ongoing maintenance.
- 6) All Urban Runoff Mitigation Plans must include the applicant's signed statement accepting responsibility for all structural and treatment control BMP maintenance. The transfer of property subject to an Urban Runoff Mitigation Plan must include as a written condition to the transfer that the transferee assumes full responsibility for maintenance of any structural, and/or source or treatment control BMPs.

■ City of San Luis Obispo General Plan

The City will employ the best available practices for pollution avoidance and control, and will encourage others to do so. "Best available practices" means behavior and technologies that result in the highest water quality, considering available equipment, life-cycle costs, social and environmental side effects, and the regulations of other agencies.

■ City of Ventura General Plan

Require new developments to incorporate stormwater treatment practices that allow percolation to the underlying aquifer and minimize offsite surface runoff using methods such as pervious paving material for parking and other paved areas to facilitate rainwater percolation and retention/detention basins that limit runoff to pre-development levels.

Require stormwater treatment measures within new development to reduce the amount of urban pollutant runoff in the Ventura and Santa Clara Rivers and other watercourses.

Use natural features such as bioswales, wildlife ponds and wetlands for flood control and water quality treatment when feasible.

■ City of Santa Clara General Plan

Maximize water retention and reduce the quantity of water runoff.

■ City of San Jose General Plan

To preserve and enhance the scenic and aesthetic qualities of rural areas located within the City's Sphere of Influence, the design and construction of public and private right-of-way improvements should conform to the following guidelines:

- 1) Streets should be designed in consideration of the natural topography and the landscape. Divided streets and grade separations may be used.
- 2) Concrete sidewalks, curbs and gutters should be constructed only when required by the topography. Crushed gravel walks and vegetation-lined swales are encouraged.

■ City of Santa Cruz General Plan

Design and site development to minimize lot coverage and impervious surfaces, limit post development runoff to pre-development volumes, and incorporate storm drainage facilities that reduce urban runoff pollutants to the maximum extent possible.

Where feasible, direct runoff from rooftops and other areas to drywells.

Require low-flow-velocity, vegetated open channels, area drains incorporating grease and sediment traps, groundwater recharge facilities and detention ponds directly connected to impervious areas.

■ City of Livermore General Plan

Revise the Subdivision Ordinance and other Municipal Code sections to reduce the creation of impermeable surfaces in new development. Examples of strategies to reach this goal might include requiring the use of vegetative swales (biofilters) and detention/infiltration basins.

Existing property owners shall be encouraged, or required as appropriate, to reduce stormwater runoff by reducing impermeable surfaces.

■ City of Palm Desert General Plan

For existing landscapes, runoff, low-head drainage, overspray or other similar conditions where water flows onto adjacent property, nonirrigated areas, walks, roadways or structures shall be prohibited.

■ City of Rohnert Park General Plan

All specific plans shall address hydrology and drainage for their respective areas, as well as practices to be incorporated as part of individual development projects.

As part of the building permit process, require all development projects to comply with hydrology and drainage policies incorporated in the applicable Specific Plans.

The City shall review and approve the proposed drainage system requirements prior to construction on the project site.

B. Groundwater quality

These policies are used to ensure the quality of groundwater resources. This can involve protection of groundwater recharge areas and wellheads from point and nonpoint sources of pollution, as well as the treatment of contaminated groundwater supplies.

These policies have clear links to groundwater policies in the following section on water supply and demand. They are also related to watershed protection policies that protect natural recharge areas and to water quality policies because of the connections between surface water and groundwater systems.

■ City of Santa Cruz General Plan

Identify and protect groundwater recharge areas to maintain suitable groundwater levels and protect groundwater quality for existing and potential municipal water sources.

Ensure that new development or land uses near surface water and groundwater recharge areas do not degrade water quality.

■ County of Shasta General Plan

Institute effective measures to protect groundwater quality from potential adverse effects of increased pumping or potential sources of contamination.

■ Sonoma County Draft General Plan – Water Resources Element

Encourage pretreatment and waste load minimization of commercial and industrial wastes prior to their connection to sewer systems.

Consider on-site wastewater management districts in areas with septic problems.

Actively pursue the abatement of failing septic systems that have been demonstrated as causing a health/safety hazard.

C. Policies and programs to support implementation

■ City of Livermore General Plan

Encourage coordination between land use planning, site design and stormwater pollution control.

■ City of Santa Clara General Plan

Participate on a regional basis in a nonpoint source control program to reduce pollutants in stormwater runoff.

Managing supply and demand of water resources

These policies are intended to ensure the reliability and most-efficient use of water supplies. The amount and availability of water supplies is a function of how much there is (supply) and how it is used (demand).

Water management has long been focused on increasing the supply side of this equation, but our ability to develop new supply options to meet future needs will largely depend on shifting focus to reduce demand on existing supplies as well. Policies to increase efficiency through indoor and outdoor water conservation, recycling of municipal wastewater, reuse of household graywater, and capture and/or infiltration of stormwater are combined with those to manage water

resources for maximum reliability. Reliability is achieved through policies that develop a portfolio of sustainable water supply options to meet local and regional needs.

Ideas for data and analysis

Analysis can build on information from any watershed assessment. Otherwise, collecting land-use based supply and demand data is recommended. Water supply and demand projections should cover wet, normal, dry and multiple-dry years.

Opportunities for demand reduction through conservation, recycling and reuse and other measures should be included.

Urban Water Management Plans provide an important reference and would ideally be cross-referenced in the General Plan to facilitate coordination with water suppliers and compliance with SB 610 water assessments and SB 221 water supply verification.

A. Water supply planning

These policies correspond to water supply and demand planning processes and actions. Some are directly related to the new “show me the water” laws.

■ City of Cathedral City General Plan

One goal of the General Plan is a sustainable, long-term supply of clean and healthful domestic water available for existing residents and future growth.

■ County of Los Angeles General Plan

Proposed large-scale development shall provide for a guaranteed supply of water to serve the project, consistent with state regulations.

■ Santa Clara County General Plan

Countywide land use and growth management planning should be coordinated with overall water supply planning in order to maximize dependability of long-term water supply resources.

■ City of Fresno General Plan

Maintain a comprehensive, long-range water resource management plan that provides for appropriate management of all sources of water available to the planning area and ensures that sufficient and sustainable water supplies of good quality will be economically available to accommodate existing and planned urban development.

■ City of San Diego General Plan

Prepare, implement and maintain long-term, comprehensive water supply plans and options in cooperation with the appropriate state and federal agencies, regional authorities, water utilities and local governments.

B. Water-use efficiency

These policies are intended to increase water-use efficiency through indoor and outdoor conservation measures. They support technologies and practices that minimize the day-to-day water use to decrease demand.

■ City of San Luis Obispo Draft General Plan

Maximize the implementation of water conservation measures as a cost-effective way to manage water demands and reduce the dependence on imported water.

In planning for urban water needs, the City will adopt and strive for the most efficient available practices. The City will

encourage other agencies to follow this policy. “The most efficient available practices” means behavior and devices that use the least water for a desired outcome, considering available equipment, life-cycle costs, social and environmental side effects, and the regulations of other agencies.

■ County of Riverside General Plan

Incorporate water conservation techniques, such as groundwater recharge basins, use of porous pavement, drought-tolerant landscaping and water recycling, as appropriate.

Require that new development utilize drought-tolerant landscaping and incorporate adequate drought-conscious irrigation systems.

■ City of Santa Cruz General Plan

Promote water conservation to reduce future demand through the implementation of the Urban Water Management Plan.

■ City of Ventura General Plan

Require low-flow fixtures, leak repair and drought-tolerant landscaping (native species, if possible), plus emerging water conservation techniques, such as reclamation, as they become available.

Demonstrate low water-use techniques at community gardens and city-owned facilities.

■ City of Livermore General Plan

The City shall adopt a series of Best Management Practices for water conservation measures that will be mandatory in new development and strongly encouraged in existing developments.

Projects deemed appropriate for the use of recycled water shall be required to use recycled water, when available, for uses outlined in the State Water Code.

Require compliance with the State and City’s mandatory water efficient landscape ordinance.

Develop and provide incentives for existing and future customers to reduce water consumption.

Develop and institute a City-sponsored program of mandatory water conservation measures for new development. Develop a program for existing developments based on a voluntary participation with incentives to achieve specific targets for water conservation, including such elements as:

- Ultra-low flush toilets;
- Plumbing retrofits;
- Leak detection;
- Efficiency standards for water-using appliances and irrigation devices, and industrial and commercial processes;
- Graywater use;
- Swimming pool and spa conservation measures such as covers to reduce evaporation;
- Xeriscape landscape design standards.

■ County of Sonoma Draft General Plan – Water Resources Element

Increase the role of conservation and safe, beneficial reuse in meeting water supply needs of both urban and rural users.

Use water effectively and reduce water demand by:

- Requiring water conserving design and equipment in new construction.

- Encouraging water conserving landscaping and other conservation measures.
- Encouraging retrofitting with water-conserving devices.
- Designing wastewater systems to minimize inflow and infiltration to the extent economically feasible.
- Limiting impervious surfaces to minimize runoff.

■ City of Cathedral City General Plan

Require the use of water-conserving appliances and fixtures in all new development, as mandated by state law.

■ City of Santa Cruz General Plan

Develop and implement a systemwide program to convert existing toilets to Ultra Low Flush (ULF) models; analyze how best to apply the savings realized from this conversion; and investigate other options and incentives for retrofitting other old water-inefficient fixtures.

Enforce the New Construction/Ultra-Low-Flush-Toilet Water Conservation Ordinance and periodically review this ordinance to determine if additional fixtures should be added.

Efficient water use in landscaping:

- 1) Choose plants that are suitable for the climate and their intended function, with an emphasis on native and drought-tolerant plants.
- 2) Prepare soils for water penetration and retention.
- 3) Design and operate suitable and efficient irrigation systems.
- 4) The City will encourage drought-tolerant landscaping, vegetable gardens and fruit trees in lieu of large expanses of lawn or other more water-demanding plantings.

Landscape maintenance: Landscaped areas will be properly designed for efficient water use, and shall be properly installed and maintained, including the upkeep and replacement of low-flow irrigation fixtures and equipment.

■ City of Palm Desert General Plan

If a project's water bills indicate that the landscaped areas are using less than or equal to the maximum water allowance for those landscaped areas of one or more acres, an audit shall not be required by the water purveyor.

■ City of Palm Desert Landscape Program

Develop and adopt a landscape ordinance for new and rehabilitated landscaping with specific irrigation designs, planting and maintenance plans emphasizing unity, aesthetics, water efficiency and stressing the planting of a diversity of native, drought-resistant species.

- Compose a list of recommended landscaping species that are native, drought tolerant and have forage value for wildlife.
- Compose a list of noxious and invasive species and educate the public about their disadvantages.
- Make drought-resistant trees and native species apart of the Master Street Tree List.

Each landscape construction documentation package shall include a cover sheet, referred to as the water conservation concept statement, similar to the following example. It serves as a checklist to verify that the elements of the landscape documentation package have been completed and as a narrative summary of the project. This applies to:

- a) All new and rehabilitated landscaping for public agency projects and private development projects including, but not limited to, industrial, commercial and recreational projects;
- b) Developer-installed landscaping in single-family and multi-family projects.

C. Groundwater supplies

The following policies address the use and management of groundwater supplies. Groundwater systems are connected to surface waters and are vital components of watersheds. Overdraft of groundwater affects base-flow to local water bodies as well as the health of terrestrial and riparian ecosystems. Thus, these policies are closely related to watershed protection and water-quality policies about surface water and groundwater systems.

■ City of Santa Cruz General Plan

Identify and protect groundwater recharge areas to maintain suitable groundwater levels and to protect groundwater quality for existing and potential municipal water sources.

■ County of Shasta General Plan

Institute effective measures to protect groundwater quality from potential adverse effects of increased pumping or potential sources of contamination.

■ City of San Jose General Plan

The City should not permit urban development to occur in areas not served by a sanitary sewer system.

The City should protect groundwater recharge areas, particularly creeks and riparian corridors.

■ County of Sonoma Draft General Plan –
Water Resources Element

Manage groundwater as a valuable and limited shared resource.

Encourage new groundwater recharge opportunities and protect existing groundwater recharge areas.

Work with public water suppliers to decrease reliance on groundwater and prevent diminishment of groundwater supplies.

Conserve, enhance and manage groundwater resources on a sustainable basis, which assures sufficient amounts of clean water required for future generations, the uses allowed by the General Plan, and the natural environment.

Revise procedures for proving adequate groundwater for discretionary projects by adding criteria for study boundaries, review procedures and required findings that the area's groundwater supplies and surface water flows will not be adversely impacted by the project and the cumulative amount of development allowed in the area and will not cause or exacerbate groundwater overdraft, land subsidence or saltwater intrusion.

Procedures for proving adequate groundwater for discretionary projects should be flexible enough to consider the expense of such study in relation to the size of the discretionary project.

Require that discretionary projects, to the maximum extent practicable, maintain or increase the site's pre-development absorption of runoff to recharge groundwater. Implementation

would include standards which could regulate impervious surfaces, vary by project type, land use, soils and area characteristics, and provide for water impoundments, protecting and planting vegetation, cisterns and other measures to increase runoff retention and groundwater recharge.

Monitor groundwater conditions, require descriptive information for well permits, and analyze, map and publicize the data gathered.

■ County of Los Angeles General Plan

Protect natural groundwater recharge areas and artificial spreading grounds and increase the storage of water underground for future use.

■ City of Woodland General Plan

The City shall cooperate with other jurisdictions in jointly studying the potential for using surface water sources to balance the groundwater supply so as to protect against aquifer overdrafts and water quality degradation.

D. Recycling and reuse of water supplies

These policies support the reuse of recycled wastewater and household graywater. Plan language can advance the use of recycled water by supporting the development or expansion of water recycling facilities, by ensuring policies are in place so that proposed projects are outfitted with purple pipe, and by requiring the use of recycled water for appropriate applications wherever feasible.

Graywater policies should support the inclusion of graywater systems in new development and simplify local permitting for installation and use of those systems.

■ City of Chino General Plan

It is the policy of the City that recycled water be used for any purposes approved for recycled water use, when it is economically, technically and institutionally feasible. Recycled water shall be the primary source of supply for commercial and industrial uses, whenever available and/or feasible. Use of potable water for commercial and industrial uses shall be contrary to city policy; shall not be considered the most beneficial use of a natural resource; and shall be avoided to the maximum extent possible.

■ City of Santa Clara General Plan

Maximize the use of reclaimed water for construction, maintenance and irrigation, and encourage its use elsewhere, as appropriate.

■ City of Livermore General Plan

Require all new industrial, commercial and office development within pressure Zone 1 to use reclaimed water for landscape irrigation, where available.

■ City of Palm Desert General Plan

Coordinate with the Coachella Valley Water District on the continued use and future expansion of tertiary-treated wastewater treatment and distribution facilities to serve existing and new development projects in the city.

■ County of Sonoma Draft General Plan –
Water Resources Element

Encourage graywater systems, roof catchment of rainwater and other methods of reusing water and minimizing the need to use groundwater.

■ County of Los Angeles General Plan

Encourage the production and use of reclaimed water and stormwater runoff to provide water for irrigation, groundwater recharge, saltwater intrusion barriers or other beneficial uses.

■ City of San Luis Obispo General Plan

Facilitate use of tertiary-treated water and seek to legalize use of graywater for non-potable household purposes.

E. Stormwater supplies

New practices are allowing communities to treat stormwater as a resource rather than a nuisance. Practices that allow the capture and reuse of stormwater on-site for landscaping, as well as those that encourage stormwater infiltration to recharge groundwater systems can help comply with water quality regulations for stormwater management – and also enhance local supplies. General Plans can advance the development of stormwater as a water supply through policies that encourage or require the capture and/or infiltration of stormwater.

■ County of Sonoma Draft General Plan –
Water Resources Element

Conserve and recognize stormwater as a valuable resource.

■ City of Santa Cruz General Plan

Investigate the feasibility of using stormwater runoff, if all water quality measures are in place, for irrigation and groundwater recharge.

■ Santa Monica Municipal Code

Maximize the amount of runoff directed to permeable areas and/or maximize stormwater storage for reuse or infiltration by such means as:

- Using cisterns, retention structures or green rooftops to store precipitation or runoff for reuse.
- Grading the site to divert flow to permeable areas.
- Orienting roof runoff towards permeable surfaces, drywells, French drains or other structural BMPs rather than directly to driveways or non-permeable surfaces so that runoff will penetrate into the ground instead of flowing off-site.

F. Policies and programs to support implementation

■ County of Inyo General Plan

Goal: To ensure planning decisions are reached in a collaborative environment and to provide opportunities of early and consistent input by Inyo County and its citizens into the planning processes of other agencies, districts and utilities.

■ County of Sonoma Draft General Plan –
Water Resources Element

Work with public water suppliers in assessments of the sustainable yield of surface water, groundwater, recycled water and conserved water. This work should include the exploration of potentially feasible alternative water supplies. Surface and groundwater supplies must remain sustainable and not exceed safe yields.

Support inter-regional planning efforts by the public water suppliers, their contractors and involved stakeholders in Sonoma County to determine the preferred combination of sources to meet projected demand.

Initiate an educational program to inform residents, agriculture, businesses and other groundwater users of best management practices in the areas of efficient water use, water conservation and increasing groundwater recharge. Implementation would include preparation and distribution of educational materials and public workshops.

■ City of Fresno General Plan

Maintain and expand cooperative multi-agency planning and programs for water conservation.

■ City of San Diego General Plan 2005

Implement conservation incentive programs that increase water-use efficiency and reduce urban runoff:

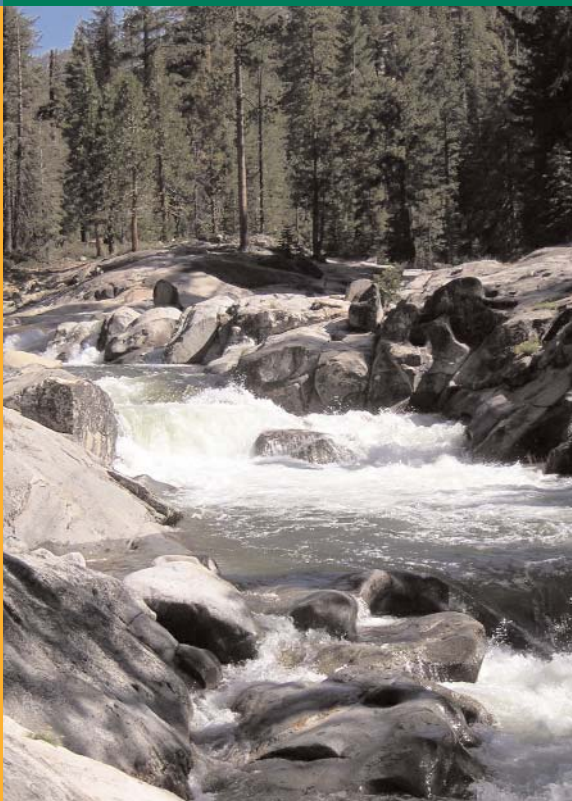
- Develop a response plan to assist citizens in reducing water use during periods of water shortages and emergencies.
- Encourage local water agencies to use state-mandated powers to enforce conservation measures that eliminate or penalize wasteful uses of water.
- Explore alternative conservation measures and technology as they become available.
- Develop and expand water-efficient landscaping to include urban forestry, urban vegetation, and demonstration projects.



The Ahwahnee Water Principles

Local Government Commission

The Local Government Commission is an award-winning, 26 year-old nonprofit membership organization of forward-thinking, locally elected officials, city and county staff, and other interested individuals. The LGC helps local officials address the problems facing their communities and maximize their civic, environmental and economic resources.



In 2004, the Local Government Commission set out to identify effective, least-cost economically and politically viable options for sustainable water resources management at the local level.

The LGC invited respected water resource policy, management and planning professionals – with experience at the federal, state and local levels – to craft a set of land use principles which would provide guidance to local officials and communities concerned about sustaining future water supplies.

The resulting Ahwahnee Water Principles provide a practical blueprint for sustainable land-use practices that can improve the reliability and quality of water resources and reduce some of the financial liabilities that new development places on local government.

These principles are practical actions that cities and counties can take as good stewards of California's water resources by ensuring that new development and redevelopment minimize the risks and impacts of stormwater runoff, ground and surface water contamination and flooding.