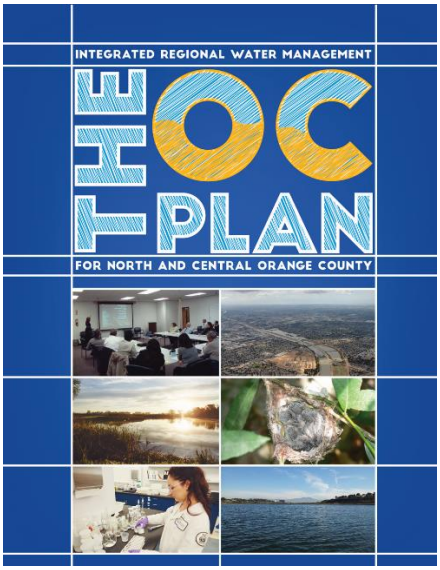
INTEGRATED REGIONAL WATER MANAGEMENT

IRWM PLAN

FOR NORTH AND CENTRAL ORANGE COUNTY

THE OC PLAN



Integrated Regional Water Management for the North and Central Orange County Watershed Management Areas

March 2018

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List of Acronyms

§	Subsection
AB	Assembly Bill
ACOE	Army Corps of Engineers
AF	Acre Feet
AFY	Acre Feet per Year
AMP	Allen-McColloch Pipeline
ASBS	Areas of Special Biological Significance
BMP	Best Management Practice
BP	Before Present
CalWEP	California Water Efficiency Partnership
CARB	California Air Resources Board
CASGEM	California Statewide Groundwater Evaluation Monitoring
CAT	Climate Action Team
CCA	Critical Coastal Area
CCWMP	Coyote Creek Watershed Management Plan
CDFG	California Department of Fish and Game (now CDFW)
CDFW	California Department of Fish and Wildlife
CEDEN	California Environmental Data Exchange Network
CEQA	California Environmental Quality Act
cfs	Cubic Feet per Second
CRA	Colorado River Aqueduct
CWA	Clean Water Act
CWC	California Water Code
CWP	California Water Plan
DAC	Disadvantaged Communities
DAMP	Drainage Area Management Plan
DMM	Demand Management Measures
DMS	Data Management System
DRPP	Demand, Runoff, and Pollution Prevention
DWR	Department of Water Resources
EDA	Economically Distressed Areas
EIR	Environmental Impact Report

EIS	Environmental Impact Statement
EWMP	Efficient Water Management Practices
EPA	Environmental Protection Agency
ET	Evapotranspiration
ETWD	El Toro Water District
FEMA	Federal Emergency Management Agency
GAMA	Groundwater Ambient Monitoring and Assessment
GIS	Geographic Information System
GHG	Greenhouse Gas
GMZ	Groundwater Management Zone
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
GWRS	Groundwater Replenishment System
HCP	Habitat Conservation Plan
IPCC	Intergovernmental Panel on Climate Change
IRP	Integrated Water Resources Plan
IRWD	Irvine Ranch Water District
IRWM	Integrated Regional Water Management
LID	Low-Impact Development
LIP	Local Implementation Plan
LAWRP	Los Alisos Water Reclamation Plant
LRP	Local Resources Program
MAF	Million Acre Feet
MEP	Maximum Extent Practicable
MCAS	Marine Corps Air Station
MCL	Maximum Contaminant Level
MGD	Million gallons per day
mg/L	Milligrams Per Liter
MHI	Median Household Income
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MS4	Municipal Separate Storm Sewer System
MSAA	Master Streambed Alteration Agreement

MWDOC	Municipal Water District of Orange County
MWRP	Michelson Water Reclamation Plant
NCC	Natural Communities Coalition
NCCP	Natural Communities Conservation Plan
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NROC	Nature Reserve of Orange County
O&M	Operations and Maintenance
OC	Orange County
OCFCD	Orange County Flood Control District
OCSD	Orange County Sanitation District
OCSP	Orange County Stormwater Program
OCWD	Orange County Water District
OCPW	Orange County Public Works Department
OPR	Office of Planning and Research
PBDE	Polybrominated Diphenyl Ethers
PCB	Polychlorinated Biphenyls
POTW	Publicly Owned Treatment Works
ppb	Parts Per Billion
QA/QC	Quality Assurance/Quality Control
RMS	Resource Management Strategies
ROWD	Report of Wastewater Discharge
RWMG	Regional Watershed Management Group
RWQCB	Regional Water Quality Control Board
SAMP	Special Area Management Plan
SAR	Santa Ana River
SAWPA	Santa Ana Watershed Project Authority
SB	Senate Bill
SCAG	Southern California Association of Governments
SCCWRP	Southern California Coastal Water Research Project
SCSC	Southern California Salinity Coalition

SDP	Seawater Desalination Program
SGMA	Sustainable Groundwater Management Act
SFHA	Special Flood Hazard Area
SMC	Stormwater Monitoring Coalition
SNMP	Salt and Nutrient Management Plan
SOCWA	South Orange County Wastewater Authority
SRF	State Revolving Fund
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Quality Control Board
SWP	State Water Project
SWRP	Stormwater Resource Plan
TDS	Total Dissolved Solids
TIN	Total Inorganic Nitrogen
TMDL	Total Maximum Daily Load
TMP	Trash Management Plan
USACE	United States Army Corps of Engineers (The Corps)
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound
WDL	Water Data Library
WDR	Waste Discharge Requirement
WIHMP	Watershed Infiltration and Hydromodification Management Plan
WMA	Watershed Management Area
WMP	Watershed Management Plan
WQMP	Water Quality Management Plan
WUE	Water Use Efficiency

SECTION 1. REGIONAL PLANNING, OUTREACH, GOVERNANCE AND COORDINATION

1.1 Introduction

The North and Central Orange County Watershed Management Area Integrated Regional Water Management (IRWM) Plan (The OC Plan) was prepared to identify and implement water management solutions on a regional scale. Agencies, organizations and stakeholders collaborated to identify water resource needs, develop goals to improve water resource management and to evaluate projects for increased regional self-reliance and improved quality of life in Orange County. This plan has been developed from and coordinates with existing plans and research documents.

The OC Plan updates and combines two existing IRWM plans that were prepared by the County of Orange. The North Orange County Watershed Management Area Integrated Regional Water Management Plan was completed in 2011 and the Integrated Regional Water Management Plan: Central Orange County Management Area was completed in 2012. Preparation and implementation of The OC Plan builds on collaborative watershed planning in Orange County that began more than a decade ago.

The goals of The OC Plan are to increase water supply, protect water quality, enhance the environment and habitat, provide flood risk management, improve the quality of life, and address climate change. The OC Plan will accomplish these goals through an established process of ranking projects to help further state and regional goals.

Integrated Regional Water Management for the Region

The OC Plan includes the Central Orange County (OC) Watershed Management Area (WMA) and the North OC WMA (herein referred to as the Region), both of which are within the Santa Ana Funding Area.[1] **Figure 1-1** shows the North and Central OC WMAs and their location within Orange County, the surrounding counties, and the South OC IRWM Region.

[1] Legislation for both Proposition 84 and Proposition 1 allocated IRWM funding for each hydrologic region of the state, and the Mountain County Overlay area, as identified in the California Water Plan, with some additional modifications, including three sub-regions for the South Coast Hydrologic Region. For IRWM grant program purposes, these areas are referred to as "funding areas" to reflect that there are differences between the boundaries of the California Water Plan hydrologic region and the IRWM funding area boundaries.
(DWR Proposition 1 Fact Sheet:
http://www.water.ca.gov/irwm/grants/docs/P1Index/IRWM_FundingAreaFactSheet121714.pdf)

Figure 1-1: North and Central OC Watershed Management Areas

Integrated planning is an appropriate approach for both WMAs and the Region for the following reasons:

- The Region is integrally linked to sensitive regional and coastal habitat by dry-weather and storm flows. Within the Central OC WMA, the entire Newport Bay Watershed drains to Newport Bay, and the Newport Coast Watershed drains directly to the Pacific Ocean. The lower portion of the Santa Ana River Watershed within Orange County, the Lower San Gabriel River/Coyote Creek Watershed, and the Anaheim Bay-Huntington Harbour Watershed are within the North OC WMA, which carries the runoff from approximately one-third of Orange County. The Region's watersheds provide riparian habitat for many flora and fauna and include 35 miles of coastline and many of the remaining significant estuary areas along Southern California. Beach closures, clean oceans and meeting total maximum daily load (TMDL)/National Pollution Discharge Elimination System (NPDES) requirements are regional challenges.
- Like the WMA concept, IRWM planning is an efficient and effective way to manage water resources. It promotes regional prioritization of important watershed issues and consensus regarding how to address these issues. Also, IRWM planning encourages the development of holistic solutions to problems, addresses problems at the source, and integrates projects and programs with overlapping jurisdiction throughout the Region. Ultimately, IRWM planning promotes sustainable resource management.
- Urbanization of the Region impacts the ecosystems in these sensitive coastal areas. Water quality can be improved by a variety of means, such as municipal land use planning, water conservation, flood control improvements, and habitat restoration and enhancement. Within the Central OC WMA, several cooperative agreements have been established for agencies to share in the management, implementation, and cost of water quality projects and programs related to the TMDLs, as well as water resource management, including wastewater collection and treatment. Each year, significant public agency funding is directed to stormwater and other water quality programs, including the protection of coastal ecosystems.
- The OC Plan addresses statewide management strategies and enables agencies to leverage financial resources through development of multi-benefit/multi-jurisdictional projects.
- The OC Plan will maximize the utilization of local water resources and efficient use of all resources by providing for more effective collaboration through the application of multiple water management strategies and implementation of multi-purpose projects that will fulfill the needs of the Region.
- The communities within the Region place a high social and economic value on their coastal resources in these areas and the protection of these resources.

- Groundwater is a regional resource and an important source of drinking water. The Region overlays the Coastal Plain of Orange County Groundwater Basin, identified by the California Department of Water Resources as Basin 8-1. Management of the groundwater basin is critical to protecting this local water supply. Issues related to groundwater quality, such as naturally occurring selenium, toxic plumes from former military operations, and high concentrations of nitrates and total dissolved solids (TDS) require regional solutions.
- The imported water system and water resources are shared regionally. The Region has wide variations in rainfall. Approximately six out of 10 years have below average rainfall. Agencies are continuing to work on programs to enhance local supplies and reduce water demand. Regional programs are more cost-effective and provide greater benefit locally and regionally.

Watershed Management in the Region

In June 2003, as directed by the County of Orange Board of Supervisors, the Orange County Public Works (OC Public Works) Department (formerly the Resources and Development Management Department) led a task force of city managers and special district general managers to develop a countywide Water Quality Strategic Plan. This water quality strategic planning effort formalized a partnership between Orange County, the Orange County Flood Control District (OCFCD), cities, and water and wastewater agencies. As a result, the County created three WMAs - North, Central, and South. Orange County serves as the regional program administrator.

This approach created a framework for municipalities, agencies, and stakeholders to work collaboratively and find cost-effective solutions to Orange County's water resources needs through resource management and capital improvement planning.

Building on this approach, The OC Plan:

- Continues watershed planning at a manageable scale
- Is consistent with the approach of new and future stormwater permits
- Facilitates meaningful public and private stakeholder involvement
- Allows priority setting at a local level
- Is similar to an initiative in Orange County that generates funds for remediating environmental impacts due to transportation projects and associated environmental projects, referred to locally as Measure M
- Follows the successful model of the Newport Bay Watershed Executive Committee and Newport Bay Watershed Management Committee
- Accommodates regional differences in managing water quality

- Allows for local and regional water and sewer infrastructure planning to be coordinated with flood control and storm drain systems
- Promotes partnership opportunities, especially between cities and districts
- Is consistent with the OC Drainage Area Management Plan (DAMP), Reports of Wastewater Discharge (ROWD), and the OC Stormwater Resource Plan (SWRP)
- Allows for optimum use of existing and future funding sources
- Can be accomplished through interagency agreements
- Provides for regular meetings and engagement by stakeholders

The primary purpose of The OC Plan is to bridge current and future efforts related to watershed planning, allowing agencies and stakeholders to leverage resources across jurisdictions. The OC Plan describes the following:

- Central OC WMA and North OC WMA that make up the IRWM Region
- Issues related to and priorities for the IRWM region
- Combined goals and objectives for the IRWM region
- Strategies for meeting the identified goals and objectives
- Current efforts within the watersheds
- Ways to evaluate the IRWM plan and update it as necessary

1.2 History of Integrated Regional Water Management Planning in the North and Central Orange County Watershed Management Areas

Central Orange County WMA. Phase 1 - The County of Orange led the first IRWM planning efforts for the Central OC WMA with development of the Phase I Central Orange County Integrated Regional and Coastal Watershed Management Plan (County of Orange, 2007). The Phase I Plan reviewed each agency's future plans and how they would work jointly across the watershed, with a strong emphasis on the sensitive coastal resources, Areas of Special Biological Significance (ASBS), and Critical Coastal Areas (CCAs) within the Central Orange County WMA. In January 2006, the City of Newport Beach was awarded a Proposition 40 planning grant by the State Water Resources Control Board for preparation of an integrated regional coastal watershed management plan to address issues related to ASBS and CCAs along the Newport Coast.

Phase 2 – In May 2006, the City of Newport Beach was awarded a Proposition 50 planning grant by the California Department of Water Resources (DWR) for the preparation of the Phase 2 Central Orange County IRWM Plan. The Phase 2 IRWM Plan includes data collection, analysis, formulation of policy and guidelines, and a list of 147 potential water related projects (City of Newport Beach, 2009).

Phase 3 - The County of Orange led the effort to complete the Phase 3 Central Orange County IRWM Plan (September 2012). The Phase 3 Plan is a compilation and revision of Phases 1 and 2 Plans and was developed to meet Proposition 84 guidelines.

North Orange County WMA. The Westminster Reconnaissance Study, conducted by the United States Army Corps of Engineers (USACE, 2001), covered most of the North Orange County WMA, and identified the challenges facing the highly-urbanized region. Because of this study, the USACE, Los Angeles County, and Orange County entered into an agreement to develop a watershed management plan for the Lower San Gabriel River/Coyote Creek Watershed, which is a watershed within the North Orange County WMA. From 2005 to 2007, the County of Orange led development of the Coyote Creek Watershed Management Plan (CCWMP, 2007). Development of the CCWMP encouraged interjurisdictional projects and planning to promote open lines of communication, cooperation and collaboration among agencies for improved management of shared resources. The CCWMP provided a framework for improving watershed management practices in the Coyote Creek region.

The CCWMP became a foundational element of the North Orange County WMA IRWM Plan (September 2011). Like the Central Orange County Phase 1 Plan, the North Orange County WMA IRWM Plan bridged existing and developing watershed planning efforts, resulting in effective collaboration and leveraging agency resources across jurisdictions. The North Orange County WMA IRWM Plan articulated: 1) issues and priorities; 2) goals and objectives; 3) current watershed efforts; 4) strategies for meeting stated goals and objectives; and 5) plan evaluation and update methods.

North and Central OC IRWM Plan (The OC Plan). Planning for the development of The OC Plan began in 2016. While each WMA is recognized by its unique elements and issues, it is also recognized that these two WMAs share many water resource management opportunities and challenges and have come together to ensure that IRWM planning is effective. Coordination of stakeholders and project proponents in a cohesive area is essential to develop a process for defining watershed goals and identifying projects that cross jurisdictional boundaries and agency mandates to achieve these goals. Regional issues can often be addressed effectively in a more collective, coordinated manner to further the goal of water resource sustainability throughout California.

The OC Plan is designed to help local agencies and governments manage their water, wastewater, and ecological resources. The OC Plan identifies potential projects intended to improve water quality and supply. The Regional Water Management Group (RWMG), described in Section 1.3.2, guides the development of project feasibility, long-range water planning, priorities among

proposed projects of agencies, and seeks potential funding. The OC Plan does not commit resources to implement any project nor does it constitute a commitment to carry out any of the proposed projects. Determinations to proceed with individual projects and required environmental review under the California Environmental Quality Act (CEQA) will be performed by the individual project proponents prior to approval of funding. The collaborations formed through implementation of The OC Plan extend beyond the pursuit of grant funds and will be a transformative opportunity to establish relationships to achieve integrated and regional water resource management.

In addition, the State of California has provided funding for IRWM planning through bond measures, and numerous state funding programs now require a nexus for IRWM planning and projects. Therefore, to be most competitive for funding, stakeholders within The OC Plan region have combined to address regional watershed issues in a coordinated and integrated approach. With a goal of implementing multi-beneficial projects and programs, the stakeholders expect to achieve a suitable balance for addressing the Region's challenges.

The OC Plan is a living document that will be updated periodically to reflect accomplishments as well as changing water resource management issues.

1.3 IRWM Plan Development and Governance

The OC Plan is governed by the following: Regional Water Management Group (RWMG); Advisory Committee (to the RWMG); Planning Group; Stakeholder Group; and Ad Hoc Working Groups as shown in **Figure 1-2**.

The County of Orange serves as the administrator of The OC Plan. Plan implementation will be in accordance with the priorities and schedule of the proposed projects, as periodically amended by each project proponent. The County of Orange will provide routine updates to the Advisory Committee, RWMG, and Stakeholder Group. The Advisory Committee will serve in a leadership role to oversee policy issues related to The OC Plan, which shall meet at least twice annually to monitor Plan implementation, including identification of any issues of concern. This approach promotes partnership opportunities among cities, special districts, other stakeholders, and funding agencies. This approach also facilitates ongoing and meaningful involvement of public and private stakeholder and group participation and decision making, with one administering agency for coordination and management.

Figure 1-2: The OC Plan Governance

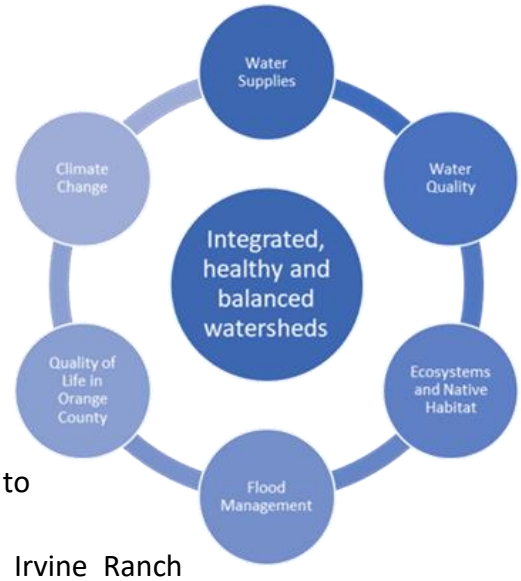
As the administering agency, the County of Orange will be accountable to the Advisory Committee and the RWMG, along with funding agencies that require regional applications and agreements. The existing North and Central WMAs Stakeholder Group will continue to be updated on The OC Plan, and serves as the public voice during development and implementation.

The OC Plan merges the existing North OC IRWM Plan and the Central OC IRWM Plan as a refined watershed planning effort for the combined region. Modifications to the overall regional priorities have been incorporated into this North and Central OC IRWM Plan.

1.3.1 IRWM Plan Development

The stakeholders of the North and Central OC WMAs have worked over the years to develop and integrate regional strategies that address environmental issues, raise community awareness, and coordinate numerous and varied projects to accomplish the following:

- Optimize watershed and coastal resources
- Improve water quality throughout the Region
- Safeguard restore/increase habitat
- Protect communities from drought
- Enhance the reliability of the local water supply and system
- Ensure sufficient water supplies to meet demands



Examples of successful coordinated efforts in the IRWM Region include:

- OCFCD and OCWD joint operation of flood control basins to maximize groundwater recharge
- Construction of water quality treatment wetlands by Irvine Ranch Water District (IRWD) and cities to improve water quality in San Diego Creek and the Upper Newport Bay
- Nitrogen and Selenium Management Program, a cooperative effort of over 20 agencies, cities, environmental groups, land managers, developers, and other stakeholders
- Groundwater Replenishment System, a water purification plant constructed and operated by OCSD and OCWD that produces recycled water for groundwater recharge

The OC Plan builds on these efforts, incorporating the goals, objectives, and recommendations of existing plans, research documents, and ongoing studies within the Region to establish its mission: To improve water quality, increase water supply and reliability, integrate flood

management, safeguard habitat, protect natural resources, and collaborate to ensure healthy watersheds now and for generations.

Building on its mission, the articulation of clear goals and objectives facilitated a list of preferred strategies in The OC Plan (**Section 3**) that are intended to guide the stakeholders to develop and promote projects that are closely aligned with The OC Plan goals and objectives. In this way, future projects will be more likely to benefit from the support of the stakeholders while avoiding inefficiencies due to the dilution of community resources, confusion of purposes, or even disputes and opposition to projects. To realize the vision and goals The OC Plan establishes a prioritization methodology to investigate the feasibility of, and identify funding for, priority projects. Individual projects are required to undergo the appropriate environmental review and permitting process.

The OC Plan is an extension of valuable planning efforts such as those discussed in **Section 1.6, Section 2,** and **Appendix B.**

1.3.1.1 IRWM Plan Development Process

The North and Central OC IRWM Advisory Committee, described in more detail in **Section 1.3.3**, initiated the process in early 2017 to update and combine the North and Central OC WMA IRWM plans. The Advisory Committee recommended formation of a RWMG consisting of the County of Orange, the Orange County Sanitation District and the Orange County Water District. These three agencies cover the entire region and have statutory authority over water supply or water management. The RWMG was charged with the responsibility to fund the update of the plan and to oversee the process of stakeholder engagement. The Advisory Committee also formed a Planning Group to oversee the day-to-day activities needed to update the plan and conduct stakeholder meetings.

An initial stakeholder workshop was held on February 21, 2017 to apprise stakeholders of the purpose of updating and combining the North and Central OC IRWM Plans, the preferred process for development, and the schedule. In addition, the group reviewed the goals and objectives and project ranking methodologies from the existing plans, considered current conditions and evaluated new goals and objectives for the combined North and Central OC IRWM Plan.

The Stakeholder Group formed an Ad Hoc Working Group to further review, discuss and develop the goals, objectives and strategies to bring back to the Stakeholder Group. The Ad Hoc Working Group's seven participants represented five groups throughout the Region: cities, wholesale water agency, groundwater management agency, the County of Orange, and

a nonprofit agency. The Ad Hoc Working Group met nine times between March and June 2017. Six overarching goals, 14 objectives, and 49 strategies were confirmed for the North and Central OC IRWM Region as detailed in **Section 3**.

A second Stakeholder Ad Hoc Working Group was formed to establish the Project Submission and Selection process for The OC Plan. This Ad Hoc Working Group met on August 15 and 22, 2017.

Stakeholder meetings were held in 2017 on February 21, March 21, May 23, June 27, and August 29 to provide updates on the IRWM Plan development and obtain stakeholder approval on goals, objectives, and strategies, weighting/prioritization of strategies, project prioritization for inclusion in The OC Plan.

1.3.1.2 IRWM Plan Adoption

The OC Plan was prepared to meet the Proposition 1 state guidelines and IRWM Plan Standards. Each agency that has a project included in The OC Plan may approve a Resolution of Adoption or Acceptance of The OC Plan. In addition, other agencies that are not members of the IRWM Region but are cooperative agencies may support or adopt The OC Plan by resolution or letter. As these agencies provide proof of plan adoption, acceptance or support in the form of resolutions or letters, these documents will be appended to The OC Plan by inclusion in **Appendix A.**

1.3.2 Regional Water Management Group

Per California Water Code, Section 10537, the regional water management group (RWMG) consists of three or more local public agencies, at least two of which have statutory authority over the water supply or water management, as well as those persons who may be necessary for the development and implementation of an IRWM Plan that meets the requirements in Water Code §10540 and §10541, and that participate by means of a written agreement that is approved by the governing bodies of those local public agencies.

The OC Plan RWMG is represented by the following three agencies: Orange County Water District (OCWD), Orange County Sanitation District (OCSD), the County of Orange (Orange County). The RWMG provides oversight and leadership for The OC Plan. The RWMG is responsible for adoption and implementation of The OC Plan.

Therefore, each of these three agencies adopted or accepted the IRWM Plan by resolution as follows (refer to **Appendix A**): OCWD Board of Directors, OCSD Board of Directors, and Orange County Board of Supervisors.

To meet the Water Code requirement to "participate by means of a written agreement," the RWMG – OCWD, OCSD, and the County of Orange – entered into a Memorandum of Understanding (MOU) (also included in **Appendix A).** The MOU provides a framework for planning water management strategies for The OC Plan implementation and executing an effective decision-making process. It establishes the responsibility to guide development, adoption and execution of The OC Plan, including establishing priorities for water resource needs, integrating water resource solutions across traditional bounds, and jointly advocating for policies and funding that assist these goals. The RWMG will work in an open and transparent stakeholder-driven process to implement the IRWM Plan and project selection.

1.3.3 Advisory Committee to the Regional Water Management Group

The Advisory Committee consists of members of the RWMG and representatives of the Newport Bay Watershed Executive Committee. The Advisory Committee's purpose is to provide leadership and guidance to the RWMG on implementation of The OC Plan. The members of the Advisory Committee may act to change the membership of the committee based on desire, need and representation across the Region.

Newport Bay Watershed Executive Committee. The Newport Bay Watershed Executive Committee plays a central role in development and updating of The OC Plan, and implementation of relevant sections of the Plan in partnership with the other Advisory Committee members.

The Newport Bay Watershed Executive Committee provides a management framework for cooperation on sediment management, water quality, and water resource, including the following actions:

- Provide a forum to evaluate and assess progress toward implementing the Section 208 water quality plan prepared under the federal Clean Water Act, Section 208, Water Quality Planning Program
- Formulate project implementation agreements for the elements of the Section 208 water quality plan and evaluate the effectiveness of the various elements of the 208 plan
- Review opportunities and provide direction for pollutant trading or offset programs
- Review opportunities and provide direction for grant funding
- Provide oversight for the Central WMA and any updates of the IRWM Plan
- Formulate project implementation agreements for any cost-shared projects that address water quality impairments, including sediment, nutrients, fecal indicator bacteria, and toxicity.

The Upper Newport Bay Sediment Control Executive Committee was established under a cooperative agreement in the early 1980s to assist the cities of Irvine, Newport Beach and Tustin;

the County of Orange; California Department of Fish and Game (now California Department of fish and Wildlife); and the Irvine Company in developing and implementing a comprehensive program to manage sediment in the San Diego Creek Watershed and in Upper Newport Bay.

Numerous studies and projects were undertaken in Newport Bay in the late 1990s, which resulted in water quality improvements in Newport Bay and its tributaries. Due to limited funding and the desire to continue collaboration, the Upper Newport Bay Sediment Control Executive Committee expanded its scope and was re-established as the Newport Bay Watershed Executive Committee (Executive Committee)[2] with an expanded scope of impairment of Newport Bay caused by nutrients, toxic pollutants, and pathogens, as well as related environmental improvements.

In addition, the Executive Committee increased membership by including the Orange County Flood Control District (OCFCD); the cities of Costa Mesa, Lake Forest and Santa Ana; IRWD: and Santa Ana Regional Water Quality Control Board (Regional Water Board). These agencies were added based on their interest in the water quality of Newport Bay along with having the resources available to support the initiatives. The Executive Committee forges voluntary solutions for documented problems and pursues research and enhancement opportunities.

Members of the Executive Committee are elected, appointed, or executive level managers, with one member from each of the signatories to the agreement. It typically meets four times a year; meetings are governed by the Brown Act. Staff support is provided by the OC Public Works/OC Environmental Resources. The Executive Committee provides strategic direction for environmental enhancement programs in the watershed, advocacy of these programs to the elected/appointed boards of the member organizations, and a forum for discussion of watershed environmental issues.

1.3.4 Planning Group

The OC Plan Planning Group (Planning Group) was formed to lead development of The OC Plan. The Planning Group consists of staff members of the Advisory Committee whose function is to provide day-to-day support for the development and implementation of The OC Plan and to manage stakeholder involvement. The Planning Group began work to formalize an update to and combination of the North and Central OC IRWM Plans in 2016 and kicked off stakeholder planning efforts in early 2017. The Planning Group will conclude its work of development of The OC Plan upon its adoption and will continue to support the RWMG management functions, including periodic updates to The OC Plan.

[2] https://cms.ocgov.com/gov/pw/watersheds/programs/ourws/wmaareas/wmacentraloc/nbexeccomm.asp

1.3.5 Stakeholders Group

The OC Plan Stakeholders Group is open to all interested stakeholders in the Region. Stakeholders have been working together to bring forward projects that have multiple benefits and reflect the goals of the integrated regional plan. Through an open, collaborative, consensus-based approach, the group seeks to provide leadership in the watershed by working to achieve common goals for the long-term management of the watershed.

The RWMG will be responsible for ongoing outreach to and involvement of stakeholders, including disadvantaged communities and tribal representatives, throughout the Region, for an opportunity to participate in meetings and workshops. Outreach may include communication of information by email, newsletters, fact sheets, and the County's ocwatersheds.com website. Native American Tribal representatives will be invited to participate at the level of input most appropriate for their tribes in IRWM Plan implementation elements.

1.3.6 Ad Hoc Working Groups

Ad Hoc Working Groups were formed by the Stakeholder Group to perform specific tasks. Participation in an Ad Hoc Working Group was open to all stakeholders dedicated to completing specific work products assigned by the Stakeholder Group. During preparation of The OC Plan, one Ad Hoc Working Group was formed to draft goals, objectives, and strategies for consideration by the Stakeholder Group. The Stakeholder Group formed another Ad Hoc Working Group to develop a proposed project prioritization process that was also reviewed and adopted by the larger Stakeholder Group. The Stakeholder Group may form Ad Hoc Working Groups in the future as the need arises.

1.3.7 Roles and Responsibilities for Regional Water Management

The Region members have various levels of responsibility for regional water management. The following lists the agencies that have responsibilities within the IRWM Region, followed by an overview of other organizations involved in The OC Plan implementation through various support roles.

1.3.7.1 Jurisdictional Participants in the IRWM Region

Table 1-1 lists the jurisdictional members in the IRWM Region, which are referred to in **Section 2** and described in **Appendix E.**

Table 1-1
Jurisdictional North and Central OC IRWM Region Members

Cities	Special Districts	County Agencies	State and Federal Agencies
Divided Boundaries in North and Central OC WMAs	***Divided Boundaries in North and Central OC WMAs***	***County***	***State***
Costa Mesa	Costa Mesa Sanitary District	County of Orange	California State Coastal Conservancy
Orange	East Orange County Water District	Orange County Flood Control District	
Santa Ana			California Department of Fish and Wildlife
North OC WMA	Irvine Ranch Water District	Orange County Council of Governments	
Anaheim	Mesa Water District		California Department of Parks and Recreation
Brea	Municipal Water District of Orange County	Orange County Transportation Authority	
Buena Park			California Department of Transportation
Cypress	Midway City Sanitary District	Orange County Department of Education	
Fountain Valley			State Water Resources Control Board – Santa Ana Region
Fullerton	Orange County Water District	Orange County Health Care Agency	
Garden Grove			
Huntington Beach	Orange County Sanitation District	Orange County Vector Control	Southern California Coastal Water Research Project
La Habra			
La Palma	***North OC WMA***		***Federal***
Placentia	Serrano Water District		U.S. Fish and Wildlife Service
Seal Beach	Yorba Linda Water District		
Stanton	Golden State Water Company – West Orange System		U.S. Army Corps of Engineers, Los Angeles District
Villa Park			
Westminster			
Central OC WMA	***Central OC WMA***		U.S. Department of Agriculture (USDA), Forest Service, Cleveland National Forest
Irvine	Golden State Water Company – Cowan Heights		
Newport Beach			
Tustin	***Divided Boundaries in Central and South OC WMA***		USDA, Natural Resources Conservation Service
Divided Boundaries Central and South OC WMA	El Toro Water District		
Laguna Hills			U.S. National Park Service
Laguna Woods			
Lake Forest			

1.3.7.2 Additional Organization Outreach and Participation in the IRWM Region

In addition to the IRWM member jurisdictions, agencies and special districts described above, additional organizations have been identified to participate in the Region's IRWM activities. These organizations are an important part of the IRWM framework. To date, some have participated and provided valuable input on The OC Plan and projects, IRWM planning and regional priorities. The organizations listed below represent those identified as important to

the Region and/or have participated in the IRWM process, either in past planning, project implementation and/or outreach efforts, or are currently actively engaged in IRWM processes and activities.

Santa Ana Watershed Project Authority. The Santa Ana Watershed Project Authority (SAWPA) was formed in 1968 as a planning agency and reformed in 1972 with a mission to develop and maintain regional plans, programs, and projects that will protect the Santa Ana River Basin water resources. The current configuration as a joint powers authority went into effect in 1975. SAWPA's member agencies include San Bernardino Valley Municipal Water District, Inland Empire Utilities Agency, Western Municipal Water District, Eastern Municipal Water District, and OCWD. OCWD actively participates in several SAWPA-led task forces and work groups organized to address Santa Ana River water quality issues. In addition, SAWPA applied for and was accepted by DWR as the official IRWM region in the Santa Ana Funding Area, which includes North and Central Orange County. This is the only DWR-recognized region in the Funding Area.

Earth Resource Foundation.[3] Earth Resource Foundation is an environmental educational non-profit organization developed to empower the public with the resources needed to make environmentally sustainable choices and changes. Its mission statement is to preserve, conserve, and restore the Earth to a healthy and sustainable state by redirecting available human, technological, monetary, and academic resources. Its headquarters is in Santa Ana, CA.

Latino Health Access.[4] Headquartered in Santa Ana, California, Latino Health Access works to assist in improving the quality of life and health of uninsured, under-served people through quality preventive services and educational programs, emphasizing responsibility and full participation in decisions affecting health.

Natural Communities Coalition.[5] Natural Communities Coalition is an Irvine-based non-profit organization that participates in and benefits from the Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP) for the Central and Coastal Subregion of Orange County. The main purpose of Natural Communities Coalition is to coordinate the land management, monitoring and research with its partners across the nearly 38,000-acre Reserve System. The Reserve System is a permanently protected open space which is managed for the benefit of plants and wildlife that define the character, uniqueness and natural diversity of Orange County.

[3] http://www.earthresource.org/
[4] http://www.latinohealthaccess.org/
[5] https://occonservation.org/

Orange County Coastkeeper (OC Coastkeeper).[6] OC Coastkeeper's goal is to protect and preserve all Orange County water bodies and restore them to healthy, fully functioning systems that will protect recreational uses and aquatic life. In pursuit of this goal, Coastkeeper balances education, advocacy, restoration, research, and enforcement to increase awareness of environmental issues and reduce pollution of Orange County watersheds and coastal waters. OC Coastkeeper is located in Costa Mesa, California.

Orange County Farm Bureau.[7] The Orange County Farm Bureau is a non-profit organization supported by more than 1,000 dues-paying members. It was established in 1917 "…to represent Orange County agriculture through public relations, education and public policy advocacy in order to promote the economic viability of agriculture balanced with appropriate management of natural resources." The Farm Bureau works with elected officials, government agencies, educators, the public and the media.

Although agriculture is not a high-profile industry, it contributes more than $200 million to the local Orange County economy. In addition to the economic value, the farmers of Orange County maintain tracts of open space, plant trees and crops that help improve air quality, provide a sumptuous harvest of locally grown products, and help protect the ambience of old Orange County.

Surfrider Foundation – Newport Beach Chapter.[8] Surfrider Foundation is a non-profit environmental organization working to protect the ocean, waves and beaches. Its network is made up of local chapter members combining their skills and passions to fulfill the Surfrider mission locally and support local programs and projects. The Surfrider Foundation Newport Beach Chapter was founded in 1990 with a focus on water quality education and activism.

Trails for All.[9] Trails for All is a non-profit organization dedicated to the creation, restoration and preservation of trails and open space throughout Southern California, including the more than 700 miles of natural surface, shared-use recreational trails in Orange County. Expanding from its original focus of trail-work day planning and organization now offering a number of services and programs including the youth-education program, Partnerships4Trails and the largest non-coastal cleanup event in California - the Inner-Coastal & Watershed Cleanup. Today, the organization is a coalition of more than 30 trail-user groups that have completed over 800 trail projects. Its 34,000 volunteers have cleared more than one million pounds of trash and recyclables from the environment and trained approximately 200 people in trail creation and management.

[6] https://www.coastkeeper.org/
[7] https://www.ocfarmbureau.org/
[8] https://newportbeach.surfrider.org/
[9] http://www.trails4all.org/

1.3.8 Framework for Decision Making

As presented earlier in this Plan, per California Water Code, Section 10537, the RWMG includes OCWD, OCSD, and the County of Orange, operating under a MOU. The MOU provides a framework for cooperating in development and management of The OC Plan and executing an effective decision-making process. It establishes the mechanism for adoption and execution of the Plan, including establishing priorities for water resource needs, integrating water resource solutions, advocating for policies and funding that assist these goals, engaging stakeholders, seeking funding for Plan implementation, and guiding future updates to the Plan.

The Advisory Committee provides oversight and leadership for The OC Plan, and is advisory to the RWMG. The Advisory Committee is periodically updated on IRWM Region planning and implementation and offers guidance on any IRWM matter.

The Stakeholders Group provides input and collective decision-making on IRWM matters, including development and implementation of goals, objectives and strategies; integration of IRWM programs and projects; project application and selection process for inclusion in the IRWM plan and for grant funding; and other IRWM activities.

1.3.9 Appropriateness of Region and Geographic Boundaries

The water supply, water quality, flood control, and ecological issues in the North and Central OC WMAs pose complex challenges that are intimately connected with the economic and environmental well-being of the watersheds. Shared issues regarding water resources and water quality throughout the Region include groundwater, surface water, recycled water, and imported water. Groundwater recharge basins in the cities of Anaheim and Orange recharge the groundwater basin that underlies the entire Region. Groundwater supplies are supplemented by imported water and recycled water. Factors such as sewer spills, aging infrastructure, and flooding also impact the management of water resources in the Region. Preliminary studies show an explicit link between pollutant discharges from Newport Bay to the downcoast ASBS along the Newport Coast Watershed. With potential costs running into the hundreds of millions of dollars for remediation projects to protect shared water resources, sensitive marine life areas, and the coastal ecosystem as a whole, the North and Central OC WMAs, as defined herein, is an appropriate region for integrated water resource and coastal watershed planning.

The Region's stakeholders work cooperatively to provide constructive management of the Region's water and natural resources, including addressing water quality issues. The associated costs for the planning and TMDL compliance and capital improvements to regional water and

wastewater system infrastructure are the responsibility of agencies within the Region, which may include the County of Orange; water and wastewater special districts; cities, state and federal agencies; a flood control district; non-profit groups; and private parties.

The Region is within the Santa Ana River Watershed, which includes parts of Riverside, San Bernardino and Orange counties, and a small portion of Los Angeles County. The portion of Orange County within The OC Plan region is within the Santa Ana IRWM Funding Area and is represented in the SAWPA IRWM Plan development and implementation by Orange County elected officials and OCWD.

The appropriateness of the Region for integrated water resource and coastal watershed planning is demonstrated by the following regional attributes:

- The drainage patterns in the North and Central OC WMAs and impacts on receiving waters are attributable to upstream land uses.
- Potential high costs for remediation projects to protect shared water resources, sensitive marine life areas, and the coastal ecosystem as a whole.
- The boundaries of the Regional Water Board jurisdiction encompass the North and Central OC WMAs.
- Stakeholders within this Region have a long-term commitment to achieving environmentally sound management of the Region's hydrologic and ecologic resources.

1.3.10 Watershed Management Challenges

The OC Plan is consistent with the resource management strategies outlined in the California Water Plan and identifies integrated projects that address multiple strategies and promotes future collaboration within and across watershed boundaries to find solutions to water resource challenges.

The complex and difficult issues that stakeholders face in the Newport Bay and Newport Coast watersheds are different from those in adjacent watersheds that have no TMDL requirements or no issues related to discharge to sensitive marine life areas.

Within The OC Plan Region, the nexus between land use decisions, water resource management, and coastal zone impacts has been firmly established through numerous studies and ongoing monitoring programs. The reality of human impacts can hardly be a surprise in a 537-square-mile region[10] with a total 2017 population of approximately 3,010,232, with 65 percent

[10] Central OC WMA 160 square miles and North OC WMA 376.81 square miles

(1,956,651) residing in the North OC WMA and 35 percent (1,053,581) residing in the Central OC WMA. Orange County is the third-most populous county in California.

In addition to the rapid transition of this region from open space to agriculture and then to urban land use, challenges include the diversity of geography, jurisdictions and demographics in such a compact area, and the multiplicity of connected issues. The Region comprises significant ecological resources and valuable tracts of open space, while at the same time including densely populated urban areas. Orange County's four largest cities, Anaheim, Santa Ana, Irvine, and Huntington Beach, are all within the IRWM Region and the first three each having a population exceeding 200,000 and Huntington Beach with just over 195,000.

The CCAs and ASBS are directly affected by urban activities within the WMAs, including freshwater drainage that carries pollutants of concern from the upper watersheds and coastal canyons, creek bed erosion due to the increase in impervious surfaces, legacy pesticides from former agricultural operations, boat maintenance in Newport Harbor, and high concentrations of selenium and nitrogen in the groundwater that may rise to the surface and move downstream. These fragile coastal ecosystems are further affected by heavy recreational use within the coastal zone. Newport Harbor has approximately 10,000 registered yachts and boats, and Corona del Mar State Beach is very popular due to easy access, sandy beaches, and the nearby rocky tide pools.

As is the case with much of Southern California, The OC Plan Region faces many water resources management challenges. Among these are the following:

- Adequate, reliable water supply: Although this region has significant groundwater resources, it still receives approximately one-third of its water from imported sources. Environmental constraints such as drought and Delta pumping restrictions attributed to importing water into the Region are affecting the reliability of imported water supply. Therefore, one objective for the Region is to meet the projected increase in water demands with consideration of cost-effective strategies, such as increasing local water supplies, sustainably managing groundwater resources, and maximize water use efficiency.
- Growth, economic sustainability, recreation: The Region is continually growing which means that there is a greater demand for potable water, a greater amount of wastewater generated, and greater need for recreational resources. Economic stability relies on implementing cost-effective solutions to these growth-related issues.
- Water quality standards: Water quality standards for urban runoff that stem from the Clean Water Act are becoming increasingly stringent. Local agencies in the Region are

challenged to meet the regulatory water quality standards in a cost-effective manner to maintain lasting results.

- Ecosystem impacts: Urbanization is often accompanied by storm water and polluted urban runoff, wastewater spills, invasive species, and erosion, all of which impact ecosystems in the Region. Functioning ecosystems offer a wide range of benefits for water supply, water quality and habitat. Therefore, healthy ecosystems provide great value when rehabilitated and preserved for the future.
- Habitat: Habitat areas in the Region include Bolsa Chica Wetlands, Seal Beach National Wildlife Refuge, Coyote Creek, Carbon Creek, Brea Creek, Fullerton Creek, Huntington Beach State Park, Peters Canyon Regional Park and Wetlands, associated beach and coastal shoreline habitat, Santiago Creek parks, Upper Newport Bay and the Santa Ana River.
- Aging Infrastructure: Outdated and deteriorating wastewater and water conveyance systems can cause leaks, sewage spills and have inadequate capacity to handle increased flows resulting in impacts to surface, groundwater and ocean water quality. Multipurpose projects that include the rehabilitation of water and wastewater infrastructure are important for improving water quality standards.
- Climate change: Climate change will influence water resources, water supply availability and habitat. Addressing these issues now will help the Region prepare for current and future impacts.

1.3.11 Plan Focus

The conditions within The OC Plan Region present both challenges and opportunities for water resource agencies and nongovernmental organizations with an interest in or responsibility for water quality and habitat protection and enhancement, particularly in the coastal zone.

The stakeholders within The OC Plan Region have a long history of working collaboratively on studies, programs, and projects to address water quality, ecosystem restoration, and water supply. As a result, there is an extensive library of technical information about the watersheds that has been created through numerous studies and project planning efforts. These efforts continue, and this region is leading scientific studies to analyze impacts on coastal water quality and to identify effective solutions. Not only do the unique ecological resources in this region provide the impetus for integrated water resource planning, but the history of collaboration and the availability of technical information make effective planning, analysis, and project implementation possible.

The planning approach and framework of The OC Plan is to ensure that the Region is clearly described and understood, solution-oriented projects are coordinated and integrated within the Region and interregionally, where possible, and funding and project benefits are leveraged to the greatest extent possible.

1.4 Outreach

The OC Plan RWMG will continue outreach to stakeholders, including disadvantaged communities and tribal representatives, throughout the Region, for an opportunity to participate in meetings and workshops. Outreach includes communication of information by email, newsletters, fact sheets, and the County's ocwatersheds.com website. Native American Tribal representatives will be invited to participate at the level of input most appropriate for their tribes in IRWM Plan implementation elements. It should be noted that the Region's disadvantaged communities are defined by their economic status while having full access to clean, reliable water. Additionally, there are no tribal lands within the Region; however, tribal members live throughout the Region and are invited to participate in IRWM planning.

For development of The OC Plan, all stakeholders were invited to all IRWM Plan development meetings, to participate on the Ad Hoc Working Groups, to provide input in development of the Plan's goals, objectives, and strategies, and to review and comment on the Pubic Review Draft IRWM Plan. Stakeholders were also invited to submit project applications for inclusion of projects in The OC Plan and for future funding consideration.

The OC Plan implementation aims to expand communication not only among stakeholders, but also among agencies and agency departments, to achieve more comprehensive and cohesive planning, and result in the implementation of projects that are more cost effective and that produce more widespread results.

1.5 Coordination

The OC Plan Region is located within the Santa Ana Funding Area (see footnote 1). The Funding Area includes the upper Santa Ana River Watershed to the east, Greater Los Angeles County IRWM Region to the north, and the South OC WMA IRWM Region to the south. The Region also borders the Gateway IRWM Region to the north.

The OC Plan region shares watersheds, groundwater basins, and cities with these adjacent regions and lies at the southern edge of the Santa Ana River Watershed, which originates in the San Bernardino Mountains and extends westward to the Pacific Ocean. The Central OC WMA includes a focus on improving and protecting coastal water quality, habitat and other coastal resources, while all three WMAs in Orange County are integrally linked to the Region's fragile coastal ecosystem. The North and Central OC WMAs share groundwater resources and the imported water system with other adjacent regions. The North OC WMA shares the South OC WMA boundary in the foothills and mountains of eastern Orange County, while the Central OC WMA also shares the South OC WMA boundary from the foothills to the coastline.

Many issues are similar for these WMAs, with the County of Orange as lead agency for all three WMAs across the county – North OC, Central OC, and South OC. Coordinating the IRWM planning for these regions is essential in creating integrated and consistent planning documents.

The OC Plan stakeholders and agencies engage in collaborative efforts on an ongoing basis, including development of the "One Water, One Watershed" (OWOW) 2.0 IRWM Plan, and involvement on the Water Advisory Committee of Orange County, the Southern California Water Committee, the Southern California Water Dialogue, and various other water resource forums. Communication and collaboration about water resource planning is regularly conducted with all adjacent IRWM regions. Region representatives also participate in various workshops across IRWM regions, including climate change workshops working closely with the U.S. Bureau of Reclamation, and state and federal agencies. These workshops have been extremely beneficial, particularly as each IRWM region develops its respective climate change adaptation plans under the IRWM planning.

One Water One Watershed (OWOW) Plan. The Santa Ana Watershed Project Authority (SAWPA) developed its first IRWM Plan, the Santa Ana Integrated Watershed Plan, in 2002, updating the plan in 2005 and adopting the 'One Water, One Watershed 1.0' IRWM Plan in November 2010, and in February 2014 as One Water, One Watershed 2.0. The focus of the OWOW Plan is to coordinate all functions across the watershed to result in sustainable watershed-wide solutions for water resources and the ecologic health of the Santa Ana River Watershed. The Santa Ana River Watershed includes parts of Riverside, San Bernardino and Orange counties, and a small portion of Los Angeles County. Some North and Central OC IRWM Region stakeholders have participated in development of the SAWPA IRWM plan updates and continue to participate in its stakeholder committee and planning meetings, including Propositions 84 and 1 IRWM grant programs.

South Orange County IRWM Plan. The South OC IRWM Plan encompasses the Laguna Coastal Streams, Aliso Creek, Dana Point Coastal Streams, San Juan Creek, San Clemente Coastal Streams, San Mateo Creek Watersheds, and a portion of the Newport Coast Watershed. The County of Orange is also the South OC IRWM Plan administrator. Coordinating IRWM planning across the three WMAs in Orange County is essential in creating integrated solutions in the watersheds.

Greater Los Angeles County IRWM Plan. The Los Angeles County IRWM Plan is a regional planning effort that covers portions of Ventura, Orange, and Los Angeles Counties. The Los Angeles County IRWM Plan creates a blueprint for achieving quantifiable targets for improving water quality and water supply, enhancing habitat and open space/recreation, and sustaining infrastructure for local communities in the Greater Los Angeles County Region. Development of their IRWM Plan has resulted in communication and collaboration among over 80 regional and local entities, including non-profit organizations, addressing integrated solutions for the region. Most of the projects supported by the IRWM Plan provide multiple benefits in line with the plan's goal to "implement multiple-objective planning and projects." The North OC WMA has been engaged in the Los Angeles County IRWM process, working to coordinate activities, programs and solutions that impact both the collective regions and watersheds.

Local Planning Efforts. Many cities and counties are in the process of updating their General Plans. Funding opportunities and greater collaboration between water agencies, non-governmental organizations, and local land use authorities are facilitating beneficial projects such as conservation, open space, restoration, enhancement, connectivity, and multi-benefit approaches. In this way, planners are finding themselves in a new place, one of noting the quality of these projects and how to get them through the regulatory planning process with more agreement and greater speed. State law is helpful in this process because conservation, safety, open space, and land use elements are required elements of every general plan in the State of California. These elements provide essential components of good watershed plans. In addition, newly proposed Fire Hazard Planning, as well as the more traditional floodplain management guidelines for preparation of General Plans include helpful explanations and instructions for planners trying to make sense of how watershed planning can be and should be integrated into general plan Updates.

In developing regional plans and prioritizing multi-benefit projects, it is important to not only coordinate efforts with other planning agencies within the Region, but it is equally important to coordinate across regional boundaries. During the preparation of The OC Plan, information from cities and agencies within the Region and information from adjoining IRWM regions was considered and used where appropriate.

Roundtable of Regions. The Roundtable of Regions, a coalition of IRWM leaders and representatives across the state, allows all the IRWM regions to voice and discuss common issues and concerns and work closely with DWR. Roundtable of Regions conducts information workgroup meetings and surveys, leads collaborative workshops, summits, and conferences; and provides important input to DWR on IRWM grant guidelines, applications and legislative issues affecting IRWMs. A recent Roundtable of Regions summit in January 2017 included presentations by Roundtable members, DWR staff, and SWRCB staff. The Roundtable of Regions facilitated subsequent meetings with DWR regarding Proposition 1 funding on June 30, 2017 and September 21, 2017. The OC Plan RWMG and other region representatives participated in these DWR meetings, as well as other Roundtable of Regions workgroup meetings, DWR workshops and summits, and events.

1.6 Technical Analysis

The stakeholders within the North and Central OC IRWM Region have a long history of working collaboratively on studies, programs, and projects to address water quality, ecosystem restoration, and water supply. As a result, there is an extensive library of data and technical analysis information about the watersheds, the region, and the jurisdictions within the Region that has been created through numerous studies and project planning efforts. Science-based studies continue to be developed to analyze coastal water quality impacts and identify effective solutions. Not only do the unique ecological resources in the Region provide the impetus for integrated water resource planning, but the history of collaboration and availability of the technical information make effective planning, analysis, and project implementation possible.

The planning approach and framework of The OC Plan ensures that solution-oriented projects are coordinated within the Region and that funding and project benefits are leveraged to the greatest extent possible. IRWM Plan performance and monitoring is discussed in **Section 6.4**.

Technical information and data sets are obtained from the extensive planning and technical studies that have been conducted for the watersheds with the Region. **Appendix B** and **Section 2.1.4** provide detail of the some of the plans and technical studies that have been used to develop The OC Plan. The following represents of some of the most significant plans and studies in the Region:

Drainage Area Management Plan (DAMP). The 2003 DAMP (Orange County) addresses the requirements of the countywide National Pollutant Discharge Elimination System (NPDES) stormwater permit.

Total Maximum Daily Loads[11] (TMDL). Adopted TMDLs – metals, nutrients, sediments, and bacteria, and technical TMDLs[12].

U.S. Army Corps of Engineers Newport Bay/San Diego Creek Watershed Study. A 2005 study focused on broad watershed ecosystem planning issues, resulting in a list of multipurpose watershed-scale ecosystem restoration projects, in which the USACE had a federal interest, as well as a watershed management plan that focused on management issues within the watershed.

Watershed Management Plans: The U.S. Army Corps of Engineers Special Area Management Plan for San Diego Creek Watershed; the Newport Coast Watershed Management Plan; and Newport Harbor Area Management Plan, Upper Newport Bay Watershed Management Plan and San Diego Creek Strategic Watershed Plan.

Serrano Creek Collaborative Use Plan. The Serrano Creek Collaborative Use Plan, which was prepared for the City of Lake Forest, addresses erosion and flood control, recreation and landscaping improvements, biological resource enhancement, and funding for improvements along Serrano Creek (City of Lake Forest 1999).

Natural Treatment System Plan. In 2005, the Irvine Ranch Water District (IRWD), in cooperation with Orange County and the cities of Irvine, Lake Forest, Newport Beach, Orange, Santa Ana, and Tustin, developed a natural treatment system plan, an ecosystem-based network of constructed water quality treatment wetlands for improving water quality in San Diego Creek and the upper Newport Bay.

Orange County Great Park Comprehensive Master Plan. The Great Park Comprehensive Master Plan for the 2,300-acre Great Park incorporates natural treatment systems, recycled water use, a wildlife corridor, and other sustainable features (City of Irvine 2002). The wildlife corridor is part of an important linkage between the Cleveland National Forest and coastal open space in this area. The Agua Chinon channel, part of the backbone infrastructure for the site, serves dual functions as a wetlands mitigation area and flood control facility and is being designed as a naturalized channel.

Urban Water Management Plans. Each water supplier within the Region has prepared and adopted an urban water management plan (UWMP) in accordance with the Urban Water Management Planning Act (California Water Code, Section 10610 et seq.). In ongoing urban water management planning, the water agencies in the Region are addressing matters of

[11] A Total Maximum Daily Load (TMDL) is a regulatory term in the U.S. Clean Water Act, describing a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.
[12] "Technical" TMDLs are TMDLs without implementation plans. Regional Board staff are developing the State required Basin Plan amendments, including implementation plans.
https://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/

regional interconnection, groundwater basin stewardship, water use efficiency, recycling, desalination, and rainfall harvesting as an outcome of implementing low-impact development strategies.

Orange County Reliability Study. The Municipal Water District of Orange County (MWDOC) completed the Orange County Reliability Study in December 2016.

Groundwater Management Plan. The Orange County Water District (OCWD) adopted its fifth update to its Groundwater Management Plan in 2015.

Basin 8-1 Alternative Plan (January 2017). Produced collaboratively by OCWD, the City of La Habra and IRWD to comply with the Sustainable Groundwater Management Act (SGMA)(2014, as amended in 2015).

Orange County Stormwater Resources Plan (OC SWRP). A functionally equivalent plan, the OC SWRP, was prepared by OC Environmental Resources (March 2017) and approved by the State Water Resources Control Board (April 2017) to meet the requirements of SB 985 and to provide watershed-based planning for stormwater projects in Orange County.

Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP) for Central and Coastal Subregion. A NCCP/HCP was developed to protect and manage habitat supporting a broad range of plant and animal populations that are now found within the Central and Coastal subregion.

In addition, numerous technical studies support projects included in The OC Plan Project List (**Appendix F**).

Overview of Plans and Studies Utilized by The OC Plan

The OC Plan incorporates adopted master plans for water, wastewater, and recycled water systems in the Region, each of which includes a detailed engineering analysis of current system conditions, future service demands, and system improvements. The OC Plan has considered extensive local planning and technical analyses in development of goals, objectives, priorities and projects. Utilizing existing planning to develop The OC Plan and projects has further provided opportunities for an informed stakeholder process. Because of this collaborative process, watershed management issues and conflicts have been clearly identified, the objectives directly respond to those issues, and implementation of the strategies and projects has been based on the findings and recommendations of those studies.

Planning Studies

Planning studies identify opportunities and constraints for projects in the Region. The IRWM stakeholders consider planning studies for project development associated with meeting goals and objectives of The OC Plan.

Technical Studies

Technical studies are scientifically-based and measure watershed conditions to assure regulatory compliance, as well as project prioritization and development. These studies contribute considerable information to The OC Plan, including (but not limited to): dry and wet weather flow analysis; trends in constituents of concern; BMP effectiveness assessments; bioaccumulation studies; identification of sources and contribution to water quality degradation; effects of hydromodification in creek channels; and degree of toxicity impacts within the Region.

In addition, annual monitoring reports are prepared for each TMDL. These reports summarize water quality results relative to the methods and effluent limitations specified in the TMDL orders issued by the Regional Water Board. A monitoring report is also prepared annually for the County's NPDES permit, which summarizes all monitoring results and data collection activities for the reporting year. Every 5 years, and as mandated by Title 23 of the California Code of Regulations and Title 40 of the Code of Federal Regulations, a Report of Waste Discharge (ROWD) is prepared for issuance of a new MS4 permit. This ROWD, summarized in greater detail within **Section 2.2.5**, addresses stormwater data and accomplishments over the past five years.

Finally, studies conducted by the USACE include a reconnaissance report that documents baseline conditions. These studies are made available to stakeholders for the purpose of project planning, permitting, and post-project comparisons. Each of these studies and regular reports has been used in the development of The OC Plan as they identify where specific actions are needed and offer science-based recommendations for strategies.

Such Plans and studies listed in **Appendix B** that were used in the development of The OC Plan and regional planning:

Technical Analyses and Methods

Many of the Region's monitoring programs and activities[13] provide data that are useful to IRWM planning and management in the Region. This section provides an overview and description of efforts of particular importance to integrated, regional planning, but is not intended as a comprehensive survey of all programs and activities. Refer to **Section 6** for a more comprehensive discussion of Data Management throughout the Region.

Surface Water Quality Monitoring

[13] Monitoring is intermittent surveillance carried out to ascertain compliance with a standard or deviation from an expected norm to: Determine compliance with standards; construct, adjust and verify predictive models; provide information to evaluate abatement measures and identify progress against control objectives; and provide early warning of future problems.

Numerous federal, state, and local agencies and organizations have conducted surface water quality monitoring in the Region over the past several decades. Watershed management area and site-specific surface water quality monitoring efforts include the following:

Core Monitoring

Routine, ongoing water quality monitoring within the regulatory framework of the NPDES and TMDL monitoring programs comprises the core monitoring programs referenced in The OC Plan. This type of monitoring addresses clearly defined questions related to point, non-point and targeted pollutant levels with a commitment to improving our understanding of County-specific environmental issues.

Unified Program Effectiveness Assessments are prepared by the County of Orange as the Principle MS4 Permittee in collaboration with the cities (Permittees) on an annual basis to comply with NPDES Permit requirements; data presented summarized core monitoring associated with NPDES and applicable TMDL compliance programs.[14]

Regional Monitoring

Stakeholder Group agencies also participate in and partner on regional monitoring programs, representing periodic, collaborative, and larger-scale multi-agency surveys. Examples include: Southern California Bight Studies, Southern California Stormwater Monitoring Coalition, and SAWPA Emerging Constituents Task Force.

Groundwater Monitoring

Groundwater monitoring data are collected and/or stored through a variety of monitoring efforts/organizations in the Region. OCWD performs 13 water resource monitoring programs for groundwater, surface water, recycled water, and imported water in relation to the Orange County Groundwater Basin. The monitoring programs are summarized in **Table 2-1**.

Waste Discharge Compliance Monitoring - NPDES permits contain monitoring requirements to verify compliance with applicable conditions. For example, the Regional Water Board has established monitoring programs for recycled water and wastewater operations that discharge to groundwater.

Underground Storage Tank Monitoring - The Regional Water Board and the County Environmental Health Division require groundwater monitoring as part of regulating compliance with underground tank regulations. Monitoring associated with UST is normally limited to the immediate vicinity of the underground tank (to check for tank leaks). At documented remediation

[14] Annual Unified Program Effectiveness Assessments can be found in the County Document Database by year (http://prg.ocpublicworks.com/DocmgmtInternet/Search.aspx). Additional information on annual reporting can be found on the Water Quality Monitoring page of the County website, including access to the Monitoring Data Portal and direct access to monitoring data sets (http://www.ocwatersheds.com/rainrecords/waterqualitydata/water_quality_monitoring_data).

sites where leaks have been detected, however, extensive groundwater monitoring is required to document site remediation and recovery.

Special Studies and Projects - Groundwater quality data are also periodically collected or compiled as part of special studies, including CEQA evaluations, groundwater supply investigations, scientific studies conducted by government or research organizations.

Geotracker (GAMA) Groundwater Information System – This is a data management system created in response to the Groundwater Quality Monitoring Act of 2001. It integrates and geographically displays groundwater information collected from multiple sources. It offers analytical tools and reporting features to assess groundwater quality and water level information to identify potential groundwater issues.

Habitat and Natural Resource Monitoring

A significant variety of habitat data has been collected within the Region. Data have been collected as part of site-specific or project specific investigations (e.g. CEQA analyses), educational or scientific investigations, volunteer organizations, and habitat conservation programs. The most significant ongoing habitat monitoring programs are conducted as part of the NCCP efforts. The NCCP identifies and provides for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity.

Additional Monitoring Efforts

Special Studies/Research – OC Watersheds along with cities, governmental agencies, NGOs and/ or universities has a strong commitment to advancements in water quality science through focused special studies to answer specific issues of concern related to Orange County. For updates on special studies, where applicable, reference annual reports and the Transitional Monitoring Program.

Watershed Sanitary Surveys - Per the California Surface Water Treatment Rule (Title 22 of the California Code of Regulations), every public water system using surface water is required to conduct a comprehensive sanitary survey of its watersheds every five years. For the Region, Metropolitan satisfies this requirement. The purpose of the Watershed Sanitary Survey is to identify actual or potential sources of contamination or any other watershed-related factor which might adversely affect the quality of water used for domestic drinking water. Every five years, Metropolitan is required to prepare and submit a Watershed Sanitary Survey, which examines possible sources of drinking water contamination in its State Water Project and Colorado River source waters.

Southern California Coastal Water Research Project (SCCWRP) – A joint powers agency focusing on marine environmental research for the Southern California Bight. SCCWRP gathers scientific information so that member agencies can effectively and cost-efficiently protect the Southern

California marine environment. Although SCCWRP initially focused on wastewater discharges from Publicly Owned Treatment Works (POTWs), SCCWRP has developed and refined urban runoff and surface water quality monitoring programs over the past decade. The North and Central OC IRWM Region uses scientific data and information from SCCWRP to analyze watershed conditions within the WMAs.

Water Supply Monitoring

OCWD performs monitoring on behalf of operators of public water systems for all production wells to ensure that water supplies comply with Safe Drinking Water Act standards. Results are reported to the SWRCB Division of Drinking Water. Monitoring broadly encompasses several categories of constituents, discussed in **Section 2**.

Sampling is conducted by water suppliers at treatment plants and within distribution systems, and monitoring results are evaluated to ensure that applicable drinking water quality standards are met. For regulated constituents, results are compared to Primary and Secondary MCLs, and unregulated contaminants are evaluated against DHS Detection Limits for Purposes of Reporting (e.g., color, corrosivity, and odor).

Monitoring for constituents for water suppliers is conducted based on a prescribed schedule, typically quarterly, annually, or once every three, six or nine years depending on the constituent. Water suppliers publish annual water quality reports (often provided as both hard copy mailers and electronically on their websites) to provide water users within their service areas information on the quality of their water, if it meets all drinking water standards, and other information the U.S. EPA recommends.

SECTION 2. REGION DESCRIPTION

2.1 North and Central Orange County IRWM Region

The North and Central OC IRWM Region (Region/IRWM Region) is comprised of the North OC Watershed Management Area (WMA) and the Central OC WMA. This IRWM Plan (The OC Plan) discusses the entire region for management, implementation and collaboration, and individual WMAs for planning within the watersheds.

The Region exemplifies the significant issues that Southern California faces. The Region experienced a relatively rapid transition during the 20th century from open space to agriculture and then to urban land uses. The urban land uses included residential communities, commercial, industrial and major military installations. The resource management strategies that prevailed during this century of transition focused first on drainage, followed by water supply, flood management, erosion control, and water quality, leading up the 21st century and the era of integration and multifunctionality.

The long-term average rainfall in Orange County is 14 inches per year. The Mediterranean climate in Orange County is characterized by brief, intense storms between October and March. It is not unusual for a majority of the annual precipitation to fall during a few storms within a short period of time. The higher elevation portions of the watershed (usually the headwater areas) typically receive significantly greater precipitation, due to orographic effects. In addition, rainfall patterns are subject to extreme variations from year to year and longer-term wet and dry cycles. The combination of steep topography, brief intense storms, and extreme temporal variability in rainfall result in "flashy" systems where stream discharge can vary by several orders of magnitude over very short periods of time.

2.1.1 Watersheds, Adjoining IRWM Regions, and Overlapping Efforts

Establishing the IRWM Region to encompass both the North OC WMA and the Central OC WMA provides the opportunity to bridge existing and developing watershed planning efforts, allowing for more effective collaboration and greater opportunity to leverage agency resources across jurisdictions within and outside of the watershed management areas. Commonalities within the Region, including hydrology, water supplies, water quality, agencies, and services, make this IRWM Region ideal for the development of partnerships.

Figure 2-1 shows the North and Central OC IRWM Region and its location in relation to the state, surrounding counties, and the South OC IRWM Region. **Figure 2-2** shows the watersheds within the IRWM Region. **Figure 2-3** shows the primary topographic features.

Figure 2-1: North and Central OC IRWM Region and Regional Location

Figure 2-2: Watersheds in the IRWM Region

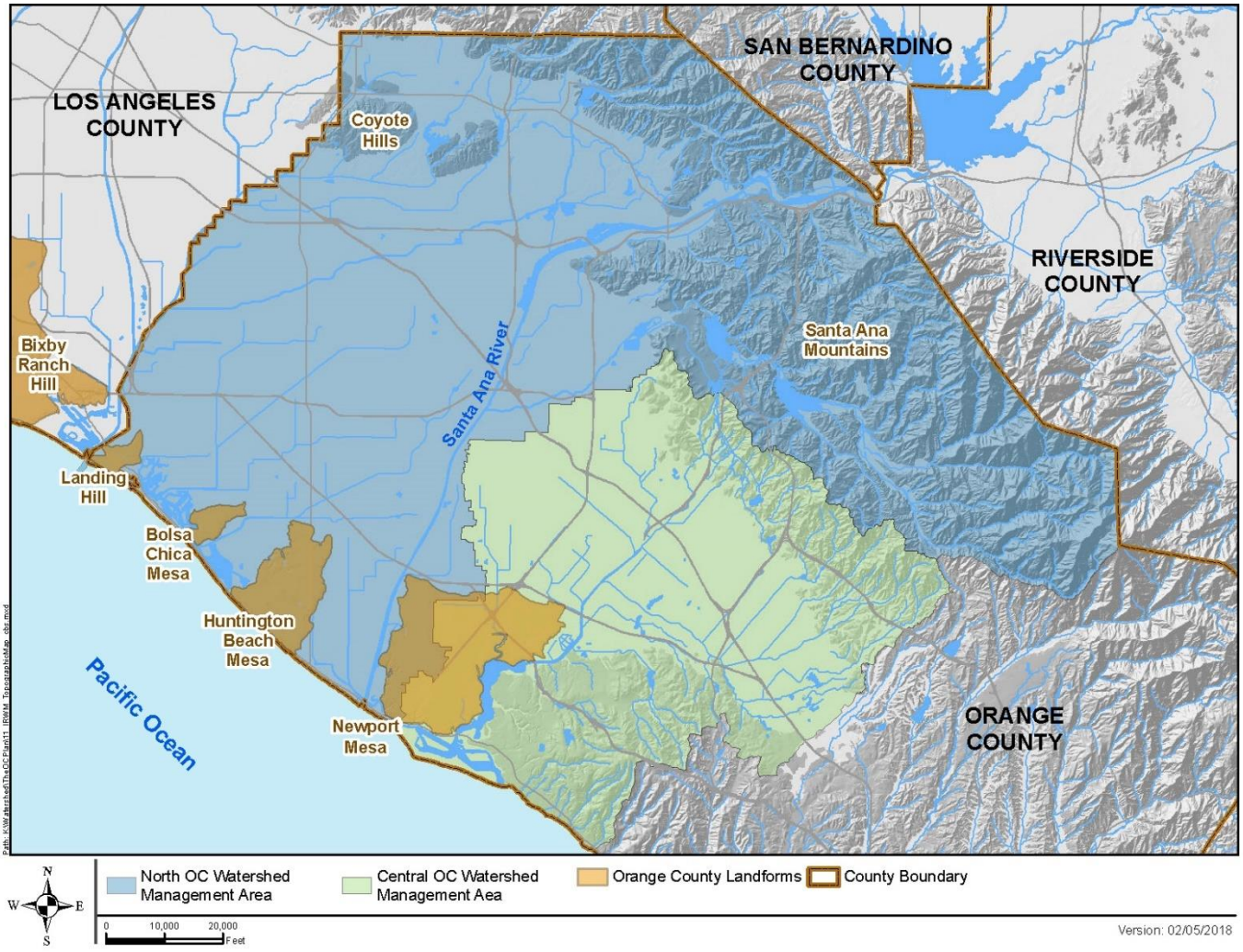


Figure 2-3: Primary Topographic Features

Appropriate IRWM Region

The OC Plan's RWMG determined that the North and Central OC WMAs are an appropriate region for integrated water planning because of the congruence with natural hydrogeologic boundaries, its inclusion within the Regional Water Board boundaries (**see Figure 2-15**), a shared groundwater basin (**see Figure 2-6**), and similar climate effects, all generating similar water planning within each WMA. Additionally, the Region includes all the coastal areas in Orange County within the Regional Water Board jurisdiction.

The OC Plan brings together short-term and long-term management strategies that will protect and enhance water resources in the Region. Water management strategies are integrated to provide a reliable water supply, protect and improve water quality, and achieve other objectives.

The OC Plan is designed to help local agencies and governments manage their water, wastewater, and ecological resources of the watersheds in an integrated manner. The OC Plan defines the Region, identifies potential projects intended to improve water quality and supply within the Region, investigates project feasibility, engages in long-range water planning, and establishes project priorities of the member agencies. It is also a goal of the Region to set a strategy to obtain funding to implement projects as funding is available. The OC Plan does not, however, specifically create a commitment to implement projects or the resources to do so.

In the Region, integration is achieved across regional boundaries by the County, OCWD, OCSD, MWDOC, and their member agencies. The Orange County Public Works (OC Public Works) Department is the principal NPDES Permittee, TMDL program coordinator, and flood control infrastructure owner and operator of countywide regional and subregional flood control facilities. Environmental stewardship is integrated across adjacent regions through the Natural Communities Coalition (NCC) as administrator of NCCP/HCP; environmental coalitions such as the Orange County Coastkeeper; Friends of Harbors, Beaches, and Parks; Orange County Green Vision; and the oversight and planning of regulatory agencies such as the California Department of Fish and Wildlife (CDFW). The OC Plan Region and the South OC WMA share County of Orange staff.

2.1.2 North Orange County Watershed Management Area

The North OC WMA encompasses the Santa Ana River Watershed, the Lower San Gabriel River/Coyote Creek Watershed, and the Anaheim Bay-Huntington Harbour Watershed. These watersheds have approximately 1.8 million residents[1] and provide employment for almost 1 million people. These watersheds carry the runoff for approximately one-third of Orange County's area, provide the riparian habitat for many flora and fauna, and include 35 miles of ocean coastline and many of the remaining significant estuary areas along the Southern California coastline. Four relatively flat elevated areas, known as mesas, occur along the coastal boundary of the basin. The mesas were formed by ground surface uplift along the Newport Inglewood Fault Zone. Ancient meandering of the Santa Ana River carved notches through the uplifted area and left behind sand- and gravel-filled deposits beneath the lowland areas between the mesas, known as gaps (Poland et al., 1956[2]). Groundwater in the shallow aquifers within the gaps, known as the Talbert and Alamitos gaps, is susceptible to seawater intrusion.

[1] Population estimates in Table 2-9.
[2] Poland, J. F. et al., 1956, *Ground Water Geology of the Coastal Zone Long Beach-Santa Ana Area, California*, USGS Water Supply Paper 1109.

The Talbert and Alamitos Seawater Intrusion Barriers were constructed in the 1960s to address this problem.

Maintaining beach water quality, clean ocean water and meeting total maximum daily load/National Pollutant Discharge Elimination System (TMDL/NPDES) requirements are critical components as are using water resources in an efficient manner. **Figure 2-4** shows the location of the North OC WMA and **Figure 2-5** shows the North OC watersheds.

2.1.2.1 Anaheim Bay-Huntington Harbour Watershed

The Anaheim Bay-Huntington Harbour Watershed covers 80.35 square miles and includes portions of the cities of Anaheim, Cypress, Fountain Valley, Garden Grove, Huntington Beach, Los Alamitos, Santa Ana, Seal Beach, Stanton, and Westminster.

Surface water systems provide drainage within this watershed, which includes the Bolsa Chica Channel that provides drainage to the Anaheim Bay-Huntington Harbour, and the East Garden Grove-Wintersburg Channel that carries flow to Bolsa Bay and ultimately to Huntington Harbour. Westminster Channel connects to the Bolsa Chica Channel and Sunset Channel.

Huntington Lake and Talbert Lake are also located in this watershed within Huntington Central Park. Huntington Lake is a man-made 12-acre lake with water year-round. Talbert Lake is 16 acres and typically dries up when groundwater levels drop during summer months.

2.1.2.2 Lower San Gabriel River/Coyote Creek Watershed

The Lower San Gabriel River/Coyote Creek Watershed covers an area of 85.49 square miles located within the northwest corner of Orange County, which includes the Carbon Creek Watershed. The watershed includes portions of the cities of Anaheim, Brea, Buena Park, Cypress, Fullerton, La Habra, La Palma, Los Alamitos, Placentia, and Seal Beach.

The primary surface water body within the watershed is the Coyote Creek, which flows from Los Angeles County to the San Gabriel River. Carbon Creek flows from the foothills to the San Gabriel River and has six retarding basins. Other creeks and channels include Brea Creek, Moody Creek, Fullerton Creek, and Los Alamitos Channel.

Brea Dam was constructed in 1942 primarily for flood control purposes. It is in the City of Fullerton on Brea Creek and is owned by the U.S. Army Corps of Engineers (USACE).[3] Recreation facilities, managed by City of Fullerton Community Services, have been built near

[3] http://www.spl.usace.army.mil/Media/Fact-Sheets/Article/477346/dam-safety-program/

the 87-foot high dam location and covers more than 241 acres. Normal dry-weather storage is about 1 acre-foot, while the flood control capacity of the reservoir is 4,000 acre-feet. The drainage area is 21.6 square miles from Brea Creek and its tributaries.

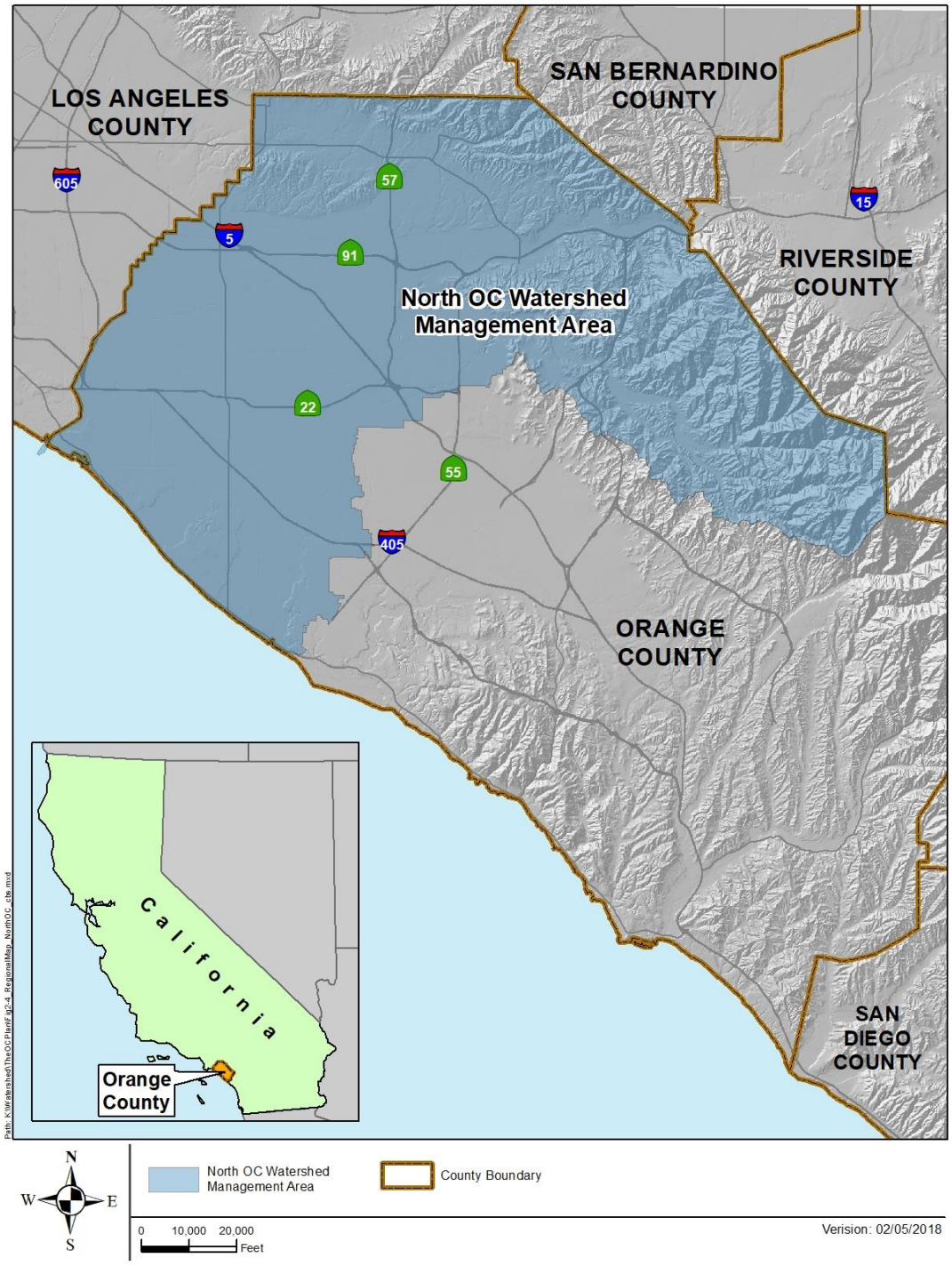


Figure 2-4: North OC Watershed Management Area Location

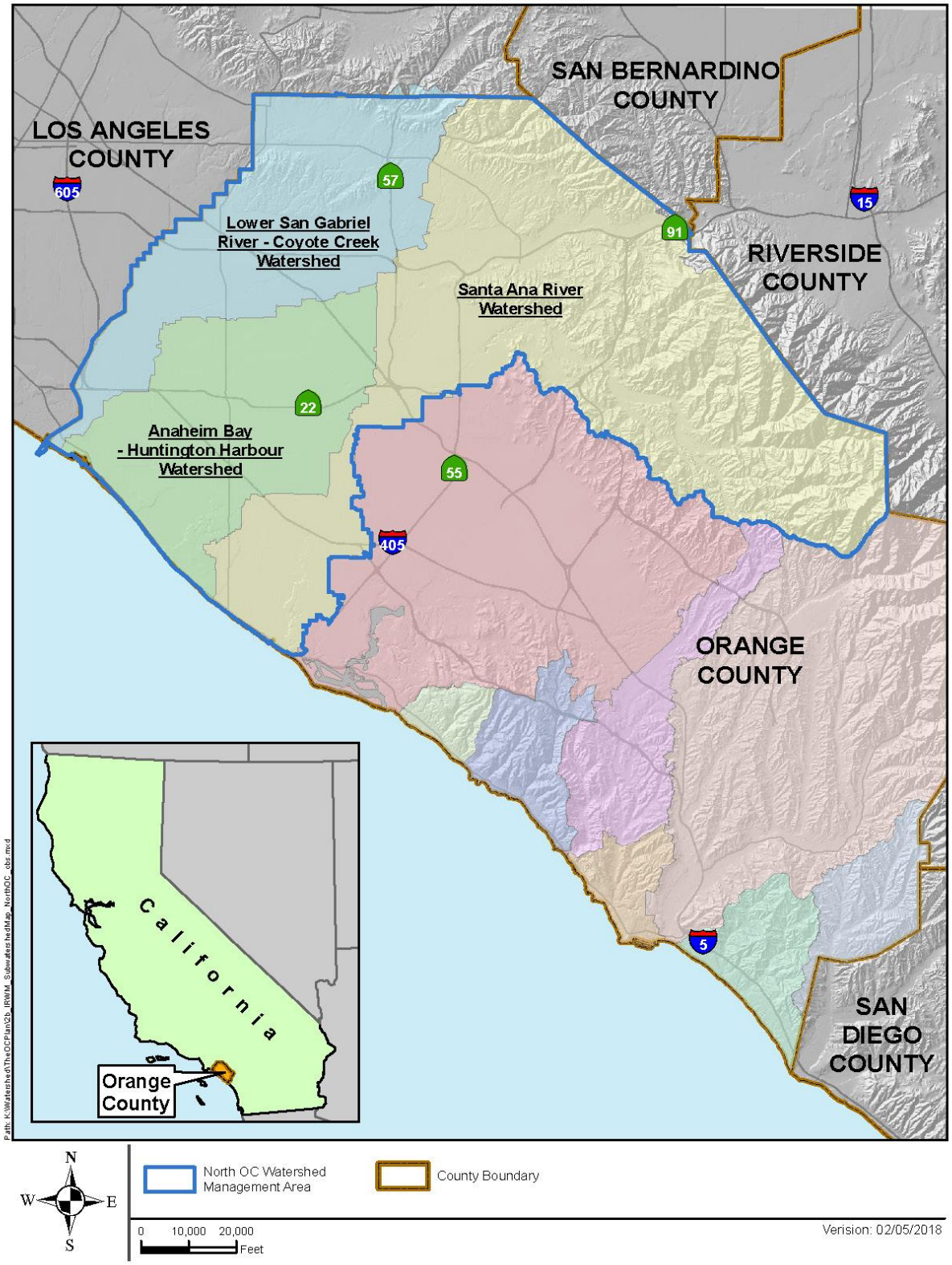


Figure 2-5: North OC Watersheds

Fullerton Dam, also located in the City of Fullerton, was constructed in 1941 for flood control purposes and is owned by the USACE and managed by the County of Orange. Recreation facilities have been built near the 46-foot high dam location. Normal dry weather storage behind the dam is 1 acre-foot, while the flood control capacity of the Fullerton Reservoir is 1,342 AF with a maximum discharge of 3,640 cubic feet per second (cfs). The drainage area is 5 square miles.

Carbon Canyon Dam, located in the City of Brea within the Carbon Creek Watershed, was constructed in 1961 for flood control purposes and is owned by the USACE and managed by Orange County. Recreation facilities have been built near the 99-foot high dam location. Normal dry weather storage behind the dam is 1 acre-foot, while the capacity of the Fullerton Reservoir is 7,033 acre-feet.[4] The drainage area is 19.3 square miles.

2.1.2.3 Santa Ana River Watershed

The Santa Ana River Watershed is home to over 6 million people and includes the major population centers of parts of Orange, Riverside, and San Bernardino Counties, as well as a sliver of Los Angeles County. **Figure 2-6** shows the entire Santa Ana River Watershed.

The Santa Ana River flows over 100 miles and drains the largest coastal stream system in Southern California. It discharges into the Pacific Ocean at the City of Huntington Beach. The total length of the Santa Ana River and its major tributaries is about 700 miles. Forty percent of the land area in the Region is hydrologically connected to the Santa Ana River.

The portion of the watershed within Orange County (referred to here as the "watershed") is located primarily in the northeast part of the county with a small portion that follows the Santa Ana River to the ocean. The watershed includes portions of the cities of Anaheim, Brea, Costa Mesa, Fountain Valley, Garden Grove, Huntington Beach, Orange, Placentia, Santa Ana, Villa Park, and Yorba Linda.

The primary surface waters in the watershed are the Santa Ana River and Santiago Creek, which is the Santa Ana River's main tributary within Orange County. The Talbert and Huntington Beach Channels drain the western side of the watershed, carrying flow to the Talbert Marsh along the coast. The Greenville-Banning Channel drains the eastern side of the watershed and carries flow to the Santa Ana River.

[4] https://en.wikipedia.org/wiki/Carbon_Canyon_Dam

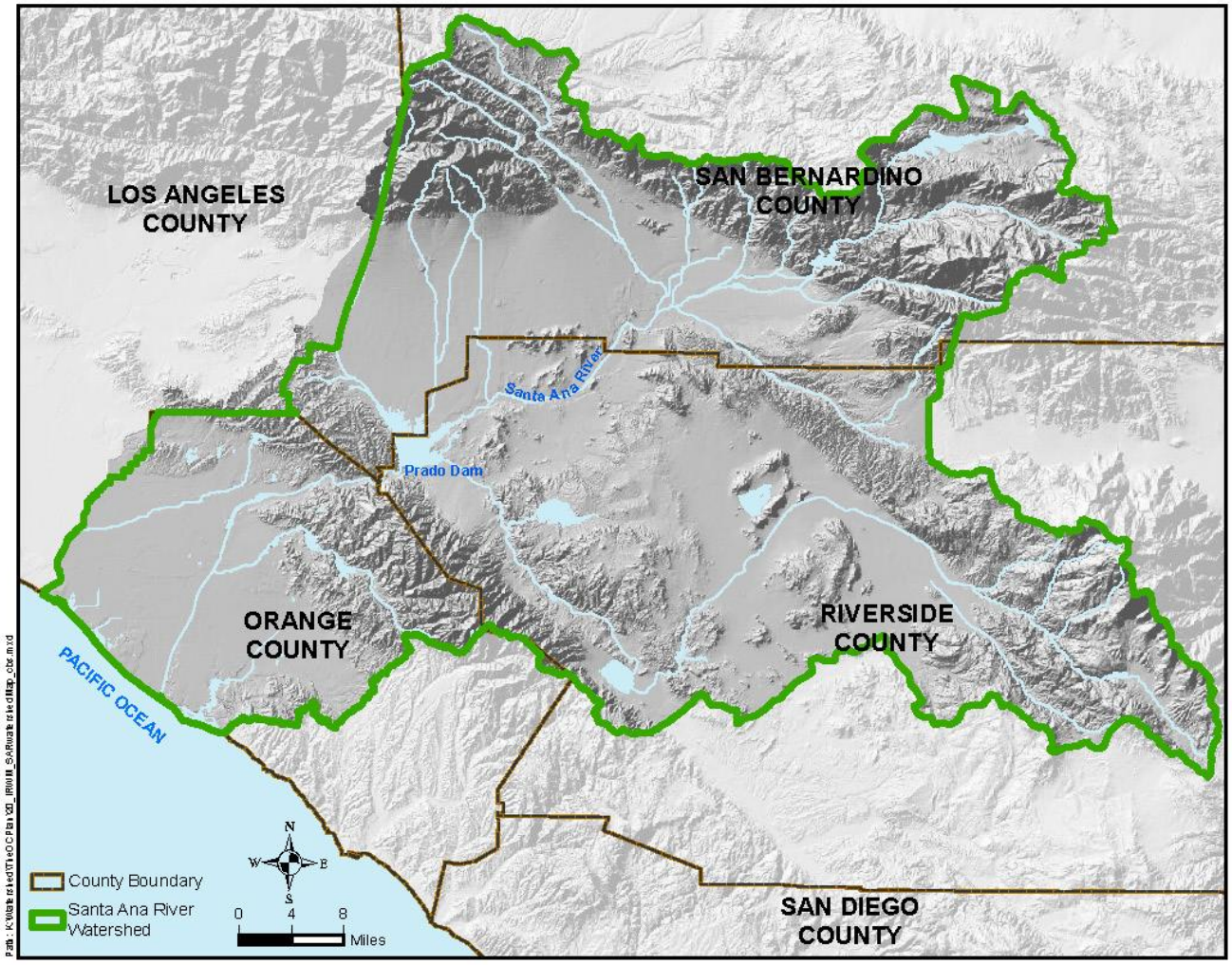


Figure 2-6: Santa Ana River Watershed

The Santa Ana River Watershed includes Santiago Dam, located at Irvine Lake, and Villa Park Dam. Irvine Lake (also known as the Santiago Reservoir) captures flows from Santiago Creek and provides water supplies to the Serrano Water District and the Irvine Ranch Water District (IRWD). While IRWD is a partial owner of the lake, Serrano Water District runs its operations. Irvine Lake has a normal storage of 25,000 acre feet

(AF) of water at 791 feet elevation. Maximum storage is 28,000 AF in the event of a flood. The reservoir is the largest man-made lake in Orange County and is the largest body of freshwater entirely within the county, which is contained by the 810-foot-high Santiago Dam, and drains an area of 64 square miles. In normal weather years, less water is stored than the maximum level. Maximum levels are only reached during wet years. After construction in 1931, the lake served the agricultural and farming communities surrounding Irvine Lake. Today, it is well known for fishing and recreation.

2.1.3 Central Orange County Watershed Management Area

The Central OC WMA encompasses the Newport Bay Watershed and the northern portion of the Newport Coast Watershed. These watersheds are within the jurisdiction of the Santa Ana Regional Board and are highly urbanized areas with challenging issues related to water quality and protection of coastal resources and habitat. Supporting nearly 1 million people, these two adjoining subregional watersheds lie at the southern edge of the broader Santa Ana River Watershed. The Central OC planning area shares groundwater resources and an imported water system with other areas in the Santa Ana region while the watershed management issues within this area are distinct and integrally linked to the Region's fragile coastal ecosystem. The headwaters originate in the local foothills, and the entire area drains to the ocean, making this a distinct planning area for water quality and ecosystem processes. **Figure 2-7** shows the location of the Central OC WMA and **Figure 2-8** shows the Central OC watersheds.

This WMA, located approximately 40 miles south of Los Angeles and 70 miles north of San Diego, includes three Critical Coastal Areas (CCA)[5], two Areas of Special Biological Significance (ASBS)[6], nine miles of coastline, and a functioning estuary designated as a state ecological reserve. Areas of Special Biological Significance are further described in **Section 2.7**.

[5] The Critical Coastal Areas (CCA) Program is an innovative program to foster collaboration among stakeholders and government agencies, to better coordinate resources and focus efforts on coastal watersheds in critical need of protection from polluted runoff. An initial list of 101 CCAs https://www.coastal.ca.gov/nps/Web/cca_project.htm

[6] These are 34 ocean areas monitored and maintained for water quality by the State Water Resources Control Board. ASBS cover much of the length of California's coastal waters. They support an unusual variety of aquatic life, and often host unique individual species. ASBS are basic building blocks for a sustainable, resilient coastal environment and economy.

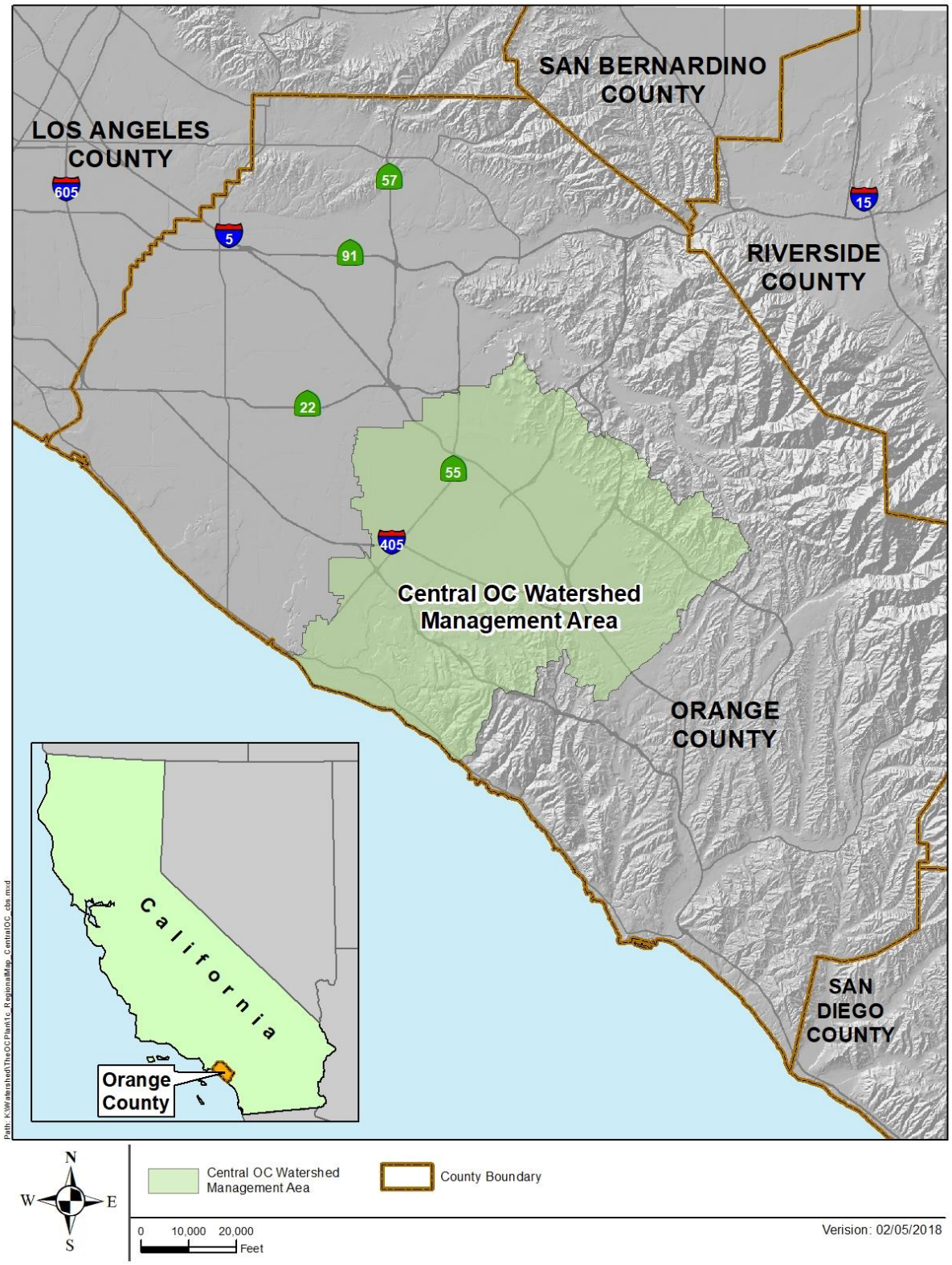


Figure 2-7: Central OC Watershed Management Area Location

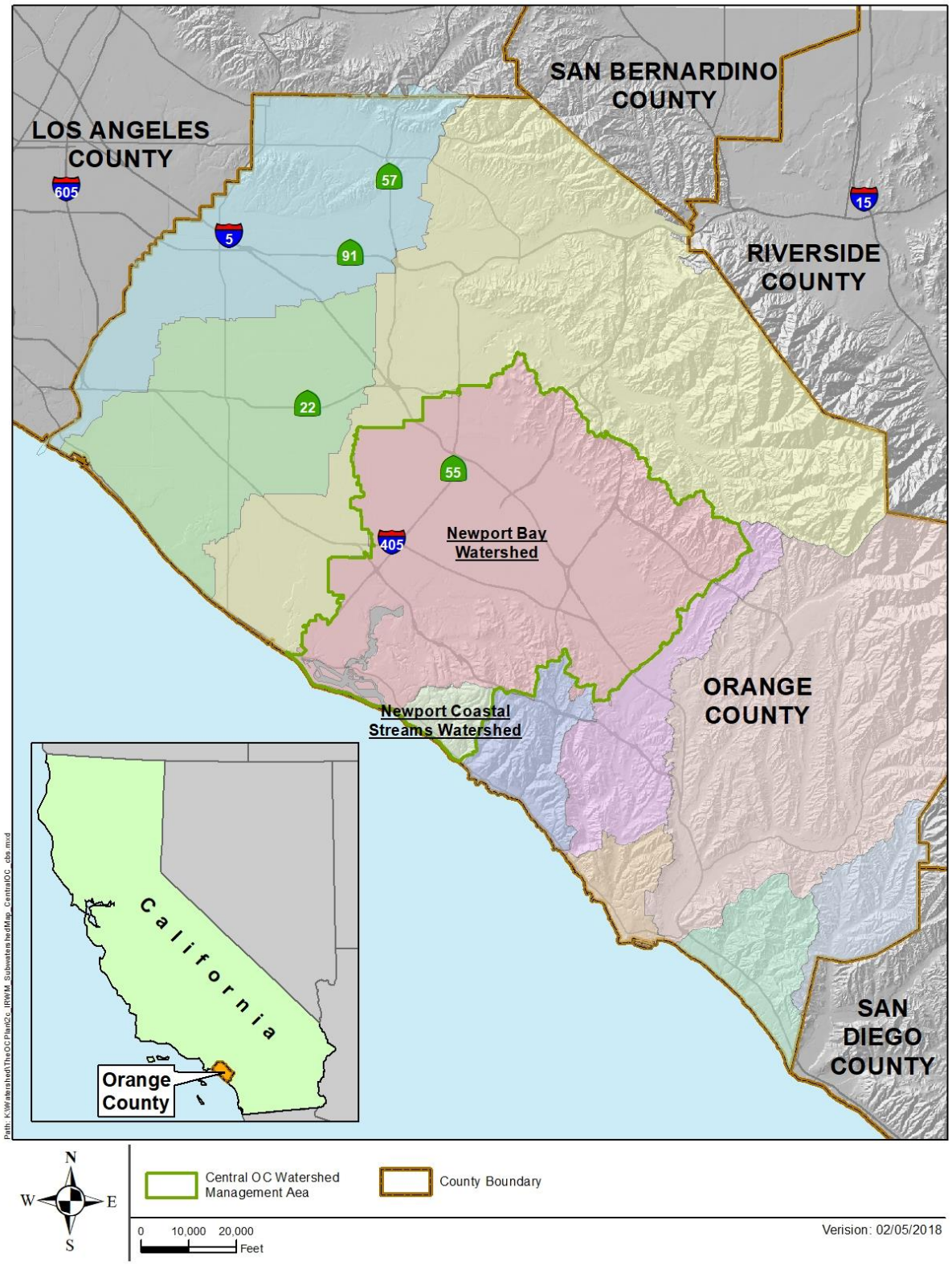


Figure 2-8: Central OC Watersheds

2.1.3.1 Newport Bay Watershed

The Newport Bay Watershed encompasses an area of approximately 154 square miles with overland flows draining toward the Pacific Coast into Newport Bay. The watershed is bounded in the northeast by the Loma Ridge Foothills and the Santa Ana Mountains. The southern edge is bounded by the San Joaquin Hills. Between the Santa Ana Mountains and the San Joaquin Hills lies the flat, alluvial Tustin Plain. The lowest area of this plain is the historical location of the "Swamp of the Frogs". Runoff originating in the northern hills now flows south through flood control channels, into the San Diego Creek Channel, through the Tustin Plain, and then into Upper Newport Bay. On the other side of the San Joaquin Hills is the Newport Coast Watershed, which consists of a series of coastal canyons that drain directly to the ocean.

Changes in land use and the location of the former military bases within the Newport Bay Watershed have resulted in the discharge of toxic substances, including metals and pesticides, into San Diego Creek and Upper Newport Bay. Legacy agricultural operations have also resulted in water quality degradation within the Region due to the use of pesticide and fertilizers.

Lower Newport Bay, which includes Newport Harbor, has additional water quality issues associated with metals used in boat paints. The Rhine Channel, located at the western end of Lower Newport Bay, has been surrounded by industrial uses such as canneries, metal plating companies, and shipyards since the 1920s. The Rhine Channel is a dead-end channel in which toxic pollutants have accumulated in the sediment. Sediment accumulation in the bay due to erosion from San Diego Creek and its tributaries has resulted in adverse effects on habitat in the bay and on the use of the Lower Newport Bay channels for navigation.

2.1.3.2 Newport Coast Watershed

Before 1940, most of the Newport Coast Watershed was undeveloped and largely covered by coastal sage scrub habitat. Some cattle grazing did occur, which disturbed the native vegetation and caused a net increase in sediment loads in runoff and sedimentation of the

canyon creek beds. Development of the Newport Coast Watershed began to increase in the 1940s and 1950s. Grading operations for the Shorecliff, Corona Highlands, Cameo Shores, and Corona Highland communities, as well as transportation corridors like Highway 1, intruded into the canyon areas along Buck Gully and Morning Canyon. One offshoot of Morning Canyon (Surrey Canyon) was filled entirely. Since 1990, the Newport Coast Watershed has been developed extensively, primarily for residential use.

The Newport Coast Watershed covers approximately 11 square miles and is located between the cities of Corona Del Mar and Laguna Beach. The boundary between the Santa Ana and San Diego Regional Water Boards falls between Muddy Canyon and Moro Canyon and divides the Newport Coast Watershed in two.

The Newport Coast Watershed consists of eight small coastal channels (listed from north to south): Buck Gully Creek, the Morning Canyon Channel, Pelican Point Creek, Pelican Point Middle Creek, Pelican Point Waterfall Creek, Los Trancos Creek, Moro Canyon and Muddy Canyon. All surface water in this coastal watershed drains to the Pacific Ocean via overland flow and storm drain systems. The Newport Coast Watershed is bordered on the north and northeast by the Newport Bay Watershed and contoured on the east and south by the Laguna Coastal Streams Watershed.

Two CCAs and two ASBSs are located in the Newport Coast Watershed: 1) Newport Beach (Robert E. Badham) Marine Life Refuge (ASBS No. 32/CCA No. 70); and 2) Irvine Coast Marine Life Refuge (ASBS No. 33/CCA No. 71).

Figure 2-9 shows the surface water bodies in the Region. **Figure 2-11,** shown later, includes the Orange County Basin Boundary (Coastal Plains of Orange County Basin).

2.1.4 Integrated Watershed Management in the Region

Agencies and stakeholders within the Region place a strong emphasis on watershed planning and integration. Over the past decade, the County, cities, water and wastewater agencies, and public stakeholders have participated in watershed-level planning to assess and develop projects to enhance the overall health of the Region's watersheds.

The overall goal of the monitoring, assessment, and research efforts is to track progress toward solving existing problems, identify emerging issues that could become problems in the future, and support research and development that improves our understanding of key processes and

advances the efficiency and effectiveness of monitoring methods. The approach is detailed in the State of the Environment Report, Santa Ana Region[7] prepared in 2013.

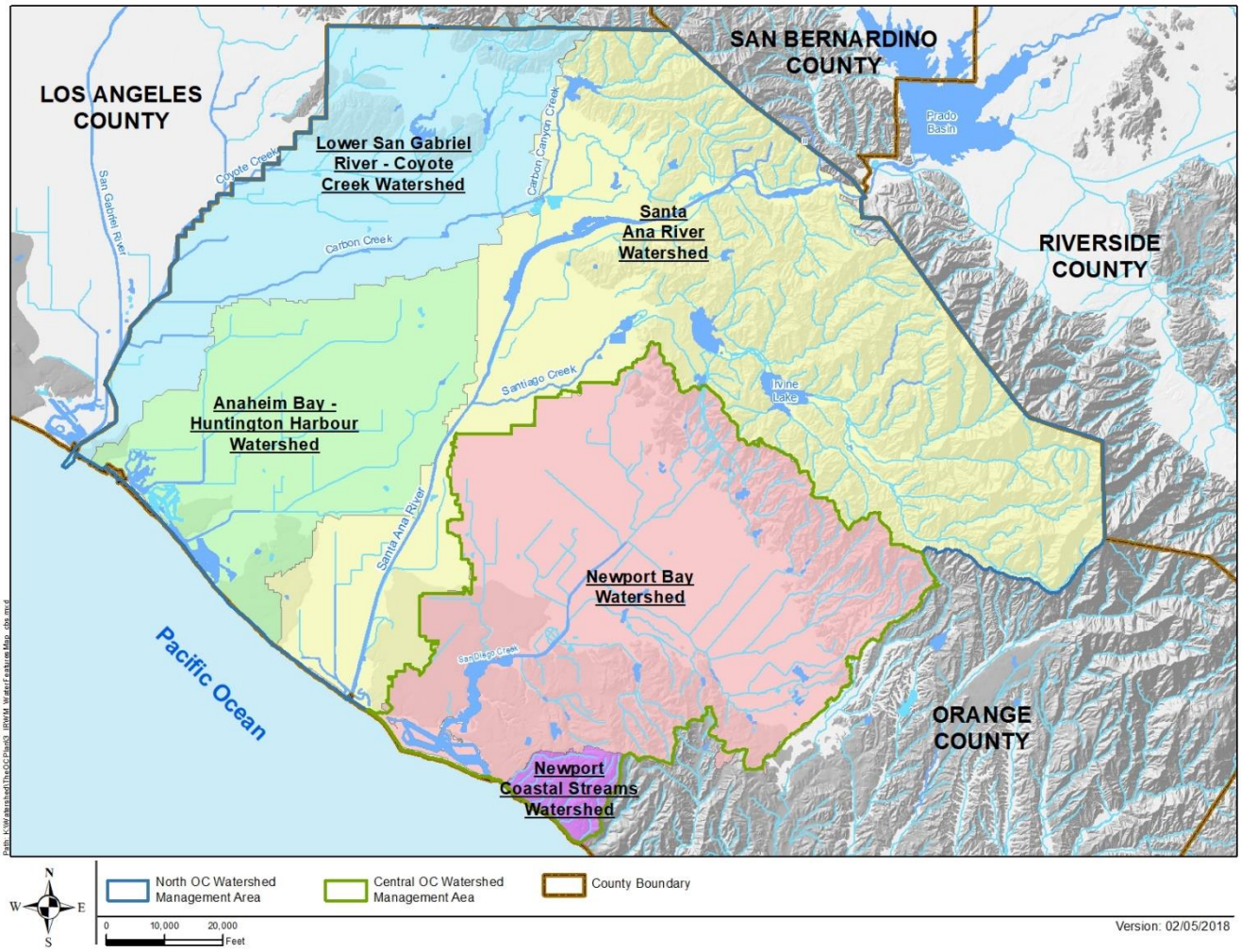


Figure 2-9: Surface Waterbodies

Integrated planning has occurred within the watershed management areas naturally, progressively, and due to regulatory requirements. These efforts include, but are not limited to:

- **Watershed Management Plans.** As presented in **Section 1.1**, in Orange County, there are 11 watersheds grouped into three watershed management areas. As each Watershed Management Area (WMA) is a collaborative framework for municipalities and special purpose agencies to work jointly and find synergies across water resource disciplines,

[7] http://www.ocwatersheds.com/documents/state_of_the_environment_reports

IRWM Plans were developed for each of the three WMAs. [8] The North and Central OC WMAs, which include five watersheds, are included in The OC Plan for IRWM planning.

Watershed management plans that have been developed include the following:

U.S. Army Corps of Engineers Special Area Management Plan for San Diego Creek Watershed. The final 2009 Special Area Management Plan (SAMP) (USACE and CDFG 2009), prepared, in conjunction with the California Department of Fish and Game's (now California Department of Fish and Wildlife [CDFW]) Master Streambed Alteration Agreement (MSAA), is a cohesive, watershed-specific plan that addresses anticipated permitting needs and compensatory mitigation, including long-term management of aquatic resources within the watershed.

Newport Coast Watershed Management Plan. The Newport Coast comprises several small coastal drainages southeast of Newport Bay. The City of Newport Beach developed a watershed management plan specific to the Newport Coast (City of Newport Beach, 2007). The watershed management plan includes an analysis of the critical issues and recommends programs and projects to reduce impacts on the critical coastal areas (CCAs) and two areas of special biological significance (ASBS) that border the coastline.

Newport Harbor Area Management Plan, Upper Newport Bay Watershed Management Plan and San Diego Creek Strategic Watershed Plan. The City of Newport Beach developed a watershed management plan for Newport Harbor within Lower Newport Bay, Upper Newport Bay, and the San Diego Creek subwatersheds. These integrated plans will be based on an adaptive management process.

- **Comprehensive Water Quality Analyses for the Watersheds.** The Environmental Monitoring Division of OC Public Works/Environmental Resources implements monitoring programs to comply with municipal separate storm sewer system (MS4) permit requirements on behalf of the County, the Orange County Flood Control District, and the 34 cities of Orange County (Orange County Stormwater Program).[9]

  The MS4 Permit Monitoring Plan for the Santa Ana Region of Orange County[10] fulfills the requirements of NPDES Permit No. CAS618030, Order No. R8 -2009-0030 (amended by Order No. R8-2010-0062). The County developed a Model Water Quality Management Plan (2011 WQMP) to assist with project development and development project proponents with addressing post-construction urban runoff and stormwater pollution from new development and significant redevelopment projects.

[8] http://www.ocwatersheds.com/gov/pw/watersheds/programs/ourws/
[9] http://www.ocwatersheds.com/rainrecords/waterqualitydata
[10] http://www.ocwatersheds.com/civicax/filebank/blobdload.aspx?BlobID=9808

- **Water Quality Studies**. Orange County is participating in the following efforts to examine emerging water quality issues and environmental concerns for Southern California at the regional scale:
    - SAWPA Emerging Constituents Task Force[11] – The Task Force was formed by a Cooperative Agreement to conduct periodic emerging constituents sampling, data management and communication in the Santa Ana River Watershed in cooperation with the Santa Ana Regional Water Quality Control Board.
    - Southern California Bight Studies[12] – The Bight studies, coordinated by the Southern California Coastal Water Research Project (SCCWRP), utilize standardized sampling and analytical methods to produce a wide range of data from both impacted and reference areas.
    - Southern California Stormwater Monitoring Coalition (SMC)[13] – The goal of the SMC is to develop the technical information necessary to better understand stormwater mechanisms and impacts, and then develop the tools that will effectively and efficiently improve stormwater decision-making. The SMC develops and funds cooperative projects to improve the knowledge of stormwater quality management and reports on the progress of those projects on an annual basis.
- **Orange County Reliability Study (December 2016).** The Municipal Water District of Orange County (MWDOC) completed the Orange County Reliability Study in December 2016, demonstrating the Region's progressive approach to water management and ongoing committed to water supply reliability. The study included estimating supply and system gaps between forecasted water demands and existing/planned water supplies and evaluating portfolios of supply projects that could be implemented by Metropolitan and its member agencies. Preparation of this study involved over 25 meetings with a workgroup represented by managers from MWDOC, MWDOC member agencies, OCWD, and the cities of Anaheim, Fullerton and Santa Ana.
- **Orange County Water District (OCWD) Groundwater Management Plan 2015 Update (June 2015)**. OCWD manages the OC Groundwater Basin for the benefit of the Region's water suppliers. The first Groundwater Management Plan was published in 1989; the 2015 Update is the fifth update prepared in compliance with the Groundwater Management Act and California Water Code, Section 10753.7.[14] The Groundwater Management Plan sets forth basin management goals and objectives, describes accomplishments, explains changes in basin management, and provides information

[11] http://www.sawpa.org/collaboration/projects/emerging-constituents-workgroup/
[12] http://www.sccwrp.org/ResearchAreas/RegionalMonitoring/Bight13RegionalMonitoring.aspx
[13] http://socalsmc.org/
[14] https://www.ocwd.com/what-we-do/groundwater-management/groundwater-management-plan/

about projects completed by OCWD in order to protect and manage the Orange County Groundwater Basin for long-term sustainability.

- **Basin 8-1 Alternative Plan (January 2017).** Pursuant to the California Sustainable Groundwater Management Act (SGMA) (2014, as amended in 2015) OCWD, the City of La Habra and Irvine Ranch Water District completed the Basin 8-1 Alternative. SGMA provides authority for agencies to develop and implement Groundwater Sustainability Plans (GSP) or alternative plans. The Basin 8-1 Alternative Plan presents an analysis of basin conditions that demonstrates that the basin has operated within its sustainable yield over a period of at least 10 years. In addition, the Alternative Plan establishes objectives and criteria for management that would be addressed in a GSP and is designed to be "functionally equivalent" to a GSP. The Basin 8-1 Alternative Plan is included as **Appendix C.**

- **Orange County Stormwater Resources Plan (OC SWRP).** A functionally equivalent plan, the OC SWRP, prepared by OC Environmental Resources (March 2017) to meet the requirements of SB 985 and to provide watershed-based planning for stormwater projects in Orange County. The OC SWRP[15] is included as **Appendix D.** The OC SWRP aligns with The OC Plan in watershed planning, identification and prioritization of projects and establishing watershed-based priorities inclusive of water quality, water supply, natural resources, and flood management. The OC SWRP was also incorporated into the Santa Ana River Watershed IRWM Plan, locally known as the One Water One Watershed (OWOW) Plan. Four primary significant planning efforts referenced throughout the OC SWRP are used for functional equivalency to meet the SWRP guidelines. These include: 1) 2013/2014 Reports of Waste Discharge; 2) existing IRWM Plans for North, Central and South Orange County; 3) Watershed Infiltration and Hydromodification Management Plan (WIHMP) mapping tools; and 4) South OC Water Quality Improvement Plan.

- **Watershed Infiltration Hydromodification Management Plan (WIHMP) mapping tools.** Developed in 2014-15, the WIHMP mapping effort provides an initial geographic information systems (GIS) screening tool for infiltration BMP site suitability at a watershed and sub-watershed level. Analysis considered land use, soils, slope, ownership, channel morphology and drainage.[16]

- **Trash Management Plan.** The Newport Bay Watershed Draft Trash Management Plan (TMP) Framework[17] was prepared as a planning level document to serve as a model for

[15] Information about the Orange County Water Stormwater Resource Plan: http://www.ocwatersheds.com/programs/ourws/oc_stormwater_resource_plan
[16] WIHMP mapping data available at OC Environmental Resources GIS Portal
[17] https://ocgov.app.box.com/v/north-oc-wmp-clearinghouse/folder/30327715862

implementation throughout Orange County. The objective of the TMP Framework is to help MS4s Permittees within the Newport Bay Watershed comply with the State of California's Trash Amendments to the Water Quality Control Plan for Ocean Waters of California and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Trash Amendments) (SWRCB 2015).

- **Natural Community Conservation Plan/Habitat Conservation Plan for Central and Coastal Subregion.** A NCCP/HCP was developed to protect and manage habitat supporting a broad range of plant and animal populations that are now found within the Central and Coastal subregion. The Central and Coastal subregion is an extensive area that includes the Central OC WMA. It consists of an approximately 325-square-mile area that covers the area of central Orange County from the coast inland to Riverside County. Along the coast, it extends from the mouth of the Santa Ana River to the mouth of San Juan Creek; inland its boundaries follow State Route 91 along the west and El Toro Road and Interstate 5 (I-5) to San Juan Creek to the east. To accomplish its goal, the NCCP/HCP created a subregional habitat reserve system and implemented a coordinated program to manage biological resources within the habitat reserve (County of Orange July 1996).

2.1.5 Social and Culture

As of the 2010 census, Orange County is the third-most populous county in California, the sixth-most populous in the United States, and more populous than 21 states. Within the coastal zone, population density far exceeds the nation as a whole, and this trend will continue into the future. Protecting coastal ecosystems while managing population growth is a constant challenge.

Orange County is said to have been named for the citrus fruit in an attempt to promote immigration by suggesting a semi-tropical paradise–a place where anything could grow. Its county seat is Santa Ana, located in The OC Plan region. The County's four largest cities, Anaheim, Santa Ana, Irvine, and Huntington Beach, are all within The OC Plan region, and each have populations of approximately 200,000 or greater.

Orange County is part of the Tech Coast[18] - the coastal regions of five counties: Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties. The term *Tech Coast* is used to emphasize the presence of many information technology companies in this area. The area hosts several important universities, including the University of California, Irvine.

The OC Plan region is also well known for tourism with attractions like Disneyland and Knott's Berry Farm, and 10 beaches along its 42 miles of coastline within three cities – Seal Beach, Huntington Beach, and Newport Beach. All this making Orange County's cultural makeup a

[18] https://en.wikipedia.org/wiki/Tech_Coast

unique mix of surf and sand lifestyle, mariners, authentic Mexican/Hispanic culture, educational excellence, prominent tourism, and a progressive business industry.

Human Rights to Water

In 2013, California became the first state to enact into law a State policy that "every human being has the right to safe, clean, affordable and accessible water adequate for human, consumption, cooking, and sanitary purposes." (Water Code Div 1 Ch 1 Section 106.3). The Code further states that it does not expand any obligation of the State to provide water or to require the expenditure of additional resources to develop water infrastructure beyond the obligations that State agencies shall consider this policy when revising, adopting, or establishing policies, regulations, and grant criteria when those policies, regulations, and criteria are pertinent to the uses of water described above. These requirements do not apply to water supplies for new development and shall not infringe on the rights or responsibilities of any public water system.

In 2016, the State Water Board adopted a resolution identifying the human right to water as a top priority and core value of the State Water Board and Regional Water Quality Control Boards (collectively the Water Boards). The resolution stated the Water Boards will work "to preserve, enhance, and restore the quality of California's water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations." Water resource management in the IRWM Region considers actions and projects that will meet the human right to safe, clean, affordable, and accessible water to support basic human needs.

2.1.6 Economic Conditions

Within the Region, there are several areas determined to be a Disadvantaged Community (DAC), which is defined as "a community with a median household income (MHI) less than 80 percent of the statewide average"[19]. Of the approximately 2.706 million residents in North and Central OC, it is estimated that 13.8 percent[20] of the population live at or below the poverty level. Further, GIS population data from the boundaries shown in **Figure 2-10** represents 21 percent (572,485 persons) of the North and Central OC population are considered DACs. There are also Economically Disadvantaged Areas (EDA) that generally include DACs that have a state MHI between 80 and 85 percent of the statewide annual MHI along with other factors such as financial hardship, unemployment and population density.

[19] US Census American Community Survey (ACS) 5-Year Data: 2010-2014 (with a median household income [MHI] of $61,489 and hence calculated DAC and Severely DAC thresholds of $49,191 and $36,893, respectively). A DAC is defined as households with less than 80 percent of state annual median household income.
[20] See Appendix E.

The DWR DAC Mapping Tool[21], using Census block group and Census tract data, was used to help identify DAC and Severely DAC areas within the Region. Areas meeting this criterion were found within nearly all cities within the Region. **Figure 2-10** shows the areas of disadvantaged communities in the Region.

2.2 Water Supplies of the Region

Water supplies for The OC Plan region include groundwater, recycled water, and imported water. The Region has major infrastructure systems for groundwater production, drinking water treatment, imported water delivery, wastewater collection and treatment, and recycled water delivery, all of which provide regional benefits. The beneficial uses of surface waters include groundwater recharge, drinking water, habitat, and recreation.

2.2.1 Groundwater

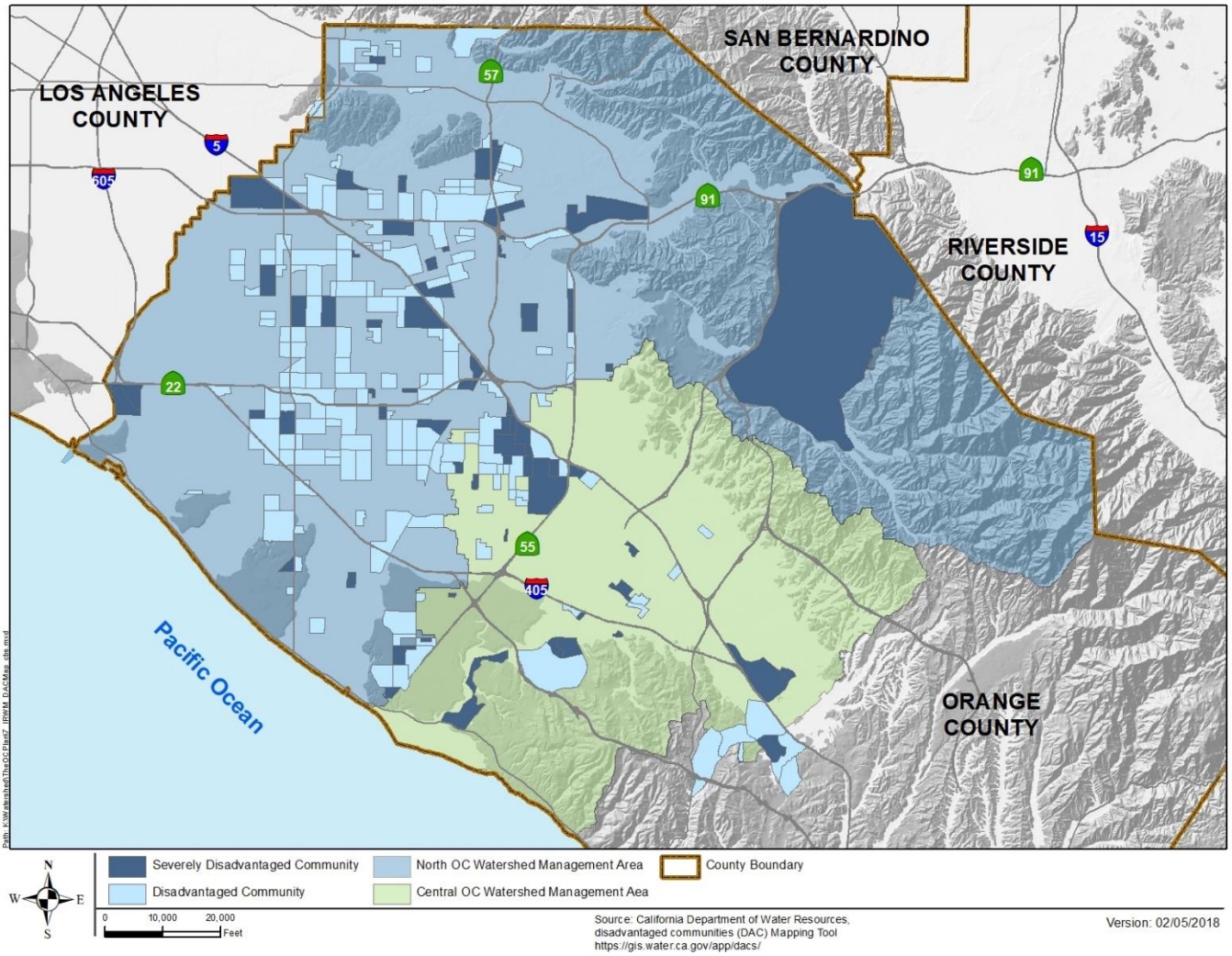
The Coastal Plain of Orange County Groundwater Basin (Basin 8-1) underlies the land area in the Region. The basin is designated as Basin 8-1 in the Department of Water Resources Bulletin 118 and is shown in **Figure 2-11.**

Approximately 90 percent of the area within Basin 8-1 is managed by the Orange County Water District. Under the Sustainable Groundwater Management Act (SGMA), OCWD is the exclusive local agency within its jurisdictional boundaries with powers to comply with the act. Historically, the approximately 10 percent of the basin outside of the jurisdiction of OCWD has not been formally managed.

In 2016, the City of La Habra was established as the Groundwater Sustainability Agency for the La Habra Basin and is preparing a Groundwater Sustainability Plan, as required by SGMA. The two basins are described below.

Orange County Groundwater Basin. Water produced from the Orange County Groundwater Basin is the primary water supply for approximately 2.4 million residents living within the service area boundaries. The basin, managed by OCWD, contains an estimated 66 million-acre feet (MAF) when full. OCWD manages the basin within an established operating range of up to 500,000 AF below full condition. This operating range was established to designate the levels of groundwater storage within which the basin that can be maintained without causing adverse impacts. The groundwater basin is not operated on an annual safe-yield basis. The net change in storage in any given year may be positive or negative; however, over a period of several years, the basin is maintained in an approximate balance.

[21] http://www.water.ca.gov/irwm/grants/resources_dac.cfm



Source: DWR DAC Mapping Tool, http://www.water.ca.gov/irwm/grants/resources_dac.cfm

Figure 2-10: Disadvantaged Community Census Tracts

Recharge water sources include water from the Santa Ana River and tributaries, imported water, and recycled water supplied by the Groundwater Replenishment System (GWRS) as well as incidental recharge from precipitation and subsurface inflow. OCWD's conjunctive use program includes over 1,500 acres of land on which there are 1,067 wetted acres of recharge facilities. This network of 25 facilities recharges over 250,000 afy, on average.

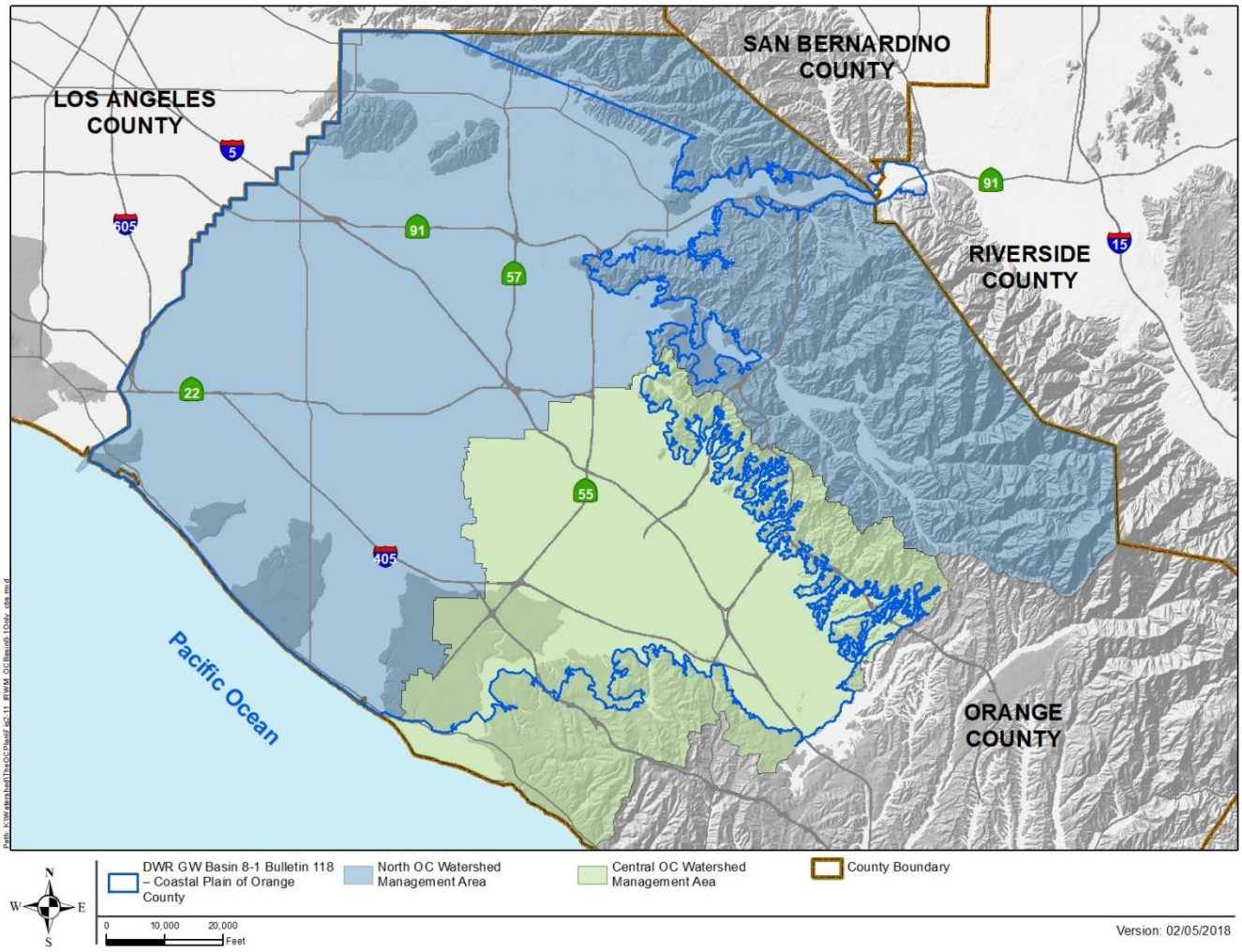


Figure 2-11: Basin 8-1 Boundary

Water resource monitoring programs for groundwater, surface water, recycled water, and imported water are summarized in **Table 2-1**.

OCWD has projected the future water budget for groundwater recharge and production under average hydrologic conditions,[22] shown in **Table 2-2**. The future projection accounts for new water supplies, such as increase in availability of recycled water, as an increase in total inflow to the basin. The projected amount of groundwater production is increased resulting in a slight positive change in storage. In the case where one or more of the new water supplies is not available in the future, the amount of groundwater production would be reduced to create a balanced water budget.

[22] Basin 8-1 Alternative, Orange County Water District, 1/1/17

Table 2-1 OCWD Monitoring Programs for the Orange County Groundwater Basin	
Monitoring Program	**Purpose**
Groundwater Production	Manage basin storage; collect revenues based on production
Groundwater Elevation	Manage basin storage; prepare groundwater level contour maps; manage seawater intrusion barrier injection rates
CA Statewide Groundwater Elevation Monitoring (CASGEM) Program	Compliance with state CASGEM program
Title 22 Water Quality Program	Compliance with CA SWRCB Division of Drinking Water, Title 22 Monitoring for more than 100 regulated and unregulated chemicals at approximately 200 large- and small-system drinking water wells
Groundwater Contamination Plumes	Monitor location of contamination plumes and levels of contamination to protect drinking water wells and basin water quality
Seawater Intrusion	Monitor effectiveness of existing seawater intrusion barriers
Santa Ana River Monitoring Program	Annual review to affirm that OCWD recharge practices are protective of public health
Basin Monitoring Program Task Force	Annual report prepared to comply with Regional Water Board Basin Plan
Santa Ana River Watermaster Monitoring	Determine annual Santa Ana River baseflow and stormflow and TDS at two locations to comply with the 1969 judgment on Santa Ana River water rights
Prado Wetlands	Evaluate changes in water quality and effectiveness of wetlands treatment of surface water used for groundwater recharge
Emerging Constituents	Compliance with federal and state regulations
Recycled Water	Monitor quality of water production by Groundwater Replenishment System (GWRS)
Imported Water	Monitor water quality of supply used for groundwater recharge

Table 2-2 Orange County Groundwater Basin Water Budget Future Projection – Average Rainfall	
Flow Component	**Acre-Feet**
INFLOW	
Measured Recharge	
Santa Ana River Baseflow	52,000
Santa Ana River Stormflow	52,000
GWRS Recharge in Forebay	104,000
Imported Water (for groundwater recharge)	65,000
Talbert Barrier Injection	30,000
Alamitos Barrier Injections in OC	2,000
Net Estimated Unmeasured or Incidental Recharge*	62,000
TOTAL INFLOW	**367,000**
OUTFLOW	
Groundwater Production	351,000
TOTAL OUTFLOW	**351,000**
CHANGE IN STORAGE	+16,000

*Subsurface outflow is included within net unmeasured recharge

La Habra Groundwater Basin. The La Habra Groundwater Basin is located north of the Orange County Groundwater Basin within the cities of La Habra and Brea. It comprises a shallow alluvial depression between the Coyote Hills and the Puente Hills. Prior to the 1950s, hundreds of wells produced water for domestic use and irrigation. The majority of these wells were abandoned due to high concentrations of nitrate, total dissolved solids, and metals, and taste and odor problems. However, in recent years, the City of La Habra has explored options to increase groundwater production from this subbasin.

Pursuant to SGMA, the City of La Habra, under a memorandum of agreement with the City of Brea, has been established as the GSA for the La Habra Groundwater Basin. The La Habra City Council also approved Ordinance No. 1767 to prohibit the extraction and exportation of groundwater underlying La Habra for use outside of the city. The ordinance was codified in

the La Habra Municipal Code as Chapter 13.31, Groundwater Extraction and Exportation, and took effect on February 18, 2016.

To prepare for a groundwater sustainability plan, pursuant to SGMA, the La Habra GSA shall consider the interests and work cooperatively with all beneficial uses and users of groundwater, as wells as those responsible for implementing groundwater sustainability plans. A list of interested parties was developed for this purpose and who will continue to contribute throughout the process to develop a Groundwater Sustainability Plan.

The La Habra Groundwater Basin is not adjudicated. Instead, La Habra follows a "safe yield" which is used for the management and future planning of the La Habra Groundwater Basin for sustained beneficial use. The safe yield is the volume of groundwater that can be pumped without depleting the aquifer to a point where it cannot recover through natural recharge over a reasonable period of time. The safe yield for the La Habra Basin was estimated to be approximately 4,500 AFY. This safe yield was determined through an average from two separate studies that considered natural groundwater recharge and natural groundwater discharge. The City of La Habra has been producing groundwater since the late 1990s and monitoring non-pumping and pumping groundwater elevations since 2008. Previous investigations into groundwater levels and the safe yield have been used to manage the La Habra Groundwater Basin for over 10 years.

According to the DWR Bulletin 45 (1934), the storage capacity of the historical La Habra Basin is approximately 153,000 AF. Approximately 57 percent of the historical La Habra Basin is in the eastern portion of the basin which is now designated within Basin 8-1. The Cities of La Habra and Brea overlie approximately 60 percent of the eastern portion of the historical La Habra Basin (Stetson, 2014[23]). Accordingly, the storage capacity of the current La Habra Basin is approximately 55,000 AF.

Groundwater within the La Habra Groundwater Basin generally flows from the Puente Hills in a south or southwesterly direction. Subsurface flow out of the basin occurs near Coyote and La Mirada Creeks into the Coastal Plain of Los Angeles and at the gap between the East and West Coyote Hills into the Coastal Plain of Orange County.

Since the City of La Habra currently depends on local groundwater to meet approximately 40 percent of its water consumption and the City of Brea uses groundwater to meet irrigation needs, preserving the sustainability of the La Habra Basin is essential for the well-being of the two cities. Currently (and historically), the City of La Habra manages (and has managed)

[23] Stetson Engineers, Inc. 2014. Task 3 Hydrogeologic Investigation of the La Habra Groundwater Basin. Technical Memorandum

the La Habra Basin through management plans and programs for groundwater levels, basin storage, water quality, groundwater export prohibition, and groundwater-surface water interactions.

By January 2020, the La Habra GSA will manage the La Habra-Brea Management Area, shown in **Figure 2-12**, through its GSP, which will describe the City's monitoring program and ensure that no undesirable results occur in the future.

As a key component of sustainable management, the cities of La Habra and Brea strongly promote conservation to preserve water supplies. Both cities have sections on their websites dedicated to water conservation in addition to including conservation guidance in their annual Consumer Confidence Reports distributed to residents. The La Habra-Brea Basin is currently monitored for groundwater elevations and for groundwater quality through productions wells and historical data.

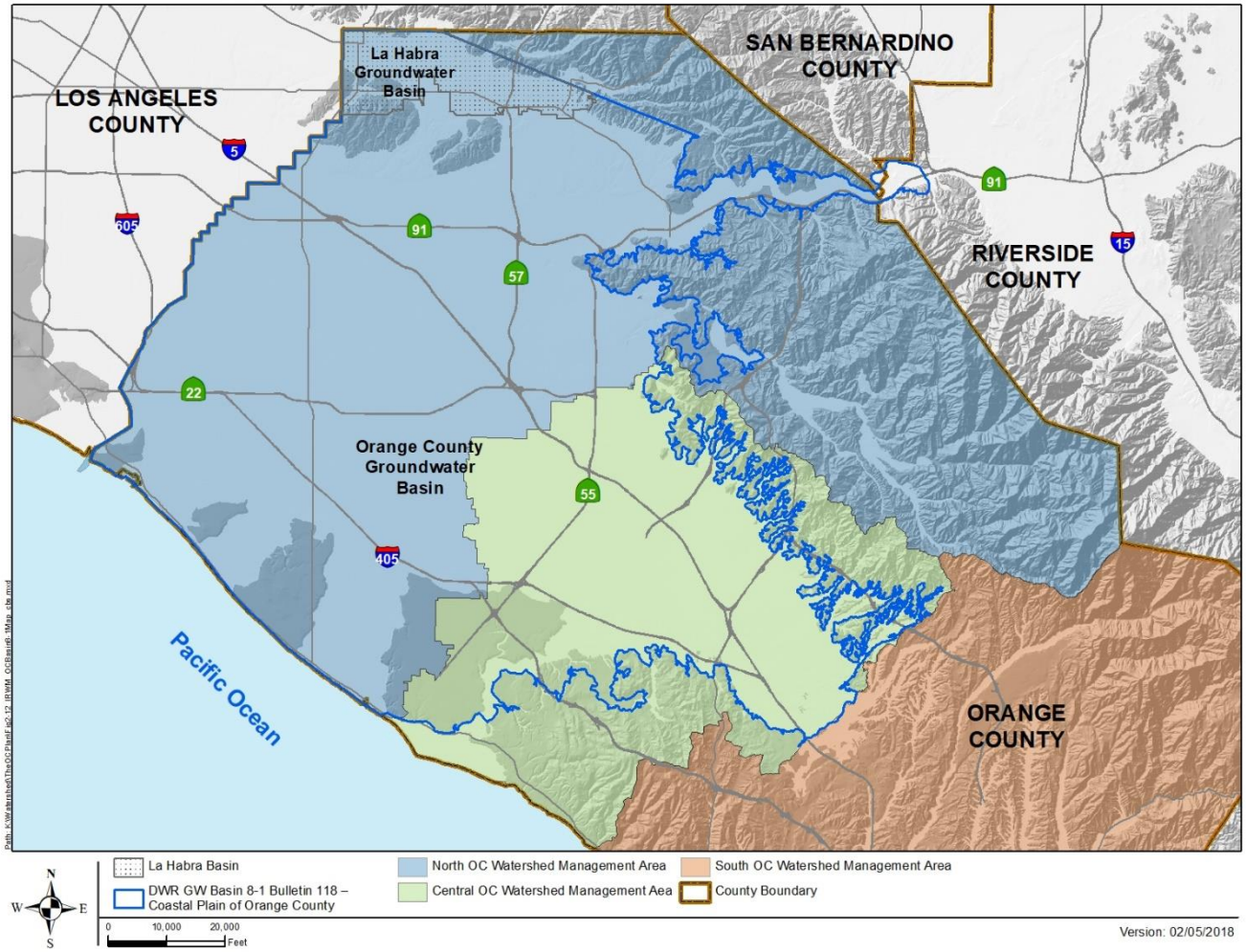


Figure 2-12: Basin 8-1 Management Areas

2.2.2 Imported Water

The OC Plan supports the development and implementation of projects and programs to build diverse water supplies. Imported water is an important water supply to meet the water demands of the growing population of the Region. In the Region, imported water supply accounts for approximately 25 percent of the potable water supply, and is obtained through the regional wholesale agencies. The local water supply provides approximately 75 percent of the local potable supply. Untreated imported water is used to replenish the groundwater basin.

Changes in population, economic conditions, and hydrologic conditions all influence water demand in the Region. Furthermore, the rapidly expanding housing base, increasing population and business growth potential will dictate future water needs.

Imported water is delivered through Metropolitan from the State Water Project (SWP/Bay Delta) and the Colorado River Aqueduct (CRA) to its member agencies. In the Region, the member agencies are MWDOC, and the cities of Anaheim, Fullerton, and Santa Ana.

Treated imported water is received into Orange County from the Diemer Filtration Plant. As shown in **Figure 2-13,** this system is shared regionally with other water agencies in South OC.

Untreated water is also delivered from the Metropolitan system into the Region and is used primarily for groundwater recharge. Agricultural demands within the Region are declining as development occurs, and landscape irrigation demands will be partially met by an increased supply of recycled water. IRWD's Irvine Lake Pipeline conveys Metropolitan untreated water and local runoff from Irvine Lake to the Rattlesnake Reservoir. Connections along the Irvine Lake Pipeline serve the Irvine Company agricultural irrigation systems and the IRWD recycled water distribution system. The Baker Aqueduct also delivers Metropolitan untreated water to Central and South OC. Use of the Baker Pipeline has declined because of the use of Allen McColloch Pipeline (AMP) and the decline in area agriculture.

As the principal importer of water in Southern California, Metropolitan's primary goal is to provide reliable water supplies to meet the water needs of its service area at the lowest possible cost. As existing imported water supplies from the Colorado River and Bay Delta face increasing challenges, the reliability of deliveries from these sources continues to decline.

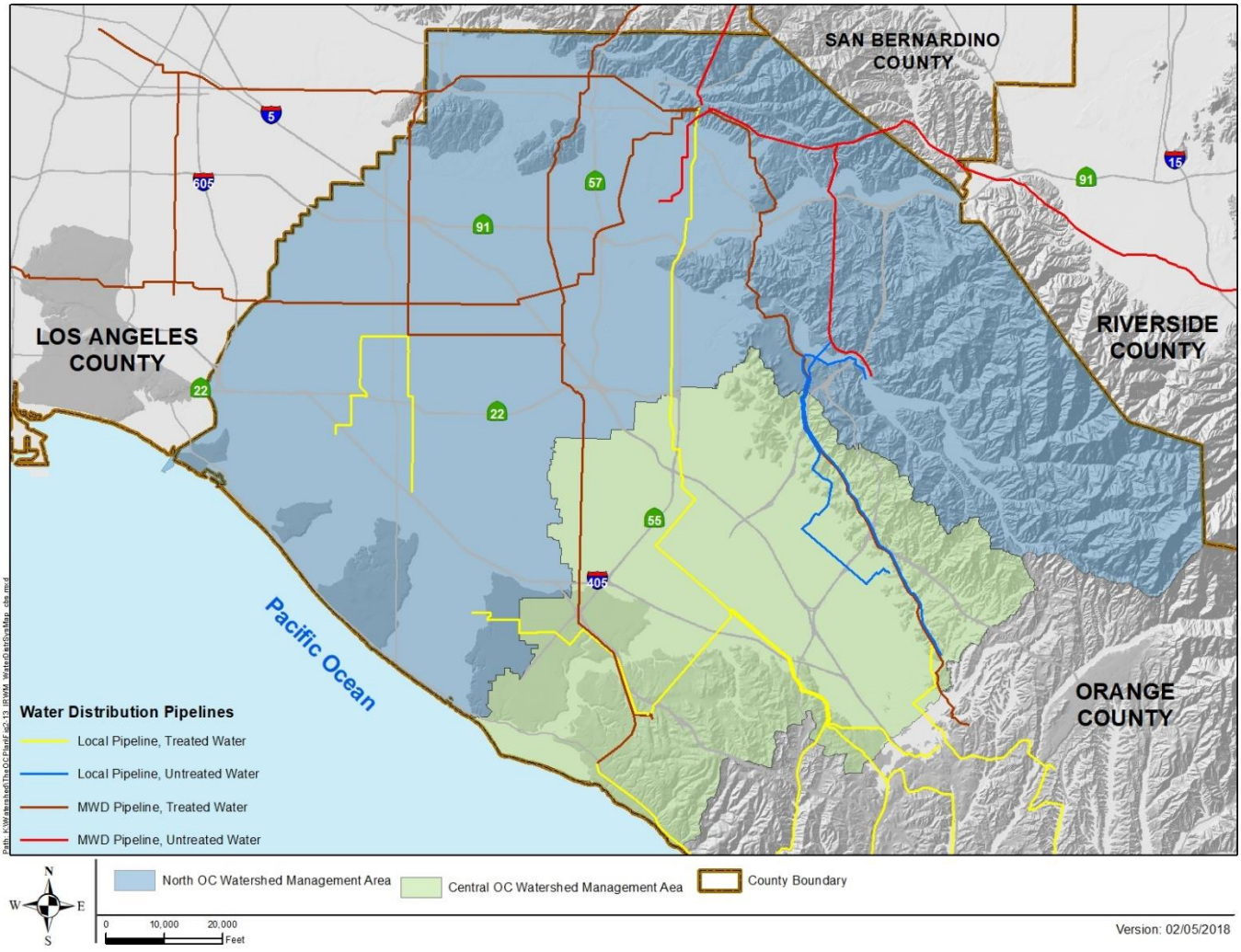


Figure 2-13: Major Water Systems Infrastructure

To address these challenges, Metropolitan and its member agencies developed an IRP in 1996. The outcome was a "Preferred Resource Mix" which would ensure Metropolitan and its member agencies would meet their full-service retail demands without interruption through the year 2020.

Metropolitan's IRP has helped maintain a reliable water supply for all of Southern California by anticipating needs and providing additional water resources to address changing conditions. Imported sources will remain important baseline supplies but conservation and new local supplies, such as water recycling and ocean desalination, will provide water for growing needs. Through regional planning, education and diversification, Metropolitan and its member agencies plan to continue to provide reliable service of imported water.

Metropolitan's IRP report is updated approximately every five years. The IRP was updated in 2010 and 2015. The 2015 IRP updated the total level of average-year supply targeted, considering conservation. This IRP highlighted goals to achieve additional conservation savings, develop additional local water supplies (target total 2.4 MAF by 2040), maintain Colorado River Aqueduct supplies (ensure a minimum of 900,000 AF is available when needed), stabilize SWP supplies and maximize the effectiveness of storage and transfer. The 2010 and 2015 IRP were both approved and are available. [24]

Imported water is augmented through IRWD's Strand Ranch Integrated Water Banking Project by capturing low-cost water for underground storage during wet periods and recovering this water for later use and importation into the IRWD service area during dry periods or emergencies. IRWD entered into a 30-year water banking partnership with Rosedale-Rio Bravo Storage District in Kern County. IRWD can store up to 50,000 AF in the water bank and may recover up to approximately 17,500 AF in any single year.

IRWD is also pursuing various additional sources of water supply for the water bank such as diverting a portion of floodwater flows in the Kern River into IRWD recharge ponds, and other agreements to provide for storage of water with other water districts in Central California.

2.2.3 Recycled Water

The IRWM Region uses recycled water to meet non-potable uses and for groundwater recharge. Recycled water in the Region is produced by OCSD and OCWD from treated wastewater produced by OCSD. IRWD also produces and distributes recycled water for non-potable uses. **Figure 2-14** shows the Region's wastewater boundaries and transmission lines.

Groundwater Replenishment System (GWRS). The GWRS is a joint project of OCSD and OCWD. After wastewater is treated at the OCSD, it flows to the GWRS where it undergoes a purification process consisting of microfiltration, reverse osmosis, and ultraviolet light with hydrogen peroxide. The product water is near-distilled-quality. Approximately 35 million gallons per day (MGD) of GWRS water are pumped into injection wells as the primary source of water for the Talbert Seawater Barrier. Another 65 MGD are pumped to OCWD's percolation basins – Kraemer, La Palma, Miller, and Miraloma – located in Anaheim where the GWRS water naturally filters through sand and gravel to the deep aquifers of the groundwater basin to increase the local drinking water supply. About 30 percent of the water that refills the basin comes from the GWRS.

[24] Metropolitan Water District of Southern California Integrated Water Resources Plan 2015 Update, http://www.mwdh2o.com/Reports/2.4.1_Integrated_Resources_Plan.pdf, Update 8/23/2016.

Operational since January 2008, the GWRS is a state-of-the-art water purification project that produces up to 100 MGD of highly treated, high-quality recycled water every day. This is enough water to meet the needs of nearly 850,000 residents within OCWD's district boundaries. OCWD and OCSD have worked together for more than 40 years, leading the way in water recycling and providing a locally controlled, drought-proof and reliable supply of high-quality water in an environmentally sensitive and economical manner.

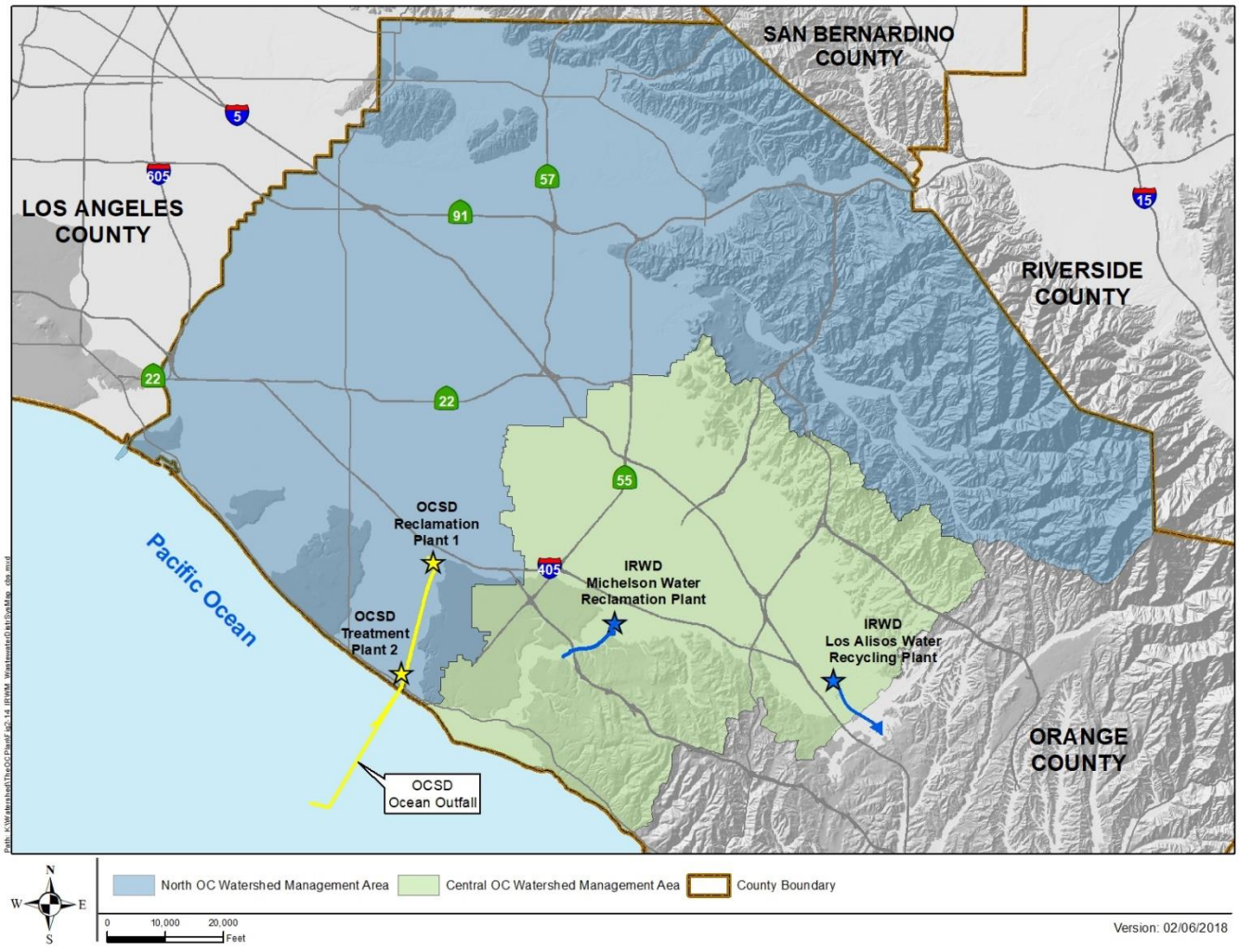


Figure 2-14: Wastewater Boundaries and Transmission Lines

The GWRS was built to allow for two expansions. The first, completed in 2015, expanded the project from 70 MGD to 100 MGD. Construction of the GWRS Final Expansion is scheduled to be completed by 2023. The GWRS Final Expansion Project includes increased production facilities at the GWRS plant in Fountain Valley, conveyance facilities to bring secondary effluent from OCSD's Treatment Plant No.2 in the City of Huntington Beach to the GWRS plan, storage tanks, and additional wastewater treatment facilities. The expansion will bring total GWRS production to 130 MGD enough water for 1 million people.

GWRS Project Benefits:

- Decreases Southern California's dependency on imported water from the Sacramento-San Joaquin River Delta and the Colorado River
- Creates a locally controlled, reliable supply of high-quality water that is drought-resilient
- Provides Orange County communities added assurance of sufficient water supplies to support economic vitality
- Produces high-quality water to replenish the groundwater basin
- Protects Orange County's groundwater basin from seawater intrusion
- Serves as a blueprint for water agencies throughout the world to help solve their local water supply issues
- Protects the environment by reusing a precious resource
- Reduces the amount of wastewater discharged to the Pacific Ocean
- Uses less than half the energy required to transport water from Northern to Southern California
- Uses one-third the energy required to desalinate seawater
- Demonstrates a successful partnership between public agencies
- Created thousands of jobs from development, construction and operation of the GWRS
- Postpones, possibly indefinitely, the need for OCSD to construct a second ocean outfall
- Designed to be expanded to increase production capacity to help meet future water needs
- Improves groundwater quality by reducing the amount of dissolved solids (salt) in the groundwater basin
- Produces water that meets or exceeds state and federal drinking water standards

Green Acres Project. OCWD also operates the Green Acres Project, a non-potable recycled water supply project that utilizes a dedicated set of pipelines to deliver irrigation and industrial water to users. Most of the recycled water is used on golf courses, greenbelts, cemeteries, and nurseries. The Green Acres Project, in operation since 1991, reduces demands on the Orange County Groundwater Basin by providing non-potable water for non-potable uses.

Secondary wastewater effluent from OCSD is filtered and disinfected with chlorine to produce approximately seven MGD of irrigation and industrial water. A portion of Green Acres Project water is also supplied by Irvine Ranch Water District. The average amount of water supplied through the Green Acres Project system is 7,300 AFY. Areas supplied by the recycled water include the cities of Costa Mesa, Fountain Valley, Huntington Beach, Newport Beach, and Santa Ana.

IRWD Recycled Water Program. IRWD has an extensive dual distribution system, which delivers recycled water from its two recycling treatment plants, the Michelson Water Recycling Plant (MWRP) and the Los Alisos Water Recycling Plant (LAWRP). Treated effluent produced at both plants meet the water quality standards set forth in the California Administrative Code, Title 22, Division 4 for use as recycled water.

The MWRP produces high-quality recycled water that earned IRWD the first unrestricted use permit issued in the state, allowing recycled water to be used for virtually everything but drinking. The permitted tertiary treatment capacity of the MWRP is currently 28.0 MGD. A biosolids digester facility is being constructed at MWRP that will allow IRWD to digest and dehydrate sludge which will then be converted to pelletized fertilizer.

The LAWRP, located in Lake Forest, has a tertiary treatment capacity of 5.5 MGD. Secondary effluent from the treatment plant is pumped to either the tertiary treatment facility where it is treated for reuse in IRWD's Lake Forest area recycled water distribution system or, if demands are low, to the South Orange County Wastewater Authority (SOCWA) pumping station which directs its flows to the SOCWA effluent transmission mains and subsequent ocean outfall.

IRWD has invested in 15 seasonal storage reservoirs with capacity of 4,536 AF to store excess recycled water during the winter months when irrigation demands are lower for use in the peak summer months. IRWD may also sell excess recycled water from MWRP to the OCWD Green Acres Project from October through March and provide excess recycled water from LAWRP to neighboring Santa Margarita Water District on an as-needed and as-available basis. IRWD also supplements its recycled water system with non-potable groundwater.

IRWD supplies recycled water through over 500 miles of distribution pipeline, to support over 5,400 recycled water customers that currently use approximately 30,000 AFY of recycled water.

2.2.4 Projected Water Supplies

The OC Plan Region relies on two distinct water supply sources: 1) Local water supply; and 2) imported water supply, which supplements and improves the Region's water resources and system reliability. The imported water supply is obtained through Metropolitan member agencies in the Region. The local water supply is critical in developing and maintaining a high-quality supply to preserve overall water supply reliability, as well as maintaining and protecting the area's ecological functions dependent on the availability of high quality surface water and groundwater. **Table 2-3** shows the target levels of new supply to be developed within the Region between 2015 and 2040 in AFY.

Table 2-3
North and Central OC Targeted New Water Supplies

Local Supply	FY 2015 Actual (AFY)	Projection 2040 (AFY)	Increase 2015-2040 (AFY)
Water Use Efficiency with New Conservation Efforts (1)	480,860	479,516 w/o additional conservation 453,465 with additional conservation	26,051
Recycling (2)	100,000	134,000	34,000
Non-Potable Recycled Water (3)	22,000	27,700	5,700
Total	**602,860**	**640,516/614,465**	**65,751**

1. WUE is actually a demand reduction; however, is presented as a supply in this comparison. Estimate by MWDOC based on SBx 7-7 compliance by 2020 and projection to 2030. Source: *OC Reliability Study Tables 4 and 7.*
2. Recycled wastewater less lower local runoff and groundwater (increase due to expansion of the GWRS).
3. Includes 70% of the total Irvine Ranch Water District recycled water use forecast, the estimated percentage use within the Central OC WMA.

Direct-use water supply sources are imported water, groundwater, and recycled water. Existing and projected non-imported (local) potable supply source quantities for each water supplier in North and Central OC water agency are listed in **Table 2-4**. Recycled (non-potable) water supply projections are shown in **Table 2-5**.

Table 2-4
North and Central OC Local (Non-Imported) Potable Water Supply by Water Agency

Water Agency	Local Potable Water Supply Projections (AFY) [1]						
	2015-16	2016-17	2019-20	2024-25	2029-30	2034-35	2039-40
Anaheim	46,937	44,554	43,435	46,626	46,946	46,933	47,000
Brea	50	115	115	115	115	115	115
Buena Park	9,809	9,242	9,889	11,087	11,162	11,160	11,175
East Orange County WD	0	776	776	854	893	932	971
Fountain Valley	6,802	6,090	6,274	6,759	6,750	6,750	6,750
Fullerton	18,946	18,818[2]	18,689	20,063	20,201	20,195	20,224
Garden Grove	17,408	19,430	19,430	20,200	20,400	20,600	20,800
Golden State – West Orange	13,324	14,061[2]	14,798	14,967	15,138	15,309	15,481
Huntington Beach	20,059	19,568	19,961	21,006	21,111	21,217	21,429
IRWD	49,596	49,217	52,815	65,168	65,168	65,168	65,168
La Habra	3,630	4,200	4,200	4,200	4,200	4,200	4,200
La Palma	1,401	1,465	1,489	1,640	1,651	1,650	1,653
Mesa WD	16,844	19,444	19,444	19,510	19,576	19,642	19,709
Newport Beach	11,203	10,875	11,195	12,209	12,284	12,269	12,276
Orange County WD	0	0	0	0	0	0	0
Orange	20,372	21,077	22,200	23,325	23,325	23,325	23,325
Santa Ana	26,351	29,520	29,520	27,802	27,992	27,985	28,025
Seal Beach	2,734	3,041	3,329	3,350	3,370	3,380	3,400
Serrano WD	1,757	2,100	2,200	2,200	2,200	2,200	2,200
Tustin	8,200	10,530	10,745	11,534	11,613	11,610	11,626
Westminster	8,371	8,665	8,840	9,288	9,752	10,240	10,752
Yorba Linda WD	14,181	12,215	14,660	15,760	15,870	15,880	15,890
Total	**297,975**	**305,003**	**314,004**	**337,663**	**339,717**	**340,760**	**342,169**

Source: MWDOC Agency Projections, October 2017
[1] Does not include a portion of IRWD that lies within RWQCB - Region 9 area.
[2] Data not provided by water agency; estimate based on straight line calculation from year 2015-16 to 2019-20.

Table 2-5
North and Central OC Local Non-Potable (Recycled) Supply Projections

Water Agency	Local Non-Potable Water Supply Projections (AFY) [1]						
	2015-16	2016-17	2020	2025	2030	2035	2040
Anaheim	71	155	155	155	155	155	155
Brea	0	0	0	0	0	0	0
Buena Park	0	0	0	0	0	0	0
East Orange CWD	0	0	0	0	0	0	0
Fountain Valley	1,355	1,500	1,500	1,500	1,500	1,500	1,500
Fullerton	0	0	0	0	0	0	0
Garden Grove	0	0	0	0	0	0	0
Golden State West Orange	0	0	280	353	427	500	500
Huntington Beach	0	0	0	0	0	0	0
IRWD	22,866	18,657	18,657	28,757	28,757	28,757	28,757
La Habra	0	0	0	0	0	0	0
La Palma	0	0	0	0	0	0	0
Mesa WD	1,158	1,100	1,100	1,100	1,100	1,100	1,100
Newport	492	500	523	560	575	590	605
OCWD	103,000	103,000	103,000	134,000	134,000	134,000	134,000
Orange	0	0	0	0	0	0	0
Santa Ana	352	300	320	320	320	320	320
Seal Beach	0	0	0	0	0	0	0
Serrano WD	0	0	0	0	0	0	0
Tustin	0	0	0	0	0	0	0
Total	**129,294**	**125,212**	**125,535**	**166,745**	**166,834**	**166,922**	**166,937**

Source: MWDOC Agency Projections, October 2017

2.2.5 Potential New Water Supplies

Regional Recycled Water Advanced Purification Center.[25] Metropolitan and the Sanitation Districts of Los Angeles County are partners in the new Regional Recycled Water Advanced Purification Center, a demonstration facility that will take treated wastewater from the Sanitation Districts' Joint Water Pollution Control Plant in Carson and applies an advanced purification process to ensure the water is safe to reuse. Planning for this local water sustainability project began in September 2017 to increase production and use of recycled water. The project will produce a safe, high-quality water source that could help replenish groundwater basins in Los Angeles and Orange counties. The project will start with a demonstration facility, located in the city of Carson, and could eventually become one of the largest advanced water treatment plants in the world. The 500,000-gallon-per-day demonstration facility will take about a year to build and then operate for at least a year to produce data for a potential full-scale plant.

The Advanced Purification Center is a 500,000 gallon/day demonstration facility, with a cost of $17 million, and is currently under construction with operations to begin in late 2018.

The center will use both tried and tested water treatment technologies employed across the world for decades and innovative processes – a unique application of membrane bioreactors, reverse osmosis, and ultraviolet/advanced oxidation process – to significantly increase efficiency in water recycling to remove contaminants such as pharmaceuticals, pesticides, viruses, bacteria and potentially harmful chemicals down to the microscopic level, leaving only clean water. Metropolitan will also test the innovative use of membrane bioreactors to significantly increase efficiency in water recycling. The demonstration plant will generate the information needed to refine the treatment process to the highest water quality standards and assist in securing regulatory approval for construction of a full-scale recycled water plant.

Under a full-scale program, the purified water would be pumped from Carson through a new pipeline network to four groundwater basins in Los Angeles and Orange counties, allowing for additional percolation into the ground and aquifer storage. Those basins, including the Orange County Groundwater Basin, provide water for 7.2 million people and are currently recharged with imported water, rain water, and, in some cases, recycled water. The full-scale program, as envisioned, would produce up to 150 million gallons of purified water per day, enough water to serve more than 335,000 homes. The facility's estimated cost to build and operate would result in a water cost comparable to other new local supplies. Once approved, it is estimated to take 11 years to design and build.

[25] http://mwdh2o.com/DocSvcsPubs/rrwp/index.html

Ocean Desalinated Water. In 2000, Metropolitan developed a Seawater Desalination Program (SDP) to provide incentives for developing new seawater desalination projects in Metropolitan's service area. In 2014, Metropolitan modified the provisions of its Local Resources Program (LRP) to include incentives for locally produced seawater desalination projects that reduce the need for imported supplies. To qualify for the incentive, proposed projects must replace an existing demand or prevent new demand on Metropolitan's imported water supplies. In return, Metropolitan offers three financial incentive formulas under the program.

Developing local supplies, including ocean desalination, is part of Metropolitan's Integrated Water Resource Plan (IRP) goal of improving water supply reliability in Metropolitan's service area, including the OC Region, and reducing pressure on imported supplies from the SWP and Colorado River.

On May 6, 2015, the SWRCB approved an amendment to the state's Water Quality Control Plan for the Ocean Waters of California (California Ocean Plan) to address effects associated with the construction and operation of seawater desalination facilities (Desalination Amendment). The amendment supports the use of ocean water as a reliable supplement to traditional water supplies while protecting marine life and water quality. The California Ocean Plan now formally acknowledges seawater desalination as a beneficial use of the Pacific Ocean and the Desalination Amendment provides a uniform, consistent process for permitting seawater desalination facilities statewide.

One such proposed seawater desalination project in the Region is the *Huntington Beach Seawater Desalination Project,* being developed by Poseidon Resources LLC (Poseidon), a private company, that would be co-located at the AES Power Plant in the City of Huntington Beach along Pacific Coast Highway and Newland Street. The proposed project would produce up to 50 MGD (56,000 AFY) of drinking water to provide approximately 10 percent of Orange County's water supply needs.[26] Poseidon is working with state agencies regarding permits for the proposed project. On August 28, 2017, the Santa Ana Regional Board confirmed a complete application for a Water Code section 13142.5(b) determination (feasibility of site, design, technology, and mitigation measures considered independently and then collectively) and Report of Waste Discharge (ROWD) for renewal/reissuance of the NPDES Permit for the proposed desalination project. The State Lands Commission certified the desalination project's Supplemental Environmental Impact Report in October 2017. The Regional Water Board will next focus on the adequacy of analysis and studies submitted as part of the determination application and ROWD through the State Water Board's neutral third-party peer review process.[27]

[26] 2015 Urban Water Management Plan, Section 7.4.2, MWDOC, June 2016
[27] http://www.waterboards.ca.gov/water issues/programs/peer review/

2.2.6 Projected Water Demands

Water demand projections for the Region are an outcome of a combination of sources of information including the Orange County Reliability Study, 2015 Urban Water Management Plans (UWMP), the OCWD Groundwater Basin Management Plan 2015 Update, the Basin 8-1 Alternative, and the 2017 MWDOC annual survey of its member agencies.

The OC Reliability Study (December 2016), led by MWDOC,[28] was prepared to comprehensively evaluate current and future water supply and system reliability for Orange County. Water demand and supplies were evaluated for current and future conditions with a planning horizon from 2015 to 2040 using a simulation model developed for the study. The OC Reliability Study showed demand projections divided into three regions within Orange County: Brea/La Habra, Orange County Groundwater Basin, and South County. The Brea/La Habra and OC Groundwater Basin regions are representative of the North and Central OC IRWM region.

The OC Reliability Study demand projections were obtained based on multiplying a unit water use factor and a demographic factor for three water use sectors, including single-family and multi-family residential (in gallons per day per household), and non-residential (in gallons per day per employee). The unit water use factors were based on a survey of Orange County water agencies (FY 2013-14) and represent a normal weather, normal economy, and non-drought condition. Additionally, MWDOC worked with OCWD to determine groundwater replenishment and seawater barrier demands. MWDOC also worked with Center for Demographic Research at California State University, Fullerton to obtain projections on employment and economic growth in the MWDOC service area, which was considered when developing the demand projections.

Also included were the effects of water conservation on demand projections. Three demand trajectories were developed representing three levels of conservation: 1) continued with existing levels of conservation as of 2013-14 (lowest conservation), 2) addition of future passive measures and active measures (baseline conservation), and 3) aggressive turf removal program - 20 percent removal by 2040 (aggressive conservation). The second level of conservation, i.e. baseline demand projection, was selected for the MWDOC 2015 UWMP. The baseline scenario assumes the implementation of future passive measures affecting new developments, including the Model Water Efficient Landscape, plumbing code efficiencies for toilets, and expected plumbing code for high-efficiency clothes washers. It also assumes the implementation of future active measures, assuming the implementation of Metropolitan incentive programs at historical annual levels seen in Orange County. Examples

[28] http://www.mwdoc.com/Uploads/OC%20Study%20Executive%20Report_with%20Appendices_1-4-2017%20FINAL%20Low%20Resolution.pdf

of active measures include rebates for new washers and toilets for existing washers and toilets whose water efficiency exceeds passive plumbing code requirements, and rebates for drip irrigation systems, irrigation timers, and turf removal.

The OC Reliability Study also considered the drought impacts on demands by applying the assumption that water demands will bounce back to 85 percent of 2014 levels i.e. pre-drought levels by 2020 and 90 percent by 2025 and continue at 90 percent of unit water use through 2040. The unit water use factor multiplied by a demographic factor yields demand projections without new conservation beyond 2013-14. To account for new conservation, projected savings from new passive and active conservation were subtracted from these demands.

Making the necessary investments to provide an adequate water supply to meet demand remains a critical requirement for The OC Plan region. Population, economic conditions, and hydrologic conditions influence water demand in the Region.

Successful water use efficiency and conservation efforts have and are expected to continue to abate the growth rate of water demand. Groundwater will continue to be the principal source of supply in the Region, with continuing efforts to develop maximize alternative local sources to minimize dependency on imported water. Considering water demand projections modeled in the studies and plans discussed above, **Table 2-6** shows water demand forecasts for North and Central OC for the 20-year planning horizon. The forecasts include new passive and active water conservation and assume normal economy and average weather conditions. Projected water demands will increase from approximately 393,539 AFY in 2015 (under demand suppressed conditions) to 453,465 AFY in 2040 with anticipated conservation. Based on the statistical model developed in the OC Study, a significant downturn in local economy could reduce average demands by about 13 percent, while hot/dry weather could increase average demands by as much as 6 to 9 percent.[29]

[29] Detail on demand forecasts are included in Appendix B and Appendix G of the Orange County Reliability Study, MWDOC, December 2016

Table 2-6 North and Central OC WMA Water Demand Projections by Basin Region						
Basin Region	**Water Demand Forecast with Conservation Measures (AFY)**					
	2015	**2020**	**2025**	**2030**	**2035**	**2040**
OC Basin	372,586	400,941	430,396	433,350	433,233	433,854
La Habra/Brea Basin	20,953	18,429	19,598	19,626	19,663	19,611
Total North and Central OC Region	**393,539**	**419,370**	**450,354**	**452,976**	**452,866**	**453,465**

Source: OC Reliability Study, MWDOC, December 2016, Tables 1 and 2, and Appendix B, Table 4 for La Habra/Brea 2015 demand

Since the Region imports a significant amount of its water from outside of the Region, there is concern about either planned or emergency outages of the import system that could be caused by natural or man-made events resulting in a disruption of water supply. Supply concerns could be caused specifically by:

- Planned shutdowns for imported delivery and treatment system maintenance and upgrades;
- Emergency shutdowns or outages of facilities such as Metropolitan's Diemer Water Filtration Plant or major supply pipelines;
- Prolonged droughts on the State Water Project and/or Colorado River Aqueduct imported water systems; or
- Delays in the development of other planned local water projects.

A goal of The OC Plan is for all North and Central OC agencies to work together to make the necessary investments to mitigate or minimize impacts from these types of events. Implementation of water use efficiency (WUE) programs and development of local supply sources, regional interconnections and other infrastructure will help to protect the Region's system. Water transfers from outside of the WMAs will also be beneficial to add a layer of insurance with respect to future droughts on the SWP or CRA systems.

Metropolitan and MWDOC have both developed complementary strategies to help insure the continued delivery of high-quality imported water supplies. Water remains a valuable resource and it is imperative that Southern California continues to develop and implement alternative strategies to meet the demands of a growing population. The OC Plan is consistent with the strategies of these regional water agencies and, like them, emphasizes a diversification of supplies.

- WUE practices focus on the five BMPs for urban WUE in California and include Utility Operations (Conservation Coordinator, Water Loss Control, Metering With Commodity Rates, and Retail Conservation Pricing), Education Programs (Public Information and School Education), Residential (home water surveys, low-flow showerhead and toilet retrofits), Commercial, Industrial and Institutional (Technical Assistance and Incentives, Landscape Irrigation Budgets and Incentives). These BMPs offer cost-effective opportunities to moderate the amount of imported and local water supplies required by municipal and industrial users. These programs are offered both regionally by MWDOC and Metropolitan and locally by individual retail water agencies.
- Water recycling already occurs at a significant level in the Region, but efforts can be extended to satisfy additional needs, particularly non-domestic demands for irrigation uses. Local recycling systems require upgrades and expansions to continue to maximize and increase supplies.
- Groundwater replenishment is a significant program in the Region.
- Stormwater and dry-weather runoff capture for irrigation is also being incorporated into the overall water supply portfolio that includes ecosystem, surface and ocean water quality benefits.
- Surface water capture and treatment for potable and non-potable supply and improved riparian habitats is also considered a critical aspect of local water supply to meet demands.

2.3 Water-Related Objectives and Conflicts

Water Supply Diversification – Reducing Dependence on Delta Supply. Complementary strategies have been developed by Metropolitan and MWDOC – the regional water wholesalers – to provide incentives for the development of local resources and ensure the continued delivery of high-quality supplemental imported water. Water remains a valuable resource, and it is imperative that Southern California continues to develop and implement alternative strategies to meet the demands of a growing population. The IRWM Plan is consistent with the strategies of these regional water agencies, emphasizing a diversification of supplies. Diversification of supplies serves two significant goals: improvement in water supply reliability and reduction in the Region's reliance on the water from the Bay-Delta.

- Water use efficiency practices focus on the California Water Efficiency Partnership's (CalWEP), formerly California Urban Water Conservation Council, five BMPs and supporting sub-BMPs[30] for promoting the conservation and efficiency of urban water use

[30] http://calwep.org/Resources; The CalWEP Bylaws amendments adopted by members in December 2016 changed the Council's principal purpose from MOU implementation (and by extension BMP adoption) to other activities that promote conservation and efficiency. The Partnership is no longer developing new BMPs or amending existing ones.

in California. The five major BMPs include BMP 1: Utility Operations, BMP 2: Public Education and School Education, BMP 3: Residential Programs, BMP 4: Commercial, Institutional, and Industrial Programs, and BMP 5: Landscape Programs. These BMPs may be cost-effective opportunities to moderate the amount of imported and local water supplies required by municipal and industrial users. Some of the programs under these BMPs are offered both regionally by MWDOC and locally by individual water agencies.

- Water recycling already occurs at a significant level in the Region, but efforts can be extended to satisfy additional needs, particularly nondomestic demands for irrigation uses. Local water recycling systems require upgrades and expansions to continue to maximize and increase supplies.
- Surface water for non-potable supply, groundwater basin recharge, and improved riparian habitats is a critical for local water supply, and efforts to improve surface water quality are progressing by means of the implementation of the TMDLs and the use of BMPs.
- Groundwater is the primary local water source for satisfying the demand for potable water. Maximizing the benefit of this water resource requires treatment for nitrates, TDS, toxic plumes, and colored water.
- In the historical Swamp of the Frogs area, significant amount of shallow groundwater seeps into local storm drains and channels through cracks, weep holes, and unlined sections of channels. At multiple locations, shallow groundwater must be pumped continuously to maintain structural integrity of foundations of several road under-crossings. These groundwater-related discharges have elevated selenium and nitrate but are otherwise of good quality. They can potentially be collected and used to supplement the local water supply. Maximizing the benefit of this water resource requires recurrent water quality monitoring and remediation of poor quality water and contamination when necessary.

Water Resource Management Challenges. As is the case with much of Southern California, the OC Region faces many water resources management challenges. Among these are the following:

- **Adequate, reliable water supply:** Although the Region has significant groundwater resources it still receives approximately one-third of its water from imported sources. Environmental constraints such as drought and impacts from the Delta are affecting the reliability of the imported water supply. Changes in the climate have increased the length of the fire season resulting in an increase in demand for potable water and the need to maintain sufficient infrastructure to fight fires.

The existing BMPs are the Council's legacy to utilities that are just starting water conservation and efficiency programs, or that need to ramp programs up quickly.

- **Growth, economic sustainability, recreation:** The Region is continually growing which means that there is a greater demand for potable water, a greater amount of wastewater generated, and more need for recreational resources. Economic stability relies on implementing cost effective solutions to these growth-related issues. Land-use decisions play a key role in developing a sustainable region.
- **Water quality standards:** Water quality standards for urban runoff that stem from the Clean Water Act are becoming increasingly stringent. Local agencies in the Region are challenged to meet the regulatory water quality standards in a cost-effective manner to maintain lasting results.
- **Ecosystem impacts:** Urbanization is often accompanied by stormwater and urban runoff, wastewater spills, invasive species and erosion, all can negatively impact ecosystems in the Region. Functioning ecosystems offer a wide range of benefits for water supply, water quality and habitat and therefore should be rehabilitated and preserved for the future.
- **Habitat:** Habitat areas in the Region include the following: Bolsa Chica wetlands, Seal Beach National Wildlife Refuge, Coyote Creek, Brea Creek, Fullerton Creek, Huntington Beach State Park, and Newport Bay, these areas include wetlands, associated beach, coastal, and shoreline habitat. Additional habitat areas include Peters Canyon Regional Park, Santiago Creek parks, and the Santa Ana River mainstem.
- **Aging infrastructure:** Outdated and deteriorating wastewater and water conveyance systems can cause leaks, sewage spills and have inadequate capacity to handle increased flows resulting in impacts to surface, groundwater and ocean water quality. Multipurpose projects that include the rehabilitation of water and wastewater infrastructure are important for improving water quality standards.
- **Climate change:** Climate change will influence how the Region manages water resources and water supply availability for humans, wildlife, and habitat needs. Climate change has also affected the length of the fire season, extending it longer into the year. Addressing these issues now will help the Region prepare for current and future impacts.

2.4 Water Quality of the Region

Water Quality Regulations. Adopted water quality regulations, based on Federal and State Laws, exist for potable water supply (drinking water), surface and groundwater receiving waters, and recycled water used for a variety of purposes. Ensuring that these waters meet regulatory standards allows for a healthy environment and protects public health.

Drinking Water Regulations. The Federal Safe Drinking Water Act (SDWA) provides the basis for national and state regulations governing the supply of safe drinking water. The SDWA formed the basis for the California Safe Drinking Water Act. This act gives authority to the SWRCB Division of Drinking Water to protect the public from any contaminant that could adversely affect public health in the public water system. The SWRCB Division of Drinking Water maintains a list of water contaminants and establishes maximum contaminant levels (MCL). This list includes all federal MCLs and each MCL must be equal to or more stringent than the US Environmental Protection Agency (EPA) MCLs. Title 22 of the California Code of Regulations defines drinking water MCLs and treatment requirements for potable water, groundwater recharge, and recycled water.

Surface Water Quality Regulations. The regulatory basis for protection of all inland surface waters, estuaries, and coastal waters in the United States is governed by the Clean Water Act (CWA), which is comprised of the Federal Water Pollution Control Act (1948) and its amendments of 1972, 1977, 1981, and 1987. In California, the primary statute governing water quality is the Porter-Cologne Water Quality Control Act (Porter-Cologne Act) (Water Quality, Division 7 of the California Water Code, as amended to Statutes 2016), which grants broad powers to protect water quality to the California State Water Resources Control Board SWRCB) and nine California Regional Water Quality Control Boards (Regional Boards). Through this, the SWRCB and Regional Boards have the authority to adopt plans and policies to regulate discharges to surface and groundwater (which is not covered under the CWA), to regulate waste disposal sites, and to require cleanup of discharges of hazardous materials and other pollutants. The governing Regional Board for the North and Central OC IRWM Region is the Santa Ana Regional Water Quality Control Board, as shown in **Figure 2-15.**

The Porter-Cologne Act requires:

1) The State Board adopt and implement an Ocean Plan and an Enclosed Bays and Estuaries Policy to protect human health and marine species in ocean and coastal waters, such as Huntington Harbour; and
2) Regional Boards adopt and regularly update a Water Quality Control Plan (Basin Plan) to protect inland freshwaters and estuaries, such as Coyote Creek and the Santa Ana River.

The primary methods of enforcing these regulations are through the issuance of NPDES Permits and Waste Discharge Requirements.

NPDES Permits and Waste Discharge Requirements. In California, the Regional Boards have the responsibility of controlling discharges from point sources through the issuance of NPDES permits. These permits regulate discharges of both wastewater and urban runoff to surface water bodies for municipal and industrial wastewater and stormwater runoff from MS4 systems, industrial and construction sites. Permit requirements are based on technology-based limits for wastewater and maximum extent practicable standard for stormwater intended to meet water quality standards. The fourth term permit was issued by the Santa Ana Regional Board on May 22, 2009 for the County of Orange, OCFCD and 25 incorporated cities, which includes all the cities (referred to as the permittees) in the Region.

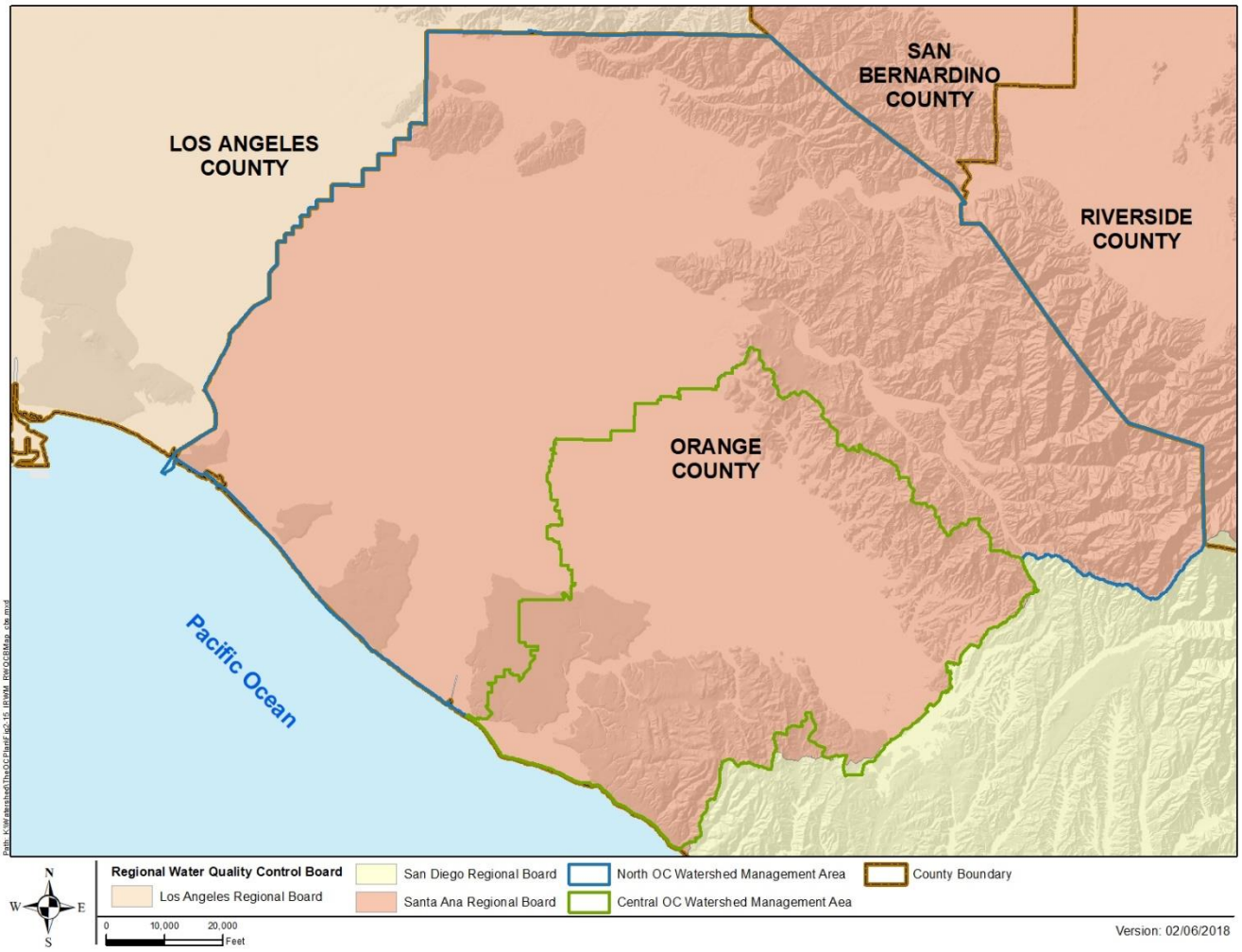


Figure 2-15: Regional Water Quality Control Boards

Local Surface Water Quality. Beneficial uses of surface water are identified for water bodies in the United States, as required by the federal Clean Water Act of 1972 and serve as the basis for determining how clean is clean enough. **Table 2-7** shows the beneficial uses associated with each water body in the Region whose uses are defined in **Table 2-8**.

Table 2-7
Beneficial Uses of Water Bodies in North and Central OC IRWM Region

	MUN	AGR	IND	PROC	GWR	NAV	POW	REC-1	REC-2	COMM	WARM	LWRM	COLD	BIOL	WILD	RARE	SPWN	MAR	SHEL	EST	Hydro-logic Unit
Lakes																					
Lower Santa Ana River Basin																					
La Habra	X	X																			845.62
Santiago	X	X	X																		801.12
Orange	X	X	X	X																	801.11
Irvine	X	X	X	X																	801.11
Bays, Estuaries, and Tidal Prisms																					
Los Cerritos Wetlands	+							X	X					X	X	X	X	X			801.11
Anaheim Bay - Outer Bay	+					X		X	X					X	X	X	X	X			801.11
Anaheim Bay – Seal Beach National Wildlife Refuge	+							X	X	X				X	X	X	X	X		X	801.11
Sunset Bay – Huntington Harbor	+					X		X	X	X					X	X	X	X			801.11
Bolsa Bay	+							X	X					X	X	X	X	X	X		801.11
Bolsa Chica Ecological Reserve	+							X	X	X				X	X	X	X	X		X	801.11
Lower Newport Bay	+					X		X	X	X					X	X	X	X	X		801.11
Upper Newport Bay	+							X	X	X				X	X	X	X	X	X	X	801.11
Santa Ana River Salt Marsh	+							X	X					X	X	X		X		X	801.11
Huntington Beach Wetlands	+							X	X					X	X	X	X	X			801.11
Tidal Prism of Santa Ana River and Newport Slough	+							X	X	X					X	X		X			801.11
Tidal Prism of San Gabriel River – River Mouth to Marina Drive	+			X				X	X	X					X	X		X	X	X	845.61
Tidal Prism of Santa Ana-Delhi Channel – Bicycle Bridge at University Dr. at Upper Newport Bay	+							u	X						X	X		X			801.11

Table 2-7
Beneficial Uses of Water Bodies in North and Central OC IRWM Region

	MUN	AGR	IND	PROC	GWR	NAV	POW	REC-1	REC-2	COMM	WARM	LWRM	COLD	BIOL	WILD	RARE	SPWN	MAR	SHEL	EST	Hydro-logic Unit
to 1036 ft. upstream																					
Tidal Prisms of Greenville Banning Channel – Santa Ana River Confluence to Inflatable Dam^								u	X						X	X		X			801.11
Tidal Prisms of flood control channels discharging to coastal or bay waters	+							X	X	X					X			X			801.11
Ocean Waters																					
SWQPA (former ASBS)						X		X	X					X				X			
Newport Bay						X		X	X	X									X		
Inland Surface Streams – Lower Santa Ana River Basin																					
Santa Ana River																					
Reach 1 – Tidal Prism to 17th Street in Santa Ana	+							X[2]	X		●				●						801.11
Reach 2 – 17 Street in Santa Ana to Prado Dam	+	X			X			X	X		X				X	X					801.11
Aliso Creek	X				X			X	X		X				X	X					845.63
Carbon Canyon Creek	X				X			X	X		X				X	X					845.63
Santiago Creek																					
Reach 1 – below Irvine Lake	X				X			X[2]	X		X				X						801.12
Reach 2 – Irvine Lake																					801.12
Reach 3 – Irvine Lake to Modjeska Canyon	●				●			●	●		●				●						801.12
Reach 4 – in Modjeska Canyon	X				X			X	X		X				X						801.12
Silverado Creek	X				X			X	X		X				X						801.12

Table 2-7
Beneficial Uses of Water Bodies in North and Central OC IRWM Region

	MUN	AGR	IND	PROC	GWR	NAV	POW	REC-1	REC-2	COMM	WARM	LWRM	COLD	BIOL	WILD	RARE	SPWN	MAR	SHEL	EST	Hydro-logic Unit
Black Star	●				●			●	●		●				●						801.12
Ladd Creek	●				●			●	●		●				●	●					801.12
San Diego Creek																					
Reach 1 – below Jeffrey Road	+							X[2]	X		X				X						801.11
Reach 2 – above Jeffrey Road to headwaters	+				●			●	●		●				●						801.11
Other tributaries: Bonita Creek, Serrano Creek, Peters Canyon Wash, Hicks Canyon Wash, Bee Canyon Wash, Borrego Canyon Wash, Agua Chinon Wash, Laguna Canyon Wash, Rattlesnake Canyon Wash, and other tributaries of these creeks	+				●			●	●		●				●						801.11
Sand Canyon Wash	+				●			●	●		●				●						801.11
Santa Ana-Delhi Channel																					
Reach 1 – upper boundary of Tidal Prism to intersection of Sunflower Ave./ Flower St.	+							U	X		X				X	X					
Reach 2 – Sunflower Ave./ Flower St. intersection to Warner Ave.	+							U	X		X				X						801.10
Wetlands																					
San Joaquin freshwater marsh	+							X	X		X			X	X	X					801.11

Source: Santa Ana Region Basin Plan, Chapter 3, Table 3-1, Beneficial Uses, Updated February 2016

X = Existing or potential beneficial use
• = Intermittent beneficial use
SWQPA = state water quality protection area
WMA = Watershed Management Area

+ = Excepted from the municipal and domestic supply
^ = Diversion Dam is 0.23 mile downstream of confluence with the Fairview Channel
ASBS = area of special biological significance
[1] Access prohibited per agency with jurisdiction
[2] Access prohibited in all or part by County of Orange
U = REC 1 and/or REC 2 are not attainable uses

Table 2-8
Definition of Beneficial Uses of Water

MUN	Municipal and domestic supply (MUN) waters are used for community, military, municipal, or individual water supply systems. These uses may include, but are not limited to, drinking waters supply.
AGR	Agricultural supply (AGR) waters are used for farming, horticulture, or ranching. These uses may include, but are not limited to, irrigation, stock watering, and support of vegetation for range grazing.
IND	Industrial service supply (IND) waters are used for industrial activities that do not depend primarily on water quality. These uses may include, but are not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.
PROC	Industrial process supply (PROC) waters are used for industrial activities that depend primarily on water quality. These uses may include, but are not limited to, process water supply and all uses of water related to product manufacture or food preparation.
GWR	Groundwater recharge (GWR) waters are used for natural or artificial recharge of groundwater for purposes that may include, but are not limited to, future extraction, maintaining water quality, or halting saltwater intrusion into freshwater aquifers.
NAV	Navigation (NAV) waters are used for shipping, travel, or other transportation by private, commercial, or military vessels.
POW	Hydropower generation (POW) waters are used for hydroelectric power generation.
REC-1	Water contact recreation (REC-1) waters are used for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses may include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, whitewater activities, fishing, and use of natural hot springs.
REC-2	Noncontact water recreation (REC-2) waters are used for recreational activities involving proximity to water but not normally involving body contact with water where ingestion of water would be reasonably possible. Uses may include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, and aesthetic enjoyment in conjunction with the above activities.
COMM	Commercial and sportfishing (COMM) waters are used for commercial or recreational collection of fish or other organisms, including those collected for bait. These uses may include, but are not limited to, uses involving organisms intended for human consumption.
WARM	Warm freshwater habitat (WARM) waters support warm-water ecosystems that may include, but are not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.

Table 2-8 Definition of Beneficial Uses of Water	
LWRM	Limited warm freshwater habitat (LWRM) waters support warm-water ecosystems that are severely limited in diversity and abundance as the result of concrete-lined watercourses and low, shallow dry-weather flows that result in extreme temperature, pH, and/or dissolved oxygen conditions. Naturally reproducing finfish populations are not expected to occur in LWRM waters.
COLD	Cold freshwater habitat (COLD) waters support cold-water ecosystems that may include, but are not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.
BIOL	Preservation of biological habitats of special significance (BIOL) waters support designated areas or habitats, including, but not limited to, established refuges, parks, sanctuaries, ecological reserves or preserves, and areas of special biological significance, where the preservation and enhancement of natural resources require special protection.
WILD	Wildlife habitat (WILD) waters support wildlife habitats that may include, but are not limited to, the preservation and enhancement of vegetation and prey species used by waterfowl and other wildlife.
RARE	Rare, threatened, or endangered species (RARE) waters support habitats necessary for the survival and successful maintenance of plant or animal species designated under state or federal law as rare, threatened, or endangered.
SPWN	Spawning, reproduction, and development (SPWN) waters support high-quality aquatic habitats necessary for reproduction and early development of fish and wildlife.
MAR	Marine habitat (MAR) waters support marine ecosystems that include, but are not limited to, preservation and enhancement of marine habitats, vegetation (e.g., kelp), fish and shellfish, and wildlife (e.g., marine mammals and shorebirds).
SHEL	Shellfish harvesting (SHEL) waters support habitats necessary for shellfish (e.g., clams, oysters, limpets, abalone, shrimp, crab, lobster, sea urchins, and mussels) collected for human consumption, commercial, or sports purposes.
EST	Estuarine habitat (EST) waters support estuarine ecosystems, which may include, but are not limited to, preservation and enhancement of estuarine habitats, vegetation, fish and shellfish, and wildlife, such as waterfowl, shorebirds, and marine mammals.

Impaired Water Bodies and Total Maximum Daily Loads (TMDLs[31]). For the beneficial uses established by the Basin Plan, water quality objectives are adopted to protect these established beneficial uses. If a water body's beneficial uses are impaired, then the water body is listed as

[31] A Total Maximum Daily Load (TMDL) is a regulatory term in the U.S. Clean Water Act, describing a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.

"impaired" per Section 303(d) of the Clean Water Act, and Regional Boards are required to prepare TMDLs. Once a TMDL has been adopted and is being implemented, the listing comes off the 303(d) list. The TMDL is then written into and adopted in the local NPDES permit, which then governs the implementation schedule.

The Central OC WMA began addressing water quality impairments during the 1970s due to increased sediment to Newport Bay. The County of Orange began investigations into the erosion within drainage channels in collaboration with the U.S. Geological Survey (USGS). In 1983, a group of local agencies and The Irvine Company formed a partnership to begin to address sediment management needs in the watershed. That collaboration has since expanded into the Newport Bay Watershed Executive Committee, and the regional governance structure now in place to address water quality issues and to oversee IRWM planning in an advisory capacity.

In 1998, the Regional Water Board began a detailed evaluation of water quality in the Newport Bay Watershed and determined that several water bodies were impaired Act. Consequently, TMDLs have been established for four general pollutant categories (sediment, nutrients, fecal coliform bacteria, and toxic pollutants). TMDL implementation sets the amount of pollution that needs to be reduced and assigns responsibility for the reduction.

San Diego Creek, the Peters Canyon Channel, Upper Newport Bay, Lower Newport Bay, and the Rhine Channel are listed on the U.S. EPA Section 303(d) list of impaired water bodies due to fecal coliform bacteria, organochlorine pesticides, polychlorinated biphenyls (PCBs), metals, and sediment toxicity (California Water Board 2012). The U.S. EPA and the Regional Water Board have implemented TMDLs for San Diego Creek and Newport Bay for toxic pollutants (including pesticides and metals), sediment, and nutrients. Additionally, a TMDL for fecal coliform bacteria has been established for Newport Bay. The TMDLs have been established to restore the beneficial uses of and improve water quality in the Newport Bay Watershed.

Development in Newport Coast Watershed's eight coastal canyons that drain directly to the two ASBS have caused hydromodification and increased urban runoff containing fertilizers, metals, bacteria, and sediment. Three reaches – Borrego Creek, San Diego Creek, Serrano Creek – within this watershed are included on the 303(d) list for impaired water quality.

As introduced in Section 2.1.2, the Santa Ana River Watershed, the Lower San Gabriel River/Coyote Creek Watershed, and the Anaheim Bay-Huntington Harbour Watershed carry runoff for approximately one-third of Orange County's area. Since these watersheds also provide the riparian habitat for many flora and fauna and include 35 miles of ocean coastline and many of the remaining significant estuary areas along the Southern California coastline, high water quality is vital. Beach closures, clean oceans and meeting TMDL/NPDES requirements are critical components of planning.

Within the North OC WMA, no TMDLs have been adopted to date. **Table 2-9** shows the 2012 Clean Water Act Section 303(d) List of Water Quality Limited Segments currently requiring TMDLs within The OC Plan region. **Figure 2-16** shows the impaired main water bodies within the Region.

Table 2-9
2012 Clean Water Act Section 303(d) List of Water Quality Limited Segments Requiring TMDLs in the North and Central OC IRWM Region by WMA

Water Body	Water Body Type	Pollutants	Est. TMDL Completion
North OC WMA			
Bolsa Chica Channel	River & Stream 5.1 miles	Ammonia Indicator Bacteria pH	2021 2021 2021
Bolsa Chica State Beach	Coastal & Bay Shoreline 2.64146 miles	Copper Nickel	2019 2019
Coyote Creek	River & Stream 13 miles	Ammonia Copper, dissolved Dizinon Indicator Bacteria Lead Toxicity pH	2021 2007 2019 2009 2007 2008 2019
East Garden Grove Wintersburg Channel	River & Stream 2.9 miles	Ammonia	2021
Anaheim Bay	Bay & Harbor 402 acres	Dieldrin Nickel PCBs Sediment Toxicity	2019 2019 2019 2019
Huntington Beach State Park	Coastal & Bay Shoreline 5.78956 miles	PCBs	2019
Huntington Harbour	Bay & Harbor 221 acres	Chlordane Copper Lead Nickel Pathogens	2019 2019 2019 2019 2019

Table 2-9
2012 Clean Water Act Section 303(d) List of Water Quality Limited Segments Requiring TMDLs in the North and Central OC IRWM Region by WMA

Water Body	Water Body Type	Pollutants	Est. TMDL Completion
		PCB	2019
		Sediment Toxicology	2019
Santa Ana Delhi Channel	River & Stream 6.77845 miles	Indicator Bacteria	2021
Santiago Creek Reach 4	River & Stream 10 miles	Salinity/TDS/Chlorides	2019
Seal Beach	Coastal & Bay Shoreline 0.534905 miles	Enterococcus PBBs	2019 2019
Central OC WMA			
Balboa Beach	Coastal & Bay Shoreline 1.81906 miles	DDT Dieldrin PCBs	2019 2019 2019
Borrego Creek	River & Stream 3.15 miles	Ammonia Indicator Bacteria	2021 2021
Buck Gully Creek	River & Stream 0.30451 miles	Fecal Coliform Total Coliform	2019 2019
Los Trancos Creek	River & Stream 0.189866 miles	Fecal Coliform Total Coliform	2019 2019
Morning Canyon Creek	River & Stream 1.06678 miles	Indicator Bacteria	2021
Newport Bay Upper (Ecological Reserve)	Estuary 654 acres	Chlordane Copper DDT Indicator Bacteria Metals Nutrients PCBs Pesticides Sediment Toxicity Sedimentation/Siltation	2019 2007 2019 2000 2019 1999 2019 2004 2019 1999
Newport Bay Lower (entire lower bay, including Rhine Channel, Turning Basin and South Lido Channel to east end of H-J Moorings)	Bay & Harbor 767 acres	Chlordane Copper DDT Indicator Bacteria Nutrients PCBs Pesticides Sediment Toxicity	2019 2007 2019 2009 1999 2019 2004 2019
Newport Slough	River & Stream 1.3489 miles	Enterococcus Fecal Coliform Total Coliform	2021 2021 2021

Table 2-9
2012 Clean Water Act Section 303(d) List of Water Quality Limited Segments Requiring TMDLs in the North and Central OC IRWM Region by WMA

Water Body	Water Body Type	Pollutants	Est. TMDL Completion
Peters Canyon Channel	River & Stream 3 miles	DDT Indicator Bacteria pH Toxaphene	2019 2021 2021 2019
San Diego Creek Reach 1	River & Stream 7.83 miles	Fecal Coliform Nutrients Pesticides Sedimentation/Siltation Selenium Toxaphene	2019 1999 2004 1999 2007 2019
San Diego Creek Reach 2	River & Stream 6.27476 miles	Indicator Bacteria Nutrients Sedimentation/Siltation Unknown Toxicity	2021 1999 1999 2004
Serrano Creek	River & Stream 7.2 miles	Ammonia Indicator Bacteria pH	2021 2021 2021
Silverado Creek	River & Stream 11 miles	Pathogens Salinity/TDS/Chlorides	2019 2019

Source: California State Water Resources Control Board, Final 2012 California Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report)[32]

Trash Management. Trash management discharged to local water bodies is an important element in the watershed. The county and cities are planning a countywide trash management plan in order to help MS4 Permittees to comply with the State of California's Trash Provisions to the Water Quality Control Plan for Ocean Waters of California and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Trash Provisions).

One primary intent of the requirements is significant reductions in the discharge of trash to local water bodies from cities and counties throughout the state. The Trash Provisions define trash as follows:

> *Trash means all improperly discarded solid material from any production, manufacturing, or processing operation including, but not limited to, products, product packaging, or containers constructed of plastic, steel, aluminum, glass, paper, or other synthetic or natural materials.*

[32] http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2012.shtml

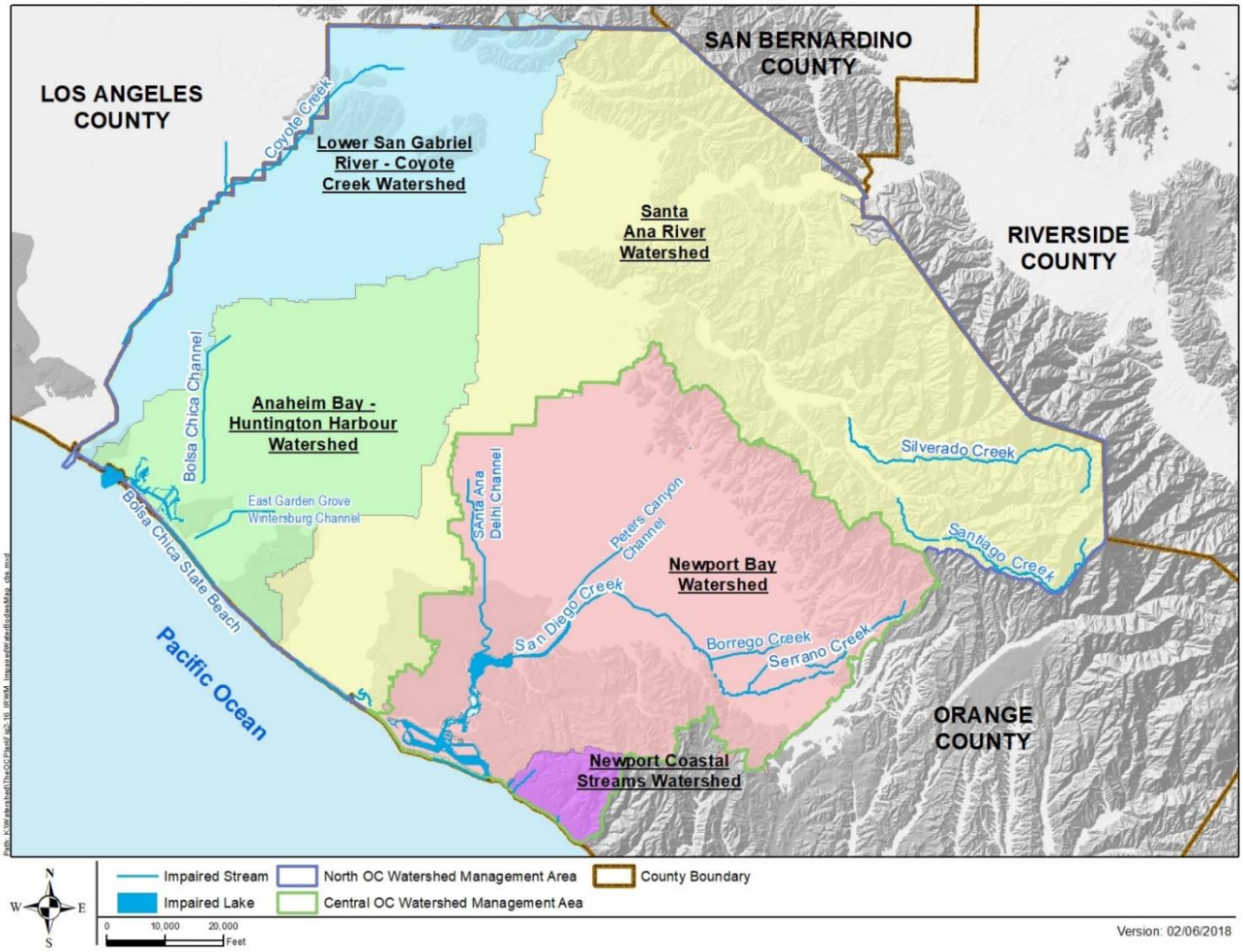


Figure 2-16: Impaired Water Bodies

A central element of the statewide Trash Provisions is a land-use based compliance approach that focuses trash controls in areas with high trash generation rates, which are referred to as "priority land uses." The Trash Provisions define priority land uses as those land uses that have been developed (i.e., not simply zoned) as high-density residential, industrial, commercial, mixed urban, and public transportation stations. The Trash Provisions also allow Permittees to propose alternative equivalent land uses that better represent high-trash generating areas.

Since the Trash Provisions have not yet been implemented through the Orange County MS4 Permit, the Santa Ana Regional Board is implementing the initial steps of the Trash Provisions through the orders issued on June 2, 2017 in accordance with Water Code section 13383, as specified in the Trash Provisions.[33]

[33] http://www.swrcb.ca.gov/santaana/water_issues/programs/stormwater/oc_permit.shtml

Recycled Water Regulations. The supply and use of recycled water is regulated by the Santa Ana Regional Board and the SWRCB Division of Drinking Water. Title 22 defines requirements for the treatment, delivery and use of recycled water for non-potable uses as well as groundwater recharge.

Ocean Water Quality Monitoring Regulations. The land and ocean are inextricably linked, and much of the water pollution in California ends up in the ocean. As discussed, ocean water quality is regulated by the Clean Water Act and Porter-Cologne Act. In response to the Porter-Cologne Act, the SWRCB adopted the California Ocean Plan setting ocean water quality standards. Assembly Bill 411 (AB411), passed in 1997 and implemented in 1999, mandates monitoring requirements for ocean water quality.

AB411 requires testing for indicator bacteria to determine if standards are met for total coliform, fecal coliform/E. coli, and enterococcus. Indicator bacteria were selected to indicate the presence of harder to detect and more harmful micro-organisms that may cause diseases. Testing is required at all beaches from April through October that receive 50,000 or more visitors per year and beaches adjacent to storm drain outfalls with drainage during summer months. AB411 also stipulates closure of beaches to water-contact recreation when measured bacteria is thought to be caused by human sewage. In 2011, California adopted Senate Bill 482, Beach Safety Program, which changed implementation responsibility of the AB411 from the CDPH to the SWRCB.

The Beaches Environmental Assessment and Coastal Health Act (Beach Act) of 2000, amends the CWA, incorporating provisions intended to reduce the risk of illness to users of the Nation's recreational waters. The Beach Act authorizes the U.S. EPA to award program development and implementation grants to eligible states, territories, tribes, and local governments to support microbiological testing and monitoring of coastal recreation waters that are adjacent to beaches and similar points of access used by the public.

Monitoring activities for the Orange County coastal recreation waters are conducted by the County Health Care Agency. The Orange County Ocean Water Protection Program ensures that all public recreational waters meet applicable water quality standards for swimming and shellfish harvesting. The Health Care Agency routinely conducts microbial monitoring of ocean waters, responds to sewage spills and other unauthorized discharges of waste, closes ocean and bay waters, posts warning signs, responds to illness complaints, and issues health advisories.

Delivered Potable Water Quality. Water retailers are required to meet Safe Drinking Water Act requirements. This applies to both direct supplies from imported water as well as water

requiring additional treatment. As such, each retailer ensures that all potable water meets these water quality standards, resulting in water quality that is equal to or better than these standards.

Groundwater Quality. OCWD adopted the first Groundwater Quality Protection Policy in 1987; the latest revision was adopted by its Board of Directors in 2014. The policy guides the actions of OCWD to prevent groundwater quality degradation, undertake investigation and clean up as necessary to protect the basin from contamination, and encourage appropriate treatment of poor-quality groundwater. The policy includes water quality monitoring, removal of contaminants, regulatory agency support, toxic residuals removal and hazardous waste management. In addition, OCWD provides water quality information to regulatory agencies, other water agencies and the public. To meet the current and future water quality testing requirements, OCWD operates the Advanced Water Quality Assurance Laboratory at the Fountain Valley campus.

The laboratory houses approximately 30 chemists and laboratory technicians, 12 water quality monitoring personnel and all the analytical instruments that are needed to perform more than 400,000 analyses of approximately 20,000 water samples taken each water year. The laboratory supports the extensive water quality testing requirements for the GWRS.[34]

OCWD extensively monitors the quality of the Orange County Groundwater Basin, testing for more than 100 regulated and unregulated chemicals at frequencies established by regulation, such as nitrate, salts, selenium, trichloroethylene, volatile organic compounds, and radon. To ensure that results are representative of the ambient groundwater conditions, OCWD follows industry recognized quality assurance and quality control protocols. There are over 2,000 wells in OCWD's monitoring network with more than 1,100 sampling points, which include active drinking, private domestic, irrigation, and industrial wells, single and multi-point wells, and inactive wells. Annually, approximately 17,000 samples are collected from monitoring wells providing data to depths of 2,000 feet in many areas of the Basin.[35]

OCWD publishes an annual Engineer's Report that summarizes the groundwater quality. The 2015-2016 Engineer's Report shows when blended together, groundwater (without treatment) and treated supplemental water for 2015-16 was determined to have a flow-weighted average of 489 milligrams per liter (mg/L) of total dissolved solids (TDS) which is less than the average TDS concentration of 496 mg/L reported for the prior year (2014-15). The average groundwater TDS concentration for the basin for 2015-16 was 449 mg/L (compared to 452 mg/L reported for

[34] 2015-2016 Engineer's Report on Groundwater conditions, Water Supply an Basin Utilization in the Orange County Water District, February 2017
[35] Groundwater Management Plan 2015 Update, Orange County Water District, July 17, 2015

2014-15), ranging from a low of 222 mg/L in Seal Beach to a high of approximately 711 mg/L in certain inland areas.

Average concentrations of TDS, nitrate (NO3) and hardness for groundwater and groundwater combined with supplemental water supplied by agencies within OCWD's service area during the 2015-16 water year are summarized in **Table 2-10**. These concentrations were determined from groundwater and supplemental water analyses and from production reports submitted to and filed with OCWD by each water agency. The City of Tustin and IRWD have active groundwater treatment projects that help to reduce certain constituents reported in **Table 2-10** in their groundwater supply prior to service to their customers (see note 6 for detailed explanation).

Table 2-10 shows: 1) untreated groundwater in OCWD service area; and 2) untreated groundwater blended with treated supplemental water supplied by various agencies within OCWD service area.

Table 2-10
Untreated Groundwater Quality in OCWD Service Area in 2015-2016

City/Agency	Groundwater (mg/L)[1,7]			Delivered Blend (mg/L)[1,2,7]		
	TDS[3]	NO_3-N	Hardness[5]	TDS[3]	NO_3-N	Hardness[5]
Anaheim	584	2.9	323	599	2.2	317
Buena Park	422	1.4	262	470	1.2	269
East Orange County Water District	606	4.3	342	617	3.2	329
Fountain Valley	431	1.4	249	486	1.1	260
Fullerton	482	2.4	252	523	1.9	263
Garden Grove	528	3.6	320	556	2.9	315
Golden State Water Company	419	1.8	236	471	1.4	250
Huntington Beach	337	0.2	172	414	0.3	203
Irvine Ranch Water District[6]	352	0.8	129	356	0.8	131
La Palma	295	ND[8]	148	397	ND[8]	190
Mesa Water District	333	0.4	113	338	0.4	116
Newport Beach	268	1.4	1334	362	1.1	174
Orange	464	2.0	269	513	1.6	276
Santa Ana	401	2.1	239	455	1.7	252
Seal Beach	222	ND[8]	81	356	ND[8]	148
Serrano Water District	711	3.2	374	710	1.9	361

Table 2-10
Untreated Groundwater Quality in OCWD Service Area in 2015-2016

City/Agency	Groundwater (mg/L)[1,7]			Delivered Blend (mg/L)[1,2,7]		
	TDS[3]	NO_3-N	Hardness[5]	TDS[3]	NO_3-N	Hardness[5]
Tustin[6]	698	7.0	384	690	5.8	369
Westminster	362	1.3	233	421	1.1	246
Yorba Linda Water District	686	1.7	344	675	1.3	330
Weighted Average[7]	**449**	**1.9**	**237**	**489**	**1.6**	**249**
Source: OCWD, 2015-2016 Engineer's Report, Table 6						

[1] All groundwater results (alone or blend) are for untreated groundwater.
[2] Delivered blend includes untreated groundwater and treated imported Metropolitan water (i.e., blend of Colorado River water and State Water Project water as measured at the Metropolitan Diemer Plant, except Serrano Water District, which blends with treated Santiago Reservoir water. Annual average water qualities for Metropolitan and Santiago Reservoir (Irvine Lake) for 2015-2016 are:

- Metropolitan Water Quality – TDS = 648 mg/L; No^3-N = 0.2 mg/L; Hardness (as $CaCO_3$) = 295 mg/L
- Santiago Reservoir Water Quality – TDS = 709 mg/L; NO_3-N = ND mg/L; Hardness (as $CaCO_3$) = 343 mg/L.

[3] Secondary Drinking Water Standards for TDS are: 500 mg/L = recommended limit and 1,000 mg/L = upper limit.
[4] Primary Drinking Water Standards for nitrate NO_3-N (i.e., nitrate expressed as nitrogen) is 10 mg/L
[5] Hardness is reported as mg/L of CaCO3; general classifications of hard and soft water are within the following concentration ranges: 0-75 mg/L = soft; 75-150 mg/L = moderately hard; 150-300 mg/L = hard; and 300+ mg/L = very hard.
[6] Agencies with active groundwater quality improvement projects that treat for one or more of the constituents are listed in the table. Water quality marked with an asterisk (*) are reduced prior to delivery to customers.
[7] All water quality results are flow-weighted averages based on groundwater and imported water delivered to each entity.
[8] ND = non-detect; Nitrate (expressed as NO_3-N) analytical detection limited for OCWD Advanced Water Quality Assurance Laboratory is 0.1 mg/L.

There are several regional groundwater contamination plumes within the OCWD Management Area, all of which are under active remediation. The U.S. EPA is the lead agency in remediation of the plume in the North Basin area. Remediation for individual sites within the South Basin area is within the jurisdiction of either the California Department of Toxic Substances Control or the Regional Water Board. The U.S. Navy is taking the lead in remediation of plumes from the former El Toro and Tustin Marine Corps Air Stations and the Naval Weapons Station Seal Beach.

AB1249 Compliance. CWC §10541 (e)(14) (AB 1249) requires that an area within the boundaries of an integrated regional water management plan that has nitrate, arsenic, perchlorate, or hexavalent chromium contamination in the Region, must include a description of the (1) location and extent of that contamination, (2) the impacts caused by the contamination to communities

within the Region, (3) existing efforts being undertaken in the Region to address the impacts, and (4) and additional efforts needed to address the impacts.

OCWD conducted a water quality database search for these four parameters from 2014 to 2016 for all drinking water production wells within the North and Central Orange County Watershed Management Areas. All wells were identified where there was one occurrence of perchlorate concentration greater than the 6 ppb MCL, hexavalent chromium concentration was greater than the former MCL of 10 ppb, arsenic concentration was greater than the 10 ppb MCL, or the nitrate (as N) concentration was greater than the 10 mg/L MCL.

For all wells, there were no samples with a hexavalent chromium concentration greater than 10 ppb. Arsenic concentrations were greater than 10 ppb in at least one sample in a total of three production wells during 2014-2016.

Perchlorate concentrations greater than 6 ppb were found in one water sample from three production wells:

- IRWD-5: 2 of 4 samples > 10 ppb As MCL; well is blended before entering distribution system
- LP-CITY: 13 of 40 samples > 10 ppb As MCL; well screen has been recently modified to reduce contribution from zones with elevated arsenic concentrations; average concentration into distribution system maintained below the MCL
- YLWD-15: 6 of 14 samples > 10 ppb As MCL; well is blended in a reservoir before entering distribution system

The arsenic and perchlorate wells are shown on **Figure 2-17.** Potable water from these wells is treated via reverse osmosis or ion exchange at treatment plants in the City of Tustin and/or blended with groundwater pumped from other wells prior to being served to residents to reduce perchlorate concentrations to below the MCL. **Figure 2-18** shows areas with nitrate (as N) concentrations above the MCL of 10 mg/L.

Management of nitrates is a component of the salinity management program in the Santa Ana River Watershed. The Basin Plan for the Santa Ana River Region 8 contains water quality objectives for nitrates in the groundwater management zones in the watershed. Because Santa Ana River water is used to recharge the Orange County Groundwater Basin, controlling the levels of nitrates in the river has an impact on groundwater quality. OCWD operates an extensive system of wetlands in the Prado Basin to reduce nitrate levels in river water upstream of recharge basins. Groundwater with elevated nitrate levels in the Tustin area is treated at the Tustin Main Street and 17th Street Treatment Plant prior to distribution to residents.

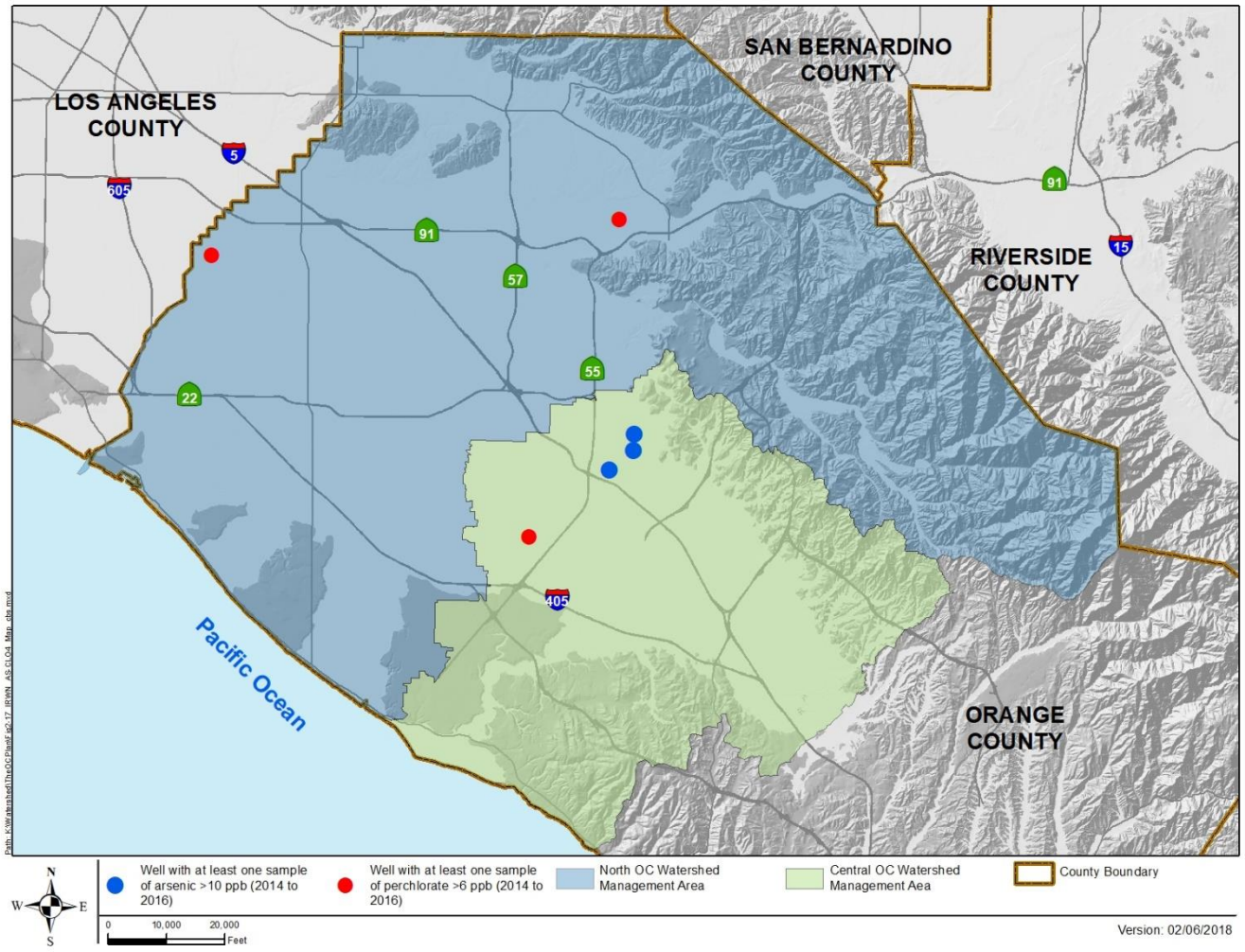


Figure 2-17: Production Wells with Arsenic and Perchlorate Concentrations Above the MCL

Further, OCWD monitors, reviews and comments on local land-use plans, environmental documents, and proposed regulatory agency permits to provide input to land-use planning agencies regarding proposed projects and programs that could cause short- or long-term water quality impacts to the Orange County Groundwater Basin.

Salt and Nutrient Management Program. The watershed's salinity management program, overseen by the Regional Water Board, is managed by the Basin Monitoring Program Task Force. The Task Force, administered by SAWPA, consists of over 20 water and wastewater agencies and local governments. Beginning in 1995, the task force evaluated the impacts to groundwater quality of Total Inorganic Nitrogen (TIN) and total dissolved solids (TDS). Formation of the Task Force was in response to concerns by the Regional Water Board that water quality objectives for nitrogen and TDS were being exceeded in some groundwater basins in the watershed.

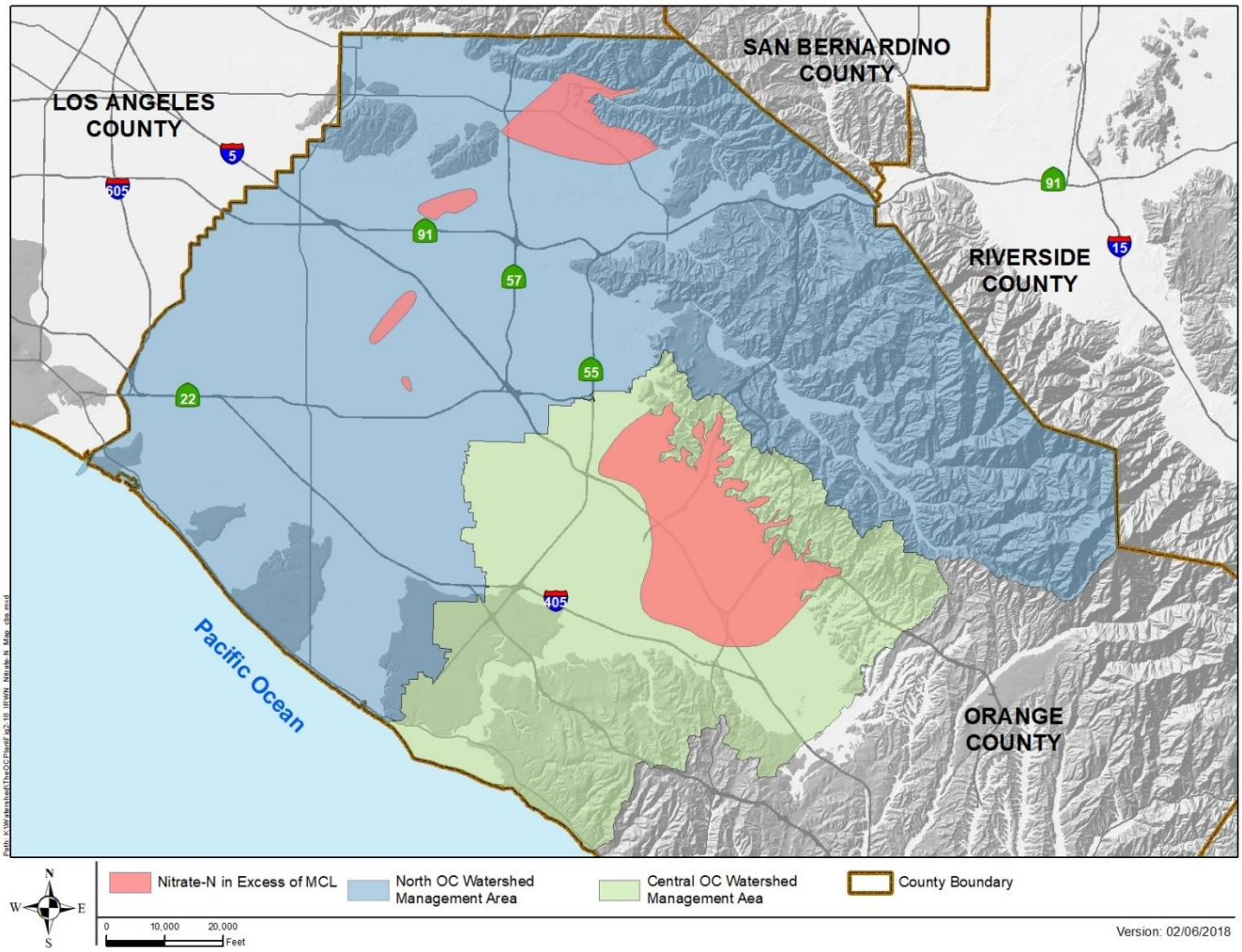


Figure 2-18: Areas of Nitrate-N Above the MCL

Water quality objectives for TDS and nitrate-nitrogen in groundwater management zones were adopted by the Regional Water Board based on historical water quality data. Every three years the Task Force calculates the current ambient water quality for each groundwater management zone. The most recent recalculation for the groundwater basin was completed in 2014.

The Task Force completed the study and developed amendments to the Santa Ana River Basin Plan that were adopted in 2004. This nearly 10-year effort involved collecting and analyzing data in 25 newly defined groundwater management zones in the watershed to recalculate nitrogen and TDS levels and to establish new water quality objectives. Models were developed and data were collected to enable an evaluation of the potential short-term and long-term impacts on water resources due to changes in land use, the quantity and quality of runoff, and point source discharges. The Basin Plan charges the Task Force with implementing a watershed-wide TDS/Nitrogen management program.

Southern California Salinity Coalition (SCSC).[36] Formed in 2002 and administered by the National Water Resources Institute (NWRI), SCSC is a nonprofit coalition of water and wastewater agencies in Southern California dedicated to managing salinity in water supplies. SCSC's member agencies include the Eastern Municipal Water District, Inland Empire Utilities Agency, Metropolitan Water District of Southern California, Orange County Sanitation District, Orange County Water District, San Diego County Water Authority, Sanitation Districts of Los Angeles County, and Santa Ana Project Watershed Authority.

Consequences of salinity includes detrimental effects on plant growth and crop yield, damage to infrastructure, reduction of water quality, sedimentation problems, and soil erosion. Salinity impacts residential, commercial, industrial, and agricultural water users, groundwater, wastewater, and recycled water resources, and utility distribution systems. When salinity levels of imported water are reduced, the Region benefits from both the improved use of local groundwater and recycled water and reduced costs to water consumers and utilities. A 100 mg/L salinity decrease in imported water would result in $95 million per year of economic benefits. Similarly, a 100 mg/L reduction in salt content in groundwater would lead to $65 million per year of economic benefits.

SCSC's objectives to coordinate salinity management strategies includes establishing proactive programs to address the critical need to remove salts from water supplies; preserve, sustain, and enhance the quality of source water supplies; support economic development; and reach out to the general public on salinity problems. This can be accomplished through state and federal advocacy; salinity information and education programs; focus regional and watershed planning on salt balance issues; evaluation of brine management alternatives; develop an inventory of salt-generating sources; and identify research funding priorities. The SCSC also works closely with the Southern California Regional Water Quality Control Boards, U. S. Environmental Protection Agency Region IX, and local agencies to assist dischargers in meeting their requirements through salt and nutrient management plans that can be implemented in a timely fashion.

2.5 Jurisdictional Boundaries

Federal, state, and local agencies have jurisdiction within the Region. On a federal level, the IRWM Region is within U.S. EPA Region 9, which covers the entire Pacific Southwest.

On a state level, the Region falls under the jurisdiction of the Regional Water Board and the DWR Southern District. For the California Department of Fish and Wildlife (CDFW), the Region is located within the CDFW's South Coast Region. The Newport Beach Marine Life Refuge and the

[36] http://www.socalsalinity.org/about.htm

Irvine Coast Marine Life Refuges are in CDFW's Marine Region, which serves the entire state coastline from border to border and three nautical miles out to sea. The CDFW also has jurisdiction over the Upper Newport Bay State Ecological Reserve. The California Department of Parks and Recreation has jurisdiction over certain open-space areas, including Corona Del Mar State Beach and Crystal Cove State Park.

On a local level, the County of Orange and municipalities – cities and special districts – have jurisdictional boundaries with authority for land use, water resources, habitat, water quality, flood control, and recreation facility management. **Appendix E** lists and describes the Federal, State and local agencies with jurisdiction in the IRWM Region.

Population Summary for the North and Central OC Region. Population estimates for The OC Plan are listed in **Appendix E** by each city within the Region based on the U.S. Census July 2016 estimates. Combined, total 2017 population is approximately 3,010,232, with 65 percent (1,956,651) residing in the North OC WMA and 35 percent (1,053,581) residing in the Central OC WMA. The U.S. Census shows, collectively, that about 13.8 percent (415,412) of this population is living at or below the poverty level.

Regional Agency Jurisdiction Detail

County of Orange. The County of Orange has jurisdiction over land use in unincorporated areas and is responsible for managing county-owned parks and drainage facilities. The County is also responsible for managing the Orange County Stormwater Program in compliance with the NPDES stormwater permit, for monitoring water quality, and for providing flood protection.

The Orange County Stormwater Program (OCSP), is a collaborative program between the County of Orange, all incorporated cities within the County, and the OCFCD, formed to comply with the requirements of Municipal NPDES Municipal Separate Storm Sewer System (MS4) Permits. The OCSP owns and operates MS4s, therefore they are required under the Federal CWA to obtain an NPDES MS4 permit to:

- Effectively prohibit non-stormwater discharges into the MS4, and
- Reduce the discharge of pollutants from MS4s to the Maximum Extent Practicable (MEP), including Best Management Practices (BMPs), design and engineering methods, and such other provisions appropriate for the control of such pollutants.

In response to these regulations, the OCSP has obtained, renewed, and complied with NPDES MS4 permits from both the Santa Ana and San Diego RWQCB's since 1990. It has also developed a DAMP, subsequent ROWDs and other programmatic documents, which detail and/or summarize the specific water pollutant control program elements for the OCSP to demonstrate

compliance with NPDES MS4 permit requirements. Each individual city also has a LIP to implement the DAMP at a local level and to direct city stormwater compliance activities.

To effectively carry out the requirements of the OCSP, the Permittees in both Regional Water Board areas agreed that the County would be the Principal Permittee and the Orange County Flood Control District and the incorporated cities would be Permittees. As the Principal Permittee, the County has managed the overall stormwater program cost effectively by combining resources to complete activities that benefit all the Permittees. The County, as Principal Permittee, collaborates with all Permittees by facilitating the following:

- Providing administrative and technical support for the Permittees and the committees within the management structure;
- Developing and executing inter-governmental agreements necessary for program implementation;
- Planning and implementation needed to direct the program for short and long term;
- Developing BMPs;
- Developing reports and other materials required by the NPDES MS4 permits;
- Developing budgets and fiscal analyses;
- Reviewing and developing policy positions and representing the OCSP before appropriate agencies; and
- Program coordination with all affected local government agencies.

Regional services provided to all of Orange County include regional flood control – by *Orange County Flood Control District* – water quality enhancement, recreation, and agricultural services. These regional services are countywide and are provided equally within city boundaries as well as in unincorporated areas. Municipal services are provided for inhabited unincorporated areas for which Orange County has land use authority. **Figure 2-19** presents the flood control infrastructure in North and Central OC.

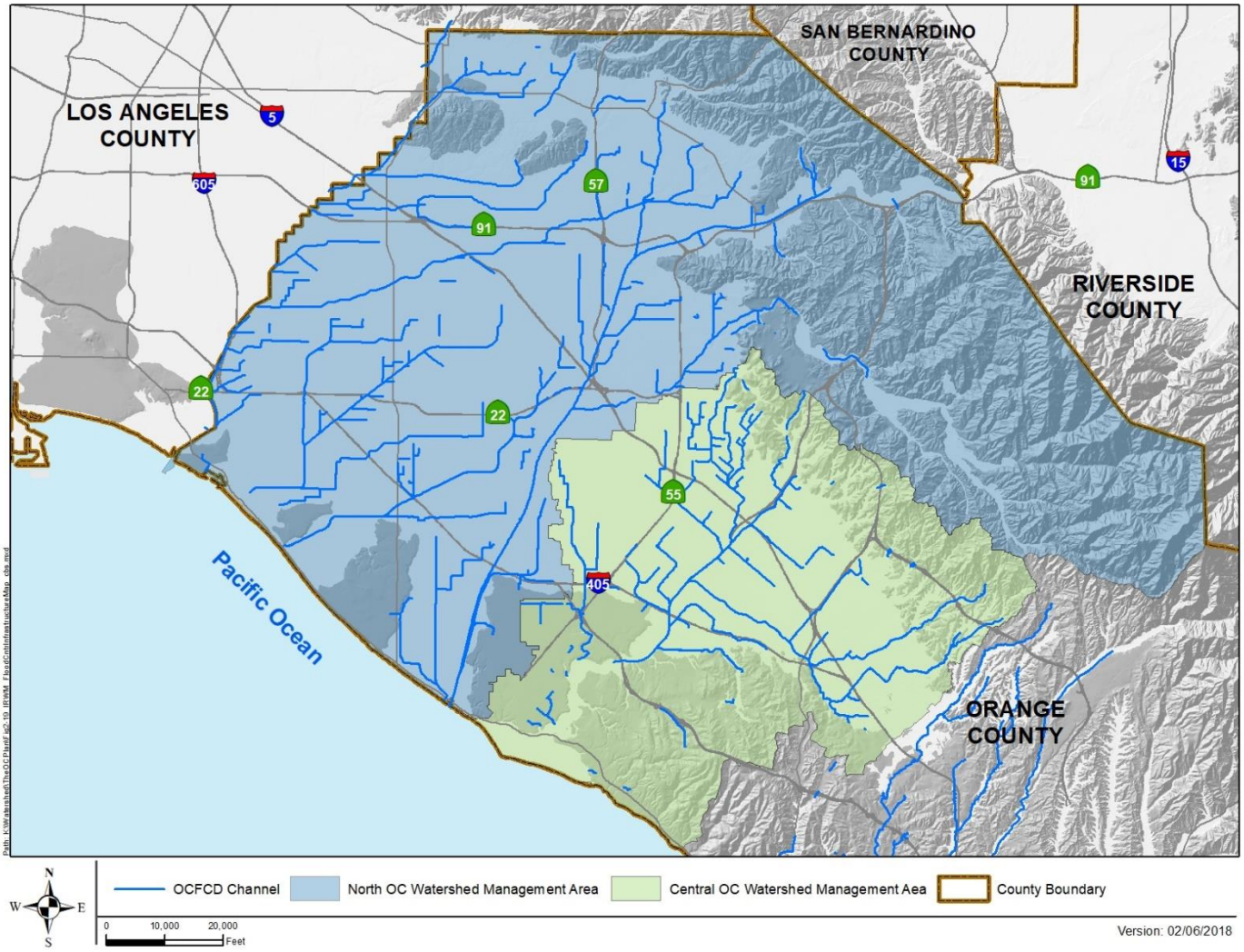


Figure 2-19: Flood Control Infrastructure

Within the Region, the County has authority for 37 unincorporated island areas, with a sphere of influence by 15 cities.[37] **Figure 2-20** shows IRWM Region cities and unincorporated jurisdictional boundaries.

Orange County Parks Department (OC Parks) manages regional recreational facilities and historical and natural resources throughout Orange County, including 37,000 acres of parkland and open space, with regional and wilderness parks, nature preserves and recreational trails, historic sites, harbors, and beaches.

[37] http://oclafco.org/index.php/unincorporated-islands/

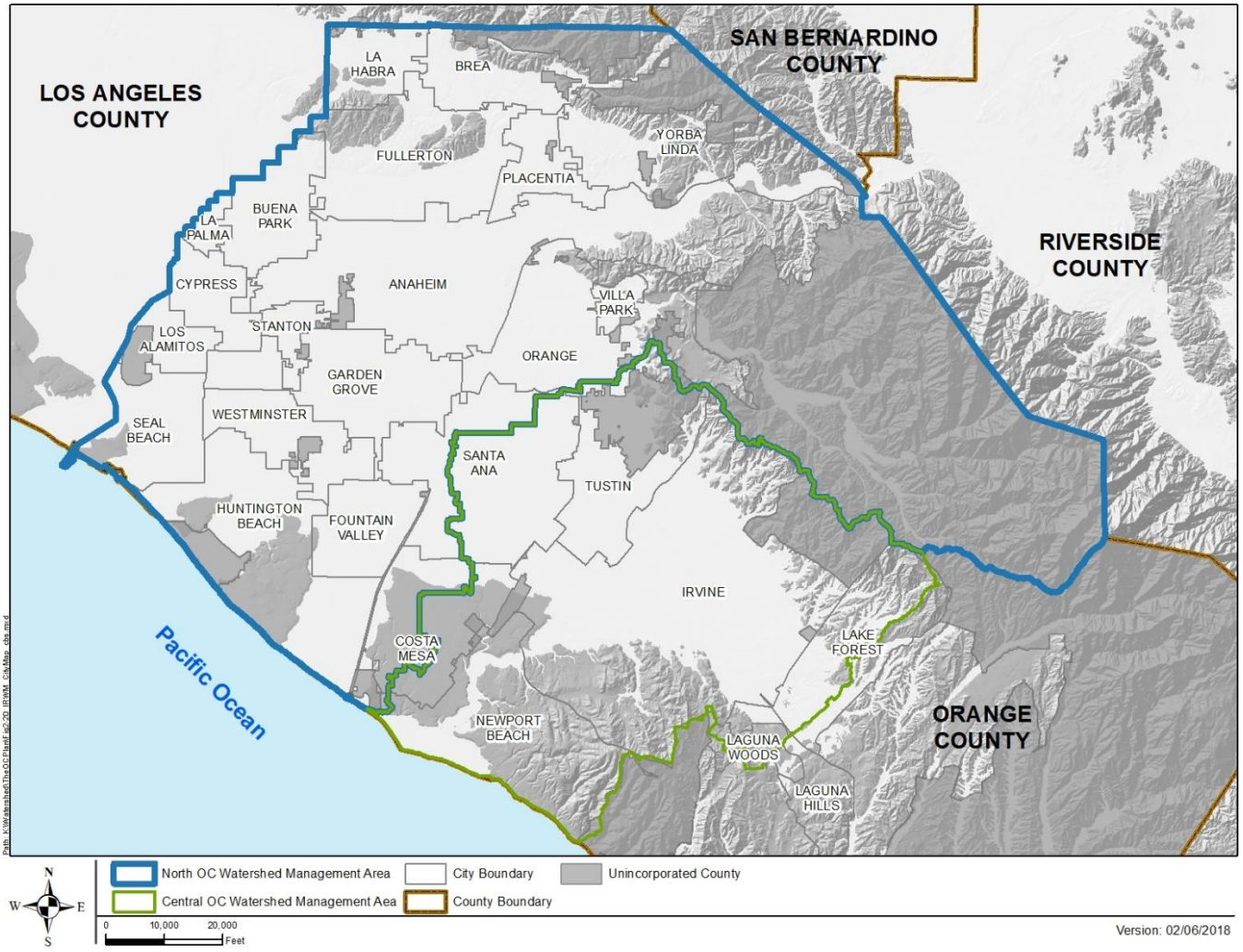


Figure 2-20: City and Unincorporated Jurisdictional Boundaries

Municipal Water District of Orange County. MWDOC is a wholesale water supplier whose efforts focus on sound planning and appropriate investments in water supply development, water use efficiency, public information, legislative advocacy, water education, and emergency preparedness. MWDOC is the third largest member agency of Metropolitan and holds key leadership positions on the Metropolitan Board of Directors, which oversee finances, policy development, long- and short-term resource planning, and program implementation. Established in 1951, MWDOC now serves over 2.3 million Orange County residents. MWDOC's service area is 600 square miles and covers all of Orange County except for the cities of Anaheim, Fullerton and Santa Ana, which are direct Metropolitan member agencies.

MWDOC purchases over 70 billion gallons of imported water from Metropolitan per year from two sources – Northern California (transported through the State Water Project) and the Colorado River (transported through the Colorado River Aqueduct). MWDOC delivers this water to its 28 member agencies, who in turn, provide retail water services to the public.

Orange County Water District. OCWD is a special district that was formed by an act of the California State Legislature to protect Orange County's water rights to the Santa Ana River and to manage the groundwater basin that underlies northern and central Orange County. OCWD holds rights to all Santa Ana River flows that reach Prado Dam. OCWD recharges the Orange County groundwater basin primarily with water from the Santa Ana River and recycled water from the GWRS, supplemented by untreated imported water purchased from Metropolitan. The groundwater basin is not adjudicated but is cooperatively managed by OCWD according to the basin management plan. OCWD operates the Groundwater Replenishment System in partnership with OCSD and operates the Green Acres Project to enhance the supply of recycled water for irrigation and industrial uses.

OCWD manages the groundwater basin by balancing the demand for water with the need to protect the long-term health of the water supply. OCWD actively recharges the groundwater basin and works to expand the basin's yield. Pumping rates are managed to maximize water withdrawals within the basin's safe operating range. The basin's water supply is managed such that supplies are adequate to meet typical demands during drought years and that there are supplies available to help lessen the impacts of drought conditions.

Orange County Sanitation District. OCSD is a public agency that is responsible for safely collecting, treating, and disposing the wastewater generated by approximately 2.6 million people living in a 479-square-mile area of central and northwest Orange County. OCSD is a special district that is governed by a Board of Directors consisting of 25 board members appointed from 20 cities, two sanitary districts, two water districts and one representative from the Orange County Board of Supervisors. OCSD has two operating facilities that treat wastewater from residential, commercial and industrial sources.

Figure 2-21 shows OCWD, OCSD, and MWDOC jurisdictional boundaries. **Figure 2-22** shows water agency boundaries – cities and districts.

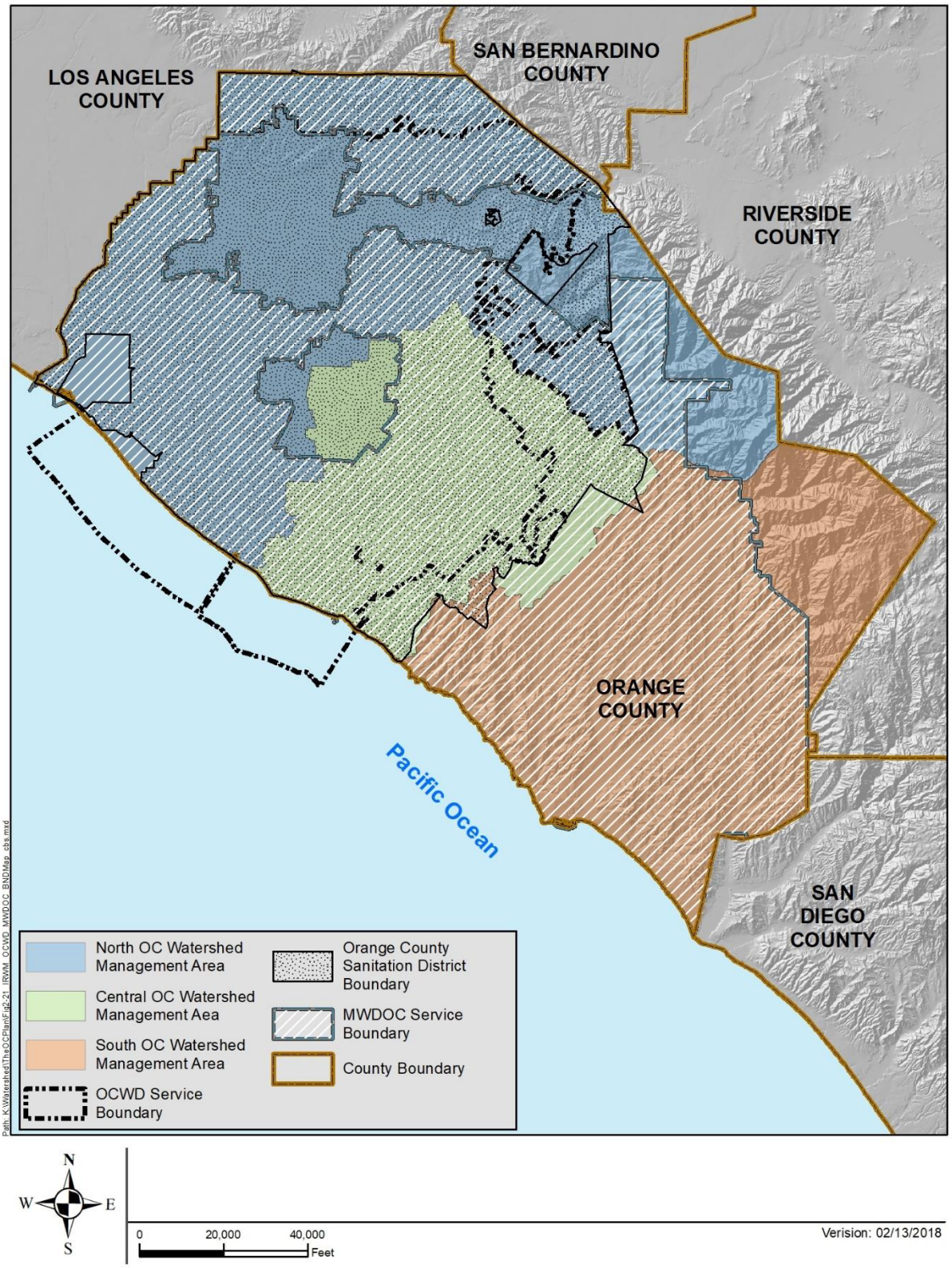


Figure 2-21: OCWD, OCSD and MWDOC Jurisdictional Boundaries

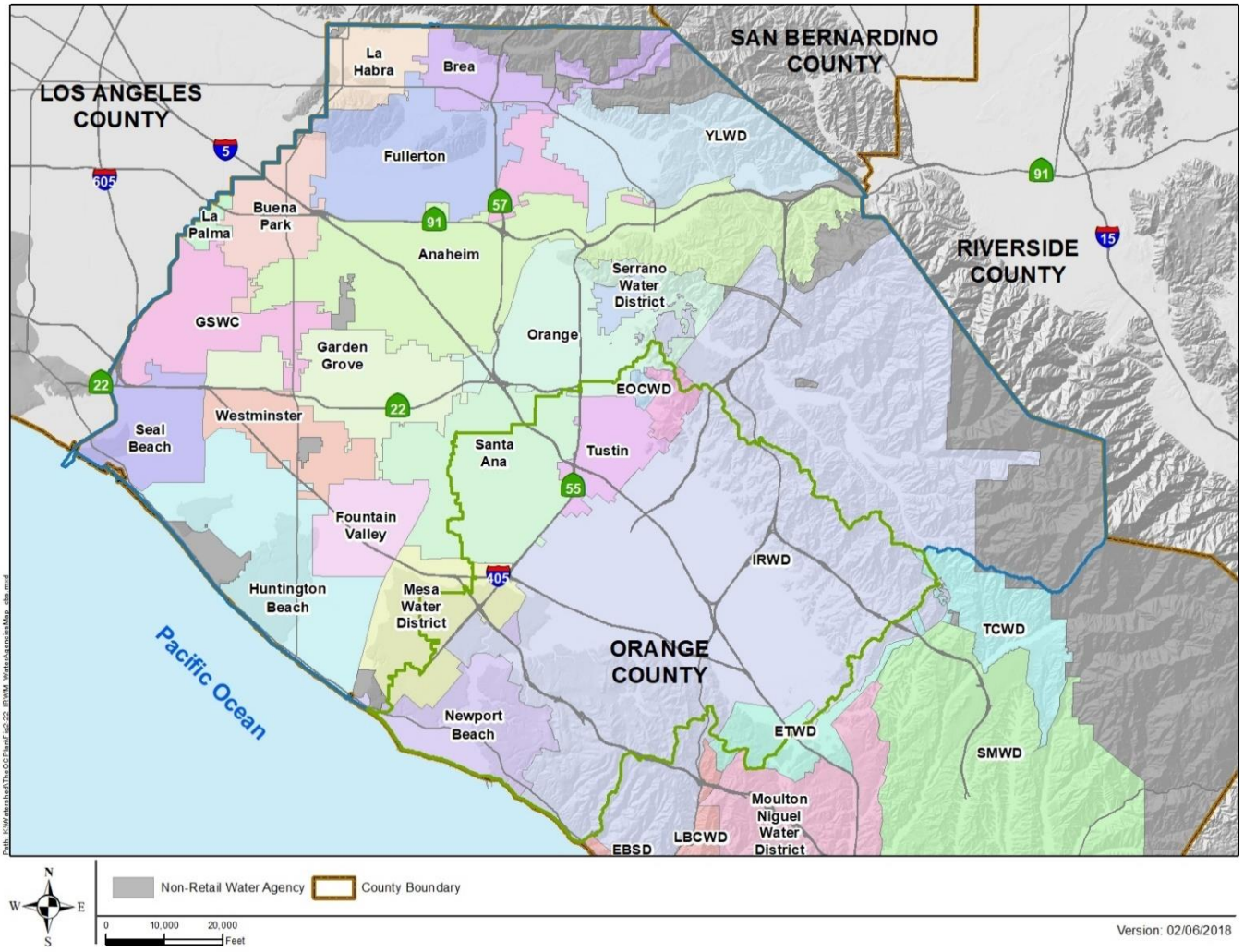


Figure 2-22: Water Agencies – Cities and Water Districts

2.6 Open Space and Land Use

Land use within the Region has changed dramatically over the past 40 years, as agricultural lands have been converted to urban uses, with development of large master-planned communities, and commercial and industrial areas, which have created a dynamic regional economy.

Major reuse programs are underway in the Region on two former military bases. These environmentally impaired sites are being redeveloped to include mixed-use communities that will be a significant source of population growth over the 20-year planning horizon. Former Marine Corps Air Station (MCAS)-Tustin with its two historical hangers is now the site of Tustin Legacy. The City of Tustin is developing a 1,600-acre mixed-use community incorporating residential, commercial, and institutional uses with over 110 acres of parkland, bike and

pedestrian trails. The 4,600-acre former MCAS–El Toro in the City of Irvine, will be the site of Heritage Fields, a 2,300-acre mixed-use development, and the Orange County Great Park, a 2,300-acre park that will offer open space, natural drainage, groundwater recharge, and valuable habitat corridors, along with sports fields and educational and cultural facilities for countywide benefit.

Land use is the cornerstone of the Region's future, and integrated planning is used on multiple levels to address the challenge of ensuring that there are livable communities, a wide range of recreational opportunities and a growing economy, along with healthy, functioning ecosystems.

Overall, the land-use character of the Region is urban. Predominant land uses include commercial and residential uses, with some industrial and institutional areas, scattered agricultural uses and open-space areas such as parks, beaches, the San Joaquin Freshwater Marsh, and Newport Bay. There is minimal agricultural land use as there are very few rural areas – only 0.2 percent of the population lives in areas designated as rural (SCAG 2005). A large portion of unincorporated Orange County, a mountainous area on the east side of the Region, is undeveloped.

The University of California, Irvine, located northeast of Upper Newport Bay, encompasses 1,500 acres, some of which are dedicated to institutional uses such as university facilities and student housing. The Region's open space, recreation, and park areas are described further in the following section.

Figure 2-23 shows land use in the Region. Note the current land use data base is the source for the map and does not reflect recent development in Orange County, including Tustin Legacy.

2.7 Parks, Forests, Refuges, and Areas of Special Biological Significance

Open Space, Recreation, and Parks. Orange County Parks Department (OC Parks) manages regional, wilderness, coastal and historical facilities, throughout the county. Featuring 60,000 acres of parkland, open space and shoreline, Orange County's award-winning parks and programs are enjoyed by millions of residents and visitors each year, in ways as diverse as the parks themselves.[38] Of this total acreage, Orange County's extensive regional parks system comprises 39,000 acres in 25 urban and wilderness parks, including seven regional historic sites, 7,000 acres of open space and 230 miles of regional riding and hiking trails.[39]

[38] http://www.ocparks.com/about
[39] Orange County, Regional Wilderness & Parks, http://www.ocgov.com/visitors/wilderness

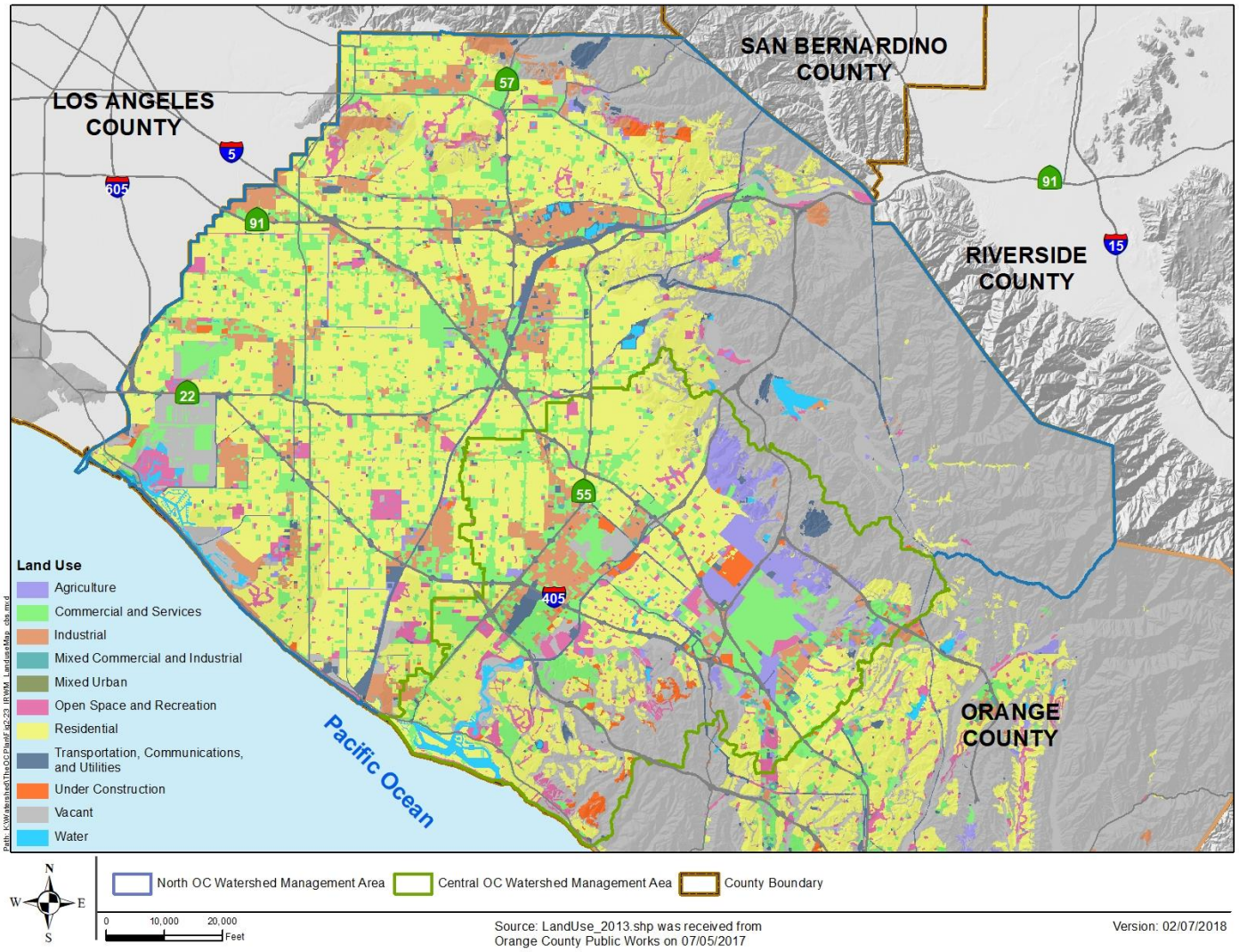


Figure 2-23: Land Use

Included in the North and Central OC Region are approximately 37,000 acres within the following areas: Limestone Canyon/Whiting Ranch Wilderness Parks; Upper Newport Bay Nature Preserve; Newport Harbor; Irvine, Mason, and Peters Canyon Regional Parks; Orange Coast River Park, Huntington Beach Central Park, and the Santa Ana River Trail system.

The Santa Ana River Trail System provides a greenbelt of open space and recreation along the river, such that one could bike from Huntington Beach to Yorba Linda and beyond into Riverside County. Huntington Beach Central Park includes the Shipley Nature Center and provides opportunities for bird watching, along with equestrian uses and walking paths.

The California Department of Parks and Recreation has jurisdiction over certain open-space areas, including Corona Del Mar State Beach and Crystal Cove State Park.

Multiple preserves and nature parks are present in the Region providing open space, recreation, and habitat including the Talbert Nature Preserve, the Seal Beach National Wildlife Refuge, and the Cypress Nature Park. The Coyote Creek watershed connects coastal dune open space at the mouth of the watershed to upland riparian woodlands in the canyons approaching the upper watershed, where vast open space is bisected by newer development in the communities of North OC.

In many areas, however, urbanization across the Region has left many communities "park poor." The lack of distributed park areas causes strain on the Region's existing beaches, parks, and natural areas. In response to this issue, cities and non-governmental organizations are seeking creative ways to fund park improvements and develop much needed conservation programs to acquire lands adjacent to environmental and habitat sensitive areas.

Marine Protected Areas (MPA). MPAs along the Southern California coast (Point Conception to California/Mexico border) have been in effect in state waters since January 1, 2012. The 50 MPAs in this region cover approximately 356-square-miles, or about 15 percent of Southern California state waters. Within the North and Central OC WMAs, the following are MPAs identified for the Region:[40]

- Bolsa Bay State Marine Conservation Area: This area overlaps the Bolsa Chica Ecological Reserve and includes the waters below the mean high tide line within Bolsa Bay estuary southward of a line that approximates the Warner Avenue Bridge. Take is prohibited, except the recreational take of finfish by hook and line from shore is allowed in designated areas only. Boating, swimming, wading, and diving are prohibited.
- Bolsa Chica Basin State Marine Conservation Area: This area also overlaps the Bolsa Chica Ecological Reserve and includes the waters below the mean high tide line within the Bolsa Chica Basin estuary northeastward of the Pacific Coast Highway Bridge. No take is allowed, and boating, swimming, wading, and diving are prohibited.
- Upper Newport Bay State Marine Conservation Area: This area overlaps the Upper Newport Bay Ecological Reserve and includes the waters below the mean high tide line within Upper Newport Bay northeastward of Pacific Coast Highway. Take is prohibited, except the recreational take of finfish by hook and line from shore is allowed in designated areas only. Swimming is allowed only in the area between North Star Beach and mid-channel. Boats are limited to speeds less than five miles per hour. Shoreline access is limited to established trails, paths, or other designated areas.

[40] https://www.wildlife.ca.gov/Conservation/Marine/MPAs/Network/Southern-California#mainland

Areas of Special Biological Significance (ASBS). An ASBS is a protected area designated to support and protect natural marine ecosystems and heritage, improve the opportunities for human activities, and ensure a strong coastal economy. An ASBS differs from a MPA, such that ASBS policies are based upon attainment of water quality standards. ASBS regulations prohibit waste from entering the protected habitat through drains and natural water outputs. The SWRCB has designated three ASBS within Orange County: the Robert E. Badham (Newport Coast) ASBS (No. 32), the Irvine Coast (Crystal Cove) ASBS (No. 33), and the Heisler Park ASBS (No. 30)[41]. ASBS Number 32 and a portion of Number 33 are within the Central OC WMA shown in **Figure 2-24.**

The Robert E. Badham ASBS was designated in 1974 (Index No. 32) and comprises 0.7 miles of coastline in Orange County and covers about 220 acres. The Robert E. Badham State Marine Park (formerly known as the Newport Beach Marine Life Refuge) is located along the shoreline of this ASBS out to a distance of 200 feet offshore and is administered by the CDFW. Adjacent to the northern end of the ASBS, Newport State Beach (administered by the California Department of Parks and Recreation) is a heavily used recreational area, while coastal bluffs and rocky tide pools dominate the southern end. Uses of the watershed, nearshore, and offshore areas include industrial service supply, navigation, recreation, commercial and sport fishing, and shellfish harvesting.

Key pollution threats to the Robert E. Badham ASBS include the adjacent marina, commercial and residential runoff from Corona del Mar, and flows altered by homeowners in Buck Gully, draining onto Little Corona Beach.

The Irvine Coast ASBS was designated in 1974 (Index No. 33), covers approximately 941 acres, and begins at Pelican Point and continues 3.4 miles along the coastline to the City of Laguna Beach. This ASBS contains the Irvine Coast State Marine Park (formerly called a Marine Life Refuge) and the overlapping Crystal Cove State Marine Conservation Area, which are administered by the CDFW. These Marine Protected Areas and the adjoining beach provide excellent tidal and offshore communities featuring tide pools, kelp beds, and dolphin birthing grounds. Despite increasing urbanization, Crystal Cove State Park (administered by the California Department of Parks and Recreation) contains some of the last undeveloped Orange County coastline. Key pollution threats include road runoff and possible septic tank leakage.

[41] Orange County Marine Protection Area Council. Water Quality- ASBS. Retrieved online 7/27/17. http://www.ocmarineprotection.org/asbs.html

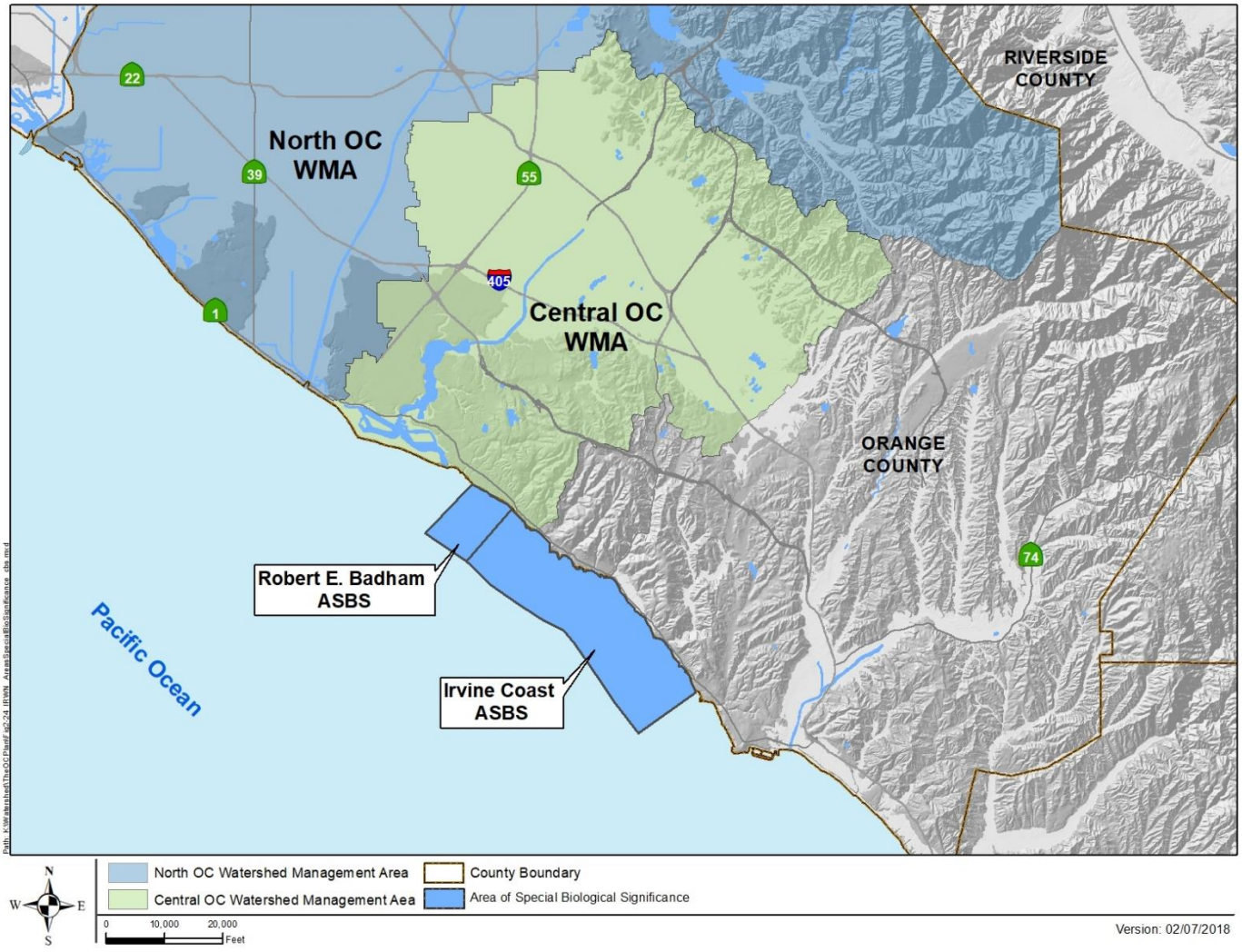


Figure 2-24: Areas of Special Biological Significance

2.8 Ecosystem Processes, Habitat and Vegetation

The following discusses the Region's geology, soils, biological resources, and wildlife. **Figure 2-25** shows the location of the Region's vegetation and habitat.

Before 1940, most of the Region was undeveloped and largely covered by native habitat. Development of the Region began to increase in the 1940s and 1950s. Grading operations for the numerous communities, as well as transportation corridors, intruded into the canyon areas and cut across agricultural lands. Since that time, the Region has been developed extensively, primarily for residential use.

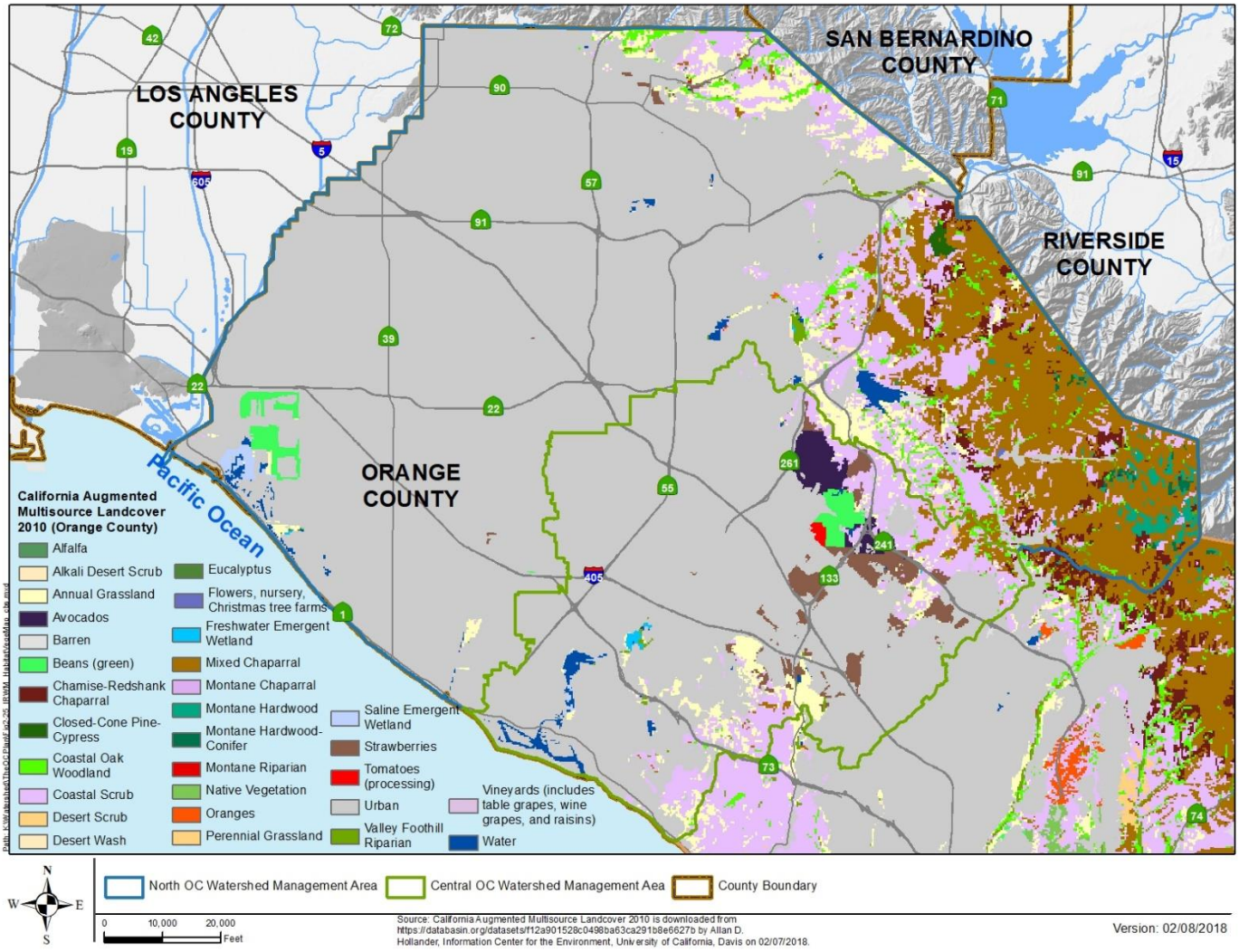


Figure 2-25: Habitat and Vegetation

2.8.1 Geology and Hydrology

Geologic and Hydrologic Features of the Santa Ana River Watershed.[42] This section presents the geomorphology – the study of the classification, description, nature, origin, and development of present landforms and their relationships to underlying structures – and of the history of geologic changes as recorded by these surface features.

The Santa Ana River Watershed drains a 2,840 square-mile area, although covers an area of 210.47 square miles within Orange County; the largest watershed in Orange County.

[42] One Water, One Watershed Plan 2.0, *Section 3.0 Watershed Setting*, Santa Ana Watershed Project Authority, February 2014

The upper Santa Ana River Watershed or headwaters, including the highest point in the drainage system, is delineated by the east-west ridgeline of the San Gabriel and San Bernardino Mountains. Over this ridgeline lies the Mojave Desert, which is part of the Lahontan Basin. This upper "erosion" zone of the watershed has the highest gradient, highest erosion level of new sediment to the system, and fastest stormwater runoff. As flows consist mainly of snowmelt and storm runoff from the undeveloped land in the San Bernardino National Forest, water quality tends to be high, with low concentrations of total dissolved solids (TDS), nitrates, and other pollutants. In this zone, the Santa Ana River channel is confined in its lateral movement, contained by the slope of the high, mountainous terrain. Within the upper watershed, the river and its tributaries travel around large boulders and over sand and gravel bars punctuated by pools and riffles reaching depths of about six feet. A visual "fly-through" of the Santa Ana River Watershed is available here: http://www.youtube.com/watch?v=HXDQCXKP6lM

Sedimentary and crystalline materials from the upper watershed move down slope through a process fed by storm pulses; therefore, sediment does not move at a continuous speed. River flow from Seven Oaks Dam to the City of San Bernardino consists mainly of storm flows, flows from the Lower San Timoteo Creek, and groundwater that is rising due to local geological features. From the City of San Bernardino to the City of Riverside, the river flows perennially and much of the reach is operated as a flood control facility. The principal tributary streams in the upper watershed originate in the San Bernardino and San Gabriel Mountains.

From the City of Riverside to the recharge basins below Imperial Highway, river flow consists of highly treated publicly-owned treatment works (POTW) effluent, urban runoff, irrigation runoff water, imported water applied for groundwater recharge, and groundwater forced to the surface by underground barriers. Near Corona, the Santa Ana River cuts through the Santa Ana Mountains and the Peralta-Chino Hills, which together form the northern end of the Peninsular Ranges in Southern California. The Santa Ana River then flows down onto the Orange County coastal plain where the channel lessens in gradient, and the valley floor is reached. Here the soft features of the channel where sediment has been deposited are more prevalent. Floodplains are strewn with boulders and characterized by sand and gravel washes. Within this valley floor, the transport and depositional processes are less confined by higher terrain as water, dissolved material and sediment move toward the sea. Over time, aquatic and terrestrial wildlife have adapted to this dynamic process and channel formation. However, rapid urbanization has artificially increased the rate of sedimentation and loss of habitat in this part of the watershed, negatively affecting water quality and wildlife habitat.

The Orange County Coastal Plain is composed of alluvium derived from the mountains. Upstream from the Santa Ana Canyon lay Prado Dam and Prado Wetlands; a portion of the Santa Ana River flows are passed through the Prado Wetlands to improve water quality and remove nitrates before being used for groundwater recharge. Santiago Creek, the only major tributary to

the lower Santa Ana River, joins the Santa Ana River in the City of Santa Ana. The lower limit of both the groundwater recharge area and the Santa Ana River's ordinary flows is 17th Street in the City of Santa Ana. Prior to channelization of the lower part of the Santa Ana River, the channel used to meander slowly across broad flood plains. Currently, the Santa Ana River is a concrete channel from 17th Street in the City of Santa Ana to Adams Avenue in Huntington Beach. The riverbed is ordinarily dry from 17th Street in the City of Santa Ana to the Victoria Street Bridge. The Greenville-Banning Channel, which carries stormwater discharge and urban runoff, is channelized to the Victoria Street Bridge where it joins the Santa Ana River. Discharge from the Greenville-Banning Channel combines with tidal flow from the Pacific Ocean, and water is present in the Santa Ana River from the Victoria Street Bridge to the river mouth.

Geologic and Hydrologic Features of the North Orange County Watershed. The Orange County Groundwater Basin, underlying the northern portion of Orange County, formed in a synclinal, northwest-trending trough that deepens as it continues beyond the Orange-Los Angeles county line. The Newport-Inglewood fault zone, San Joaquin Hills, Puente Hills, and Santa Ana Mountains form the uplifted margins of the syncline. The total thickness of sedimentary rocks in the basin surpasses 20,000 feet, of which only the upper 2,000 to 4,000 feet contain fresh water. In the southeastern area underlying the city of Irvine and along the basin margins, the thickness of fresh water-bearing sediments is less than 1,000 feet (Herndon and Bonsangue, 2006[43]).

The La Habra Groundwater Basin is separated from the Orange County Groundwater Basin by the Coyote Hills. The La Habra Groundwater Basin lies in the synclinal trough between the Puente Hills and the Santa Fe Springs - Coyote Hills uplift. The Whittier fault, located in the Puente Hills, forms the northern limit of the La Habra syncline.

The Newport-Inglewood fault zone, comprising the most significant structural feature in the basin from a hydrogeologic standpoint, consists of a series of faulted blocks which are generally up thrown on the southwest side. Folding and faulting along the Newport-Inglewood fault zone have created a natural restriction to seawater intrusion into the groundwater basin (Herndon and Bonsangue, 2006).

Formations of Miocene or older age constitute the base of water-bearing strata, as they are consolidated units with minimal water transmissive capacity. The tops of Miocene-aged units, including the non-marine Sespe formation, marine Vaqueros formation, and Monterey shale, form the base of water bearing sediments in the coastal and Irvine areas of the basin, whereas the tops of the Miocene-aged marine Puente and Topanga formations and El Modeno volcanics

[43] Herndon, Roy L. and John D. Bonsangue. 2006. *Hydrogeology of the Orange County Groundwater Basin – An Updated Overview*, Geology of the Orange County Region, Southern California, Annual Field Trip Guide No. 33, South Coast Geological Society, Inc.

define the base of permeable sediments along inland boundary of the basin from the city of La Habra to the city of Villa Park.

Fresh water-bearing formations within the groundwater basin are comprised of Pliocene or younger (last 5 million years), semi-consolidated to unconsolidated sedimentary units. The upper Pliocene-aged Pico formation is reportedly present throughout much of the basin and is significant in that the base of its upper unit is reported to form the base of the fresh water aquifer system where it exists. Other Pliocene-aged sediments, including the Fernando and Repetto formations, are believed to contain producible quantities of fresh water.

Unconsolidated sands and gravels of the Pleistocene-aged San Pedro, Lakewood, and La Habra formations, and to a lesser extent, the Coyote Hills formation and Palos Verdes sand, constitute the primary production aquifers within the groundwater basin. The non-marine Coyote Hills and La Habra formations underlie the Fullerton and Anaheim areas, whereas the marine Lakewood and San Pedro formations underlie the majority of the central and coastal portions of the basin. The Coyote Hills and La Habra formations are present in the La Habra Groundwater Basin and are underlain by the San Pedro formation. These marine and non-marine formations are time correlative and are thought to interfinger throughout the basin. Total depths of the base of these formations range from approximately 500 to 2,000 feet.

Overlying the Pleistocene deposits are younger, Recent-aged alluvial sediments that range from less than 50 feet to approximately 300 feet thick. These sediments include coarse-grained channel deposits laid down by the Santa Ana River, which has flowed into the Pacific Ocean as far north as the present-day San Gabriel River mouth and as far south as Newport Bay. It is these channel deposits, which have not been substantially offset by the Newport-Inglewood fault zone, that provide the conduits for seawater to migrate inland toward groundwater pumping depressions.

Pleistocene or younger aquifers within the basin form a complex series of interconnected sand and gravel deposits. In coastal and central portions of the basin, these deposits are extensively separated by lower-permeability clay and silt deposits or aquitards. In the inland areas, the clay and silt deposits become thinner and more discontinuous, allowing larger quantities of groundwater to flow more easily between shallow and deeper aquifers (DWR, 1967).

The La Habra Groundwater Basin has been characterized as a layered aquifer system consisting of the near-surface alluvium, the La Habra Aquifer, and the San Pedro Aquifer (Montgomery, 1977[44]; Geoscience, 2009[45]). The alluvial aquifer is typically about 100 feet thick. The older

[44] Montgomery, Consulting Engineers Inc. (Montgomery). 1977, November. La Habra Basin Groundwater Study.

alluvium covers most of the surface of the eastern La Habra Groundwater Basin with younger alluvium deposited in Coyote Creek and Brea Creek stream channels. The La Habra aquifer is composed of non-marine pebbly sandstones within the La Habra formation and underlying the Coyote Hills formation. This aquifer can reach a thickness of 1,200 feet near the center of the basin. Underlying the Coyote Hills formation is the San Pedro formation which contains the San Pedro aquifer, representing the most productive aquifer in the La Habra Groundwater Basin. This confined aquifer is thickest along the axis of the syncline in the basin.

Geologic and Hydrologic Features of the Newport Bay Watershed. The Newport Bay Watershed encompasses an area of approximately 154 square miles. The watershed is bounded to the north by the Santiago Hills (Loma Ridge) and to the south by the San Joaquin Hills. The Tustin Plain, a broad alluvial valley, occupies the major portion of this watershed. The Newport Bay Watershed is within the United States Geological Survey (USGS) hydrologic unit no. 18070204. The watershed is composed of the San Diego Creek sub-watershed, with an area of 119 square miles, which is the largest system draining into Upper Newport Bay. The Santa Ana Delhi Channel drains 17 square miles and Big Canyon Wash drains 2 square miles. The remaining 16 square miles are divided among several small sub-watersheds that discharge into lower Newport Bay.

Upper Newport Bay is a drowned river valley, initially formed by the Santa Ana River in approximately the mid-Pleistocene (1.8 million to approximately 10,000 years before present [BP]), a time when sea level was approximately 100 feet lower than the current level. During the Holocene (10,000 years BP to present), the Santa Ana River is thought to have changed course west and away from its former outlet into Upper Newport Bay (USACE 2001a).

Sedimentation in and near Newport Bay has had major impacts on the local geomorphology. The sand spit known as the Balboa Peninsula is the result of sediments from the Santa Ana River and other sediment-laden waters interacting with ocean currents. The present configuration and large size of the Balboa Peninsula is apparently the result of growth from an excessively large sediment influx into the ocean upcoast (northwest) during the 1861–1862 flood season (USACE 2001a). Excessive sedimentation remains an identified problem in San Diego Creek and Upper Newport Bay. The San Diego Creek channel system underwent significant natural and man-made changes during the 20th century. Circa 1900, essentially no defined channels had developed in the Tustin Plain. Storm flow from the Santiago and San Joaquin Hills mainly entered an ephemeral lake in the form of sheet flow or groundwater. The outflow from this lake was prevented from entering Upper Newport Bay by a natural ridge at the head of the Upper

[45] Geoscience. 2009. Draft Preliminary Geohydrologic Evaluation of the La Habra Basin. Prepared for City of La Habra, April 2, 2009.

Newport Bay Trough. Most of the flow emptied into the Santa Ana River, which entered the Pacific Ocean through the Newport-Mesa area (USACE 2001b).

The ephemeral lake and the alkali flat area to the north and east were usually swampy and marshy. These wet areas and the remainder of the Tustin Plain were later drained by ditches primarily constructed during 1902 and 1916. The ditches throughout the wet areas were originally used to drain the low-lying areas and to flush out the alkali, while those in the eastern portion of the Tustin Plain were designed to remove the irrigation return flow and to prevent floodwater from inundating crop and orchard lands (USACE 2001d). The irrigation system was gradually expanded to integrate the natural drainage of San Diego Creek and routed into Upper Newport Bay. Based on USGS topographic information, the drainage system was well developed by the early 1930s. The lower reaches of San Diego Creek and Peters Canyon Wash were modified for flood protection, primarily during the 1960s when the easements were granted to OCFCD (USACE 2001b).

The uppermost portion of Upper Newport Bay contained salt evaporation ponds and was separated from the rest of the bay by an earthen dike. Heavy stormwater runoff destroyed the salt ponds and breached the dike in 1969. Subsequent sedimentation events during the storm season in 1978 and 1980 made Upper Newport Bay shallower, and intertidal salt marsh vegetation became established and expanded rapidly.

In 1985, 85 acres of Upper Newport Bay were dredged to create the Unit I Sediment Control Basin (depths –3 to –7 feet mean sea level). A second dredging project in 1988 created the 37-acre Unit II Sediment Control Basin, just south of the Main Dike (depth –14 feet mean sea level). Both basins have worked well, collecting large volumes of coarser grained sediment from periodic flood runoff, primarily from San Diego Creek.

Open-water estuary/marine aquatic habitats still predominate in Newport Bay. The current shoreline includes scattered bare and disturbed areas, extensive intertidal salt marsh with cordgrass, less common pickleweed, rare eelgrass, and small fringing areas of willow/mulefat scrub wetland. Algae and other forms of plankton are seasonally dominant.

Studies of physical conditions in Upper Newport Bay confirm a picture of significant tidal, seasonal, and annual variability. During peak storms, the upper part of Upper Newport Bay has been characterized by a well-mixed, freshwater column. During lesser flows, salinity stratification has been noted in the lower part of Upper Newport Bay, with freshwater overlying slightly diluted seawater (Orange County 1998).

Changes in land use from ranching and grazing to farmland resulted in the discharge of pesticides and nutrients into San Diego Creek and Upper Newport Bay. Since the 1960s,

commercial, residential, and light industrial development has replaced open space and agricultural lands. Development and the related increase in impervious surfaces has increased runoff and altered drainage patterns. Several drainages were channelized for flood control because the amount of runoff necessitated increasing the size and number of channels that drain into San Diego Creek and Upper Newport Bay. As a result, the basins were constructed to control sedimentation of the bay (USACE 1999). Additional erosion control structures were installed in the channels. Channel erosion is most evident along Borrego Canyon Wash and Serrano Creek, where the estimated flow velocities are generally greater than 10 feet per second (Chang 2008).

Geologic and Hydrologic Features of the Newport Coast. The geology of the Newport Coast is characterized by consolidated sandstone, shale, and volcanic rocks that are overlain along the coastline by terrace deposits and along the larger streams by thin and narrow alluvial deposits. The consolidated rocks are offset and uplifted along numerous faults. A major portion of the Newport Coast is underlain by the Monterey Formation, a marine shale, which extends inland as much as 1.5 miles. The Monterey Formation is a Miocene marine formation that is the likely source of selenium in Big Canyon Wash and the Newport Coast drainages. Other inland portions are characterized by outcrops of the Tertiary Vaqueros and Topanga marine sandstones and the San Onofre Breccias, which are ancient landslide deposits (Todd, 2006).

Geologic and Hydrologic Features of Anaheim Bay-Huntington Harbour. The Anaheim Bay-Huntington Harbour and Lower San Gabriel River/Coyote Creek Watersheds are also part of the Santa Ana River Watershed. The Anaheim Bay-Huntington Harbour watershed encompasses an area of 81 square miles. The main surface water systems that provide drainage in this watershed are the Bolsa Chica Channel that provides drainage to the Anaheim Bay-Huntington Harbor Complex and the East Garden Grove-Wintersburg Channel that carries flow to Bolsa Bay and ultimately to Huntington Harbour. The Coyote Creek Watershed encompasses an area of 85 square miles within the Santa Ana region. This watershed is in the northernmost portion of Orange County. This watershed straddles the Los Angeles and Orange County border in its upper reaches and then continues through Orange County until it discharges into the San Gabriel River in Long Beach.

2.8.2 Soils

The Orange County coastal plain is composed mostly of alluvium derived from the mountains. The soil groups in the lower Santa Ana River Watershed, which includes the Anaheim-Bay Huntington Harbor and Lower San Gabriel River/Coyote Creek, are described as:

- Sedimentary and crystalline materials from the upper watershed move down slope through a process fed by storm pulses; therefore, sediment does not move at a continuous speed. Sediment deposits are more prevalent in the soft features of the channels. Today,

only 20% of the SAR is a concrete channel, the majority being near the mouth of the river from 17th Street in the City of Santa Ana to Adams Avenue in Huntington Beach.

- Floodplains are strewn with boulders and characterized by sand and gravel washes. Within this valley floor, the transport and depositional processes are less confined by higher terrain as water, dissolved material and sediment move toward the sea.

The soil groups in the Newport Bay Watershed are described as:

- San Joaquin Hills and Loma Ridge/Santiago Hills slopes are strongly sloping to very steep, well-drained clays, clay loams, sandy loams, loams, gravelly loams, and cobble loams of the Alo-Bosanko and the Cieneba-Anaheim-Soper associations.
- The area around Upper Newport Bay and the junction of the San Joaquin Hills and the Tustin Plain is the Myford association: level to moderately steep, moderately well drained sandy loam with strongly developed subsoil. These are soils developed on terraces.
- The vast majority of the Tustin Plain and the riparian zones of the numerous named drainages that collect water in the Tustin Plain are nearly level soils related to alluvial fans and floodplains of the Chino-Omni, Metz–San Emigdio, and Sorrento-Mocho associations. The latter two are well to somewhat excessively drained sandy loams, clay loams, loams, and calcareous loamy sands. The Chino-Omni association is composed of poorly drained to somewhat poorly drained calcareous silt loams to clays (USACE 2001a).

Major portions of the Santiago Hills and San Joaquin Hills contain soils with low infiltration capacities. Natural soils in the central portion of Upper San Diego Creek mainly consist of soils with higher infiltration capacities. Peters Canyon Wash upstream of the El Modena–Irvine Channel confluence is also composed largely of soils with high infiltration capacities. In contrast, the drainage areas of the El Modena–Irvine Channel lower Peters Canyon Wash, and lower San Diego Creek (downstream of Peters Canyon Wash) mainly consist of soils with low infiltration capacities (USACE 2001b).

The soil types within the Newport Coast Watershed can be divided into three major soil associations: the Myford soil association situated on the terraces and the Alo-Bosanko association and Cieneba-Anaheim-Sopa association developed on sandstone and shale formations in the coastal hills. The Myford soil association is predominantly Myford soils, which are sandy loams greater than 60 inches thick on nearly level to moderately steep slopes. Myford sandy loam and Marina loamy sand soils occur extensively across the lower portions of the Newport Coast Watershed. The Alo-Bosanko soil association is characterized by clay soils, generally less than 40 inches thick, on relatively steep slopes. The Cieneba-Anaheim-Sopa association includes a variety of sandy loams, loams, clay loam, gravelly loams, and cobbly loams on steep slopes. Clay soils and Anaheim loams are extensive within the Newport Coast

Watershed, and Calleguas clay loam is commonly found with the two hill associations (Todd 2006).

Soils are important to the water balance because different soils have varying capacities to absorb and retain moisture (from rainfall or irrigation) and transmit water down toward the water table. An important characteristic of soils is their moisture-holding capacity; overall, the average soil moisture-holding capacity is low but reasonable for sandy and for relatively thin soils on steep topography. The soil moisture-holding capacity estimated for the local native soils is assumed to be representative of the local urban soils (Todd 2006).

2.8.3 Biological Resources

Nine natural habitat types have been identified in the Region: woodland habitat; cliff and rock habitat; scrub habitat; chaparral habitat; grassland habitat; vernal pools, seeps, and wet meadows; marsh habitat; marine and coastal habitat; and riparian habitat.

Woodland Habitat. Woodland habitats are multilayered vegetation communities dominated by trees that characteristically have an open canopy. The extent of woodland habitat in the watersheds is limited primarily to one subcommunity, coast live oak woodland. Coast live oak woodland is typically found on north-facing slopes and shaded ravines usually below 4,000 feet. It is described as evergreen woodland dominated by Coast Live Oak (*Quercus agrifolia)* and reaching a height of 30 to 80 feet. The shrub layer is poorly developed but may include Toyon (*Heteromeles arbutifolia)*, Currants (*Ribes spp)*, Laurel Sumac (*Rhus laurina)*, or Mexican Elderberry (*Sambucus Mexicana)*. The herb layer is continuous and dominated by Bromegrass (*Bromus diandrus)* and several other introduced taxa.

Cliff and Rock Habitat. Cliff and rock habitats are characterized by vascular plants and lichens that grow on steep, rocky faces. Some cliff faces have been identified in the San Joaquin Hills, in the foothills of the Santa Ana Mountains, and around Upper Newport Bay.

Scrub Habitat. Scrub communities are generally dominated by small shrubs with drought tolerant deciduous leaves. Most of the plant species found within these communities regenerates after fire events. These communities often occur on dry xeric sites, such as south-facing slopes, and provide structures for shelter and nesting. The Orange County Habitat Classification System identifies eight scrub communities within the county: southern coastal bluff scrub, maritime succulent scrub, Venturan-Diegan transitional coastal sage scrub, southern cactus scrub, Riversidian coastal sage scrub, floodplain sage scrub, chenopod scrub, and sage-scrub grassland ecotone. The most prominent of these are the Venturan-Diegan transitional

coastal sage scrub (described in the Central/Coastal NCCP), southern cactus scrub, and floodplain sage scrub (County of Orange, 1996[46]).

Chaparral Habitat. Chaparral communities are dominated by large arborescent shrubs that generally have large evergreen leaves. Most chaparral plant species regenerate from underground root structures after fire events. These communities generally occur on moderately moist mesic sites, such as north-facing slopes.

Grassland Habitat. Grasslands consist of low-growing herbaceous species dominated by annual and perennial grasses and forbs. The native grassland communities that once blanketed the Southern California landscape have largely been outcompeted by nonnative annual grasslands. Existing native grasslands are presently restricted to designated open-space areas contained within the NCCP reserve system.

Vernal Pools, Seeps, and Wet Meadows. Three types of vernal pools, seeps, or wet meadows are found in the Region. The southern hardpan vernal pool is typically found on level grassland or scrub areas with a deep underlying clay hardpan layer. Alkali meadows are seeps and wet areas that occur in low-lying alkaline or saline soils. Freshwater seeps are isolated, small perennial water sources often associated with outcrops. Southern hardpan vernal pools have been observed in Whiting Ranch Regional Park, while alkali meadows and freshwater seeps are known to occur in and around Upper Newport Bay.

Marsh Habitat. All four of the marsh habitats identified in the County of Orange inventory are represented in the Region. Two of these, southern coastal salt marsh and coastal brackish marsh, are linked to Upper Newport Bay in the lower part of the watershed. Coastal freshwater marsh and cismontane alkali marsh are found near Newport Bay as well as in other areas. The salt marsh bird's beak (*Cordylanthus maritimus*) is an endangered plant species that grows only in the salt marshes.

Open-water estuary/marine aquatic habitats still predominate in Newport Bay. The current shoreline includes scattered bare and disturbed areas, extensive intertidal salt marsh with cordgrass, less common pickleweed, rare eelgrass, and small fringing areas of willow/mulefat scrub wetland. Algae and other forms of plankton are seasonally dominant.

Marine and Coastal Habitat. Habitats in this category include tidal mud flats and marine open-water subtidal areas.

[46] County of Orange. 1996. *Natural Community Conservation Plan & Habitat Conservation Plan*, County of Orange, Central & Coastal Subregion, Parts I & II: NCCP/HCP. Prepared for County of Orange Environmental Management Agency by R.J. Meaded Consulting, Inc., July 17, 1996.

Riparian Habitat. Riparian areas are defined as narrow ecotones that typically exist between the bankfull channel of alluvial streams and adjacent uplands. These systems are characterized by two distinct zones, although either may be absent under certain conditions. One zone is the portion of the riparian corridor that is flooded by a river or stream at least every 5 or 10 years. The other zone consists of abandoned floodplains or terraces that are now flooded only episodically during larger precipitation events.

2.8.4 Wildlife

The mountainous zone, coastal foothills, and the central flats of the Region provide a tremendous diversity of habitat types distinguished by their microclimate, slope aspect, and soil type. These habitats provide nesting, breeding, and foraging habitat for hundreds of wildlife species. Native species include large resident predators such as the mountain lion *(Felis concolor californica)* as well as migratory birds and waterfowl such as the southwestern willow flycatcher that spends only a part of the year along willow-dominated riparian corridors (USACE 2001c). A total of 20 federal- and state-listed endangered and threatened wildlife species have been identified as historically, currently, or potentially occurring within the County of Orange area, with six species currently within the Region. Of the 20 listed species previously observed in the area, four species can survive only in riparian ecosystems: California least tern (*Sterna antillarum browni*), southwestern willow flycatcher (*Empidonax trailli extimus*), least Bell's vireo (*Vireo bellii*), and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) and two species are not associated with riparian ecosystems (coastal California gnatcatcher and Riverside fairy shrimp). Two endangered species, the light-footed clapper rail (*Rallus longirostris obsoletus*) and the California least tern have been observed in Upper Newport Bay.

2.9 Climate Change Impacts on the Region

Climate change is a shift in the average weather that a given region experiences. This is quantified by changes in climate variables such as average temperature, average precipitation, wind patterns, and changes in extremes in temperature and precipitation. Although the Earth's climate is always changing, the current climate change occurring today differs from previous climate changes in both its rate and its magnitude.

Climate change is affecting California in many ways several of which impact our water resources: sea levels are rising, snowpack is decreasing, and water temperatures are increasing. In the future, droughts are expected to become more frequent and more severe, and storm intensities are expected to increase. These changes affect our ability to meet crucial water management objectives such as ensuring reliable water supply and quality, managing floods, and protecting ecosystem functions and critical habitats. Integrated regional water planning is an excellent framework for addressing water-related climate impacts, as it provides a process for

stakeholders with varied water-related priorities to work together to develop solutions that satisfy all water uses and needs. Because climate change impacts so many aspects of water resources, this process is ideal for addressing adaptation to climate change and for developing measures to help mitigate future climate change.

Planning for climate change can be viewed as a process of assessing risks, evaluating and selecting strategies that appear most effective based on current knowledge, and monitoring conditions and updating strategies as knowledge improves. The *Climate Change Handbook for Regional Water Planning* (US EPA Region 9 and CA DWR, November 2011) outlines a process for accomplishing this in the context of regional water management. Many of the potential and observed impacts from climate change on water resources are depicted in **Figure 2-26**.

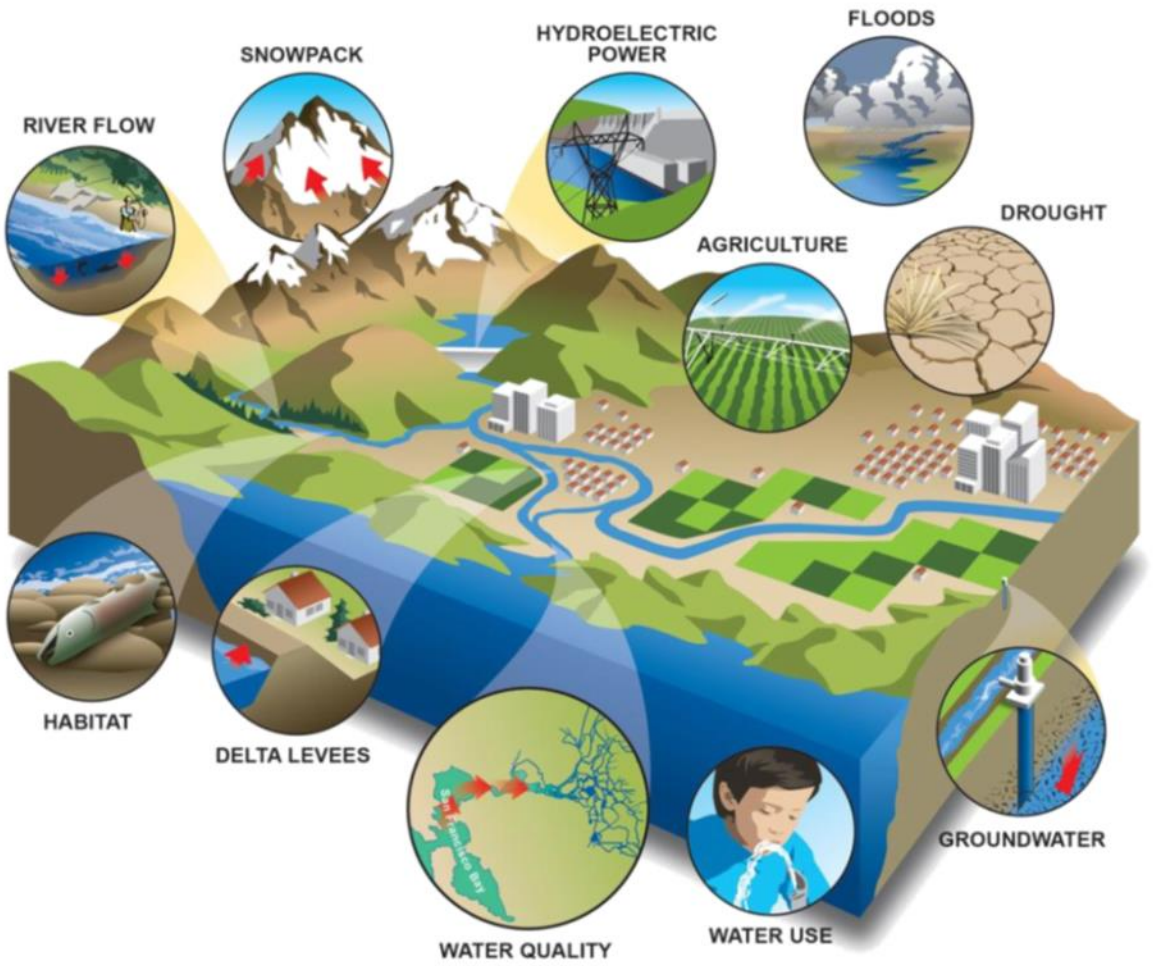


Figure 2-26: Potential and Observed Climate Change Impacts on Water Resources in California
Source: https://www.water.ca.gov/Programs/All-Programs/Climate-Change-Program

Understanding climate change impacts in the Region allows regional water management planners to assess risks, and informs decisions concerning future actions. A climate change impact assessment may indicate that immediate action is required even though analysis indicates that those threats may not become critical for several years. Using the results of the assessment, resource management strategies can be prioritized.

Adapting to climate change impacts is an ongoing process and being responsive over time is critical to addressing to climate change. This includes improving information accessibility and monitoring systems and working together across institutional and social boundaries to leverage resources from diverse sources (National Academy of Sciences[47]).

The IRWM stakeholders are aware of the detriment and cost that inaction on climate change may have on the Region. Snowmelt, either from the Sierra Nevada or the Rockies, is a major component of the imported water supplies in the IRWM planning region. A large fraction of the precipitation in western mountain regions falls on days with temperatures just a few degrees below freezing (Bales et al., 2008[48]). Thus, warming by even a few degrees might result in a large shift from snowfall to rainfall, a result of great consequence to the Western U.S. and California, where snowpack represents a significant component of water storage during the year. In addition to the shift in storage, there may be impacts caused by the change in the total quantity of precipitation, and in length and severity of droughts across the large region that supplies water to Orange County. A warming California climate would also foster more large brush and forest fires, especially with the extreme tree mortality from the recent 2012-2015 drought. Continuing increases in global GHG emissions at current rates would result, by late in the century, in sea level rising by more than four feet, and a greater incidence of heat wave days. These impacts will translate into real costs for California, including flood damage and flood control costs that could amount to several billion dollars in many regions. Water supply costs due to scarcity and increased operating costs would also increase.

This following presents a high-level summary of the effects of climate change in the Region and ongoing adaptation efforts in the context of water supply, which is inherently a statewide issue given the inter-basin transfers of water that occur through the southwest. A summary of other system impacts is also discussed and derived from the vulnerability assessment presented in **Table 2-12**. Based on the following summarized information, it is thought that climate adaptation through increased water use efficiency and conservation will play a key role in the selection of future IRWM projects. Further, as understanding of the nature and impacts of climate change, especially in the North and Central OC IRWM Region improves with time, this information will be incorporated in future versions of the IRWM plan.

[47] http://nas-sites.org/americasclimatechoices/
[48] https://journals.ametsoc.org/doi/full/10.1175/2009JCLI2470.1

Specifically, changes in hydrological conditions due to climate change most likely to affect The OC Plan's water planning, include:[49]

1. ***Sea Level Rise.*** Water supply effects of sea level rise, via salt water intrusion, are also likely in the coastal aquifers. Sea level rise could increase coastal erosion and impact coastal infrastructure and ecological resources such as estuaries and tidal wetlands. Sea level rise has implications not only for coastal areas but also for the management of the Sacramento-San Joaquin Delta. Refer to **Section 3.8** for further information on potential climate change impacts.
2. ***Warmer Temperatures Changing Mountain Snowpack Runoff.*** Rising average temperatures throughout California will ultimately reduce the amount of mountain snowpack as more precipitation will fall as rain, instead of snow, and warmer weather will cause more snowpack to melt earlier in the year. Refer to **Section 3.8** for further information on impacts of warmer temperatures on snowpack runoff.
3. ***Changes in Precipitation and Temperature Affecting Average Runoff Volume***. The effects of climate change on annual precipitation and runoff are less clear, but of great potential importance. The existing amount of surface storage on most major streams and water storage reservoir in Southern California provides some capacity to accommodate shifts in inflows for most years. However, any reduction of annual runoff volumes due to declines in precipitation or increase in evapotranspiration (ET) in reservoirs or the broader watersheds would directly reduce water supplies.
4. ***Changes in Drought Persistence.*** Droughts differ from typical emergency events such as floods or forest fires, in that they occur slowly over a multiyear period. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline. Droughts in the western United States are often persistent, and the recent period (2012-2016) constituted one the most severe droughts over the past millennium. Although the change in precipitation that led to the recent drought was not tied to climate change, the slightly warmer temperatures resulted in higher ET from the landscape and increased the severity of the drought. For example, water year 2015 was the warmest on record for California and one of the lowest annual rainfall quantities recorded. North and Central OC's reliance on imported water from throughout the state makes drought awareness a high concern.
5. ***Higher Water Temperatures in Streams and Reservoirs.*** Higher temperatures overall will increase water temperatures throughout the system, including inflows into reservoirs, water stored within reservoirs, and water flowing downstream. Such increases will significantly affect ecosystem uses of the water system. Most species have evolved to

[49] Adapting California's Water Management to Climate Change, November 2008, as found in California Water Plan Update 2009, Volume 4 Reference Guide.

survive within a specific temperature range. Increased water temperature can also reduce the amount of dissolved oxygen that it holds, affecting aquatic organisms. Because of warmer temperatures in streams, water quality standards related to aquatic life may require greater reservoir outflows.

6. ***Potential Increase in Water Demands for Landscape Use Due to Higher Temperatures.*** Higher temperatures, and associated higher ET rates, are likely to also change water demands throughout the state, although this will likely be limited by available supplies, an important issue as landscape irrigation accounts for half or more of residential water use in Southern California.
7. ***Increased Flood Flows and Flood Frequencies.*** Increased intensity and frequency of major storms, another anticipated effect of climate change, would further augment flood problems in Southern California. With continued increases in floodplain urbanization and the associated increase in damage potential, flooding costs from climate change could exceed those of water supply. The effects of changes in flood flows on ecosystems are less well studied but could be significant. An indirect effect of larger floods and storms could be the effect on levees in the Sacramento-San Joaquin Delta, with significant adverse effects of water quality through salinity intrusion that limits water exports for an extended time frame, impacting the supplemental water to North and Central OC.
8. ***Damage to Trees and Increased Risk of Wildfire and Erosion.*** The recent drought, coupled with other accessories such as pests, has significantly affected the health of forests in California, which constitute the most important watersheds throughout the state. Recent analysis of aerial imagery has shown that nearly 100 million trees may be facing mortality in the recent drought.[50] The presence of these dead trees has the potential to significantly enhance wildfire risk in the near term and increase the risk of erosion and adverse water quality over the slightly longer term. To the degree that the recent drought is indicative of future drier and warmer conditions, it may be a significant threat to California's forests as well as its water supply. Additionally, we have seen in the recent wildfires, the ability for these fires to spread to urban areas and create tremendous damage to neighborhoods, resulting in impacts on water supply.

Climate Change Vulnerability Assessment. CWC §10541(e)(10), states that IRWM plans must include an evaluation of the adaptability to climate change of water management systems in the Region. A vulnerability assessment for the Region was prepared **(Table 2-11)** prioritizing climate change issues in the Region. This assessment allowed the Region to assess its water resource sensitivity to climate change, prioritize climate change vulnerabilities, and ultimately guides decisions as to what strategies and projects would most effectively adapt to and mitigate against climate change.

[50] http://www.fs.fed.us/news/releases/new-aerial-survey-identifies-more-100-million-dead-trees-california

A series of questions from DWR's 2011 *Climate Change Handbook for Regional Water Planning,* shown in **Table 2-11***,* were used as a basis for determination of climate change vulnerabilities relevant to the Region. Also shown in **Table 2-11** are the priority level to the Region using the scale of low, medium or high.

Table 2-11
Climate Change Vulnerability Assessment: Prioritized Issues in the Region

Vulnerability Issue	Description	Priority Level
Imported supply would decrease	Imported water makes up at least 25% of the Region's supplies. The vulnerability of SWP and CRA supplies combined with the area's dependence on imported water makes the Region highly vulnerable to any decreases in imported supply.	High
Local supply would decrease	Decreases in local precipitation would decrease the local runoff to recharge groundwater (both naturally and through managed spreading grounds), reducing the amount of local groundwater supply available to meet demand.	High
Demand for all sectors would increase	Demand is expected to increase in the Region due to population growth. Climate change is expected to further increase demand due to higher temperatures increasing evapotranspiration and put strain on the Region's limited supplies.	High
Episodes of flooding would increase	Increases in the intensity of storms may increase the frequency of flooding as storms exceed the capacity of flood control facilities.	High
Ability to store groundwater/ recharge capacity would decrease	Reductions in imported water supply and local surface water may intensify groundwater use. This increased groundwater use may result in a reduction of the volume of groundwater that could be produced from the groundwater basin in times of drought. In addition, reductions in local surface water flows will reduce the supply available for recharge. Together these concerns make this issue of medium concern to the Region.	Medium
Higher drought potential (unmet demands)	The frequency, duration, and intensity of droughts are expected to increase with climate change and reduce both the local and imported supplies available. A reduction in either imported or local supplies has the potential to cause unmet demand should demand reduction measures not be sufficient, making the Region moderately vulnerable to this issue.	Medium
Assimilative capacity of water bodies would decrease	During general drought conditions, natural inflow is not available to maintain or improve assimilative capacity of groundwater basins. Reduced precipitation could further reduce natural inflow,	Medium

Table 2-11
Climate Change Vulnerability Assessment: Prioritized Issues in the Region

Vulnerability Issue	Description	Priority Level
	and further reduce assimilative capacity. Given that the Region is using imported water for groundwater recharge, this issue is of medium concern to the Region.	
Erosion and sedimentation would increase	Increases in the intensity of storms could increase erosion and sedimentation, which both impact water quality and increase flood risk. This may be exacerbated with increases in wildfires. As the Region has issues with erosion and sedimentation, this vulnerability issue has been prioritized as medium.	Medium
Constituent of concern concentrations would increase	Decreases in local surface water flows caused by reduced precipitation may reduce the volume of water available to dilute constituents of concern. As surface water quality is of concern to the Region to maintain local supply, this issue is of low concern to the Region.	Low
Invasive species would increase	A reduction in local water supply available to support native species may impact these species ability to compete with invasive species. Though this is an issue of concern to the Region, it's considered a low priority at this time in comparison to other issues.	Low
Available necessary habitat would decrease	Habitat for a few threatened or endangered species exists in the Region (i.e. coastal sage scrub, grasslands, riparian, coastal California gnatcatcher, coastal cactus wren, and orange-throated whiptail)[51] Changes in temperature and water available may cause shifts in the location and quality of habitat necessary for these species. Given that habitat has been designated for species in the Region, this vulnerability issue has been designated to be of low priority.	Low
Impacts to water dependent species would increase	Reduced surface water flows and increased water temperatures can negatively impact aquatic species. Though water dependent species are not currently experiencing issues, this is still an issue of concern for the Region.	Low

[51] https://www.fws.gov/carlsbad/HCPs/FAQ%20Orange%20County%20Central%20Coastal%20NCCP%20and%20HCPsjw.pdf

Estimating the impacts and effects of climate change at a regional level is challenging due to the coarse spatial scale of models that project climate change impacts of temperature and rainfall, and due to the long timescale evaluated in many models (to the year 2100). Recently, state entities have been working to downscale climate models to allow for climate change planning at a level that can be useful for planning efforts. The timescale used for these models has also been downscaled to provide outputs for the year 2050, and though this is still a longer timescale than is used in IRWM planning, it is still useful for assessing climate change.

To incorporate climate change into water resources management, downscaled temperature and precipitation projections are input into hydrologic and other models to project impacts to water supply, water demand, snow pack, sea level rise, and wildfires. The results of these models have been summarized in a variety of studies and planning documents at the state and regional levels. A number of these documents were reviewed to determine which best represented the impacts for the Region. These documents include:

- *Climate Change Analysis for the Santa Ana River Watershed,* Santa Ana Watershed Basin Study, Lower Colorado Region, Technical Memorandum 86-68210-2013-02, August 2013
- *OWOW 2.0 Plan Chapter 5.13 Energy and Environmental Impact Response*, Appendix F1 SARW FAQS Regarding Climate Change and Appendix F2 Climate Change Analysis for the Santa Ana River Watershed, Santa Ana Watershed Basin Study, California, Lower Colorado Region
- *Cal-Adapt* website managed by the California Energy Commission (accessed October 2017)[52]
- *Colorado River Basin Supply and Demand Study* by U.S. Bureau of Reclamation (USBR) (2012)[53]
- *California Adaptation Planning Guide* by the California Emergency Management Agency and the California Natural Resources Agency (2012)[54]
- *Climate Change Handbook for Regional Water Planning* by US EPA Region 9 and CA DWR, (November 2011)[55]
- *DWR Climate Change Action Plan*[56]
- *Using Future Climate Projections to Support Water Resources Decision Making in California* by the California Climate Change Center (2009)[57]
- *Potential Effects of Sea Level Rise on Coastal Groundwater Conditions and Seawater Intrusion* by Tim Sovich and Li Li (February 2013)

[52] http://cal-adapt.org/tools/
[53] https://www.usbr.gov/lc/region/programs/crbstudy/finalreport/index.html and https://www.usbr.gov/watersmart//bsp/docs/finalreport/ColoradoRiver/CRBS_Executive_Summary_FINAL.pdf
[54] http://resources.ca.gov/docs/climate/01APG_Planning_for_Adaptive_Communities.pdf
[55] http://www.water.ca.gov/climatechange/docs/Climate_Change_Handbook_Regional_Water_Planning.pdf
[56] http://www.water.ca.gov/climatechange/CAP.cfm
[57] http://www.energy.ca.gov/2009publications/CEC-500-2009-052/CEC-500-2009-052-D.PDF

GHG Emissions. In addition to being affected by climate change the water sector is a contributor to the greenhouse gas emissions that are a cause of climate change. The emissions arise from energy used in the transport of water through the SWP, in the treatment of municipal supply and in the treatment of wastewater. Therefore, any effort or specific IRWM projects that lead to reduced water imports and/or reduced water use and disposal will also have a greenhouse gas reduction, or climate mitigation benefit.

The relationship between water and energy is complex. Approximately one-fifth of California's electricity is generated by hydropower, while approximately one-fifth of the state's electricity and 30 percent of the state's non-power plant natural gas[58] is used for conveyance, treatment, distribution, and end use of water (Climate Action Team [CAT] 2008). Therefore, increases in water use efficiency can translate into energy use reduction and reductions in GHG emissions. Consideration of energy and water use as part of project evaluation is critical to reducing GHG emissions. Each molecule of CO2 emitted to the atmosphere will enhance global warming for approximately a century (Intergovernmental Panel on Climate Change (IPCC) 2003); therefore, efforts to reduce GHG emissions to the atmosphere will reduce future impacts of climate change and are referred to as climate change mitigation.[59]

Selection between alternative projects designed to address the same objective may yield significantly different GHG emissions. GHG emissions for water projects can also be reduced in several ways, including reduction in water use, efficient design of facilities, energy efficiency for operations, and incorporation of renewable energy.

Although statewide efforts to address climate change are in progress, it is understood that local governments and agencies within the Region play an essential role in fulfilling California's emissions reduction targets and in reducing the local effects of climate change in the Region. Local governments have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Land-use planning and urban growth decisions are also areas where successful implementation of climate change strategies relies on local government. Local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth and the changing needs of their jurisdictions.

[58] Non-power plant natural gas is natural gas that is not used to generate electricity but is used to provide directly used energy; for example, to heat boilers and water heaters.
[59] *Climate Change Handbook for Regional Water Planning* by US EPA Region 9 and CA DWR, November 2011

Relationship of Climate Change Analysis to IRWM Plan Standards. The IRWM climate change standard requirements and the information provided in The OC Plan are identified in **Table 2-12** for each major area of assessment.

Table 2-12
IRWM Plan Standards: Climate Change

IRWM 2016 Guidelines Requirement	Location in The OC Plan
Regional Vulnerabilities: A discussion of the potential effect of climate change on the IRWM region, including an evaluation of the IRWM region's vulnerabilities to the effects of climate change and potential adaptation responses to those vulnerabilities. The evaluation of vulnerabilities must, at a minimum, be equivalent to the vulnerability assessment contained in the *Climate Change Handbook for Regional Water Planning* (DWR, 2011).	Section 2.9 Climate Change Impacts on Region, and Table 2-11
GHG Emissions: A process that discloses and considers GHG emissions when choosing between project alternatives and mitigation strategy.	Section 5 Projects
Vulnerability Assessment: A list of prioritized vulnerabilities based on the vulnerability assessment and the IRWM's decision making process.	Table 2-11
Future Evaluation: A plan, program, or methodology for further data gathering and analysis of the prioritized vulnerabilities.	Chapter 4 Regional Water Management and Chapter 6 Implementation

Table 2-13 summarizes the impacts and effects of climate change on the Region by 2050 and 2100, which are typically based on an average of various climate change analyses. Generally, climate change is expected to increase temperature in the Region and increase the number of heat wave days by three to five days per year. Rainfall projections vary with some projections showing that the Region will increase slightly in the long term. It is generally accepted that storms will be less frequent, but more intense, which will impact the ability of the Region to capture stormwater for water supply, degrade surface water quality, or increase flood risk. With higher temperatures and changes in rainfall volume and frequency both in the Region and across the state, additional impacts will be felt in the Region.

Table 2-13
Projected Effects of Climate Change on the Region by 2050 and 2100

Impact To	Effect
Temperature	***Scenario 1: Emissions Peak 2040, then decline*** • Average Annual Maximum temperature: Observed annual mean 73.8°F increased approximately 3°F between 2020 and 2050 • Average Annual Minimum temperature: Observed annual mean 50.4°F increased to 52.9°F between 2020 and 2050 ***Scenario 2: Emission continue to rise strongly through 2050 and plateau around 2100:*** • Average Annual Maximum temperature: Observed annual mean 73.8°F increased approximately 6°Fto 79.5°F between 2020 and 2100 • Average Annual Minimum temperature: Observed annual mean 50.4°F increased to 55.7°F between 2020 and 2100
Precipitation	***Scenario 1: Emissions Peak 2040, then decline*** • Average Annual Mean: Observed 14.5" increasing to 15.0" between 2020 and 2050 ***Scenario 2: Emissions continue to rise strongly through 2050 and plateau around 2100:*** • Average Annual Mean: Observed 14.5" increasing to 15.0" between 2020 and 2100
Supplies	• Decrease in imported and local water supply expected, but not quantified
Demands	• Increase expected but not quantified
Wildfires	• Same to slight increase in wildfire risk

Source: For temperature and precipitation www.Cal-Adapt.org/tools for Orange County, CA (accessed October 2017)

Imported water supplies from the SWP and the Colorado River supplies to the lower basin states (Arizona, California, and Nevada) are projected to decrease. It can be assumed, that decreases in local rainfall will also decrease the local supply available to the Region, though hydrologic modeling has not been done to quantify potential local supply changes. In the future the Region may explore hydrologic modeling to better understand the impacts climate change could have on local water supplies.

Increases in temperature and a drier climate are also expected to increase agricultural and urban water demand, particularly for irrigation, due to increases in ET rates. As with local supply, hydrologic modeling has not been done to quantify potential demand changes.

The changes to climate are also expected to increase the frequency of wildfires, with studies suggesting a slightly increased risk of wildfire in the Region. Increases in wildfires have the potential to increase sedimentation and turbidity of surface waters and increase flash flooding.

Understanding projected climate change impacts and effects on the Region will help to identify in what ways water resources in the Region are most vulnerable to climate change. Chapter 3

includes such an analysis of the Region's vulnerabilities to climate change as well as the corresponding regional goals and objectives for both adapting to and mitigating against climate change impacts. Chapter 4 also provides strategies identified by the Region to help meet these climate change-related objectives and address regional vulnerabilities.

While the majority, if not all, of the RMS already listed in Chapter 4 will help to also adapt to climate change, the Region identified additional strategies that would specifically mitigate against climate change through a reduction in energy consumption and GHGs. These include:

- **Optimize sanitary sewer systems:** Optimizing sanitary sewer systems will reduce energy used to treat wastewater as well as increase the volume of recycled water available and help to both adapt to climate change by increasing supplies available to the Region and mitigate against climate change by reducing emissions.
- **Improve efficiency of drinking water treatment and distribution systems:** Improving the efficiency of treatment and distribution systems will reduce the energy used to treat and distribute drinking water as well as reduce in-system water losses, helping to both adapt to and mitigate against climate change.
- **Develop an inventory of emissions from water and wastewater systems:** Developing an inventory of emissions generated by water and wastewater systems will allow the Region to better understand its carbon footprint and set targets for reducing emissions and mitigate against climate change.
- **Increase the use of renewable energy sources:** Increasing the use of renewable energy sources for powering water and wastewater treatment and distribution systems will reduce the Region's carbon footprint and help to mitigate against climate change.

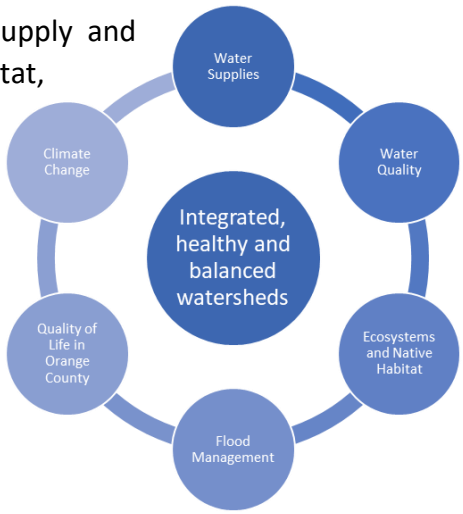
SECTION 3. GOALS, OBJECTIVES AND STRATEGIES

3.1 Regional Vision, Mission and Goals

The OC Plan focuses on the North OC WMA and the Central OC WMA as the IRWM Region. The OC Plan builds upon projects and plans of the agencies within the Region, with an overarching area of emphasis on water resources, balanced environmental sustainability, and collaboration.

The Vision, Mission, Goals, and Objectives for the North and Central OC IRWM Region are:

- **Vision:** Integrated, healthy and balanced watersheds.
- **Mission:** To improve water quality, increase water supply and reliability, balance flood management, safeguard habitat, protect natural resources, and collaborate to ensure healthy watersheds now and for generations.



- **Goals:**
  1. Provide Adequate and Reliable Water Supplies
  2. Protect and Enhance Water Quality
  3. Restore Ecosystems and Improve Native Habitat
  4. Integrate Flood Management
  5. Improve the Quality of Life in Orange County
  6. Address Climate Change
- **Objective Focus Areas:** Water Supply Management; Improve Water Quality; Ecosystem and Habitat Restoration; Flood Risk Management; Distribution of Benefits to Disadvantaged Communities (DAC) and Tribal Communities; Open Space Management and Access, and Recreational Opportunities; Public Education; and Energy Efficiency, Carbon Sequestration, and Climate Change.

The vision of The OC Plan for IRWM is to identify the highest priority issues related to water resources in the North and Central OC IRWM Region and to articulate an agreed-upon set of goals and strategies to maintain holistic, healthy and balanced watersheds. Clear goals and objectives will lead to a list of preferred strategies that guide the stakeholders to develop and promote projects aligned with these goals and objectives.

A *goal* is defined as the desired result. An *objective* is defined as an attainable achievement that helps accomplish a goal. A *strategy* is defined as an action to be taken that will help accomplish an objective or objectives and the overall goal(s).

The OC Plan is a living document that will continue to be updated as appropriate. As the objectives are accomplished or the goals of the IRWM Plan are collectively discussed and modified, the IRWM Plan will be revised accordingly.

3.2 Methodology for Determining Goals and Objectives

Goals and objectives were the focus of an initial stakeholder workshop on February 21, 2017. The stakeholders reviewed the goals and objectives from the existing North and Central OC IRWM Plans and the ranking methodology used for those plans. They then considered current conditions within the WMAs and overarching goals applicable to the region from such sources as the Orange County Water Reliability Study (2016), Central OC WMA Executive Action Plan (2016), OCWD Groundwater Management Plan 2015 Update, Basin 8-1 Alternative (2017)[1], Santa Ana Region Basin Plan, local land use plans, and various statewide plans. The stakeholders then discussed the importance and appropriateness of the objectives for the combined North and Central OC IRWM Plan.

A Stakeholder Ad Hoc Committee was formed to further develop the goals, objectives and strategies to bring back to the full stakeholder group. The Ad Hoc Committee's seven participants represented five groups throughout the Region: cities, wholesale water agency, groundwater management agency, the County of Orange, and a nonprofit agency. The Ad Hoc Committee met nine times between March and June 2017.

The Ad Hoc Committee confirmed six overarching goals for the North and Central OC IRWM Region: 1) Provide Adequate and Reliable Water Supplies; 2) Protect and Enhance Water Quality; 3) Restore Ecosystems and Improve Native Habitat; 4) Integrate Flood Management; 5) Improve the Quality of Life in Orange County; and 6) Address Climate Change.

Objectives were then reviewed, classified, and refined based on the goals and further refined in the focus areas of: Water Supply Management; Improve Water Quality; Ecosystem and Habitat Restoration; Flood Risk Management; Distribution of Benefits to DAC and Tribal Communities; Open Space Management and Access, and Recreational Opportunities; Public Education; and Energy Efficiency, Carbon Sequestration, and Climate Change. Where practical, goals and timelines were developed, and numeric objectives were established.

[1] An alternative groundwater plan for the Coastal Plain of the Orange County Groundwater Basin to the Sustainable Groundwater Management Act required Groundwater Sustainability Plan.

The goals, objectives, and strategies were approved by the RWMG, which directed that they be presented to the stakeholders for discussion and approval. A June 27, 2017 Stakeholder meeting was held and the goals, objectives and strategies were discussed and approved.

The objectives are instrumental in the project prioritization process as projects are presented by project proponents for inclusion in the IRWM Plan and subsequently for funding opportunities. Projects will be prioritized in accordance with the likelihood the project or program will achieve IRWM Plan objectives.

Statewide Priorities

The California Department of Water Resources has identified Statewide Priorities, **Table 3-1,** based on the California Water Action Plan 2016 Update, issued by the California Natural Resources Agency, California Department of Food and Agriculture, and the California EPA (January 2016).

Table 3-1: Statewide Priorities

	Action	Description
1.	Make Conservation a California Way of Life	▪ Building on current water conservation efforts and promoting the innovation of new systems for increased water conservation. ▪ Expand agricultural and urban water conservation and efficiency to exceed SB- X7-7 targets ▪ Provide funding for conservation and efficiency ▪ Increase water sector energy efficiency and GHG reduction capacity ▪ Promote local urban conservation ordinances and programs
2.	Increase Regional Self- Reliance and Integrated Water Management Across All Levels of Government	▪ Ensure water security at the local level, where individual government efforts integrate into one combined regional commitment where the sum becomes greater than any single piece. ▪ Support and expand funding for Integrated Water Management planning and projects ▪ Improve land use and water alignment ▪ Legislation for local and regional self-reliance ▪ Provide assistance to DACs ▪ Demonstrate State leadership ▪ Encourage State focus on projects with multiple benefits ▪ Increase the use of recycled water ▪ Streamline permitting for local water reuse or enhancement projects
3.	Achieve the Co-Equal goals for the Delta	▪ This action is directed towards State and federal agencies; however, consideration will be afforded to eligible local or regional projects that also support achieving the co-equal goals providing a more reliable water supply for California and to protect, restore, and enhance the Delta ecosystem.

Table 3-1: Statewide Priorities

	Action	Description
4.	Protect and Restore Important Ecosystems	▪ Continue protecting and restoring the resiliency of our ecosystems to support fish and wildlife populations, improve water quality, and restore natural system functions. ▪ Restore key mountain meadow habitat ▪ Manage headwaters for multiple benefits ▪ Bring back salmon to the San Joaquin River ▪ Protect key habitat of the Salton Sea through local partnership ▪ Restore coastal watersheds ▪ Continue restoration efforts in the Lake Tahoe Basin ▪ Continue restoration efforts in the Klamath Basin ▪ Water for wetlands and waterfowl ▪ Eliminate barriers to fish migration ▪ Assess fish passage at large dams ▪ Enhance water flows in stream systems statewide ▪ Achieve ecological goals through integrated regulatory and voluntary efforts
5.	Manage and Prepare for Dry Periods	▪ Effectively manage water resources through all hydrologic conditions to reduce impacts of shortages and lessen costs of state response actions. Secure more reliable water supplies and consequently improve drought preparedness and make California's water system more resilient. ▪ Revise operations to respond to extreme conditions ▪ Promote safe and effective water transfers ▪ Improve enforcement of the water right priority system ▪ Encourage healthy soils
6.	Expand Water Storage Capacity and Improve Groundwater Management	▪ Increase water storage for widespread public and environmental benefits, especially in increasingly dry years and better manage our groundwater to reduce declines in groundwater levels. ▪ Provide essential data to enable Sustainable Groundwater Management ▪ Support funding partnerships for storage projects ▪ Update Bulletin 118, California's Groundwater Plan ▪ Improve sustainable groundwater management ▪ Support distributed groundwater storage ▪ Increase statewide groundwater recharge ▪ Accelerate clean-up of contaminated groundwater and prevent future contamination
7.	Provide Safe Water to All Communities	▪ Provide all Californians the right to safe, clean, affordable and accessible water adequate for human consumption, cooking, and sanitary purposes. ▪ Consolidate water quality programs ▪ Provide funding assistance for vulnerable communities ▪ Manage the supply status of community water systems ▪ Additionally, as required by Water Code §10545, in areas that have nitrate, arsenic, perchlorate, or hexavalent chromium contamination, consideration will be given to grant proposals that included projects that help address the impacts caused by nitrate, arsenic, perchlorate, or hexavalent chromium contamination, including projects that provide safe drinking water to small DAC.

Table 3-1: Statewide Priorities

	Action	Description
8.	Increase Flood Protection	▪ Collaboratively plan for integrated flood and water management systems, and implement flood projects that protect public safety, increase water supply reliability, conserve farmlands, and restore ecosystems. ▪ Streamline and consolidate permitting ▪ Create a Delta Levee Assessment District ▪ Improve access to emergency funds ▪ Better coordinate flood response operations ▪ Prioritize funding to reduce flood risk and improve flood response ▪ Identify State funding priorities for Delta levees ▪ Encourage flood projects that plan for climate change and achieve multiple benefits
9.	Increase Operational and Regulatory Efficiency	▪ This action is directed towards State and federal agencies; however, consideration will be afforded to eligible local or regional projects that also support increased operational of the State Water Project or Central Valley Project.
10.	Identify Sustainable and Integrated Financing Opportunities	▪ This action is directed towards State agencies and the legislature.

Source: Statewide Water Action Plan 2016 Update; resources.ca.gov/california_water_action_plan/

Efforts to meet statewide priorities and improve water supply and water quality conditions have been ongoing in the Region for many years and have advanced as new technologies and resources have become available. The Ad Hoc Committee reviewed the statewide priorities for relevance to the Region. **Table 3-2** shows the statewide priorities applicable to the North and Central WMAs and identifies the statewide priorities that are applicable to the IRWM Plan Goals. The projects included on The OC Plan project list in **Appendix F** support those applicable to the Region.

The Resource Management Strategies (RMSs) as identified in the California Water Plan (CWP) Update 2013 were evaluated by the Ad Hoc Committee and the RWMG for applicability to the Region. An RMS, as defined in the CWP Update 2013, is a technique, program, or policy that helps local agencies and governments manage their water and related resources, in support of the Statewide Priorities.

Table 3-2: Statewide Priorities Relevant to North and Central OC IRWM Region

Statewide Priorities California Water Action Plan 2016 Update	North and Central OC IRWM Plan Goals					
	(1) Provide Adequate and Reliable Water Supplies	(2) Protect and Enhance Water Quality	(3) Restore Ecosystems and Improve Native Habitat	(4) Integrate Flood Management	(5) Improve the Quality of Life in Orange County	(6) Address Climate Change
(1) Make Conservation a Way of Life						
a. Expand Agriculture & Urban Water Conservation and Efficiency to Exceed SB7-7 Targets	√					
b. Increase Water Sector Energy Efficiency and Greenhouse Gas Reduction Capacity	√				√	√
c. Promote Local Urban Conservation Ordinances and Programs (Model Water Efficient Landscape Ordinance -July 2015)	√	√				
(2) Increase Regional Self-Reliance and Integrated Water Management Across All Levels of Government						
a. Encourage State Focus on Projects with Multiple Benefits that Promote IRWM	√	√	√	√	√	
b. Increase the Use of Recycled Water	√					√
(3) Achieve the Co-Equal Goals of the Delta*						
(4) Protect and Restore Important Ecosystems						
a. Restore Coastal Watersheds		√	√			
(5) Manage and Prepare for Dry Periods	√		√	√		√
(6) Expand Water Storage Capacity and Improve Groundwater Management						
a. Provide Essential Data to Enable Sustainable Groundwater Management	√	√	√			
b. Improve Sustainable Groundwater Management	√	√	√		√	√
c. Increase Statewide Groundwater Recharge	√		√			
(7) Provide Safe Drinking Water for All Communities	√	√	√		√	
(8) Increase Flood Protection				√	√	
(9) Increase Operational and Regulatory Efficiency	√	√				
(10) Identify Sustainable and Integrated Financing Opportunities	√					

* This action is directed towards state and federal agencies.

A key objective of the CWP Update 2013 is to present a diverse set of RMSs to meet the water-related resource management needs of each IRWM region across the state. The primary objective and emphasis of each strategy is discussed along with identification of interdependencies among many of the strategies. The RMSs addressed by The OC Plan are shown in **Table 3-3** and detailed in Section 4**.** Details of the Objectives and implementation Strategies to meet the Objectives and support the RMS are discussed in Section 3.5 and in Section 4.

Table 3-3: Statewide Resource Management Strategies Relevant to North and Central OC IRWM Region

2013 California Water Plan Resource Management Strategies	North and Central OC IRWM Plan Objectives														
	1 - Water Supplies		2 - Water Quality		3 - Ecosystems and Habitat		4 - Flood Management		5- Quality of Life			6 - Address Climate Change			Not Applicable to Region
Management Objectives - RMS	WS-1	WS-2	WQ-1	WQ-2	ECO-1	ECO-2	FM-1	FM- 2	QL-1	QL-2	QL-3	ACC-1	ACC-2	ACC-3	
Reduce Water Demand															
Agricultural Water Use Efficiency	√	√	√	√							√		√	√	
Urban Water Use Efficiency	√	√	√	√					√		√		√	√	
Improve Flood Management															
Flood Management	√	√	√	√	√	√	√	√	√	√	√		√	√	
Improve Operational Efficiency and Transfers															
Conveyance – Delta															√
Conveyance – Regional/Local	√	√	√	√			√	√	√			√	√	√	
System Reoperation	√	√						√				√	√	√	
Water Transfers	√	√										√	√	√	
Increase Water Supply															
Conjunctive Management and Groundwater Storage	√	√	√	√							√	√	√	√	
Desalination (Brackish and Seawater)	√	√										√	√	√	
Precipitation Enhancement															√

Table 3-3: Statewide Resource Management Strategies Relevant to North and Central OC IRWM Region

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	1 - Water Supplies		2 - Water Quality		3 - Ecosystems and Habitat		4 - Flood Management		5- Quality of Life			6 - Address Climate Change			Not Applicable to Region
Management Objectives - RMS	WS-1	WS-2	WQ-1	WQ-2	ECO-1	ECO-2	FM-1	FM- 2	QL-1	QL-2	QL-3	ACC-1	ACC-2	ACC-3	
Municipal Recycled Water	√	√	√	√					√		√	√	√	√	
Surface Storage – CALFED/State															√
Surface Storage – Regional/Local	√	√	√	√			√	√	√			√	√	√	
Improve Water Quality															
Drinking Water Treatment and Distribution	√	√	√	√					√		√	√	√	√	
Groundwater/Aquifer Remediation	√	√	√	√										√	
Matching Water Quality to Use	√	√	√	√	√	√		√	√		√		√	√	
Pollution Prevention	√	√	√	√	√	√		√	√	√	√	√	√	√	
Salt and Salinity Management	√	√	√	√	√				√		√		√	√	
Urban Stormwater Runoff Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Practice Resources Stewardship															
Agricultural Lands Stewardship			√	√	√	√			√	√	√	√	√	√	
Ecosystem Restoration	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Forest Management															√
Land Use Planning and Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Recharge Areas Protection	√	√	√	√	√	√	√	√	√	√		√	√	√	
Sediment Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Watershed Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
People and Water															
Economic Incentives Policy	√	√	√	√	√	√	√	√	√	√	√	√	√	√	

Table 3-3: Statewide Resource Management Strategies Relevant to North and Central OC IRWM Region

2013 California Water Plan Resource Management Strategies	North and Central OC IRWM Plan Objectives														
	1 - Water Supplies		2 - Water Quality		3 - Ecosystems and Habitat		4 - Flood Management		5- Quality of Life			6 - Address Climate Change			Not Applicable to Region
Management Objectives - RMS	WS-1	WS-2	WQ-1	WQ-2	ECO-1	ECO-2	FM-1	FM- 2	QL-1	QL-2	QL-3	ACC-1	ACC-2	ACC-3	
Outreach and Engagement	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Water and Culture	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Water-Dependent Recreation			√	√	√	√		√	√	√	√		√	√	
Other Strategies															
Crop idling, dewvaporation/ atmospheric pressure desalination, fog collection, irrigated land retirement, rainfed agriculture, snow fences, and waterbag transport/storage technology															√

3.3 Water Management Issues

The following presents the primary issues that provided the foundation for establishing the regional Goals and Objectives in Sections 3.4 and 3.5:

3.3.1 Water Supplies

a. Demand for potable water exceeds local water supplies; therefore, supplemental water is needed.

b. Although the Region has made great strides in water conservation and management, there is still a gap between local demand for potable water and local supplies necessitating more water conservation, local potable water supply projects, and expanded use of recycled water.

c. The Region receives approximately one-third of its water from imported sources. Environmental constraints such as drought and impacts from the Delta are affecting the reliability of imported water supply. Continuing awareness and education of the significance of imported water reliability to the Region is vital.

d. Drought has worsened the frequency and intensity of wildfires. When combined with urban fires – residential and commercial structures, the demand for potable water to fight fires may exceed the local water supply. Local water suppliers maintain capacity in storage for fire suppression.

3.3.2 Water Quality

a. Some receiving waters in the Region do not meet the water quality objectives as defined by the Santa Ana Regional Water Board in the Basin Plan for the Santa Ana region.

b. Nonpoint source pollution is a concern in the Region.

c. Trash in waterways reduces aesthetic quality and accumulates in the intertidal habitats; plastics have been documented as a threat to aquatic life through ingestion and entanglement and suspended microscopic particles can act as intermediary for chemical uptake in wildlife through bioaccumulation processes.

d. Most existing drainage infrastructure was not designed and constructed for a 100-year storm event or for water quality control.

e. Existing development prior to 2011 did not incorporate low impact development (LID) design principles.

f. Emerging contaminants, such as pyrethroid pesticides and polybrominated diphenyl ethers (PBDEs), pharmaceuticals, and personal care products, have been identified as a potential public health concern. These constituents are being detected at low concentrations in drinking water but their risks to public health are not known.

g. Water quality protection needs to be consistent with the Basin Plan, including protection of groundwater resources from contamination.

h. Local agencies in the Region are challenged to meet regulatory water quality standards in a cost-effective manner to maintain lasting results.

i. Leaks and sewage spills can occur due to wastewater and water conveyance systems; inadequate capacity to handle increased flows can impact surface, groundwater and ocean water quality. Multipurpose projects that include the rehabilitation of water and wastewater infrastructure are important for improving water quality.

3.3.3 Ecosystems and Native Habitat

a. Temporary post-fire loss of upland habitat has occurred. Wildfires occasionally denude the foothills of vegetation resulting in increased erosion and the potential for an increase in invasive species.

b. Sedimentation of Upper Newport Bay has been reduced over the past 20 years by upstream sediment control improvements, facility maintenance, and the Upper Newport Bay Ecosystem Restoration Project. Currently, sediment is well under control and all key Sediment TMDL targets have been met. A commitment to prevention of loss of estuarine habitat in Upper Newport Bay continues while a maintenance phase begins. With sea level rise and climate change issues that could bring further changes to the Upper Newport Bay

and even require sediment input to keep up with rising sea level, the Region is adopting a more holistic approach to sediment management.

c. Loss and degradation of riparian habitat has occurred due to channelized flood conveyance systems and heavy erosion of natural channels due to hydromodification.

d. Stormwater and urban runoff, wastewater spills, invasive species, and erosion impact ecosystems in the Region. Functioning ecosystems offer a wide range of benefits for water supply, water quality and habitat, and should be rehabilitated and preserved for the future. Habitat areas in the Region include rivers, creeks, wetlands, bays, beaches, coastal shorelines, wildlife refuges and preserves, and regional and state parks.

e. The Region lacks a system for early exclusion and protection from invasive species. Issues related to invasive species that are specific to this region include (1) African clawed frogs, (2) zebra and quagga mussels, (3) cowbirds, which threaten native songbirds, (4) Arundo and pampus grass, and (4) commercially available invasive plants.

f. The Region is largely developed, with much of the older development not incorporating habitat requirements for species or open-space linkages at the time of development. Therefore, the habitat is fragmented, and there are poor linkages between open-space areas in some parts of the Region. Although completion of open space master planning for the historic Irvine Ranch was completed in 2014 and culminated with a donation of 2,500 acres of open space, a general lack of master planning for designated open-space areas in the Region has allowed piecemeal development to fragment or isolate important habitat areas.

g. Marine habitat is degraded. There has been a loss of eelgrass in Upper Newport Bay, for example, and there are contaminated fish and invertebrate stocks due to sediment and water pollution.

3.3.4 Flood Management

a. Areas within the Region are not fully protected from a 100-year flood. Some Orange County regional and local facilities cannot convey the 100-year storm discharge. Many sub-regional facilities are also deficient. There are aging facilities in the Region that do not meet current standards. Several existing flood control facilities are approaching or have exceeded their expected useful life, making the threat of flood damage from these facilities imminent, requiring upgrades to adequately manage risk of floods.

b. Regulatory permits are required for the County, cities, and Orange County Flood Control District (OCFCD) to improve and provide capital improvements, maintenance and repairs to its flood control facilities. Maintenance is needed to ensure that flood control facilities can continue to convey their designed discharges. Repairs are needed for frequently

occurring problems such as bank erosion and invert aggradation or degradation. Oftentimes improvements are designed to maintain the same right-of-way without purchasing private property. Most permits require mitigation for soft bottom or earthen slopes, which require a wider right-of-way. The facilities are in urban or suburban settings where right-of-way is limited. Other regulatory requirements burden the design process, cause delays, and add to the cost of improvements.

c. Limited funding is available for flood control capital improvement projects. Property tax revenue is the main source of funding for flood control capital improvement projects. A portion of the funding comes from agencies such as the Federal Emergency Management Agency (FEMA), or state-sponsored grants. Current economic conditions may further delay the flood control improvements.

d. Reducing scour and erosion on canyons and channels while supporting natural systems and minimizing use of concrete and riprap is essential yet can be challenging to accomplish.

e. Obtaining right-of-way for naturalization efforts is extremely challenging.

3.3.5 Quality of Life in Orange County

a. Orange County has a strong outdoor recreation legacy because of its pleasant climate, natural beauty, diversity of natural habitats, and fish and wildlife resources. Open space set aside for water resource protection, storage, or extraction are often suitable for recreational use. These include protected watershed lands, floodways, and reservoirs.

b. The Region is continually growing, which means that there is a higher demand for potable water, a greater amount of wastewater generated, and the need for additional recreational resources. Economic stability relies on implementing cost-effective solutions to these growth-related issues. Land-use decisions play a key role in developing a sustainable region.

c. Residents including, disadvantaged communities, along with other communities, utilize the waters within the Region as recreational locales. Waters within the Region include area beaches, local creeks and streams, and wetland environments. Water quality of the watersheds can impact these recreational opportunities. Furthermore, disadvantaged and low-income water customers may face affordability problems. Pricing decisions should consider equity as well as efficiency.

d. Environmental justice highlights the fact that disadvantaged and low-income members of the community tend to disproportionately endure environmental pollution and unhealthy conditions.

e. Addressing environmental disparities and increasing access to natural places for urban communities reflect a commitment to promoting healthy environments for vulnerable populations. Orange County's extensive regional parks system comprises 39,000 acres in 25 urban and wilderness parks, including seven regional historic sites, 7,000 acres of open space and 230 miles of regional riding and hiking trails.[2] The policy report, *Healthy Parks, Schools and Communities, Green Access and Equity for Orange County,*[3] mapped and analyzed park access and equity. The report identifies significant disparities in access to green space between North and South Orange County. Densely populated northern communities have less green space and public transportation to parks and beaches than Southern communities, where more affluent residents live. The wide-ranging benefits associated with access to parks and recreational areas include increased physical activity, better health, enhanced community and cultural pride, economic vitality and environmental conservation. The January 2011 report found that green space is an economic stimulus that creates jobs, boosts local businesses and raises property values. It also reports that being located near green space adds five to ten percent to the total value of a home, in both high-income and low-income communities.

f. Water education and awareness helps individuals understand where they fit within the larger world of water. Once they identify their watershed address and discover their role in the water cycle, it becomes easier for them to recognize that water knows no boundaries. It flows throughout the world and connects everyone. Knowledge helps people to think about the actions they take individually and collectively – and that understanding the real value of water promotes the management, conservation and protection of the resource.[4]

g. Prevention of flooding - minor or major, improves quality of life by protecting residents' homes and properties.

3.3.6 Climate Change

a. Climate change will influence water resources, particularly water supply availability for human and habitat needs. Addressing these issues now will help the Region prepare for current and future impacts.

b. Climate change has affected the length of the fire season, extending it longer into the year, increasing the demand on potable water and the need to maintain sufficient infrastructure to fight fires. Recent statewide response to wildfires has been substantial.

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[2] Orange County, Regional Wilderness & Parks, http://www.ocgov.com/visitors/wilderness

[3] http://kresge.org/news/low-income-park-poor-communities-californias-north-orange-county-stand-benefit-increased-access , https://www.cityprojectca.org/blog/archives/8175 and https://www.cityprojectca.org/blog/wp-content/uploads/2011/03/CityProject_OCreport_ENGLISH1.pdf

[4] Dennis Nelson, CEO & President, Project WET Foundation, *Using Water Education to Conserve Water,* 2011

c. The California Water Plan recognizes climate change as a threat to water supply reliability and remains a key issue as state experts work to determine how to best incorporate a changing climate into water management planning, including flood planning due to sea level rise, peak flow changes and a reduced snowpack.

d. Changing climate is expected to shift precipitation patterns and result in sea level rise, impacting water resources and ecosystems. The areas of concern for California include the reduction in the Sierra Nevada and Rocky Mountain snowpack, increased intensity and frequency of extreme weather events, and sea level rise leading to increased risk of coastal flooding and levee failure in the Sacramento-San Joaquin Delta, a major source of water supply to the Region.

e. Climate change also adds complexities and questions regarding environmental impacts in the future. For example, rising water temperatures are attracting invasive species to waterways in which they have not previously lived and, according to a 2013 study by the UC Davis Center for Watershed Sciences, 82 percent of California's 121 native fish species could have critically low numbers.

f. Climate change is causing changes in weather patterns that affect both energy demand and energy supply, with reduced reliability and efficiency. Weather changes also effects water demand and supply. Energy efficiency reduces use of fossil fuels. However, energy efficiency can address some of the energy sector's vulnerabilities to climate change impacts.

g. A 2013 report issued by the Columbia University Water Center, in conjunction with Veolia Water and Growing Blue, raises an additional concern to add to future projections of water scarcity. The study clearly shows that decision makers need to be thinking beyond the problems of water scarcity to the way drought will affect regions that are already facing problems. Droughts will create an additional impact that needs to be understood, because drought magnifies the effects of scarcity.

h. The Earth's atmosphere contains carbon dioxide (CO2) and other greenhouse gases (GHGs) that act as a protective layer, causing the planet to be warmer than it would otherwise be. If the level of CO2 rises, mean global temperatures are also expected to rise as increasing amounts of solar radiation are trapped inside the "greenhouse." The level of CO2 in the atmosphere is determined by a continuous flow among the stores of carbon in the atmosphere, the ocean, the earth's biological systems, and its geological materials. As long as the amount of carbon flowing into the atmosphere (as CO2) and out (in the form of plant material and dissolved carbon) are in balance, the level of carbon in the atmosphere remains constant. Human activities—particularly the extraction and burning of fossil fuels and the depletion of forests—are causing the level of GHGs (primarily CO2) in the atmosphere to rise. In the past 150 years, human industrial activity has accelerated

the rate of change in the climate due to the increase in GHGs (carbon dioxide, methane and nitrous oxide). Scientific studies describing this climate change continue and impacts continue to be assessed.

i. The California Environmental Protection Agency has found temperatures in the state have risen by about 1.5 degrees since 1895. Looking ahead, temperatures could rise by 2.7 degrees and its sea levels by 55 inches in the next 40 years, according to the California Energy Commission and the California Natural Resources Agency. These are among the ongoing issues North and Central Orange County face as they grapple with climate change.

j. Climate Change is considered in The OC Plan objectives as it impacts all elements of watershed management. All applicable RMSs also considered the effects of Climate Change on the IRWM region.

k. Climate change impacts threaten our health by affecting the food we eat, the water we drink, the air we breathe, and the weather we experience. These impacts will be felt inequitably by vulnerable populations and may force changes to social and livelihood strategies. The OC Plan includes the most vulnerable when considering climate change adaptation and the cost of impacts. Such unequal impacts may include:

   1) Vulnerable populations with fewer resources have the hardest time stabilizing after wildfire events that damage homes and force evacuation.
   2) Extreme weather events can be especially devastating for vulnerable populations, worsening existing issues linked to social determinants of health, such as availability of healthy housing, access to health care and food affordability.[5] Extreme heat's link to heat waves and air pollution makes conditions ripe for more heat-related illness, such as heat stroke, asthma and heart attacks.
   3) Cool green spaces - Vegetation and green spaces can be susceptible to increased heat or dryness, as well as to increased risk for hazards such as flooding. Parks play an important role in cooling urban areas through temperature decreases. So, while parks have the potential to help residents adapt to climate change, they are often distributed inequitably and in a manner that is difficult to address. Increasing plant life generally, and street trees in particular, has the possibility to both help mitigate climate change through reduced electricity dependence and help people adapt to hotter temperatures by lessening the urban heat island effect. Adaptation to the heat impacts of climate change will be easier for residents who have access to parks and other public green spaces. The cooling benefits of such areas will likely become increasingly important to help mitigate the urban heat island effect.

[5] "The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment", U.S. Global Change Research Program, 2016. https://health2016.globalchange.gov/

4) Access to safe drinking water will help adapt to urban heat island effects and sudden heatwaves. Financial assistance, water pricing, and water market policies intended to influence water management can influence the amount and time of water use, wastewater volume, and source of water supply.
5) Food access can be unpredictable with potentially significant disruptions in food production and distribution networks, reducing availability of imported produce, raising local food prices. Among the community agriculture projects which have been the most successful in improving food access equity are those whose production is directly tied to food banks, food pantries or other supplementary food sites which primarily serve vulnerable populations.

3.4 Regional Goals

Since water is at the core of IRWM planning, there is also a significant connection between water resources, land uses, and all other aspects of the environment. Coordinating water resource management and environmental protection in a cost-efficient manner produces multiple benefits for the greatest number of people. Partnerships make this coordination possible.

The OC Plan stakeholders identified six connected goals within the Region in **Figure 3-1:**

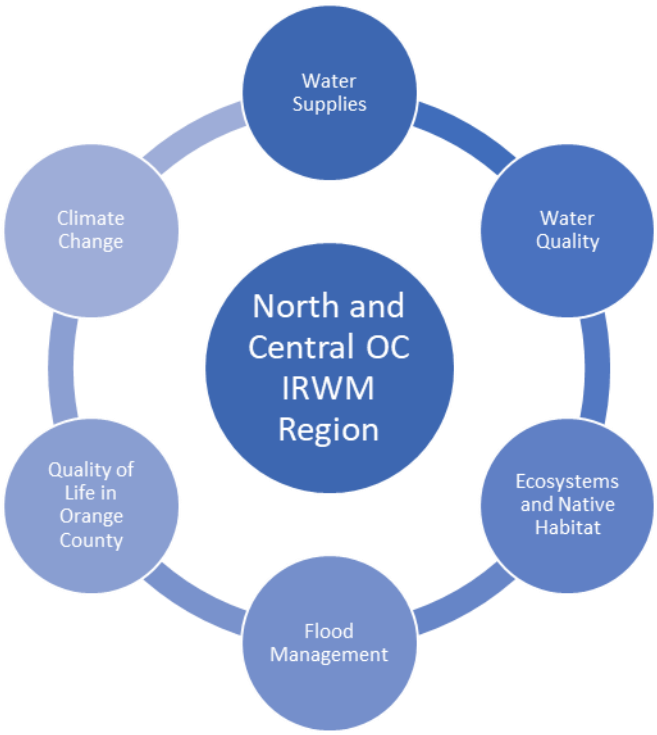

Figure 3-1: The OC Plan Goals

The desired outcomes in The OC Plan regional goals include the following:

GOAL 1. Provide Adequate and Reliable Water Supplies

Outcome: Meet projected water demands through increased local potable and recycled water supplies, maximized water conservation and water use efficiency strategies, sustained groundwater resources, and optimized operation of water systems and use of imported water.

Outcome: Protected and improved water supply reliability.

GOAL 2. Protect and Enhance Water Quality

Outcome: Reliability of water supplies for all communities in the Region through improved and sustained water quality.

Outcome: Protected and improved water quality within the Region consistent with the Santa Ana Region Basin Plan.

GOAL 3. Restore Ecosystems and Improve Native Habitat

Outcome: Protected, restored, and improved stewardship of aquatic, riparian, and watershed resources within the Region.

Outcome: Balanced competing interests of the community in a way that protects environmental resources while promoting a healthy economy and recreational opportunities in the watersheds.

GOAL 4. Integrate Flood Management

Outcome: Reduced flood risk to public and private property, improved public safety, and improved floodplains.

GOAL 5. Improve the Quality of Life in Orange County

Outcome: Critical water needs – supply and quality – of DAC, low-income, and tribal communities and other vulnerable populations are met through their participation in the IRWM process and implementation of multi-benefit projects for their communities.

Outcome: Implemented projects that address safe drinking water and wastewater treatment needs of DAC, low-income, tribal and other vulnerable communities.

Outcome: Equitable distribution of benefits is ensured to all persons of the Region.

Outcome: Increased acreage and access to open space and enhanced recreational opportunities that benefit disadvantaged communities

GOAL 6. Address Climate Change

Outcome: Increased energy efficiency, increased biomass per acre to benefit carbon sequestration[6], and adaptive measures implemented to address the effects climate change.

Outcome: Coordinated, integrated, and balanced flood risk management, water quality, water supply, and habitat, while the potential impacts of climate change, such as storms of greater intensity that occur over at less frequent intervals, are documented.

[6] It is believed that greenhouse gases are increasing in the atmosphere and contributing to climate change. Scientists, policy makers, and citizens are trying to determine how to decrease and possibly reverse the emission of greenhouse gases, especially carbon dioxide (CO_2). Carbon sequestration, a process where CO_2 is pulled from the atmosphere and stored for a long period of time, may be one way to slow or reverse the accumulation of CO_2 in the earth's atmosphere. Terrestrial sequestration utilizes natural processes in ecosystems to absorb CO_2 from the atmosphere and store it in plants, animals, and soil.
https://www.nrs.fs.fed.us/niacs/carbon/forests/carbon_sequestration/

3.5 Objectives and Strategies

Meeting The OC Plan goals requires specific achievements. The following objectives and strategies have been identified that will help achieve the stated goals. A unit of measure is associated with each strategy to help meet the related objective, which must be measurable in an IRWM plan. Neither quantitative nor qualitative metrics are considered inherently better.

Goal 1. Provide Adequate and Reliable Water Supplies

Objective WS-1: Meet projected increase in water demands of 49,000 AFY by 2040 within the Orange County Basin area with consideration of cost-effective strategies.

Strategies	*Measure*
A. Increase local potable water supplies	Acre feet
B. Increase recycled water supplies to offset potable water	Acre feet
C. Sustainably manage groundwater resources	Yes/No
D. Maximize water conservation and water use efficiency strategies and efforts	Yes/No
E. Reduce the vulnerability of water systems to interruptions and to the effects of climate change, including sea level rise	Yes/No
F. Optimize use of imported water in times of surplus	Acre feet
G. Replace potable water supply lost due to groundwater contamination	Acre feet

Objective WS-2: Meet projected increase in water demands of 1,800 AFY by 2040 within the La Habra Basin area with consideration of cost-effective strategies.

Strategies	*Measure*
A. Increase local potable water supplies	Acre feet
B. Increase recycled water supplies to offset potable water	Acre feet
C. Sustainably manage groundwater resources	Yes/No
D. Maximize water conservation and water use efficiency strategies and efforts	Yes/No
E. Reduce the vulnerability of water systems to interruptions and to the effects of climate change, including sea level rise	Yes/No
F. Optimize use of imported water in times of surplus	Acre feet
G. Replace potable water supply lost due to groundwater contamination	Acre feet

Goal 2. Protect and Enhance Water Quality

Objective WQ-1: Improve water quality consistent with the Basin Plan.

Strategies	*Measure*
A. Meet NPDES and TMDL water quality regulatory requirements	Yes/No
B. Attain water quality standards in fresh and marine environments	Yes/No
C. Expand the use of water quality treatment systems with a focus on regional projects	Measure of system use

Objective WQ-2: Maintain groundwater quality to protect water supplies and ensure reliability.

Strategies	*Measure*
A. Protect and improve groundwater quality consistent with beneficial uses	Yes/No
B. Clean up groundwater contamination	Acre feet

Goal 3. Restore Ecosystems and Improve Native Habitat

Objective ECO-1: Restore, enhance and expand terrestrial and aquatic ecosystems.

Strategies	*Measure*
A. Increase functioning habitat that sustains viable populations of native species and restore habitat for terrestrial and aquatic species	Acres impacted
B. Remove invasive species that are a danger to habitat, water supply or other economic or beneficial use	Acres impacted
C. Increase use of water quality treatment systems that also increase wildlife habitat and wetlands by restoring a natural water balance not dependent on urban runoff or supplemental water	Yes/No
D. Preserve open space	Acres of open space

Objective ECO-2: Restore, enhance and expand habitat for threatened and endangered species.

Strategies	*Measure*
A. Increase functioning habitat that sustains viable populations of threatened and endangered species	Acres impacted
B. Remove invasive species that negatively impact threatened and endangered species	Acres impacted

Goal 4. Integrate Flood Management

Objective FM-1: Reduce flood risk to public and private property and improve public safety.

Strategies	*Measure*
A. Improve flood protection based on risk management standards	Yes/No
B. Improve flood control facilities and remove properties from the FEMA 100-year floodplain with consideration for climate change on flow	Conveyance improved and acres removed
C. Improve storm drain systems where historical flooding exists, when feasible	Conveyance improved

Objective FM-2: Improve floodplains

Strategies	*Measure*
A. Reduce scour and erosion on canyons and channels while supporting natural systems and minimizing use of concrete and riprap	Conveyance maintained
B. Implement stream channel naturalization efforts to promote multiple benefits such as creation or improvement of habitat and/or improvement in water quality while protecting public health	Acres impacted

Goal 5. Improve Quality of Life in Orange County

Objective QL-1: Identify and support critical water needs of disadvantaged, low-income, and tribal communities.

Strategies	*Measure*
A. Increase participation of small, disadvantaged, low-income communities and tribes in the IRWM process	Number of participants
B. Develop multi-benefit projects that predominantly benefit affected disadvantaged and low-income communities	Number of projects
C. Address public health, flood management, safe drinking water, and wastewater treatment needs of disadvantaged and low-income communities	Extent of needs addressed

Objective QL-2: Increase acreage of open space and increase park and recreational opportunities.

Strategies	*Measure*
A. Increase acres of and access to open spaces	Acres of open space
B. Provide for increased proximity and access to open spaces in disadvantaged communities	Areas impacted
C. Increase recreational opportunities	Number of opportunities
D. Add trail connectors and extensions to provide and improve regional recreational opportunities	Miles of trails / connectors
E. Increase recreational opportunities in multipurpose projects and programs	Number of opportunities
F. Increase recreational opportunities in disadvantaged and low-income communities	Number of opportunities
G. Support water quality improvement efforts that enhance public recreation	Yes/No

Objective QL-3: Develop and enhance public education programs.

Strategies	*Measure*
A. Incorporate principles of environmental justice and needs of disadvantaged, low-income and tribal communities in design and construction of projects and programs	Yes/No
B. Promote watershed public education	Yes/No
C. Increase community involvement in stewardship of water resources	Yes/No

Goal 6. Address Climate Change

Objective ACC-1: Increase Energy Efficiency.

Strategies	*Measure*
A. Maximize production of on-site energy	Yes/No
B. Participate in local utility's green energy program	Yes/No
C. Prioritize more passive systems over more active energy consuming systems	Yes/No
D. Prioritize lower energy consuming alternatives over lower cost and higher energy alternatives	Yes/No
E. Utilize natural gas, electric, or biofuel based equipment for construction	Yes/No
F. Recover construction emissions by generating more energy during the lifetime of the project	Tons of CO2 reduced

Objective ACC-2: Increase biomass per acre in consideration of carbon sequestration.

Strategies	*Measure*
A. Use higher density vegetation schematics	Yes/No
B. Increase square feet of wetlands	Square feet increased
C. Recycle green waste	Yes/No

Objective ACC-3: Implement measures and plan for future changes to climate.

Strategies	*Measure*
A. Develop adaptive measures to address the effects of sea level rise on water supply and water quality conditions	Yes/No
B. Implement measures that respond to more intense rain events	Yes/No
C. Implement measures that respond to the uncertainty and availability of imported water	Yes/No
D. Implement measures that respond to hotter and drier summers	Yes/No

3.6 Prioritization and Weighting of Objectives

For each goal, objectives were identified with specific achievements to help attain the stated goals. A series of strategies were then developed to identify actions and methods to meet objectives.

For project prioritization purposes, a score is associated with the relative benefit attained by the objective and strategy. **Appendix G** shows the prioritization of objectives relative to the weighting/ranking, which were developed and approved by the IRWM Region stakeholders. **Section 5 Projects** further explains the project scoring process and weighting of the stated Strategies. The weighting of objectives is included in an appendix to allow for flexibility for the IRWM RWMG and stakeholders to revise as appropriate.

3.7 Benefits of Integration to Meet Objectives

North and Central OC agencies and stakeholders place a strong emphasis on watershed planning and integration. The value of integrated regional planning can be seen when water management strategies are found to be complementary within a given region and also achieve multiple regional objectives. Benefits of integration include:

- Sharing knowledge, resources, facilities, and costs;
- Reducing duplicative efforts;
- Achieving broader goals and objectives;
- Improving regional collaboration; and
- Improving local understanding of water resources.

The OC Plan considers IRWM planning concepts, state standards, and resource management strategies through the integration of projects and programs that incorporate a wide range of water management strategies. Though projects in this IRWM Plan must address at least one of the strategies targeting a regional objective, those addressing multiple objectives are typically the most cost-effective and resource-efficient and are likely to be given higher priority in the IRWM Plan. Use of single-purpose strategies may ultimately increase total costs within a region because related impacts are not addressed at the same time. **Table 3-3** shows the multiple resource management strategies that can meet each IRWM Plan objective. This table is also shown in **Section 4** as **Table 4-2** with more detail on the Regional Objectives to demonstrate their relationship to regional water management.

Regional integration allows agencies, cities, and districts to share resources, such as labor and expenses. Integrating also provides the ability to address a broad range of water management goals and optimize efforts to achieve goals, while addressing several water-related issues or needs.

Finally, integration allows for collective planning, increased public participation and shared cost.

The following considers the use of multiple complementary strategies necessary to achieve the objectives of the IRWM Plan Strategies that may ultimately increase total costs within a region are, for example, when habitat and flood risk are not addressed at the same time or the implementation of a local water supply strategy is not planned to prevent resultant flood risk management issues resulting in the public within the Region paying for both the water project and additional flood program expenses.

Water Supply Objectives

Developing local water supplies to reduce imported water demands is costly. Integration of a local water supply strategy with other water resource objectives may produce greater benefits such as increase in flood risk management or improved water quality. When a project is planned with full regional integration, conflicts are minimized, and benefits extend beyond the planning area. An increased supply of recycled water available in areas where it can be fully used reduces demand for imported water, reduces wastewater discharge into the ocean, and conserves water resources in the Bay-Delta and the Colorado River.

Water Quality Objectives

One of the major issues related to watershed management is that land use and other urban activities in the upper watershed areas affect water quality downstream. Projects and programs to address this issue must be implemented throughout the Region. Sustained water quality improvements can be achieved through land use planning, flood control, nonpoint source pollution control, strategic placement of treatment wetlands, and water conservation. Given the level of urbanization in the Region and the interrelationships of the issues, single-purpose strategies will not result in sustained water quality improvements. Treating the symptoms is not just inefficient or ineffective; if the root causes of water quality problems are left alone it can exacerbate the problem.

Flood Management Objectives

The level of urbanization within The OC Plan Region makes habitat and ecosystem restoration particularly challenging, due to competing needs for flood control, recreation, and other urban land uses. Measurable progress toward achieving regional goals for habitat depends on the use of multipurpose strategies. Some proposed projects within the Region can serve dual purposes for flood risk management and habitat when designed and managed with that purpose in mind. Achieving this balance may further benefit water quality if erosion and sedimentation are managed to protect receiving waters. To be effective, these multi-function drainage systems often require greater levels of stormwater management to minimize the impact on the natural drainages during storm events. A key component of flood management is the use of Geographic Information Systems (GIS), databases and other data management tools. It promotes the development, installation, application or updating of flood control and pollutant control data for protection of waterways. These strategies are integrally linked, and any stand-alone alternative would not fully achieve the objective or provide long-term regional benefit.

Quality of Life Objectives

Planning and associated investments to carry the Region through the next 25 years are central to preserving the quality of life in North and Central OC IRWM Region. The OC Plan incorporates benefits for disadvantaged, low-income and tribal communities within its projects. The DAC low-income and tribal community members utilize the waters within the Region as recreational areas. Waters within the Region include beaches, creeks and streams and wetland environments. Since many of these waters are accessible to the DACs, and low-income and tribal community members, projects focused on providing safe drinking water, enhanced water quality, and access to park and recreational opportunities will benefit these communities. Water quality greatly impacts the recreational opportunities in the Region. The Regional Water Board has designated beneficial uses for many of the watershed waters. Proposed projects will integrate measures that contribute to these beneficial uses, enhancing the opportunities to the DAC, low-income and tribal communities.

Open space lands set aside for water resource protection, storage, or extraction are sometimes suitable for recreational use. These include protected watershed lands and reservoirs. Recreational opportunities that draw Californians outside increases public health. Moreover, recreation and tourism are economic engines that improve the quality of life, increase property values, and provide jobs for Orange County residents.

Climate Change Objectives

Integrating strategies to increase energy efficiency, reduce GHG emissions, and combat future changes to climate can reach across nearly any project. Elements of projects should consider:

1) Potential effects of climate change on the Region and consideration for whether adaptations to the water management system are necessary;
2) Contribution of the project to adapting the identified system vulnerabilities to climate change effects on the Region;
3) Changes in the amount, intensity, timing, quality and variability of runoff and recharge;
4) Effects of sea level rise on water supply conditions and suitable adaptation measures;
5) Contribution of the project in reducing GHG emissions as compared to project alternatives;
6) Project's ability to help the Region reduce GHG emissions as new projects are implemented over the 20-year planning horizon; and
7) Reduction in energy consumption achieved by the project, especially the energy embedded in water use, and resultant reduction in GHG emissions. Further, managing multiple water demands throughout the Region, adapting water management systems to the effects of climate change, and potentially offsetting climate change impacts to

the water supply can be improved an informed relationship between land use and water planner resulting in integrated projects with greater benefits.

3.8 Potential Climate Change Impacts Considered in Objectives

Climate change is expected to shift precipitation patterns and result in sea level rise, longer fire seasons, and impact water resources, ecosystems, and greenhouse gas emissions. The areas of concern for California include the reduction in the Sierra Nevada and Rocky Mountain snowpack, increased intensity and frequency of extreme weather events, and sea level rise leading to saltwater intrusion, increased risk of coastal flooding, and levee failure in the Sacramento-San Joaquin Delta. Changes in global climate can affect average temperature, evaporation, and the amount, frequency, and intensity of precipitation in Southern California.

The Region stakeholders are committed to addressing these by incorporating climate change considerations into resource management strategies.

Climate change elements most likely to affect water planning of the North and Central OC IRWM Region include:[7]

- **Snowpack.** California's snowpack, a major part of annual water storage, is decreasing with increasing winter temperatures. Rising average temperatures throughout California will ultimately reduce the amount of mountain snowpack as more precipitation will fall as rain instead of snow and warmer weather will cause more snowpack to melt earlier in the year. Mountain snowpack acts as a natural water storage reservoir, releasing water gradually throughout the warmer periods of the year as snow melts. As a prediction of future conditions, water year 2016 was an average precipitation year, but parts of the Sierras experienced what has been termed a snow drought, because of warmer conditions. Reservoirs and groundwater basins that lie downstream of the mountains will likely experience inflows different from historical patterns and operational rules may need to be modified to adapt to the variability and to sustain the existing mix of stream flows and out-of-basin exports from the Delta.
- **Hydrologic Pattern.** Changes in hydrological conditions due to climate change presents many uncertainties in the magnitude, pattern, and the rate of potential change. Likely impacts of changing climatic conditions in the Santa Ana River Watershed include a decrease of surface water supplies, increase in temperatures, more severe flood events, and increase dependence on groundwater supplies.

[7] California Water Plan Update 2013, Volume 1 – The Strategic Plan, *Box 5-2 Sources of Future Change and Uncertainty*

Warmer temperatures and decreasing snowpack cause more winter runoff and less spring/summer runoff. The existing amount of surface storage in most major streams and water storage reservoirs in Southern California may provide some capacity to accommodate shifts in inflows for most years. However, any reduction of runoff volumes due to declines in precipitation or increase in evapotranspiration would directly reduce water supplies.

Increased intensity and frequency of major storms, another anticipated effect of climate change, would further augment flood problems in southern California. With continued increases in floodplain urbanization, flooding costs from climate change could exceed those of water supply. The effects of changes in flood flows on ecosystems are less well studied but could be significant. Larger floods and storms could impact levees in the Sacramento-San Joaquin Delta, as well as increasing salinity that reduces water exports for an extended period of time.

- **Rainfall Intensity.** Regional precipitation changes remain difficult to predict, but larger precipitation events could be expected with warmer temperatures in some regions. Changes in drought persistence and precipitation affect average runoff volume. Increased flood flows and flood frequencies are possible.
- **Sea Level Rise.** Sea level rise is increasing the threat of coastal flooding and saltwater intrusion. The Delta region is a critical component of Orange County's current water supply system and any levee failures will disrupt water exports. Sea level rise may increase the potential of saltwater intrusion in the Delta and will require higher freshwater outflows to sustain the present low-salinity zone standards (also known as the X2 standard in San Francisco Bay). The use of freshwater flows used for low-salinity zone maintenance may have an effect on the volume of water available for export for the SWP to transport to Southern California. Sea level rise, combined with winter storms, will increase the risk of levee failure and adversely affect the water quality in the Delta, particularly during extreme events.

  Sea level rise could increase the potential for salt water intrusion, negatively affecting groundwater, a major source of local water supply in the Region. Additional impact could be increased coastal erosion harming coastal infrastructure and ecological resources such as estuaries and tidal wetlands.

  The U.S. Bureau of Reclamation conducted a study in collaboration with SAWPA of the potential impacts to water resources due to climate change in the Santa Ana River Watershed. (USBR, 2013)[8] The purpose of the study was to refine the watershed's water

[8] http://www.sawpa.org/wp-content/uploads/2014/01/Appendix-F2-Technical-Memorandum-No.-86-68210-2013-02-Climate-Change-Analysis-for-the-Santa-Ana-River-Watershed-Santa-Ana-Watershed-Basin-Study-California-Lower-Colorado-Region.pdf

projections and identify potential adaptation strategies considering projected effects of climate change. Results of the study indicate that increasing temperatures will melt ice sheets and glaciers and cause thermal expansion of ocean water, increasing the volume of water in the oceans and raising sea levels. Regional mean sea level along the Southern California coast is projected to rise by 1.5 to 12 inches by 2030, 5 to 24 inches by 2050, and 16 to 66 inches by 2100. Regional sea level rise may be higher or lower than global mean sea level rise due to regional changes in atmospheric and ocean circulation patterns. Sea level rise is likely to increase the coastal area vulnerability to flooding during storm events.[9]

Based on 2013 modeling simulations to evaluate the potential effects of projected sea level rise on coastal Orange County groundwater conditions,[10] including the Talbert and Alamitos injection barriers, where future sea level rise could affect barrier injection requirements and how these existing barriers are to be operated. The study found that a 3-foot sea level rise will increase the potential for shallow groundwater to be closer to ground surface, which could lead to property damage such as seepage into foundations and utilities, potentially causing structural problems, corrosion, mold, and various geotechnical issues such as increased liquefaction potential.

At both barriers, shallow groundwater concerns and the need to avoid injection-induced artesian conditions could limit injection rates to less than those necessary to achieve protective groundwater elevations and prevent intrusion. Additional mitigation measures could be required, such as extraction wells systems seaward of the barrier, which would lower the protective elevation requirement while still preventing intrusion. The feasibility and effectiveness of these additional measures still need to be evaluated.

- **Water Demand.** Plant evapotranspiration (ET) increases with increased temperature. Therefore, potential increase in water demands will occur for landscape use due to higher temperatures, although this will likely be limited by available supplies. The most important effect across the state is likely to be on landscape irrigation demands in urban areas and agricultural water demands. Landscape irrigation accounts for half or more of residential water use in southern California. While agricultural demands constitute nearly 80 percent of the state's water demand, the Region's agricultural water demands constitute only approximately one percent of the Region's total water demand.

  Droughts occur slowly over a multiyear period and impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in

[9] OCWD Groundwater Management Plan 2015 Update, Section 7.5, *Evaluation of Potential Impacts Due to Climate Change,* pg. 7-9
[10] Technical Memorandum, *Potential Effects of Sea Level Rise on Coastal Groundwater Conditions and Seawater Intrusion,* Orange County Water District, Tim Sovich, Li Li, February 27, 2013; https://www.ocwd.com/media/6386/seawater-intrusion-tech-memo.pdf

groundwater basins decline. Droughts in the western United States are often persistent; the recent period constituted one the most severe droughts over the past millennium. Although the change in precipitation that led to the recent drought was not tied to climate change, the slightly warmer temperatures resulted in higher ET from the landscape and increased the severity of the drought.

While the Region's reliance on imported water from throughout the state makes drought awareness one of the Region's highest concerns, of equal importance to the Region are local Basin water supplies that are affected during prolonged periods of drought, including the need for water supplies due to the increased frequency and intensity of wildfires. During a drought, flexibility to manage pumping from the basin becomes increasingly important. OCWD typically experiences a decline in the supply of recharge water (local supply of Santa Ana River water and net incidental recharge) of up to 55,000 afy or more during drought.[11]

In addition, recent trends in water supplies used to recharge the groundwater basin show a decline in Santa Ana River base flow, which may be a result of increased recycling, drought conditions, declining per capita water use, and changing economic conditions in the upper watersheds. The volume of stormwater that can be recharged into the basins is highly dependent on amount and timing of precipitation in the upper watersheds, which is highly variable.[12]

- **Aquatic Life and Forest Health.** Higher water temperatures in streams and reservoirs are expected to have a negative effect on native species. Higher temperatures overall will increase water temperatures throughout the system, including inflows into reservoirs, water stored within reservoirs, and water flowing downstream. Such increases will significantly affect ecosystem uses of the water system. Most species have evolved to survive within a specific temperature range. Increased water temperature can also reduce the amount of dissolved oxygen that it holds, affecting aquatic organisms. Because of warmer temperatures in streams, water quality standards related to aquatic life may require greater reservoir outflows, requiring a careful balance between human needs for drinking water and maintaining healthy ecosystems. Climate change planning must consider a balance of human consumptions needs with water quality strategies for aquatic life.

  Forests are an important component of the local watershed. The recent drought has significantly affected the health of forests in California making them susceptible to pests and diseases. Due to the recent drought, nearly 100 million trees may be dying.[13] The

[11] OCWD Groundwater Management Plan 2015 Update, Section 10.8, *Drought Management,* pg. 10-15
[12] OCWD Groundwater Management Plan 2015 Update, Section 5.2, *Sources of Recharge Water Supplies,* pg. 5-7
[13] http://www.fs.fed.us/news/releases/new-aerial-survey-identifies-more-100-million-dead-trees-california, November 2016

presence of these dead trees has the potential to significantly enhance wildfire risk in the near term and increase the risk of erosion and adverse water quality over the slightly longer term. To the degree that the recent drought is indicative of future drier and warmer conditions, it may be a significant threat to California's forests as well as its water supply.

- **Greenhouse Gas Emissions — Carbon Intensity or Carbon Footprint.** Storage, transport, and treatment of water involves substantial amounts of energy, which in most cases result in the release of greenhouse gas emissions that contribute to climate change. Each water management strategy should be evaluated for its contribution to the accumulation of greenhouse gasses in the atmosphere by reducing energy consumption. Proposed projects will also be evaluated on its ability to reduce GHG emissions as compared to a project alternative over the 20-year planning horizon, and the project's ability to reduce energy consumption, particularly the energy embedded in water use, and the resultant reduction in GHG emissions.

  Within the numerous state policies and legislation dealing with climate change, three are particularly important regarding the State's response to climate change, providing guidance on how IRWM planning efforts can analyze climate change on a project level.

  Executive Order (EO) S-3-05 and the California Global Warming Solutions Act of 2006 (AB 32; amending California Health and Safety Code Division 25.5, §38500, et seq.) laid the foundation for California's response to climate change, while SB 97 directed the Governor's OPR to develop CEQA Guideline amendments for the analysis of climate change in CEQA documents for the approval of the Natural Resources Agency.

  EO S-3-05 made California the first state to formally establish GHG emissions reduction goals. EO S-3-05 includes the following GHG emissions reduction targets for California:

  By 2010, reduce GHG emissions to 2000 levels;

  By 2020, reduce GHG emissions to 1990 levels; and

  By 2050, reduce GHG emissions to 80 percent below 1990 levels.

  AB 32 further details and codifies the mid-term GHG reduction target established in EO S-3-05. AB 32 also identifies the California Air Resources Board (CARB) as the state agency responsible for the design and implementation of emissions limits, regulations, and other measures to meet the target. CARB was required to and did develop a Scoping Plan in 2008 that describes the approach California will take to GHGs to achieve the goal of reducing emission to 1990 levels by 2020.[14] The first update was in 2014. In 2016, the Legislature passed SB 32, which codifies a 2030 GHG emissions reduction target of 40

[14] https://www.arb.ca.gov/cc/scopingplan/scopingplan.htm

percent below 1990 levels. With SB 32, the Legislature passed companion legislation AB 197, which provides additional direction for developing the Scoping Plan.

The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target was released in January 2017,[15] which reflects the 2030 target set by Executive Order B-30-15 and codified by SB 32. The final emission target of 80 percent below 1990 levels in 2050 would put the state's emissions consistent with the global consensus of the scale of reductions needed to stabilize atmospheric greenhouse gas concentrations at 450 parts per million carbon dioxide equivalent, and reduce the likelihood of catastrophic climate change. Currently, global levels are at just above 400 parts per million.

The strategies in the Scoping Plan Update will be considered when identifying different ways to meet The OC Plan objectives. These strategies include potential actions to enhance carbon sequestration and reduce greenhouse gases, including land management actions – protection of land and land use; manage and restore land to secure and increase carbon storage and minimize GHG and black carbon emissions in a sustainable manner; and innovate biomass utilization pathways.

These strategies require choices that can forestall the impacts of climate change, while also making our communities and economy more resilient – and more equitable at the same time.

[15] https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf

SECTION 4. REGIONAL WATER MANAGEMENT

The OC Plan was developed with information that was currently available at the time and is meant to be adaptable when new data are available and changed conditions occur. The OC Plan identifies resources and strategies needed to meet future challenges to reduce vulnerability. This section describes the Region's plan to adapt to changing conditions and to develop projects that can be implemented to achieve regional sustainability.

4.1 Process to Consider Resource Management Strategies

As introduced in **Section 3.2**, the Resource Management Strategies (RMSs) described in Volume 3 of the *California Water Plan (CWP) Update 2013* were evaluated for applicability to the Region. As explained in Section 3, the intent of RMSs is to encourage diversification of water management approaches to mitigate for uncertain future circumstances in compliance with Water Code §10541(e)(1). RMSs, as defined in the CWP Update 2013, are techniques, programs, or policies that help local agencies and governments manage their water and related resources.

The 30 RMS strategies are organized under eight management objectives, shown in **Table 4-1**, which describe their primary objective and emphasis while recognizing interdependencies. The RMS that will be implemented to achieve the objectives of The OC Plan are shown in **Table 4-2**. This table is consistent with Table 3-3 and shows the detail of the Regional Objectives to demonstrate their relationships to regional water management. A brief explanation of how the RMS are applicable to the Region is provided in **Section 4.2**. Resource management strategies that are not applicable to the Region are discussed in the **Section 4.3**.

In many instances, regional strategies can address multiple IRWM planning objectives. For example, in addition to addressing the objective to protect and create aquatic and riparian habitat, ecosystem restoration can also help reduce controllable pollutant sources to receiving waters and improve recreation and open space. The remainder of this chapter describes the RMSs selected for inclusion in the IRWM Plan and is organized into the same groupings as the RMSs are in the CWP.

Table 4-1
CWP Update 2013 Resource Management Strategies

Reduce Water Demand	
• Agricultural Water Use Efficiency	• Urban Water Use Efficiency
Improve Flood Management	
• Flood Risk Management	
Improve Operational Efficiency and Transfers	
• Conveyance – Delta – *Not Applicable*	• System Reoperation
• Conveyance – Regional/Local	• Water Transfers
Increase Water Supply	
• Conjunctive Management and Groundwater Storage	• Municipal Recycled Water
• Desalination (Brackish and Sea Water)	• Surface Storage – CALFED/State – *Not Applicable*
• Precipitation Enhancement – *Not Applicable*	• Surface Storage – Regional/Local
Improve Water Quality	
• Drinking Water Treatment and Distribution	• Pollution Prevention
• Groundwater/Aquifer Remediation	• Salt and Salinity Management
• Matching Water Quality to Use	• Urban Stormwater Runoff Management
Practice Resources Stewardship	
• Agricultural Land Stewardship	• Recharge Area Protection
• Ecosystem Restoration	• Sediment Management
• Forest Management	• Watershed Management
• Land Use Planning and Management	
People and Water	
• Economic Incentives (Loans, Grants and Water Pricing)	• Water and Culture
• Outreach and Engagement	• Water-Dependent Recreation
Other Strategies	
• Crop Idling for Water Transfers – *Not Applicable*	• Rainfed Agriculture – *Not Applicable*
• Dewvaporation/Atmospheric Pressure Desalination – *Not Applicable*	• Snow Fences – *Not Applicable*
• Fog Collection – *Not Applicable*	• Waterbag Transport/Storage Technology – *Not Applicable*
• Irrigated Land Retirement – *Not Applicable*	• Climate Change

Table 4-2
Relation of RMS to The OC Plan Regional Objectives

√ = Supports attainment of the IRWM Plan Objective	Regional Objectives													
Resource Management Strategies *California Water Plan Update 2013*	WS-1: Meet projected increase in water demands of 49,000 AFY by 2040 within the Orange County Groundwater Basin area with consideration of cost-effective strategies	WS-2: Meet projected increase in water demands of 1,800 AFY by 2040 within the La Habra Groundwater Basin area with consideration of cost-effective strategies	WQ-1: Improve water quality consistent with the Basin Plan	WQ-2: Maintain groundwater quality to protect water supplies and ensure reliability	Eco-1: Restore, enhance and expand terrestrial and aquatic ecosystems	Eco-2: Restore, enhance and expand habitat for threatened and endangered species	FM -1: Reduce flood risk to public and private property and improve public safety	FM-2: Improve floodplains	QL-1: Identify and support critical water needs of disadvantaged and low-income communities, and tribal members	QL-2: Increase acreage of open space and park and recreational opportunities	QL-3: Develop and enhance public education programs	ACC-1: Increase energy efficiency	ACC-2: Increase biomass per acre in consideration of carbon sequestration	ACC-3: Implement measures and plan for future changes to climate
Reduce Water Demand														
Agricultural Water Use Efficiency	√	√	√	√							√		√	√
Urban Water Use Efficiency	√	√	√	√					√		√		√	√
Improve Flood Management														
Flood Risk Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Improve Operational Efficiency and Transfers														
Conveyance – Regional/Local	√	√	√	√			√	√	√			√	√	√
System Reoperation	√	√						√				√	√	√
Water Transfers	√	√										√	√	√
Increase Water Supply														
Conjunctive Management and Groundwater Storage	√	√	√	√							√	√	√	√
Desalination	√	√										√	√	√
Municipal Recycled Water	√	√	√	√					√		√	√	√	√
Surface Storage – Regional/Local	√	√	√	√			√	√	√			√	√	√
Improve Water Quality														
Drinking Water Treatment and Distribution	√	√	√	√					√		√	√	√	√

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Groundwater /Aquifer Remediation	√	√	√	√										√
Matching Water Quality to Use	√	√	√	√	√	√		√	√		√		√	√
Pollution Prevention	√	√	√	√	√	√		√	√	√	√	√	√	√
Salt and Salinity Management	√	√	√	√	√				√		√		√	√
Urban Runoff Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Practice Resources Stewardship														
Agricultural Lands Stewardship			√	√	√	√			√	√	√	√	√	√
Ecosystem Restoration	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Land Use Planning and Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Recharge Areas Protection	√	√	√	√	√	√	√	√	√	√		√	√	√
Sediment Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Watershed Management	√	√	√	√	√	√	√	√	√	√	√	√	√	√
People and Water														
Economic Incentives Policy	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Outreach and Engagement	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Water and Culture	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Water-Dependent Recreation			√	√	√	√		√	√	√	√		√	√

4.2 Resource Management Strategies Applicable to the Region

While projects may support only one objective, those that address multiple objectives are given higher priority in this IRWM Plan.

The RMSs deemed applicable to the Region were incorporated into the development of the IRWM Plan. The following describes the applicability of RMS to the IRWM Region.

Reduce Water Demand

Water use efficiency has become a viable long-term supply option in the Region because it saves considerable capital and operating cost for utilities and consumers, avoids environmental degradation, and creates multiple benefits.

Agricultural Water Use Efficiency (WUE) RMS: Water use efficiency is defined by California Water Code (CWC) Section 10817 as "the efficient management of water resources for beneficial uses, preventing waste, or accomplishing additional benefits with the same amount of water." Improvements in agricultural WUE are expressed as yield improvements for a given unit amount of water and can be estimated over individual fields or entire regions. Although the amount of agricultural land is relatively small in the Region, Efficient Water Management Practices (EMWPs) have been developed to improve agricultural water use and management. EWMPs include installing infrastructure to improve on-farm irrigation systems and regional distribution systems, improving water management through use of new technologies, and reducing crop evapotranspiration.

Urban WUE RMS: Multiple water suppliers in the Region are signatory to the California Water Efficiency Partnership (CalWEP [formerly the California Urban Water Conservation Council]) Memorandum of Understanding (MOU) regarding urban WUE and are committed to implementing Best Management Practices (BMP) and Demand Management Measures (DMM) to support the 20x2020 Water Conservation Plan, among other local, regional and statewide water conservation goals. BMPs include indoor and outdoor water saving methods, pricing and management tools, and public education programs. Alternative water sources, such as recycled water, desalinated water, gray water, and rainwater are also considered in urban water demand reduction.

Improve Operational Efficiency and Transfers

California's water system is designed to move water from where it originates to where it is needed.

Conveyance—Regional/Local RMS: Imported water accounts for more than 25 percent of the Region's potable water supply and is obtained through the regional wholesale agencies. The Region obtains imported water supply from Metropolitan, the SWP contractor, through

MWDOC and the cities of Anaheim, Fullerton and Santa Ana. Imported water is sourced from the Bay-Delta (via the SWP) and the CRA. The Region's demand on imported water indirectly impacts the conveyance system of the Delta.

System Reoperation RMS: The Region considers system reoperation[1] as it relates to increased water supply, reliability and efficiency. System reoperation allows for better management and movement of existing water supplies and could increase water supplies during dry years.

Water Transfers RMS: Water transfers refer to purchasing water from a willing seller to meet local water demands. Transfers can be temporary or long-term, and between adjacent water districts or across the state. Water transfers are also a method for sharing water during emergencies. Interconnections with other agencies result in the ability to share water supplies during short-term emergency situations or planned shutdowns of major imported water systems. Transfers of water can alleviate short-term outages and can also be long-term water exchanges to manage droughts or other water shortages. The Region considers both local and regional transfer as exchange opportunities that promote reliability within their systems.

Increased Water Supply

The Region's communities are finding innovative ways to generate new water supplies.

Conjunctive Management & Groundwater RMS: Conjunctive management or conjunctive use refers to the coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies in a region, in an economically and environmentally responsible manner, to meet various management objectives.

In the Region, groundwater supplies and surface water supplies are conjunctively managed. OCWD maintains groundwater storage levels on a long-term basis within a specified operating range to prevent the groundwater basin from becoming over-drafted. Short-term excursions from the operating range due to extreme drought or other factors are not expected to cause adverse impacts but would need to be monitored closely and be of limited duration.[2] The CWP Update 2013 (p. SC-77) supports this method of groundwater basin management as a recognized and acceptable approach to conjunctive water management - utilization of groundwater in storage during years of diminishing surface water supply, followed by active recharge of the aquifer when surface water or other alternative supplies become available.

[1] System reoperation is generally defined as changing the operational and management procedures of existing water system facilities to obtain water resources related benefits. Reoperation is considered an alternative to constructing major new facilities, although it may consist of physical modification of existing facilities. DWR, System Reoperation Program, Phase 1 - Plan of Study, 2011, p. 1.
http://www.water.ca.gov/system_reop/docs/system_reop_phase1_plan_of_study_6-2011.pdf
[2] OCWD Groundwater Management Plan Update 2015, p. 10-3

Conjunctive management of water supplies in the Region is a long-established practice. Surface water diversion of the Santa Ana River into recharge basins dates to the 1940s. OCWD continuously evaluates and implements projects to improve the capacity of recharge facilities to increase groundwater replenishment. Additionally, OCWD reviews opportunities to increase sources of recharge water. Such projects are evaluated for their reliability and cost effectiveness.

Additionally, impediments to conjunctive use of surface and groundwater supplies in Orange County have been characterized and opportunities to remove those impediments are being implemented or considered, such as:[3] 1) Declining Santa Ana River baseflow reduces available recharge water for the groundwater basin – *Opportunity:* Operation of the GWRS for new source of recharge, and maintaining water purchase reserve account for flexibility to purchase imported water in large quantities when available; 2) Limited imported water supply increases demands on groundwater supplies and decreases the supply to recharge the groundwater basin – *Opportunity:* Operation of the GWRS provides a new source of water to replace imported water, and managing the groundwater basin within operating safe yield allows for water storage in the basin during wet years for use during dry years when imported water deliveries are reduced; and 3) Flash storms produce river flows that overwhelm the recharge system – OCWD is unable to capture all stormflows, resulting in loss of potential water supply – *Opportunity:* Work with the USACE to change operation of Prado Dam to allow increased temporary storage of stormflows behind dam to allow for greater capture in recharge basins and minimize losses to the ocean.

Desalination – Brackish & Seawater RMS: Desalination is the process of removing salt from water supplies for beneficial uses. Reverse osmosis is the primary technology used in California to remove salts. Benefits of desalination include diversification of local water supplies and improved reliability during dry years. Options for the Region to expand its water supply portfolio include remediating brackish groundwater and ocean water desalination.

A major component of OCWD's sustainable basin management is to operate seawater intrusion barriers to prevent the encroachment of seawater into fresh groundwater zones along the coast. Future efforts may include expansion of existing barriers and construction of new barriers.

Developing local supplies, including ocean desalination, is part of Metropolitan's Integrated Regional Plan goal of improving water supply reliability in the Region and reducing pressure on imported supplies from the SWP and Colorado River. Metropolitan's Local Resources Program includes incentives for locally produced seawater desalination projects that reduce the need for imported supplies.

[3] OCWD Groundwater Management Plan Update 2015, see Table 10-4 for more.

As discussed in **Section 2.2.5**, a seawater desalination project in the Region is proposed to produce up to 50 MGD (56,000 AFY) of drinking water.

Recycled Municipal Water RMS: Orange County is a water recycling leader in California, in both quantity and innovation. Recycled water is widely accepted as a water supply source throughout the Region, providing water for groundwater replenishment and landscape irrigation.

The Groundwater Replenishment System (GWRS), OCWD's water purification system in operation since 2008, uses wastewater that would otherwise be discharged to the Pacific Ocean. The wastewater is purified using a three-step process (microfiltration, reverse osmosis, and advanced oxidation/disinfection) to produce high-quality water used to recharge the Orange County Groundwater Basin and for injection into the Talbert Seawater Intrusion Barrier. The plant produces up to 103,000 AFY of recycled water. Design of the GWRS final expansion that will produce an additional 31,000 AFY of recycled water is underway.

Surface Storage—Regional/Local RMS: Surface storage is the term for the use of man-made, above-ground reservoirs to collect water for later use or release when needed. Surface storage has played a key role in California where the quantity, timing, and location of water demand frequently does not match the natural water supply availability. Benefits include water quality management, system operational flexibility, power generation, flood management, ecosystem management, sediment transport management, recreation, water supply augmentation, and emergency water supply. Many California water agencies rely on surface storage as a part of their water distribution systems.

Metropolitan maintains three major reservoirs and a group of six smaller reservoirs, combined with a total capacity of 1.68 million acre-feet (MAF). The Region continues to explore development of surface storage projects for emergency and supplemental water supply purposes.

Improve Water Quality

Improved water quality can directly improve the health of Californians and natural ecosystems.

Drinking Water Treatment and Distribution RMS: Providing a reliable supply of safe drinking water is the primary goal of public water systems in the Region. To achieve this goal, public water systems must develop and maintain adequate water treatment and distribution facilities. Standard treatment for surface water can involve filtration and disinfection to make water suitable for potable uses. Groundwater supplies may need treatment when water filtered does not meet drinking water standards.

The reliability, quality, and safety of raw water supplies are critical to achieving this goal. In general, public water systems depend on other entities to help protect and maintain the quality of the raw water supply. Many agencies and organizations have a role in protecting water

supplies in the Region. For example, the Regional Water Board's Basin Plan recognizes the importance of this goal and emphasizes protecting both groundwater and surface water supplies.

Groundwater/Aquifer Remediation RMS: Efforts to protect the groundwater basin and to assess the potential threat to public health and the environment from contamination in the Santa Ana River Watershed and within Orange County is vital to the Region. Remediation of groundwater contamination is an important management strategy as groundwater is a primary water supply in the Region. One of the Orange County Groundwater Basin Management objectives is "Contamination Prevention and Remediation" to meet the goal to protect and enhance groundwater quality. OCWD's broad activities include: to implement the District's Groundwater Quality Protection Policy and evaluate and implement projects to address groundwater contamination.[4]

Groundwater remediation involves extraction and treatment of contaminated groundwater from point and nonpoint sources. Treated water can be used for beneficial uses or injected back into the aquifer. Groundwater contaminants can include nitrate, organic compounds, heavy metals, and TDS or salinity.

There is an extensive program in the Region to monitor groundwater quality as described in detail in the Basin 8-1 Alternative Plan (**Appendix C**). Two major groundwater contamination plumes are in the process of remediation and projects to complete the clean-up will be an important component in this strategy. In addition, the U.S. Navy is actively remediating groundwater contamination caused by their past operations in the Region.

OCWD does not have the regulatory authority to require responsible parties or potentially responsible parties to clean up pollutants that have contaminated groundwater. However, in some cases, OCWD has pursued legal action against entities that have contaminated the groundwater basin to recover OCWD's monitoring and remediation costs. In other cases, OCWD coordinates and cooperates with regulatory oversight agencies that investigate sources of contamination.

OCWD also uses financial incentives to encourage pumping and treatment of groundwater that does not meet drinking water standards to protect water quality by reducing the spread of poor-quality groundwater.

Matching Quality to Use RMS: Matching water quality to use is a management strategy recognizing that not all water uses require the same water quality. One common measure of water quality is its suitability for an intended use; a water quality constituent often is only considered a contaminant when that constituent adversely affects the intended use of the water. Agricultural, commercial, landscape, and residential water uses have different water

[4] OCWD Groundwater Management Plan 2015 Update and Basin 8-1 Alternative, OCWD, January 2017

quality standards. High-quality water sources can be used for drinking and industrial purposes that benefit from higher quality water and lesser quality water can be adequate for some uses. The Region considers this strategy in its goals as agencies seek to meet the water quality requirements and beneficial uses set forth by the Regional Water Board. In addition, efforts to increase water reuse include urban and stormwater runoff treated to recycled water standards for non-potable water uses. Recycled water can be substituted for potable water when uses do not require potable water quality. Blending water sources is often an effective means to match water quality to water uses and improve the quality of lesser quality sources.

Pollution Prevention RMS: Pollution prevention protects the water quality of surface water and groundwater sources for beneficial uses. The SWRCB has identified 23 beneficial uses of water, including fish and wildlife, recreation, and drinking water.

Pollution prevention aims to control pollution from both point and non-point sources. Managing point source pollution involves source water quality control measures and treatment techniques. Non-point sources of pollution are one of the primary concerns of the SWRCB and Regional Boards. Non-point source pollutants are generated from a variety of sources, including land use activities associated with agricultural operations and livestock grazing, urban runoff, deposition of airborne pollutants, hydromodification, and discharges from marinas and recreational boating activities. The Orange County Stormwater Resource Plan (**Appendix D**) identifies nonpoint source pollution control as a main water quality benefit of increasing filtration and/or treatment of runoff. The Region implements point source and non-point source pollution controls through source and structural BMPs for urban users, and Efficient Water Management Practices for agricultural users. The Regional Water Board is adopting TMDLs to control both point and non-point pollution sources.

Salt and Salinity Management RMS: Within the Region, efforts to control seawater intrusion are vital to protect the water quality of the groundwater basin. Two seawater intrusion barriers are in operation to maintain a protective barrier against intrusion of high-saline water into fresh water aquifers. Expansion of the existing barriers and the need for new seawater intrusion barriers are under active consideration.

Three desalters are in operation within the Region, one in Irvine and two in Tustin. The Tustin desalters are used to treat pumped groundwater to remove nitrates and TDS and the Irvine

desalter operates to remove volatile organic compounds (VOCs) from contaminated groundwater that is used for irrigation and to remove excess nitrate and TDS for drinking water purposes.

The North and Central OC IRWM Region is part of a Santa Ana River Watershed-wide salt and nutrient management program under the oversight of the Regional Water Board. As presented in **Section 2.4**, a task force conducted a study to evaluate the impacts to groundwater quality of elevated levels of Total Inorganic Nitrogen (TIN) and TDS in the watershed. Formation of the Task Force was in response to concerns by the Regional Water Board that water quality objectives for nitrogen and TDS were being exceeded in some groundwater basins in the watershed. This nearly 10-year effort involved collecting and analyzing data in 25 newly defined groundwater management zones in the watershed to recalculate nitrogen and TDS levels and to establish new water quality objectives.

The Basin Plan charges the agencies of the new Basin Monitoring Program Task Force formed by SAWPA with implementing a watershed-wide TDS/Nitrogen management program. Task Force members agreed to fund and participate in a process to recalculate ambient water quality every three years in each of the 25 groundwater management zones and to compare water quality to the water quality objectives to measure compliance with the Basin Plan.

The Basin Plan contains TDS concentration objectives for the Santa Ana River and the groundwater management zones (GMZ), and a plan to manage TDS concentrations pursuant to those objectives. The Basin Plan TDS concentration objective is 700 milligrams per liter (mg/L) for baseflow discharge of the Santa Ana River at the USGS gaging station below Prado Dam (Santa Ana River below Prado Dam)—the so-called Reach 3 TDS concentration objective. The purpose of the Reach 3 TDS concentration objective is to protect the beneficial uses of the Santa Ana River (SAR) in the Orange County Groundwater Management Zone (GMZ)—the primary use being groundwater recharge.

In 2009, the SWRCB adopted the Recycled Water Policy (State Water Board Resolution No. 2009-0011) to protect groundwater resources and increase the beneficial use of recycled water from municipal wastewater sources in a manner consistent with state and federal water quality laws and regulations. The Policy provides direction regarding the appropriate criteria to be used by the SWRCB and the Regional Boards in issuing permits for recycled water projects. The Policy recognizes the potential for increased salt and nutrient loading to groundwater basins because of increased recycled water use, and therefore, requires regional or sub-regional salt and nutrient management planning.

Urban Stormwater Runoff Management RMS: Urban stormwater runoff management aims to protect waterways from increased pollutant loading and impacts of urbanization. Urban stormwater runoff management is a broad series of activities to manage both stormwater and

dry-weather runoff. Dry-weather runoff occurs when, for example, excess landscape irrigation water flows to the storm drain.

Traditionally, urban stormwater runoff management was viewed as a response to flood control concerns resulting from the effects of urbanization. Concerns about the water quality impacts of urban runoff have led agencies and cities in the Region to look at watershed approaches to control runoff and provide other benefits, including the use of stormwater diversions to provide increased groundwater recharge and improve water quality. Best management practices have been developed to manage pollutant loads and flows into waterways. Impacts to water quality from urban and stormwater runoff is managed under the federal Clean Water Act.

Effective runoff management can help improve ecosystems, improve riparian and fish habitat, prevent flooding, protect groundwater and surface water quality, decrease sedimentation, and improve recreation. On the other hand, removal of these flows in some cases may have an unintended consequence of drying up a channel that provides wildlife habitat.

Practice Resource Stewardship

The IRWM Plan recognizes the importance of protecting the beneficial uses of water resources.

Ecosystem Restoration RMS: Ecosystems can be threatened as physical changes occur, including those associated with erosion of levees and banks, poor water quality, temperature, dissolved oxygen levels and pollutants, and non-native invasive species. Ecosystem restoration focuses on restoration of aquatic, riparian, and floodplain ecosystems. These natural systems are most directly affected by water and flood management actions and are particularly vulnerable to the impacts of climate change. Ecosystem restoration can provide habitat for native plants and animals and improve the aesthetic value of land for current and future generations. Benefits of restored ecosystems also include increased connectivity of habitat, endangered species habitat, increased stormwater capture and storage, groundwater recharge, flood control and protection, water quality protection, water supply reliability, and recreation. The Region includes ecosystem restoration in its Restore Ecosystem and Improve Native Habitat objectives.

Orange County Coastkeeper manages an extensive program to maintain and restore healthy coastal ecosystems through projects such as expanding eelgrass habitats and restoring populations of Olympia Oysters, to name a few. Reconstruction of Burris Basin (an OCWD groundwater recharge basin) included the implementation of a comprehensive habitat management plan to remove non-native trees and vegetation, planting of native habitat, creation of bird habitat, and construction of a small freshwater marsh habitat on the basin's edge.

The Nature Reserve of Orange County (NROC) was formed in 1996 as a result of conservation planning by federal and state wildlife agencies, county and city governments, major landowners

and the environmental community. The partnership was formed to establish a Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP) for the Central and Coastal sub-region of Orange County. The result is a 37,000-acre regional open-space reserve that permanently protects a wide range of local wildlife and natural habitats. NROC manages monitoring and restoration programs throughout the reserve, which is in two nearly equal sections – the Coastal Reserve extends from Newport Bays through Dana Point and north to Irvine, and the Central Reserve in the county's foothills, extend north of Irvine to the Santa Ana River.

An exceptional representation of collaboration, the NROC Board of Directors is composed of public and private owners of reserve land, wildlife agencies, local governments and community representatives including the U.S. Fish and Wildlife Service, the California Department of Fish & Game, the California Department of Parks and Recreation, the County of Orange, IRWD, Metropolitan, the University of California at Irvine, the Transportation Corridor Agencies, the City of Irvine, The Irvine Company, Headlands Reserve, LLC, the California Department of Forestry, the Coastal Greenbelt Authority, and the Orange County Fire Authority, as well as three at-large public members representing the environment, business and recreation communities.[5]

Agricultural Lands Stewardship RMS: Agricultural land stewardship means farm and ranch landowners — the stewards of the state's agricultural land — producing public environmental benefits in conjunction with the food and fiber they have historically provided while keeping land in private ownership (CWP Update 2005, Agricultural Land Resource Management Strategy).

Agricultural land stewardship aims to preserve the Region's agriculture while managing the lands for multiple benefits, including water management improvements, and maintaining agricultural land in private ownership. Agriculture can provide multiple benefits to the Region, including economic benefits, employment, local food supplies, open space preservation, and habitat value. Implementation of agricultural land stewardship practices can protect environmentally sensitive habitat, increase groundwater recharge, provide water for wetlands, and support flood management efforts.

The Region is predominately urban with limited agricultural land, although the Region maintains a rich agricultural history. While agriculture is not a high-profile industry, the Region practices this RMS and contributes more than $200 million to the Orange County economy. When all economic factors are considered, including payroll, purchase of goods and transportation, agriculture has a total value to the local economy of $1 billion.[6] In addition to the value to the economy, the farmers of Orange County maintain tracts of open space, plant

[5] http://irwd.com/about-us/nature-reserve-of-orange-county
[6] https://www.ocfarmbureau.org/about

trees and crops that help improve air quality, provide a harvest of locally grown products and help preserve the legacy of old Orange County.

Land Use Planning and Management RMS: Local land use and water supply planning are implemented and coordinated through a patchwork of existing state and local laws and policies. Cities and counties set policies in General Plans, zoning ordinances, or other planning documents that identify current and future land uses within their boundaries. Water-related projects can be included in the General Plan elements for conservation, open space, and safety. Projects should be coordinated with these documents for appropriate implementation.

Regional wholesalers, such as Metropolitan, base their water supply plans on regional growth projections developed by local and regional planning agencies. Many local agencies also use a land use planning methodology based on land use or population for calculating water demand projections. One of the most important elements of any water supply analysis is the demand projection methodology. Choosing a methodology should be predicated on the land use plan that is being examined and the prevalence of relevant information. Each methodology has limitations and each final demand calculation is essentially a future prediction.

Land use planning is also essential for determining potential water rights and for beneficial use. All water rights are limited by Article X, Section 2 of the California Constitution which requires that water be reasonably used for beneficial purposes. It is unclear whether the reasonableness of use of water refers only to wasteful use of water or may include some water use that is merely less than optimal. Where water is scarce, the reasonableness of a particular beneficial use may be compared against other beneficial uses.

The Endangered Species Act – although not a "water right" – is another regulatory mechanism that can affect a jurisdiction's ability to use water under its rights and entitlements.

Recharge Areas Protection RMS: Recharge areas protection addresses lands that are an important source for groundwater recharge, which provide the primary means of replenishing groundwater. Good natural recharge occurs in areas where good quality surface water can percolate through sediment and rock to the saturated zone, containing groundwater. Recharge areas include stream beds and offstream areas which allow water to permeate into the ground. Stream beds can be used for natural recharge or

managed recharge by increasing flow volume or decreasing velocity. Offstream recharge sites include ponds, basins, or injection wells to artificially recharge groundwater. Open ponds or basins can provide important bird or wildlife habitat.

If recharge areas cease to function properly, it will limit groundwater replenishment and/or groundwater quality for storage or use. Recharge areas should be protected for water supply, water quality, and environmental purposes and can be protected through land use planning, land conservation or habitat protection programs. Recharge areas protection can also prevent open spaces from being developed for urban infrastructure.

OCWD operates an extensive network of recharge basins to increase recharge of surface water into the groundwater basin to support groundwater production. Recharge occurs by natural percolation of precipitation and through active managed aquifer recharge in a network of recharge facilities. OCWD monitors the groundwater basin by collecting groundwater elevation and quality data from nearly 700 wells, including over 400 OCWD-owned monitoring wells; it manages an electronic database that stores water elevation, water quality, production, recharge and other data on over 2,000 wells and facilities within and outside OCWD boundaries. While the Santa Ana River is a major source of groundwater recharge in the basin, an OCWD-operated water recycling plant provides up to 100 mgd of advanced tertiary-treated wastewater for recharge operations and a seawater intrusion barrier operated to protect the basin's water quality. OCWD also recharges surface water within the Santiago Creek bed and in recharge basins located adjacent to the creek following the Basin Plan water quality objectives.

Sediment Management RMS: The key to effective water-sediment management is to address excessive sediment in watersheds. The Orange County Stormwater Resource Plan includes sediment and flow control to return to a more natural condition as an objective for protecting and enhancing natural resources and community benefits.

Watershed Management RMS: Understanding a watershed's ecological processes is a critical factor to successful watershed management and can allow for adaptive management of the watershed. A primary objective of watershed management is to increase and sustain a watershed's ability to provide for the diverse needs of the communities that depend upon its resources, including local, regional, state, federal, and tribal stakeholders. Actions which can degrade watershed health include altering land uses to affect runoff and flood flows, increasing pollutant loads in water bodies, fragmenting habitat and wildlife corridors, and introducing invasive species. Watershed management planning encompasses a broad perspective on resource management and seeks to balance the various functions of a watershed, including water resources, ecosystems, open space, and community needs. Watershed management promotes multi-benefit projects and often requires the involvement of multiple stakeholders. The IRWM Region seeks to accomplish this objective through the development and implementation of this IRWM Plan.

Improve Flood Management

The OC Plan promotes and practices integrated flood management to provide multiple benefits including better emergency preparedness and response, increased flood protection, more sustainable flood and water management systems, and enhanced floodplain ecosystems.

Flood Management RMS: Flood management provides safety and economic benefits by reducing the risk to human life, property, and infrastructure from flood damage. Flood management can also protect ecosystems and agricultural lands by reducing development in floodplains and preserving natural habitat and open spaces. Allowing seasonal flooding of some areas could improve habitat values and increase groundwater recharge.

The Flood Management RMS has been subdivided into four approaches: nonstructural, restoration of natural floodplain functions, structural, and flood emergency management. This RMS is considered in The OC Plan's *Integrate Flood Management* objective. The Orange County Flood Control District (OCFCD) is tasked with the goal of protecting the county from the threat of floods by designing and constructing channels, storm drains, dams, pump stations and other drainage related facilities. The OCFCD Regional Backbone Flood Control Infrastructure provides the primary flood control protection for the County and comprises channels, dams, retarding basins, pump stations and levees. **Figure 2-17** in **Chapter 2** shows the regional flood control infrastructure and includes more than the OCFCD-owned facilities. OCFCD's goal is to provide 100-year storm event protection to its regional flood control Infrastructure.

People & Water

Economic Incentives (Loans, Grants, and Water Pricing) RMS: Economic incentives implemented by the Region include financial assistance, water pricing, and water market policies intended to influence water management. Economic incentives can influence the amount and time of water use, wastewater volume, and source of water supply. Examples of economic incentives include low interest loans, grants, and water rates and rate structures. Free services, rebates, and the use of tax revenues to partially fund water services also have a direct effect on the prices paid by water users.

Outreach and Engagement RMS: Outreach and engagement for water management in California includes tools and practices by water agencies to facilitate input by public individuals and groups toward good water management outcomes. Members of The OC Plan region actively perform outreach and engagement through numerous programs, including educational programming for professional, worker and student opportunities, as well as elected officials and regulatory personnel as appropriate to support the goals of the IRWM Plan.

MWDOC strives to provide a variety of services and outreach programs that provide benefit to its stakeholders and constituents of all ages, aimed at increasing awareness of rebates and water use efficiency. Their outreach efforts focus on water use efficiency awareness and

rebates, public information, legislative advocacy, water education, and emergency preparedness.

OCWD is committed to community engagement and hosts/sponsors events to educate and inform stakeholders about critical and emerging issues; maintains an H2O Learning Center on its website, which contains information on water reuse, water use efficiency, resources, publications, fact sheets and reports; and provides an all-day event called the *Groundwater Adventure Tour* that takes participants to OCWD's H2O Learning Center, Groundwater Replenishment System, Advanced Water Quality Assurance Laboratory, Anaheim Recharge Basins, and Prado Wetlands. Further, each water supplier in the Region has individual outreach programs.

Retail water suppliers also promote water use efficiency through various outreach methods including, but not limited to, websites, social media, mailers, billing inserts, programs, events and classes, online and field trainings, and rebates.

In addition, the Water Advisory Committee of Orange County was formed and meets monthly to facilitate discussion on current and emerging water issues affecting Orange County. The Orange County Water Summit is held annually to bring together business professionals, academics, elected officials and water industry representatives to talk about water issues, projects and emerging technologies.

The SAWPA Disadvantaged Community Involvement (DCI) Program is designed to ensure the involvement of DACs and economically distressed areas (EDAs), or underrepresented communities (collectively referred to as DACs) in IRWM planning efforts. The SAWPA DCI Program is exploring the strengths and needs of overburdened communities in the watershed, through engagement and education, to uncover and share the needs and capacities within the water agencies and communities, and to assure integrated water management projects are supported by communities and made ready for implementation and prioritized in the OWOW Plan Update 2018.

Water and Culture RMS: Water and culture are connected in a multitude of ways, with subtle and complex implications for water management in California. Some cultural relationships to water are so pervasive, they may be easy to overlook, such as subsistence activities including traditional hunting, fishing, and collecting plants for food sources; and recreation activities that include swimming, surfing, boating, kayaking, as well as water providing the scenic backdrop for hiking, wildlife viewing, and picnicking. Other cultural considerations are less apparent and may be difficult to recognize, such as spiritual activities including outdoor baptisms, sweat lodges, lakeside weddings, and Native American ceremonies. The historic preservation to maintain the legacy of the past by protecting historical features may be challenged by water management projects and activities, for example, receding waterlines at lakes or reservoirs could expose protected historic features. Increasing the awareness of how cultural values, uses, and practices

are affected by water management, as well as how they affect water management, will help inform policies and decisions.

Water-Dependent Recreation RMS: Water-dependent recreation includes opportunities to access beaches, lakes, river corridors, or wetlands. Orange County, California, has beautiful beaches, scenic vistas, and pristine wilderness areas that are visited year-round by residents and out-of-town guests. The Region offers a variety of water-dependent recreation opportunities in any season, enhanced by interpretive signs and educational facilities. Each year, millions of California residents and visitors come to the Region's lakes, rivers, and beaches seeking recreation experiences, including boating, surfing, scuba diving, beach activities, hiking, bird watching, and many other experiences. Upper Newport Bay is an important natural feature that many enjoy by kayaking, canoeing, and enjoying that natural environment. Other water-dependent recreation areas include Newport Harbor, Huntington Harbour, Bolsa Chica State Beach and the Bolsa Chica Ecological Reserve, Del Mar State Beach, Huntington Beach, and numerous other beaches, along with some marine protected areas for fishing.

Monitoring activities for the Orange County coastal recreation waters are conducted by the County Health Care Agency and OCSD. The Orange County Ocean Water Protection Program ensures that all public recreational waters meet applicable water quality standards for swimming and shellfish harvesting. The Health Care Agency and OCSD routinely conduct microbial monitoring of ocean waters, responds to sewage spills and other unauthorized discharges of waste, closes ocean and bay waters, posts warning signs, responds to illness complaints, and issues health advisories. Improving water-dependent recreation contributes to watershed stewardship in the Region.

Other Strategies

Climate Change: Climate Change is considered in The OC Plan objectives as it impacts all aspects of watershed management, such as:

Climate change impacts on urban water supplies include:

- Warming temperatures, resulting in increased water usage, particularly for outdoor irrigation.
- Decreasing snowfall, reducing the natural water storage found in the Sierra Nevada snowpack.
- Precipitation shifting from snow to rain, requiring a change in water supply management.
- Rising sea levels: Threatening water supply infrastructure in coastal communities, increasing seawater intrusion into coastal freshwater aquifers, reducing water exports from the Delta.
- Increasing frequency of floods, droughts, and wildfires damaging watersheds that provide water to urban communities.

Climate change affects water-dependent resources that currently support many cultural activities and recreational activities. Changes in temperature and precipitation may affect ecosystems throughout the Region and affect the subsistence activities that these ecosystems support. Changes in surface runoff and volume, greater salinity intrusion associated with sea level rise, and warmer water temperatures may also affect recreation and spiritual practices associated with water as water levels, stream flows, and water quality are reduced. Historic preservation activities may also be affected, with important cultural sites being at greater risk as a result of exposure during extended drought periods, such as inundation, or physical damage during extreme flood events. More frequent and intense wildfires could also affect all of these cultural activities.

All applicable RMSs also considered the effects of Climate Change on the IRWM region.

4.3 Resource Management Strategies Not Applicable to the Region

Resource Management Strategies that are applicable within the IRWM region and related Objectives are discussed in **Section 4.1** and shown in **Table 4-2** above. The following RMSs do not apply to the Region since they are either directed toward implementation by State agencies or the legislature, or they are not considered in the Region as noted below:

Conveyance – Delta and Surface Storage CALFED RMS: This RMS is not directly applicable to the Region, as most of the Region's conveyance issues are related to local infrastructure and the Region does not own or operate conveyance in the Delta region or surface storage facilities in the CALFED region.

Precipitation Enhancement RMS: Precipitation enhancement, commonly called "cloud seeding," artificially stimulates clouds to produce more rainfall or snowfall than they would produce naturally. Cloud seeding injects substances into the clouds that enable snowflakes and

raindrops to form more easily. Precipitation enhancement is the one form of weather modification done in California. The Region currently does not practice this.

Forest management RMS: Forest management is not applicable to the Region due to a lack of forest-zoned land use.

Crop idling for water transfers RMS: Does not apply due to the limited agricultural land and farming that occurs in the Region; crop idling does not occur.

Dewvaporation RMS: Atmospheric pressure desalination is not used within the Region; however, reverse osmosis desalination is implemented and addressed accordingly.

Fog collection RMS: This practice is not applicable due to the limited rainfall and precipitation within the Region.

Irrigated land retirement RMS: Less than one percent of the Region has agricultural farming; retirement of irrigated agricultural land would have little impact on water supplies in the Region.

Rainfed Agriculture RMS: Due to limited regional rainfall and limited agricultural land, this practice is not applicable.

Snow Fences RMS: The Region does not experience snow of any accumulation; therefore, snow fences are not considered in the IRWM Plan objectives.

Waterbag Transport/Storage Technology RMS: This technology is not an applicable practice in the Region and has not been explored; above-ground reservoir storage facilities are utilized for water storage.

4.4 Regional Strategies

The OC Plan considers IRWM planning concepts, State standards, and the State's resource management strategies through the integration of projects and programs that incorporate a wide range of water management strategies resulting in a synergistic approach to the Region's watershed management.

The OC Plan includes proposed projects that will implement regional strategies. Projects that address multiple objectives are typically the most cost-effective and resource-efficient and are given higher priority in The OC Plan. Integration of the regional strategies enhance the benefits of project implementation throughout the Region. As discussed in **Section 3.7**, the value of integrated regional planning is a direct result of the extent to which water management strategies are determined to be complementary within a given region and then further identified to achieve multiple regional objectives. Benefits of integration include:

- Sharing knowledge, resources, facilities, and costs;
- Reducing duplicative efforts;
- Achieving broader goals and objectives;
- Improving regional collaboration; and
- Improving local understanding of water resources.

To understand selection of the Region's strategies, it's important to understand the Region's goals and objectives, which are explained in **Section 3.**

Further, interregional projects have substantial benefits for the IRWM Region, particularly collaborating among agencies across the entire Santa Ana River Watershed that reaches beyond the regional boundaries. Benefits to implementing interregional projects include increased opportunity for project implementation, collective planning as opposed to confinement with in political boundaries, increased participation and cooperation by the public, and shared costs.

4.4.1 Provide Adequate and Reliable Water Supplies Strategies

The OC Plan Strategies:

WS-1&2 A. Increase local potable water supplies
WS-1&2 B. Increase recycled water supplies to offset potable water
WS-1&2 C. Sustainably manage groundwater resources
WS-1&2 D. Maximize water conservation and water use efficiency strategies and efforts
WS-1&2 E. Reduce the vulnerability of water systems to interruptions and to the effects of climate change, including sea level rise
WS-1&2 F. Optimize use of imported water in times of surplus
WS-1&2 G. Replace potable water supply lost due to groundwater contamination

To meet Objectives WS-1 and WS-2, *Meet projected increase in water demands of 49,000 AFY by 2040 in the Orange County Basin with consideration of cost effective strategies* and *Meet projected increase in water demands of 1,800 AFY by 2040 in the La Habra Basin with consideration of cost-effective strategies,* respectively, WS-1 A through G and WS-2 A through G were developed.

These strategies implement water development, savings and benefits including improvements in technology and management of water. Importantly, conjunctive management enables the Region to coordinate use of both surface water and groundwater resources to maximize the availability and reliability of water supplies in the Region to meet various objectives. Managing both resources together allows water managers to use the advantages of both resources for maximum benefit. Implementation of conjunctive management will increase pumping and

needed treatment of local groundwater for water supply, consistent with sustainability and conjunctive use with other supplies.

In wet years, the use of imported supplies increases, allowing imported water to be used to replenish the groundwater basin in addition to direct domestic use. In dry years, there is a shift to greater pumping from the groundwater basin to meet demands. Groundwater recharge is essential in conjunctive use projects to increase stored groundwater, and can occur naturally, in-lieu[7], or through artificial means, such as recharge ponds or injection wells.

4.4.2 Protect and Enhance Water Quality Strategies

The OC Plan Strategies:

- WQ-1 A. Meet NPDES and TMDL water quality regulatory requirements.
- WQ-1 B. Attain water quality standards in fresh and marine environments.
- WQ-1 C. Expand the use of water quality treatment systems with a focus on regional projects.
- WQ-2 A. Protect and improve groundwater quality consistent with beneficial uses.
- WQ-2 B. Clean up groundwater contamination.

The IRWM Region stakeholders considered surface and groundwater quality during the development of the IRWM Plan's goals, objectives, and strategies.

Surface Water Quality

To meet Objective WQ-1, *Improve water quality consistent with the Basin Plan*, strategies WQ-1 A through C were developed.

These management strategies will promote sub-regional and regional BMPs, to address non-point-source pollutants during both wet and dry weather. Each project's performance would typically be measured by the number and area of sites affected; estimated reduction in nuisance and/or storm runoff volume or rate; and/or estimated reduction in quantity of key pollutants potentially exposed to discharge to the environment, compared to pre-project or conventional conditions.

[7] According to the California Water Code: "In-lieu recharge" means accomplishing increased storage of groundwater by providing interruptible surface water to a user who relies on groundwater as a primary supply, to accomplish groundwater storage through the direct use of that surface water in lieu of pumping groundwater. Satisfying the demand of a user with additional surface water eliminates the need to pump groundwater, thus increasing the amount of groundwater available for other uses or to remain in storage.

Groundwater Quality

To meet Objective WQ-2, *Maintain groundwater quality to protect water supplies and ensure reliability*, strategies WQ-2 A and B were developed.

Groundwater quality protection projects and activities will help prevent contamination of aquifers by sewage, industrial or other wastes. In some cases, groundwater remediation is necessary to improve the quality of degraded groundwater for beneficial use. Drinking water supply is the beneficial use that typically requires remediation when groundwater quality is degraded. Implementation of this strategy also protects recharge of groundwater aquifers in a cost-effective manner consistent with minimizing socioeconomic and environmental impacts.

4.4.3 Restore Ecosystems and Improve Native Habitat Strategies

The OC Plan strategies:

ECO-1 A. Increase functioning habitat that sustains viable populations of native species and restore habitat for terrestrial and aquatic species.

ECO-1 B. Remove invasive species that are a danger to habitat, water supply or other economic or beneficial use.

ECO-1 C. Increase use of water quality treatment systems that also increase wildlife habitat and wetlands by restoring a natural water balance not dependent on urban runoff or supplemental water.

ECO-1 D. Preserve open space.

ECO-2 A. Increase functioning habitat that sustains viable populations of threatened and endangered species.

ECO-2 B. Remove invasive species that negatively impact threatened and endangered species.

To meet Objective ECO-1, *Restore, enhance and expand terrestrial and aquatic ecosystems,* strategies ECO-1 A through D were developed. To meet Objective ECO-2, *Restore, enhance and expand habitat for threatened and endangered species*, strategies ECO-2 A through B were developed.

These strategies implement ecosystem restoration of aquatic, riparian, and floodplain ecosystems. The Region desires to increase functioning habitat for native terrestrial, aquatic, threatened and endangered species; remove invasive species; and restore a natural water balance not dependent on urban runoff by reducing negative impacts of surface runoff on riparian eco-systems, and beneficial uses.

These natural systems are most directly affected by water and flood management actions and are particularly vulnerable to the impacts of climate change. Ecosystem restoration can provide habitat for native plants and animals and improve aesthetic value of the land for current and

future generations. Protecting receiving waters and marine ASBS to the extent feasible is important. Implemented projects may have a number or acreage of sites retrofitted with control measures and/or measure estimated reduction in daily or storm discharges to the receiving waters or ASBS. Projects may also be considered that protect and enhance natural resources re-establishing native aquatic, riparian and transitional biotic communities.

Further, this objective includes a strategy to preserve open space to provide opportunities for controlled recreational access and enjoyment of aquatic ecosystem areas while minimizing the environmental impacts of uncontrolled use.

4.4.4 Integrate Flood Management Strategies

The OC Plan Strategies:

- FM-1 A. Improve flood protection based on risk management standards.
- FM-1 B. Improve flood control facilities and remove properties from the FEMA 100-year floodplain with consideration for climate change on flow regimes.
- FM-1 C. Improve storm drain systems where historical flooding exists, when feasible.
- FM-2 A. Reduce scour and erosion on canyons and channels while supporting natural systems and minimizing use of concrete and riprap.
- FM-2 B. Implement stream channel naturalization efforts to promote multiple benefits such as creation or improvement of habitat and/or improvement in water quality while protecting public health.

To meet Objective FM-1, *Reduce flood risk to public and private property and improve public safety,* strategies FM-1 A through C were developed. To meet Objective FM-2, *Improve floodplains,* strategies FM-2 A and B were developed.

Flood management practices recognized by The OC Plan include, but are not limited to: maintaining flood protection, improving flood control facilities, improving sub-regional facilities and local storm drain systems, reducing scour and erosion on canyon and channel stability, and stream channel naturalization efforts to promote multiple benefits.

Project performance would typically be measured by protection and conveyance improved acres cleared in 100-year floodplain, and acres of stream channel naturalization. This would also be accomplished by managing development through the planning process (County and cities) to match pre- and post-project flows.

A key component of flood management is the use of Geographic Information Systems (GIS), databases and other data management tools to support data development and manage the watersheds in the Region. This promotes the development, installation, application, or updating

of flood control and pollutant control data, methods of measurement and management to protect waterways. Short-term project performance may be measured by expansion of catalogued data, confirmation of previous data conclusions, identification of erosion and sedimentation sources, and identification of accurate and rapid source tracking methods. Long-term per-project performance would typically be measured by estimated reduction in nuisance runoff volume or rate discharged to beaches; and/or estimated reduction in concentration or quantity of pathogens or indicator pollutants discharged compared to project conditions.

4.4.5 Improve the Quality of Life in Orange County Strategies

The OC Plan Strategies:

- QL-1 A. Increase participation of small, disadvantaged, low-income communities and tribes in the IRWM process.
- QL-1 B. Develop multi-benefit projects that predominantly benefit affected disadvantaged and low-income communities.
- QL-1 C. Address public health, flood management, safe drinking water, and wastewater treatment needs of disadvantaged and low-income communities.
- QL-2 A. Increase acres of and access to open spaces.
- QL-2 B. Provide for increased proximity and access to open spaces in disadvantaged communities.
- QL-2 C. Increase recreational opportunities.
- QL-2 D. Add trail connectors and extensions to provide and improve regional recreational opportunities
- QL-2 E. Increase recreational opportunities in multipurpose projects and programs.
- QL-2 F. Increase recreational opportunities in disadvantaged and low-income communities.
- QL-2 G. Support water quality improvement efforts that enhance public recreation.
- QL-3 A. Incorporate principles of environmental justice and needs of disadvantaged and low-income communities in design and construction of projects and programs.
- QL-3 B. Promote watershed public education.
- QL-3 C. Increase community involvement in stewardship of water resources.

To meet Objective QL-1, *Identify and support critical water needs of disadvantaged, low-income, and tribal communities,* strategies QL-1 A through C were developed. To meet Objective QL-2, *Increase acreage of open space and increase park and recreational opportunities,* strategies QL-2 A through G were developed. To meet Objective OL-3, *Develop and enhance public education programs,* strategies QL-3 A through C were developed.

Strategies and associated investments to carry the Region through the next 25-year planning horizon are central to preserving the quality of life in North and Central OC. The IRWM

stakeholders have made it a priority to incorporate quality of life strategies into The OC Plan and within projects, particularly benefiting disadvantaged, low-income and tribal communities. The communities utilize the waters within the Region as recreational destinations, including area beaches and harbors, local creeks and streams, and wetland environments. Since many of these waters are accessible to the disadvantaged, low-income and tribal communities where it is safe to provide public access, projects focused on providing safe drinking water and enhance water quality will promote recreational and educational opportunities, and stewardship of water resources for all communities in the Region.

Through addressing water quality issues in areas of recreational use, the IRWM Plan incorporates principles of environmental justice in a way that provides every resident equal opportunity and fair treatment in the regional water planning process. Disadvantaged, low-income and tribal communities will continue to be engaged to ensure their active involvement in the IRWM Plan and in IRWM Plan projects recognized to provide benefits to these communities within their areas of influence.

4.4.6 Address Climate Change Strategies

The OC Plan Strategies:

- ACC-1 A. Maximize production of on-site energy.
- ACC-1 B. Participate in local utility's green energy program.
- ACC-1 C. Prioritize more passive systems over active energy consuming systems.
- ACC-1 D. Prioritize lower energy consuming alternatives over lower cost and higher energy alternatives.
- ACC-1 E. Utilize natural gas, electric, or biofuel-based equipment for construction.
- ACC-1 F. Recover construction emissions by generating more renewable energy during the lifetime of the project.
- ACC-2 A. Use higher density vegetation schematics.
- ACC-2 B. Increase total square feet of wetlands.
- ACC-2 C. Recycle green waste.
- ACC-3 A. Develop adaptive measures to address the effects of sea level rise on water supply and water quality conditions.
- ACC-3 B. Implement measures that respond to more intense rain events.
- ACC-3 C. Implement measures that respond to the uncertainty and availability of imported water.
- ACC-3 D. Implement measures that respond to hotter and drier summers.

To meet Objective ACC-1, *Identify and support critical water needs of disadvantaged, low-income, and tribal communities,* strategies ACC-1 A through F were developed. To meet Objective ACC-2, *Increase acreage of open space and increase park and recreational*

opportunities, strategies ACC-2 A through C were developed. To meet Objective ACC-3, *Develop and enhance public education programs,* strategies ACC-3 A through D were developed.

The Region's vulnerabilities to climate change as well as the corresponding regional goals and objectives for both adapting to and mitigating against climate change impacts were analyzed in **Section 2.9** and discussed in **Chapter 3.** Climate change strategies were identified, as listed above, to meet the climate change objectives and address regional vulnerabilities.

As stated in **Section 2.9,** statewide efforts to address climate change are in progress and it is understood that local governments and agencies play an essential role in fulfilling California's emissions reduction targets and in reducing the local effects of climate change in the Region. Local governments have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth and the changing needs of their jurisdictions. Decisions on how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas sectors.

While the majority, if not all, of the RMSs listed in **Table 4-2** above and the specific strategies listed above will help to adapt to climate change, the Region acknowledged additional strategies that would specifically mitigate against climate change through a reduction in energy consumption and GHGs: optimize sanitary sewer systems; improve efficiency of drinking water treatment and distribution systems; develop an inventory of emissions from water and wastewater systems; and increase the use of renewable energy sources.

4.5 Impacts and Benefits

4.5.1 Regional and Inter-Regional Benefits

Implementation of the IRWM Plan and its projects will guide the North and Central OC IRWM Region toward a future with a reliable supply of water, improved and protected water quality, and achievement of the statewide priorities and program preferences for integrated regional planning.

As the IRWM Plan is implemented and benefits of water supply and water quality are realized, so will the adjacent areas and regions benefit from these efforts. To emphasize the advantages of implementing projects with interregional benefits as stated earlier, benefits include

increased opportunity for project implementation, collective planning to monitor regional changes and facilitate refinements for implementation, increased participation and cooperation by the public, shared costs, and cooperative land-based planning as opposed to confinement within political boundaries. Individual projects that are implemented and produce beneficial results may also be used as pilot projects that are transferable to other regions.

Development and enhancement of the Region's local water supplies safeguards reliability of imported water suppliers for other regions.

Long-term attainment and maintenance of water quality standards within the watersheds will result in enhanced local supplies, habitat restoration, pollution control, and outdoor recreational opportunities. Pollution reduction in impaired water bodies and sensitive habitat benefits wildlife habitat. Overall watershed health realized in the Region provides greater opportunities for communities to enjoy the area in which they live, including beach activities, hiking, biking, bird watching, horseback riding, and other activities that thrive in this region.

Elements of the IRWM Plan and the Region's cooperative framework present a potential model for other regions and areas of the State, particularly with the coastal influence and a significant groundwater basin. Regional planning presents the opportunity for collective and collaborative planning in a logical and beneficial process. Prioritization of projects within the Region provides the greatest benefits both regionally and inter-regionally.

Regional solutions are necessary to achieve both statewide priorities and regional objectives for water supply reliability, groundwater management, water conservation, and water quality. In certain cases, integrated projects have been defined where appropriate to implement a single strategy across the entire region that would involve all participants on a phased, as-needed funding basis. Regional solutions are being addressed throughout the objectives.

Collaboration will achieve enhanced regional benefits, increase opportunity for project implementation, facilitate collective planning, and increase participation and cooperation by the public, which will also benefit adjacent areas.

4.5.2 DAC/Environmental Justice Benefits

The OC Plan has prioritized incorporating benefits for DAC, low-income and tribal communities within its projects and programs, where possible. Area beaches, local creeks and streams, and wetland environments provide recreational opportunities for residents including DACs, and low-income and tribal communities.

Projects focused on providing safe drinking water, enhanced water quality, and access to park and recreational opportunities, will benefit these communities. Also, projects will contribute to beneficial uses such as agricultural supply, contact and non-contact water recreation, warm freshwater habitat, and wildlife habitat, enhancing opportunities to residents in DACs. **Figure 2-10** depicts the DACs throughout the Region.

Coastal Benefits

The many miles of public beaches and parks, wetland and refuge habitat areas, as well as creeks and preserves located along regional stream/river courses serve as community gathering places for DACs and are used year-round. Many of the recreational areas, as noted above under Water-Dependent Recreation RMS, are accessible via public transit and often do not charge an entrance fee for walk-in visitors. Many recreational areas are also handicap accessible.

Within the limited space of the coastline, population density far exceeds the nation as a whole. Today, the beaches in the Region draw millions of visitors year-round to swim, surf, fish, birdwatch, and provide a variety of other recreational activities. It is important for the Region to consider projects focused on improving water quality that will benefit these recreational areas that serve all communities and DACs equally. DACs will continue to enjoy the beach and ocean resources because of fewer beach closure days due to higher water quality. Water quality is a key consideration for the Region to ensure protection of the health and safety of the entire population in the area, especially for the disadvantaged community residents that do not have the means to travel to other areas of the state or country.

Inland Benefits

The OC Plan includes projects that would meet multiple objectives and provide multiple benefits for the DACs, including recreational and aesthetic benefits and increased water supply reliability.

Projects listed include the following: creek/channel restoration and stabilization; water quality improvements; natural treatment systems; habitat restoration; storm drain improvements; wildlife corridors; aquatic habitat; and trail projects.

These projects would meet multiple objectives and provide multiple benefits, including recreational and aesthetic benefits and increased water supply reliability, which provide enjoyment of the Region's natural systems for residents including DACs and low-income communities. Expanded opportunities for recreational benefits include contact and non-contact water recreation, walking paths, bird watching, nature study, painting and photography, and other passive activities.

In addition, educational and public outreach activities increase residents' understanding and appreciation of wetlands and other areas of significance, including how human interaction impacts habitat areas and other natural resources. Educational programs currently being implemented as part of the outreach efforts in the Region are designed to inspire broad implementation of water quality and water conservation improvements across the community.

Benefits of Disadvantaged Community Participation

Through addressing water quality issues in areas of recreational use, The OC Plan incorporates environmental justice in a way that provides every resident equal opportunity and fair treatment in the regional water planning process.

The RWMG will conduct outreach to stakeholders, including disadvantaged communities and tribal representatives, throughout the Region, for an opportunity to participate in meetings and workshops. Outreach may include communication of information by email, newsletters, fact sheets, and the County's ocwatersheds.com website. Native American Tribal representatives will be invited to participate at the level of input most appropriate for their tribes in IRWM Plan implementation elements. Additionally, The OC Plan projects have recognized the benefits to support DACs within their areas of influence.

The OC Plan strives to ensure equitable distribution of benefits to the entire region through involvement of community members and implementation of a wide variety of projects. Environmental justice brings to light the fact that minority members of the community tend to disproportionately endure environmental pollution and unhealthy conditions. Specifically, the Region has prioritized projects that:

- Increase the participation of DACs and small communities in the IRWM process;
- Develop multi-benefit projects with consideration of affected DAC and vulnerable populations;
- Contain projects that address safe drinking water and wastewater treatment needs of DACs; and
- Address critical water supply or water quality needs of California Native American Tribes within the Region.

Since the water quality protection benefits of The OC Plan and its projects significantly protect the recreational beaches and waterways of the North and Central OC IRWM Region that many members of DACs and those from other regions frequently use, The OC Plan and implementation of its projects will benefit the Region's DACs and support regional and inter-regional environmental justice.

4.5.3 Environmental Impacts and Benefits to Other Resources

The regional watersheds contain a wide variety of environmental resources, extending from headwaters to ocean, and from urban landscape to forested mountaintop. These resources include water, wildlife, and cultural and physical landscapes.

Currently, local watersheds are suffering from a variety of water resource and related land resource problems. Most of these are related to widespread changes in the watersheds, including changes in the hydrologic regime, channel instability, habitat loss, ecosystem degradation, urban impacts to water quality, threats to recreational resources, and others. While change is a part of the evolution of any landscape, dramatic change from a balanced historic state often results in undesirable consequences.

All proposed projects within the IRWM Plan are individually evaluated under CEQA guidelines to identify potential impacts (both negative and beneficial) to the following:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Population and Housing
- Public Services
- Recreation
- Transportation and Traffic
- Utilities and Service Systems
- Effects on Tribal Cultural Resources and Consultation with California Native American Tribes

Where significant potential negative impacts are identified, the CEQA process will implement appropriate mitigation measures into the project. Responsibility for mitigation measures lies with the individual project sponsor(s). Where there are potential impacts to jurisdictional waters, habitats or species, mitigation requirements are determined within permitting processes with the Regional Water Board, CDFW, USACE and others as appropriate. Federal anti-degradation policies for surface water quality and "no net loss" policies for wetlands are typically reflected in the permit requirements. The data management methods identified in **Section 6** will work in conjunction with environmental impact analysis and ongoing project monitoring to identify potential impacts.

SECTION 5. PROJECTS

The OC Plan does not commit any resources to implementation of any project nor does its creation constitute a commitment by the RWMG or any member entity or stakeholder to carry out any of the proposed projects. Determinations to proceed with individual projects and required environmental review under the California Environmental Quality Act (CEQA) will be performed by the individual agencies prior to approval of funding.

Some additional State grant programs require projects be listed in an IRWM plan to be eligible for funding. Project inclusion in The OC Plan, and subsequently the SAWPA One Water One Watershed (OWOW) Plan, would satisfy this requirement. While the North and Central OC Region remains within the SAWPA OWOW Plan, projects will also be transmitted to SAWPA for inclusion in the OWOW Plan for funding eligibility. If the North and Central OC Region, under The OC Plan, becomes a DWR-approved IRWM region, the project list will be kept current within The OC Plan for future funding opportunities.

5.1 IRWM Plan Project Solicitation and Prioritization Framework

The purpose of IRWM planning is to identify and implement water management solutions on a regional scale that increases self-reliance and manages water to achieve social, environmental and economic objectives. Projects should help meet the goals, objectives, and strategies of The OC Plan (**Section 3**):

1. Provide adequate and reliable water supplies
2. Protect and enhance water quality
3. Restore ecosystems and improve native habitat
4. Integrate flood management
5. Improve the quality of life in Orange County
6. Address climate change

During development of The OC Plan, project lists from the 2011 North OC WMA IRWM Plan and the 2012 Central OC WMA IRWM Plan were reviewed. A large percentage of the proposed projects in the plans were either completed, no longer being considered by the sponsoring agency, or needed updated information. In addition, some projects lacked an identified project sponsor. For these reasons, stakeholders were requested to re-submit proposed or new projects and project ideas for inclusion in The OC Plan.

The project solicitation was conducted in early 2018. All regional stakeholders were asked to submit proposed projects and project ideas for consideration of inclusion in The OC Plan and

the OWOW Plan. An application form was provided to project proponents to submit projects. **Appendix H** includes a copy of the solicitation and project application form.

The invitation informed stakeholders about the purpose of IRWM planning, IRWM plan update process, regional goals, and project solicitation for The OC Plan and the OWOW Plan. It emphasized that soliciting projects for The OC Plan and the OWOW Plan is a stimulus for new project ideas, encourages partnerships, and can result in regional projects that meet the Region's goals and objectives, while establishing the strength to successfully compete for limited grant funds and bring additional funds to invest in the Region.

The projects included in the IRWM Plan Project List (**Appendix F**) are listed based on the ranking criteria described in **Section 5.2.**

5.2 Ranking Criteria Development

Planning efforts typically include an established process for ranking projects in relation to the IRWM Plan goals and objectives. The point of an integrated plan is to move beyond a single focus and to collaborate and rank across programs and jurisdictions. This effort is challenging, specifically when balancing objectives.

The Stakeholder Group formed an Ad Hoc Committee to propose ranking criteria for the established goals, objectives, and strategies that would be applied to proposed projects. Any stakeholder who wished to participate in this effort was invited to be part of the Ad Hoc Committee. The Ad Hoc Committee met several times during the months of June and July 2017 to assign ranking criteria for projects using a matrix based on the plan's goals, objectives, and strategies. The Ad Hoc Committee considered four main categories of criteria that are relevant to projects in the Region:

- Regional/local objectives
- Regulatory compliance
- Project factors
- State objectives

These categories considered DWR plan standards in development of the ranking criteria for projects that would support goals, objectives, strategies (see **Section 4.4** and **Appendix G**). The Ad Hoc Committee assigned a weighting factor for each goal and each supporting strategy based on its importance to the region. These weighting factors were first discussed in **Section 3.6** and are shown in **Appendix G.** The OC Plan emphasizes regional and local water resource goals. Although IRWM planning does recognize the nexus among water resources, land uses, environmental stewardship, and the economy, the primary focus remains on water resources.

The prioritization methodology has two main purposes:

First, to generate scores for an entire list of projects within the Region based on all the considerations that are imbedded in the scoring matrix. The most important function of this tool is to help the Region identify and agree on priorities. Then the combined influence of the community can promote projects that address the priorities that will result in multiple benefits. Ranking each proposed project against all the criteria will inform the Region of which projects should be most heavily promoted based on providing the greatest impact for the Region.

Second, to refine additions to lists of future projects. Dividing the criteria into categories allows the ranking to be readily updated or refined in the future. Each category can be turned on or off when scoring projects for different purposes, performing sensitivity analyses, or for other reasons. Separate scoring can be performed for projects that are driven solely by TMDLs, by Measure M funding from the Orange County Transportation Authority, or by any desired future factors. Goals and strategies can be turned off or their assigned weights can be adjusted to answer specific questions. Adjustments of strategies and weights will facilitate prioritization for different purposes, which is useful when applying for project funding. However, for the ranking of projects in this IRWM Plan, all categories have been used. The ranking of projects, which are included in **Appendix F,** is for overall regional priorities, not for specific funding programs at this time.

Weighting factors were developed for each goal and each strategy:

Goal Scoring: Each of the IRWM Project Ad Hoc Committee members assigned a number between 1.0 and 5.0 (1.0 being the lowest) to rank each goal in relation to the other goals. The ranking scores of all Ad Hoc Committee members were averaged to create an overall score for each goal.

Strategy Scoring: The process was repeated to score each of the strategies in relation to the others under each goal. The individual score for each strategy was then calculated by multiplying the score of the goal by the score of the strategy. The resulting scores ranged from 13 to 22.

The Ad Hoc Committee also developed a system to apply weighting criteria to calibrate the relative value of the projects in relation to each other based on the quantification of benefits and the scale of the projects submitted. For example, project proponents who claim a benefit of increased local potable water supply (WS1-A) would be scored in relation to all other projects that claim a benefit of increased local potable water supply. If the water supply projects submitted for the IRWM Plan ranged from an increase of 1 AF to 1,000 AF of new water, the smaller benefit project would receive a lower score than the larger benefit project.

The impact weights for each of the strategies are determined after the projects are submitted or when projects are to be scored in preparation for a grant application.

In addition to establishing six goals for The OC Plan, the Ad Hoc Committee ranked a category considered as Project Administration. Strategies under this category allow for weighting of project factors such as: 1) Readiness of project construction – status of project financing, funding match committed, and ready to proceed. The more "shovel-ready" a project is, the more weight it will receive; 2) Status of regulatory compliance for the watershed relevant to local, state, and federal laws, generally related to water supply and water quality, including CEQA and permitting; 3) Project partners are identified; and 4) Cost-effectiveness is demonstrated. This "Project Administration" goal and related strategies is only for project scoring and was not included in The OC Plan overall goals, objectives, and strategies in **Section 3**.

The work product of the IRWM Project Ad Hoc Committee, the proposed ranking criteria, was presented to the Stakeholder Group for discussion and comments. The Stakeholders accepted the proposal, which was finalized for inclusion in The OC Plan. **Section 5.2.1** shows the project ranking criteria weighting and scores.

5.2.1 Regional/Local Objectives Weighting

Regional/Local Objectives ranking criteria are tied directly to the stated goals. As detailed in **Section 3,** goals are divided into six categories: water supplies, water quality, ecosystems and native habitat, flood management, quality of life, and climate change.

The process described above resulted in a relative priority of The OC Plan Goals and Strategies, along with the additional Project Administration category for this section. The following lists the goals in priority order, with the ranking criteria scoring detail contained in **Appendix I**.

1. Providing Adequate and Reliable Water Supplies
2. Protect and Enhance Water Quality
3. Restore Ecosystems and Improve Native Habitat
4. Integrate Flood Management
5. Improve the Quality of Life in Orange County
6. Address Climate Change

Additional Project Goal: Project Administration

The Project Application Form is designed to calculate a total score based on the weighting of each goal and strategy. On the Project Application Form, the ability to meet an Objective is indicated by "yes" or "no", with a number 1 corresponding to "yes" and a zero corresponding to

"no". The 1/0 values (yes/no) are then multiplied by their assigned weighting factor. For project prioritization purposes, the Project Application Form also assigns a score associated with the relative benefit attained by the objective and strategy.

Table 5-1 shows the framework used for project weighting. **Appendix I** shows the actual prioritization of objectives relative to the weighting/ranking, which were developed and approved by the Region stakeholders, consistent with **Section 3.6**. Inclusion of the weighting of objectives in an appendix allows for flexibility for the RWMG and stakeholders to revise as appropriate.

Table 5-1
Basis for Goals and Strategies Weighting and Scoring for Project Prioritization

Goals, Objectives, and Strategies	Weight	Strategy Score	IW	Total Points
Goal	Range 1-5 (GW)	n/a		
Objectives Listed (not weighted)				
Strategies Listed	Range 1-5 (SW)	GW x SW	Range 1-5 TBD at Project Submission	Strategy Score x IW
This repeats for each of the six goals and related strategies *GW = Goal Weight* *SW = Strategy Weight* *IW = Impact Weight*				

5.3 Contribution to State Agency Priorities

As discussed in **Section 3.2** and shown in **Table 3-1,** DWR identified Statewide Priorities based on the 2014 California Water Action Plan, issued by the California Natural Resources Agency, California Department of Food and Agriculture, and the California EPA (January 2016).

Efforts to meet the Statewide Priorities and improve water quality conditions have been underway in the North and Central OC Region for many years, and continually advance as new technologies and resources become available. Statewide Priorities are incorporated into IRWM Objectives and RMS, as defined in **Sections 3 and 4**.

The OC Plan and its proposed projects are consistent with the Program Preferences for IRWM planning identified in the California Water Code and implementing legislation for Proposition 1, Chapter 7. It is also consistent with the priorities for projects that support the Basin Plan as outlined in the 2015 Triennial Review (Santa Ana Regional Board 2015) and assists in

implementing the TMDLs that have been adopted and are pending for this region. It further supports implementation of the California Ocean Plan and the non-point source plan for the state (California Water Board 2009, 2003). The State Program Preferences and 2015 Triennial Review are listed below.

California Water Code IRWM Program Preferences

- Include integrated projects with multiple benefits
- Support and improve local and regional water supply reliability
- Contribute expeditiously and measurably to the long-term attainment and maintenance of water quality standards
- Eliminate or significantly reduce pollution in impaired waters and sensitive habitat areas, including ASBS
- Include safe drinking water and water quality projects that serve disadvantaged communities

Santa Ana Regional Water Board Basin Plan and 2015 Triennial Review[1]: Priorities for Grant Projects that Support the Basin Plan

- Projects that implement approved TMDLs, including studies called for in TMDL implementation plans
- Projects that support development of scheduled TMDLs
- Projects that address pollutant loadings in urban runoff discharges
- Projects that protect and improve the quality of local groundwater resources
- Removal and prevention of invasive, exotic aquatic and riparian vegetation to enhance and protect water quality standards, including habitat and recreation beneficial uses
- In support of WARM, COLD, RARE, WILD, SPWN, MAR, SHEL, and EST beneficial uses, projects that protect, restore, and/or enhance aquatic, wetland, and riparian habitat and habitat connectivity, particularly habitat of rare, threatened, or endangered species
- Projects that support watershed management planning efforts, especially those that build local capacity in watershed management through citizen involvement and public education
- Projects that provide tools managing and/or enhancing access to regional water resources data, water quality data, and watershed data

[1] Santa Ana Region Basin Plan Update and Amendments; and Resolution No. RS-2015-0085, Adoption of FY2015-2018 Triennial Review Priority List and Work Plan, Santa Ana Regional Water Quality Control Board, July 24, 2015 https://www.waterboards.ca.gov/santaana/water_issues/programs/basin_plan/index.html and https://www.waterboards.ca.gov/santaana/water_issues/programs/basin_plan/docs/R8-2015-0085_Triennial_Review_Priority_List_and_Work_Plan_2015-2018.pdf

- Projects that include opportunities to build or expand organizational capacity to implement watershed management
- Projects that lead to water quality improvements within the CCAs of the region
- Projects that utilize partnerships among diverse stakeholders and that integrate the priorities of regional water boards with those established by other watershed stakeholders

5.3.1 The OC Plan and State Agency Priorities

The OC Plan, its strategies, and the integrated, multi-benefit projects support the State agency priorities listed above. Implementation of The OC Plan represents progress toward achieving the stated priorities of the Santa Ana Regional Board, as well as IRWM Program Preferences. High-priority projects incorporate multiple strategies to achieve results.

As discussed in **Section 1**, the IRWM region stakeholders represent a diverse group of people, including municipalities, local water districts, state agencies, environmental organizations, academic institutions, and the general public. The stakeholders have a long history of collaboration on projects and studies and have participated in each of the planning efforts within the watersheds. Through their involvement, they have established regional priorities for water supply reliability, water quality, ecosystem restoration and habitat improvement, flood management, climate change, and an improved quality of life in Orange County. The OC Plan builds on previous efforts, providing a structure for implementation that supports the use of multiple strategies and the leveraging of resources to increase the level of benefit.

Improving water quality conditions is a priority for the Region stakeholders. Improvements are made as new technologies and resources become available. The County of Orange's Drainage Area Management Plan (DAMP) includes watershed action plans for each watershed, which were prepared in cooperation with the NPDES stormwater permittees. In 2006, the County of Orange, in cooperation with the NPDES stormwater permittees, developed Watershed Action Plans to capture the regional efforts undertaken to provide a watershed-based collaborative effort to address constituents of concern in a specific watershed. In 2009, the Watershed Action Plans were incorporated into the Watershed Infiltration and Hydromodification Management Plans (WIHMPs), integrating stormwater and TMDL efforts. The new draft NPDES stormwater permit for the portion of Orange County regulated by the Regional Water Board will require the creation of Watershed Master Plans, which will integrate water quality, hydromodification, water supply, and habitat.

Similar to the efforts to improve water quality described above, the water agencies within the Region have worked together over many years to ensure water supply reliability and enhance local water supplies to meet the water demands associated with the significant growth that has

occurred. The efforts include groundwater management and treatment programs, infrastructure improvements, indoor and outdoor water conservation and water use efficiency programs, and an extensive recycled water system. Water conservation and quality programs are included, to address the disposal of pharmaceutical products that are adversely affecting wastewater. The objectives and projects of The OC Plan support IRWM preferences for integrated regional planning to improve the reliability of the local and regional water supply and ensure safe drinking water supplies for disadvantaged communities.

The Region's objectives are consistent with these priorities and preferences, and the proposed projects will provide measurable contributions toward their attainment. The OC Plan is intended to be used as a regional and local planning tool. To ensure that it remains an effective tool for project planning and funding, a basic tenet of The OC Plan is to support the State's goals for integrated regional water management planning.

5.4 Project Integration

The OC Plan's approach to integration includes the use of several strategies for implementing the projects in a manner that supports synergistic watershed management. Full integration is achieved through well-planned implementation of the various projects. Although the projects must incorporate at least one of the strategies, the majority incorporate several complementary strategies, often to achieve multiple objectives. For example, projects that assist with increasing water supply by offsetting imported water supply needs may also include incentive programs to enhance WUE and reduce GHG emissions through use of energy efficient technologies. Full integration is achieved through the identification of an appropriate mix of projects that incorporate multiple strategies to achieve multiple objectives. Such projects are typically the most cost-effective and resource-efficient, and are given higher priority in The OC Plan.

The watershed issues identified for the North and Central OC WMAs are inherently integrated. For example, several of the issues refer to land use as an underlying element of several challenges associated with water resources. Overlap is prevalent among the issues. For instance, the loss of marine habitat is identified as a habitat issue, but water quality degradation contributes to this habitat loss.

The OC Plan addresses integration from two perspectives: 1) in the development of goals, objectives and strategies; and 2) in the scoring and weighting of projects. This rewards projects that meet more than one goal and have multiple agency partners. For example, projects that incorporate water use efficiency may also benefit the Region by:

- Reducing wastewater and/or runoff
- Increasing water supply reliability and imported water offset
- Reducing imported water supply needs
- Improving environmental and habitat protection by using recycled water supplies
- Using land use planning to effectively address water issues and identify ways to incorporate water use efficiency measures in proposed development

The project review process itself allows an open exchange and dialogue of existing and future plans. As discussed above, projects are ranked based on numerous review factors, specifically the level of contribution in achieving the IRWM Plan strategies and objectives. Since projects are either derived from existing plans or developed through combining projects from a variety of plans, the most immediate needs and balanced implementation are identified.

Benefits to implementing interregional projects include increased opportunity for project implementation, collective planning to monitor regional changes and facilitation of refinements for implementation, increased participation and cooperation by the public, shared costs, and cooperative land-based planning as opposed to confinement within political boundaries.

The project prioritization methodology emphasizes integrated projects that address multiple goals and produce multiple benefits. For example, a project that uses low-impact development strategies and reduces polluted runoff, enhances local habitat, improves water supply, reduces peak flows, and reduces flood risk would unquestionably be addressing multiple water resources objectives and strategies. Such a project would score higher than a project that addressed only water quality concerns. Placing an emphasis on projects that provide multiple benefits encourages stakeholders to develop projects that integrate strategies to achieve multiple goals.

Integration for The OC Plan originates from the criteria that were derived from local-, regional-, state- and regulatory-related goals, including the State's RMS. Therefore, The OC Plan, is integrating its efforts with the State of California, across the Region, and interregionally to further the state water resource goals.

SECTION 6. IMPLEMENTATION

6.1 Introduction

The County of Orange will oversee The OC Plan implementation at the staffing level on behalf of and in collaboration with the RWMG and agencies, organizations and other stakeholders in the Region. As discussed in **Section 1.4**, the RWMG will meet, as appropriate, to discuss IRWM Plan implementation and refinement issues, provide updates to and receive guidance from the Advisory Committee, and provide recommendations to The OC Plan Stakeholders Group. The County of Orange will be informed of strategic decisions, project recommendations, and coordinated project implementation to ensure appropriate implementation of The OC Plan.

Implementation elements presented and discussed in this section include financing, data management, and plan performance and monitoring.

6.2 Finance

6.2.1 Funding

The RWMG is committed to The OC Plan implementation. A key element of implementation is funding. As the administering agency, the County of Orange will be accountable to the Advisory Committee and the RWMG, along with funding agencies that require regional applications and agreements. The Advisory Committee will make policy decisions and provide direction for the RWMG for IRWM funding where necessary. Members of the Advisory Committee and those who attend the meetings fund their own participation.

In an effort to ensure certainty and longevity of funding for The OC Plan and projects, the RWMG MOU will consider methods toward contribution of funding and/or resources for such implementation elements as assistance in grant application preparation, public outreach, IRWM meeting facilitation, interregional IRWM coordination, and long-term IRWM planning. In addition to these implementation elements, project execution and operation is correspondingly understood as 'implementation.' The MOU will also reflect current practice that "the RWMG parties shall use their best efforts to aid the lead agencies designated in project implementation agreements in advocating for funding, including grants, to fund the cost-shared projects."

Individual projects will be implemented by the respective project proponents. Project proponents conduct project planning through their individual and collaborative planning activities among Region stakeholders. Financial development is an essential component of project planning to ensure project implementation will yield the highest level of benefit in

terms of efficiency, economies of scale, and cost avoidance. Project financial development also includes an analysis of the operation and maintenance costs for each IRWM Plan project and how the costs would be funded and the certainty of that funding.

Securing project funding is key to IRWM Plan implementation. Accordingly, implementation efforts of the RWMG and Stakeholder Group will, in part, focus on:

- Refining project cost estimates;
- Further evaluating potential impacts and benefits of the projects;
- Ensuring participation of and benefits to DAC;
- Addressing the cost-effectiveness and regional affordability of proposed projects;
- Prioritizing projects; and
- Ensuring adequate funding for IRWM Plan implementation.

The OC Plan, as a foundation of IRWM planning in the Region, may be used as a funding tool and promote continued pursuit of project partnerships and funding. Implementation of The OC Plan may be funded by a variety of sources and methods, as appropriate.

The following is a program-level description of the sources of funding that are or could be utilized for the ongoing funding of The OC Plan.

Local Financing. Local financing, particularly in-kind services provided by members of the RWMG and stakeholders, is the most important financing resource used to implement the IRWM Program. All the Region's program management activities (program administration, meetings, plan performance monitoring, outreach, and data management), project development and integration activities, and even funding and financing development are contributed as in-kind services. The capability of entities to continue to dedicate staff resources for implementation of The OC Plan is critical to the success of the IRWM Program.

In addition to in-kind services, project implementation and O&M costs are typically funded by the local project sponsors or partners through ratepayers, operating funds, water enterprise funds, assessments, fees, and taxes. Even project sponsors who receive grant funds are typically required to provide local cost share.

Additional local funding opportunities include Metropolitan's Local Resources Program, On-Site Retrofit Program Incentives for Recycled Water Use, and other programs, as well as the possibility of private foundation funding partnerships.

State Financing. The Region will continue to evaluate and apply for state funding opportunities that may include the following sources:

- California Department of Water Resources
  - Water-Energy Grant Program
  - IRWM Implementation Grant Program – Proposition 1 and future IRWM funding
  - IRWM Drought Grant Program
  - Local Groundwater Assistance Grant Program
  - CalConserve Water Use Efficiency Revolving Fund 2015 Loan Program
  - Water Desalination Grant Program
  - Sustainable Groundwater Planning Grant Program
- California State Water Resources Control Board
  - Water Recycling Funding Program Grants and State Revolving Fund (SRF) Loans
  - Drinking Water Grants & Loans (Clean, Safe and Reliable Drinking Water)
  - Proposition 1 Storm Water Grant Program
  - Groundwater Quality Funding Program (Proposition 1 Groundwater Sustainability)
- California Department of Fish and Wildlife
  - Proposition 1 Watershed Restoration & Delta Water Quality and Ecosystem Restoration Grant
- California Water Commission
  - Water Storage Investment Program

Federal Financing. Local agencies may seek federal funding opportunities to fund projects as they become available. Possible grant funding sources include U.S. Bureau of Reclamation (USBR) grant programs. The USBR WaterSMART grant program provides funding for various types of water supply improvement projects, including water and energy efficiency improvement, system optimization review, and advanced water treatment pilot and demonstration projects. USBR also operates the WaterSMART Title XVI Program, which provides grants for water reclamation and reuse. The following lists the potential USBR funding programs that could be used to leverage state funds to make a project more cost effective:

- WaterSMART: Water-Energy Program
- WaterSMART: Title XVI Reclamation and Reuse Program Funding
- WaterSMART: Development of Feasibility Studies Under Title XVI
- Bay-Delta Restoration Program: Conservation Field Services Program

6.3 Data Management

The OC Plan has been prepared through a collaborative process that has generated and will continue to generate data and information to support its implementation. This data can be a valuable resource to stakeholders, regional entities, and the state. The Region's stakeholders

can utilize data developed through The OC Plan process to better manage water supply reliability, water quality monitoring, invasive species removal, aquatic/riparian habitat management, species of concern, recreation and open space, land-use development, climate change impacts, and project progress. The proper collection, organization, storage, analysis, and dissemination of Plan implementation data is essential to the continued success of implementation of The OC Plan and to the ongoing participation and support of stakeholders.

6.3.1 Data Collection and Needs Within the Region

The objective of data collection is to: 1) define existing conditions; 2) help develop water management objectives; 3) evaluate project and overall Plan effectiveness; 4) provide a tool for IRWM planning and decision making; and 5) provide a means to better inform state agencies, stakeholders, and the general public. Data of many different types and sources is collected throughout the Region by various governmental and non-governmental organizations (NGOs). Collected data is associated with individual projects and programs, as well as on-going operations, maintenance, and monitoring of regional infrastructure. Both basic and advanced hydrologic and hydraulic data sets are also collected for major surface waters and groundwater basins. Additionally, physical, chemical and biological data sets associated with the North and Central OC IRWM Region are actively collected.

Water Supply Data Needs. Providing an adequate water supply remains a critical requirement for the Region. While local water provides most of the potable water supply for Region, imported water supply remains an important component. The continued collection and analysis of the Region's water use data – industrial, agricultural, and domestic – will assist the RWMG and Stakeholder Group with water needs planning and how and where to focus conservation efforts.

Water Quality Data Needs. The urbanization of the Region has placed considerable stress on the quality of its local water resources. Dry and wet weather surface flows have increased due to a reduction of absorbent landscape and an increase in impermeable coverage. Increased stream flows often lead to erosion of riparian habitats.

As described in **Section 2.1.4,** in response to permit requirements from the Regional Water Board, the County of Orange developed a 2011 Model Water Quality Management Plan (WQMP) to assist with project development in North and Central OC. The County of Orange is the principal permittee responsible for compliance with the MS4 permit. As such, the county, along with the incorporated cities under the jurisdiction of the Regional Water Board, seek to address the impacts of urbanization by addressing unnatural water balance and geomorphic issues resultant from urbanization. A Project WQMP is a plan for minimizing the adverse effects of urbanization on site hydrology, runoff flow rates and pollutant loads. Future data collection

related to addressing and tracking the status of these high-priority water quality conditions is discussed in **Section 6.3.2.**

Streambed and overland flows carry pollutants endemic to urbanized areas, increasing pollutant loading in local water bodies. Urban runoff is considered to be the major contributor of pollution to water bodies throughout the Region and the leading cause of water quality impairments. Effective management will require: 1) data collection focused on better characterizing the specific sources of polluted runoff; 2) BMPs developed to address the pollutants generated; 3) monitoring and assessment of water quality improvement strategy effectiveness; and 4) continual refinement and improvement of strategies. Future data collection related to addressing coastal and inland receiving water quality is summarized in **Section 6.3.2**.

It is the purpose of IRWM planning to provide a regional focus, prevent duplicating data efforts, and provide access to water and land use plans, GIS data, IRWM planning information, and various technical data. The Region stakeholders shall continue to promote the collection and dissemination of data that will provide information valuable to the management, conservation, and quality of the Region's limited water supply, and for the continued preservation of the Region's delicate ecological resources.

6.3.2 Data Gaps

Many governmental and non-governmental organizations currently collect surface water quality, surface flow, groundwater, habitat, and water use data within the Region. Despite the extensive ongoing water resources monitoring within the Region, opportunities exist for additional data gathering to close existing gaps. Monitoring is generally conducted to support specific organizational, regulatory, or research objectives rather than within a regional or integrated framework. As a result, many of the gaps discussed here are related to a general lack of regional, integrated planning and concomitant data support strategies.

North and Central OC agencies and organizations have extensive data available to the public for surface and groundwater as well as recycled/potable water; however, there is not one integrated analysis that assists identifying all potential data gaps for water management. Since a primary purpose of IRWM planning is to provide a regional focus, it is expected that this assessment of gaps will be updated and refined substantially over the next several years. Water supply and groundwater data are collected and posted for public review on a regular basis, and to answer the primary questions related to water sustainability (e.g. OC Water Reliability Study).

Stormwater Runoff Data. Regional stormwater runoff data collection efforts have been coordinated and managed by the MS4 Permittees, as described in **Section 2.** To meet MS4 requirements, Watershed Management Plans (WMPs), are currently in development and includes an extensive effort to identify existing data resources and gaps. Further data analysis will take place over the next several years with the issuance of a new NPDES permit and development of the WMPs. Though the WMP will represent a significant data gathering process, data gaps, overlaps, and interactions will be identified through the development process. Filling the data gaps and coordinating data collection and management within the WMAs will continue to be a priority for the RWMG and Stakeholder Group to best assess regional water management needs and the effectiveness of implemented water management projects.

Habitat and Natural Resource Monitoring Data. Habitat mapping efforts within the Central OC WMA are reasonably complete (e.g. NCC mapping); however, additional data collection is needed to better address habitat health and viability and to update habitat maps across the entire Region as it relates to other water resources. Additional habitat health, species composition, and invasive species data are required in all watersheds to provide for a greater understanding of geographic-, temporal-, and water quality-related trends. Although several federal, state, and local agencies collect data with respect to the quantity and quality of habitat, currently no single entity provides a comprehensive assessment of such data.

Monitoring and Assessment Approaches. In some instances, data gaps can be addressed through modifications to existing monitoring and assessment approaches. For instance, monitoring approaches that better focus on water quality or environmental "risk", such as those being implemented through the ROWDs, rather than static regulatory benchmarks such as chemical concentrations, could better and more cost-efficiently focus management efforts toward solutions. Likewise, considerable benefit, including cost-savings, could be achieved through data gathering approaches that are designed to assess cumulative impacts rather than those of a single source or project.

Another key issue with respect to monitoring approaches is that of linkages between media. Although the cycling of many constituents among water supply systems, surface waters, groundwater, and potentially biota, is well understood from a theoretical perspective, little real-world data exist to support the development of effect management approaches.

6.3.3 Data Management System and Dissemination

Water and natural resource data are collected throughout the Region by various entities such as permitted dischargers, NGOs, research institutes, and government agencies. In addition, the Region stakeholders maintain a wide-ranging list of studies and data sets. Technical information and data sets are obtained from the planning and technical studies that have been conducted

within the Region. These targeted studies will be used to support proposed IRWM projects.

In addition, extensive data collection, management and support conducted for OCWD and MWDOC as part of SAWPA's Prop 84 IRWM Drought Grant Program provided aerial survey data, land use and water use data by property coding and classification data. These data will allow The OC Plan proponents to more effectively implement water use efficiency and water conservation measures throughout the Region in the years ahead.

The responsibility of maintaining and managing this data is typically the responsibility of the entity collecting it. It is the intent of the RWMG to support data collection throughout the Region and assist with consistency, management, and dissemination of the data to support regional decision making, stakeholder interests, and public education and involvement. To achieve this goal, the RWMG and Stakeholders Group has a geospatial-based Data Management System (DMS) for tracking implemented IRWM projects, proposed IRWM projects and other layers of data and made available by the member agencies. The DMS allows for consistent public access to project information, regional data sets and interactive map-based exploration of watershed information.

Data dissemination occurs through several means including IRWM Stakeholder meetings, website postings, email notices, agency contacts, and the online DMS. The CEQA and NEPA process for implementation projects also provides opportunities for public input, review, and data dissemination.

IRWM Stakeholder meetings are one primary means for data dissemination where partner agencies and organizations provide handouts, slideshow presentations, and hold question/answer periods regarding implemented projects and programs. The OC Plan and project performance reports are posted within the DMS.

Primary data management functions will continue to reside with the primary data collectors (data owners). The data owners are responsible for the collection, storage, Quality Assurance/Quality Control (QA/QC), analysis, reporting in compatible formats, and dissemination of the data to any databases already receiving their data. Data owners are responsible for ensuring that the data disseminated to the existing state databases, including California Environmental Data Exchange Network (CEDEN), Surface Water Ambient Monitoring Program (SWAMP), Water Data Library (WDL), and Groundwater Ambient Monitoring and Assessment (GAMA), is in a format compatible with those databases. Data will be made available in the DMS, when feasible.

The County of Orange shall work with stakeholders to implement a consistent QA/QC program for data collection and analysis, avoid data redundancy, work to fill data gaps, and ensure data comparability. The County will host the online DMS, providing geospatial capabilities for locating and identifying projects in the North and Central OC WMAs. The DMS will also act as a repository and dissemination site for project data provided to the County, when applicable and available.

Figure 6-1 shows the process of data collection, storage, and dissemination to IRWM participants, stakeholders, the public, and the state.

Examples of data to be made available on the County's website and in The OC Plan DMS include, but are not limited to, the following:

- Project location and/or footprints;
- Raw verified and validated data sets;
- Project information;
- IRWM planning process information such as meeting schedules, meeting minutes, agendas, annual reports;
- Plan updates; and
- Other information as available.

All information will be posted in user-friendly electronic formats accessible to the general public. Other relevant information will be made available on the website such as related web links and stakeholder and agency contact information. Other monitoring websites will be identified and utilized as appropriate during implementation of the Plan.

The OC Plan DMS supports the Region's efforts to share collected data with other interested parties including local, state, and federal agencies by providing transparency of information and consistency of data. The data formats will be compatible with state data management programs to provide widespread access to the general public.

IRWM stakeholders and the general public shall be informed of updates in IRWM planning procedures and online data availability through email notifications or physical mailings to interested parties. Consistent outreach with the public will encourage ongoing participation. Additionally, the DMS will be updated regularly with pertinent data and information about planning efforts in the WMAs, particularly for project planning.

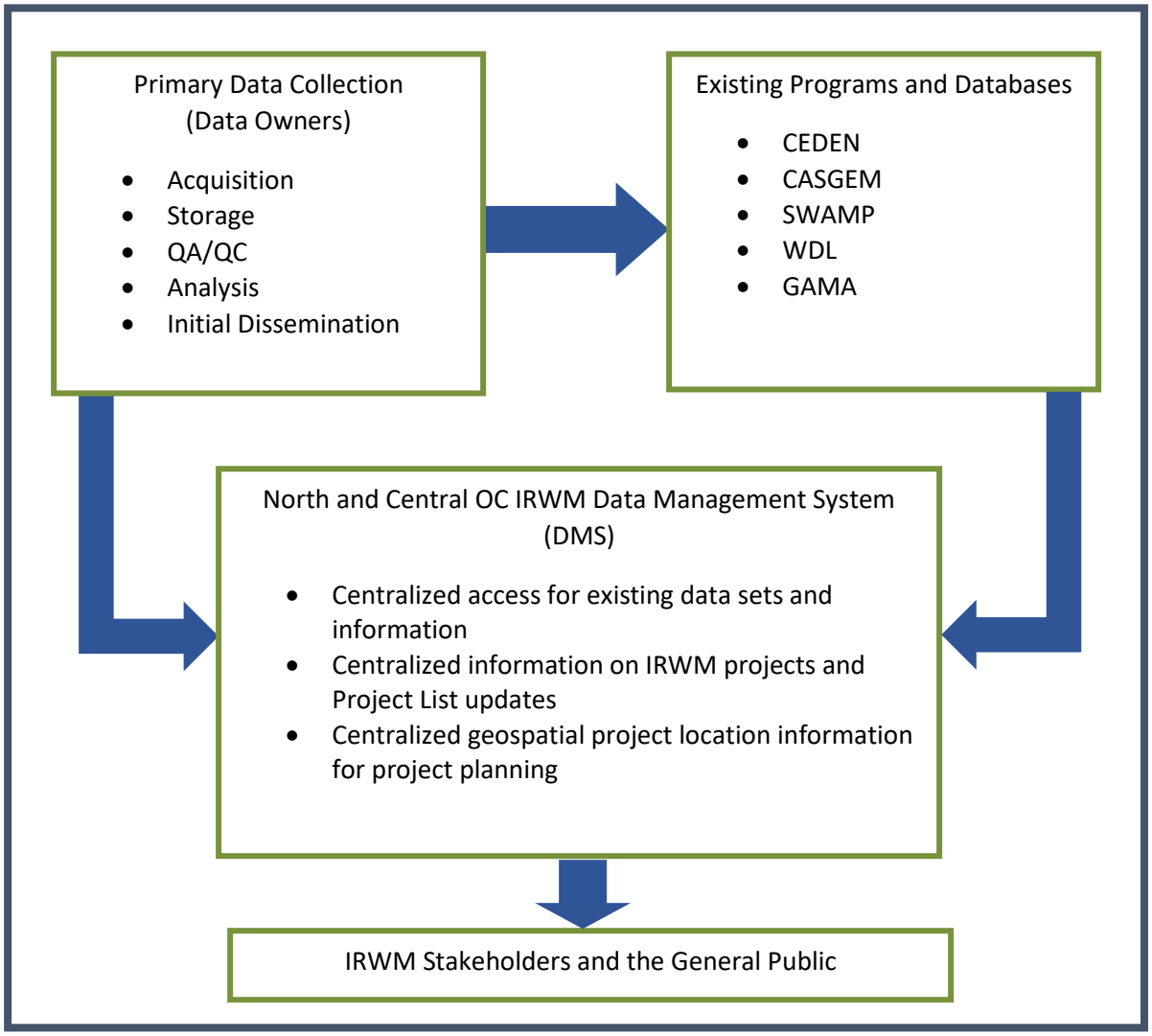

Figure 6-1: Data Management

6.3.4 State Data Management Programs

To promote data reliability, the Region will implement techniques compatible with State programs such as the CEDEN, SWAMP, WDL, and the GAMA Program. The following provides an overview of the State information and data exchange programs:

CEDEN. The California Environmental Data Exchange Network (CEDEN) provides for state-wide coordinated data sharing. CEDEN is a growing statewide cooperative data exchange program of various groups involved in the water and environmental resources of the State of California. Most of CEDEN's data exchange services are custom developed using a robust tool set which has been used to connect scores of programs into the network. SCCWRP maintains

the Southern California Regional Data Center for uploading data to CEDEN.[1] Surface water quality monitoring data is submitted to CEDEN and data is posted on the County's website from 2001 to present.

CASGEM. California Water Code §10920 *et seq*. established the California Statewide Groundwater Elevation Monitoring Program (CASGEM) to monitor, track and report seasonal and long-term groundwater elevation trends in groundwater basins statewide. Collection and evaluation of such data on a statewide scale is an important fundamental step toward improving management of California's groundwater resources. To achieve this goal, the statute requires collaboration between local monitoring entities and DWR to collect groundwater elevation data. DWR's role is to coordinate the CASGEM program, to work cooperatively with local entities, and to maintain the collected elevation data in a readily and widely available public database. OCWD is the a "Monitoring Entity" for Basin 8-1, the Coastal Plain of Orange County Groundwater Basin. As a Monitoring Entity, OCWD regularly collects and uploads groundwater elevation data to the CASGEM Online System for long-term tracking and reporting. An overview of CASGEM is available on the program web site.[2]

SWAMP. The Surface Water Ambient Monitoring Program (SWAMP) is a statewide ambient monitoring effort designed to assess the conditions of surface waters throughout the state of California. Ambient monitoring refers to any activity in which information about the status of the physical, chemical, and biological characteristics of the environment is collected to answer specific questions about the status, and trends in those characteristics. For the purposes of SWAMP, ambient monitoring refers to these activities as they relate to the characteristics of water quality. The SWAMP integrates existing water quality monitoring activities of the SWRCB and the RWQCBs, and coordinates with other monitoring programs. Responsibility for implementation of monitoring activities resides with the nine RWQCBs that have jurisdiction over their specific geographical areas of the state.

In accordance with CWA section 305(b), the SWRCB and RWQCBs periodically compile an inventory of the state's major waters and the water quality condition of those waters, using monitoring data and other pertinent information. This inventory is known as the Water Quality Assessment. The Water Quality Assessment is the foundation upon which the TMDL Program is built.

To better understand the waters of the Region, monitoring and assessment, for both status and trends, needs to be planned and ongoing. The Regional Water Board uses SWAMP resources to ensure that monitoring is conducted in each hydrologic unit once in every five-year period. The Regional Water Board locates monitoring sites on main stem rivers and streams just above tidal influence; main stem rivers and streams just above the confluence with major

[1] http://www.sccwrp.org/Data/DataSubmission/SouthernCaliforniaRegionalDataCenter.aspx
[2] http://www.water.ca.gov/groundwater/casgem/

tributaries; and major tributaries just above the confluence with the main stem rivers and streams.[3]

WDL. The Water Data Library (WDL) database[4] stores data from various monitoring stations, including groundwater level wells, water quality stations, surface water stage and flow sites, rainfall/climate observers, and water well logs. The data is provided by DWR Region offices and dozens of local and federal cooperators.

GAMA. The Groundwater Ambient Monitoring and Assessment (GAMA) Program is a comprehensive groundwater quality monitoring program that was created by the SWRCB in 2000.[5] It was later expanded by AB 599 - the Groundwater Quality Monitoring Act of 2001, resulting in a publicly-accepted plan to monitor and assess groundwater quality in basins that account for 95 percent of the state's groundwater use. The GAMA Program is based on interagency collaboration with the SWRCB, DWR, Department of Pesticide Regulations, USGS, and Lawrence Livermore National Laboratory, along with cooperation of local water agencies and well owners. As discussed in **Section 2**, the Basin 8-1 Alternative Plan (January 2017) was produced collaboratively by OCWD, the City of La Habra and IRWD for the purpose of complying with the Sustainable Groundwater Management Act (SGMA) for the Orange County Groundwater Basin.

The main goals of GAMA are to:

- Improve statewide groundwater monitoring and establish ambient groundwater quality on a basin-wide scale.
- Continue periodic groundwater sampling and groundwater quality studies to characterize chemicals of concern and identify trends in groundwater quality.
- Centralize and increase the availability of groundwater information to the public and decision makers to better protect our groundwater resources.

The GAMA Program includes four projects to meet the statutory requirements of Groundwater Quality Monitoring Act of 2001 and GAMA Program goals. As California's most comprehensive and state-of-the-art groundwater research program, these projects inform citizens, community water systems, environmental groups, and state and federal agencies.

Priority Basin Project. The Priority Basin Project initially focused on assessing the deep groundwater resource that accounts for over 95 percent of all groundwater used for public drinking water. To date, the USGS has sampled over 2,500 public supply wells and has developed a statistically unbiased assessment of the quality of California's drinking water aquifers. In 2012, the Priority Basin Project started the second phase of the project

[3] http://www.waterboards.ca.gov/water_issues/programs/swamp/
[4] http://www.water.ca.gov/waterdatalibrary/
[5] http://waterboards.ca.gov/gama/

to assess the quality of shallow aquifers typically used for domestic and small community water supplies. Areas of the state with the greatest densities of households that rely on domestic wells are prioritized into study units for this phase of the project.

GeoTracker GAMA. The GeoTracker GAMA groundwater information system integrates and displays water quality data from various sources on an interactive Google-based map. The system centralizes and increases the availability of groundwater information to the public and decision makers, a main goal of the GAMA Program. Analytical tools and reporting features help users assess groundwater quality and identify potential groundwater issues in California.

Domestic Well Project. The Domestic Well Project samples private wells from volunteer well owners on a county level, at no cost to the well owners. Since 2002, over 1,100 of the estimated 600,000 private wells in six counties in California have been sampled for commonly detected chemicals. The well owners receive the analytical test results and fact sheets, and the water quality data is placed on GeoTracker GAMA without divulging well ownership.

Special Studies Project. The Special Studies Project focuses on specific groundwater quality studies, using state-of-the-art scientific techniques and methods that help researchers and public policy planners to better understand how groundwater contamination occurs and behaves. Studies include sources of nitrate, wastewater indicators, groundwater recharge, detection of pharmaceutical compounds and personal care products using low-level anthropogenic compounds as tracers, and isotopic composition as a contamination source tool. Lawrence Livermore National Laboratory, the project technical lead, has pioneered the use of tritium-helium groundwater age-dating techniques, which are critical in understanding groundwater sources and flow.

Partnerships and effective coordination with the local agencies will be an important part of the GAMA Program. Thus, projects implemented as part of The OC Plan that may result in information beneficial to the comprehensive analysis of groundwater resources will be coordinated with the GAMA Program.

6.4 Plan Performance and Monitoring

As stated previously, the County of Orange will oversee The OC Plan implementation at the staffing level on behalf of and in collaboration with the RWMG and agencies, organizations and other stakeholders in the Region. Plan performance will be implemented and measured to ensure the IRWM objectives are being met. To this end, the project review process includes evaluating and ranking each proposed project based on the extent to which it meets The OC Plan objectives. As IRWM projects are implemented, they will be monitored to comply with all

rules, laws and permit requirements, as well as tracked with a Data Management System (DMS), maintained by the County of Orange, or other designated entity, to continuously track project success, outcomes and overall IRWM Plan implementation. Primary data management functions will continue to reside with the primary data collectors (data owners).

Some data is available from a number of sources to evaluate Plan performance, including:

- Urban Water Management Plans
- Annual Watermaster Reports
- Groundwater Management Plans
- US Geological Survey (USGS) groundwater monitoring databases
- Basin Studies
- MS4 Permit water quality monitoring
- Stormwater BMP project reporting
- General Plan land use
- MSHCP implementation data
- Stream connectivity and fish passage documentation, as applicable
- Project progress reports

The data and information provided in these sources is expected to come from existing databases and monitoring efforts with established procedures. The Region assumes that the agencies and organizations performing these monitoring efforts have validation procedures in place to ensure accuracy of the data.

State-Funded Projects. Per state funding requirements, the lead agency of each implemented state-funded project will be responsible for developing project-specific monitoring plans and activities at the start of project operation/implementation. Therefore, at a minimum, projects implemented with state funds will include a Project Monitoring and Performance Plan, for which the project proponent will be responsible. For example, a Project Monitoring and Performance Plan may include water quality monitoring that will be performed, and lessons learned will be documented. By implementation of these plans, the RWMG will establish an effective methodology to evaluate and monitor the project's and Region's ability to implement IRWM projects and meet The OC Plan objectives.

The following are the contents typically required in a project-specific Monitoring and Performance Plan:

- Clearly and concisely (in a table format) describe what is being monitored for each project. Examples include monitoring for water quality, water depth, flood frequency, and effects the project may have on habitat or particular species (before and after

construction).

- Measures to remedy or react to problems encountered during monitoring. An example would be to coordinate with the CA Department of Fish and Wildlife if a species or its habitat is adversely impacted during construction or after implementation of a project.
- Ensure compliance with all rules, laws and permit requirements.
- Location of monitoring
- Monitoring frequency
- Monitoring protocols/methodologies, including who will perform the monitoring
- Data Management System (DMS) or procedures to keep track of what is monitored. Each project's monitoring plan will also need to address how the data collected will be or can be incorporated into statewide databases.
- Procedures to ensure the monitoring schedules are maintained and that adequate resources (including funding) are available to maintain monitoring of the project throughout the scheduled monitoring timeframe

A Project Monitoring and Performance Plan will address how the project will result in measurable improvements in water supply, water quality, watershed condition, capacity for effective watershed management, and other measurable benefits. In this way, the projects will meet the objectives of The OC Plan. Data made available by the project proponents will be included in the DMS.

Section 6.3.4 above describes how the state-compatible data will be available to stakeholders.

6.4.1 Plan Implementation and Performance Through Measurable Objectives

Consistent with the governance model in **Section 1**, the RWMG operates in accordance with an executed MOU to oversee the planning and implementation of water management strategies as established in The OC Plan. The agreement further establishes the responsibility to guide development, adoption and execution of the Plan, including establishing priorities for water resource needs, integrating water resource solutions across traditional bounds, and jointly advocating for policies and funding that assist these goals. The agreement also provides for the RWMG to engage Region member agencies, stakeholders and other organizations in IRWM processes and for collective decision-making, including overseeing stakeholder involvement in project selection for the Plan and grant funding; seek funding for Plan implementation; and guide future updates to the Plan.

For The OC Plan, the Stakeholder Group, through a series of meetings, collectively developed the objectives and strategies, and prioritized them according to their water management responsibilities. Subsequently, the project ranking criteria were developed and agreed upon by the Stakeholder Group. The steps for weighting and ranking of goals and strategies for use in

project evaluation and scoring included:

1. Identification and weighting of goals, objectives and strategies
2. Ensuring objectives are prioritized based on regional concerns, including: providing adequate and reliable water supplies, protecting and enhancing water quality, restoring ecosystems and improving native habitat, integrating flood management, improving the quality of life in Orange County, and addressing climate change
3. Identifying and assessing weighted values for goals and strategies and for project ranking

6.4.2 Adaptive Management and Climate Change

The OC Plan considers long-term regional water resource planning for the Region over the next 20 to 50 years. This approach to watershed planning reflects the regional goals, as described in **Section 3**, and sets the foundation for developing the regional objectives. **Section 3** provides further discussion of IRWM stakeholder efforts to meet the diverse set of watershed-scale goals, balance water needs and resolve potential water issues through development of objectives. The process of developing objectives considered collaboration, coordination and implementation of projects through IRWM planning to meet priorities, as well as consideration of the 2016 IRWM Plan Standards.

In developing The OC Plan goals and objectives, the Stakeholder Group considered regional conflicts, Basin Plan Objectives, California's 20x2020 Water Conservation Plan, climate change impacts, and priorities of the WMAs. Measurable goals were identified for each strategy category and subsequently used to prioritize projects. The objectives are measurable milestones that will enable the community to track progress toward maintaining a natural balance in watershed resources. Objectives provide the foundation for assessment of projects in The OC Plan; as such, the overarching metrics for the goals and associated objectives (which provide detail) consider local planning priorities associated with the categories in **Table 3-3**. The objectives and strategies are included in **Section 3.5**.

Adaptive Management

Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of previously employed policies and practices. It can be viewed as a structured, iterative process of robust decision making. In this way, decision making simultaneously meets one or more resource management objectives and, either passively or actively, accrues information needed to improve future management. Adaptive management is a tool to both learn about and change a system to improve long-term management outcomes. The challenge in using the adaptive management approach is to find

the correct balance between gaining knowledge to improve management in the future and achieving the best short-term outcome based on current knowledge.[6,7]

The OC Plan is a living document, and as such is expected to be updated periodically. The Region will utilize an adaptive management approach to IRWM Plan implementation so that monitoring results inform future planning and implementation, and allow for improvement and modification of the Region's needs, goals, and objectives; RMS and IRWM Plan impacts and benefits; and project prioritization.

In particular, there is a level of uncertainty in projecting the impacts of climate change that will require such an approach, and enable the Region to respond to changes in climatic conditions or new information from climate models. For example, if climate models indicate that decreases in local surface water flows will reduce the volume of water that can be recharged to aquifers, the Region may choose to alter its project prioritization scheme to encourage the implementation of more recycled water projects or water use efficiency projects to increase local supplies. The implementation framework laid out in this chapter will allow the Region to respond to these types of changes efficiently and in a manner beneficial to the various stakeholders in the Region.

Both collaborative local water planning and stormwater resource planning, as described below, support adaptive management for The OC Plan.

Local Water Planning. It is the intent of The OC Plan to be congruent with local plans and to include current, relevant elements of local water planning and water management issues common to multiple local entities in the Region. IRWM planning does not replace or supersede local planning, but rather incorporates local planning elements.

The RWMG shall coordinate water management activities and information with local water planners and stakeholders through IRWM meetings, workshops, outreach activities, and email and website updates. Additionally, The OC Plan strategies and priority projects are planned and implemented through extensive coordination and cooperation between IRWM members. Planning activities addressed in this teaming process include (but are not limited to):

- Groundwater Management
- Urban Water Management
- Water Supply Management
- Wastewater Management
- Watershed Management

[6] https://www.greenfacts.org/glossary/abc/adaptive-management.htm
[7] https://en.wikipedia.org/wiki/Adaptive_management

- City and County General Planning
- Land Development (including LID)
- Flood Protection
- Stormwater and Urban Runoff Management (including the OC SWRP)
- Ecological Resource Management
- Salt and Salinity Management
- Emergency Response/Disaster Plans

Many existing plans, including the OC SWRP, Water Supply Master Plans, Groundwater Management Plans, Watershed Management Plans, Water Reliability Assessments, Recycled Water Studies, Urban Water Management Plans, and Long-Range Plans contain proposed projects that are instrumental in meeting the goals and objectives of the Region. Projects within local and regional plans and studies have been incorporated into The OC Plan, and will continue to be implemented in coordination with applicable plans.

Although The OC Plan addresses region-wide water management issues, local plans provide planning guidance and/or goals specific to a local water or natural resource. In the case that a stated goal or activity of a local plan conflicts with, or is inconsistent with, The OC Plan, the RWMG will work with stakeholder groups to meet with local governments or agencies to identify inconsistencies between the plans and resolve any issues. As IRWM planning develops and progresses, the dynamic relationships between local plans and The OC Plan will continue to consider and incorporate the following:

- Consistency and coordination regarding local plan content and The OC Plan content;
- Relevant, accurate, and current local plan information and references of which The OC Plan is based;
- Water management issues and climate change adaptation and mitigation strategies from local plans into The OC Plan; and
- Limits, levels, management tools or criteria relevant to water management in local plans that are applicable to The OC Plan.

Both local plans and The OC Plan will periodically be updated to reflect effective, integrated, and consistent water planning and management. Local plans will also be updated to comply with relevant compliance requirements. Updates to The OC Plan will consider planning changes due to compliance mandates (e.g. NPDES, TMDL or WDR) as well as increasing challenges in managing water resources due to climate change, increasing population and water demand, uncertainty in the availability of water from the Sacramento-San Joaquin Delta, and reduced surface flows. When The OC Plan is updated, the relevancy of the plans included here will be reviewed and the most updated or recent plans will be included.

Stormwater Resource Planning. Water Code § 10562 (b)(7) (i.e. SB 985) requires the development of a stormwater resource plan to receive grants for stormwater and dry weather runoff capture projects. The RWMG is subsequently required to incorporate applicable SWRPs into IRWM plans. Per the requirement set forth above, the OC SWRP is included as **Appendix C** of The OC Plan and was included in the local planning coordination efforts described above. Indeed, the OC SWRP utilizes the integrated project prioritization and selection process from The OC Plan as a model for stormwater projects and aligns with the goals and objectives contained herein.

Consideration of Effects of Climate Change to Region

The Region's Stakeholders are aware of the detriment and cost that inaction on climate change would have on the Region. Snowmelt, either from the Sierra Nevada or the Rockies, is a major component of the imported water supplies in the Region. A large fraction of the precipitation in western mountain regions falls on days with temperatures just a few degrees below freezing (Bales et al., 2008). Thus, warming by even a few degrees might result in a large shift from snowfall to rainfall, a result of great consequence to the Western US and California, where snowpack represents a significant component of water storage during the year. In addition to the shift in storage, there may be impacts caused by the change in the total quantity of precipitation, and in length and severity of droughts across the large region that supplies imported water to the Region. A warming California climate would also foster larger brush and forest fires, especially with the extreme tree mortality from the recent 2012-2015 drought. Continuing increases in global GHG emissions at current rates would result, by late in the century, in sea level rising by more than four feet, and a greater incidence of heat wave days. These impacts will translate into real costs for California, including flood damage and flood control costs that could amount to billions of dollars in many regions. Water supply costs due to scarcity and increased operating costs would also increase.

In addition to being affected by climate change, the water sector is a contributor to the GHG emissions. Greenhouse gases from human activities are the most significant driver of observed climate change since the mid-20th century.[8] The water sector emissions arise from energy used in the transport of water through the SWP and CRA, in the treatment of municipal supply and in the treatment of wastewater. Therefore, any effort or specific IRWM projects that lead to reduced water imports and/or reduced water use and disposal will also have a GHG reduction, or climate mitigation benefits.

For the above reasons, and because the IRWM Plan Act, CWC §10541(e)(10), states that IRWM plans must include an evaluation of the adaptability to climate change of water management

[8] https://www.epa.gov/climate-indicators/greenhouse-gases

systems in the region, analysis of climate impacts was done as part of The OC Plan development process. Although statewide efforts to address climate change are in progress, it is understood that local governments and agencies within the WMAs play an essential role in fulfilling California's emissions reduction targets and in reducing the local effects of climate change in the Region. Local governments have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations.

Land use planning and urban growth decisions are also areas where successful implementation of climate change strategies relies on local government. Local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth and the changing needs of their jurisdictions. Decisions on how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas sectors.

The discussion above and **Section 2.9** present a high-level summary of the effects of climate change in the Region and ongoing adaptation efforts in the context of water supply, which is inherently a statewide issue given the inter-basin transfers of water that occur through the southwest. Based on the body of information summarized here, it is envisioned that climate adaptation through increased water use efficiency and conservation will play a key role in the selection of future IRWM projects. Further, as understanding of the nature and impacts of climate change, improves with time, this information will be incorporated in future versions of The OC Plan.

Appendix A
Resolutions/Letters of IRWM Plan Adoption/Acceptance/Support and the Regional Water Management Group Memorandum of Understanding

The OC Plan Regional Water Management Group (RWMG) is represented by the following three agencies: Orange County Water District (OCWD), Orange County Sanitation District (OCSD), the County of Orange (Orange County). The RWMG provides oversight and leadership for The OC Plan. The RWMG is responsible for adoption and implementation of The OC Plan. Therefore, each of these three agencies adopted or accepted the IRWM Plan.

In addition, each agency that has a project included in The OC Plan may approve a Resolution of Adoption or Acceptance of The OC Plan. Other agencies that are not members of the IRWM Region but are cooperative agencies may support or adopt The OC Plan by resolution or letter.

To meet the Water Code requirement to "participate by means of a written agreement," the RWMG entered into a Memorandum of Understanding (MOU)**.** The MOU provides a framework for planning water management strategies for The OC Plan implementation and executing an effective decision-making process. It establishes the responsibility to guide development, adoption and execution of The OC Plan, including establishing priorities for water resource needs, integrating water resource solutions across traditional bounds, and jointly advocating for policies and funding that assist these goals. Copies of resolutions and letters of adoption, acceptance or support are included on the following pages.

Appendix B
The OC Plan Technical Studies/Data Sets

Technical information and data sets are obtained from the extensive planning and technical studies that have been conducted for the watersheds with the Region.

The OC Plan incorporates adopted master plans for water, wastewater, and recycled water systems, each of which includes a detailed engineering analysis of current system conditions, future service demands, and system improvements. The OC Plan has considered extensive local planning and technical analyses in development of goals, objectives, priorities and projects. Utilizing existing planning to develop The OC Plan and projects has further provided opportunities for an informed stakeholder process. Because of this collaborative process, watershed management issues and conflicts have been clearly identified, the objectives directly respond to those issues, and implementation of the strategies and projects has been based on the findings and recommendations of those studies.

Table B-1 lists the technical studies and data sets that have been used to develop The OC Plan.

Table B-1: The OC Plan Technical Studies/Data Sets

Supporting Technical Documents for The OC Plan or Projects	Derived Information and Use	Reference or Source
Population Growth	Future Population; Calculate future water demand	United States Census Bureau 2010
Westminster Reconnaissance Study	Describes the North OC WMA and challenges facing the region	United States Army Corps of Engineers (USACE), 2001
Coyote Creek Watershed Management Plan	Description of conditions in the Coyote Creek Watershed	County of Orange, 2007
North OC WMA IRWM Plan	Historic and current information used for basis of the combined North and Central OC IRWM Region	Orange County, 2011
Central OC WMA IRWM Plan	Historic and current information used for basis of the combined North and Central OC IRWM Region	Orange County, 2012
Drainage Area Management Plan	Requirements of the countywide NPDES stormwater permit; Assess flood risks	Orange County, 2003

Table B-1: The OC Plan Technical Studies/Data Sets		
Supporting Technical Documents for The OC Plan or Projects	**Derived Information and Use**	**Reference or Source**
U.S. Army Corps of Engineers Newport Bay/San Diego Creek Watershed Study	Habitat and environmental information	USACE, 2005
U.S. Army Corps of Engineers Special Area Management Plan for San Diego Creek Watershed	Habitat and environmental information	USACE, 2009
Newport Coast Watershed Management Plan	Newport Coast Watershed information	City of Newport Beach, 2007
Newport Harbor Area Management Plan	Adaptive management in the Newport Harbor Area	City of Newport Beach, 2010
Serrano Creek Collaborative Use Plan	Regional information for erosion and flood control, recreation and landscaping improvements, biological resource enhancements along Serrano Creek	City of Lake Forest, 1999
Natural Treatment System Plan	Treating dry weather runoff; and riparian habitat and water-quality benefits to wildlife	Irvine Ranch Water District (IRWD), Orange County, and cities of Irvine, Lake Forest, Newport Beach, Orange, Santa Ana, and Tustin, 2005
Water Quality Control Plan, Santa Ana River Basin (8)	Surface water quality; Identification of beneficial uses and impaired water bodies	California Regional Water Quality Control Board, Santa Ana Region, 1995
Orange County Great Park Comprehensive Master Plan	Parks and open space information	City of Irvine, 2002
Urban Water Management Plans	Agency-specific water planning; water demand projections	North and Central OC Water Suppliers, 2015
Orange County Reliability Study	Water demand and supply projections within Orange County	Municipal Water District of Orange County (MWDOC), 2016
OCWD Groundwater Management Plan	Groundwater management information for the Orange County Groundwater Basin	Orange County Water District (OCWD), 2015

Table B-1: The OC Plan Technical Studies/Data Sets		
Supporting Technical Documents for The OC Plan or Projects	**Derived Information and Use**	**Reference or Source**
Basin 8-1 Alternative Plan	Orange County Groundwater Basin conditions and operations; data on sustainable management of the groundwater basin	OCWD, City of La Habra, IRWD, 2017
Orange County Stormwater Resources Plan	Watershed-based planning information for stormwater management	Orange County Environmental Resources, 2017
Watershed Infiltration Hydromodification Management Plan (WIHMP) Mapping Tools	Areas susceptible to hydromodification; Information for county-wide MS4 compliance	Orange County Environmental Resources, 2014-15
Natural Community Conservation Plan/Habitat Conservation Plan for Central and Coastal Subregion	Wildlife habitat information	Orange County, 1996
Southern California Bight Studies	Environmental and habitat data	Southern California Coastal Water Research Project, 2013 - 2017
Re-calculation of Ambient Water Quality in the Santa Ana Watershed, for the period 1993-2012	Groundwater basin quality; Salt and nutrient management in groundwater	SARWQCB and Basin Monitoring Program Task Force; began 1995
Climate Change Handbook for Regional Water Planning	Climate change information; development of climate change objectives	U.S. Environmental Protection Agency Region 9 and CA Department of Water Resources (DWR), 2011
DWR Climate Change Action Plan	Climate change information; development of climate change objectives	CA DWR, 2012 to current
Using Future Climate Projections to Support Water Resources Decision Making in California	Analysis of climate change; development of climate change objectives	California Climate Change Center, 2009
Colorado River Basin Supply and Demand Study	Water demand and reliability; evaluation of water supply in the Region	U.S. Bureau of Reclamation (USBR), 2012
California Adaptation Planning Guide	Watershed planning	California Emergency Management Agency and the California Natural Resources Agency, 2012
Cal-Adapt Website	Climate change impacts on energy	California Energy Commission

Table B-1: The OC Plan Technical Studies/Data Sets		
Supporting Technical Documents for The OC Plan or Projects	**Derived Information and Use**	**Reference or Source**
Climate Change Analysis for the Santa Ana River Watershed, Technical Memorandum No. 86-69210-2013-02	Identification of potential impacts to region due to climate change	USBR, 2013
Healthy Parks, Schools and Communities, Green Access and Equity for Orange County	Open Space information	The City Project, 2011
Residential Runoff and Reduction Study, MWDOC, 2004.	Water conservation data; assess reduction in dry-weather runoff volume and non-point source pollutants	MWDOC
SmarTimer and Edgescape Evaluation Study (SEEP), MWDOC, 2008	Water Conservation data; assess water conservation improvements	MWDOC
Residential Runoff Reduction Study, July 2004	Effectiveness data for flow/pollutant reduction	MWDOC
SmarTimer and Edgescape Evaluation Program, November 2008	Effectiveness data for flow/pollutant reduction	MWDOC
OCTA Mitigation Funding, 2009	Mitigation and funding activities conducted by the OCTA	Audubon Society, OCTA
SCCWRP 2009	Regional Coastal wetland restoration grant funding and report	Audubon Society, SCCWRP
USFWS, Partners for Fish and Wildlife, 2007	Regional Coastal wetland restoration strategies	Audubon Society, USFWS
Arundo donax Distribution and Impact Report, March 2011.	Arundo water consumption and habitat impacts	California Invasive Plant Council

Appendix C
Basin 8-1 Alternative Plan

Pursuant to the California Sustainable Groundwater Management Act (SGMA) (2014, as amended in 2015) Orange County Water District, the City of La Habra, and Irvine Ranch Water District completed the Basin 8-1 Alternative. SGMA provides authority for agencies to develop and implement Groundwater Sustainability Plans (GSP) or alternative plans.

The Basin 8-1 Alternative Plan presents an analysis of basin conditions that demonstrates that the Orange County Groundwater Basin has operated within its sustainable yield over a period of at least 10 years. In addition, the Alternative Plan establishes objectives and criteria for management that would be addressed in a GSP and is designed to be "functionally equivalent" to a GSP.

The Basin 8-1 Alternative Plan can be viewed at:
https://www.ocwd.com/media/4918/basin-8-1-alternative-final-report-1.pdf

Appendix D
Orange County Stormwater Resources Plan

The Orange County Stormwater Resources Plan (OC SWRP), a functionally equivalent plan, prepared by Orange County Environmental Resources (March 2017) to meet the requirements of SB 985 and to provide watershed-based planning for stormwater projects in Orange County.

The OC SWRP can be viewed at:
http://www.ocwatersheds.com/programs/ourws/oc_stormwater_resource_plan

Appendix E
Federal, State and Local Agencies with Jurisdiction in the IRWM Region

Federal, State and Local Agencies with Jurisdiction in the IRWM Region	
STATE AND FEDERAL AGENCIES, AND JOINT POWERS AUTHORITIES	
California Coastal Conservancy	Partners with local government, other public agencies, nonprofit organization and private landowners to purchase, protect, restore, and enhance coastal resources; established in 1976 to protect and improve natural lands and waterways, help people get to and enjoy the outdoors, and sustain local economies along the length of California's coast and around San Francisco Bay.
California Department of Fish and Wildlife	CDFW is responsible for conserving, protecting and managing California's fish, wildlife, and native plant resources. Per Fish and Wildlife Code Section 1602, entities are required to notify CDFW of any proposed activity that may substantially modify a river, stream or lake.
California Department of Parks and Recreation	The California Department of Parks and Recreation seek to provide for the health, inspiration and education of Californians by helping to preserve the state's biological diversity, protecting natural and cultural resources, and creating opportunities for outdoor recreation. They have jurisdiction over several natural areas in North and Central OC, including Bolsa Chica State Park, Corona del Mar State Beach, and Huntington State Beach.
California Department of Transportation (Caltrans)	Caltrans manages more than 50,000 miles of California's highway and freeway lanes and adjacent property within rights of way, provides inter-city rail services, permits more than 400 public-use airports and special-use hospital heliports, and works with local agencies.
State Water Resources Control Board	Oversees regional water boards; manages water rights for surface waters in the watershed.
State Water Resources Control Board – Santa Ana Region	Regulatory agency responsible for the protection and, where possible, the enhancement of the quality of California's waters; the Santa Ana Regions includes the upper and lower Santa Ana River watersheds, the San Jacinto River watershed, and several other small drainage areas; the Santa Ana Region covers parts of southwestern San Bernardino County, western Riverside County, and northwestern Orange County; Santa Ana Regional Board makes critical water quality decisions for its Region, including setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement actions.
Southern California Coastal Water Research Project (SCCWRP)	A pubic agency since 1969, created as a joint powers authority, SCCWRP is a leading U.S. environmental research institute that works to develop a scientific foundation for informed water-quality management of ocean and coastal watersheds in Southern California

Federal, State and Local Agencies with Jurisdiction in the IRWM Region	
	and beyond.
U.S. Fish and Wildlife Service	Habitat and wildlife management, including protection of endangered species.
United States Army Corps of Engineers (USACE), Southern California offices	With environmental sustainability as a guiding principle, the USACE team is working diligently to strengthen the Nation's security by building and maintaining America's infrastructure and providing military facilities where our service members train, work and live. They are protecting and restoring the Nation's environment. The USACE has worked closely with OCWD, the County of Orange and other stakeholders in the North and Central OC WMAs managing waters of the United States and natural resources, including rivers, dams and levees.
United States Department of Agriculture (USDA), Forest Service, Cleveland National Forest	The Cleveland National Forest spans 460,000 acres intersecting parts of Orange and Riverside Counties. The agency's mission is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations. The U.S. Forest Service provides firefighting, forestry research, as well as technical and financial help to state and local government agencies, businesses, private landowners and work government-to-government with tribes to help protect and manage non-federal forest and associated range and watershed lands. They have partnerships with public and private agencies to plant trees, improve trails, educate the public, and improve conditions in wildland/urban interfaces and rural areas. The U.S. Forest Service also promotes sustainable forest management and biodiversity conservation internationally.
U.S. National Park Service	Helps communities preserve and enhance important local heritage and close-to-home recreational opportunities; funding to register, record and save historic places, create community parks and local recreation facilities, conserve rivers and streams, and develop trails and greenways
USDA, Natural Resources Conservation Service (NRCS)	Works to improve the health of natural resources while sustaining and enhancing the productivity of American agriculture; achieved through strong partnerships with private landowners, managers, and communities to protect, restore, and enhance the lands and waters upon which people and the environment depend. Among many actions, NRCS helps to eliminate and reduce impairments to water bodies and help prevent the designation of additional water bodies to the "impaired" list, decrease threats to "candidate" and threatened/ endangered species; strengthen relationships with agriculture, conservation, and community organizations, and other mission stakeholders; and help build and support coalitions of public and private partners based on ecologic and industry needs.

Federal, State and Local Agencies with Jurisdiction in the IRWM Region	
Santa Ana Watershed Project Authority (SAWPA)	SAWPA is joint power authority under California law, composed of five member agencies; Eastern Municipal Water District, Inland Empire Utilities Agency, Orange County Water District, San Bernardino Valley Municipal Water District, and Western Municipal Water District. The SAWPA jurisdictional area includes the Santa Ana River Watershed.
COUNTY AGENCIES	
County of Orange	Manages land use, recreational facilities, stormwater protection, and water quality. The County of Orange, represented in this process primarily by OC Public Works, is active in integrated water management in a variety of ways; both as a landowner and a regional planner for the area, and engaged in various municipal operations such as roads and flood control; the County is partnered with each city and the OCFCD to comply with NPDES MS4 permit requirements; and the primary coordinator for regional water quality testing, inspection, education and report compliance. The County has jurisdiction over County beaches, parks, and facilities including North Tustin, Santa Ana Heights, and Moro Canyon, and Limestone Canyon/Whiting Ranch Wilderness Parks, Upper Newport Bay Nature Preserve, Newport Harbor, and Irvine, Mason, and Peters Canyon Regional Parks.
Orange County Flood Control District	Land use, flood control, stormwater protection, and water quality throughout the Orange County and control of streams flowing into the County; mitigates effects of tides and waves and protects harbors, waterways, public highways, and properties from such waters - OCFCD is a separate political entity, governed by the County Board of Supervisors and staffed by OC Public Works. OCFCD's purpose is to: (1) control flood and storm waters within the County boundary, and streams flowing into the County; (2) improve channels to remove or reduce flood flows to containment within the Federal Emergency Management Agency (FEMA) Special Flood Hazard Area (SFHA) also known as the 100-year floodplain; (3) improve deficient channels in accordance with OCFCD criteria to convey the 100-year storm event;(4) mitigate the effects of tides and waves; and (5) to protect the harbors, waterways, public highways, and property in the County from such waters.
Orange County Council of Governments	Voluntary advisory organization that represents 34 cities, County of Orange, transportation agencies, sanitation and water districts, as well as the local air district.

Federal, State and Local Agencies with Jurisdiction in the IRWM Region		
Orange County Transportation Authority	Funding for water quality projects with a link to transportation projects.	
Orange County Department of Education	Provides education within the Region.	
Orange County Health Care Agency	Responsible for monitoring water quality at over 150 locations along the Orange County coastline.	
CITIES	Cities listed provide the following unless exception noted: land use, water service, water conservation, sanitary sewer service, stormwater protection, water quality, recreational facilities, economic and community development.	
North and Central OC Cities – Divided Boundaries		**Population/ % Below Poverty Line[1]**
City of Costa Mesa	Encompasses a total of 16 square miles with its southernmost border only one mile from the Pacific Ocean. According to the United States Census Bureau, the city's total area is 15.7 square miles of land and 0.05 square miles (0.29%) is water. The western half of the city is in the North OC WMA and the balance is in the Newport Bay Watershed in the Central OC WMA; Mesa Water District provides water service and water conservation for most of Costa Mesa, including John Wayne Airport; a small portion of Costa Mesa is provided water and water conservation service by IRWD; sanitary sewer services provided by Costa Mesa Sanitary District.	112,822 14.5%
City of Orange	Most of the city lies within the North OC WMA; the balance is in the northern boundary of the Newport Bay Watershed in Central OC WMA; a portion is provided potable and recycled water service, water conservation, wastewater collection, treatment and reclamation, habitat protection and restoration, and water quality by IRWD; a small portion of water service is provided	140,504 13.2%

[1] https://www.census.gov/quickfacts/fact/map; estimates as of July 1, 2016

Federal, State and Local Agencies with Jurisdiction in the IRWM Region		
	by Serrano Water District.	
City of Santa Ana	Approximately one-third of the city lies within the North OC WMA; the balance is in the Newport Bay Watershed in the Central OC WMA; a portion of Santa Ana is provided potable and recycled water service, water conservation, wastewater collection, treatment and reclamation, habitat protection and restoration, and water quality by IRWD.	334,217 22.1%
North OC Cities		**Population/ % Below Poverty Line**
City of Anaheim	Provides water and electric services; a small portion of City water and sanitary sewer services provided by Yorba Linda Water District.	351,043 16.5%
City of Brea	Portion of City water and sanitary sewer services provided by Yorba Linda Water District.	42,471 7.1%
City of Buena Park		83,156 13.4%
City of Cypress	Water service and water conservation provided by Golden State Water Company.	48,906 7.3%
City of Fountain Valley		56,529 8.1%
City of Fullerton		140,721 16.8%
City of Garden Grove	Small portion of city water service and water conservation provided by Golden State Water Company.	174,858 17.6%
City of Huntington Beach		195,212 9.4%
City of La Habra		61,664 13.2%
City of La Palma	Small portion of city water service and water conservation provided by Golden State Water Company.	15,774 7.3%
City of Los Alamitos	Water service and water conservation provided by Golden State Water Company.	11,636 11.2%
City of Placentia	Portion of city water and sanitary sewer services	52,228

Federal, State and Local Agencies with Jurisdiction in the IRWM Region		
	provided by Yorba Linda Water District.	11.4%
City of Seal Beach	Small portion of city water service and water conservation provided by Golden State Water Company.	24,440 8.1%
City of Stanton	Water service and water conservation provided by Golden State Water Company.	38,644 21.8%
City of Villa Park	Potable water is provided to the city by Serrano Water District.	5,918 3.7%
City of Westminster	No recycled water use in city; sanitary sewer service is provided by Midway City Sanitation District – collects wastewater to convey wastewater to Orange County Sanitation District treatment plants.	91,565 17.8%
City of Yorba Linda	Water and sanitary sewer services provided by Yorba Linda Water District.	68,235 3.6%
Central OC Cities		**Population/ % Below Poverty Line**
City of Irvine	IRWD provides potable and recycled water service, water conservation, wastewater collection, treatment and reclamation, habitat protection and restoration, and water quality.	266,122 12.3%
City of Newport Beach	A portion of Newport Beach is provided potable and recycled water service, water conservation, wastewater collection, treatment and reclamation, habitat protection and restoration, and water quality by IRWD; a portion of Newport Beach is provided sanitary sewer service by Costa Mesa Sanitary District.	86,688 7.1%
City of Tustin	IRWD provides water service and wastewater collection for a portion of Tustin; City of Tustin Water Services provides water to a portion of the city and unincorporated North Tustin; East Orange County Water District owns, operates and maintains sewer lines in North Tustin and the western portion of the city; OCFCD, OC Parks, City of Tustin and IRWD provide habitat protection, stormwater and water quality management.	80,395 13.6%

Federal, State and Local Agencies with Jurisdiction in the IRWM Region		
Cities Partially in Central OC WMA – Balance in South OC WMA		**Population/ % Below Poverty Line**
City of Laguna Hills	Divided between Central OC WMA in a portion of the Newport Bay Watershed and South OC WMA; a portion of the city is provided potable and recycled water service, water conservation, and wastewater collection and treatment by El Toro Water District.	7,937 (20% in Central OC) 8.5%
City of Laguna Woods	Divided between Central OC WMA and South OC WMA; potable and recycled water service, water conservation, and wastewater collection and treatment is provided by El Toro Water District.	16,406 (50% in Central OC) 10.3%
City of Lake Forest	Approximately two-thirds of the city lies within the Newport Bay Watershed in the Central OC WMA, the balance is in the South OC WMA; a portion of Lake Forest is provided potable and recycled water service, water conservation, wastewater collection, treatment and reclamation, habitat protection and restoration, and water quality by Irvine Ranch Water District, and a portion is provided by El Toro Water District.	192,455 (70% in Central OC) 7.4%
SPECIAL DISTRICTS		
North and Central OC Special Districts - Shared		
Costa Mesa Sanitary District	Sanitary sewer service to a 16-square-mile area; includes most of Costa Mesa, a portion of Newport Beach, and some unincorporated area.	
East Orange County Water District	Retail and wholesale (member of MWDOC) water services; wholesale distribution system delivers water to five sub-agencies within its boundaries, including the Golden State Water Company, City of Tustin, City of Orange, Orange Park Acres Mutual Water Company, and its own retail zone, which includes portions of the unincorporated community of North Tustin; 2015 population served - 3,257.	
Irvine Ranch Water District	Potable and recycled water service, water conservation, wastewater collection, treatment and reclamation, habitat protection and restoration, and water quality; serves all of Irvine and portion of the cities of Tustin, Santa Ana, Orange, Costa Mesa, Lake Forest, Newport Beach and some unincorporated areas of Orange County; 2015	

Federal, State and Local Agencies with Jurisdiction in the IRWM Region	
	population served - 379,510.
Mesa Water District	Serves most of the City of Costa Mesa, including John Wayne Airport, portions of the City of Newport Beach and a small portion of unincorporated Orange County; 2015 population served - 107,588.
Municipal Water District of Orange County	Imported water wholesaler for 28 member agencies and cities; administers various water use efficiency programs that also reduce urban runoff and increase water quality; lead agency implementing a variety of BMP water use programs on behalf of the member agencies and cities.
Midway City Sanitation District	Provides sanitary sewer and solid waste service to all Westminster and Midway City, an unincorporated area of Orange County.
Orange County Water District	Manages and replenishes the Orange County Groundwater Basin, ensures water reliability and quality, prevents seawater intrusion, and protects Orange County's rights to Santa Ana River water.
Orange County Sanitation District	Wastewater services in North and Central OC WMAs; intake of urban runoff from several runoff diversion structures; serves 23 member cities and three sanitary districts.
North OC Special Districts	
Serrano Water District	Potable water to the City of Villa Park and a small portion of the City of Orange; manages Irvine Lake – a large recreation facility in addition to a water source to both Serrano Water District and Irvine Ranch Water District; 2015 population served - 6,464.
Yorba Linda Water District	Water and sewer services in most of the City of Yorba Linda, parts of Placentia, Brea, Anaheim and unincorporated areas; 2015 population served – 74,787.
Golden State Water Company – West Orange System	Potable water service and water conservation; located in the northwest portion of Orange County, the West Orange System serves most of the Cities of Cypress, Stanton, and Los Alamitos, small portions of the cities of Seal Beach, Garden Grove and La Palma, and adjacent unincorporated areas of Orange County including the community of Rossmoor; 2015 population served – 169,573 (combined with Cowan Heights system shown below).
Central OC Special Districts	
El Toro Water District	Potable and recycled water service, water conservation, and wastewater collection and treatment; serves Laguna Woods and parts

Federal, State and Local Agencies with Jurisdiction in the IRWM Region	
	of Lake Forest, Laguna Hills in the Central OC WMA, and parts of Mission Viejo and Aliso Viejo in the South OC WMA; 2015 population served – 48,797.
Golden State Water Company - Cowan Heights	Retail water service in Cowan Heights; unincorporated area north of Tustin; population combined with West Orange System above).

Agency	Project Title	Primary Project Goal	Project Description	Project Status	Completion Date	Project Total Cost	Potential Regional Project
City of Anaheim	St. College Detention Basin	Flood Management	Creation of a detention basin in property at the southeast corner of St. College Blvd. and Cerritos Ave. to capture and treat stormwater flows.	Planning	2022	$5,000,000	Yes
City of Anaheim	Anaheim Shallow Aquifer Pumping for Nonpotable Uses	Water Supply	Installation of wells to utilize shallow groundwater for irrigation at parks and possibly schools in the area near Euclid Avenue between Lincoln and Cerritos Avenue.	Planning	TBD	$5,000,000	No
City of Anaheim	Anaheim Right of Way Projects	Water Quality	Inclusion of infiltration drywells, basins, parkway swales, and other similar BMPs in road projects (widening, reconstruction, etc.) intended to capture surface flows from roads and allow treatment and infiltration.	Planning	2022	$2,000,000	Yes
City of Anaheim	Richfield Road Storm Drain	Flood Management	Construction of storm drain facility with possible diversion of captured flow from tributary area into Foster-Huckleberry Basin for retention, treatment and infiltration.	In Design	March, 2021	$3,500,000	Yes
City of Anaheim	OCSD Trunkline Repurposing	Water Quality	Repurposing of 36" sewer trunkline to capture stormwater (low flow and/or peak flow). Includes the construction of a connection from a regional flood control facility to a tank and infiltration wells to drain captured water.	Planning	2022	$3,000,000	Yes
City of Anaheim	Ball Road Sewer adn Storm Drain Reconstruction	Flood Management	Reconstruction of undersized and deteriorated sewer lines and reconstruction of stormdrain facility to include retention/detention for the treatment of stormwater flows.	Planning	TBD	$2,000,000	No
City of Anaheim	Anaheim South Recycled Water Project	Water Supply	Constructing approximately 6 miles of new recycled water transmission mains and a pumping station to deliver recycled water from the Orange County Water District's Groundwater Replenishment System (GWRS) to southern portion of Anaheim for irrigation and o	In Design	December, 2020	$16,500,000	No
City of Anaheim	Anaheim Bay-Barber Channel Watershed Stormwater Capture Projects	Flood Management	Development of stormwater capture/treatment/infiltration system projects in Anaheim Bay-Barber Channel watershed. Multiple locations are under consideration, including but not limited to Energy Field Park, Southern California Edison easements, and Stodda	Planning	2022	$2,000,000	Yes

Agency	Project Title	Primary Project Goal	Project Description	Project Status	Completion Date	Project Total Cost	Potential Regional Project
City of Anaheim	Modjeska Park Detention Basin	Flood Management	Creation of a detention basin in Modjeska Park to address flood management, while also providing an opportunity to infiltrate some storm water into the ground water basin, addressing water quality, and allow the opportunity to include recreational ameniti	In Design	March, 2021	$3,200,000	Yes
City of Anaheim	Boysen Park Detention Projects	Flood Management	Installation of underground chambers to capture stormwater runoff from parking lot and for treatment and infiltration, and/or reconstruction of the park to lower areas and connect to the top of a County storm drain box to allow peak flow to drain to the p	Planning	2022	$2,000,000	Yes
City of Anaheim	Anaheim Hills Golf Course Constructed Wetland	Water Quality	A future reconfiguration of the Anaheim Hills Golf Course to include a constructed wetland water feature as well as a water reclamation system.	Planning	2022	$3,000,000	Yes
City of Cypress	Installation of Automatic Rectrable Screens at Various Catch Basin Locations	Water Quality	Installation of automatic retractable screens at various catch basins throughout the city.	Planning	F Y 2018/2019	$18,200	No
City of Fullerton	West Coyote Hills Land Acquisition and Protection	Ecosystems and Nativ	Acquire open space	Shovel Ready	December 2020	$34,000,000	Yes
City of Fullerton	Main Plant Water Well #7 Replacement	Water Supply	Drill new large capacity well	Planning	December 2020	$4,000,000	No
City of Huntington Beach	Trash Removal Project - Phase I	Water Quality	Design and installation of trash/debris removal device (Contech CDS unit)	Planning	2020	$200,000	No
City of Huntington Beach	Trash Removal Project - Phase II	Water Quality	Design and installation of trash/debris removal device (Contech CDS)	Planning	2021	$200,000	No
City of Newport Beach	San Diego Creek Diversion/Trash Removal Project	Water Quality	This project would mirror the Santa Ana-Delhi Channel Diversion project to (1) capture all dry weather trash and trash from a first flush storm, and (2) divert nuisance flows to OCSD for eventual use in the Groundwater Replensishment System.	Planning	7/1/2023	$10,000,000	Yes
City of Orange	Orange Trash Capturing Devices	Water Quality	Install trash capturing devices citywide to meet state Trash Provision requirements	Planning	2028	$2,500,000	No
City of Santa Ana - Public Works Department	City of Santa Ana street drainage and water quality improvement project	Water Quality	The City of Santa Ana street improvement focuses on water quality and drainage issues with an emphasis on capture and reuse opportunities.	Planning	2024	$30,000,000	Yes
City of Tustin	Citywide Installation of Catch Basin BMPs and/or CDS units	Water Quality	Installation of catch basin inserts and screens such as CPS units citywide	Shovel Ready	ongoing	$200,000	Yes
City of Tustin	Irvine Boulevard Storm Drain Improvements	Flood Management	Add several catch basins to eliminate flooding on Irvine Boulevard	Planning		$7,800,000	No
City of Tustin	Newport Avenue Extension	Flood Management	Extend Newport Avenue from Edinger to Sycamore	Planning			Yes
City of Tustin	Emergency Operations Center and City Corporate Yard	Water Quality	Construct new parking lot with swales and modular wetland and solar panels.	Planning		$15,830,418	No

Agency	Project Title	Primary Project Goal	Project Description	Project Status	Completion Date	Project Total Cost	Potential Regional Project
City of Tustin	Tustin Legacy Linear park	Quality of Life in Oran	Construct Linear park as pedestrian and bicycle corridor with passive recreation areas.	Planning		$9,034,130	No
City of Westminster	Westminster City Wide Trash Capture Devices	Water Quality	Installation of trash capture devices such as screens, inserts, and/or CDS units.	Planning	ongoing	$300,000	No
City of Westminster	Proposed Waterline within the Abandoned Navy Railroad	Water Supply	Construct a 12-inch waterline, valves, fire hydrants, fittings and a 16-foot wide access/bike path.	Planning	2022	$5,000,000	Yes
City of Westminster	Well no. 6 Replacement	Water Supply	Abandon an aging existing well no. 6 located at 14581 Von Circle and construct a new well at Bowling Green Park located at 14700 Bowling Green Street	Planning	2022	$5,500,000	No
City Tustin	Simon Ranch Reservoir	Water Supply	Replace existing reservoir	Planning		$9,994,852	No
County of Orange/OC Parks	Fullerton Creek Rehabilitation	Water Quality	Rehabilitation of Fullerton Creek, East of State College Blvd. and within Craig Regional Park	Planning	2022	$1,500,000	No
East Orange County Water District	Peters Canyon Water Treatment Plant Reconstruction	Water Supply	Reconstruction of the Peters Canyon Water Treatment Plant (PCWTP) will provide stormwater treatment, water supply reliability, financial relief to a Disadvantaged Community, environmental benefits through green technology for a regional area.	Planning	4/1/21	$20,000,000	Yes
Irvine Ranch Water District	Central Orange County Water Supply and Water Quality Improvement Project	Water Supply	Utilize existing flood control basins for groundwater recharge and water quality improvement	Planning	2022	$10,000,000	No
John Wayne Airport	John Wayne Airport Stormwater Harvest/Treat/Reuse Project	Water Quality	This proposed project is a harvest and reuse stormwater project at the Airport's Central Utility Plant (CUP). The project is anticipated to improve water quality within the Santa Ana Delhi Channel. The project also includes energy efficiency improvements.	Planning	01/01/2022	$25,000,000	Yes
Municipal Water District of Orange County (MWDOC)	North/Central Orange County Irrigation Efficiency, Runoff Reduction, and Pollution Prevention Program	Water Supply	The Municipal Water District of Orange County (MWDOC) proposes the implementation of a comprehensive and holistic regional water use efficiency improvement program targeting public agency, residential, commercial, industrial, and institutional properties	Planning	9/2024	$7,075,721	Yes
Orange County Water District	NCWMA_OCWD_OCWD Recharge Basins Rehabilitation	Water Supply	Rehabilitate existing groundwater recharge basins to increase infiltration capacity.	In Design	2040	$100,000,000	Yes
Orange County Water District	NCWMA_OCWD_Recharge in Lower Santiago Creek	Water Supply	Increase groundwater recharge in the lower Santiago Creek bed	Planning	2020	$5,000,000	Yes
Orange County Water District	NCWMA_OCWD_Desilting Santa Ana River Flows	Water Supply	Increase groundwater recharge by removing suspended sediments in recharge water	Planning	2015	$20,000,000	Yes
Orange County Water District	NCWMA_OCWD_Chantilly Stormwater Recharge	Water Supply	increase groundwater recharge by capturing storm flows that are lost to the ocean	Planning	2025	$5,000,000	Yes
Orange County Water District	NCWMA_OCWD_New OCWD Recharge Basin	Water Supply	develop a new recharge basin to increase capacity to recharge the groundwater basin	In Design	2025	$5,000,000	Yes

Agency	Project Title	Primary Project Goal	Project Description	Project Status	Completion Date	Project Total Cost	Potential Regional Project
Orange County Water District	NCWMA_OCWD_Placentia and Raymond Basins Improvements	Water Supply	improvements to two existing flood retarding basins to increase recharge capacity for groundwater recharge	Planning	2022	$8,500,000	Yes
Orange County Water District	NCWMA_OCWD_Orange County Seawater Intrusion Control Program	Water Quality	comprehensive program to manage seawater intrusion in Orange County	Planning	2015	$50,000,000	Yes
Orange County Water District	NCWMA_OCWD_South Basin VOC Contamination Remediation	Water Quality	remediate VOC groundwater contamination plume	Planning	2022	$50,000,000	Yes
Orange County Water District	NCWMA_OCWD_North Basin VOC Contamination Remediation	Water Quality	remediate VOC contamination plume	Planning	2022	$50,000,000	Yes
Orange County Water District	NCWMA_OCWD_MTBE Contamination Remediation	Water Quality	remediate MTBE contamination in the Orange County Groundwater Basin	In Design	2022	$50,000,000	Yes
Orange County Water District	NCWMA_OCWD_Groundwater Replenishment System Final Expansion	Water Supply	expand GWRS plant from curent treatment capacity of 100 MGD to 130 MGD	Shovel Ready	2030	$229,000,000	Yes
Orange County Water District	NCWMA_OCWD_Groundwater Replenishment System Flow EQ Tanks	Water Supply	construction of tanks to store peak wastewater flows during the day to supplement GWRS production during off peak hours	Planning	2023	$24,000,000	Yes
Orange County Water District	NCWMA_OCWD_GWRS Booster Pump Station at Burris Basin	Water Supply	construct booster pump station to provide increased capacity to recharge recycled water into the groundwater basin	In Design	2023	$20,000,000	Yes
Orange County Water District	NCWMA_OCWD_Increase Water Supply through Brine Concentration	Water Supply	provide additional treatment to brine produced by GWRS in order to increase amount of product water by 11 MGD	In Design	2025	$18,000,000	No
Orange County Water District	NCWMA_OCWD_Urban Runoff Diversion Program to OCSD System	Water Supply	capture and divert sewer system flows up to 5 MGD for GWRS treatment to produce additional recycled water supply	In Design	2025	$10,000,000	Yes
Orange County Water District	NCWMA_OCWD_Ranney Recharge Well	Water Supply	install a Ranney well to recharge GWRS water into the groundwater basin	In Design	2025	$10,000,000	Yes
Orange County Water District	NCWMA_OCWD_OC Regional Stormwater Infiltration Project	Water Supply	develop regional stormwater capture and infiltration system for use as an alternative to on-site stormwater management	In Design	2022	$1,000,000	Yes
Orange County Water District	NCWMA_OCWD_South OC Water Storage in OCWD	Water Supply	store water in the OCWD groundwater basin for use by interested south Orange County retail agencies for emergency supply	In Design	2025	$10,000,000	Yes
Orange County Water District	NCWMA_OCWD_West Orange County Wellfield	Water Supply	construction of extraction wells to reduce aquifer outflow to Los Angeles County	In Design	2024	$60,000,000	Yes
Orange County Water District	NCWMA_OCWD_Wildlife Exhibit	Quality of Life in Oran	build museum-grade exhibits to display wildlife specimens and provide watershed education to the public	Planning	2022	$1,500,000	Yes
Orange County Water District	NCWMA_OCWD_Quagga Mussel Research	Water Supply	develop method to treat imported water to eliminate the threat of quagga mussel infestations in order to increase imported water recharge in the Santa Ana River and Santiago Creek	In Design	2020	$500,000	Yes
Orange County Water District	NCWMA_OCWD_GWRS Pipeline Turnout into Burris Basin	Water Supply	construction of an outlet to allow for conveyance of GWRS water into Burris Basin to increase groundwater recharge	In Design	2022	$2,700,000	Yes

Agency	Project Title	Primary Project Goal	Project Description	Project Status	Completion Date	Project Total Cost	Potential Regional Project
Poseidon Resources	Ocean Desalination Water Treatment Plant and Distribution Project	Water Supply	Construction of a 50 mgd ocean desalination plant and pipelines necessary to distribution treated water to water agencies in Orange County	Planning	2025	$800,000,000	Yes

Appendix G
Weighting of Goals, Objectives, and Strategies

Weighting of Objectives and Strategies

For each regional goal, objectives were identified with specific achievements to help attain the stated goals. For each objective, a series of strategies were developed to identify actions and methods of appropriate ways that objectives could be met.

For project prioritization purposes, a score is associated with the relative benefit to the region attained by the objective and strategy. **Table 1** shows the prioritization of objectives relative to the weighting/ranking, which were developed and approved by the IRWM region stakeholders and shown in **Section 3 Goals, Objectives and Strategies** of The OC Plan. **Section 5 Projects** further explains the project scoring process and weighting of the stated Strategies. The weighting of objectives is included in this appendix to allow for flexibility for the IRWM RWMG and stakeholders to revised as appropriate.

Goal Weight (GW) (1 [low] – 5 [high]) Strategies Weight (SW) (1 [low] – 5 [high])

Table 1: Objectives Weighting for Prioritization		
Goals and Objectives	**Weight**	**GWxSW**
Goal 1. Provide Adequate and Reliable Water Supplies	**4.6**	
WS-1: Meet projected increase in water demands of 49,000 AFY by 2040 within the Orange County Basin area with consideration of cost-effective strategies WS-2: Meet projected increase in water demands of 1,800 AFY by 2040 within the La Habra Basin area with consideration of cost-effective strategies		
A. Increase local potable water supplies	4.4	20.2
B. Increase recycled water supplies to offset potable water	4.1	18.9
C. Sustainably manage groundwater resources	4.7	21.6
D. Maximize water conservation and water use efficiency strategies and efforts	3.9	17.6
E. Reduce the vulnerability of water systems to interruptions and to the effects of climate change, including sea level rise	4.3	19.6
F. Optimize use of imported water in times of surplus	3.6	16.3
G. Replace potable water supply lost due to groundwater contamination	3.7	17.0
Goal 2. Protect and Enhance Water Quality	**4.6**	
WQ-1: Improve water quality consistent with the Basin Plan		
A. Meet NPDES and TMDL water quality regulatory requirements	4.7	21.6
B. Attain water quality standards in fresh and marine environments	4.3	19.6
C. Expand the use of water quality treatment systems with a focus on regional projects	3.7	17.0
WQ-2: Maintain groundwater quality to protect water supplies and ensure reliability		
A. Protect and improve groundwater quality, consistent with beneficial uses	4.9	22.2
B. Clean up groundwater contamination	4.1	18.9

Table 1: Objectives Weighting for Prioritization		
Goals and Objectives	**Weight**	**GWxSW**
Goal 3: Restore Ecosystems and Improve Native Habitat	**3.4**	
ECO-1: Restore, enhance and expand terrestrial and aquatic ecosystems		
A. Increase functioning habitat that sustains viable populations of native species and restore habitat for terrestrial and aquatic species	3.9	13.2
B. Remove invasive species that are a danger to habitat, water supply or other economic and beneficial use	3.3	11.3
C. Increase use of water quality treatment systems that also increase wildlife habitat, and wetlands by restoring a natural water balance not dependent on urban runoff or supplemental water	4.1	14.2
D. Preserve open space	3.0	10.3
ECO-2: Restore, enhance and expand habitat for threatened and endangered species		
A. Increase functioning habitat that sustains viable populations of threatened and endangered species	4.1	14.2
B. Remove invasives that negatively impact threatened and endangered species	3.6	12.2
Goal 4: Integrate Flood Management	**3.3**	
FM-1: Reduce flood risk to public and private property and improve public safety		
A. Improve flood protection based on risk management standards	3.7	12.2
B. Improve flood control facilities to remove properties from FEMA 100-year floodplain with consideration for climate change on flow	3.6	11.7
C. Improve storm drain systems where historical flooding exists, when feasible	3.6	11.7
FM-2: Improve floodplains		
A. Reduce scour and erosion on canyons and channels while supporting natural systems and minimizing use of concrete and riprap	3.4	11.3
B. Implement stream channel naturalization efforts to promote multiple benefits such as creation or improvement of habitat and/or improvement in water quality while protecting public health	3.9	12.7
Goal 5: Improve the Quality of Life in Orange County	**3.1**	
QL-1: Identify and support critical water needs of disadvantaged and low-income communities, and tribal members		
A. Increase the participation of small, disadvantaged, low-income communities, and tribes in the IRWM process	4.0	12.6
B. Develop multi-benefit projects that predominantly benefit affected disadvantaged and low-income communities	4.0	12.6
C. Address public health, flood management, safe drinking water, and wastewater treatment needs of disadvantaged and low-income communities	4.3	13.5
QL-2: Increase acreage of open space and park and recreational opportunities		
A. Increase acres of and access to opens spaces	3.4	10.8
B. Provide for increased proximity and access to open spaces in disadvantaged communities	4.0	12.6
C. Increase recreational opportunities	3.4	10.8
D. Add trail connectors and extensions to provide and improve regional recreational opportunities	3.6	11.2
E. Increase recreational opportunities in multipurpose projects and programs	3.7	11.7

Table 1: Objectives Weighting for Prioritization		
Goals and Objectives	**Weight**	**GWxSW**
F. Increase recreational opportunities in disadvantaged or low-income communities	3.7	11.7
G. Support water quality improvement efforts that enhance public recreation	4.1	13.0
QL-3: Develop and enhance public education programs		
A. Incorporate principles of environmental justice and needs of disadvantaged and low-income communities in design and construction of projects and programs	3.7	11.7
B. Promote watershed public education	3.7	11.7
C. Increase community involvement in stewardship of water resources	3.4	10.8
Goal 6: Address Climate Change	**3.3**	
ACC-1: Increase energy efficiency		
A. Maximize production of on-site energy	3.3	10.8
B. Participate in local utility's green energy program	3.4	11.3
C. Prioritize more passive systems over more active energy consuming systems	4.0	13.1
D. Prioritize lower energy consuming alternatives over lower cost and higher energy alternatives	4.4	14.6
E. Utilize natural gas, electric, or biofuel based equipment for construction	3.1	10.3
F. Recover construction emissions by generating more renewable energy during the lifetime of the project	2.9	9.4
ACC-2: Increase biomass per acre in consideration of carbon sequestration		
A. Use higher density vegetation schematics	2.9	9.4
B. Increase total square feet of wetlands	3.6	11.7
C. Recycled green waste	3.9	12.7
ACC-3: Implement measures and plan for future changes to climate		
A. Develop adaptive measures to address the effects of sea level rise on water supply and water quality conditions	3.7	12.2
B. Implement measures that respond to more intense rain events	3.3	10.8
C. Implement measures that respond to the uncertainty and availability of imported water	4.6	15.0
D. Implement measures that respond to hotter and drier summers	2.7	8.9
Project Administration	**3.1**	
A. Project design readiness (defined in narrative)	4.6	14.5
B. Environmental compliance (CEQA/NEPA)	4.1	13.0
C. Higher local funding match	2.9	9.0
D. Secured local funding match	3.9	12.2
E. Multiple project partners NOT including NGO	3.1	9.8
F. Multiple project partners INCLUDES an NGO	4.5	14.1
G. Greater project benefit area	3.8	11.8
H. Cost effectiveness	4.1	13.0
I. Permit requirements (401, 404, 1600, etc.)	4.1	13.0

Appendix H
Project Solicitation Notice and Application Form

During development of The OC Plan, project lists from the 2011 North OC WMA IRWM Plan and the 2012 Central OC WMA IRWM Plan were reviewed. A large percentage of the proposed projects in the plans were either completed, no longer being considered by the sponsoring agency, or needed updated information. In addition, some projects lacked an identified project sponsor. For these reasons, stakeholders were requested to re-submit proposed or new projects and project ideas for inclusion in The OC Plan.

The project solicitation was conducted in early 2018. All regional stakeholders were asked to submit proposed projects and project ideas for consideration of inclusion in The OC Plan. An application form was provided to project proponents to submit projects.

The following pages include a copy of the online solicitation and project application form.

Online Solicitation Notice

https://cms.ocgov.com/gov/pw/watersheds/programs/ourws/wmaareas/wmacentraloc/default.asp

Efforts to develop a combined Integrated Regional Water Management (IRWM) Plan for the North and Central OC Watershed Management Areas began in February 2017. The comment period for the draft plan (*The OC* Plan) closed on December 22, 2017. Responses to comments are being prepared and the final draft plan will be completed by the end of February 2018.

The Call for Projects to build the IRWM Project List is now open through February 21st. Projects can be submitted via the new North/Central IRWM website/Data Management System (DMS); instructions for submitting projects are provided below. To provide agencies and stakeholders additional guidance on submitting projects using the website/DMS, two technical assistance workshops have been scheduled for the following:

- January 16, 2018, 2:30-3:30 pm
- February 6, 2018, 2:30-3:30 pm

Both workshops will be held at Orange County Public Works, 2301 North Glassell Street in Orange - Conference Room 2A. The project team will demonstrate how to submit projects using the website/DMS, assist with project submittal, and answer questions for those needing assistance.

Project Submittal Process

1. Download the IRWM Project Solicitation Excel Score Sheet from the Project Submittal page of the website/DMS.
2. Complete the IRWM Project Solicitation Excel Score Sheet and save locally using the designated file nomenclature ("NCWMA_OrgName_ProjectName").
3. Drag and drop saved IRWM Project Solicitation Excel Score Sheet into web submission box on the left-hand side of the Project Submittal page of the website/DMS. (If you would like to add more information about an existing, previously funded project, please also use this process to submit photos, data, reports, etc.).
4. Complete the "Project Submittal Form" online through the Project Submittal page of the website/DMS, including geospatial project location (dropped pin, lat/lon, or address), and click "Submit Entry" button.
5. County staff will receive both the Project Submittal Form entry and associated geospatial data as well as the IRWM Project Solicitation Excel Score Sheet; after these are reviewed briefly for completeness, they will be added to the IRWM Project Data Explorer map on the website/DMS and the IRWM Project List. County staff will strive to have all projects uploaded within three business days of submittal, barring any technical issues.

If you have additional questions regarding the development of *The OC Plan* and associated Call for Projects process, please refer to the list of North/Central IRWM Plan FAQ.

North/Central Watershed Management Area IRWMP - Project Information

Project Title:

Project Lead Agency/Organization:

Lead Agency/Organization Contact: **Lead Agency Contact phone:** **Email:**

Project Status: Completed: Ongoing: Planning: Other:

CEQA Complete: Completed: In process:

Project Partners (if applicable):

Project Location:
(Address or Lat/Lon)

(Note: We will need Geospatial data in GIS - To add your project to the project list, you will be asked to enter an address, LAT/LONG, or drop apoint on a map.)

Project Benefit Area: (e.g., Acres, Stream Miles, Square Miles etc.)

Project Description:
(Please describe the project)
Up to 200 words

(e.g. What does the project entail? Land area, construction, planning etc.)

Description of Project Benefits:

Up to 200 words

(e.g. How does it benefit the WMA? How does the project help meet local water needs and align with IRWM objectives.)

IMPORTANT INFORMATION:

1). Once you have completed the project information on Tabs 1 and 2, save the workbook locally and use the file name convention as follows: NCWMA_OrgName_ProjectName.

2). Upload the workbook file to the North OC IRWM Website at: https://arcg.is/0qqiqD

PROJECT TOTAL SCORE: 0.00

PROJECT TITLE: Project Title carried over from Tab 1

AGENCY: Agency carried over from Tab 1

PROJECT SCORING

USER NOTES

1. **FILL IN THE YELLOW AREAS ONLY.**

(NOTE: If a triangle appears when you click a yellow cell, select from the dropdown menu.)

2. **Blue areas will be automatically calculated.**

3. **Additional sheets in this workbook include the objectives for reference.**

4. **The DUE DATE for initial list development is February 21, 2018.**

There are 6 colored boxes on this sheet. Each colored box contains a list of strategies under goal categories: Water Supply (WS), Water Quality (WQ), Ecosystems/Habitat (ECO), Flood Management (FM), Quality of Life (QL), and Climate Change (ACC). Click on the yellow area for the strategies that apply to the project. A project score will automatically be calculated. If a project benefit can be qualitied, enter that information in the box to the right of the list of strategies.

GOAL 1. PROVIDE ADEQUATE AND RELIABLE WATER SUPPLIES (WS)	Goal and Strategy Weight		For County Staff Use Only		Provide/Describe a metric achieved	
Does your project hit any of the following Objectives?		0	WS0		Provide/Describe a metric achieved	0
Objective WS-1: Meet projected increase in water demands of 49,000 AFY by 2040 within the Orange County Groundwater Basin area with consideration of cost-effective strategies.	4.6		Points Per Response	1	Example: mgd produced, afy captured, $ per volume per year, etc.	
WS1-A: Increase local potable water supplies	4.4		WS1	0		
WS1-B: Increase recycled water supplies to offset potable water	4.1		WS2	0		
WS1-C: Sustainably manage groundwater resources	4.7		WS3	0		
WS1-D: Maximize water conservation and water use efficiency strategies and efforts	3.9		WS4	0		
WS1-E: Reduce the vulnerability of water systems to interruptions and to the effects of climate change, including sea level rise	4.3		WS5	0		
WS1-F: Optimize use of imported water in times of surplus	3.6		WS6	0		
WS1-G: Replace contaminated groundwater potable water supply	3.7		WS7	0		
Objective WS-2: Meet projected increase in water demands of 1,800 AFY by 2040 within the La Habra Groundwater Basin area with consideration of cost-effective strategies.	4.6					
WS2-A: Increase local potable water supplies	4.4		WS8	0		
WS2-B: Increase recycled water supplies to offset potable water	4.1		WS9	0		
WS2-C: Sustainably manage groundwater resources	4.7		WS10	0		
WS2-D: Maximize water conservation and water use efficiency strategies and efforts	3.9		WS11	0		
WS2-E: Reduce the vulnerability of water systems to interruptions and to the effects of climate change, including sea level rise	4.3		WS12	0		
WS2-F: Optimize use of imported water in times of surplus	3.6		WS13	0		
WS2-G: Replace contaminated groundwater potable water supply	3.7		WS14	0		

GOAL 2. PROTECT AND ENHANCE WATER QUALITY (WQ)	Goal and Strategy Weight				Provide/Describe a metric achieved	
Does your project hit any of the following Objectives?		0	WQ0		Provide/Describe a metric achieved	0
Objective WQ-1: Improve water quality consistent with the Basin Plan.	4.6		Points Per Response	1	Example: kg/day reduced, mg/L target met, mgd captured, etc.	
WQ1-A: Meet NPDES and TMDL water quality regulatory requirements	4.7		WQ1	0		
WQ1-B: Attain water quality standards in fresh and marine environments	4.3		WQ2	0		
WQ1-C: Expand the use of water quality treatment systems with a focus on regional projects	3.7		WQ3	0		
Objective WQ-2: Maintain groundwater quality to protect water supplies and ensure reliability.	4.6					
WQ2-A: Protect and improve groundwater quality consistent with beneficial uses.	4.9		WQ4	0		
WQ2-B: Clean up groundwater contamination	4.1		WQ5	0		

GOAL 3. RESTORE ECOSYSTEMS AND IMPROVE NATIVE HABITAT (ECO)	Goal and Strategy Weight				Provide/Describe a metric achieved	
Does your project hit any of the following Objectives?		0	ECO0		Provide/Describe a metric achieved	0
Objective ECO-1: Restore, enhance and expand terrestrial and aquatic ecosystems.	3.4		Points Per Response	1	Example: acres restored, megagrams carbon sequestered, people served, # jobs, etc.	
ECO1-A: Increase functioning habitat that sustains viable populations of native species and restore habitat for terrestrial and aquatic species.	3.9		ECO1	0		
ECO1-B: Remove invasive species that are a danger to habitat, water supply or other economic or beneficial use.	3.3		ECO2	0		
ECO1-C: Increase use of water quality treatment systems that also increase wildlife habitat and wetlands by restoring a natural water balance not dependent on urban runoff or supplemental water.	4.1		ECO3	0		
ECO1-D: Preserve open space	3.0		ECO4	0		

Objective ECO-2: Restore, enhance and expand habitat for threatened and endangered species.	3.4				
ECO2-A: Increase functioning habitat that sustains viable populations of threatened and endangered species	4.1		ECO5	0	
ECO2-B: Remove invasives that negatively impact threatened and endangered species	3.6		ECO6	0	

GOAL 4. INTEGRATE FLOOD MANAGEMENT (FM)	Goal and Strategy Weight				Provide/Describe a metric achieved
Does your project hit any of the following Objectives?		0	FM0		Provide/Describe a metric achieved: 0
Objective FM-1: Reduce flood risk to public and private property and improve public safety.	3.3		Points Per Response	1	Example: acre-feet stored/diverted, acres or linear feet protected, etc.
FM1-A: Improve flood protection based on risk management standards	3.7		FM1	0	
FM1-B: Improve flood control facilities to remove properties from the 100-year floodplain with consideration for climate change on flows	3.6		FM2	0	
FM1-C: Improve storm drain systems where historical flooding exists, when feasible	3.6		FM3	0	
Objective FM-2: Improve floodplains	3.3				
FM2-A: Reduce scour and erosion on canyons and channels while supporting natural systems and minimizing use of concrete and riprap.	3.4		FM4	0	
FM2-B: Implement stream channel naturalization efforts to promote multiple benefits such as creation or improvement of habitat and/or improvement in water quality while protecting public health.	3.9		FM5	0	

GOAL 5. IMPROVE THE QUALITY OF LIFE IN ORANGE COUNTY (QL)	Goal and Strategy Weight				Provide/Describe a metric achieved
Does your project hit any of the following Objectives?		0	QL0		Provide/Describe a metric achieved: 0
Objective QL-1: Identify and support critical water needs of disadvantaged, low-income, and tribal communities.	3.1		Points Per Response	1	Example: acres restored, megagrams carbon sequestered, people served, # jobs, etc.
QL1-A: Increase the participation of small, disadvantaged, low-income communities, and tribes in the IRWM process	4.0		QL1	0	
QL1-B: Develop multi-benefit projects with consideration of affected disadvantaged and low-income communities	4.0		QL2	0	
QL1-C: Address public health, flood management, safe drinking water, and wastewater treatment needs of disadvantaged and low-income communities	4.3		QL3	0	
Objective QL-2: Increase acreage of open space and increase park and recreational opportunities.	3.1				
QL2-A: Increase access to existing open spaces	3.4		QL4	0	
QL2-B: Provide for increased proximity and access to open spaces in disadvantaged communities	3.6		QL5	0	
QL2-C: Increase recreational opportunities	3.7		QL6	0	
QL2-D: Add trail connectors and extensions to provide and improve regional recreational opportunities	4.1		QL7	0	
QL2-E: Increase recreational opportunities in multi-purpose projects and programs	3.7		QL8	0	
QL2-F: Increase recreational opportunities in disadvantaged or low-income communities	3.7		QL9	0	
QL2-G: Support water quality improvement efforts that enhance public recreation	3.4		QL10	0	
Objective QL-3: Develop and enhance public education programs.	3.1				
QL3-A: Incorporate principles of environmental justice and needs of disadvantaged, low-income and tribal communities in design and construction of projects and programs.	3.7		QL11	0	
QL3-B: Promote watershed public education.	3.7		QL12	0	
QL3-C: Increase community involvement in stewardship of water resources.	3.4		QL13	0	

Goal 6. ADDRESS CLIMATE CHANGE (ACC)	Goal and Strategy Weight				Provide/Describe a metric achieved
Does your project hit any of the following Objectives?		0	AAC0		Provide/Describe a metric achieved: 0
Objective ACC-1: Increase Energy Efficiency	3.3		Points Per Response	1	Example: acres restored, megagrams carbon sequestered, people served, # jobs, etc.
ACC1-A: Maximize production of on-site energy	3.3		ACC1	0	
ACC1-B: Participate in local utility's green energy program	3.4		ACC2	0	
ACC1-C: Prioritize more passive energy consuming systems over more active energy consuming systems	4.0		ACC3	0	
ACC1-D: Prioritize lower energy consuming alternatives over lower cost and higher energy alternatives	4.4		ACC4	0	
ACC1-E: Utilize natural gas, electric, or biofuel based equipment for construction	3.1		ACC5	0	
ACC1-F: Recover construction emissions by generating more renewable energy during the lifetime of the project	2.9		ACC6	0	
Objective ACC-2: Increase biomass per acre in consideration of carbon sequestration.	3.3				
ACC2-A: Use higher density vegetation schematics	2.9		ACC7	0	
ACC2-B: Increase total square feet of wetlands per acre	3.6		ACC8	0	
ACC2-C: Recycle green waste	3.9		ACC9	0	
Objective ACC-2: Increase biomass per acre in consideration of carbon sequestration.	3.3				
ACC3-A: Implement adaptive measures to address the effects of sea level rise on water supply and water quality conditions	3.7		ACC10	0	
ACC3-B: Implement measures that respond to more intense rain events	3.3		ACC11	0	
ACC3-C: Implement measures that respond to the uncertainty and availability of imported water	4.6		ACC12	0	
ACC3-D: Implement measures that respond to hotter and drier summers	2.7		ACC13	0	

GOAL 1. PROVIDE ADEQUATE AND RELIABLE WATER SUPPLIES	
Objective WS-1: Meet projected increase in water demands of 49,000 AFY by 2040 within the Orange County Basin area with consideration of cost-effective strategies.	
Strategies	***Measure***
A. Increase local potable water supplies.	Acre feet
B. Increase recycled water supplies to offset potable water.	Acre feet
C. Sustainably manage groundwater resources.	Yes/No
c. Sustainably manage groundwater resources.	Yes/No
a. Increase local potable water supplies.	Yes/No
F. Optimize use of imported water in times of surplus.	Acre feet
G. Replace potable water supply lost due to groundwater contamination.	Acre feet
Objective WS-2: Meet projected increase in water demands of 1,800 AFY by 2040 within the La Habra Basin area with consideration of cost-effective strategies.	
Strategies	***Measure***
A. Increase local potable water supplies.	Acre feet
B. Increase recycled water supplies to offset potable water.	Acre feet
C. Sustainably manage groundwater resources.	Yes/No
D. Maximize water conservation and water use efficiency strategies and efforts.	Yes/No
a. Increase local potable water supplies.	Yes/No
d. Maximize water conservation and water use efficiency strategies and efforts.	Acre feet
G. Replace potable water supply lost due to groundwater contamination.	Acre feet

GOAL 2. PROTECT AND ENHANCE WATER QUALITY	
Objective WQ-1: Improve water quality consistent with the Basin Plan.	
Strategies	***Measure***
A. Meet NPDES and TMDL water quality regulatory requirements.	Yes/No
B. Attain water quality standards in fresh and marine environments.	Yes/No
C. Expand the use of water quality treatment systems with a focus on regional projects.	Measure of system use
Objective WQ-2: Maintain groundwater quality to protect water supplies and ensure reliability.	
Strategies	***Measure***
A. Protect and improve groundwater quality consistent with beneficial uses.	Yes/No
B. Clean up groundwater contamination.	Acre feet

GOAL 3. RESTORE ECOSYSTEMS AND IMPROVE NATIVE HABITAT	
Objective ECO-1: Restore, enhance and expand terrestrial and aquatic ecosystems.	
Strategies	***Measure***
A. Increase functioning habitat that sustains viable populations of native species and restore habitat for terrestrial and aquatic species.	Acres impacted
B. Remove invasive species that are a danger to habitat, water supply or other economic or beneficial use.	Acres impacted
C. Increase use of water quality treatment systems that also increase wildlife habitat and wetlands by restoring a natural water balance not dependent on urban runoff or supplemental water.	Yes/No
D. Preserve open space.	Acres of open space
Objective ECO-2: Restore, enhance and expand habitat for threatened and endangered species.	
Strategies	***Measure***
A: Increase functioning habitat that sustains viable populations of threatened and endangered species	Acres impacted
B: Remove invasives that negatively impact threatened and endangered species	Acres impacted

GOAL 4. INTEGRATE FLOOD MANAGEMENT	
Objective FM-1: Reduce flood risk to public and private property and improve public safety.	
Strategies	***Measure***
A. Improve flood protection based on risk management standards.	Yes/No
B. Improve flood control facilities and remove properties from the FEMA 100-year floodplain with consideration for climate change on flow regimes.	Conveyance improved and acres removed
C. Improve storm drain systems where historical flooding exists, when feasible.	Conveyance improved
FM2: Improve floodplains	
Strategies	***Measure***
A. Reduce scour and erosion on canyons and channels while supporting natural systems and minimizing use of concrete and riprap.	Conveyance maintained
B. Implement stream channel naturalization efforts to promote multiple benefits such as creation or improvement of habitat and/or improvement in water quality while protecting public health.	Acres impacted

GOAL 5. IMPROVE THE QUALITY OF LIFE IN ORANGE COUNTY	
Objective QL-1: Identify and support critical water needs of disadvantaged, low-income, and tribal communities.	
Strategies	***Measure***
A. Increase participation of small, disadvantaged, low-income communities and tribes in the IRWM process.	Number of participants
B. Develop multi-benefit projects that predominantly benefit affected disadvantaged and low-income communities.	Number of projects
C. Address public health, flood management, safe drinking water, and wastewater treatment needs of disadvantaged and low-income communities.	Extent of needs addressed
Objective QL-2: Increase acreage of open space and increase park and recreational opportunities.	
Strategies	***Measure***
A. Increase acres of and access to open spaces.	Acres of open space
B. Provide for increased proximity and access to open spaces in disadvantaged communities.	Areas impacted
C. Increase recreational opportunities	Number of opportunities
D. Add trail connectors and extensions to provide and improve regional recreational opportunities.	Miles of trails / connectors
E. Increase recreational opportunities in multipurpose projects and programs.	Number of opportunities
F. Increase recreational opportunities in disadvantaged and low-income communities.	Number of opportunities
G. Support water quality improvement efforts that enhance public recreation.	Yes/No
Objective QL-3: Develop and enhance public education programs.	
Strategies	***Measure***
A. Incorporate principles of environmental justice and needs of disadvantaged, low-income and tribal communities in design and construction of projects and programs.	Yes/No
B. Promote watershed public education.	Yes/No
C. Increase community involvement in stewardship of water resources.	Yes/No

GOAL 6. ADDRESS CLIMATE CHANGE	
Objective ACC-1: Increase Energy Efficiency	
Strategies	***Measure***
A. Maximize production of on-site energy.	Yes/No
B. Participate in local utility's green energy program.	Yes/No
C. Prioritize more passive systems over more active energy consuming systems.	Yes/No
D. Prioritize lower energy consuming alternatives over lower cost and higher energy alternatives.	Yes/No
E. Utilize natural gas, electric, or biofuel based equipment for construction.	Yes/No
F. Recover construction emissions by generating more energy during the lifetime of the project.	Tons of CO2 reduced
Objective ACC-2: Increase biomass per acre in consideration of carbon sequestration.	
Strategies	***Measure***
A. Use higher density vegetation schematics.	Yes/No
B. Increase square feet of wetlands.	Square feet increased
C. Recycle green waste.	Yes/No
Objective ACC-3: Implement measures and plan for future changes to climate.	
Strategies	***Measure***
A. Develop adaptive measures to address the effects of seal level rise on water supply and water quality conditions.	Yes/No
B. Implement measures that respond to more intense rain events.	Yes/No
C. Implement measures that respond to the uncertainty and availability of imported water.	Yes/No
D. Implement measures that respond to hotter and drier summers.	Yes/No

Appendix I
Ranking and Prioritization of Goals, Objectives, and Strategies

Regional/Local Objectives ranking criteria are tied directly to the stated goals. Goals are divided into six categories, which have been weighted (Appendix G) and shown below, along with the additional Project Administration category, in priority order with the ranking criteria scoring detail in the attached spreadsheet.

1. Providing Adequate and Reliable Water Supplies
2. Protect and Enhance Water Quality
3. Restore Ecosystems and Improve Native Habitat
4. Integrate Flood Management
5. Improve the Quality of Life in Orange County
6. Address Climate Change

Additional Project Goal: Project Administration

The Project Application Form (Appendix F) is designed to calculate a total score based on the weighting of each goal and strategy. On the Project Application Form, the ability to meet an Objective is indicated by “yes” or “no”, with a number 1 corresponding to “yes” and a zero corresponding to “no”. The 1/0 values (yes/no) are then multiplied by their assigned weighting factor. For project prioritization purposes, the Project Application Form also assigns a score associated with the relative benefit attained by the objective and strategy.

The following pages show the actual prioritization of objectives relative to the weighting/ranking, which were developed and approved by the Region stakeholders, consistent with Appendix G.

(1) Provide Adequate and Reliable Water Supplies (WS)				
Goal Weight (GW)	4.6			
Strategies and Corresponding Weights (SW)				
	SW	GW x SW	CW	Pts.
WS-1 & 2, A. Increase local potable water supplies	4.4	20.2		0.0
WS-1 & 2, B. Increase recycled water supplies to offset potable water	4.1	18.9		0.0
WS-1 & 2, C. Sustainably manage groundwater resources	4.7	21.6		0.0
WS-1 & 2, D. Maximize water conservation and water use efficiency strategies and efforts	3.9	17.6		0.0
WS-1 & 2, E. Reduce the vulnerability of water systems to interruptions and to the effects of climate change, including sea level rise	4.3	19.6		0.0
WS-1 & 2, F. Optimize use of imported water in times of surplus	3.6	16.3		0.0
WS-1 & 2, G. Replace contaminated groundwater potable water supply	3.7	17.0		0.0
Total				**0**

(2) Protect and Enhance Water Quality (WQ)				
Goal Weight (GW)	4.6			
Strategies and Corresponding Weights (SW)				
	SW	GW x SW	CW	Pts.
WQ-1, A. Meet NPDES and TMDL water quality regulatory requirements	4.7	21.6		0.0
WQ-1, B. Attain water quality standards in fresh and marine environments	4.3	19.6		0.0
WQ-1, C. Expand the use of water quality treatment systems with a focus on regional projects	3.7	17.0		0.0
WQ-2, A. Protect and improve groundwater quality, consistent with beneficial uses	4.9	22.2		0.0
WQ-2, B. Clean up groundwater contamination	4.1	18.9		0.0
Total				**0**

(3) Restore Ecosystems and Improve Native Habitat (ECO)				
Goal Weight (GW)	3.4			
Strategies and Corresponding Weights (SW)				
	SW	GW x SW	CW	Pts.
ECO-1, A. Increase functioning habitat that sustains viable populations of native species and restore habitat for terrestrial and aquatic species	3.9	13.2		0.0
ECO-1, B. Remove invasive species that are a danger to habitat, water supply, or other economic or beneficial use	3.3	11.3		0.0
ECO-1, C. Increase use of water quality treatment systems that also increase wildlife habitat, and wetlands	4.1	14.2		0.0
ECO-1, D. Preserve open space	3.0	10.3		0.0
ECO-2, A. Increase functioning habitat that sustains viable populations of threatened and endangered species	4.1	14.2		0.0
ECO-2, B. Remove invasives that negatively impact threatened and endangered species	3.6	12.2		0.0
Total				**0**

(4) Integrate Flood Management (FM)				
Goal Weight (GW)	3.3			
Strategies and Corresponding Weights (SW)				
	SW	GW x SW	CW	Pts.
FM-1, A. Improve flood protection based on risk management standards	3.7	12.2		0.0
FM-1, B. Improve flood control facilities to remove properties from the 100-year floodplain with consideration for climate change on flow regimes	3.6	11.7		0.0
FM-1, C. Improve storm drain systems where historical flooding exists, when feasible	3.6	11.7		0.0
FM-2, A. Reduce scour and erosion on canyon and channel stability	3.4	11.3		0.0
FM-2, B. Implement stream channel naturalization efforts to promote multiple benefits such as creation or improvement of habitat and/or improvement in water quality while protecting public health	3.9	12.7		0.0
Total				**0**

(5) Improve the Quality of Life in Orange County (QL)				
Goal Weight (GW)	3.1			
Strategies and Corresponding Weights (SW)				
	SW	GW x SW	CW	Pts.
QL-1, A. Increase the participation of small, disadvantaged, low-income communities, and tribes in the IRWM process	4.0	12.6		0.0
QL-1, B. Develop multi-benefit projects with consideration of affected disadvantaged and low-income communities	4.0	12.6		0.0
QL-1, C. Address public health, flood management, safe drinking water, and wastewater treatment needs of disadvantaged and low-income communities	4.3	13.5		0.0
QL-2, A. Increase access to existing open spaces	3.4	10.8		0.0
QL-2, B. Provide for increased proximity and access to open spaces in disadvantaged communities	4.0	12.6		0.0
QL-2, C. Increase recreational opportunities	3.4	10.8		0.0
QL-2, D. Add trail connectors and extensions to provide and improve regional recreational opportunities	3.6	11.2		0.0
QL-2, E. Increase recreational opportunities in multi-purpose projects and programs	3.7	11.7		0.0
QL-2, F. Increase recreational opportunities in disadvantaged or low-income communities	3.7	11.7		0.0
QL-2, G. Support water quality improvement efforts that enhance public recreation	4.1	13.0		0.0
QL-3, A. Incorporate principles of environmental justice and needs of disadvantaged and low-income communities in design and construction projects and programs	3.7	11.7		0.0
QL-3, B. Promote watershed public education	3.7	11.7		0.0
QL-3, C. Increase community involvement in stewardship of water resources	3.4	10.8		0.0
Total				**0**

(6) Address Climate Change (ACC)				
Goal Weight (GW)	3.3			
Strategies and Corresponding Weights (SW)				
	SW	GW x SW	CW	Pts.
ACC-1, A. Maximize production of on-site energy	3.3	10.8		0.0
ACC-1, B. Participate in local utility's green energy program	3.4	11.3		0.0
ACC-1, C. Prioritize more passive energy consuming systems over more active energy consuming systems	4.0	13.1		0.0
ACC-1, D. Prioritize lower energy consuming alternatives over lower cost and higher energy alternatives	4.4	14.6		0.0
ACC-1, E. Utilize natural gas, electric, or biofuel based equipment for construction	3.1	10.3		0.0
ACC-1, F. Recover construction emissions by generating more renewable energy during the lifetime of the project	2.9	9.4		0
ACC-2, A. Use higher density vegetation schematics	2.9	9.4		0
ACC-2, B. Increase total square feet of wetlands per acre	3.6	11.7		0
ACC-2, C. Recycle green waste	3.9	12.7		0
ACC-3, A. Implement adaptive measures to address the effects of sea level rise on water supply and water quality conditions	3.7	12.2		0
ACC-3, B. Implement measures that respond to more intense rain events	3.3	10.8		0
ACC-3, C. Implement measures that respond to the uncertainty and availability of imported water	4.6	15.0		0
ACC-3, D. Implement measures that respond to hotter and drier summers	2.7	8.9		0
Total				**0**

Project Administration				
Goal Weight (GW)	3.1			
Strategies and Corresponding Weights (SW)				
	SW	GW x SW	IW	Pts.
PA-1, A. Project Design Readiness (Define in narrative)	4.6	14.5		0
PA-1, B. Environmental Compliance (CEQA/NEPA, etc.)	4.1	13.0		0
PA-1, C. Higher Local Funding Match	2.9	9.0		0
PA-1, D. Secured Local Funding Match	3.9	12.2		0
PA-1, E. Multiple Project Partners NOT including NGO	3.1	9.8		0
PA-1, F. Multiple Project Partners Includes an NGO	4.5	14.1		0
PA-1, G. Greater Project Benefit Area	3.8	11.8		0
PA-1, H. Cost Effectiveness	4.1	13.0		0
PA-1, I. Permit Requirements (401,404,1600, etc.)	4.1	13.0		0

Total	**0**