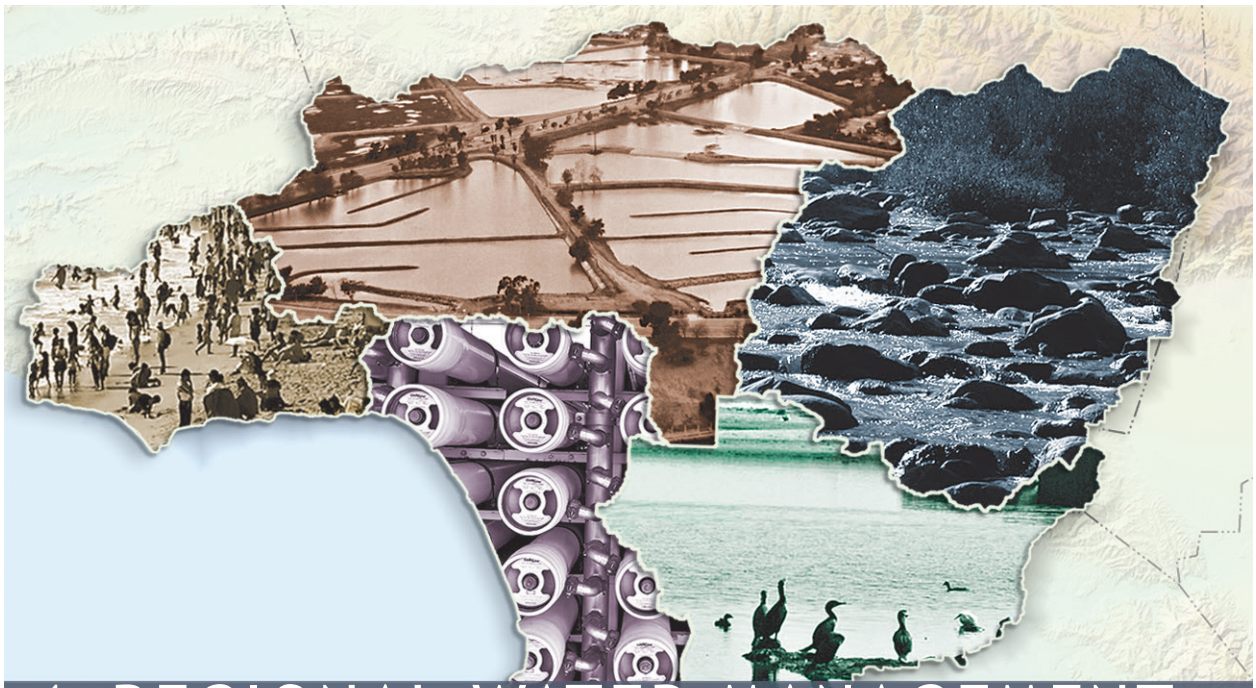

4. REGIONAL WATER MANAGEMENT

The Region integrates a diverse mix of water management strategies

The public receives the benefit of more efficient use of limited fiscal resources through the coordination of water management strategies.

4.1 Introduction

As part of the 2013 Plan Update process, the GLAC Region reviewed the management strategies called out in the 2006 Plan relative to the new IRWM Plan 2013 objectives and the Resource Management Strategies (RMS) listed in the California Water Plan Update 2009 (DWR, 2009). The purpose of reviewing these Management Strategies in this context is to identify which ones will help achieve the Plan objectives through project or program implementation within the GLAC Region. In order to determine which strategies are suitable for the Region, Subregional SC meetings were held to solicit feedback and input from the Region's stakeholders. Section 4.3 describes each of the Resource Management Strategies that the stakeholders determined were relevant to the GLAC Region. Those RMS's not discussed in Section 4.3 were considered not applicable. This chapter presents the strategies considered by the SC stakeholders for the 2013 Plan Update, and updates the 2006 Plan language accordingly. This chapter also specifically includes an evaluation of the adaptability of water management systems in the Region to climate change.

4.2 California Water Plan Resource Management Strategies

Division 43, Chapter 2, Section 75206(a) of the California Water Code authorizes funding (pursuant to Proposition 84) for long-term water needs of the state, and requires that eligible projects implement IRWM Plans that address the water management strategies identified within the *California Water Plan Update 2009*:

Eligible projects must implement regional water management plans that meet the requirements of this section. Integrated regional water management plans shall identify and address the major water related objectives and conflicts within the region, consider all of the resource management strategies identified in the California Water Plan, and shall use an integrated, multi-benefit approach to project selection and design.

Table 4-1: DWR California Water Plan Update 2009 Resource Management Strategies		
CA Water Plan Update 2009 Volume 2 Chapter Number	**Resources Management Strategy within CA Water Plan Update 2009**	**Strategy Overview**
Reduce Water Demand		
2	Agricultural Water Use Efficiency	Increasing water use efficiency and achieving reductions in the amount of water used for agricultural irrigation. Includes incentives, public education, and other efficiency-enhancing programs.
3	Urban Water Use Efficiency	Increasing water use efficiency by achieving reductions in the amount of water used for municipal, commercial, industrial, irrigation, and aesthetic purposes. Includes incentives, public education, and other efficiency-enhancing programs.
Improve Operational Efficiency and Transfers		
4	Conveyance - Delta	Maintaining, optimizing use of, and increasing the reliability of regional treated and untreated water conveyance facilities. Included within this strategy is maintaining the ability to obtain and convey imported water supplies into the Region.
5	Conveyance – Regional/ Local	Strategies include improvement conveyance systems, upgrading aging distribution systems, promoting development of more extensive interconnections among water resources systems, establishing performance metrics for quantitative and qualitative indicators (e.g., quantity of deliveries, miles of rehabilitated conveyance facilities, and resiliency of conveyance to earthquakes and fewer regulatory conflicts), and assuring adequate resources to maintain the condition and capacity of existing constructed and natural conveyance facilities.
6	System Reoperation	Managing surface storage facilities to optimize the availability and quality of stored water supplies and to protect/enhance beneficial uses. Includes balancing supply and delivery forecasts, coordinating and interconnecting reservoir storage, and optimizing depth and timing of withdrawals.
7	Water Transfers	Contracting to provide additional outside sources of imported water to the Region over and above contracted State Water Project and Colorado River supplies
Increase Water Supply		
8	Conjunctive Management and Groundwater Storage	Using and managing groundwater supplies to ensure sustainable groundwater yields while maintaining groundwater-dependent beneficial uses, including coordinating management of groundwater and surface water supplies (conjunctive use).
9	Desalination	Developing potable water supplies through desalination of seawater. Includes disposal of waste brine.
10	Precipitation Enhancement	Increasing precipitation yields through cloud seeding or other precipitation enhancing measures.
11	Recycled Municipal Water	Developing usable water supplies from treated municipal wastewater. Includes recycled water treatment, distribution, storage, and retrofitting of existing uses.
12	Surface Storage – CALFED	Developing additional CALFED storage capacity or more efficiently using existing CALFED storage capacity.
13	Surface Storage – Regional/Local	Developing additional yield through construction or modification (enlargement) of local or regional surface reservoirs or developing surface storage capabilities in out-of-region reservoirs.
Improve Water Quality		
14	Drinking Water Treatment and Distribution	Includes improving the quality of the potable supply delivered to potable water customers by increasing the degree of potable water treatment. Strategy also may include conveyance system improvements that improve the quality of supply delivered to treatment facilities.
15	Groundwater and Aquifer Remediation	Includes strategies that remove pollutants from contaminated groundwater aquifers through pumping and treatment, in situ treatment, or other means.
16	Matching Water Quality to Use	Optimizing existing resources by matching the quality of water supplies to the required quality associated with use.

Table 4-1: DWR California Water Plan Update 2009 Resource Management Strategies		
CA Water Plan Update 2009 Volume 2 Chapter Number	**Resources Management Strategy within CA Water Plan Update 2009**	**Strategy Overview**
17	Pollution Prevention	Strategies that prevent pollution, including public education, efforts to identify and control pollutant contributing activities, and regulation of pollution-causing activities. Includes identifying, reducing, controlling, and managing pollutant loads from non-point sources.
18	Salt and Salinity Management	Recommendations that encourage stakeholders to proactively seek to identify sources, quantify the threat, prioritize necessary mitigation action and work collaboratively with entities with the authority to take appropriate actions.
19	Urban Runoff Management	Includes strategies for managing or controlling urban runoff, including intercepting, diverting, controlling, or managing stormwater runoff or dry season runoff.
Practice Resources Stewardship		
20	Agricultural Lands Stewardship	Includes strategies for promoting continued agricultural use of lands (e.g. agricultural preserves), strategies to reduce pollutants from agricultural lands, and strategies to maintain and create wetlands and wildlife habitat within agricultural lands. Stewardship strategies for agricultural lands include wetlands creation, land preserves, erosion reduction measures, invasive species removal, conservation tillage, riparian buffers, and tailwater management.
21	Economic Incentives	Includes economic incentives (e.g. loans, grants, water pricing) to promote resource preservation or enhancement.
22	Ecosystem Restoration	Strategies that restore impacted or impaired ecosystems, and may include invasive species removal, land acquisition, water quality protection, revegetation, wetlands creation and enhancement, and habitat protection and improvement, habitat management and species monitoring.
23	Forest Management	Strategies that promote forest management include long-term monitoring, multi-party coordination, improvement in communications between downstream water users and communities and upstream forest managers, residents, and workers, and revisions of water-quality management plans between the State Water Board and forest management agencies to address concerns with impaired water bodies.
24	Land Use Planning and Management	Includes land use controls to manage, minimize, or control activities that may negatively affect the quality and availability of groundwater and surface waters, natural resources, or endangered or threatened species.
25	Recharge Area Protection	Includes land use planning, land conservation, and physical strategies to protect areas that are important sources of groundwater recharge.
26	Water-Dependent Recreation	Enhancing and protecting water-dependent recreational opportunities and public access to recreational lands.
27	Watershed Management	Comprehensive management, protection, and enhancement of groundwater and surface waters, natural resources, and habitat
Improve Flood Management		
28	Flood Risk Management	Strategies that decreasing the potential for flood-related damage to property or life including control or management of floodplain lands or physical projects to control runoff.
Other		
29	Other Strategies	Other Resource Management Strategies include: Crop Idling for Water Transfers Dewvaporation/Atmospheric Pressure Desalination Fog Collection Irrigated Land Retirement Rainfed Agriculture Waterbag Transport/Storage Technology

4.3 2013 GLAC Region Water Management Strategies

The GLAC Region management strategies presented below also indicate any California Water Plan RMS (RMS #) that correlate to these overall strategies.

Water Supply

Desalination (RMS # 9)

Brackish groundwater desalination (i.e., the removal of salts by forcing water through porous membranes) has been in practice in the Region for many years, in part due to financial incentives provided by the MWD and allowing for greater water reliability. WRD and West Basin MWD operate brackish water desalters that produce significant water supplies from local groundwater sources.

Until recently, seawater desalination had not been a cost-effective alternative to more conventional sources of water supply. As improvements in membrane technology have lowered operating pressures, the cost of producing drinking water from seawater has become more attractive. Considering the vast supply of seawater available to coastal regions and the demand for "new" drinking water, seawater desalination presents a promising new option for the Region's water supply. Several water providers are currently examining the feasibility of desalinating seawater through pilot and demonstration scale projects.

In order to further diversify the regional water resource portfolio, the MWD has utilized a program to provide $250 per acre-foot for water produced

Figure 4-1. Local water suppliers operate brackish water desalters that have the potential to produce significant drinking water supplies from otherwise unusable groundwater sources. Seawater desalination facilities have the potential to provide even larger quantities of reliable water supplies to the Region. .

Reverse Osmosis Membranes at West Basin Municipal Water District, Brewer Desalination Facility. Desalination of local brackish groundwater helps reduce the Region's dependence on imported water.

from desalination that offsets imported water, and thereby defray the production cost which is particularly sensitive to the cost of electrical power. This program identifies viable desalination projects through a proposal process. Ongoing research to improve membrane efficiency has lowered power requirements and therefore the total cost of seawater desalination.

Other challenges to the expanded use of desalination in the Region include the following: disposal of saline discharge water (or brine) into the ocean and its effects on marine biology; environmental concerns about impingement and entrainment of fish, fish larvae, and plankton by seawater intake structures; and a need for new infrastructure to deliver water from ocean desalination facilities to more inland locations. Public acceptance will also need to be built through public education.

Opportunities for greater use of brackish desalination in the Region include a planned expansion of desalination of brackish groundwater, such as WRD's expanded desalination of brackish groundwater at the Goldsworthy Desalter, and new ocean desalination facilities. For seawater desalination, West Basin MWD has been operating a demonstration facility since 2010 to test various technologies for operating a full-scale facility, including reverse osmosis membranes, ocean intake and brine discharge technologies, and energy recovery methods. This is currently located at the SeaLab facility in Redondo

Images courtesy of West Basin Municipal Water District

Ocean-Water Desalination Demonstration Facility and Water Education Center at the SeaLab in Redondo Beach.

Beach and also includes an education center that offers tours to the public to learn about water supply reliability and the ocean-water desalting process. The next step for West Basin MWD is to proceed with the environmental process for a full-scale ocean-water desalination facility.

Groundwater Management and Conjunctive Use (RMS # 6, 8, 15 & 25)

Groundwater represents a significant portion of local supplies in the Region, although the extent of impervious surfaces resulting from urban and suburban development has greatly curtailed natural recharge. In some basins expanded pumping has caused significant declines in groundwater levels, seawater intrusion and other water quality concerns, and has limited the ability of producers to continue pumping from the basin without drilling deeper wells. Given long-standing groundwater demand, very few basins remain unadjudicated in the Region. This adjudication provides opportunities to better develop conjunctive use programs to meet pumping requirements as well as maximize the longer-term storage potential offered by underground basins.

Many overlying groundwater users in the Region use artificial recharge as a means of maintaining groundwater levels and production volumes. Artificial recharge can occur with either local water (e.g., surface runoff or recycled water) or imported water. Spreading grounds are typically used to recharge local and imported water whereas imported and recycled water recharge can occur through direct means using spreading grounds or injection wells. Imported water recharge can also occur through in-lieu means. In some instances, spreading is limited because of the capacity limitations of the spreading facilities rather than water supply. Therefore, there is a need for further examination of the potential to increase groundwater recharge at existing facilities through system reoperation, sediment removal and other strategies. Increasing local supplies (like stormwater and recycled water) made available for recharging groundwater basins is also a critical part to further implementation of the conjunctive use strategy.

Groundwater Management and Conjunctive Use Opportunities	
Increase native filtration	Expand advanced wastewater treatment
Increase recharge of recycled water supplies	Increase stormwater recharge
Reduce impervious surfaces	Expand existing or construct new spreading facilities

Figure 4-2. Groundwater basin water quality is a significant issue in the Region as many factors have contributed to the deterioration of water quality in the groundwater basins.

GROUNDWATER MANAGEMENT

San Gabriel Valley Water Company's Plant B6 in Baldwin Park

Figure 4-3. Groundwater Projects. The San Gabriel Basin Water Quality Authority has helped fund a complex network of groundwater remediation projects. Over one million residents rely primarily on these resources for potable supply.

San Gabriel Valley Water Company's Plant No. 8 treatment facility in South El Monte.

Spreading basins in the Arroyo Seco are used to percolate rain water into underlying aquifers.

Recharge by in-lieu means does not require facilities. It simply requires that an agency suspend production from its wells and meet retail demand needs through deliveries of other supplies into its distribution system. Groundwater levels recover due to the reduction in pumping.

Groundwater basin water quality is a significant issue in the Region. Many factors have contributed to the deterioration of water quality in portions of certain groundwater basins including historic overdrafting resulting in seawater intrusion, industrial discharges, farming and agricultural chemical usage, and naturally occurring constituents. The cost of treating these contaminants is significant.

Additionally, effective treatment has not yet been identified for some chemicals and various agencies are currently testing different treatment technologies to identify the preferred treatment alternatives. Stormwater quality concerns may also need to be addressed as recharge may impact groundwater quality and are discussed below under Stormwater Quality and Flood Management.

Opportunities for the optimized use of groundwater basins in the Region include: a reduction in impervious surfaces to increase native infiltration; expansion of existing, or construction of new, conjunctive use facilities to spread or inject both local and imported water when available; expansion of existing, or development of new, projects to replenish local groundwater aquifers using recycled water; enhancement of seawater intrusion barrier facilities to increase their effectiveness; implementation of projects to recharge treated stormwater; and inter-basin transfers of recycled water. All of these opportunities for optimized use of groundwater basins should be used to maximize storage potential identified in Table 4-2; to the extent that institutional challenges can be overcome and cost-effectiveness can be demonstrated.

Imported Water and Conveyance – Delta, Regional/Local (RMS # 4, 5 & 12)

The Region is heavily dependent on imported surface water for drinking water supply. The primary sources of imported water supplies are the SWP, the Colorado River Aqueduct (CRA), and

Table 4-2. Groundwater Management and Conjunctive Use	
Basin	**Additional Storage Potential (Acre-Feet)**
Los Angeles Coastal Plain	450,000
San Fernando Valley	504,000
San Gabriel Valley	245,000
Total	**1,199,000**

MWD has estimated in its Integrated Water Resources Plan 2010 Update that the groundwater basins underlying the Los Angeles IRWMP planning area have long-term storage potential of an additional 1,199,000 acre-feet. Water supply agencies are continually evaluating projects to make use of this efficient and reliable storage.

the Mono Basin and Owens Valley conveyed via the Los Angeles Aqueduct (LAA). Although these sources have been instrumental in the growth of much of the Region, each of these sources face various challenges and issues, including concerns about the higher salt content of some sources.

The California SWP is a system of reservoirs, pumps and aqueducts that carries water from north of the Sacramento area to areas north, west and south of the Sacramento-San Joaquin Delta. Although originally designed to deliver slightly more than four million AFY, the system was never fully completed and typically delivers less than designed. The decline of key fish populations in the Bay-Delta system (e.g., the Delta smelt) has limited the volume of water that can be pumped to the SWP. The potential impact of further declines in ecological indicators in the Bay-Delta system on SWP water deliveries is unclear, and uncertainty about the long-term stability of the levee system surrounding the Delta system raises concerns about the ability to transfer water via the Bay-Delta to the SWP. These concerns have led to the development of the Bay Delta Conservation Plan (BDCP). The

Figure 4-4. The Region is continually improving its ability to reduce its dependence on imported surface water for drinking water supply.

The primary sources of imported water supplies to the Region are the State Water Project, the Colorado River Aqueduct, and the Los Angeles Aqueduct.

BDCP is a planning and environmental permitting process to restore habitat for Delta fisheries and improve the Delta water conveyance in a way that provides reliable water delivery operations to 25 million Californians. The heart of the BDCP is a long-term conservation strategy that sets forth actions needed for a healthy Delta. This "Delta fix" is not anticipated to produce new water for Southern California, only allow for delivery of allotments prior to Delta pumping restrictions.

The CRA delivers water from the Colorado River to southern California. MWD has traditionally received in excess of its entitlement when excess water is available. Future water allotments to California supplies from the Colorado River may be reduced as other states increase their diversions in accord with their authorized allotments. California's Colorado River Water Use Plan and the Quantification Settlement Agreement identify measures to increase the beneficial uses of the water and offset potential reductions in future deliveries to California.

The LAA delivers high-quality water from the Mono Basin and Owens Valley to the City of Los Angeles. Approximately 480,000 AFY of water can be delivered to the City of Los Angeles, however the amount the aqueduct delivers varies from year to year due to fluctuating precipitation in the Sierra Nevada mountains and mandatory in-stream flow requirements. In addition, the diversion of water

from Mono Lake has been reduced by a decision of the SWRCB and export of water from the Owens Valley is limited by the Inyo-Los Angeles Long Term Water Agreement (and related MOU), and an additional MOU between the Great Basin Air Pollution Control District and the City of Los Angeles (to reduce particulate matter air pollution from the Owens Lake bed). As a result of these restrictions, future deliveries are expected to be reduced to an average of 250,000 AFY over the next 20 years.

Thus, although imported water will continue to be an important component of the Region's water supply, as the major sources are fully allocated or have constraints on deliveries, it is unlikely that substantial new sources of imported water will be available to meet the Region's future needs.

Improve and Protect Water Quality (RMS # 14, 17, 19)

For the purposes of this Plan, the strategy to improve and protect water quality includes the quality of potable water, the quality of groundwater, and the quality of stormwater and urban runoff.

The USEPA requires all states to establish and implement a Source Water Assessment Program (SWAP) for all public water systems, as promulgated in the 1996 Amendments to the federal Safe Drinking Water Act. In California, the federal SWAP requirement is administered by the CDPH (Health and Safety Code Chapter 4, Section 116270). CDPH developed the Drinking Water Source Assessment and Protection (DWSAP) Program, to evaluate the vulnerability of water sources to contamination and prioritize activities for protective measures. Surface water used for local water supplies may be susceptible to potential contamination from a variety of land use practices such as runoff, recreational activities, residential and industrial development, and wildland fires.

Figure 4-5. For the purpose of this Plan, the strategy to improve and protect water quality includes the quality of potable water, groundwater, and stormwater/urban runoff.

The CDPH requires that water suppliers complete a Watershed Sanitary Survey every five years, to examine possible sources of drinking water contamination and recommend how to protect water quality at the source.

Protection of groundwater quality has historically been a local concern, most notably reflected by seawater intrusion along the coast. Los Angeles County operates and maintains three seawater intrusion barrier systems composed of 290 injection wells along the coast that rely upon recycled water and imported water to reduce the intrusion of saline water in underground aquifers. In recent decades, there has been a growing recognition that historical and current agricultural and industrial activities have the potential to adversely affect groundwater quality, which is reflected in expanded enforcement of other regulatory programs to implement the clean-up of contaminants. Public water supply wells are also subject to the Wellhead Protection Program, which requires the identification of potential water quality threats (in close proximity to the wellhead) and implementation of measures to address the identified threats.

The protection of surface water quality (e.g., in the rivers, creeks, and storm drains) is regulated by the SWRCB and its RWQCBs, via the applicable Basin Plan, which identifies surface and groundwater bodies, designates applicable beneficial use classifications to each water body, establishes general and water body-specific water quality objectives; and suggests an implementation plan for maintaining or restoring the water quality objectives. The RWQCBs utilize NPDES permits and Waste Discharge Requirements to limit the discharge of contaminants and protect surface water quality.

Coupled with the introduction of imported and recycled water supplies for groundwater recharge is the issue of salt management within the basins. The development of basin salt and nutrient management plans is a strategy that is currently being implemented to better understand and address this issue.

Constraints to the implementation of water quality protection and improvement programs and projects include the extent of urbanization, pressure for development within the foothills and adjacent mountains, contamination of soils from previous land uses, and importation of water which contributes to salt management issues.

Opportunities for the expansion of water quality protection and improvement programs and projects include Safe Drinking Water Act (SDWA) projects and programs to remediate groundwater contamination and address surface water impairments through the establishment and implementation of TMDLs, and public education to reduce point and non-point source pollutants.

Surface Storage (RMS # 6, 12 & 13)

As the water supply in the Region is heavily dependent on imported surface water, various surface reservoirs (managed by MWD and the DWR) located outside the Region are used to facilitate water delivery to various local water agencies. Several smaller reservoirs have been developed within the Region to assist in the management of local water supplies. However, most of these reservoirs are limited in their ability to capture local runoff. Most of the remaining dams in the Region have been created for flood management purposes and are not used for long term surface storage. Insufficient storage also limits recycled water delivery. In the future, reservoirs could store recycled water produced in the cooler months when irrigation demand is low for delivery in the warmer months when demand is high.

Surface Storage Opportunities	
Increase water storage capability	Improve management of water flows
Increase operational flexibility of local reservoirs, canals and dams	Surface impoundments for recycled water and treated stormwater runoff

Figure 4-6. LACFCD oversees several surface water storage facilities, which were created to improve flood protection and store runoff for subsequent release and diversion to groundwater spreading grounds for recharge.

LACFD operates inflatable dams on the San Gabriel River to promote short-term in stream recharge.

LACFCD oversees several surface water storage facilities which were created to improve flood protection and store runoff for subsequent release and diversion to groundwater spreading grounds for recharge. These include dams for short-term storage, and in-stream rubber dams to promote short-term in-stream recharge. Las Virgenes MWD purchases pretreated potable water from MWD and stores it in the Las Virgenes Reservoir in the City of Westlake Village. The reservoir also provides seasonal water storage allowing Las Virgenes MWD to purchase supplies off-season and deliver at times of peak demand to meet high summer irrigation needs. The in-city drinking water distribution systems of the City of Los Angeles once included 15 open distribution reservoirs. Due to concerns from CDPH about open water storage, nine reservoirs have been bypassed, replaced, or covered.

Constraints on the development of additional surface storage in the Region include: the lack of suitable sites for surface impoundments, since most of the mountainous areas are protected open space and habitat; constraints on open reservoirs to reduce potential contaminants; political constraints; and the cost of developing new reservoirs.

Opportunities to enhance surface storage include: modification of local reservoirs, waterways, retention ponds and dams to increase storage capability and operational flexibility; installation of additional in-channel rubber dams to improve management of flows; creation of new surface impoundments for recycled water and/or treated stormwater runoff; and the development of unused resource extraction sites (e.g., gravel pits) as surface impoundments. It should be noted that gravel pits are privately-owned industrial sites and any use other than the owner's intended use would be subject to approval by the owner.

Water Conservation/Urban Water Use Efficiency (RMS # 2, 3 & 21)

Water conservation is a critical water resource management strategy for the Region. Given that there is very little agricultural crop production in the Region, the conservation strategy is primarily on more efficient municipal use. The strong reliance on imported water and the inherent variability in both imported and local supplies has spurred efforts throughout the Region to minimize the use of water where possible through water efficiency measures.

Water Conservation Opportunities	
Passive Conservation	**Active Conservation**
Responses to Price Shifts	**New Technologies - Indoor Devices**
Building and Plumbing Codes	**New Technologies - Outdoor Devices**
Consumer Behavioral Changes	**Economic Incentives (Subsidies and Rebates)**

Figure 4-7. Strong reliance on imported water and the inherent variability in both imported and local supplies has spurred efforts throughout the Region to minimize the use of water where possible through water use efficiency measures.

Conservation is an element in drought planning as well as an ongoing strategy to ensure long term availability of local supplies in the face of additional demand generated by population growth.

Since the drought of 1987-1992, conservation efforts have stepped up significantly within the Region. Most local agencies have adopted specific goals for water conservation which suggests that additional conservation is still feasible. The California Urban Water Conservation Council (CUWCC) has established a set of 14 BMPs for water conservation, recently categorized as Foundational and Programmatic, although not all agencies in the Region are signatories to a MOU to implement these BMPs. The DWR requires in the Urban Water Management Plan updates that water suppliers address these 14 BMPs every five years. Reporting of progress is through DWR, or both DWR and the CUWCC if a signatory.

Additionally, the Water Conservation Bill of 2009 (20x2020) requires individual retail water supplier to set water conservation targets for 2015 and 2020 to support an overall state goal of reducing urban potable per capita water use by 20 percent by the year 2020. The majority of municipal water suppliers operating within the Region will be incorporating additional conservation strategies to meet these targets.

Opportunities to expand water conservation generally fall into two categories – active and passive (or code-based). Active conservation comes from programs offering things such as rebates, device installation, and plumbing retrofit. Rebates can be given for both hardware installation and for landscape conversion to lower water-use types (e.g. turf removal). Although many agencies have ongoing programs, expanding active conservation can be directly influenced by water agencies. Expansion of passive or code-based conservation can occur either through local ordinances or new State laws that require certain water conservation actions or penalize the theft or waste of water. Passive conservation can also be produced by building and plumbing codes, consumer behavioral changes (particularly through education and water pricing), and responses to price shifts. In addition, local water agencies could continue to develop

A demonstration landscape project In the City of Inglewood. This garden showcases native and drought tolerant plants that can provide attractive alternatives to traditional Southern California landscaping.

and update water conservation master plans to coordinate and prioritize conservation efforts, and identify enforcement protocols.

Given the substantial progress already made by local agencies, further expansion of water conservation will need to incorporate economic incentives and new technology, and in some instances, change public perceptions (e.g., about the desirability of sub-tropical landscaping in a semi-arid climate or use of gray water for irrigation). Conservation techniques must offer the consumer opportunities to save money as well as save water. In some cases—such as subsidies or rebates to change out older, water-using appliances like washing machines and toilets—the subsidizing agency can reduce demand as an alternative to building infrastructure. The expanded utilization of California friendly landscaping may also benefit from economic incentives such as rebates or land use ordinances established by cities or counties. Newer technologies, such as smart irrigation controllers that use current weather information to modify irrigation patterns, have worked well in commercial applications, but have proven to be expensive for homeowners without the use of rebates. As this technology evolves, it is anticipated that such controllers will become more widespread.

Water conservation also has the potential to produce secondary benefits such as through improved irrigation techniques that reduce irrigation runoff and thereby improve surface water quality.

A constraint on the development of water conservation that may need to be addressed by local agencies is the loss of revenue to utilities with increased conservation. The unit cost of conservation also increases over time as cheaper conservation strategies are employed first. Additionally, there is often low incentive to conserve water due to the low cost of water and the difficulty of raising the cost of water.

Water Recycling (RMS #11 & 16)

Recycled (or reclaimed) water is used for a variety of applications in the GLAC Region, including landscape irrigation, groundwater recharge, and some industrial processes, thereby helping the Region to supplement its potable water supplies with a local supply. Recycled water can be supplied in a manner that matches the water quality to its use. In addition, use of recycled water can reduce the energy-intensity of the Region's water supply, reduce the Region's reliance on imported water, reduce the Region's greenhouse gas footprint, and thereby increase the resiliency of the Region to drought and climate change. The cost of developing needed infrastructure (treatment, storage facilities, pump stations, and distribution lines) to distribute recycled water has limited the use of recycled water in some areas. Some agencies, including the MWD and the U.S. Bureau of

Figure 4-8 As the cost of "new" water increases because of market forces, reclaimed water will become an increasingly economic and environmental choice.

Figure 4-9. Water Recycling. Recycled/reclaimed water currently provides 120,000 acre-feet/year to the Region. Recycled water will become an increasingly important water source for the Region.

Reclamation, have provided grant funding or subsidies for the development of recycled water facilities in the past. Temporal and spatial disparities in production and demand for recycled water inhibit the development of fully utilized recycled water systems. Recycled water is produced at a fairly constant rate year-round, yet demand for landscape irrigation uses is seasonal – high in the summer and low in the winter. Construction of storage facilities (e.g. surface impoundments, tanks and reservoirs) could allow producers to store excess recycled water to make it available during periods of higher demand. As groundwater recharge and industrial uses increase, the use of available supplies can be maximized as recycled water can be utilized by these uses year-round. Additionally, as the cost of "new" water increases due to scarcity and market forces, recycled water will become even more economically and environmentally desirable. In the future, recycled water will become an ever more important source of water in the Region for both non-potable uses and potable uses.

Key challenges for future expansion of the use of recycled water in the Region include: identification of new recycled water users close to wastewater treatment plants or distribution infrastructure; disposal of advanced treatment waste products (e.g., brine); diurnal and seasonal variations in recycled water supply and demand; cost-effectiveness of building additional infrastructure (storage facilities due to seasonal variations in demand, pump stations, distribution lines, dual plumbing); treatment requirements; regulatory trends (which suggest increasingly stringent recycled water standards); potential requirements to maintain minimum in-stream flows which may limit operational flexibility or the availability of supplies; proximity of recycled water production to area of demand; nutrient TMDLs; and public support. In general, significant increased funding will be needed to overcome many of these obstacles and achieve significant increases in the amount of water supply obtained from recycled water.

Opportunities to expand recycled water use are continually being sought by the Region's water and wastewater agencies, which often work in partnership (when they are not under the same agency's authority). Water agencies can encourage large water users in close vicinity of wastewater treatment plants and recycled water distribution systems to modify their operations to use recycled water as opposed to potable water; build or modify existing waste-

water infrastructure to address water quality issues, capacity issues, and provide storage; add and/or expand regional distribution systems; merge regional systems as needed; and develop or expand groundwater recharge and seawater intrusion projects.

Additionally, development of new regional partnerships and projects could be pursued, such as those identified in USBR's 2002 Southern California Comprehensive Water Reclamation and Reuse Study (which identified proposals for several regional projects within the Calleguas/ Las Virgenes, East San Gabriel, West Basin, and Central Basin areas).

The 2009 California State Water Recycling Policy has also mandated that salt and nutrient management plans (SNMPs) be created and implemented to determine how to deal with salt loading issues. The implementation of recycled water projects can serve as both salinity management strategies and challenges. SNMPs are under development for the major basins in the Region and will be completed in the next several years

Water Supply Reliability (RMS 6, 8, 9, 11, 13, 15, 16, 19 & 25)

The availability of imported water in southern California, beginning with the development of LADWP's system from the Owens Valley and later continuing with MWD's Colorado River Aqueduct and partnership in the California SWP, allowed many agencies throughout the Region to shift their reliance to imported water and away from local supplies. Increasing costs of imported water, concerns about the health of the Bay-Delta ecosystem, enlightened environmental attitudes in areas where imported water originates and increasing competition for potable water resources have all resulted in a rekindling of interest in local resources. In some cases, new reservoir storage, expansion of groundwater recharge basins, or the implementation of conjunctive groundwater projects have all been developed to take advantage of surplus imported water (water not required to satisfy immediate consumptive demand) in years when snowfall has been abundant. These measures can decrease reliance on imported water and improve local water supply reliability during periods of drought.

Pumping and treating brackish groundwater can expand local supplies and create opportunities to enhance water supply reliability by removing and replacing the brackish water with higher quality water. This could be accomplished through well injection operations (to replace the removed brackish water with fresh or treated water) or expanded groundwater spreading operations to recharge surplus runoff or imported water. Such operations must be carefully designed to avoid adversely affecting the quality of the injected or recharged water.

Urban growth displaces open space and increases impervious surfaces, thereby reducing natural recharge of precipitation. The channelization of streams, particularly when the channel bottom becomes impervious, reduces natural percolation of stream flow into underlying soils. Thus, the preservation of open space, particularly in those areas that directly recharge aquifers used for water supply, and the preservation of or restoration to natural stream channels, preserves groundwater recharge in many areas, thus contributing to the long-term reliability of existing groundwater supplies. The creation of new parkland, which may reduce impervious surfaces (e.g., via removal of existing development) may also reduce runoff and enhance groundwater recharge. The creation of new habitat, such as wetlands, can improve groundwater recharge by increasing retention of runoff.

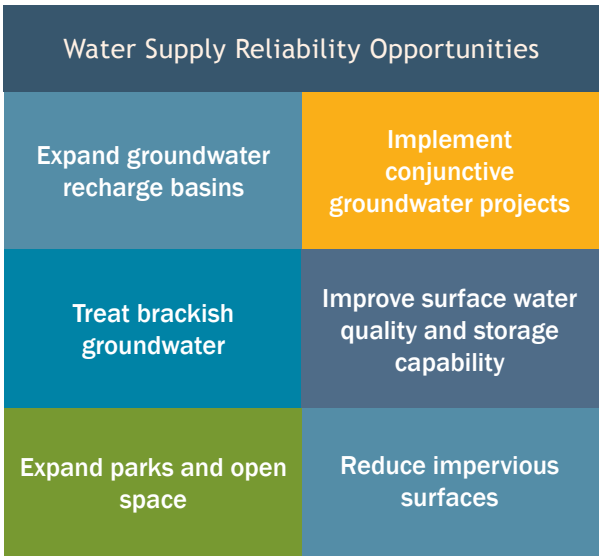

Figure 4-10. Increasing competition for potable water resources has resulted in a rekindling of interest in local resources.

Constraints to the improvement of water supply reliability include the limited availability of undeveloped land for the expansion of recharge facilities or creation of constructed wetlands, and the limited ability to recharge groundwater across large portions of the coastal plain due to limited permeability in soils with high clay content. Constrains may also include the cost of ensuring water reliability as it may be necessary to construct new facilities, and legal constrains such as court adjudicated limits on groundwater pumping.

Opportunities to improve water supply reliability include: the expansion of groundwater recharge basins; the implementation of conjunctive use groundwater projects; and the development of natural treatment systems, such as constructed wetlands, to improve both surface water quality and storage capability.

Water Transfers and Local/Regional Conveyance (RMS # 7, 6 & 5)

Prior to 1991, water transfers within the Region had mostly been limited to transfers of annual groundwater basin rights (which continue to occur, although conditions imposed by groundwater basin adjudication sometimes restrict export of groundwater outside the basins' boundaries), and transfers of water to enhance operational flexibility.

Additionally, MWD's transmission facilities have not been used to transfer local water from one agency to another, mainly because of water quality issues and potential downstream impacts. Lastly, regulations limit mixing of different source waters in transmission lines used for potable water, which sometimes imposes restrictions on the movement of water.

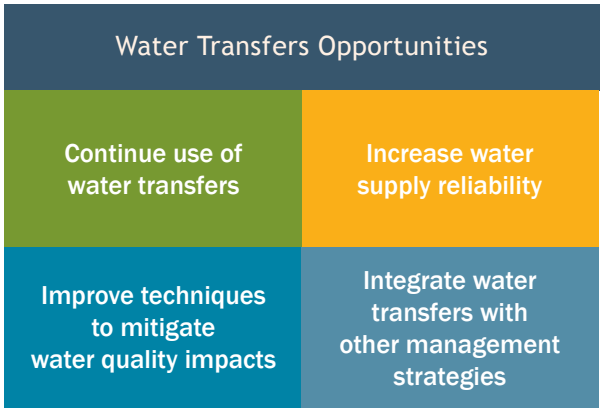

Figure 4-11. Historically, water transfers were arrangements between two parties; one with surplus water supply, and one in need of additional water.

With the 1991 drought, the Governor's Water Bank was developed. MWD and other SWP contractors took advantage of that resource to augment supplies and lessen the severity of the impacts of the drought. Since that time, MWD has participated in water transfers as a water management strategy to augment supplies. The City of Los Angeles plans to develop water transfers as part of its supply strategy rather than purchasing water from MWD during dry years. Should the costs of purchasing and wheeling transfer water from outside the Region be lower than purchasing MWD water, other agencies would likely be interested in such a supply strategy.

However, over the course of the past 15 years, significant changes have occurred in agriculture which led to concerns that one-year or "spot market" water transfers might be a less viable tool. For instance, the significant rise in the percentage of permanent crops in California's Central Valley led to a concern that not only would there be less agricultural water available to transfer, but the significant investment in those permanent crops would force those farms to compete for available water transfer supplies. In addition, growing urbanization in the Central Valley has created a higher urban demand in a number of areas.

The good news is, despite these shifts and challenges, MWD and other agencies have been able to secure transfer water and move that water when needed. For example, during the most recent drought, MWD was able to acquire significant amounts of SWP transfer and exchange supplies via spot market transactions. In addition, MWD's participation in cooperative buyer coalitions proved to be a more effective means for acquiring SWP water transfer supplies than participating in the state-wide 2009 Governor's Drought Water Bank (2009 Bank). Accordingly, MWD led the effort in 2010 to re-convene a State Water Contractors Buyers Group, which provided MWD with a greater amount of transfer supplies than the 2009 Bank secured for all buyers and at a lower cost.

Constraints to the use of water transfers within the Region include institutional constraints related to the wheeling (or transfer) of water, which may affect various transmission elements, and the limitation on using MWD facilities because of potential water quality impacts to downstream users.

Water Quality

Nonpoint Source Pollution Control (RMS #17, 19, 23 & 24)

To conform to the requirements of the federal Clean Water Act and the federal Coastal Zone Act Reauthorization Amendments of 1990, the State of California has developed the Nonpoint Source (NPS) Program Strategy and Implementation Plan (1998–2013) which has identified actions to reduce nonpoint pollution, and a companion volume, the California Management Measures for Polluted Runoff Review Document, which identifies a range of management measures for agriculture, forestry, urban areas, marinas and recreational boating, hydro-modification (including modification of stream channels, water impoundments, and stream bank erosion), and wetlands, riparian areas and vegetated treatment systems. Additional information on sources of nonpoint source pollution and measures to reduce and/or treat polluted runoff is provided in the California NPS Encyclopedia, developed by the SWRCB.

To reduce stormwater pollution the RWQCBs have issued stormwater and urban runoff NPDES permits which regulate the discharge of runoff from municipal storm sewer systems (MS4s), otherwise known as storm drains. These permits prohibit non-stormwater discharges into the storm drain system, limit discharges to receiving waters that would cause or contribute to a violation of water quality standards, and require implementation of a Stormwater Quality Management Program (SQMP) that includes the use of BMPs to reduce the discharge of pollutants identified.

In 2012, RWQCB adopted a new MS4 Stormwater Permit for the Los Angeles Basin area. As part of the new MS4 Stormwater Permit, permittees have the option to customize the programs as part of a Watershed Management Program or Enhanced Watershed Management Program. Within most of Los Angeles County, the SQMP has seven programs, including:

- The Industrial/Commercial Facilities Control Program, which covers industrial and commercial facilities, including restaurants, automobile service facilities, retail gasoline outlets, automobile dealerships and other federally-mandated facilities;

The Santa Monica Urban Runoff Recycling Facility collects, treats, and reuses approximately 500,000 gallons per day of urban runoff.

Caltrans has a successful program to reduce pollutants from freeway stormwater runoff. Their research is ongoing in the Los Angeles Basin.

- The Planning and Land Development Planning Program, which requires implementation of post-construction BMPs and site-specific mitigation measures for commercial developments on sites one acre or greater in impervious area, automotive repair shops, retail gasoline outlets, restaurants, residential development with ten or more dwelling units, parking lots with 25 or more spaces (or are greater than 5,000 square feet in area), single-family hillside residences, and locations within, or directly adjacent, or discharging to, environmentally sensitive areas;
- The Development Construction Program, which requires control of erosion and the prevention of runoff from construction sites, and the containment of construction materials, equipment fuel, maintenance and washing fluids through a combination of BMPs, and inspections. For projects over one acre in area, preparation of a Stormwater Pollution Prevention Program is required, per the Construction Activities Stormwater General Permit (Order No. 99-08-DWQ);
- The Illicit Connections and Illicit Discharges Elimination Program, which requires the County and the cities to identify and investigate illicit discharges, resolve undocumented connections to the storm drain system, and take enforcement action;
- The Public Agency Activities Program, which consists of maintenance, inspection, and response to minimize stormwater impacts from public agency activities;
- The Public Information and Participation Program, which requires measures to increase awareness, change behavior, and involve the public in mitigating the impacts of stormwater pollution; and
- The Countywide Monitoring Program, which requires measures to assess receiving water impacts, identification of sources of pollution, evaluation of BMPs, and measurement of long-term trends in mass emissions.

In response to the identification of water quality impairments (via the 303(d) list), the RWQCBs have begun to establish TMDLs for contaminants including trash, metals, organic compounds, nutrients, and bacteria. Given the pervasive nature of some contaminants, development of implementation plans for TMDLs may need to include measures to address NPS pollutants. In addition, the discharge of dry-weather runoff is prohibited in a portion of the North Santa Monica Bay, which may require specific measures to address NPS pollutants in upland areas draining to the ASBS (described in Chapter 2, Regional Description).

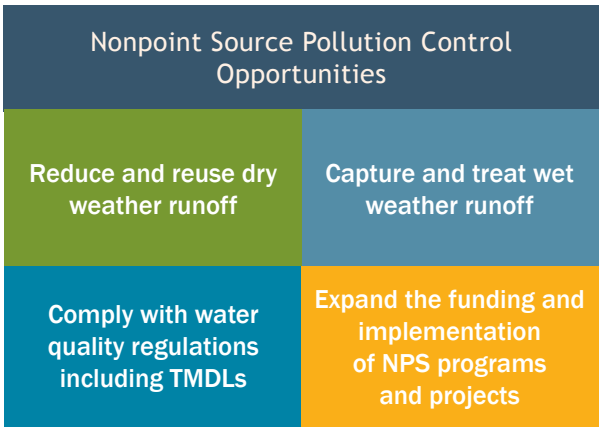

Figure 4-12. Improvement of stormwater runoff quality will lead to an increase in the availability of local non-potable water supplies.

Constraints to the implementation of NPS pollution control programs and projects include: the substantial portion of the Region that has been subject to urban and suburban development; the pervasive nature of surface water contaminants; and the need for widespread individual action for some aspects of NPS pollution control.

Opportunities include the continued implementation of existing programs in accordance with NPDES permits, and establishment and implementation of TMDLs, which may expand funding and implementation of NPS programs and projects.

Stormwater Quality and Flood Management (RMS # 15, 17, 19, 27 & 28)

Historically, the management of stormwater has been viewed either as an element of flood management, or as a means to augment water supply via the managed transfer of runoff from river or stream channels into groundwater recharge basins (discussed above in groundwater management). However, that component of stormwater that is not already used for groundwater recharge (and is therefore discharged via the flood control network to the ocean), is a potential candidate for capture and treatment to improve surface water quality in the rivers and other bodies of water, and to further augment local water supplies.

Given the extent of urbanization in the Region (with approximately 54 percent developed), runoff quality has been notably degraded in most of the rivers and tributaries. The capture (and subsequent treatment) of stormwater, as a structural solution to surface water quality impairments, could be implemented as one element of a comprehensive surface water quality improvement program.

In some locations, historical concerns about the quality of stormwater runoff have limited the willingness of water supply agencies to consider recharge of stormwater from urbanized areas.

Challenges to the expansion of stormwater capture and management include: the need to maintain flood protection for any potential modification of storm drain systems that would expand or enhance capture of stormwater in detention basins, cisterns, or recharge basins; concerns about the potential for contaminants in stormwater to migrate to groundwater; limited land availability, which limits options for development of structures to capture and manage stormwater; and short duration/high intensity storm events which make storage difficult. Other constraints may include plumbing codes and other regulatory restrictions on stormwater reuse.

Opportunities for expansion of stormwater capture and management include development of local and regional facilities to capture and treat urban runoff and stormwater as part of a TMDL compliance strategy. This could include package treatment plants to remove contaminants, filtration systems, or natural treatment systems such as constructed wetlands. Water cleansed by such facilities could either be recharged to groundwater, or stored for delivery to local uses, such as landscape irrigation. As mentioned previously, the new MS4 Stormwater Permit includes the option to develop Enhanced Watershed Management Programs that identify projects that retain stormwater runoff and achieve other benefits such as flood control and water supply. In addition, new developments can implement low impact development (LID) to reduce stormwater runoff, and existing developments could retrofit existing infrastructure to reduce runoff and potentially use stormwater onsite.

Flood management measures in the Region began in earnest in the 1920s, but the major elements of the current system were developed beginning in the 1930s. The current flood management system generally consists of concrete river and stream channels designed to expedite flow, dams and reservoirs on the rivers to regulate flow, debris basins on streams to capture sediment washed down from the mountains, and hundreds of miles of channels to direct flow into spreading basins, rivers, or directly to the ocean. Flood management measures are less developed in those portions of the Region within the Santa Monica and San Gabriel Mountains, where a larger percentage of stream miles are in their natural state, except for dams on the San Gabriel River, Malibu Creek, and several major tributary streams and channel armoring in some developed areas.

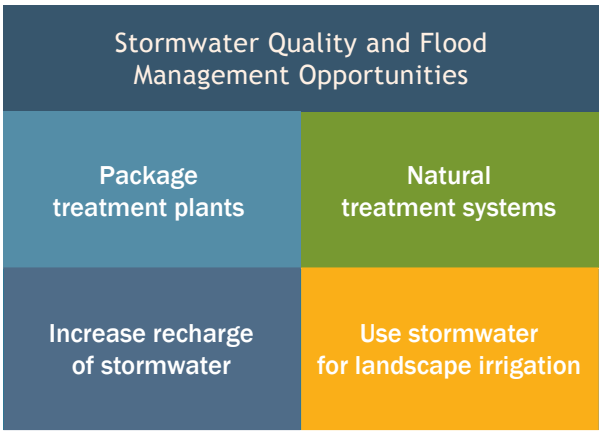

Figure 4-13. Stormwater currently lost to the ocean is a potential candidate for capture treatment, recharge, and reuse.

Despite the extensive network of flood management structures and channels, the counties track areas throughout the Region where flooding or drainage problems persist. Information is reported by the cities, through individual complaints, or directly to each county in unincorporated areas. Unmet drainage needs have been identified throughout the Region, but mostly in localized urban areas. If the situation requires a new drainage structure, the cities and the counties, sometimes in conjunction with the U.S. Army Corps of Engineers, will study the best solution. The recently completed Los Angeles County Drainage Area project, which enhanced flood protection on the lower Los Angeles River, is an example. The Army Corps Coastal Sediment Management Plan includes an appendix on ASBSs that should be considered in coastal flood control management planning. The Nature Conservancy's Coastal Resilience Ventura could also serve as a model.

Constraints to the expansion of flood management programs include: limited funding, and the lack of undeveloped land within the urbanized portions of the Region that could be used for flood management improvements and steep slopes within the local mountains, which combined with the potential for heavy rains, can result in substantial soil erosion or debris flows and may affect the capacity at downstream drainage facilities.

Opportunities to enhance flood management include projects such as the Sun Valley Watershed Plan, which addresses an area of chronic flooding with alternative approaches to construction of a flood conveyance channel through the use of gravel pits and underground drains below parkland to infiltrate runoff and thereby enhance groundwater recharge. If successful, the Sun Valley Plan can serve as a model for future localized flood management improvements. Flood attenuation to reduce peak flood flows, via expanded on-site infiltration and increased upstream storage, represents an opportunity to enhance the potential for river channel modifications, such as those proposed in the Los Angeles River Revitalization Master Plan.

Water and Wastewater Treatment (RMS # 6,14, 18)

As noted above, the principle sources of water supply in the Region are imported water and groundwater, with recycled and local surface water supplementing these sources. Water utilized in the Region for potable purposes must meet state and federal drinking water standards. The federal SDWA, passed by Congress in 1974, requires the USEPA to develop drinking water standards that must be implemented nationwide. In California, the EPA has delegated implementation of drinking water regulations to the state. CDPH has responsibility to protect the quality of drinking water, in accord with California's Drinking Water Source Assessment and Protection Programs that were developed in response to the 1995 reauthorization of the Federal SDWA. Drinking water standards for the State of California are specified in the State's Safe Drinking Water Act, which is in the Health and Safety Code (Division 104, Part 12, Chapter 4, Sections 116270-117130) with implementing regulations in Title 22 of the California Code of Regulations.

Responsibility for treatment of potable water supplies rests with the approximately 120 wholesale and retail water agencies and districts in the Region. Compliance with SDWA rules may require improvements to potable water supply treatment facilities, reduction of disinfection by-product production, and implementation of source water protection practices. Considerable uncertainty exists over the timing and extent of possible future requirements related to contaminants which are not currently regulated, such as endocrine-disrupting compounds,

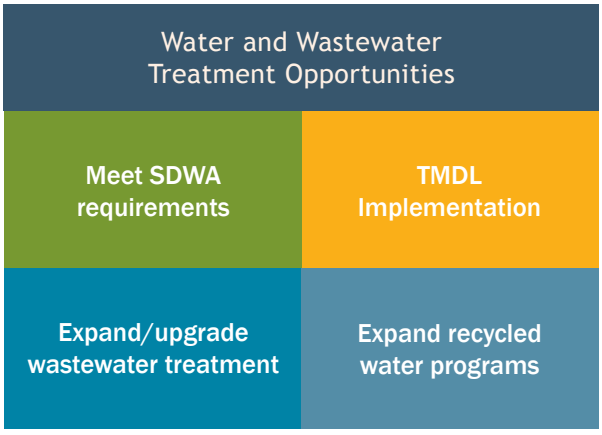

Figure 4-14. The majority of water utilized in the Region's watersheds is potable water which must meet drinking water standards.

pharmaceuticals, and components of common household products, such as shampoo, which have been detected in various source waters.

The treatment of wastewater in the Region is governed by provisions of the federal Clean Water Act, the California Porter-Cologne Water Quality Control Act, and various implementing regulations such as federal and state water quality regulations. Key implementing regulations include the National and California Toxics Rules (40 CFR Sec. 131.36-131.38), the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, and the Water Quality Control Plan for the Los Angeles Region (and Santa Ana Region). These are in turn implemented via NDPES discharge permits, and individual Waste Discharge Requirements for wastewater treatment plants established by the RWQCBs. Wastewater treatment services within the Region are currently provided by:

- Sanitation Districts of Los Angeles County
- Orange County Sanitation District
- City of Los Angeles Department of Public Works, Bureau of Sanitation
- Las Virgenes MWD (under a joint partnership with Triunfo Sanitation District)
- City of Burbank
- Los Angeles County Department of Public Works

In addition, various other entities operate small treatment facilities (e.g., less than 0.2 mgd) or onsite package plants.

In addition to these regulatory constraints, constraints to the expansion of water and wastewater treatment facilities in the future may include: anti-degradation issues; land and siting constraints; uncertainty over pending regulatory developments; challenges associated with conflicting or competing regulatory requirements, and the cost of implementation.

Opportunities to expand water treatment include projects designed to meet SDWA requirements. Opportunities to expand or modify wastewater treatment facilities include projects and programs needed to meet new regulatory requirements that may include new state and federal water quality standards, new permit conditions, TMDL implementation (including acceptance of dry weather runoff diversions to assist municipal stormwater permittees in compliance with their regulatory requirements) and modifications to facilitate the expansion of recycled water programs and/or to meet new recycled water regulatory requirements. Recently adopted statewide policy for onsite wastewater treatment systems (OWTS) provides an opportunity to address OWTS issues locally.

Habitat

As part of the 2013 Plan Update, the GLAC Region completed an Open Space, Habitat and Recreation Technical Memorandum (OSHARTM). The objective of the OSHARTM is to provide a framework for the Region's water and land managers to assist in the development of integrated projects for funding through the IRWMP.

Malibu Lagoon has suffered the negative impacts of human activity. Completely filled in at one point to create ballparks, work has continued since 1983 to restore the natural ecosystem and associated water quality benefits.

Rocky tidal pool in Paradise Cove along the Malibu coastline.

Ecosystem Restoration (RMS # 22, 28)

Despite their exceptional importance and value, many of the Region's inland, riverine, and coastal ecosystems have suffered from over a hundred years of human impacts—development activities to support population growth have taken a heavy toll on many ecosystems. Many rivers, streams, and wetlands have been diked, ditched, and filled. Dams and flood control channels have been built to contain and direct waterways; fundamentally altering the natural processes that used to exist. Much of the historic coastal dunes, woodlands, wetlands, grasslands, scrub communities, and estuary ecosystems have succumbed to development or been degraded by declines in water quality and ecosystem functionality.

In recent decades, technologies have emerged to restore function and productivity to degraded or destroyed ecosystems. Scientists, engineers, and community groups have begun working with federal, state, and local governments to restore ecosystem function to the Region's native ecosystems. According to the CWP Update 2009 (Ecosystem Restoration, Chapter 22), ecosystem restoration improves the condition of modified natural landscapes and biological communities to provide for their sustainability and for their use and enjoyment by current and future generations. Few, if any, of California's ecosystems can be fully restored to their condition before development. Instead, efforts must focus on rehabilitation of important elements of ecosystem structure and function. Successful restoration increases the diversity of native species and biological communities, and the abundance and connectivity of habitats.

Restored ecosystems result in physical, chemical, and biological changes to both the specific system, and the areas that it influences. The benefits of ecosystem restoration are difficult to quantify, but, depending upon the type of ecosystem restored (e.g., aquatic vs. terrestrial), they can include capturing and storing stormwater, groundwater recharge, flood protection, increasing water supply reliability, wildlife habitat creation and enhancement, water quality enhancement, and recreation. Economic benefits can also be realized through increased property values and the reduced cost of water quality enhancement compared to conventional stormwater treatment systems.

To achieve long-term success, ecosystem restoration needs to address the causes and not just the symptoms of ecological disturbance. Sometimes these causes are obvious; sometimes they are subtle and far removed in space and time from the ecological damage, as is the case in many southern California coastal wetlands. Most watersheds that drain into the Region's coastal wetlands were hydrologically modified as a result of urbanization and flood protection measures. Runoff quantities and velocities were increased by the straightened, more efficient drainage systems that reduced deposition of sediments on the floodplain and increased the movement of sediments (and pollutants) downstream. These materials entered the coastal

Ballona wetlands in Playa Del Rey. The Region has lost more than 90 percent of its historic wetlands. The last remaining 600 acres of the Ballona wetlands are in the planning stages of restoration.

wetlands, estuaries and bays, causing water quality problems that fundamentally changed how many of these ecosystems functioned.

These large-scale cause-and-effect relationships pose major constraints to ecosystem restoration such as: the scale of the impact, the cost of both restoration and maintenance, and the magnitude and potentially permanent nature of the environmental changes that resulted in the loss of many ecosystem functions. In addition, although human activities in the watershed have substantially altered many ecological processes, some of these activities provide important public benefits (e.g., flood protection and water supply). Ecosystem restoration efforts therefore must balance the need to provide high quality environments that fulfill the needs of plant and animal communities with preservation of the functions provided by human modifications to such ecosystems. Additional constraints include the high cost of land acquisition and restrictions on some grant funding programs for acquisition.

Opportunities for ecosystem restoration in the Region have been identified in many existing plans, such as the Los Angeles and San Gabriel River Master Plans, and the Los Angeles River Revitalization Master Plan. Existing or future ecosystem restoration projects include: the Oxford Retention Basin; the Ballona Wetlands Restoration Project; the Hazard Park Wetlands Restoration; Devil's Dip Creek Restoration and Daylighting; Topanga Creek Restoration Program; Malibu Creek and Tributary Restoration; Malibu Ecosystem Restoration Feasibility Plan; Las Flores Creek Restoration and fish passage barrier removal; Solstice Creek Restoration, Arroyo Sequit Restoration, Whittier Narrows Nature Center Ecosystem Restoration; Malibu Lagoon Habitat Enhancement Program; Ballona Creek Ecosystem Restoration Project; Hydrodynamic Study for the Restoration of the Tujunga Wash; Taylor Yard Multi-Objective Feasibility Study, the Limekiln Canyon Stream Restoration and Habitat Improvement Project; Puente Chino Hills Wildlife Corridor; Los Cerritos Wetlands Restoration; Medea Creek Restoration at Chumash Park; Oak Park Medea Creek Restoration; and Las Virgenes Creek Bank Stabilization, Stream Restoration, Fish Migration Enhancement and Trail Connection project.

Environmental and Habitat Protection and Improvement (RMS # 22, 27)

Risks to the environment and upland and riparian habitat in the Region include urbanization and the loss of green space, invasive species, hydrological alterations, channel hardening, incompatible land uses, habitat fragmentation, and other common problems associated with urbanization and pollution. The results of riparian and aquatic habitat degradation can lead to increased erosion of banks and channels; diminished water quality for wildlife and domestic use; loss of habitat for wildlife; alteration in flood protection; loss of aquatic and terrestrial productivity and health; and loss of recreational, educational, and aesthetic values. For some surface water bodies, water quality impairments include increases of non-toxic elements such as sediment, nutrients, and water temperature, as well as toxic contaminants such as pesticides, bacteria, and heavy metals. Degraded water quality may require substantial treatment to remove the pollutants that may limit recreational use of southern California beaches, bays, and lagoons, and may potentially affect fish and wildlife habitat quality. Recreational waters are undoubtedly used more in warm summer dry weather, however, in Los Angeles County year-round recreation demand, even during wet weather, is higher than many other counties or states. For example, water quality regulations at Santa Monica Bay Beaches are relevant year round in all weather conditions.

In addition, the loss of habitat throughout the coastal watersheds has aggravated water supply and reliability problems since riparian vegetation, wetlands, and surrounding uplands can act to slow and retain stormwater flows and allow the water to recharge groundwater.

The long-term restoration, improvement, and protection of the Region's riparian and aquatic habitat and environment would reduce the water quality, water supply and biological impacts of urbanization and the environmental degradation associated with the increased population in the Region. Because many of the issues involved in environmental and habitat protection and improvement cut across traditional political and organizational boundaries success will only be accomplished

Figure 4-15. Multiple agencies in the Greater Los Angeles Region are collaborating across organizational boundaries to develop long-term solutions to historical environmental degradation.

through cooperative planning efforts like the IRWMP that include non-governmental organizations, private landowners, industry, and local, state and federal government agencies.

The potential for habitat protection and improvement is limited by extensive development in the Region, as well as by geologic and topographic constraints. Improvement in such a heavily urbanized Region is hindered because the physical and hydrological landscape has been irreversibly altered in so many locations that it may be difficult to recreate the natural state of the landscape. Hydrologic and land use changes in the watersheds also continue to impact stream corridors and downstream aquatic habitats. Many created habitats that were designed to mitigate for losses from development seldom perform the same ecological functions as those that were removed. Additional constraints include the high cost of land acquisition and restrictions in some grant funding programs for land acquisition.

Opportunities for improvement and protection of the Region's riparian and aquatic habitat (including land acquisition and fish passage removal) include the following examples: Las Virgenes Creek Naturalization and Restoration, Restoration of Southern Steelhead Habitat in Solstice Creek, Triunfo Creek Riparian Enhancement, Hahamongna Watershed Park Habitat Restoration and BMP Implementation; the Flint Wash Restoration; the Central Arroyo Park Habitat Restoration and BMP Implementation; the Lower Arroyo Park Habitat Restoration and BMP Implementation; the San Rafael Creek Restoration; Santa Fe Dam Recreation Area and Habitat Enhancements; Rio Hondo Vision Plan (Emerald Necklace Concept); Wilmington Drain Restoration Multiuse Project; Machado Lake Improvements; Stone Canyon Creek Restoration; the Long Beach RiverLink; the Sepulveda Basin Habitat Enhancement; the Arroyo Seco Watershed Feasibility Study; the Cold Creek Diamond Acquisition; and the Topanga Connection Acquisition.

Wetlands Enhancement and Creation (RMS 22, 27)

The Region has lost more than 90 percent of its historic wetlands. Those remaining are threatened by development, changes in hydrology, invasive species, and poor water quality. The results of degradation of remaining wetlands and the associated environment can lead to increased erosion of banks and channels; diminished water quality for wildlife and domestic use; loss of ecosystem function; loss of habitat for wildlife; alteration in flood protection; loss of aquatic and terrestrial productivity and health; and loss of recreational, educational, and aesthetic values. Water quality impairments include increases of both non-toxic elements such as sediment, nutrients, and water temperature, as well as toxic contaminants such as pesticides, bacteria, and heavy metals. The degraded water quality may require substantial treatment to remove the pollutants that may affect aquatic and terrestrial habitat quality and function, and may limit recreational use of beaches, bays, and lagoons.

In addition, the loss of wetlands throughout the coastal watersheds has aggravated water supply and reliability problems, since riparian vegetation and wetlands can act to slow and retain stormwater flows and allow the water to recharge groundwater.

The long-term restoration, improvement, and protection of the Region's wetlands would help ameliorate the water quality, water supply and biological impacts of environmental degradation. Because many of the issues involved in wetland restoration and enhancement cut across traditional political and

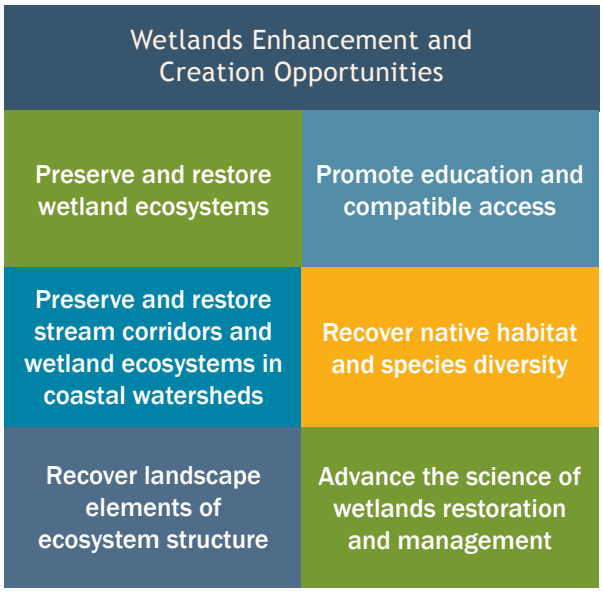

Figure 4-16. The long-term restoration, improvement and protection of the Region's wetlands would help ameliorate the water quality, water supply and biological impacts of environmental degradation.

organizational boundaries, success can more easily be accomplished through cooperative planning efforts like the IRWMP that include non-governmental organizations, private landowners, industry, and local, state and federal government agencies. Education and public outreach will be critical in helping the public understand their role in protection and achieving buy-in on the necessary improvements.

Wetland restoration and enhancement is constrained by existing development over much of the historical wetland areas, private ownership, permanently altered hydrology, and lack of funding for operation and maintenance. In today's funding environment, it is probably not possible that all of the required projects can be completed as single purpose projects. With planning, cooperation, and vision, projects can be integrated to achieve multiple goals. Integrated projects may be more likely to be funded, in that funding agencies may treat them more favorably, or various fund sources would be available to fund individual elements of projects. In addition, wetland restoration and enhancement projects may require ongoing maintenance and operation that requires environmental permits.

Opportunities for enhancement and creation of the Region's wetlands include: Los Cerritos Wetland Restoration (Bryant, Bixby, and Hellman); Gardena Willows Restoration; Ballona Wetlands Restoration; Colorado Lagoon Enhancement; DeForest-Dominguez Wetlands Restoration; Hansen Dam Recreational Area Wetlands Restoration Project; Los Angeles River Headworks Wetlands and Water Protection Project; the Multiuse Wetlands Project at Children's Museum of Los Angeles; and El Dorado Park Wetlands.

Open Space, Recreation

Recreation and Public Access (RMS # 23, 24 24 & 26)

Open space used for recreation and public access has the potential to enhance water supply (by preserving or enhancing groundwater recharge and thereby improving water supply reliability) and improve surface water quality, to the extent that these open spaces filter, retain, or detain stormwater runoff (although few existing parks or open spaces include specific features to improve the quality of stormwater runoff, and poorly managed open space has the potential to be a source of sediment which can degrade water quality). Additional open space areas will also benefit the public, including DACs.

The 2013 OSHARTM developed by the GLAC Region as part of the IRWM Plan Update assessed the need for recreation and open space relative to population and existing recreation and open space areas. The OSHARTM pointed out that although much of the remaining open space in the Region is located in the northern foothills and the mountains, the bulk of the need exists within the densely developed coastal plain and the inland valleys. If new parkland and open space can be created within these urbanized areas, particularly within or near Disadvantaged Communities, then public access to parkland could be improved. To increase open space, the acquisition of land will be necessary. Opportunities for acquisition could include vacant parcels, under-utilized public land, and brownfields (when remediation is feasible), including the lands

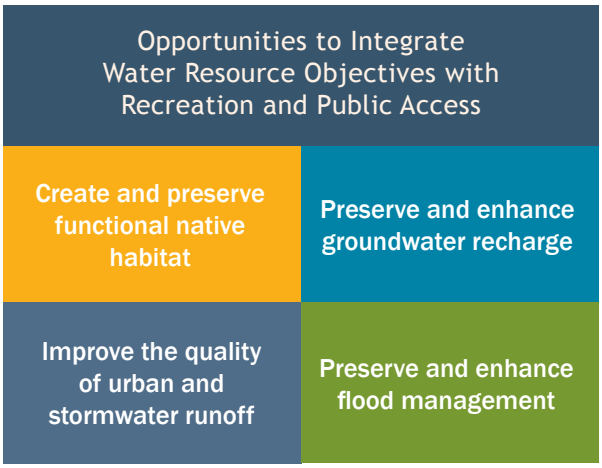

Figure 4-17. Open space used for recreation and public access has the potential to enhance water supply and improve surface water quality.

along rivers, creeks or tributaries that meet these criteria. Also maintenance of the forested upland areas in the mountains will be key to maintaining the water quality and recreational value of an important regional resource.

Current plans and proposals for new parks, trails and recreational projects in the Region include: Rio de Los Angeles State Park, Annandale Golf Course Habitat Restoration and Infiltration; Welch Site BMP and Habitat Restoration; Lincoln Heights Freeway Interchange Restoration and BMP; Malibu Linear and Civic Center Legacy Park; Trancas Canyon Park; Las Flores Creek Park; Morris Dam Peninsula Park; Azusa Canyon River Wilderness Park; San Gabriel River Master Plan, (National Park Service) San Gabriel River Watershed Special Resource Study, San Gabriel Canyon Spreading Grounds; Maywood Riverfront Park; San Gabriel River Discovery Center at Whittier Narrows Regional Park; Woodland (Duck) Farm Park; Pico State Historic Park; Paseo del Rio at San Gabriel and Rio Hondo Spreading Grounds; Santa Fe Springs Park Expansion; Downey Landing, City of Downey; Bellflower Riverview Park; Pacoima Wash Greenway Project Parkside Drive Park; South Los Angeles Wetlands Park; Puente Creek Nature Center; Strathern Pit Multiuse Project; North Atwater Creek Restoration and Water Quality Enhancement; Marsh Street Park; Walteria Lake Enhancement; and Lafayette Creek Daylighting.

Coupled with open space recreation is the need for maintaining the water dependent recreation opportunities within the Region. The Santa Monica Bay coastline is a vital and key recreation destination for the entire Region as well as the world. Maintaining this environmental, recreational and economic resource through pollution prevention and education programs and access route maintenance is critical. The Los Angeles River has also in recent years become a recreation resource for kayaking and other activities. Further enhancements as part of the Los Angeles River Revitalization Plan could allow for more public access and ability to use the River as a recreation resource.

As new parks or open space are created, these places may also provide opportunities to meet other regional needs, including:

- Creation or preservation of functional native habitat and habitat linkages
- Preservation or enhancement of groundwater recharge, to the extent that new parks preserve existing open space or reduce impervious surfaces
- Improve the quality of urban or stormwater runoff, so that new parks or open space are designed to include runoff water quality improvement features, such as vegetated swales, buffers, or other BMPs
- Preserve or enhance flood management; the preservation of open space can avoid potential increases in runoff associated with new development, and reduce runoff if impervious surfaces are reduced.

Each year more than 33 million visitors enjoy the beaches and mountains within the Santa Monica Mountains National Recreation Area. Visitors hike, bike or ride on hundreds of miles of mountain trails, or drive the scenic roads.

Sustain Communities

Asset Management

With more than 10 million people residing in a developed area of approximately 1,125 square miles, the infrastructure developed for water, wastewater, and flood protection is significant. To maintain the quality of potable water, the collection and treatment of wastewater, and minimize risks to life and property from flood events, this infrastructure must be maintained, repaired as needed, and replaced or expanded when appropriate.

Traditionally viewed as a form of monetary management, in the past decade, asset management has increasingly replaced traditional assessments of repair and replacement costs. The Statewide General Waste Discharge Requirements for Sanitary Sewer Systems requires the development of Sewer System Management Plans (SSMP) for all publicly owned sewage collection systems greater than one mile in length in California, with a goal to protect public health and the environment by reducing the severity and number of sanitary sewer overflow events.

Although the specific components of an asset management program may vary, in general the process consists of the development of an overall strategy, an inventory of assets, an assessment of asset condition, a financial valuation, and the establishment of capital and operating budgets followed by the ongoing maintenance, repair, and replacement of assets. Challenges to implementing such a program might include funding for replacement infrastructure, obsolescence of technologies, and the cost of implementing the asset management program.

Public agencies and districts responsible for water, wastewater, and flood protection should implement asset management programs, which will preserve and protect water quality, enhance water supply reliability, and protect the public and environment.

Integrated Planning (RMS # 3 through 28 except 10 & 20)

This Plan is the most visible evidence of integrated planning in the Region, but it is not the only example. As noted elsewhere, in recent years the potential for a transformation of the watersheds in this Region has emerged, beginning with visions of restoring the Los Angeles and San Gabriel Rivers, development of watershed management plans on most of the major tributaries and creeks, and the preparation of IRPs by water and sanitation agencies. These various plans promote integrated efforts to manage resources and recognize that water and watershed resources are interconnected.

Three general approaches to integrated planning are: 1) Geographic Integration, which links similar kinds of projects or programs that are geographically separated, but can work together to create a whole that is greater than the sum of its parts; 2) Multi-purpose Projects, where multiple water management strategies are incorporated into individual projects or programs; and 3) Collaborative Projects, which requires agencies, jurisdictions or organizations to work together on collaborative projects or programs which cross jurisdictional boundaries and address multiple water management strategies.

Due to the extensive urbanization constraints in the Region, the opportunities for implementing water resource projects are constrained by the availability of funding and competing demands for available land to site new projects. Plans, programs, and

Figure 4-18. The IRWMP has provided an opportunity to integrate planning at the scale of watersheds, Subregions, and the Greater Los Angeles County Region.

projects need to integrate multiple water management strategies to meet regional water resource needs, efficiently use fiscal resources, and provide the public with tangible community benefits.

As the IRWMP will largely be implemented by the individual actions of local agencies, jurisdictions, and organizations, the consistent application of integrated planning will be necessary to assure that the objectives and planning targets established in this Plan are realized.

Land Use Planning (RMS #24)

The constitution of the State of California confers responsibilities for land use planning to the cities and counties (for unincorporated areas). The Government Code establishes requirements for the development of General Plans to guide land development decisions, which must include seven required elements: land use, circulation, housing, conservation, open space, noise, and safety. Because of this structure, water resources may be discussed within the conservation element (as relates to water supply and stormwater management), the open space element (as relates to water-based recreation or the use of lands that may protect water supply or enhance groundwater recharge), and the safety element (as relates to flood protection). Thus, most jurisdictions' policies with respect to water resources and their management are typically fragmented throughout several elements. The State of California's General Plan Guidelines (GOPR, 2003) describe the concept of an optional water resources element, which would combine water supply and demand, water quality, wastewater treatment and disposal, watershed features and processes, flood management, and stormwater management.

In 2001, Senate Bill 610 and Senate Bill 221 further correlated development to water supply by requiring Water Supply Assessments be conducted to determine if supplies were available to meet any new demands.

Given the pervasive nature of some NPS pollutants, land use planning, in the form of ordinances, could be used to reduce stormwater runoff volume and/or the discharge of pollutants from development or redevelopment sites. Some portions of the Region require the development of a Standard Urban Stormwater Mitigation Plan (SUSMP), to retain the runoff from storms of approximately 0.75 inches. SUSMP requirements could be amended to require both retention and treatment of runoff with individual jurisdictions extending these requirements to development/redevelopment on smaller sites or additional development types. Existing stream corridors, open spaces, or other valued watershed resources could be protected via ordinance (i.e., a stream protection ordinance) or incentives could be provided to reduce impervious surfaces and increase natural recharge. To address water quality issues, the Orange County Drainage Area Master Plan was followed by the development of watershed action plans and the subsequent amendment of local General Plans to integrate water quality and runoff policies. A more comprehensive approach to natural resource management, which could provide corollary benefits to water resources, is provided by the City of Santa Monica's Sustainable City Plan, which promotes a well-maintained open space system that can support natural functions, wildlife habitat, passive and active recreation, and supports implementation of land use and transportation planning and policies that encourage compact development and mixed-use projects.

Implementation of projects designed to capture, treat, and reuse urban and stormwater runoff as part of the implementation of the IRWMP, could require acquisition of land to site those projects. To the extent that acquisition displaces existing uses, cities and counties may consider modification of their general plans to facilitate the accommodation of displaced uses or provide incentives to take advantage of newly created open spaces (e.g., detention basin or natural treatment areas) or recreational areas.

Figure 4-19. The State of California Government Code establishes requirements for the development of General Plans to guide landuse decisions.

Where feasible, general plan modifications should incorporate the concepts articulated in Common Ground from the Mountains to the Sea, and in the SCAG Compass Growth Vision Report, such as mixed-use land use designations with increased density along existing transportation corridors. Cities and counties should also consider providing incentives to private development that promote the inclusion of features that improve surface water quality, enhance groundwater recharge, and reduce water demand.

Constraints to the use of land use planning to enhance the integrated management of water resources include: the lack of fiscal resources to support development of optional general plan elements; cost effectiveness of the program; the potential for disparities amongst local jurisdictions to subtly affect development patterns (as developers may choose those jurisdictions with less stringent requirements); and the absence of model programs to demonstrate the effectiveness of such measures.

Opportunities to expand the use of land use planning in the integrated management of water resources include: the adoption of natural resource protection measures (e.g., floodplain or stream protection ordinances); the preparation of water resource elements in city and county General Plans; the adoption of Sustainability Plans by jurisdictions, agencies, and organizations; and the SCAG Compass Growth Vision Report. As part of the IRWM's 2013 OSHARTM, next steps were identified that would call for further collaboration with city land use planning departments to further refine the opportunity areas for developing recreation, open space and habitat benefits on a subregional level.

Watershed Planning (RMS # 27)

Numerous watershed plans have been prepared in the Region, including the Arroyo Seco Watershed Restoration Feasibility Study, the Ballona Creek Watershed Management Plan, Common Ground, from the Mountains to the Sea, Compton Creek Watershed Management Plan, Dominguez Channel Watershed Management Master Plan, Malibu Creek Watershed Management Area Plan, Rio Hondo Watershed Management Plan, San Gabriel River Corridor Master Plan, Sun Valley Watershed Plan,

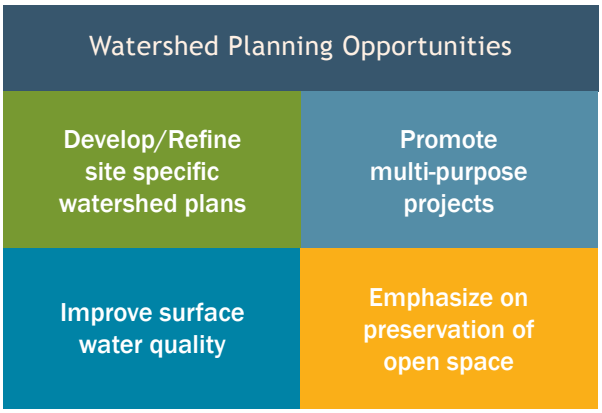

Figure 4-20. As noted by the 2005 update of the California Water Plan: "...Los Angeles County [is] the most productive county in the state in terms of watershed planning." (DWR, 2005).

and the draft Upper San Gabriel River Watershed Management Plan. Draft plans are under development for the Tujunga Wash, the Headwaters of the Los Angeles River, and Coyote Creek, along with the Green Visions Plan for Los Angeles County and portions of Orange and Ventura Counties.

The primary focus of these plans has been improvement of surface water quality, with additional emphasis on preservation of open space, and the promotion of multi-purpose projects. Most of these efforts have been stakeholder-driven, so that the list of recommended actions reflects local concerns and priorities.

Constraints on the development of additional watershed plans include: availability of funding; absence of established stakeholder groups for some of these areas; and a defined minimum scope to assure regional consistency.

Opportunities for the preparation of new watershed plans include: Burbank (east and west) Wash; Verdugo Wash; the main stems of both the Los Angeles and San Gabriel Rivers (although the respective river master plans cover the river corridors and some adjacent lands); Los Cerritos Channel; and numerous smaller watersheds that drain directly to Santa Monica Bay and San Pedro Bay. In addition, this IRWMP could serve to promote regional consistency between both new and existing plans, and use the opportunity to come into compliance with MS4 permits.

- The GLAC Region Water Resource Management Strategies presented in this

Chapter include nearly all of the 2009 California Water Plan RMS. The remaining RMS not included the previous sections are identified and explained here: #2 Agricultural Water Use Efficiency and #20 Agricultural Lands Stewardship: given that the GLAC Region does not have significant areas of agricultural crops, these RMS were considered to be irrelevant for GLAC implementation. Local small-scale nurseries do exists, but would be covered by other strategies like, pollution prevention etc.

- #10 Precipitation Enhancement and #29 Other Strategies: The GLAC Region has many other water supply development opportunities that should be exhausted before engaging in these newer strategies

4.4 Climate Change

The strategies discussed above can be used to help the Region adapt to the climate change vulnerabilities identified in Chapter 2, and mitigate further climate change impacts. The Climate Change Subcommittee reviewed the Resource Management Strategies discussed above, and also developed an initial list of both adaption and mitigation strategies through review of relevant climate change related documents. These documents include:

- Managing an Uncertain Future (DWR, 2008)
- Climate Change Scoping Plan (CARB, 2006)
- Climate Action Team Biennial Report (CalEPA, 2010)
- Resolution on Sea Level Rise (OPC, 2010)
- Coastal Regional Sediment Management Plan for Los Angeles County Coast (USACE, 2012)

Strategies from this initial list were considered based on their potential for addressing the Region's vulnerability issues and removed if they were deemed infeasible or irrelevant for the GLAC Region. Strategies were also refined and added to develop a more accurate and comprehensive list. Table 4-3 shows the management strategies considered. These strategies are listed based upon their ability to help the Region plan for future impacts of climate change on water resources, mitigate against further climate change by reducing GHGs, and providing carbon sequestration.

IRWM Plan projects that implement any of these strategies would therefore be helping the Region meet the specific targets identified that support the objective.

Table 4-3: Management Strategies Considered for Climate Change		
Adaptation or Mitigation Measure	**Infeasible/ Irrelevant/ Opposition**	**Considerations / Explanations**
Reduce Water Demand		
Agricultural water use efficiency		Although no large-scale crop lands exist in the Region, there are nurseries.
Urban water use efficiency		
Crop idling for water transfers	Irrelevant	There is a spot market for imported water transfers, but irrelevant because there are no large-scale crops in the Region.
Water meters installation		This is only applicable for smart meters and multi-unit residence water meters since the Region is already metered.
Education/public outreach		
Gray water use		There could be public perception issues and potential groundwater quality impacts, but Los Angeles County can permit.
Decentralized stormwater use		
Rainfed agriculture	Infeasible	Agriculture is limited to specific small scale ventures like nurseries that require more water than naturally occurs through local rainfall.
Improve Operational Efficiency/Transfers		
Conveyance - regional/local		
System reoperation		
Water transfers		
Localized/decentralized treatment		For wastewater, this could reduce available supplies of recycled water.
Shift water use to off-peak hours		
Conduct emissions inventory and target		
Treatment and distribution efficiency (urban and ag)		
Increase use of renewable energy sources		
Optimize sewer systems	Irrelevant	This is already accomplished separately with wastewater / stormwater systems so there is no impact on climate change.
Increase Water Supply		
Conjunctive management & ground-water storage		
Desalination of brackish groundwater		
Desalination of ocean water	Opposition	This will help the Region to adapt to climate change by offsetting surface supplies, but will not mitigate GHGs due to its high energy needs. Plants would also need to be constructed on the coast so there could be issues with sea level rise.
Precipitation enhancement		
Recycled Municipal Water		

Table 4-3: Management Strategies Considered for Climate Change		
Adaptation or Mitigation Measure	**Infeasible/ Irrelevant/ Opposition**	**Considerations / Explanations**
Surface Storage - Regional/local		
IPR/Reservoir Augmentation		This is already being done; several new/expanded projects are under consideration.
Dewvaporation or Atmospheric Pressure Desalination	Opposition	Dewvaporation is not favorable compared to more energy efficient supplies and would not mitigate against GHGs.
Fog Collection	Irrelevant	Future fog amounts are unknown given climate change, so is not considered useful to this Region.
Irrigated land retirement	Irrelevant	Region does not have large enough agricultural areas for this to be a meaningful measure.
Direct Potable Reuse		This is an emerging technology that has some permitting and perception challenges to near-term implementation.
Improve Water Quality		
Drinking Water Treatment and Distribution		
Groundwater/Aquifer Remediation		
Matching quality to use		
Pollution Prevention		
Salt and Salinity Management		
Urban Runoff Management		
Improve Flood Management		
Flood risk management		
Protective infrastructure		
Sediment management		
Practice Resource Stewardship		
Agricultural lands stewardship	Irrelevant	There are no large-scale crop lands in this Region to make this measure relevant.
Economic incentives (loans, grants, water pricing)		
Ecosystem restoration		
Forest management		
Land use planning and management		Strategies that include sediment management and creation of sediment reserves to adapt to SLR along beaches should be encouraged.
Recharge area protection		
Water-dependent recreation protection		Strategies that include sediment management and creation of sediment reserves to adapt to SLR along beaches should be encouraged.
Watershed management		
Water-dependent cultural resources and practices preservation		Although no federally-recognized Tribes in the Region, important cultural resources, including wetlands, do exist.