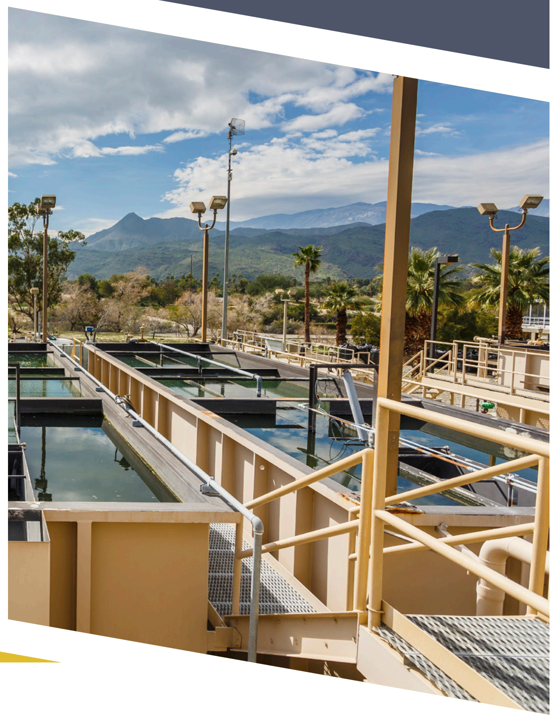
INDIO SUBBASIN

WATER MANAGEMENT PLAN UPDATE

Sustainable Groundwater Management Act Alternative Plan



Volume 1: Alternative Plan

Final to be Adopted | November 2021

http://www.indiosubbasinsgma.org/

Prepared for: Indio Subbasin Groundwater Sustainability Agencies

Coachella Valley Water District
Coachella Water Authority & Sanitary District — Service. Value. Quality.
Desert Water
Indio Water Authority — Your Water. Our Responsibility.

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INDIO SUBBASIN WATER MANAGEMENT PLAN UPDATE

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA) ALTERNATIVE PLAN

FINAL

November 2021

ACKNOWLEDGEMENTS

The Indio Subbasin Groundwater Sustainability Agencies (GSAs) appreciate and acknowledge the funding contribution from the California Department of Water Resources (DWR). Funding for this *Indio Subbasin Water Management Plan Update* has been provided in part by the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68).

Indio Subbasin GSAs

Coachella Valley Water District, Coachella Water Authority, Desert Water Agency, and Indio Water Authority compose the Indio Subbasin GSAs.

Indio Subbasin Consulting Team

Todd Groundwater and Woodard & Curran, assisted by Graham Fogg and Associates and David J. Ringel Consulting Engineer, compose the consulting technical team for the *Indio Subbasin Water Management Plan Update*.

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INDIO SUBBASIN WATER MANAGEMENT PLAN UPDATE

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA) ALTERNATIVE PLAN

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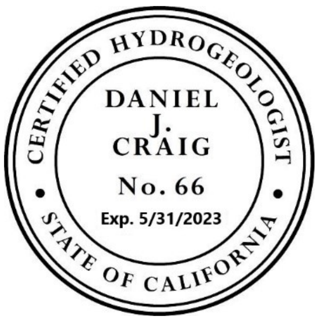

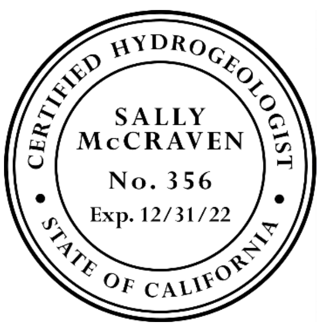

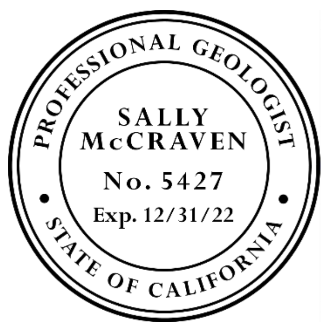

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MASTER ACRONYMS AND ABBREVIATIONS LIST

Term	Definition
˚F	degrees Fahrenheit
µg/L	micrograms per liter
2010 CVWMP	*2010 Coachella Valley Water Management Plan*
2018 Coachella Valley IRWM/SWR Plan	*2018 Coachella Valley Integrated Regional Water Management & Stormwater Resources (IRWM/SWR) Plan Update*
AB	Assembly Bill
ACS	American Community Survey
ACWA	Agua Caliente Water Authority
AD	Assessment District
AF	acre-feet
AFY	acre-feet per year
Alternative Plan Update	*Indio Subbasin Water Management Plan Update: Sustainable Groundwater Management Act Alternative Plan*
AOB	area of benefit
AOP	Annual Operating Plan
ASR	aquifer storage and recovery
ASTM	American Society for Testing and Materials
AWAG	Agricultural Water Advisory Group
AWMP	Agricultural Water Management Plan
Basin	Coachella Valley Groundwater Basin
Basin Plan	Water Quality Control Plan for Plan for the Colorado River Basin—Region 7
BDCP	Bay-Delta Conservation Plan
bgs	below ground surface
BLM	U.S. Department of the Interior Bureau of Land Management
BMP	best management practice
BMWD	Berrenda Mesa Water District
BPO	basin plan objective
BPTC	best practicable treatment or control
Bulletin 118	*California's Groundwater: Bulletin 118—Update 2003*
BWD	Borrego Water District
C2VSIM	California Central Valley Groundwater-Surface Water Simulation Model
CalEPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CalWARN	California Water and Wastewater Agency Response Network
CalWEP	California Water Efficiency Partnership
Canal	Coachella Canal
CAP	Central Arizona Project
CARB	California Air Resources Board
CAS	California Climate Adaptation Strategy
CASGEM Program	California Statewide Groundwater Elevation Monitoring Program

Term	Definition
CAT	Climate Action Team
CCLP	Coachella Canal Lining Project
CCR	California Code of Regulations
CDC	California Department of Conservation
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CDPs	census-designated plates
CEC	California Energy Commission
Census Bureau	U.S. Census Bureau
CEQA	California Environmental Quality Act
CERES	California Environmental Resources Evaluation System
Cfs	Cubic feet per second
Chromium-6	Hexavalent chromium
CIB	capital improvement budget
CII	commercial, industrial and institutional
CIMIS	California Irrigation Management Information System
CIPs	Capital improvement projects
CMP	Consolidated Monitoring Program
CNRA	California Natural Resources Agency
CO2e	CO_2 equivalents
COCs	constituents of concern
COD	College of the Desert
COVID-19	coronavirus disease 2019
CPUC	California Public Utility Commission
CRA	Colorado River Aqueduct
CRLA	California Rural Legal Assistance Inc.
CRW	Colorado River Water
CSD	Coachella Sanitation District
CUWCC	California Urban Water Conservation Council
CVAG	Coachella Valley Association of Governments
CVCC	Coachella Valley Conservation Commission
CVILC	Coachella Valley Irrigated Lands Coalition
CVIRWMP	Coachella Valley Integrated Regional Water Management Plan
CVMSHCP	Coachella Valley Multiple Species Habitat Conservation Plan
CVRWMG	Coachella Valley Regional Water Management Group
CVSC	Coachella Valley Stormwater Channel
CV-SNAP	Coachella Valley Salt and Nutrient Management Plan
CVWD	Coachella Valley Water District
CVWMP	Coachella Valley Water Management Plan
CVWMR	Coachella Valley Water Management Region

Term	**Definition**
CWA	Coachella Water Authority
CWC	California Water Code
CWP	California Water Plan
CWSRF	Clean Water State Revolving Fund
CY	calendar year
DAC	disadvantaged community
DACE	Desert Alliance for Community Empowerment
DACI	Disadvantaged Communities Infrastructure
DBCP	dibromochloropropane
DCF	Delta Conveyance Facility
DCP	Drought Contingency Plan
DDW	California State Water Resources Control Board Division of Drinking Water
DEH	Riverside County Department of Environmental Health
Delta	Sacramento-San Joaquin River Delta
DEM	digital elevation model
DLR	detection limit for purposes of reporting
DMM	Demand Management Measures
DMS	Data Management System
DOF	California Department of Finance
DPR	Delivery Reliability Report
DWA	Desert Water Agency
DWR	California Department of Water Resources
East AOB	East Whitewater River Subbasin Area of Benefit
ECVWSP	East Coachella Valley Water Supply Project
EDA	Economic Development Agency
EDA	economically disadvantaged community
EDC	Endocrine Disrupting Compound
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EJ	environmental justice
EJCW	Environmental Justice Coalition for Water
EO	Executive Order
EOP	Emergency Operations Plan
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
ESA	Endangered Species Act
ET	evapotranspiration
ETAF	evapotranspiration adjustment factor
ETc	ET of a crop
ETo	reference evapotranspiration
EVRA	East Valley Reclamation Authority

Term	Definition
feet bgs	feet below ground surface
feet msl	feet above mean sea level
FEIR	Final Environmental Impact Report
FY	fiscal year
GAMA Program	Groundwater Ambient Monitoring and Assessment Program
Garnet Hill WMP	*Mission Creek/Garnet Hill Water Management Plan*
GDE	groundwater-dependent ecosystem
GHB	general head boundary
GHG	greenhouse gas
GIPSY-OASIS	GNSS-Inferred Positioning System and Orbit Analysis Simulation Software
GIS	geographic information system
GLC	Glorious Lands Company
GMS	Groundwater Modeling System
gpcd	gallons per capita per day
gpd	gallons per day
gpd/conn	gallons per day per connection
gphud	gallons per housing unit per day
GPS	global positioning system
GRF	groundwater replenishment facility
GRP	Groundwater Replenishment Program
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWMP	Groundwater Management Plan
HCF	hundreds of cubic feet
HCM	hydrogeologic conceptual model
HCP	Habitat Conservation Plan
HFB	horizontal flow barrier
HOA	homeowners' association
I-Bank	California Infrastructure and Economic Development Bank
IBWC	International Boundary and Water Commission
IC/ID	illicit connection/illicit discharge
ICS	intentionally created surplus
ID	Improvement District
ID-1	Improvement District 1 (Reclamation)
IID	Imperial Irrigation District
ILRP	Irrigated Lands Regulatory Program
Indio Subbasin GSAs	Groundwater Sustainability Agencies created by the Coachella Valley Water District, the Coachella Water Authority, the Desert Water Authority, and the Indio Water Authority, respectively
InSAR	interferometric synthetic aperture radar
IPCC	Intergovernmental Panel on Climate Change
IPR	indirect potable reuse

Term	Definition
IRWM	integrated regional water management
IRWMP	Integrated Regional Water Management Plan
IWA	Indio Water Authority
IWFM	Integrated Water Flow Model
IWRIS	Integrated Water Resources Information System
K	conductivity
Kv	vertical conductivity
Landscape Ordinance	Ordinance No. 1302.4: An Ordinance of the Coachella Valley Water District Establishing Landscape and Irrigation System Design Criteria
LC	local concern
LCP	Landscaper Certification Program
LID	low impact development
LOS	level of service
MAR	managed aquifer recharge
MC AOB	Mission Creek Subbasin Area of Benefit
MCGH WMP	Mission Creek-Garnet Hill Water Management Plan
MC-GRF	Mission Creek Groundwater Replenishment Facility
MCL	maximum contaminant level
MDWC	Myoma Dunes Water Company
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
MHI	median household income
MMRP	Mitigation Monitoring and Reporting Plan
MO	Measurable Objective
MOU	Memorandum of Understanding
MP	Mile Post
MS4	municipal separate storm sewer system
msl	mean sea level
MSWD	Mission Springs Water District
MT	Minimum Threshold
MVP	Mid-Valley Pipeline
MWA	Mojave Water Agency
MWD	Metropolitan Water District of Southern California
MWELO	Model Water Efficiency Landscape Ordinance
NAICS	North American Industry Classification System
NCCAG	Natural Communities Commonly Associated with Groundwater
NCCPA	California Natural Communities Conservation Planning Act
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NIMS	National Incident Management System
NMFS	National Marine Fisheries Service

Term	Definition
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPW	non-potable water
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
O&M	operations and maintenance
OEHHA	Office of Environmental Health Hazard Assessment
OPR	California Governor's Office of Planning and Research
OWTS	Onsite Wastewater Treatment Systems
pCi/L	picocuries per liter
PD-GRF	Palm Desert Groundwater Replenishment Facility
PEIR	Programmatic Environmental Impact Report
PFAS	per- and polyfluoroalkyl substance
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PHG	public health goal
Plan Area	Indio Subbasin Alternative Plan Area
PMAs	projects and management actions
ppb	parts per billion
ppm	parts per million
PPR	Present Perfected Rights
ppt	parts per trillion
Proposition 1	Water Quality, Supply, and Infrastructure Improvement Act of 2014
Proposition 84	Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006
PVID	Palo Verde Irrigation District
QSA	Quantification Settlement Agreement
RAC	replenishment assessment charges
RAP	region acceptance process
RCAC	Rural Community Assistance Corporation
RCFCWCD	Riverside County Flood Control and Water Conservation District
RCOA	Riverside County Operational Area
RCP-06	Riverside County Projections 2006
RECI	water contract recreation
RECII	water non-contact recreation
Region	Coachella Valley Water Management Region
Regional Program	Regional Water Conservation Program
RMS	resource management strategies
RO	reverse osmosis
Rosedale	Rosedale Rio Bravo Water Storage District
RTP	regional transportation plan
RWQCB	Regional Water Quality Control Board

Term	Definition
SB	Senate Bill
SCAG	Southern California Association of Governments
SCSD	Salton Community Services District
SDAC	severely disadvantaged community
SDWIS	Safe Drinking Water Information System
SEMS	California Standardized Emergency Management System
SGM	Sustainable Groundwater Management
SGMA	Sustainable Groundwater Management Act
SGPWA	San Gorgonio Pass Water Agency
SGWP	Sustainable Groundwater Planning Grant Program
SMCL	Secondary Maximum Contaminant Level
SNMP	Salt and Nutrient Management Plan
SOI	sphere of influence
SPEIR	Subsequent Programmatic Environmental Impact Report
SRWS	self-regenerating water softeners
Ss	specific storage
SS/TS	source of supply/treatment study
SSA	Salton Sea Authority
SSMP	Salton Sea Management Plan
SWAMP	Surface Water Ambient Monitoring Program
SWMP	Stormwater Management Plan
SWN	State Well Number
SWP	State Water Project
SWQIS	California Statewide Water Quality Information System
SWR	stormwater resources
SWRCB	California State Water Resources Control Board
SWS	small water system
Sy	specific yield
T	transmissivity
TAC	Technical Advisory Committee
TAG	Technical Advisory Group
TAZ	transportation analysis zones
TDML	total maximum daily load
TDS	total dissolved solids
TEL-GRF	Thomas E. Levy Groundwater Replenishment Facility, formerly the Dike 4 Recharge Facility
TM	technical memorandum
TMDL	total maximum daily load
TRS	Township range section
TSS	Technical Support Services
Tulare Lake	Tulare Lake Water Storage District
ULFT	ultra low flow toilet

Term	Definition
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
Valley	Coachella Valley Water Management Region
VSD	Valley Sanitary District
WARM	Salton Sea's Warm Freshwater Habitat
WDL	Water Data Library
WDR	Waste Discharge Requirements
West AOB	West Whitewater River Subbasin Area of Benefit
WET-CAT	Climate Action Team, Water-Energy Group
WIIN	Water Infrastructure Improvements for the Nation
WMP	Water Management Plan
WMWC	Whitewater Mutual Water Company
Workplan	SNMP Development Workplan
WQO	water quality objective
WRCOG	Western Riverside Council of Governments
WRF	Water Reclamation Facility
WRFP	Water Recycling Funding Program
WRP	Water Reclamation Plant
WRSC	Whitewater River Stormwater Channel
WSA	Water Supply Assessment
WSV	Water Supply Verification
WUE	water use efficiency
WWR-GRF	Whitewater River Groundwater Replenishment Facility
WWTP	wastewater treatment plan
WY	water year

EXECUTIVE SUMMARY

ES.1 Introduction

Groundwater is a critical resource for the sustainability of Coachella Valley communities, agriculture, economic activities, environmental benefits, and other beneficial uses. The Indio Subbasin (one of four subbasins of the Coachella Valley Groundwater Basin) provides groundwater supply and a vast groundwater storage capacity with the natural ability to convey water—through groundwater flow—from areas of recharge to wells where water is pumped. Since the early 1900s, the Indio Subbasin has been actively managed to address increasing water demands (with pumping for agricultural, urban, and rural demands), beginning with capture of local stormwater to supplement the limited natural groundwater replenishment and later implementing water importation (since 1949) and source substitution projects. This has been a dynamic process with periods of groundwater depletion followed by recovery. Groundwater levels and storage reached historical lows in about 2009, but this overdraft has been stopped and increased groundwater storage has resulted from active water management planning and projects. In addition, local agencies have recognized the multi-faceted nature of groundwater issues (including subsidence, water quality, seawater intrusion, and potential impacts on environmental uses) and have developed relevant management plans, programs, and projects, including the *2002 Coachella Valley Final Water Management Plan (2002 CVWMP)* for the Indio Subbasin (Coachella Valley Water District [CVWD], 2002a) and the *Coachella Valley Water Management Plan 2010 Update (2010 CVWMP Update)* (CVWD, 2012a).

In 2014, the California Legislature enacted the Sustainable Groundwater Management Act (SGMA) to provide a framework for sustainable groundwater management. To implement SGMA in the Indio Subbasin, four local water agencies formed Groundwater Sustainability Agencies (GSAs): CVWD, Coachella Water Authority (CWA), Desert Water Agency (DWA), and Indio Water Authority (IWA). In 2016, the Indio Subbasin GSAs entered into a Memorandum of Understanding for collaborative management of the Indio Subbasin under SGMA.

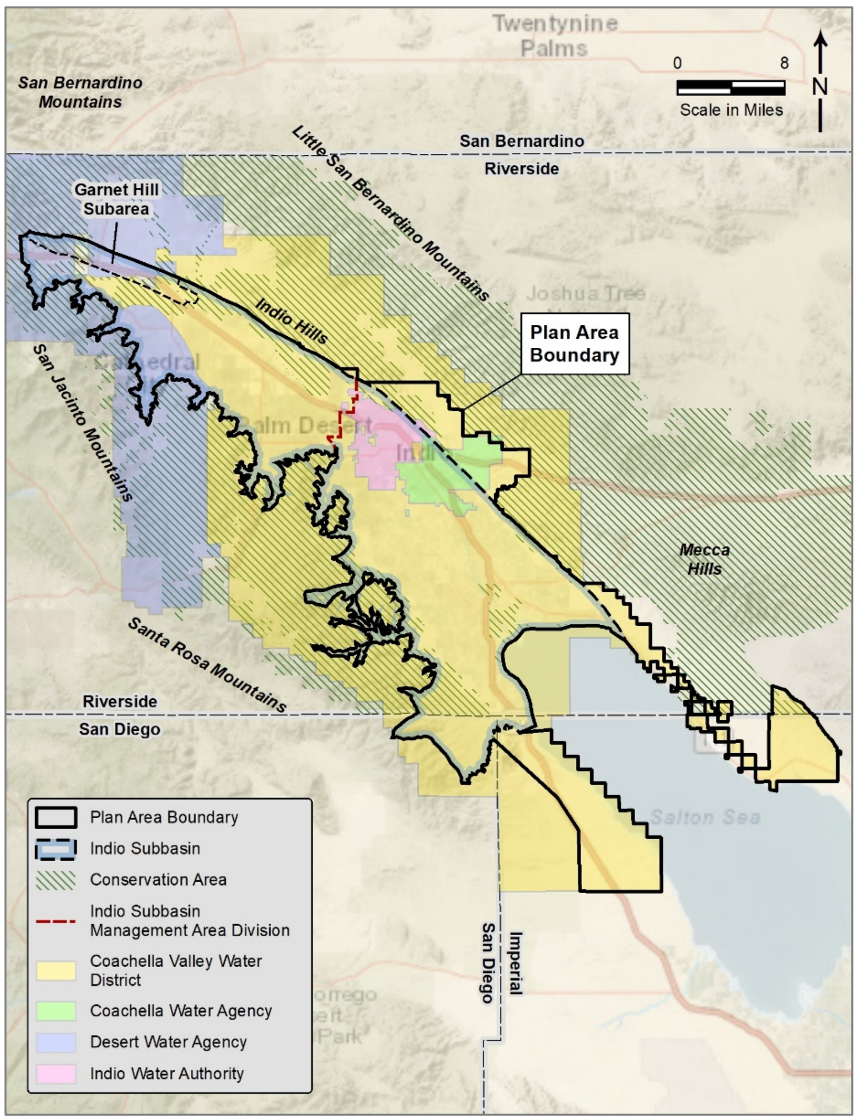
On December 29, 2016, the Indio Subbasin GSAs submitted to the Department of Water Resources (DWR) the *2010 CVWMP* (CVWD, 2012a), accompanied by a Bridge Document (Indio Subbasin GSAs, 2016), as an Alternative Plan to a Groundwater Sustainability Plan (GSP) for the Indio Subbasin. On July 17, 2019, DWR approved the *2010 CVWMP Update* as an Alternative Plan. In compliance with SGMA, the GSAs have prepared Annual Reports which can be found on the program website (www.IndioSubbasinSGMA.org). SGMA also requires plan updates every 5 years; this *Indio Subbasin Water Management Plan Update* (*Alternative Plan Update*) fulfills that requirement.

The GSAs conducted extensive stakeholder coordination and public involvement during the development of the *Alternative Plan Update* to seek input from property owners/residents, disadvantaged communities, agricultural interests, and environmental interests. Development of the *Alternative Plan Update* was also guided by the SGMA Tribal Workgroup, which included representatives from the following five Native American Tribes: Agua Caliente Band of Cahuilla Indians, Augustine Band of Cahuilla Indians, Cabazon Band of Mission Indians, Torres-Martinez Desert Cahuilla Indians, and Twenty-Nine Palms Band of Mission Indians.

ES.2 Plan Area

The Indio Subbasin is one of four subbasins that compose the Coachella Valley Groundwater Basin (Basin). The Plan Area is based on the Indio Subbasin and the areas served by, or expected to be served by, groundwater from the Subbasin, as shown in Figure ES-1. This includes areas to the east of the Subbasin within the spheres of influence of the cities of Indio and Coachella that account for several proposed large developments, and areas along the western and eastern shores of the Salton Sea that are in CVWD's domestic service area and receive groundwater from CVWD. Undeveloped mountainous terrain and conservation areas in CVWD's and DWA's boundaries are not included in the Plan Area as they do not receive water from the Indio Subbasin. The Indio Subbasin is geographically divided into West Valley and East Valley.

Figure ES-1: Plan Area



The Indio Subbasin underlies the incorporated areas of nine cities as well as unincorporated areas in portions of Riverside, San Diego, and Imperial Counties. Large tracts of land in the Plan Area are owned and managed by state and federal governments. Five Tribal/Reservation areas for Native American tribes are also located within the Indio Subbasin. The major water agencies in the Plan Area are CVWD, CWA, DWA, and IWA. Mission Springs Water District (MSWD) and Myoma Dunes Water Company (MDWC) also serve smaller portions of the Indio Subbasin.

Local water resources management began with early (19th Century) agricultural development in the region, which was initially based on groundwater supply. However, local groundwater supply proved insufficient for irrigation and subsequent urban water demand, leading agencies to acquire and import surface water supplies. The Plan Area currently relies on a combination of local groundwater, Colorado River water, State Water Project (SWP) exchange water, local surface water, and recycled water to meet demands for four predominant water user groups: municipal, agriculture, golf, and other (e.g., fish farms, duck clubs, polo, etc.).

ES.3 Hydrogeologic Conceptual Model

The Coachella Valley Groundwater Basin (Basin) encompasses more than 800 square miles and extends from the San Gorgonio Pass in the San Bernardino Mountains to the northern shore of the Salton Sea. The Basin is composed of the San Gorgonio Pass, Mission Creek, Desert Hot Springs, and Indio Subbasins. The boundary between the San Gorgonio Pass and Indio Subbasins is a bedrock constriction and divide; otherwise, the boundaries between the Subbasins are generally defined by faults that represent barriers to the lateral movement of groundwater.

The Indio Subbasin is bounded on its northern, northwestern, southwestern, and southern margins by uplifted bedrock; subbasin sedimentary fill consists of thick sand and gravel sedimentary sequences eroded from the surrounding mountains. Sedimentary infill in the Indio Subbasin thickens from north to south, and depending on location within the Subbasin, is at least several thousand and as much as 12,000 feet thick. The upper approximately 2,000 feet constitute the aquifer system that is the primary source of groundwater supply.

Sources of inflow to the Indio Subbasin include infiltration of natural inflows through mountain-front and stream channel recharge, subsurface inflows, artificial recharge of imported water, wastewater percolation, and return flows from municipal/domestic use, agriculture, golf courses, and other sources. From 2000 to 2019, combined return flows have represented the largest source of recharge in the Subbasin, followed by imported water replenishment and natural watershed runoff and stream channel recharge. Indio Subbasin groundwater outflows include groundwater pumping, subsurface and drain flows to Salton Sea, and evapotranspiration. Groundwater pumping is the largest component of outflow from the Indio Subbasin.

Seven hydrogeologic cross sections were developed to illustrate hydrogeologic conditions across the Indio Subbasin. Overall, the longitudinal cross sections document a down-valley progression of alluvial sediment from predominantly sand and gravel to increasing fine sands with clay lenses and then to clay-dominated sediments at the Salton Sea. The perpendicular cross sections document the relatively narrow, bedrock or fault-bounded character of the Indio Subbasin in the northwest, the substantial thickness of the subbasin that occurs along the eastern margin of the Indio Subbasin or along the subbasin axis, and the coarse-grained sediments along the western mountain front and limit of regional clay to the west.

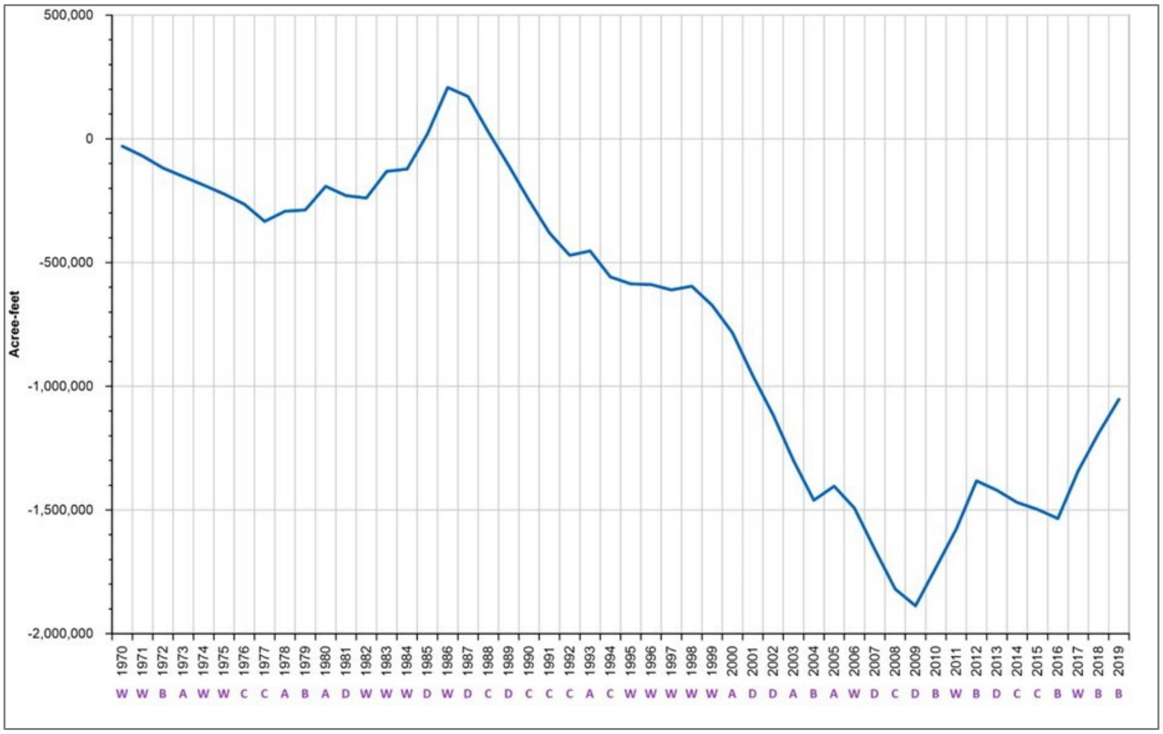
ES.4 Groundwater Conditions

Groundwater conditions are described with reference to the six sustainability indicators identified in SGMA: groundwater levels, groundwater storage, potential subsidence, groundwater quality, seawater intrusion, and interconnected surface water and groundwater dependent ecosystems (GDEs).

Regional groundwater flows are in a northwest-to-southeast direction through the Indio Subbasin. In Water Year (WY) 2018-2019, groundwater elevations ranged from greater than 1,100 feet msl near the San Gorgonio Pass Subbasin in the northwest to approximately -220 feet msl in the southeast along the northern shoreline of the Salton Sea. Average depth to water contours for the Indio Subbasin for WY 2018-19 show that greatest depths to water are observed in the northwestern portion of the basin (generally greater than 200 feet). Depths to groundwater generally decrease to about 100 to 250 feet in the mid-subbasin area and then to zero or above the ground surface in artesian wells near the Salton Sea. Long-term historical hydrographs depict the groundwater level response to historical pumping and water management activities identified and implemented in the *2002 CVWMP* and *2010 CVWMP Update*. Collectively, the hydrographs illustrate the effectiveness of groundwater replenishment, source substitution, and conservation programs under varying climatic and water use conditions.

Figure ES-2 shows the cumulative change in storage for the Indio Subbasin since 1970. Since 2009, the Indio Subbasin has recovered approximately 840,000 acre-feet (AF) of groundwater in storage, or about 45 percent of the cumulative depletion observed from 1970 to 2009.

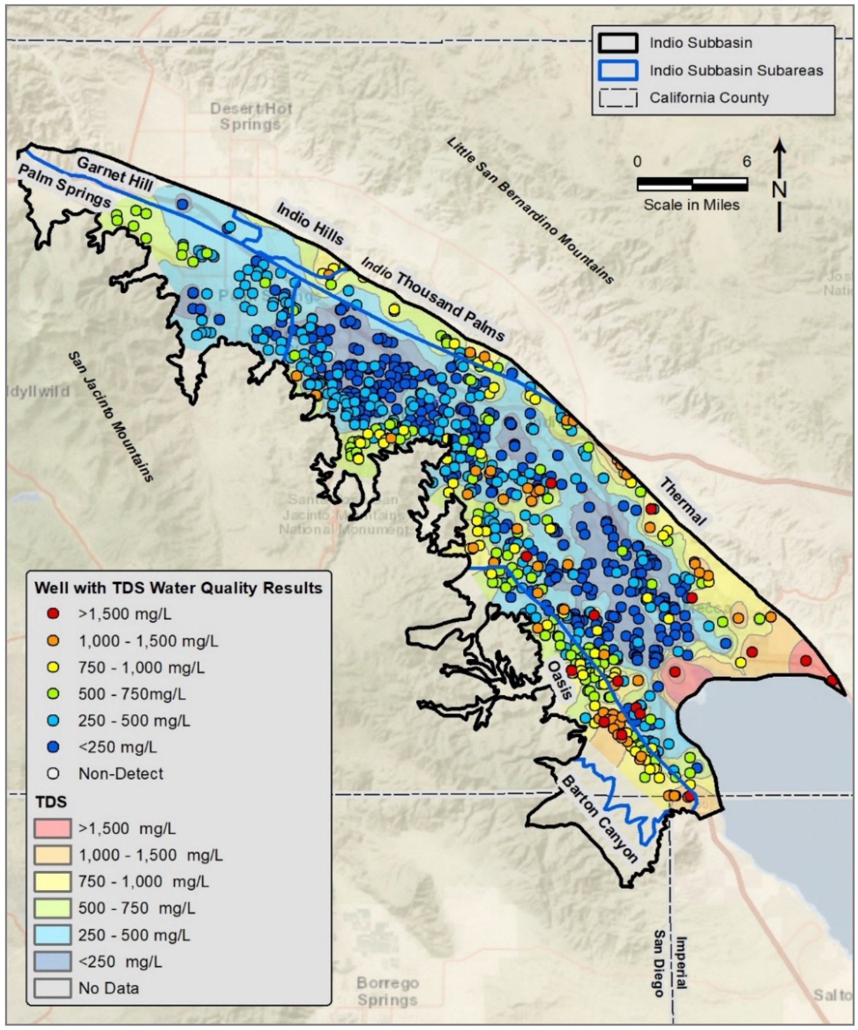
Figure ES-2: Cumulative Change in Groundwater Storage since 1970



Land subsidence is the differential lowering of the ground surface, which can damage structures and facilities. This may be caused by regional tectonism or by declines in groundwater elevations due to pumping. Land subsidence, resulting from aquifer system compaction and groundwater level declines, has been a concern in the Coachella Valley since the mid-1990s and has been investigated since 1996 through an on-going cooperative program between CVWD and the United States Geological Survey (USGS) (Sneed and Brandt, 2020). Analysis of data collected from 1995 to 2017 by the USGS indicates that as much as 2.0 feet of land subsidence occurred in the Indio Subbasin from 1995 to 2010 near Palm Desert, Indian Wells, and La Quinta (Sneed and Brandt, 2020). Since 2010, groundwater levels have stabilized or increased, and although a few areas continued to subside (albeit at a slower rate), most areas stopped subsiding from 2010 to 2017 and some even uplifted.

Groundwater quality is documented in the Indio Subbasin focusing on eight water quality constituents, including total dissolved solids (TDS), nitrate, arsenic, chromium-6, uranium, fluoride, perchlorate, and DBCP. Each of these is summarized in terms of sources and maps showing spatial distribution (see Figure ES-3). In addition, concentrations with depth are shown in 14 vertical cross-sections for TDS, nitrate, arsenic, and chromium-6; concentrations of these constituents vary with depth. Time-concentration plots are shown for TDS and nitrate. The primary (i.e., health-based) maximum contaminant levels (MCLs) are stated for each constituent with the exception of TDS, which is regulated by a range of Consumer Acceptance Contaminant Levels that are based on aesthetics (e.g., taste). While concentrations of nitrate, arsenic, or fluoride may exceed MCLs in some small water systems, County and GSA programs have been implemented to help provide better water quality. All four GSAs provide drinking water supplies that meet all state and federal health standards.

Figure ES-3: TDS Concentration Map



Elevated TDS and nitrate concentrations are linked to current and historical water and wastewater management, agricultural activity, urban land use, septic systems, and natural conditions. In the Indio Subbasin, arsenic, chromium-6, uranium, and fluoride are naturally occurring and show variable distribution. DBCP is a soil fumigant historically used in agriculture that has persisted in a few wells. Perchlorate has industrial, fertilizer, and natural sources with highly localized detections at low concentrations. Cross-sections showing the vertical distribution of TDS indicate that concentrations generally are less than 500 mg/L, lowest concentrations occur in deep wells in the central Indio Subbasin, and highest concentrations found near the Salton Sea. The time-concentration plots indicate increases in TDS concentrations since 1990, with lower rates of increase generally in deeper zones as well as in the central and eastern Thermal Subarea. With regard to nitrate, time-concentration plots show significant variability in shallow nitrate concentrations and local increases in nitrate concentrations, mostly in the western areas where concentrations are already elevated in shallow wells.

The Indio Subbasin is potentially vulnerable to saltwater intrusion from the Salton Sea. Potential saltwater intrusion is monitored through two sets of nested monitoring wells. Results from these monitoring wells do not suggest current groundwater degradation due to saltwater intrusion.

GDEs are defined as "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." As part of this *Alternative Plan Update*, potential GDEs were evaluated using a desk-top survey and field visits. Surface water connected to groundwater is generally not present in the West Valley because groundwater levels are much lower than the ground surface. Probable GDEs were identified in three upper canyon areas of the San Jacinto Mountains associated with springs, seeps, and stream channels that convey snowmelt from the San Jacinto mountain front. Probable non-GDEs include dry upland areas, cultivated and/or flooded agricultural land, obvious human-made ponds, lakes, and other features, channelized drains, and areas with no other indicators of groundwater presence near the surface. The mapping also identified Playa Wetland areas along the Salton Sea exposed seabed (playa). These wetlands occur generally downstream of stream, agricultural drain, or stormwater channel outlets. The recession of the Salton Sea is exposing thousands of acres of playa each year and water from irrigation ditches and other drainages that previously flowed directly into waters of the Sea now spreads out on the exposed playa of the Sea where new vegetation and wetlands now exist.

ES.5 Demand Projections

To provide an adequate long-range forecast of future water demands, this *Alternative Plan Update* uses a 25-year planning period from 2020 through 2045. This planning is subject to uncertainties and changes that could affect future water demands, including revised growth forecasts, conversions of agricultural lands to urban uses, development on Tribal lands, and long-term conservation regulations. Projected water demands are broken into four major categories: municipal, agricultural, golf, and other.

Total **municipal** demand for the Plan Area is 235,148 acre-feet (AF) in 2045, which is an increase of 71,143 AF from the 2016 baseline (i.e., 43 percent). The forecast assumes a population increase from 402,392 in 2016 to 616,048 in 2045, primarily in the cities of Coachella and Indio. The forecast also assumes 57,773 parcels planned for development, as well as 125,232 new housing units by 2045, corresponding with increased residential and landscape water demands. The projection anticipates 68,149 new jobs by 2045, corresponding with increased future commercial, industrial and institutional (CII) water demands. The forecast accounts for water loss and includes adjustment factors for indoor passive conservation and outdoor water use savings.

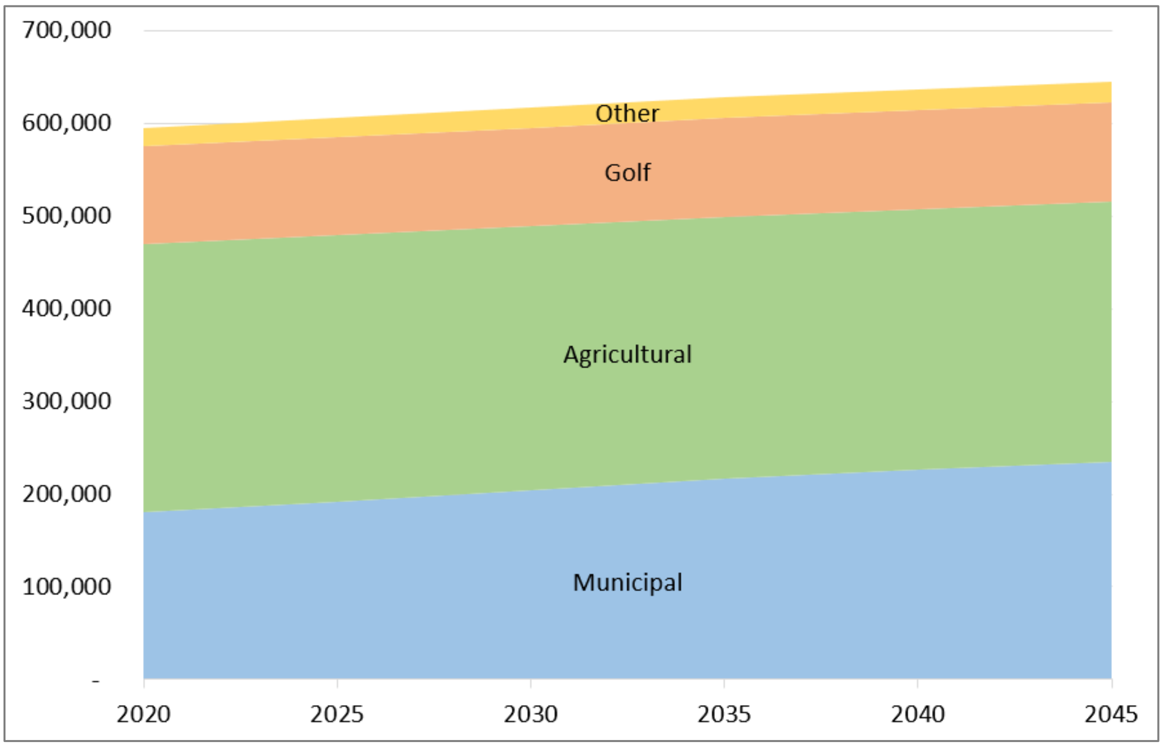
Total **agricultural** demand in the Plan Area is projected to decline from 295,150 AF in the 2016 baseline to 280,243 AF in 2045 (i.e., 5 percent). The forecast assumes that by 2045, 5,973 acres of agricultural land will be converted for urban land uses, and that 950 acres will be converted from idle to cropped in the East Valley. As part of the scenario modeling, this *Alternative Plan Update* also considered the potential for increased agricultural demand within the Plan Area as conditions in California change (see Chapter 7, *Numerical Modeling and Plan Scenarios*).

Total **golf** industry demand is estimated to increase from 105,300 AF in 2020 to 107,625 AF by 2035 (i.e., 2 percent). The forecast assumes three future golf courses approximately 150 acres in size.

Total **other** demand, historically composed of water demands from fish farm and duck clubs, polo/turf irrigation and environmental water, is estimated to increase from 18,893 AF in 2020 to 21,593 AF by 2045 (i.e., 14 percent). The forecast assumes several new recreational lakes and surf parks, along with potential water use by the Salton Sea Restoration North Shore pilot project.

Figure ES-4 presents the updated water demand projections for the Plan Area. Total water demand projected for 2045 is approximately 644,610 AF. Projected water demand for 2045 is about 240,800 AF lower than the 885,400 AF originally projected in the *2010 CVWMP Update*. This reduction is a direct result of reduced sociodemographic growth projections, along with conservation savings over the last decade, which are assumed to continue into the future.

Figure ES-4: Total Projected Water Demands in Plan Area (AFY)



ES.6 Water Supply

The Planning Area relies on a combination of local groundwater, Colorado River water, SWP exchange water, surface water, and recycled water to meet water demands.

Groundwater from the Indio Subbasin has been an important source of municipal, rural, and agricultural water supply to the Plan Area. Groundwater levels and storage are presented in Chapter 4, *Current and Historical Groundwater Conditions* and the water budget for the Indio Subbasin is summarized in Chapter 7, *Numerical Model and Plan Scenarios* for each planning scenario.

Natural surface water flow in the Coachella Valley occurs as a result of precipitation, precipitation runoff, and stream flow originating from the San Bernardino and San Jacinto Mountains, with lesser amounts from the Santa Rosa Mountains. This watershed runoff is diverted for direct use, percolates into the streambeds, or is captured in mountain-front debris basins where it recharges the groundwater basin. The 50-year hydrologic period from 1970 to 2019 had an annual average watershed runoff of 52,506 AFY, with approximately 43,319 AFY in natural infiltration. Runoff during the 25-year period from 1995 to 2019 was below average, with 38,196 AFY in watershed runoff and 29,204 AFY in natural infiltration.

Colorado River (Canal) water has been a significant water supply source for the Indio Subbasin since the Coachella Canal was completed in 1949. CVWD is the only agency in the Indio Subbasin that receives Colorado River water allocations. Total available Colorado River deliveries will increase to 464,000 AF in 2045, with delivery of 436,050 AF after conveyance losses. This includes base entitlement from the 2003 Quantification Settlement Agreement (QSA), 1988 Metropolitan Water District of Southern California (MWD)/IID Approval Agreement, IID/CVWD First Transfer, IID/CVWD Second Transfer, Coachella Canal Lining, Indian Present Perfected Rights Transfer, and QSA SWP Transfer with MWD. Colorado River supplies face a number of challenges to long-term reliability including the extended Colorado River Basin drought and shortage sharing agreements, endangered species and habitat protection, and climate change.

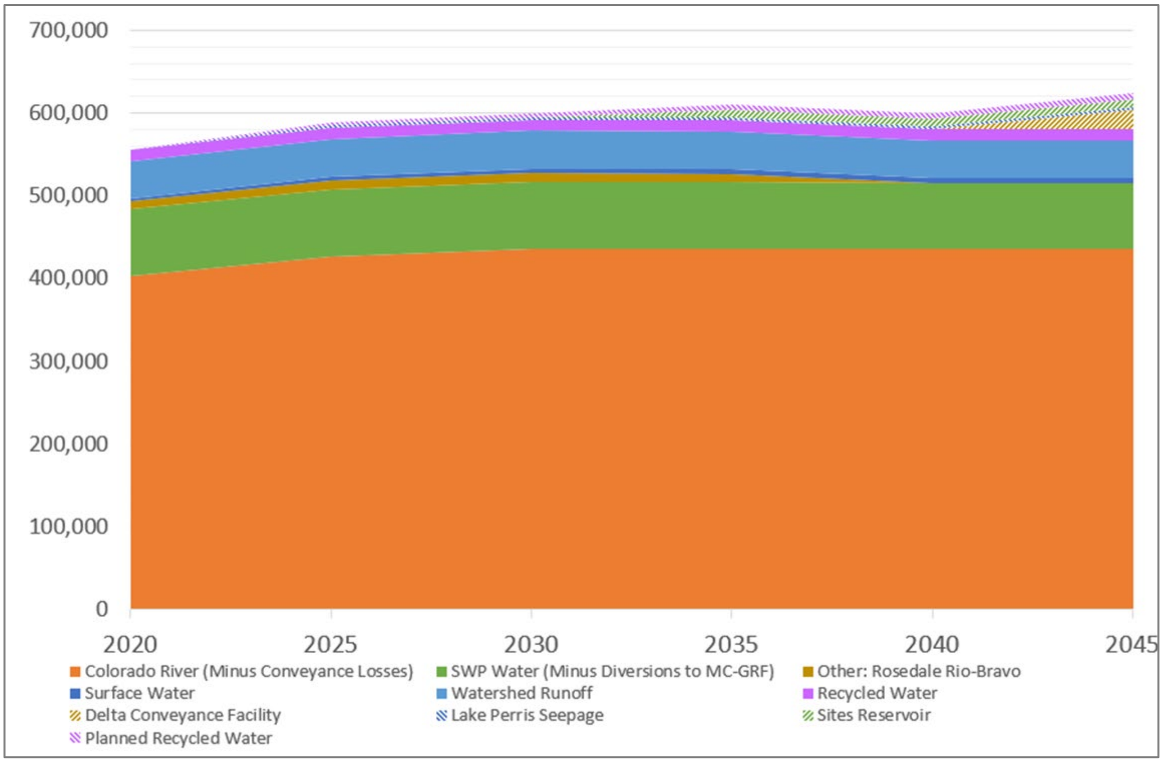
SWP exchange water has been an important component of the region's water supply mix. In 1962 and 1963, DWA and CVWD, respectively, entered contracts with the State of California that defined a Table A allocation (i.e., the maximum annual amount of water each contractor can receive excluding certain interruptible deliveries). Table A deliveries vary annually based on factors including hydrology, reservoir storage, and environmental requirements for the Sacramento-San Joaquin Delta (Delta). DWA and CVWD currently have a combined maximum annual SWP Table A amount of 194,100 AFY. In 2008, CVWD and DWA entered into separate agreements with DWR for the purchase and conveyance of supplemental SWP water under the Yuba River Accord Dry Year Water Purchase Program (Yuba Accord). Over the 10-year period from 2010-2019, the average annual amount of Yuba Accord water purchased by the GSAs was 651 AFY. In 2012, CVWD also entered into an agreement with Rosedale-Rio Bravo Water Storage District (Rosedale Rio-Bravo) that provides a total of 252,500 AF to CVWD through 2035. The balance of Rosedale Rio-Bravo water due to CVWD from 2020 to 2035 is 169,000 AFY, or an annual average of 10,563 AFY.

Since 2007, SWP deliveries have averaged only 45 percent of Table A amounts. The Delta Conveyance Facility (DCF) is a DWR project that would improve SWP reliability and result in increased deliveries in the future. CVWD and DWA have approved a 2-year agreement to advance their share of funding for DCF planning and design costs. MWD, DWR, CVWD and DWA have also begun planning for the Lake Perris Seepage Recovery Project, which is anticipated to deliver 2,752 AFY to DWA and CVWD starting in 2023. CVWD and DWA have also entered into agreements with the Sites Reservoir Authority for the purpose of obtaining 10,000 AFY and 6,500 AFY, respectively, from the Sites Reservoir Project.

There are currently eight wastewater treatment plants (WWTPs) or water reclamation plants (WRPs) within the Plan Area, with a ninth in construction by MSWD. CVWD and DWA currently deliver recycled water from three WRPs for irrigation of golf courses, large landscaped areas, and various other irrigation uses. Forecasted recycled water deliveries from the three WRPs are anticipated to increase from 13,398 AF in 2020 to 20,213 AF in 2045 with additional projects in the planning phases.

A summary of future projected supplies is illustrated in Figure ES-5. This summary shows available imported and local surface water supplies and does not include the groundwater supply; the available groundwater supply will vary under different management conditions and is quantified with simulations using the numerical model (see Chapter 7, *Numerical Modeling and Plan Scenarios*).

Figure ES-5: Indio Subbasin Supply Forecast Projected Future Supplies with Climate Change (AFY)



ES.7 Numerical Model and Plan Scenarios

The Indio Subbasin numerical groundwater flow model and associated water budget were used to assess groundwater conditions and future sustainability. The groundwater flow model, originally developed in the mid-1990s and subsequently extended for the *2002 CVWMP* and *2010 CVWMP Update*, was updated for this *Alternative Plan Update* with inflow and outflow data through 2019. Other improvements included updated Salton Sea elevations, more accurate land surface elevations and Salton Sea bathymetry, updated information on Garnet Hill subarea, and updated subsurface inflow boundary conditions from adjacent subbasins. The updated model was applied to simulation of transient three-dimensional groundwater flow within and between the shallow and deep aquifer zones. It accounts for specific Subbasin inflows and outflows, and potential flow to and from the Salton Sea.

The model assumes that the Indio Subbasin is recharged through a combination of subsurface inflow from the San Gorgonio Pass and Mission Creek Subbasins, mountain front and stream channel recharge, replenishment of imported water, wastewater percolation, and return flows from municipal/domestic, agricultural, and golf course irrigation, and from septic systems. Outflows include groundwater production from agricultural, municipal, golf course, and other pumping wells; drain flows; evapotranspiration; and groundwater outflows to the Salton Sea.

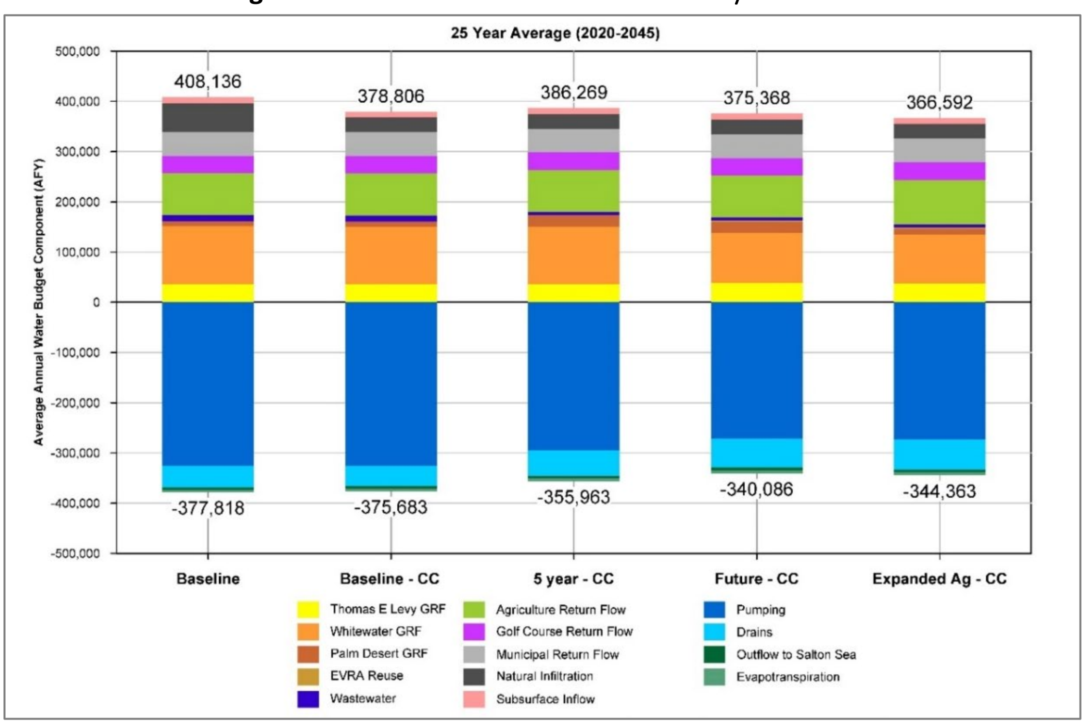
The updated Indio Subbasin model meets qualitative and quantitative calibration goals. As documented with groundwater level hydrographs, the simulations of shallow and deep aquifer water level trends throughout the Subbasin are consistent with observed groundwater conditions. Simulated groundwater elevation contour maps for shallow and deep aquifers are well matched with measured levels. Model-simulated agricultural drain flow also generally matched measured drain flow. The groundwater flow model is well calibrated with observed groundwater elevation and drain flow trends for both the historical and updated periods.

Scenarios for the *Alternative Plan Update* were developed, including baseline scenarios and future Plan scenarios addressing potential future water supply conditions, changes in land use, and implementation of water management projects including source substitution and new water supply projects. Except for the Baseline scenario, climate change conditions were assumed for all Plan scenarios, reflecting that the Indio GSAs are committed to achieving sustainability under changing climate conditions.

Each scenario was simulated over a 50-year period consistent with SGMA requirements. However, the planning assumptions were only projected for the first 25 years to the 2045 planning horizon. Thereafter, growth and supply assumptions were assumed to continue at the same rate for the second 25 years of the simulation. While extending beyond foreseeable land use and water resource planning projections, the second 25-year projections allow long-term evaluation of water supply and demand conditions, effectively testing Indio Subbasin sustainability under long-term hydrologic variability over 50 years.

Figure ES-6 illustrates the five scenarios in terms of the subbasin water budgets for each scenario including the average inflows (upper portion of graph) and average outflows (lower portion) over the planning period 2020-2045. As shown, all scenarios except Baseline account for climate change (indicated by CC).

Figure ES-6: Model Inflows and Outflows by Scenario

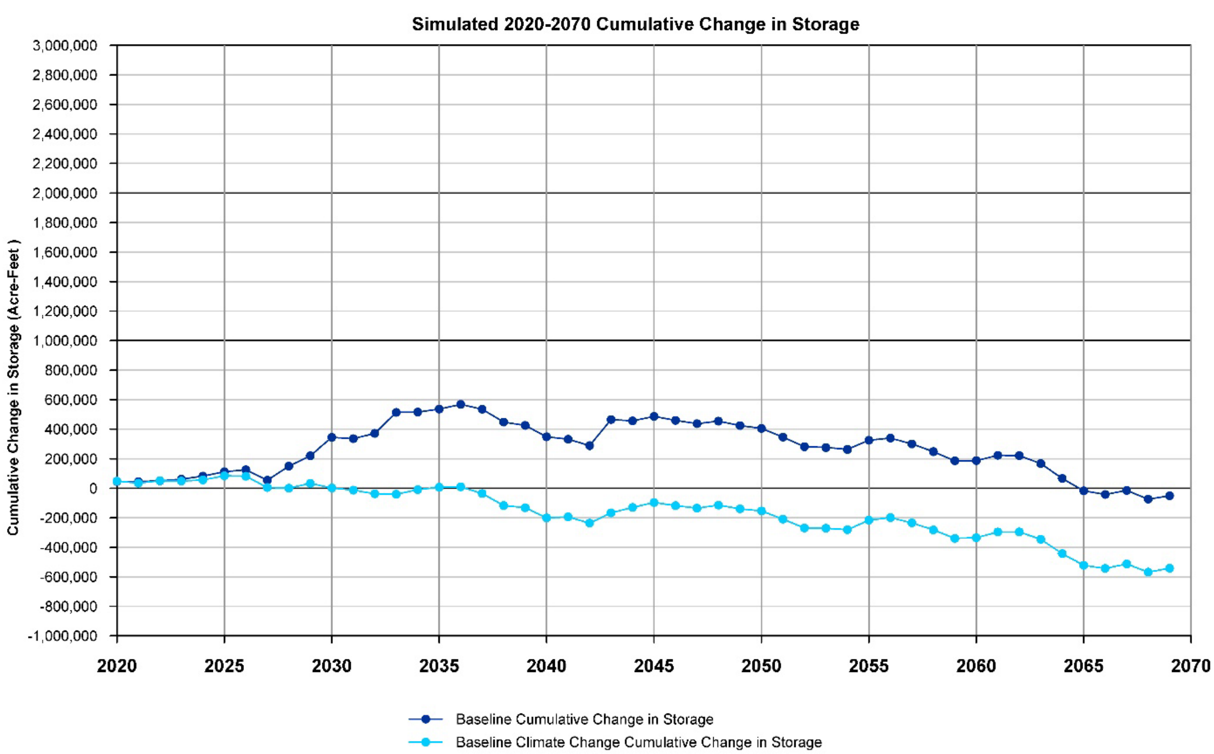


To simulate the range of possible future conditions, two different hydrological cycles were used and applied to the Plan scenarios. For the Baseline scenario, the observed hydrology for the Whitewater River watershed from 1970 to 2019 was used. Future climate change is simulated similar to the observed conditions over the last 25 years, a period marked with recurring drought and below average rainfall. While all scenarios assume 45 percent reliability of SWP supplies, the climate change scenarios assume an additional 1.5 percent reduction in SWP reliability by year 2045. Further, given the tendency for recurring drought in climate change conditions, those scenarios assume CVWD will contribute water to California's *Lower Basin Drought Contingency Plan* allotment for Colorado River water.

Modeling results are presented first with a comparison of the Baseline scenario and the Baseline with Climate Change scenario. Results are shown in terms of the respective water balances, cumulative change in storage, hydrographs at twelve wells across the subbasin, and groundwater level change maps. Modeling results are then presented for all four Plan scenarios with climate change. Results of these scenarios are shown together to allow comparison in terms of model inflows, simulated pumping, simulated drain flow, simulated net outflow to Salton Sea, hydrographs, and maps showing change in groundwater levels.

Simulation of the Baseline and Baseline with Climate Change scenarios allows direct evaluation of the effect of simulated climate change on groundwater storage. As indicated in Figure ES-7, a net increase in Subbasin-wide groundwater storage is predicted for the Baseline scenario, while a net decrease in Subbasin storage is predicted for Baseline with Climate Change. This indicates that implementation of no new projects is not sustainable with climate change as simulated with recent hydrologic conditions projected into the future.

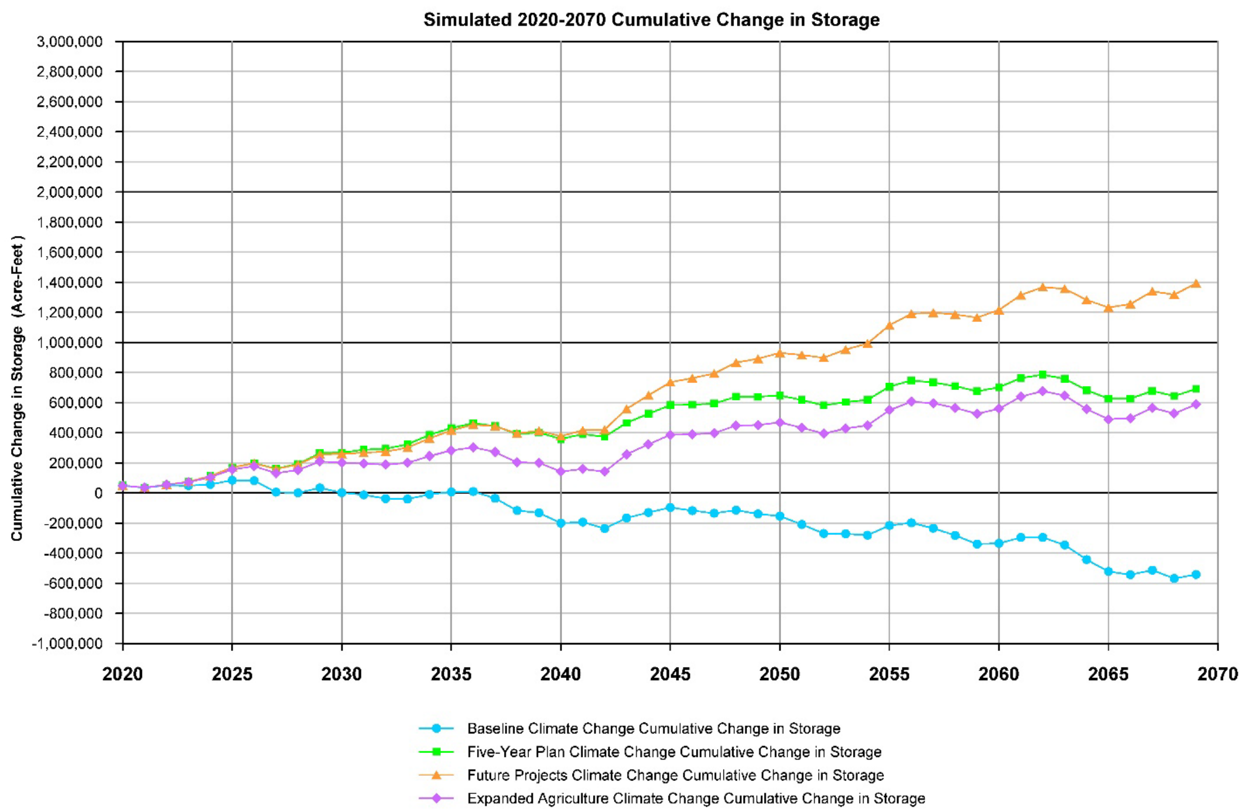
Figure ES-7: Cumulative Change in Storage for Baseline and Baseline with Climate Change



Simulation of the other three scenarios allows assessment of the effects of various water supply projects packaged as follows: 5-Year Plan with Climate Change, Future Projects with Climate Change, and Expanded Agriculture with Climate Change. As illustrated in Figure ES-8, while the Baseline with Climate Change scenario results in net groundwater storage decline, the three other scenarios show a net increase in storage at the end of the 25-year planning horizon (in 2045) and continuing stability through the end of the modeling timeframe. Simulation of the 5-Year Plan with Climate Change scenario shows that already-planned projects and management actions can maintain the water balance, even with climate change. The Future Projects with Climate Change scenario acknowledges the uncertainties that exist with regard to future water supplies, water demands, and other circumstances. This scenario also results in a stable Subbasin water balance.

In addition, all three scenarios of climate change with projects indicate increased net outflow to drains. All four climate change scenarios show a net outflow to the Salton Sea, indicating no seawater intrusion.

Figure ES-8: Cumulative Change in Storage for Future Scenarios



ES.8 Regulatory and Policy Issues

Implementation of the *Alternative Plan Update* could be affected by regulatory policy and planning issues. While these issues may represent challenges, the GSAs have identified potential solutions, and considered opportunities. The *2010 CVWMP Update* described emerging issues and these are updated in the *Alternative Plan Update*, with some topics (e.g., subsidence) described in detail in terms of current conditions, sustainable management, and implementation of projects and management actions.

Regulatory policies include water quality policies and planning regarding the Colorado River Basin Plan, anti-degradation policy, recycled water policy, Coachella Valley Salt and Nutrient Management Plan (CV-SNMP), salinity management, and agricultural discharge requirements. Policies and regulations of the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB) are updated as part of the regular review by the GSAs.

The *Alternative Plan Update* addresses water quality constituents including salinity, arsenic, perchlorate, chromium-6, uranium, and nitrate, and also introduces the potential occurrence and adverse effects on water supply of per- and polyfluoroalkyl substances (PFAs), a group of human-made chemicals that are persistent in the environment and human body, with potential adverse health effects. Occurrence in Indio Subbasin of these constituents is summarized, along with monitoring and management actions to protect drinking water supplies. The GSAs continue to track the specific water quality issues, including the evolving regulations of emerging contaminants.

Planning is underway for Salton Sea stabilization and restoration. Once known for its recreational uses, the Salton Sea has shrunk in size and deteriorated in water quality, leading to loss of the fishery and in recent years, mass die-offs of birds and fish, raising concerns about these beneficial uses. The potential for seawater intrusion into Subbasin aquifers has diminished as Subbasin groundwater levels have increased and as the Salton Sea levels have declined and the sea has retreated. State and Federal legislation has been passed to stabilize Salton Sea levels and support Salton Sea restoration.

In addition, the *Alternative Plan Update* addresses additional policy issues regarding availability of suitable water supply for small community water systems. Small water systems, often serving disadvantaged communities, may face challenges in providing safe, accessible, and affordable water because they may not have adequate resources to support maintenance, operation, and treatment costs. In response to these water supply issues, the GSAs with multiple small water systems in their respective jurisdictions have completed and continue to work on consolidating communities to a municipal water system to provide a reliable water supply source.

Climate change is another issue that has the potential to affect the availability of imported water supply and to affect water supply and water demand in the Plan Area. Colorado River supplies may be affected by the *Lower Basin Drought Contingency Plan* implemented as part of the Colorado River Drought Contingency Plan Authorization Act passed in 2019 to keep Lake Mead above critically low levels. Similarly, the supply availability and reliability of SWP is forecasted to decrease due to climate change. Climate change effects on Plan Area water supplies are addressed in the *Alternative Plan Update* with projected scenarios for numerical model simulation.

This *Alternative Plan Update* also addresses changes in water conservation. The Water Conservation Act of 2009 required urban water suppliers to increase their water use efficiency. All six suppliers in the Plan Area exceeded the per capita water use reduction of 20 percent by 2020. Subsequently in 2018, the California Legislature enacted Assembly Bill 1668 and Senate Bill 606, which together lay out a new long-term water conservation framework that affects both urban and agricultural water providers. Urban water conservation is being promoted by local agencies to enhance cost-effectiveness and to prepare for water shortages, including drought.

ES.9 Sustainable Management

The *2010 CVWMP Update* developed an overarching goal for the Valley "to reliably meet current and future water demands in a cost-effective and sustainable manner." This *Alternative Plan Update* continues to be guided by that goal with updated objectives as follows:

- Meet current and future water demands with a 10 percent supply buffer
- Avoid chronic groundwater overdraft
- Manage and protect water quality
- Collaborate with tribes and state and federal agencies on shared objectives
- Manage future costs
- Minimize adverse environmental impacts
- Reduce vulnerability to climate change and drought impacts.

The *Alternative Plan Update* incorporates a comprehensive approach to local groundwater management. Acknowledged as functionally equivalent to a GSP, it utilizes SGMA sustainability indicators and criteria as needed. SGMA provides a consistent, state-wide definition of sustainable management as the use and management of groundwater in a manner that can be maintained without causing undesirable results. Undesirable results are defined as significant and unreasonable effects caused by groundwater conditions occurring throughout a basin. Indicators of undesirable results include chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, land subsidence, degraded water quality, and depletions of interconnected surface water with adverse impacts on beneficial uses of the surface water.

SGMA also provides quantitative measures that support demonstration of sustainability. These include the Minimum Threshold (MT), a numeric value used to define undesirable results for each sustainability indicator, and the Measurable Objective (MO), a specific, quantifiable goal to track the performance of sustainable management. This *Alternative Plan Update* provides quantitative MTs for groundwater levels, based on groundwater level monitoring data showing that chronic groundwater declines occurred until about 2009. The potential undesirable impacts on wells (especially shallow domestic wells) are discussed. No reports are known of wells adversely affected by low groundwater levels historically, including the years around 2009.

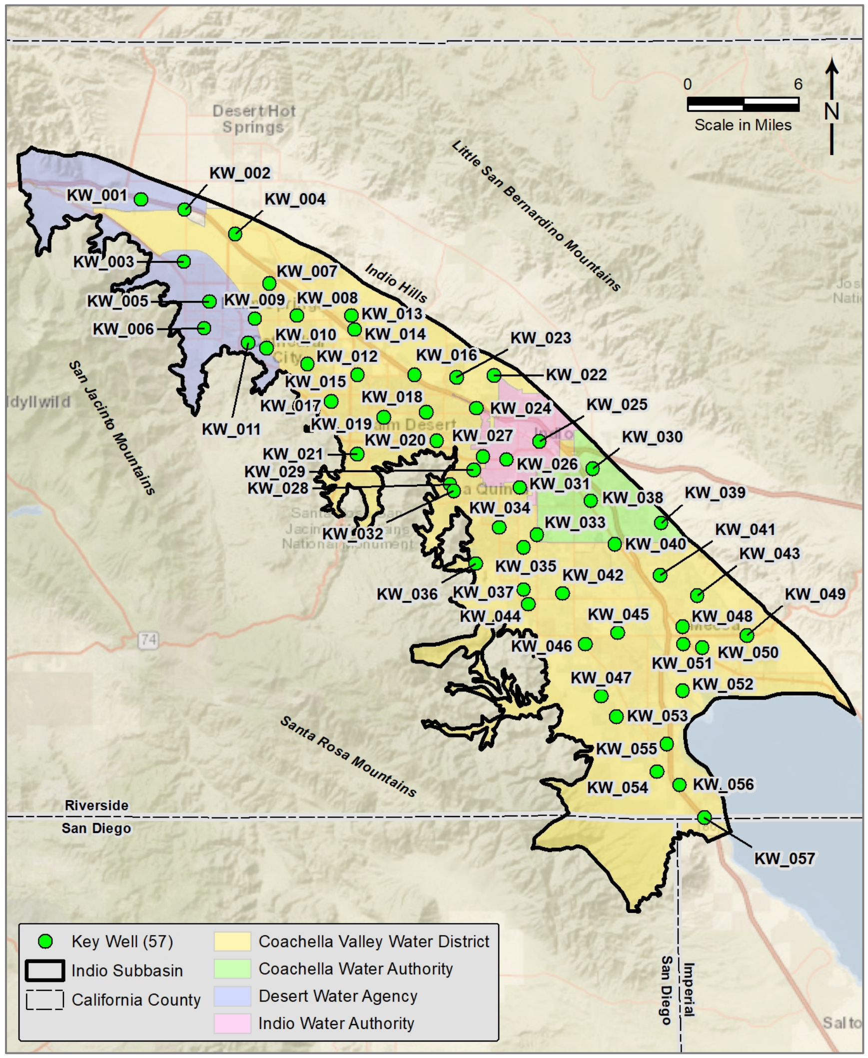
The Key Wells shown in Figure ES-9 are representative of local groundwater elevation conditions and are appropriate for monitoring groundwater levels relative to MTs. MTs are defined at each Key Well by historical groundwater low levels. Undesirable results are indicated when groundwater levels are below the MT for five consecutive same-season monitoring events, in 25 percent or more of the Key Wells in the Indio Subbasin. The MO is to maintain groundwater levels above the groundwater level MTs within the historical operating range.

Groundwater storage is the volume of water in the basin. The undesirable result associated with reduction in groundwater storage would be an insufficient supply to support beneficial uses during shortage and droughts. Groundwater levels and storage are directly related, as demonstrated by comparison of groundwater level and storage trends, which reveal similar patterns of historical overdraft, recovery, and response to different water year types including drought. As such, the groundwater level MTs will be used as proxy for storage MTs.

Land subsidence, the differential lowering of the ground surface, can damage structures and hinder surface water drainage. The land subsidence experienced historically in Indio Subbasin has been caused by declines in groundwater elevations due to an imbalance of pumping over recharge. As such, the groundwater level MTs will also be used as proxy for subsidence MTs.

As shown in the *Alternative Plan Update*, interconnected surface water generally is not present in the West Valley because groundwater levels are much lower than the ground surface. In the East Valley, a shallow semi-perched aquifer zone is present and potential GDEs may occur in this area along with non-GDE vegetation around agricultural fields and along drainage channels. Evapotranspiration from such vegetation is included in the numerical model.

Figure ES-9: Key Wells



Throughout the Alternative Plan process, the GSAs have addressed groundwater sustainability in terms of water quality, with maintenance of an extensive water quality monitoring program and implementation of applicable management responses. Specific topics addressed in the *Alternative Plan Update* include selected water quality constituents of concern, the CV-SNMP, drain flows that represent salt outflow from the Subbasin, and seawater intrusion. Specific water quality constituents (including fluoride, arsenic, chromium-6, DBCP, TDS, nitrate, uranium, and perchlorate) are discussed in terms of sources, occurrence in the Indio Subbasin, and GSA actions to assist small water systems that are adversely affected.

In 2020, work to update the *Salt and Nutrient Management Plan for the Coachella Valley Groundwater Basin* (CV-SNMP) was initiated by the CV-SNMP agencies (including CVWD, CWA and Coachella Sanitary District, DWA, IWA, Myoma Dunes Mutual Water Company, VSD, MSWD, and City of Palm Springs) working in cooperation with RWQCB staff. This has involved preparing a *Groundwater Monitoring*

Workplan, which was approved by the RWQCB in early 2021, and a *SNMP Development Workplan* with implementation scheduled to begin in early 2022. The CV-SNMP update and *Alternative Plan Update* are coordinated efforts. Elements of this *Alternative Plan Update* specifically supporting the CV-SNMP include (but are not limited to) organization of water quality data into a database; evaluation of the sources, and trends for TDS and nitrate; improvement of the monitoring program relative to TDS and nitrate; and identification of projects and actions relevant to water quality management. Additional study of salinity in groundwater—including analysis of the rate and level of increased salt contents in groundwater due to Colorado River importation—will be achieved in large part by the CV-SNMP update.

An extensive agricultural drainage system (both subsurface tile drainage systems and surface drains) was installed in the East Valley to control high water table conditions, to intercept poor quality shallow groundwater, and to convey the water to the Coachella Valley Stormwater Channel (CVSC) and Salton Sea. Drain flows are measured at 27 drains and the CVSC, and also have been simulated using the numerical model. Relatively large drain flows are beneficial because they are a response to higher groundwater levels which are protective of the deep aquifer and because they promote export of salt from the Subbasin. The GSAs have defined a specific, potential undesirable result, which is degradation of water quality in the deep Principal Aquifer due to downward migration of water with elevated TDS levels found in shallow groundwater zones. High groundwater levels in the deep zone have a direct relationship with good water quality at depth, and accordingly, the GSAs are considering groundwater levels as an appropriate proxy. A drain flow study to document drain flow, groundwater level, and water quality relationships is planned as part of Alternative Plan implementation.

Seawater intrusion from the Salton Sea has been emphasized as a potentially substantial and irreversible consequence of overdraft. However, groundwater quality monitoring data (including chloride concentrations), show no evidence that seawater intrusion is occurring in the Subbasin. This *Alternative Plan Update* shows modeled groundwater elevations near the Salton Sea, demonstrates the consistency of simulated levels with recent measured groundwater levels, and indicates minimal risk of saltwater intrusion. Moreover, modeling indicates a net outflow of groundwater to the Salton Sea, indicating no seawater intrusion. The *Alternative Plan* includes analysis of groundwater level data, modeling of groundwater storage change, and regular monitoring of groundwater quality data to detect seawater intrusion potential.

ES.10 Monitoring Program

The Indio Subbasin has been extensively monitored by the GSAs for decades, guided by the primary objective to evaluate the effectiveness of water management programs and projects and to modify actions and plans based on factual data. This *Alternative Plan Update* continues and builds on the existing monitoring programs. Chapter 10 includes description of the monitoring network, methods and protocols for data collection, and development and maintenance of the data management system (DMS). The monitoring program has been assessed with reference to the sustainability goal and objectives, data gaps have been reviewed, and improvements have been identified for implementation. The monitoring program includes the following networks: climate, streamflow, subsidence, groundwater elevations, surface and groundwater quality, pumping, and drain flow.

Climate data are available from DWR's California Irrigation Management Information System (CIMIS) for four active CIMIS stations and for the 12 Riverside County Flood Control and Water Conservation District precipitation monitoring stations. Data are used to support groundwater conditions characterization and evaluation of irrigation water demands (agricultural and golf course).

Streamflow is measured by the United States Geological Survey (USGS) at 19 locations within the Indio Subbasin. Surface water diversions by DWA from Snow, Falls, Whitewater, and Chino watersheds are measured by DWA. Streamflow data are compiled annually to support tracking of basin conditions as part of the Indio Subbasin Annual Reports.

Subsidence is documented in a recently completed comprehensive USGS report of findings (Sneed and Brandt, 2020). The USGS, in cooperation with the GSAs, continues to study land subsidence in the Coachella Valley through the USGS land-subsidence monitoring network, which currently includes 24 stations. InSAR (Interferometric Synthetic Aperture Radar) data are also available that use radar images from satellites to provide broad spatial mapping of vertical displacement of the land surface.

Groundwater Elevations are available for selected wells in the Indio Subbasin dating back to 1910. Over 345 wells are currently monitored by the GSAs as part of their respective groundwater level monitoring programs. The data are used to characterize Subbasin conditions, evaluate pumping and recharge operations, and support groundwater modeling and model calibration. As part of this *Alternative Plan Update*, 57 Key Wells were selected to assess sustainability in the Indio Subbasin.

Surface Water and Groundwater Quality monitoring is performed by multiple agencies in the Plan Area. For example, water purveyors are required by State law to monitor and report the quality of their water sources. These data are publicly available on the SWRCB's Groundwater Ambient Monitoring and Assessment Program (GAMA) website. In addition, Tribes monitor the quality of their wells and maintain records; not all these data are publicly available.

Groundwater Pumping is recognized as critical to Subbasin management. Accordingly, Division 2 Part 5 of the California Water Code requires each person (i.e., well owner/operator) within the counties of Riverside, San Bernardino, Los Angeles, and Ventura extracting more than 25 AFY of groundwater to file a "Notice of Extraction and Diversion of Water" with the SWRCB. In addition, the enabling legislation of CVWD and DWA respectively require that all production subject to replenishment assessment be reported monthly. The reporting threshold for pumpers (designated minimal producers) within the CVWD boundary is 25 AFY, while the threshold for DWA is 10 AFY; 550 wells are metered.

Drain Flows and the CVSC receive intercepted shallow groundwater from agricultural areas and convey the flow to the Salton Sea. A USGS gage station measures flow in the lower CVSC near the Salton Sea, while CVWD measures drain flows at 27 sites on a monthly basis. The CVSC and drain system also receive flows from CVWD's irrigation system in excess of requested deliveries (regulatory water), treated wastewater, and fish farm effluent. The drain flow data are used in tracking groundwater outflow and in calibrating the numerical groundwater flow model.

ES.11 Projects and Management Actions

A variety of projects and management actions (PMAs) are planned for implementation over the planning horizon (to 2045) to achieve sustainability in the Subbasin. Projects were identified by the GSAs through a several-month process involving the GSAs, the general public, and interested stakeholders. Project information was compiled into a draft list that was discussed and presented during the SGMA Tribal Workgroup and Public Workshops held on March 3, 2020. The project selection process included review and input from the GSAs and stakeholders, which was used to refine the project list for inclusion in the Plan. This project list was created based on priorities identified by the GSAs and stakeholders.

The *Alternative Plan Update* includes a final list, shown in Figure ES-10**,** of 30 possible PMAs representing a wide variety of activities by the four GSAs. Projects are classified into four categories based on project benefits: water conservation, water supply development, source substitution and replenishment, and water quality protection.

Figure ES-10: Categorized Projects and Management Actions

Water Conservation

- PMA 1: Urban Water Conservation
- PMA 2: Golf Water Conservation
- PMA 3: Agricultural Water Conservation

Water Supply Development

- PMA 4: Increased Surface Water Diversion
- PMA 5: Delta Conveyance Facility
- PMA 6: Lake Perris Seepage
- PMA 7: Sites Reservoir
- PMA 8: Future Supplemental Water Acquisitions
- PMA 9: EVRA Potable Reuse

Source Substitution & Replenishment

- PMA 10: Mid-Valley Pipeline Direct Customers
- PMA 11: Mid-Canal Storage Project
- PMA 12: East Golf Expansion
- PMA 13: Oasis Distribution System
- PMA 14: WRP-10 Recycled Water Delivery
- PMA 15: Tertiary Expansion
- PMA 16: Canal Water Pump Station Upgrade
- PMA 17: WRP-7 Recycled Water Delivery
- PMA 18: WRP-4 Tertiary Expansion & Delivery
- PMA 19: DWA WRP Recycled Water Delivery
- PMA 20: PD-GRF Phase 2 Expansion
- PMA 21: TEL-GRF Expansion
- PMA 22: WWR-GRF Operation

Water Quality Protection

- PMA 23: Eliminate Wastewater Percolation
- PMA 24: Wellhead Treatment
- PMA 25: Small Water System Consolidations
- PMA 26: Septic to Sewer Conversions
- PMA 27: Implement CV-SNMP Groundwater Monitoring Program Workplan
- PMA 28: Implement CV-SNMP Development Workplan
- PMA 29: Colorado River Salinity Forum
- PMA 30: Source Water Protection

ES.12 Plan Evaluation and Implementation

This *Alternative Plan Update* describes the planning process for achieving a reliable and sustainable water supply. Using an adaptive management process, the GSAs can adjust project implementation if monitoring shows that water demands and supplies are higher or lower than projected or if tracking of groundwater levels indicates that undesirable results (including storage depletion and subsidence) could occur in the foreseeable future.

While overdraft has been reversed in terms of chronic groundwater level declines, storage depletion, subsidence, and seawater intrusion, the GSAs still face uncertainties in terms of forecasted demands and water supply availability. Accordingly, the *Alternative Plan Update* has focused on securing water reliability and resilience, namely the ability to provide consistent water supply and to respond to changing future conditions. Water supply reliability in the Indio Subbasin is the GSAs' ability to consistently provide adequate water supply to meet projected demands, both for groundwater replenishment and direct delivery, while sustainably managing the Subbasin. To maintain water reliability and resilience through the planning horizon, the GSAs established the following priorities (in no particular order) for use in selection of PMAs:

- Fully use available Colorado River water supplies
- Support improvement of the long-term reliability of SWP supplies, including participation in the Delta Conveyance Facility (DCF)
- Continue developing recycled water as a reliable local water supply
- Implement source substitution and replenishment for resilience in response to changing conditions and for maintenance of long-term groundwater supply reliability
- Increase water-use efficiency across all sectors
- Participate in development of the Coachella Valley Salt and Nutrient Management Plan (CV-SNMP) to address salt and nutrient management in the Indio Subbasin.

The Indio Subbasin GSAs are working collaboratively to implement the *Alternative Plan Update* and ensure the sustainability of the Indio Subbasin. This includes implementing PMAs as well as ongoing Plan implementation and administrative activities. Alternative Plan implementation includes the program management, tribal coordination, public outreach, ongoing data collection and monitoring, monitoring network improvements, and funding activities necessary to implement this Plan. Chapter 12 summarizes the timeline for each of these implementation activities.

GSA operations and Plan implementation will incur costs, which will require funding by the GSAs. The activities associated with Subbasin-wide management and Plan implementation will be borne by the four GSAs. Some activities (such as the Annual Reports and 5-Year Plan Updates) will be funded under the cost-sharing arrangement established by the Memorandum of Understanding signed in 2016, along with multiple supplements. Other management activities will be funded by individual GSAs or through other cost-sharing agreements or amendment to the MOU. Projects will be administered by the GSA project proponents. GSAs may elect to implement projects individually or jointly with one or more GSAs.

The overarching goal of the *Alternative Plan Update* is to reliably meet current and future water demands in a cost-effective and sustainable manner. Implementation of the original *2002 CVWMP* and *2010 CVWMP Update* has achieved that overarching goal. With the passage of SGMA in 2014, the GSAs are addressing the sustainability indicators established in the legislation. This *Alternative Plan Update* establishes the groundwater conditions and hydrogeological conceptual model for the Indio Subbasin, forecasts water demands through the planning horizon, describes water supplies available to the GSAs, defines sustainable management for this region, presents water management projects and programs to ensure Subbasin sustainability, and models the simulated conditions that would result from implementation of those project portfolios. This planning process has demonstrated that with the proposed projects identified in this Plan, and despite anticipated climate changes, the Indio GSAs are able to meet forecasted demands under a variety of conditions and maintain the Indio Subbasin in balance, even increasing groundwater storage over time. Subsidence and saltwater intrusion have been stopped and are not anticipated to occur during Plan implementation.

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CHAPTER 1: INTRODUCTION

Groundwater is a critical resource for the sustainability of Coachella Valley communities, agriculture, economic activities, environmental benefits, and other beneficial uses. The Indio Subbasin (one of four subbasins of the Coachella Valley Groundwater Basin) provides groundwater supply and a vast groundwater storage capacity with the natural ability to convey water—through groundwater flow—from areas of recharge to wells where water is pumped. Since the early 1900s, the Indio Subbasin has been actively managed to address increasing water demands (with pumping for agricultural, urban, and rural demands), beginning with capture of local stormwater to supplement the limited natural groundwater replenishment and later implementing water importation (since 1949) and source substitution projects. This has been a dynamic process with periods of groundwater depletion followed by recovery. Groundwater levels and storage reached historical lows in about 2009, but this overdraft has been stopped and replaced with increased groundwater storage as a result of active water management planning and projects. In addition, local agencies have recognized the multi-faceted nature of groundwater issues (including subsidence, water quality, seawater intrusion, and potential impacts on environmental uses) and have developed relevant management plans, programs, and projects, including the 2002 *Coachella Valley Final Water Management Plan (2002 CVWMP)* for the Indio Subbasin (Coachella Valley Water District [CVWD], 2002a) and the *Coachella Valley Water Management Plan 2010 Update (2010 CVWMP Update)* (CVWD, 2012a).

In 2014, the California Legislature enacted the Sustainable Groundwater Management Act (SGMA) to provide a framework for sustainable groundwater management. SGMA defines sustainable management as the use and management of groundwater in a manner that can be maintained without causing overdraft or *undesirable results*, defined in terms of chronic lowering of groundwater levels, depletion of groundwater storage, seawater intrusion, land subsidence, degraded water quality, and depletion of interconnected surface water with adverse impacts on beneficial uses of the surface water.

SGMA promotes local management of groundwater resources in basins that it has designated as high or medium priority. DWR designated Indio Subbasin as a medium-priority basin. Lower priority basins are not required to comply with SGMA. To implement SGMA, local authorities have formed Groundwater Sustainability Agencies (GSAs) to manage the high- and medium-priority basins and to develop, submit, and implement Groundwater Sustainability Plans (GSPs) to manage local groundwater for long-term sustainability. For basins—such as Indio Subbasin—with established groundwater management, GSAs were empowered to submit Alternative Plans for GSP compliance.

Four local water agencies—Coachella Valley Water District (CVWD), Coachella Water Authority (CWA), Desert Water Agency (DWA), and Indio Water Authority (IWA)—manage groundwater in the Indio Subbasin in compliance with SGMA. These agencies have been designated as *Exclusive* GSAs over their respective areas and are referred to as the Indio Subbasin GSAs.

On December 29, 2016, the Indio Subbasin GSAs submitted to the California Department of Water Resources (DWR) the *2010 CVWMP Update* (CVWD, 2012a), accompanied by a Bridge Document (Indio Subbasin GSAs, 2016), as an Alternative Plan to a GSP for the Indio Subbasin. The following additional documents were submitted as part of the Alternative Plan to document the ongoing commitment of the Indio Subbasin GSAs to continued assessment of plan assumptions, associated environmental impacts, and implementation status.

- *Program Environmental Impact Report (EIR) CVWMP and State Water Project (SWP) Entitlement Transfer* (CVWD, 2002b)
- *Subsequent Program EIR* for the *2010 CVWMP Update* (CVWD, 2012b)
- *2014 Status Report on the 2010 CVWMP Update* (CVWD and MWH, 2014)
- Annual Engineer's Reports on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit, West Whitewater River Subbasin Area of Benefit, and East Whitewater River Subbasin Area of Benefit (CVWD)
- Annual Engineer's Reports Groundwater Replenishment and Assessment Program for the Whitewater River, Mission Creek, and Garnet Hill Subbasins (DWA)

On July 17, 2019, DWR approved the *2010 CVWMP Update* as an Alternative Plan. In compliance with SGMA, the GSAs have prepared Annual Reports,[1] which can be found on the program website (www.IndioSubbasinSGMA.org). SGMA also requires plan updates every 5 years; this *Indio Subbasin Water Management Plan Update* (*Alternative Plan Update*) fulfills that requirement.

1.1 Background for *Alternative Plan Update*

1.1.1 Indio Subbasin

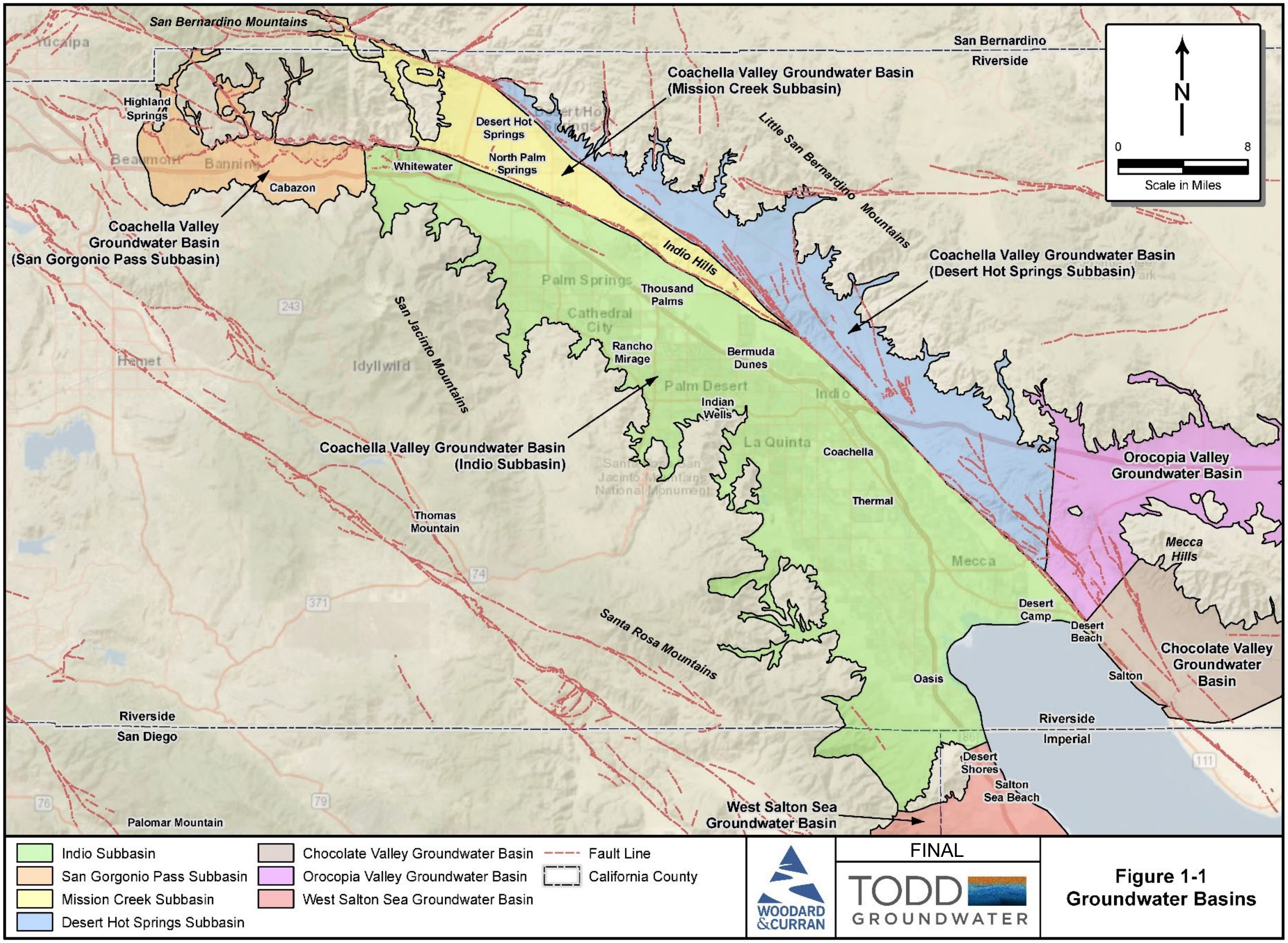
The Indio Subbasin is one of four subbasins of the Coachella Valley Groundwater Basin (Figure 1-1). The three neighboring subbasins include the San Gorgonio Pass Subbasin to the west, Mission Creek Subbasin to the north, and Desert Hot Springs Subbasin to the north/northeast. DWR designated the Indio Subbasin as medium priority, as it did the Mission Creek Subbasin and the San Gorgonio Pass Subbasin. DWR designated the Desert Hot Springs Subbasin as very low priority.

The Indio Subbasin, encompassing 525 square miles of the Coachella Valley Groundwater Basin, is bounded on its northern, northwestern, and southwestern margins by uplifted bedrock and on the south by the Salton Sea. The Indio Subbasin is filled with sediments, deposited mostly by the Whitewater River and its tributaries, that include mostly sand and gravel sequences on the north with increasingly thick layers of silt and clay on the south. These sediments are as much as 12,000 feet in thickness with the upper 2,000 feet representing substantial groundwater storage and the primary source of groundwater supply.

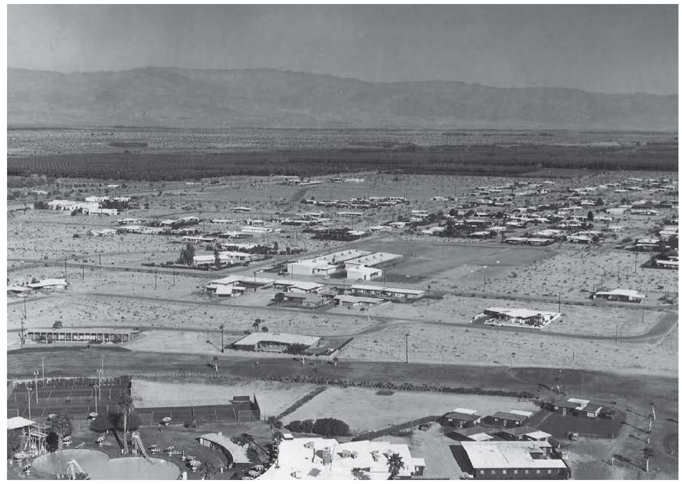
Situated in an arid area with limited sources of natural recharge, the groundwater basin currently receives most of its inflow from groundwater replenishment facilities and from agricultural and urban return flows. Groundwater flow generally is from northwest to southeast. Discharge from the Indio Subbasin occurs mostly through pumping wells, evapotranspiration (ET), outflows from agricultural drainage facilities to the Salton Sea, and subsurface groundwater outflows to the Salton Sea. Groundwater historically has been and currently is used for multiple beneficial uses including agricultural, rural domestic, municipal, golf course, and environmental purposes.

[1] Each Annual Report is submitted to DWR by April 1 and documents conditions for the preceding year. For example, the first annual report submitted April 1, 2018, documented conditions for water year (WY) 2016-17. Subsequent annual reports in 2019, 2020, and 2021 have documented conditions for WY 2017-18, 2018-19, and 2019-20, respectively.

Figure 1-1. Groundwater Basins



1.1.2 Historical Water Management Planning



Early development in Coachella Valley included agricultural, urban, and rural land uses.

The Coachella Valley has a long history of agricultural and resort-oriented municipal development, in which the groundwater resources of the Indio Subbasin have played a central role. While natural recharge in this arid area is limited, the groundwater basin provides vast groundwater storage capacity and the natural ability to convey water—through groundwater flow—from areas of recharge to production wells.

Since the early 1900s, local water management has addressed increasing water demands (agricultural, urban, and rural) by supplementing the limited natural recharge with multiple projects. These have involved conducting replenishment operations along the Whitewater River (since 1918), importing Colorado River water (1949), contracting for State Water Project (SWP) supplies (1962/1963), implementing water recycling, instituting water conservation, and other activities. Throughout the history of developing water supplies to meet demands, the groundwater basin has provided groundwater from storage for periods when demands have exceeded available supplies. In general, groundwater levels (and storage) declined until Colorado River water import in 1949 provided a substitute for groundwater pumping for agriculture in the East Valley and groundwater levels subsequently increased. In 1973, artificial recharge of imported water from the Colorado River Aqueduct (SWP exchange water) began at the Whitewater River Groundwater Replenishment Facility (WWR-GRF), helping to increase and stabilize groundwater levels. However, the period from the early 1980s to the late 2000s was characterized by increased municipal development leading to chronic groundwater level declines, groundwater storage depletion, and demand exceeding available supply. Groundwater in storage in the Indio Subbasin reached its minimum in 2009, coinciding with historical groundwater level lows throughout much of the Subbasin. Groundwater levels have since increased or at least stabilized. This reflects the cumulative effect of active water management planning and projects, as described in the next section.

Construction of the Coachella Canal began in the 1930s.

1.1.3 2002 Coachella Valley Water Management Plan

The *2002 CVWMP* (CVWD, 2002a) and the *2010 CVWMP Update* (CVWD, 2012a) have been critical to addressing overdraft in the Indio Subbasin. These plans were based on the 1992 Groundwater Management Planning Act (now superseded by SGMA).

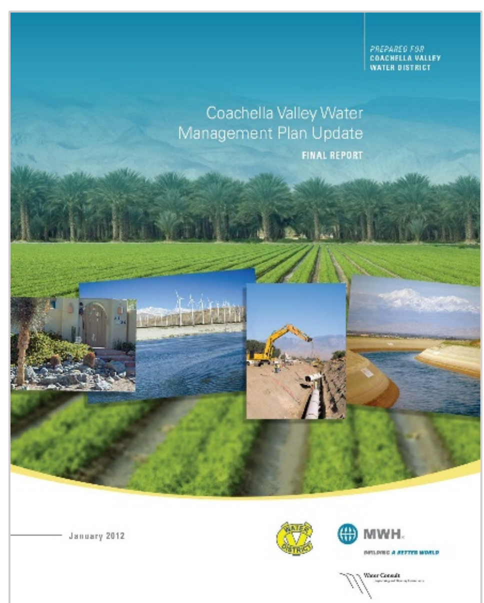
CVWD began development of the *2002 CVWMP* (CVWD, 2002a) in 1994 with the general goal of providing adequate quantities of safe, high-quality water at the lowest cost to local water users. The *2002 CVWMP* identified the groundwater overdraft that had occurred and the threat of continued overdraft, based on projections of growth and water demand. The primary objective was to eliminate overdraft and associated adverse impacts including basin storage depletion, declining groundwater levels, subsidence, and water quality degradation. Additional objectives were to maximize conjunctive use opportunities, to minimize adverse economic impacts to water users, and to minimize environmental impacts. These objectives were used as criteria to evaluate four alternatives and select a preferred alternative. The selected alternative, which was subsequently implemented, involved a combination of water conservation (municipal, agricultural, and golf course), increased water importation, increased groundwater recharge including new facilities, and source substitution, which is the delivery of an alternate surface water supply in lieu of pumping groundwater.

1.1.4 2010 Coachella Valley Water Management Plan Update

The *2010 CVWMP Update* was prepared to respond to changes affecting water supplies, water demands, and evolving federal and state laws and regulations. Significant changes perceived at the time included local population growth and land use changes, and external factors including fluctuations in SWP allocation due to Bay-Delta restrictions, uncertainty of future Colorado River supplies as the Quantification Settlement Agreement (QSA) was negotiated and litigated, and climate change affecting not only local water demand, but also supplies from the Sierra Nevada and Colorado River watershed.

The *2010 CVWMP Update* objectives were stated as follows:

1. Meet current and future water demands with a 10 percent supply buffer.
2. Eliminate long-term groundwater overdraft.
3. Manage and protect water quality.
4. Comply with state and federal laws and regulations.
5. Manage future costs.
6. Minimize adverse environmental impacts.



2010 Coachella Valley Water Management Plan Update

Each objective was defined to contribute to improved water supply reliability for the Coachella Valley by ensuring adequate supplies to meet current and future demands, eliminating the long-term depletion of groundwater storage, and protecting basin water quality. Accordingly, the *2010 CVWMP Update* addressed future land use development, potential reductions in imported water supply reliability, climate change, water quality issues and changing regulations, subsidence, water conservation, and other issues. It also included an update and application of a numerical groundwater flow model. Most importantly, it described projects and management actions for implementation. Environmental review of projects was provided in the *Subsequent Program EIR* for the *2010 CVWMP Update* (CVWD, 2012b).

To initiate this *Alternative Plan Update*, the *2010 CVWMP Update* was reviewed in terms of its water demand projections relative to actual demands between 2010 and 2019, water supply projections relative to actual supply, status of implementation, and suitability of the numerical model for additional update and improvement (see Todd Groundwater and Woodard & Curran, 2020 in Appendix 1-A). Key findings concerning water demand and supply include the following:

- The *2010 CVWMP Update* projected a 40 percent growth in population from 2010 to 2020, reflecting trends at the time. Actual population within a similar timeframe (2010-2019) was only 10 percent.
- Since the *2010 CVWMP Update*, actual demands (for urban, golf course, agricultural and other uses) have been on average 150,000 acre-feet per year (AFY) lower than projected.
- Since the *2010 CVWMP Update*, actual supplies served to users have been lower than projected due to lower water demands throughout the region. Simply put, more groundwater has been put into or remained in storage.

Implementation of projects described in the *2010 CVWMP Update* included the following:

- **Water conservation:** The GSAs implemented water conservation programs for both large irrigation customers and residential customers.
- **New supply development:** As part of the QSA, CVWD's Colorado River allocation through the Coachella Canal will increase to 424,000 AFY by 2026 and remain at that level until 2047, decreasing to 421,000 AFY until 2077, when the agreement terminates. This allocation is supplemented with 35,000 AFY secured by CVWD as a SWP transfer from Metropolitan Water District of Southern California (MWD). CVWD and DWA have actively participated in statewide programs to improve the long-term reliability of SWP supply and to secure additional supplies.
- **Source substitution:** Golf courses connected to the Coachella Canal distribution system in the East Valley now meet most of their total water use with Coachella Canal water. Improvements continue to the Mid Valley Pipeline, which helps deliver non-potable water (including Coachella Canal water and recycled water) to West Valley golf courses.
- **Groundwater recharge:** WWR-GRF and Thomas E. Levy Groundwater Replenishment Facility (TEL-GRF) continue to replenish the Indio Subbasin with SWP exchange water and Colorado River water. In 2019, Palm Desert Groundwater Replenishment Facility (PD--GRF) began replenishing the mid-valley area of the basin with Colorado River supplies.
- **Water quality protection:** The Indio Subbasin GSAs and other local agencies are developing an updated Salt and Nutrient Management Plan (SNMP). GSAs have implemented additional water quality programs including operating wellhead treatment facilities to address elevated arsenic in local wells and implementing well abandonment policies.

Evaluation of the model in terms of additional update and improvement indicated the following:

- The original 1936-1999 regional model was well calibrated to measure groundwater elevation and water budget trends across the basin.

- Reassessment of the *2010 CVWMP Update* model regarding its simulation of measured data for the period 1997-2019 indicated that the model accurately reproduces actual groundwater elevations and trends.

Evaluation of the 2010 model indicated that most of the model recharge and discharge input data for the period 1997-2008 should be retained, and the simulation period 2009-2019 was updated with actual data and improved estimates. This *Alternative Plan Update* included update of model inputs and model performance reassessment prior to conducting predictive management scenario simulations.

1.1.5 SGMA and Alternative Plan Development

SGMA affords GSAs a 20-year timeframe to implement a GSP or Alternative Plan. SGMA confirms existing authorities and powers of GSAs and provides tools for GSAs to monitor and manage groundwater levels and quality, land subsidence, and changes in surface water flow or quality affecting groundwater levels or quality. SGMA also establishes authority for GSAs to require well registration and reporting of annual groundwater extractions and surface water diversions for subsurface storage. Additionally, GSAs have authority to impose limits on groundwater extractions from individual wells, assess fees to implement local GSPs (and Alternative Plans), and request revisions of basin boundaries and create new subbasins. As stated in SGMA (§10728.6), CEQA is not applicable to Plan preparation and adoption. However, it is applicable to a project that would be implemented as an action pursuant to this Plan Update, noting that projects included in the *2010 CVWMP Update* have been addressed in the *Subsequent Program EIR* (CVWD, 2012b).

In December 2016, CVWD, CWA, DWA, and IWA submitted a *SGMA Alternative Groundwater Sustainability Plan Bridge Document for the Indio Subbasin* (*Bridge Document*) (Indio Subbasin GSAs, 2016), which included submittal of the *2010 CVWMP Update*. The *Bridge Document* explained to DWR how the *2010 CVWMP Update* was functionally equivalent to the requirements for a GSP and meets the requirements of SGMA.

The *Bridge Document* submitted to DWR identified the following water management elements for implementation:

- Water conservation measures
- Acquisition of additional water supplies
- Conjunctive use programs to maximize supply reliability
- Source substitution programs
- Groundwater recharge programs
- Water quality protection measures
- Other management activities

In its review and subsequent approval of the *Bridge Document*, DWR provided an *Alternative Assessment Staff Report* (DWR, 2019) for the Indio Subbasin. This DWR Assessment summarized the principles of its review, the materials submitted as the Alternative Plan, and the required conditions for approval. The DWR Assessment also provided detailed description and evaluation of the Alternative Plan contents as a functional equivalent to a GSP. Lastly, the DWR Assessment presented seven recommendations for improvements to be included in the first 5-year update of the Alternative Plan.

1.1.6 Approach to *Alternative Plan Update*

DWR approved the Alternative Plan for the Indio Subbasin, concluding that:

> …technical information in the 2002 and 2010 [CVWMPs] and related documents demonstrate a detailed understanding of the geology and hydrology of the Subbasin, the direct and indirect adverse effects of past groundwater management practices that led to overdraft conditions, and that the Agencies have demonstrated a commitment to eliminating overdraft to stop those adverse effects and to prevent them from occurring in the future. The Alternative quantifies objectives for sustainable management and for correcting groundwater problems and contains a robust set of plans and management actions designed to eliminate overdraft and associated adverse impacts to groundwater conditions. Department staff find the Agencies have set forth a reasonable and feasible approach to eliminating overdraft, which will, in turn, have a beneficial effect to the overall groundwater conditions in the Indio Subbasin, sufficient to avoid undesirable results.

While noting that the Alternative Plan elements are functionally equivalent to GSP elements, DWR also provided seven recommendations to be addressed in this *Alternative Plan Update*, which would facilitate DWR's ongoing evaluation and determination of whether implementation of the Alternative Plan is achieving the sustainability goal. The GSAs recognize and incorporate applicable and useful elements of the SGMA framework and GSP preparation process. This *Alternative Plan Update* document generally follows the sequence and elements of a GSP (as provided in Article 5 of the GSP Regulations) but also provides chapters on water supplies, water demands, and regulatory and policy issues. These additional topics were provided in the *2010 CVWMP Update* and are recognized as fundamental to local water management. In preparing this *Alternative Plan Update*, the DWR evaluation and recommendations have been carefully considered and addressed, consistent with local adaptive management. Responses to DWR evaluation and recommendations are incorporated as appropriate throughout this *Alternative Plan Update* and addressed specifically in Chapter 9, *Sustainable Management*.

This *Alternative Plan Update* was built on the *2010 CVWMP Update* and continues implementation of its projects and management actions, with some refinements and deferrals based on Subbasin conditions. In the context of reversing historical overdraft conditions in the Subbasin, this *Alternative Plan Update* has been developed to provide documentation of groundwater conditions and a comprehensive and detailed update of the water supply analysis, demand forecast, and scenario evaluation (to account for climate change) using the groundwater model. This update also acknowledges and incorporates the Coachella Valley Salt and Nutrient Management Plan (CV-SNMP) effort that has recently been initiated.

1.2 Plan Goals and Objectives

The basic goal of this *Alternative Plan Update* remains the same as the prior iterations of the CVWMP:

- *To reliably meet current and future water demands in a cost-effective and sustainable manner.*

During the planning process, and to align with SGMA, the GSAs also established a sustainability goal (see Chapter 9, *Sustainable Management* for more detail):

- *To maintain a locally managed, economically viable, sustainable groundwater resource for existing and future beneficial uses in the Indio Subbasin by managing groundwater to avoid the occurrence of undesirable results.*

The underlying Plan objectives were also refined from the *2010 CVWMP Update* to reflect the water supply uncertainties facing the Indio Subbasin:

1. Meet current and future municipal water demands with a ten percent supply buffer
2. Avoid chronic groundwater overdraft
3. Manage and protect water quality
4. Collaborate with tribes, state, and federal agencies on shared objectives
5. Manage future costs
6. Minimize adverse environmental impacts
7. Reduce vulnerability to climate change and drought impacts

1.3 GSA Governance

The GSAs responsible for managing the Indio Subbasin in compliance with the SGMA are listed in Table 1-1 and include the following:

Coachella Valley Water District (CVWD) is a public agency of the State of California organized and operating under the County Water District Law, California Water Code section 30000, et seq, and Coachella Valley Water District Merger Law, Water Code section 33100, et seq. CVWD has groundwater management powers across a portion of the Indio Subbasin and manages replenishment assessment programs under Water Code section 31630-31639. CVWD is governed by a board of five directors, elected by district voters to 4--year terms.

Coachella Water Authority (CWA) is a joint powers authority formed as a component of the City of Coachella and the Housing Authority of the City of Coachella and has statutory authority over water supply.

Desert Water Agency (DWA) is one of the statutorily named, exclusive local agencies given the power to comply with SGMA (Section 10723(c)(1)). DWA is an independent special district created by an act of the State Legislature as set for in Chapter 100 of the appendix to the California Water Code. DWA has groundwater management powers across a portion of Indio Subbasin and manages a replenishment assessment program in addition to provision of retail water service to a portion of its service area. DWA is led by a publicly elected, five-member Board of Directors.

Indio Water Authority (IWA) is a joint powers authority formed as a component of the City of Indio and Housing Authority of the City of Indio and has statutory authority over water supply.

CVWD, CWA, DWA, and IWA each successfully filed a Notice of Election to become exclusive GSAs within their respective jurisdictional areas in the Indio Subbasin.

CVWD has served as the Plan manager for this *Alternative Plan Update*, led by Zoe Rodriguez del Rey, Water Resources Manager, zrodriguezdelrey@cvwd.org.

Table 1-1. Indio Subbasin Groundwater Sustainability Agencies

Name and Address of GSA	Contact with Plan Implementation Authority
Coachella Valley Water District 75525 Hovley Ln E Palm Desert, CA 92211	Jim Barrett jbarrett@cvwd.org
Coachella Water Authority 53-462 Enterprise Way Coachella, CA 92236	Castulo Estrada cestrada@coachella.org
Desert Water Agency 1200 S Gene Autry Trail Palm Springs, CA 92264	Mark Krause mkrause@dwa.org
Indio Water Authority 83101 Avenue 45 Indio, CA 92201	Reymundo Trejo rtrejo@indio.org

1.4 Relationship to Other Planning Efforts

This *Alternative Plan Update* builds on a history of regional collaboration on water management planning and implementation. The GSAs have coordinated and shared information with each of the following planning efforts described below.

1.4.1 Mission Creek Subbasin Alternative Plan Update

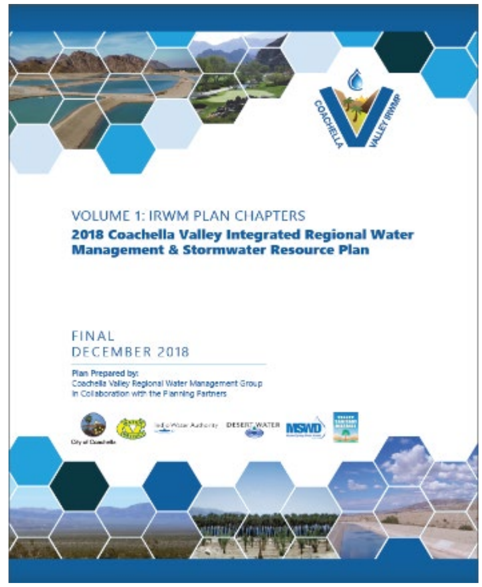
The Mission Creek Subbasin of the Coachella Valley Groundwater Basin is coordinated by a management committee made up of: CVWD, DWA, and Mission Springs Water District (MSWD). CVWD and MSWD have public water systems that rely on groundwater from the Mission Creek Subbasin. CVWD and DWA are GSAs with groundwater replenishment authority for this region and conduct an active recharge program utilizing SWP exchange water. In December 2004, MSWD, CVWD, and DWA signed a Settlement Agreement, in which the agencies agreed to jointly prepare a water management plan for the Mission Creek and Garnet Hill Subbasins.

The *Mission Creek-Garnet Hill WMP* (CVWD et al., 2013) was completed in January 2013 and was adopted by CVWD, DWA, and MSWD. The purpose of the *Mission Creek-Garnet Hill WMP* was to manage the water resources to reliably meet demands and protect water quality in a sustainable and cost-effective manner. The General Managers of MSWD, CVWD, and DWA met regularly to discuss development of the *Mission Creek-Garnet Hill WMP* and continue to meet quarterly to discuss plan implementation and other water management issues associated with the Mission Creek Subbasin and Garnet Hill Subarea. CVWD and DWA coordinated the planning efforts to ensure consistency between the *Mission Creek-Garnet Hill WMP* and the *2010 CVWMP Update*.

Using the same approach as in Indio Subbasin, the Mission Creek management committee submitted the *Mission Creek-Garnet Hill WMP*, along with a Bridge Document (Mission Creek management committee, 2016), as an Alternative Plan to a GSP for the Mission Creek Subbasin. On July 17, 2019, DWR approved the Alternative Plan. Throughout the course of this *Alternative Plan Update*, there has been ongoing communication, coordination, and information sharing among the two planning teams.

1.4.2 Coachella Valley Integrated Regional Water Management Plan

The Coachella Valley Integrated Regional Water Management (IRWM) Program was established in 2009 by the Coachella Valley Regional Water Management Group (CVRWMG). At that time, the CVRWMG was composed of CVWD, CWA, DWA, IWA, and MSWD, but has since expanded to include Valley Sanitary District (VSD) as well. The *2018 Coachella Valley Integrated Regional Water Management & Stormwater Resources (IRWM/SWR) Plan Update* (2018 Coachella Valley IRWM/SWR Plan) (CVRWMG, 2018) serves as a combined plan that addresses the requirements of DWR's IRWM Program Guidelines and the State Water Resources Control Board's (SWRCB's) Stormwater Resource Plan Guidelines. Both State programs provide grant funding to support multi-benefit water management projects that align with the program goals of expanding water supply reliability, improving water quality, and protecting water-based natural resources. The *2018 Coachella Valley IRWM/SWR Plan* presents an integrated regional approach for addressing water management issues through a process that identifies and involves water management stakeholders from the Coachella Valley. Given that the Indio Subbasin GSAs are all CVRWMG members, this *Alternative Plan Update* was coordinated with and shared information with the IRWM program.



2018 Coachella Valley Integrated Regional Water Management & Stormwater Resources Plan

1.4.3 Urban Water Management Plan

Under the Urban Water Management Planning Act, DWR requires that urban water suppliers develop Urban Water Management Plans (UWMPs) every 5 years. In the 2015 cycle, each of the water purveyors within the Indio Subbasin prepared and submitted 2015 UWMPs. These UWMPs define their current and future water use, water use targets, sources of supply, source reliability, and existing conservation measures. The Water Conservation Act of 2009 set a goal for the State to reduce urban water use by 20 percent by the year 2020. As documented in the *2015 UWMPs*, all the GSAs surpassed their established 2015 water use targets. The *2010 CVWMP Update* and *Mission Creek/Garnet Hill Water Management Plan* (*Mission Creek/Garnet Hill WMP*) (Coachella Valley Water District [CVWD], Desert Water Agency [DWA], and Mission Springs Water District [MSWD], 2013) were used as references for development of *2015 UWMPs* within their study areas.

In the 2020 cycle, all the region's water purveyors – CVWD, CWA, DWA, IWA, MSWD, and Myoma Dunes Mutual Water Company – prepared a regional *2020 UWMP* (CVWD et al., 2021). This *2020 Regional UWMP* (RUWMP) built on the demand forecasting and supply analysis prepared for the Alternative Plan Updates for the Indio and Mission Creek Subbasins. Water supply reliability analysis and drought assessment were completed at the regional scale assuming supplies available to each water purveyor. Throughout the planning process for this *Alternative Plan Update*, the GSAs have ensured ongoing communication, coordination, and information sharing with the *2020 RUWMP* team. As documented in the *2020 RUWMP*, all the GSAs successfully surpassed their respective 20 percent by 2020 water use targets.

1.4.4 Coachella Valley Multiple Species Habitat Conservation Plan

The *Coachella Valley Multiple Species Habitat Conservation Plan* (*CVMSHCP*) (CVAG, 2016) is a multi-agency conservation plan for the entire Coachella Valley and surrounding mountains to address State and Federal Endangered Species Act (ESA) compliance in the region. The *CVMSHCP*, last amended in 2016, defines a shared regional vision for balanced growth to enhance and maintain biological diversity and ecosystem processes while also fostering economic growth. The *CVMSHCP* protects 240,000 acres of open space and 27 species; enhances infrastructure without environmental conflicts; offers opportunities for recreation, tourism, and job creation; and ensures the survival of endangered species (CVAG, 2016). The *CVMSHCP* was considered in the development of this *Alternative Plan Update*, with emphasis in the groundwater dependent ecosystem analysis.

1.4.5 Coachella Valley Salt and Nutrient Management Plan

The California Recycled Water Policy states that salts and nutrients from all sources must be managed on a basin-wide or watershed-wide basis to attain water quality objectives and protect beneficial uses. This is typically through development of a Salt and Nutrient Management Plan (SNMP).

The original 2009 Recycled Water Policy required development of a SNMP by 2014 for each groundwater basin or subbasin in California (later clarified as applicable to priority basins for the GAMA Priority Basin Project). The 2018 Recycled Water Policy amendment includes a requirement that each Regional Water Quality Control Board (RWQCB) evaluate each basin or subbasin in its region before April 8, 2021. The RWQCB is required to identify basins where salts and/or nutrients are a threat to water quality and therefore need salt and nutrient management planning to achieve water quality objectives and protect beneficial uses in the long term. These RWQCB evaluations are to be updated every 5 years.

The amended Recycled Water Policy continues to encourage collaborative development of a SNMP among SNMP groups, RWQCBs, the agricultural community, IRWM groups, water and wastewater agencies, other salt and nutrient contributors, stakeholders, and now, GSAs.

In 2015, CVWD, DWA, and IWA created an SNMP for the Coachella Valley Groundwater Basin (CVWD, et al., 2015). Subsequently, the RWQCB provided comments and recommendations on the 2015 SNMP's compliance with the updated Recycled Water Policy (Colorado River Basin RWQCB, 2020). In response, a process to update the Coachella Valley SNMP (CV-SNMP) was begun in 2020 with development of a CV-SNMP Groundwater Monitoring Program Workplan that the RWQCB approved in February 2021. The CV-SNMP process also included preparation of a CV-SNMP Development Workplan, approved by the RWQCB in October 2021, that describes a detailed scope of work for update of the CV-SNMP through a collaborative process between the water and wastewater agencies, RWQCB, and other stakeholders.

1.5 Notice and Communication

This *Alternative Plan Update* has been developed with input from all five tribes located within the Indio Subbasin, stakeholders, and members of the public. The GSAs established a program website (www.IndioSubbasinSGMA.org), initiated regular stakeholder communications, provided program updates, and solicited input at public workshops and tribal workgroups.

1.5.1 Participating Agencies and Coordination

The four GSAs—CVWD, CWA, DWA, and IWA—led all stakeholder outreach and communications in accordance with a Communications Plan that was developed at program outset (see Appendix 1-B). The Communications Plan contains outreach strategies and methods to address effective communication with stakeholders during development of the *Alternative Plan Update*, including building trust between and among the GSAs and property owners/residents, disadvantaged communities, tribes, agricultural interests, and environmental interests. In response to tribal feedback, the GSAs held separate tribal engagement meetings.

1.5.2 GSAs Decision Making Process

The GSAs are the designated decision-making entities for the *Alternative Plan Update* process. On October 5, 2016, the GSAs entered into a Memorandum of Understanding (MOU) to establish an agreement for collaboration and cost-share for management of the Indio Subbasin under SGMA. Each GSA is responsible for the portion of the Indio Subbasin within their respective jurisdictional area (see Figure 2-1). The MOU establishes that its intent is to foster cooperation, coordination, and communication among the GSAs regarding management of the Indio Subbasin.

The 2016 MOU established the GSAs' intent to develop and submit the Alternative Plan to DWR. On April 3, 2018, the GSAs approved a Supplement to the MOU that outlined the GSAs' intent to prepare an Annual Report for Water Year 2017. On October 29, 2018, the GSAs approved a Second Supplement to the MOU that allowed for ongoing preparation of Annual Reports by April 1 of each water year, along with preparation of a *2022 Indio Subbasin Alternative Plan Update* (see Appendix 1-C). The Second Supplement directs CVWD to serve as the managing entity for selected consultants but allows for input and review of all SGMA-related deliverables and transmittal of all data and files to each of the four GSAs.

The GSAs met monthly to discuss *Alternative Plan Update* development and implementation activities, assignments and consultant management, milestones, and ongoing work progress. The GSAs participated in all public workshops and directed outreach meetings. Public input, no matter the method received (e.g., phone, email, public meeting), was shared with all the GSAs for consideration throughout the planning process.

1.5.3 Stakeholder Involvement

Public engagement includes both stakeholder coordination and general public involvement. The goal of the public engagement effort was to understand the needs of stakeholders, increase awareness and understanding of the *Alternative Plan Update*, and promote active involvement in the process. Tribes and stakeholders with interest in water management—including agency representatives, municipalities, agricultural representatives, golf course industry representatives, Homeowners Associations, other large irrigators, environmental justice groups, and non-governmental organizations—are the primary audience for the *Alternative Plan Update*. The general public was engaged throughout the planning process to share information about the Indio Subbasin and water management decisions and solicit input to the *Alternative Plan Update*.

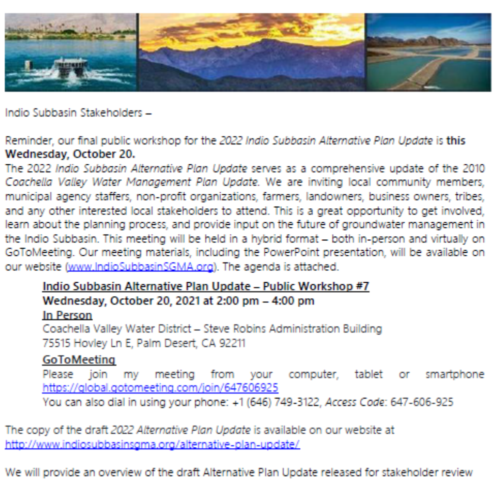
As the best way to communicate with and consider the interests of all beneficial uses and users of groundwater in the Subbasin, the GSAs established a program website (www.IndioSubbasinSGMA.org). The website provides information to stakeholders during plan development and implementation. From the website, stakeholders can sign up to receive email updates and announcements. Public workshop and meeting announcements, agendas, and materials are posted on the website in advance of each meeting.

To encourage stakeholder involvement in the planning process, the GSAs also provided outreach documents, including the program website, in both English and Spanish to accommodate the primary languages of many community members.

Indio Subbasin SGMA Website, July 2021

Additionally, a stakeholder email list was compiled and maintained throughout the planning process in order to communicate with stakeholders. Announcements were sent in English and Spanish to announce workshops or release of new planning materials. A project-specific email address was advertised and maintained to receive input and feedback from stakeholders.

The GSAs will continue using the stakeholder email list to communicate items of interest to stakeholders during Plan implementation, including upcoming workshops, release of Annual Reports, and GSA Board meetings addressing SGMA topics.



Indio Subbasin Stakeholders –

Reminder, our final public workshop for the *2022 Indio Subbasin Alternative Plan Update* is **this Wednesday, October 20.**

The 2022 *Indio Subbasin Alternative Plan Update* serves as a comprehensive update of the 2010 *Coachella Valley Water Management Plan Update*. We are inviting local community members, municipal agency staffers, non-profit organizations, farmers, landowners, business owners, tribes, and any other interested local stakeholders to attend. This is a great opportunity to get involved, learn about the planning process, and provide input on the future of groundwater management in the Indio Subbasin. This meeting will be held in a hybrid format – both in-person and virtually on GoToMeeting. Our meeting materials, including the PowerPoint presentation, will be available on our website (www.IndioSubbasinSGMA.org). The agenda is attached.

Indio Subbasin Alternative Plan Update – Public Workshop #7
Wednesday, October 20, 2021 at 2:00 pm – 4:00 pm
In Person
Coachella Valley Water District – Steve Robins Administration Building
75515 Hovley Ln E, Palm Desert, CA 92211
GoToMeeting
Please join my meeting from your computer, tablet or smartphone https://global.gotomeeting.com/join/647606925
You can also dial in using your phone: +1 (646) 749-3122, *Access Code*: 647-606-925

The copy of the draft *2022 Alternative Plan Update* is available on our website at http://www.indiosubbasinsgma.org/alternative-plan-update/

We will provide an overview of the draft Alternative Plan Update released for stakeholder review from September 27 – October 29.

Partes Interesadas de la Subcuenca de Indio –

Invitamos a miembros de la comunidad, personal de agencias municipales, organizaciones no lucrativas, agricultores, terratenientes (persona que posee tierras), propietarios de negocios, tribus, y cualquier otro grupo local interesado para que asistan al tercer taller público para la actualización del plan de alternativa de la Subcuenca de Indio del 2022 (*por 2022 Indio Subbasin Alternative Plan Update*), una actualización completa del Plan de Gestión del Agua del Valle de Coachella de 2010 (por *2010 Coachella Valley Water Management Plan Update*), el cual fue aprobado como plan de alternativa para cumplir con la Ley de Gestión Sostenible del Agua Subterránea (*por Sustainable Groundwater Management Act, SGMA*). Esta es una gran oportunidad para involucrarse, conocer del proceso de planificación, y contribuir en el futuro de la gestión del agua subterránea de la Subcuenca de Indio. Está junta se llevará a cabo en formato híbrido – en persona y virtualmente. Visite nuestra página web (www.IndioSubbasinSGMA.org) para tener acceso a los materiales de la reunión.

Actualización del plan alternativa de la Subcuenca de Indio – Taller Público #7
Miércoles, 20 de octubre de 2021 de 2:00 p.m. – 4:00 p.m.
En Persona
Edificio Administrative Steve Robbins de la Coachella Valley Water District
75515 Hovley Ln E, Palm Desert, CA 92211
Teléfono
(207) 558-4270, 316-818-074#

Una copia de la versión preliminar de la Actualización del Plan Alternativo de 2022 se encuentra en nuestra página web: http://www.indiosubbasinsgma.org/alternative-plan-update/ .

Los temas de discusión incluirán una descripción general de la Actualización del plan alternativo y se revisarán todos los capítulos.

Example of stakeholder email announcement (English on left; Spanish on right).

1.5.4 Public Workshops

Seven public workshops were held (generally on a quarterly basis) during plan development. The public workshops were intended to inform stakeholders and the general public of the *Alternative Plan Update* progress, solicit data and information to support planning and analysis for the Subbasin, and seek input on key decisions made throughout the planning process. The GSAs recognize the need for and importance of public participation and worked diligently to make sure that tribes, stakeholders, and participants were heard. While the public workshops were planned to be held at various locations within the Subbasin, most workshops were held digitally (video/phone conference) due to the COVID-19 pandemic.

Public workshops were announced through the stakeholder email list and the website. The first workshop announcement was sent approximately 30 days prior to an upcoming workshop and a reminder announcement with the agenda was sent approximately 72-hours in advance. Meeting materials (agenda and presentation) were uploaded to the website approximately 72-hours in advance of each workshop.

At public workshops, members of the public were invited to provide input and comments on *Alternative Plan Update* materials and analysis. GSAs accepted verbal comments and questions from any participant at meetings and encouraged written comments at any time during the planning process. At each public workshop, the GSA team provided an overview and update on different technical topics and asked for feedback. The workshops topics are summarized in Table 1-2 below.

Public Workshop #1 was held in February 2020.

1.5.5 SGMA Tribal Workgroup

The *Alternative Plan Update* process represents an opportunity for communication and cooperation among GSAs, tribal governments, and other interested stakeholders. Accordingly, implementation of the Communication Plan has included outreach to the following five tribes:

- Agua Caliente Band of Cahuilla Indians
- Augustine Band of Mission Indians
- Cabazon Band of Mission Indians
- Torres-Martinez Desert Cahuilla Indians
- Twenty-Nine Palms Band of Mission Indians.

Representatives of the tribal governments and Federal Bureau of Indian Affairs have participated in the *Alternative Plan Update* process through quarterly meetings of the SGMA Tribal Workgroup. The meetings have provided regular updates and opportunities for discussion and input. While the SGMA Tribal Workgroups were planned to be held in person, most meetings were held digitally (video/phone conference) due to the COVID-19 pandemic.

A tribal email list was also compiled with representatives of all five tribal governments and the Bureau of Indian Affairs. SGMA Tribal Workgroup meetings were announced through the tribal email list and the website. The first announcement was sent approximately 30 days prior to an upcoming meeting and a reminder announcement with the agenda was sent approximately 72-hours in advance. Meeting materials (agenda and presentation) were uploaded to the website approximately 72-hours in advance of each meeting.

At the SGMA Tribal Workgroup meetings, tribal representatives have been invited to provide input and comments on *Alternative Plan Update* materials and analysis. GSAs accepted verbal comments and questions from any participant at meetings and encouraged written comments following the meetings. The SGMA Workgroup discussion topics generally followed the same outline as for the public workshops (see Table 1-2 below), with some additional detail focused on tribal interests.

The GSAs will continue to coordinate and collaborate with the tribal governments through the SGMA Tribal Workgroup during implementation of the *Alternative Plan Update*.

1.5.6 List of Public Meetings Where the Alternative Plan Update was Discussed

Table 1-2 lists the schedule for *Alternative Plan Update* meetings. Meeting agendas and summaries from public meetings are provided in Appendix 1-D. Due to local and state restrictions during the COVID-19 pandemic, in-person meetings were changed to videoconferences as of March 2020.

Table 1-2. Public Meetings on the *Alternative Plan Update*

Meeting Group/Type	Meeting Date or Proposed Date	Meeting Topics
SGMA Tribal Workgroup 1	February 20, 2020	Overview of SGMA, Water Management Planning in the Indio Subbasin, Indio Subbasin *Alternative Plan Update*
Public Workshop 1	February 20, 2020	Overview of SGMA, Water Management Planning in the Indio Subbasin, Indio Subbasin *Alternative Plan Update*
SGMA Tribal Workgroup 2	May 21, 2020	*Alternative Plan Update* Status, Plan Area, Hydrogeologic Conceptual Model, 2010 Plan Assessment, Groundwater Model Assessment and Approach
Public Workshop 2	May 21, 2020	*Alternative Plan Update* Status, Plan Area, Hydrogeologic Conceptual Model, 2010 Plan Assessment, Groundwater Model Assessment and Approach
SGMA Tribal Workgroup 3	November 19, 2020	*Alternative Plan Update* Status, Plan Area, Hydrogeologic Conceptual Model, Groundwater Model Update, Demand Forecast, Supply Analysis
Public Workshop 3	November 19, 2020	*Alternative Plan Update* Status, Plan Area, Hydrogeologic Conceptual Model, Groundwater Model Update, Demand Forecast, Supply Analysis
SGMA Tribal Workgroup 4	March 13, 2021	*Alternative Plan Update* Status, Groundwater Conditions, Sustainable Management Criteria, Groundwater Model Status, Projects and Management Actions
Public Workshop 4	March 13, 2021	*Alternative Plan Update* Status, Groundwater Conditions, Sustainable Management Criteria, Groundwater Model Status, Projects and Management Actions
SGMA Tribal Workgroup 5	June 24, 2021	*Alternative Plan Update* Status, Groundwater Conditions, Sustainable Management, Groundwater Model and Plan Scenarios

Meeting Group/Type	Meeting Date or Proposed Date	Meeting Topics
Public Workshop 5	June 24, 2021	*Alternative Plan Update* Status, Groundwater Conditions, Sustainable Management, Groundwater Model and Plan Scenarios
CVWD Board of Directors Study Session	August 3, 2021	Overview of *Alternative Plan Update*
DWA Board of Directors	August 3, 2021	Overview of *Alternative Plan Update*
SGMA Tribal Workgroup 6	August 26, 2021	*Alternative Plan Update* Status, Groundwater Model, Plan Scenarios, Projects and Management Actions, Simulation Results
Public Workshop 6	August 26, 2021	*Alternative Plan Update* Status, Groundwater Model, Plan Scenarios, Projects and Management Actions, Simulation Results
SGMA Tribal Workgroup 7	October 20, 2021	Overview of *Alternative Plan Update*
Public Workshop 7	October 20, 2021	Overview of *Alternative Plan Update*
CVWD Board of Directors	December 7, 2021	Overview and adoption of *Alternative Plan Update*
CWA Board of Directors	December 8, 2021	Overview and adoption of *Alternative Plan Update*
DWA Board of Directors	December 7, 2021	Overview and adoption of *Alternative Plan Update*
IWA Board of Directors	December 15, 2021	Overview and adoption of *Alternative Plan Update*

1.5.7 Comments Received and Response Summary

Comments to the GSAs from tribal representatives, stakeholders, and the public were accepted directly via email. These comments were transferred into a tracking matrix, which was organized by applicable topic or chapter. Comments were then reviewed by the GSAs and consulting team for consideration during finalization of the *Alternative Plan Update*. The following five letters, as listed below, were received on the *Alternative Plan Update*. Responses to the comments are provided in Appendix 1-E.

1. California Department of Fish and Wildlife
2. Leadership Counsel for Justice and Accountability and Coachella Valley Waterkeeper
3. Agua Caliente Water Authority
4. La Quinta Residents for Responsible Development
5. United States Department of the Interior – Bureau of Indian Affairs

1.6 Plan Update Adoption

Each of the GSAs held a public hearing to consider adoption of the final *Alternative Plan Update*, as listed in Table 1-2 above. The adoption hearings were publicly noticed under the Brown Act for each individual GSA, as well as published collectively in *The Public Record*. Additionally, prior to each adoption hearing, an announcement with the hearing date and GSA website link was sent to the Indio Subbasin tribal and stakeholder email lists.

CHAPTER 2: PLAN AREA

This chapter describes the Indio Subbasin Alternative Plan Area (Plan Area), including its geographic, institutional, land use planning, and water resources management context.

2.1 Geographic Area

The Plan Area is based on the Indio Subbasin and the areas served by, or expected to be served by, groundwater from the Subbasin. The California Department of Water Resources (DWR), in *California's Groundwater Bulletin 118—Update 2003* (Bulletin 118) (DWR, 2003), defines the Coachella Valley Basin (known as Basin 7-021) as having four subbasins, including the Indio Subbasin (Subbasin 7-021.01). The other subbasins in this region are the Mission Creek, San Gorgonio Pass, and Desert Hot Springs Subbasins. The Indio Subbasin is identified by the U.S. Geological Survey (USGS) as the Whitewater River Subbasin. Subbasins are further described in Chapter 3, *Hydrogeologic Conceptual Model*.

As shown in Figure 2-1, the Plan Area encompasses the entire Indio Subbasin, which is part of the larger Coachella Valley Groundwater Basin, including the Garnet Hill Subarea. The Garnet Hill Subarea is included in the *2012 Mission Creek/Garnet Hill Water Management Plan* (*2012 MC/GH WMP*) (Coachella Valley Water District [CVWD], Desert Water Agency [DWA], and Mission Springs Water District [MSWD], 2013), which was developed in coordination with the *Coachella Valley Water Management Plan 2010 Update* (*2010 CVWMP Update*) (CVWD, 2012). The Garnet Hill Subarea is also included in the *2022 Mission Creek Subbasin Alternative Plan Update* (Mission Creek GSAs, 2021). Garnet Hill Subarea data collection, analysis, modeling, and planning is being coordinated to ensure consistency between this *Alternative Plan Update* and the *2022 Mission Creek Subbasin Alternative Plan*.

Figure 2-1 shows Groundwater Sustainability Agency (GSA) boundaries in the Indio Subbasin. The four GSAs have been formed by CVWD, Coachella Water Authority (CWA), DWA, and Indio Water Authority (IWA). In this *Alternative Plan Update*, these GSAs are referred to as the Indio Subbasin GSAs.

Figure 2-2 shows the incorporated areas of the nine cities that overlie the Indio Subbasin and identifies communities in the Subbasin's unincorporated areas. As indicated on both maps, the Plan Area includes portions of Riverside, San Diego, and Imperial Counties.

While encompassing the Indio Subbasin, the Plan Area also includes lands beyond the Subbasin that are, or in the future may be, reliant on groundwater pumped from the Subbasin. This includes areas to the east within the spheres of influence of the cities of Indio and Coachella that account for several proposed large developments such as Citrus Ranch, Dillon Trails, Desert Lakes, and Lomas del Sol. The Plan Area also includes areas along the western and eastern shores of the Salton Sea that are in CVWD's domestic service area (i.e., Area 23 and the former Improvement District 11) that receive groundwater from CVWD.

As shown in Figure 2-1, portions of CVWD's and DWA's boundaries are not included in the Plan Area; these include undeveloped mountainous terrain and conservation areas (shown by shading) and areas in other subbasins that do not receive water from the Indio Subbasin.

Figure 2-1. Plan Area

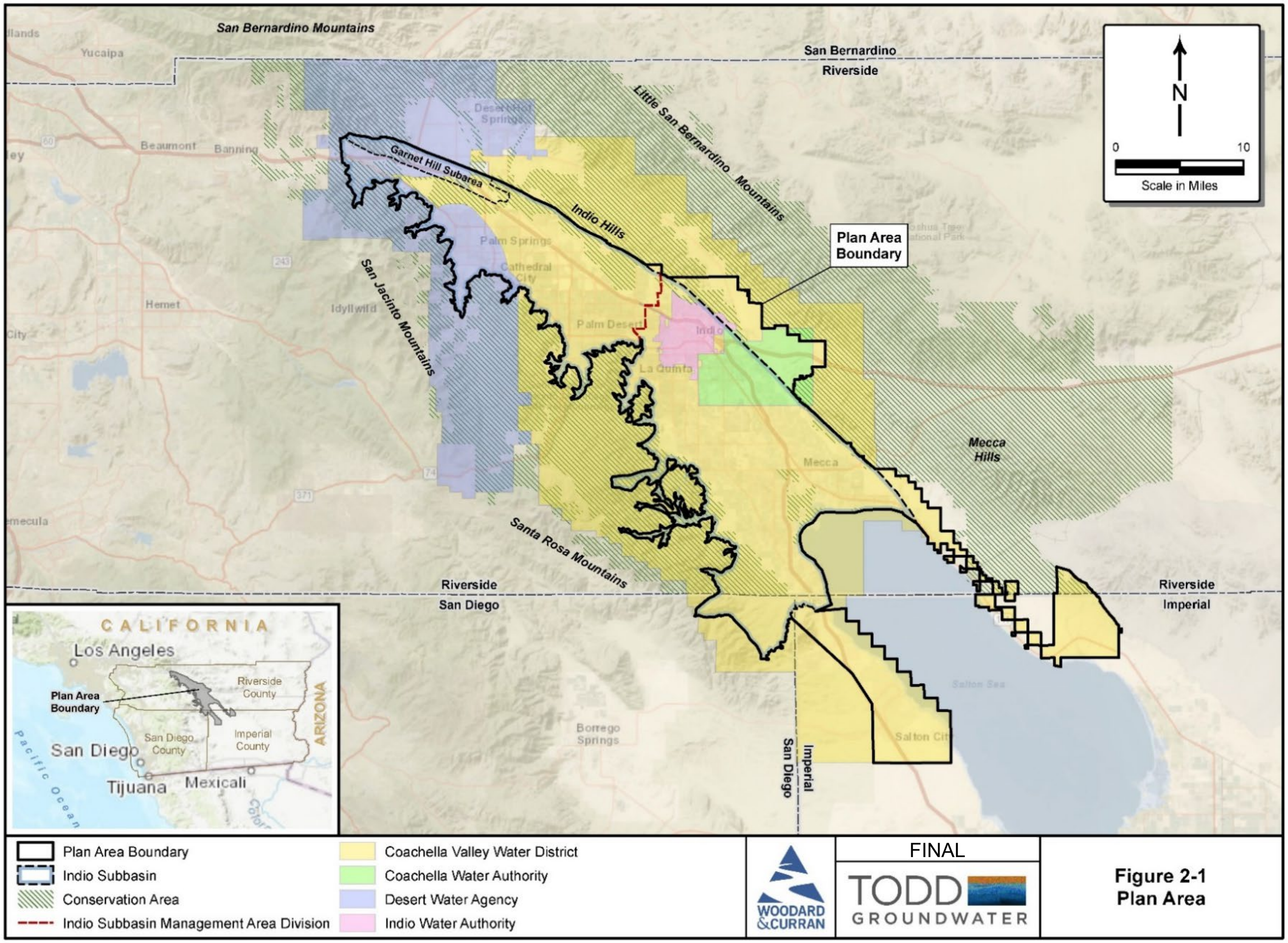
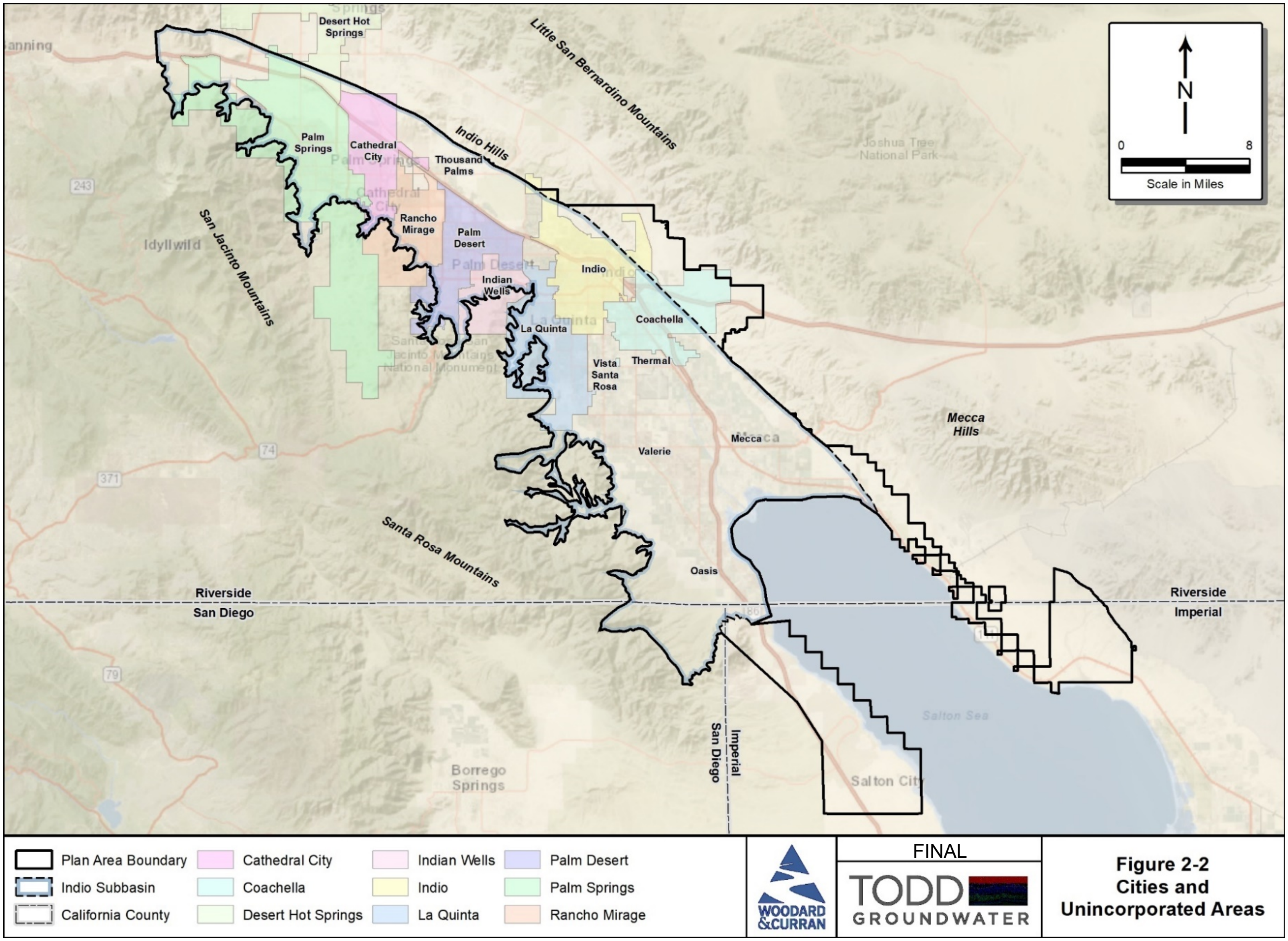


Figure 2-2. Cities and Unincorporated Areas



The Indio Subbasin is geographically divided into the West Valley and the East Valley. The West Valley, which includes the cities of Palm Springs, Cathedral City, Rancho Mirage, Indian Wells, and Palm Desert, has a predominantly resort/recreation-based economy that relies on groundwater as its principal water source. The East Valley, which includes the cities of Coachella, Indio, and La Quinta, and the communities of Mecca, Thermal, and Oasis, has a predominantly agricultural economy using groundwater and Colorado River water imported via the Coachella Canal (Canal). The East Valley is southeast of a boundary line extending from Washington Street and Point Happy northeast to the Indio Hills near Jefferson Street, and the West Valley is northwest of this line (shown in red on Figure 2-1).

2.2 Water Management and Land Use Planning Agencies

This section introduces the key water resource management agencies and shows portions of the Plan Area under the jurisdiction of water management and land use planning agencies at the local, state, and federal levels. As discussed below, some agencies have both water and land use management roles. Consistent with Sustainable Groundwater Management Act (SGMA) requirements and local management, the Indio Subbasin GSAs maintain ongoing collaborative relationships with multiple agencies at local, state, and federal levels. Cooperative efforts among water agencies have included data sharing and collaboration on water budget analyses and numerical model development for the Indio, Mission Creek, and San Gorgonio Pass Subbasins, respectively (see Figure 1-1 for Subbasin locations). Land use plans are listed in Section 2.5, *Land Use Planning*.

2.2.1 Water Agencies

As described below, the major water agencies in the Plan Area are CVWD, CWA, DWA, and IWA (refer to Figure 2-1). MSWD and Myoma Dunes Water Company (MDWC) also serve portions of the Indio Subbasin. CVWD was formed in 1918 under the County Water District Act provisions of the California Water Code. The water-related services provided by CVWD include irrigation water delivery and agricultural drainage, urban and domestic water delivery, wastewater reclamation and recycling, stormwater protection, and groundwater management achieved through replenishment, source substitution, and conservation. CVWD imports Colorado River water via the Coachella Canal (Canal) primarily for agricultural and golf course irrigation and for groundwater replenishment. CVWD is a California State Water Project (SWP) contractor and imports SWP water through an exchange of Colorado River Aqueduct (CRA) water with Metropolitan Water District (MWD). SWP exchange water is used for groundwater replenishment. CVWD operates more than 95 wells for domestic supply. It also operates five wastewater reclamation plants, two of which provide recycled water for irrigation.

CWA was established in 1957 as City of Coachella's water department. CWA is a retail water supplier that meets its demand through groundwater pumped from six CWA-owned and operated wells. The water-related services provided by Coachella include domestic water delivery, wastewater collection and reclamation, and local drainage control. Coachella also operates a secondary treatment wastewater facility.

DWA was founded in 1961 as a groundwater management agency. DWA provides domestic water delivery, irrigation water delivery, and water reuse and groundwater replenishment. DWA is a SWP contractor and imports SWP water through an exchange of CRA water with MWD for groundwater replenishment. DWA pumps groundwater from more than 25 wells for delivery to its retail customers in Cathedral City and Palm Springs. It also uses local surface water from Whitewater River and three mountain streams in its service area. DWA's local surface water is diverted to WWR-GRF subsurface storage and is recovered by means of nearby production wells. DWA receives secondary treated wastewater from Palm Springs, treats it to tertiary standards for water recycling, and delivers it to large irrigation customers, including golf courses.

IWA was formed in 2000 as a Joint Powers Authority to serve as the legislative and policy entity responsible for delivering water to Indio residents for all municipal water programs and services. IWA provides water supply to most of Indio, and some unincorporated areas of Indio Hills, operating more than 20 wells throughout its service area to meet its customers' domestic water needs.

As described above, these four water agencies are the Indio Subbasin GSAs, and together in 2016 they submitted the approved *2010 CVWMP Update* as the region's Alternative to a Groundwater Sustainability Plan (Alternative Plan) to comply with SGMA. Since then, the Indio Subbasin GSAs have been collaborating on the Alternative Plan implementation. While the Indio Subbasin GSAs also collaboratively led development of this *Alternative Plan Update*, other public agencies are also responsible for, and involved in, water and land use management both in and near the Plan Area.

The MSWD service area overlies a portion of the northernmost Indio Subbasin, including part of the Garnet Hill Subarea, which is included in the MC/GH WMP and the *2022 Mission Creek Subbasin Alternative Plan Update* (Mission Creek GSAs, 2021).

Other local water purveyors include the Myoma Dunes Water Company (MDWC), which is a retail urban water supplier serving the community of Bermuda Dunes with groundwater from five wells.

In addition, numerous small private water systems serve local communities (e.g., mobile home parks) and rural businesses.

2.2.2 Local Agencies: Cities and Counties

Figure 2-2 identifies the incorporated areas of the nine cities overlying portions of the Plan Area. As described in the preceding section, two of these cities, Coachella and Indio, have water management roles in addition to land use planning authority.

As shown in Figure 2-1 and Figure 2-2, the Plan Area overlaps Riverside, Imperial, and San Diego Counties. Riverside County encompasses most of the Plan Area, with small portions of the Plan Area in the San Diego and Imperial Counties. County governments have direct local groundwater management roles in well permitting and regulation of small water systems. Most relevant to Indio Subbasin, Riverside County has a well ordinance administered by the Riverside County Department of Environmental Health that regulates construction, reconstruction, abandonment, and destruction of wells throughout the county. The Riverside County Department of Environmental Health is also the permitting agency for small water systems.

SGMA enabled county governments to elect to become GSAs; Riverside County did not elect to become a GSA for Indio Subbasin, nor did San Diego County. San Diego County portions of the Indio Subbasin are within CVWD's boundaries. CVWD is the exclusive GSA for these areas. Imperial County elected to become GSA for all groundwater basin areas within its boundaries. Additionally, CVWD and Imperial County resolved overlap issues through a Memorandum of Understanding such that CVWD is the exclusive GSA for Indio Subbasin areas in Imperial County.

2.2.3 State and Federal Agencies

Figure 2-3 shows that large tracts of land in the Plan Area are owned and managed by state and federal governments. Areas under State jurisdiction include State Parks and State Refuges, plus California Department of Fish and Wildlife (CDFW)-owned and operated lands and conservation easements.

Federal agencies with significant lands in the Plan Area include the U.S. Department of the Interior Bureau of Land Management (BLM), the U.S. Forest Service (USFS), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Department of the Interior Bureau of Reclamation (USBR).

2.2.4 Tribal Governments

Figure 2-4 shows Tribal/Reservation boundaries for the following five Native American tribes: the Agua Caliente Band of Cahuilla Indians, the Augustine Band of Cahuilla Indians, the Cabazon Band of Mission Indians, the Torres Martinez Desert Cahuilla Indians, and the Twenty-Nine Palms Band of Mission Indians. The largest of these lands is the Agua Caliente Reservation, which covers 31,500 acres, and the Torres-Martinez Reservation that covers 24,800 acres; however, much of these Tribal/Reservation lands are located outside the Plan Area. Table 2-1 lists the acreage of Tribal/Reservation lands within the Plan Area, which totals 28,070 acres.

Table 2-1. Tribal/Reservation Lands within Plan Area

Tribe	Acres
Agua Caliente Band of Cahuilla Indians	10,184
Augustine Band of Mission Indians	649
Cabazon Band of Mission Indians	707
Torres Martinez Desert Cahuilla Indians	15,852
Twenty-Nine Palms Band of Mission Indians	678

The Agua Caliente Band of Cahuilla Indians has established the Agua Caliente Water Authority (ACWA) to regulate and administer groundwater in which the Tribe holds federally reserved water rights. ACWA has established a system of permits and fees and engages in monitoring activities.

Figure 2-3. Federal, State, and Local Government Land

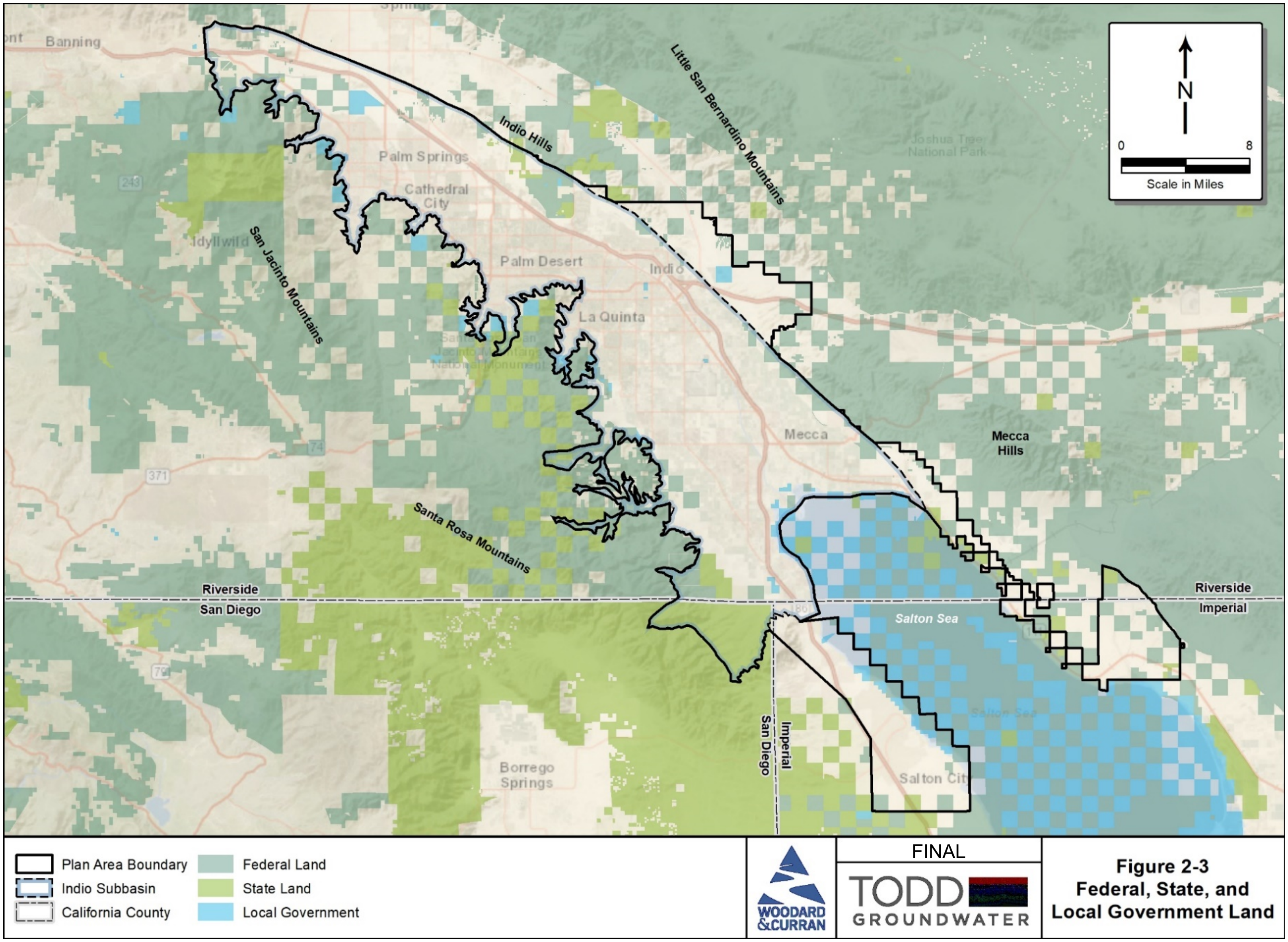
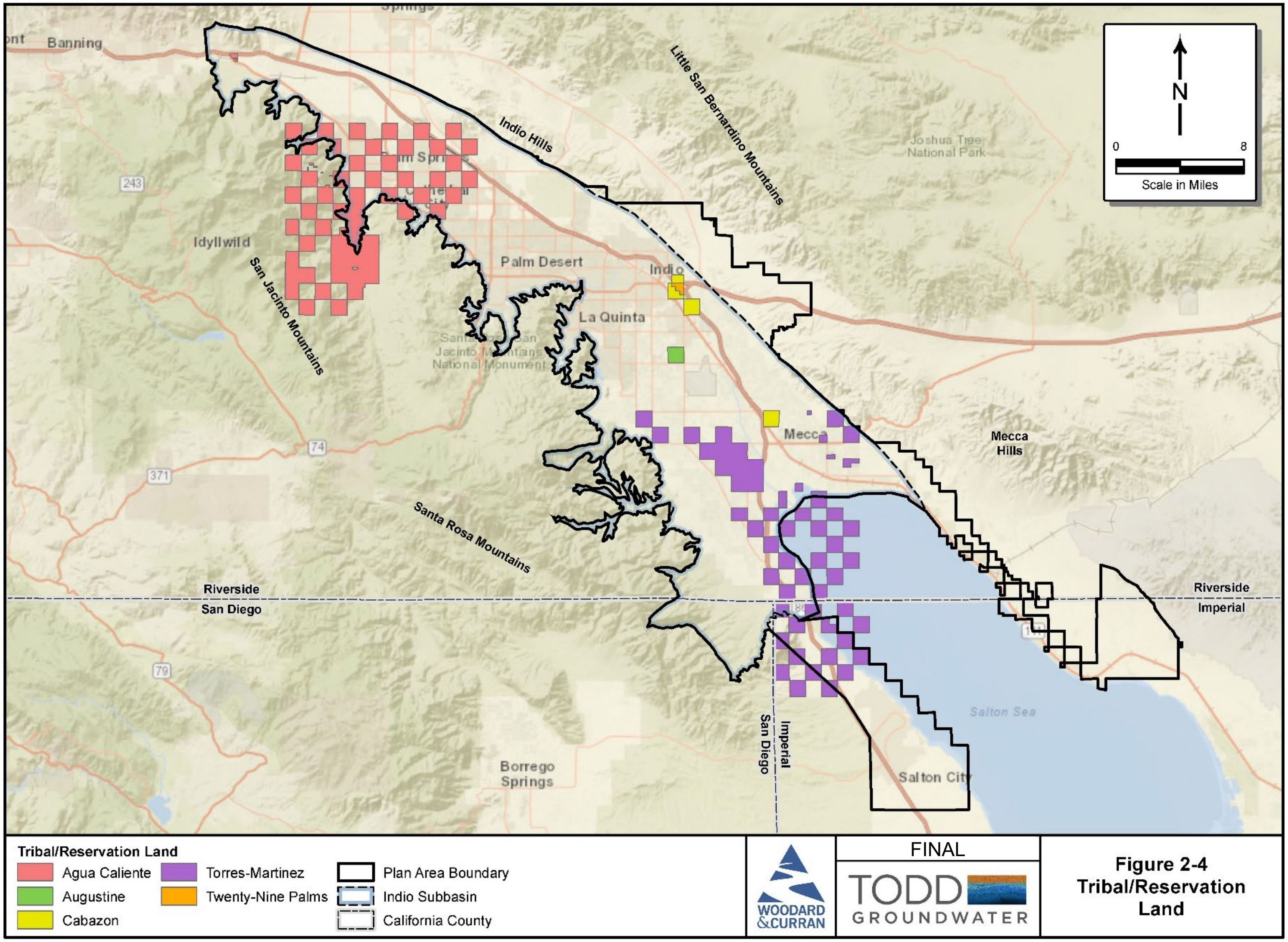


Figure 2-4. Tribal/Reservation Lands



The *2018 Coachella Valley Integrated Regional Water Management & Stormwater Resources (IRWM/SWR) Plan Update* (2018 Coachella Valley IRWM/SWR Plan) (Coachella Valley Regional Water Management Group [CVRWMG], 2018) provides detailed information about regional Tribal nations, Tribal water resources, and key water resources issues, including Tribal water rights, groundwater quality, potential for long-term overdraft, and Tribal participation in regional water planning. Tribal government representatives and the Federal Bureau of Indian Affairs have participated in the *Alternative Plan Update* process via quarterly meetings of the SGMA Tribal Workgroup (see Section 1.5.5).

2.3 Water Resources Management

Local water resources management began with early (19^{th} Century) agricultural development in the region, which was initially based on groundwater supply. However, local groundwater supply proved insufficient for irrigation and subsequent urban water demand, leading agencies to acquire and import surface water supplies. These early development efforts included the following:

- Developing local surface water for replenishment (e.g., Whitewater River) or diversion (e.g., from Snow, Falls, and Chino Canyon creeks)
- Importing Colorado River water supply through the Canal beginning in 1949 delivered to farmland, golf courses, and replenishment facilities
- Contracting for SWP supply (exchanged for water from the CRA and used for replenishment beginning in 1973)
- Developing recycled water used for landscape and golf irrigation

Water sources are further described in Section 2.4, *Water Sources*.

Development of farmland subsequently necessitated construction of agricultural drainage systems in the form of both tile drainage systems, subsurface, and surface drains (from 1930s to 1990s). In addition, stormwater drainage systems have been developed by local agencies over the years, including the Whitewater River/Coachella Valley Stormwater Channel (CVSC).

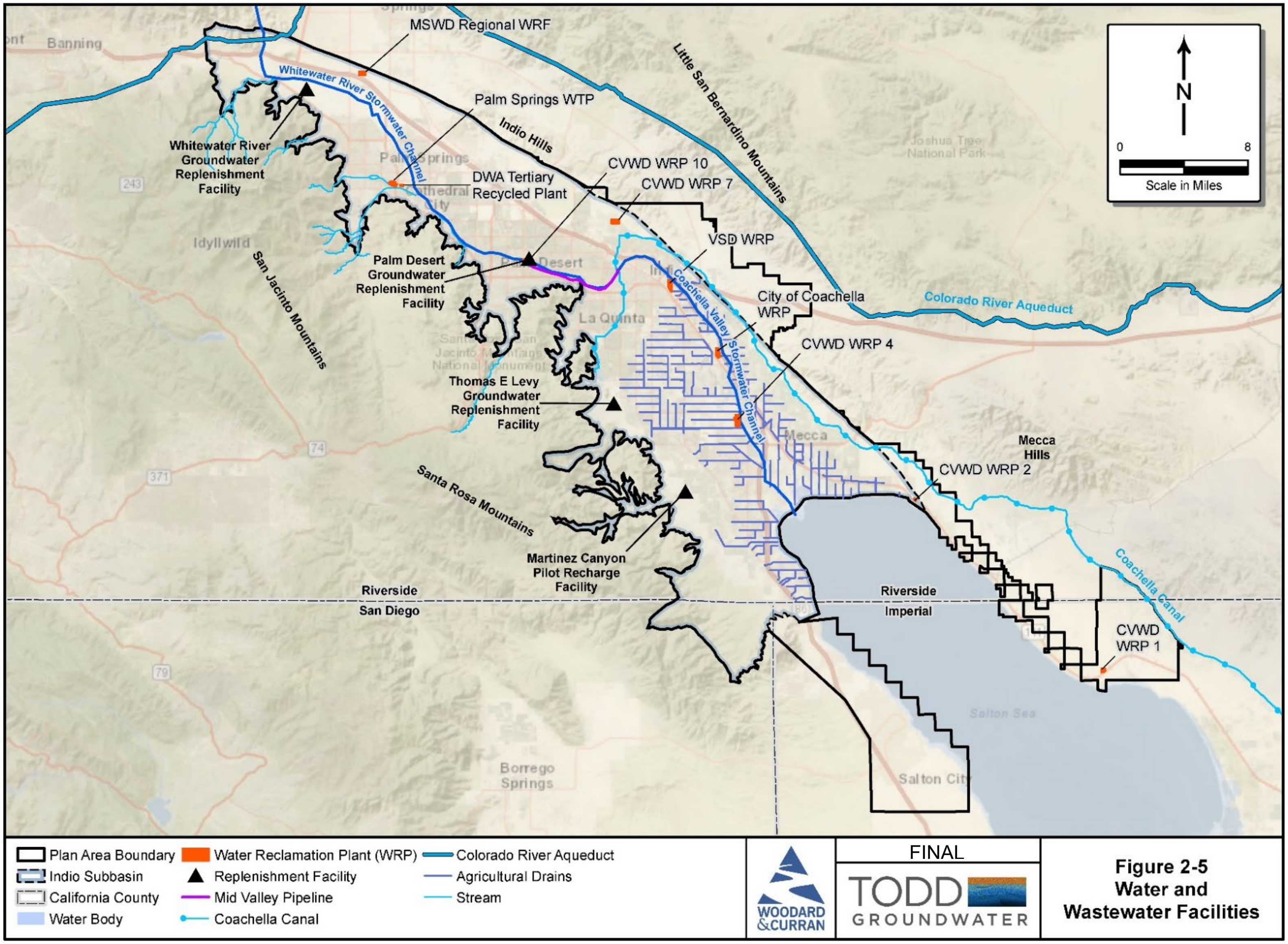
Major systems and facilities are shown on Figure 2-5 and include the Canal, the CRA, GRFs, water reclamation plants (WRPs), and agricultural drain systems.

Other water resource management programs have included implementation of water conservation, source substitution, and water quality programs.

As noted in Section 2.1, *Geographic Area*, the original *2002 Coachella Valley Water Management Plan* for the Indio Subbasin (CVWD, 2002) was developed to eliminate overdraft and provide comprehensive water resources management; in 2010, this plan was updated as the *2010 CVWMP Update* with the following water management elements:

- Water conservation
- Acquisition of additional water supplies
- Conjunctive use
- Source substitution
- Groundwater recharge
- Water quality improvements

Figure 2-5. Water and Wastewater Facilities



With passage of SGMA, the Indio Subbasin GSAs developed the original Alternative Plan consisting of the *2010 CVWMP Update* (CVWD, 2012) and the *SGMA Alternative Groundwater Sustainability Plan Bridge Document for the Indio Subbasin* (*Bridge Document*) (Indio Subbasin GSAs, 2016), which was approved by DWR in 2019. Subsequently the Indio Subbasin GSAs have prepared Annual Reports[1]; these documents together have served as major planning and reporting documents for water resource management.

2.4 Water Sources

The Plan Area currently relies on a combination of local groundwater, Colorado River water, SWP exchange water, local surface water, and recycled water to meet water demands. Details about each water source are provided in Chapter 6, *Water Supply*.

2.4.1 Local Groundwater

Local groundwater is pumped from the Indio Subbasin for water supply in the Plan Area. Groundwater has been the principal source of urban water supply in the Plan Area since the early part of the 20th century. Groundwater also supplies water for crop irrigation, fish farms, duck clubs, golf courses, greenhouses, and industrial uses.

The Indio Subbasin is not adjudicated. It experienced chronic groundwater level declines and storage depletion (i.e., overdraft) until the Subbasin was at its minimum storage level in 2009. Overdraft was reversed through management including substantial replenishment and source substitution by CVWD and DWA, and significant water conservation by local communities with the support of the GSAs.

The following three replenishment facilities are currently operated in the Indio Subbasin (refer to Figure 2-5):

- Whitewater River Groundwater Replenishment Facility (WWR-GRF)
- Palm Desert Groundwater Replenishment Facility (PD-GRF)
- Thomas E. Levy Groundwater Replenishment Facility (TEL-GRF)

CVWD operates the PD-GRF.

For replenishment, the Subbasin is divided into two management areas, the West Whitewater River Subbasin management area (i.e., West Valley) and the East Whitewater River Subbasin management area (i.e., East Valley). The Subbasin is divided into areas of benefit (AOBs). The West Valley is composed of two AOBs, one managed by CVWD and one by DWA, collectively referred to as the West Whitewater River Subbasin Management Area. The West Whitewater River Subbasin Management Area and the WWR-GRF are jointly managed by CVWD and DWA under the terms of the 1976 Water Management Agreement as revised December 15, 1992 and July 15, 2014. CVWD also operates the PD-GRF, which is located in the City of Palm Desert to replenish the Indio Subbasin's mid-

[1] https://sgma.water.ca.gov/portal/alternative/print/23; refer to Section D.

valley area. The East Valley is composed of one AOB (see red dividing line on Figure 2-1); the East Whitewater River Subbasin AOB and the TEL-GRF are managed by CVWD.

In the designated AOBs, groundwater replenishment programs are funded through Replenishment Assessment Charges (RACs) paid by groundwater pumpers (other than minimal pumpers[2]) on a per acre-foot basis; this charge covers applicable costs of importing water and recharging the Subbasin.

2.4.2 Colorado River Water

Colorado River water has been a major source of supply for the Plan Area since 1949 with the completion of the Coachella Canal. The Colorado River is managed and operated in accordance with the Law of the River, which is the collection of interstate compacts, federal and state legislation, various agreements and contracts, an international treaty, a U.S. Supreme Court decree, and federal administrative actions that govern the rights to use of Colorado River water in the seven Colorado River Basin states.

The Coachella Canal was completed in 1949.

The Coachella Canal (refer to Figure 2-5) is a branch of the All-American Canal that brings Colorado River water into the Imperial and Coachella Valleys. Initially, water delivered from the Canal was used exclusively for agricultural irrigation. As urban growth increased, other water users (primarily golf courses and homeowners' associations) began using Colorado River water for large landscape irrigation. Use of Canal water for non-potable purposes helps conserve the Coachella Valley's groundwater supply for domestic use.

Water imported via the Coachella Canal is also used at the TEL-GRF and conveyed through the Mid-Valley Pipeline to the PD-GRF for groundwater replenishment. Colorado River water obtained through transfer agreements with MWD is also used at WWR-GRF. As documented in the *Indio Subbasin Annual Report for Water Year 2018-2019* (Indio Subbasin GSAs, 2020), approximately 76 percent of delivered Colorado River water conveyed through the Canal was for agricultural use, about 11 percent was delivered for urban and golf course irrigation uses, and about 13 percent was replenished at TEL-GRF and PD-GRF.

2.4.3 State Water Project

The SWP is managed by DWR and includes 705 miles of aqueduct and conveyance facilities extending from Lake Oroville in northern California to Lake Perris in the south. DWA and CVWD initially contracted for water from the SWP in 1962 and 1963, respectively. CVWD and DWA purchased additional SWP transfers from the Tulare Lake Basin Water Storage District in Kings County and from the Berrenda Mesa Water District in Kern County.

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[2] CVWD's enabling legislation defines a minimal pumper as any producer who produces 25 or fewer acre-feet (AF) in any year. DWA's legislation defines a minimal pumper as any producer who produces 10 or fewer AF in any year.

There are no physical facilities to deliver SWP water to the Plan Area. CVWD's and DWA's SWP water is exchanged with MWD for an equal amount of Colorado River water from MWD's CRA.

SWP exchange water (i.e., Colorado River water) is recharged at the WWR-GRF and at the Mission Creek Groundwater Replenishment Facility (MC-GRF) in the Mission Creek Subbasin.

2.4.4 Surface Water

Natural surface water flow in the Plan Area occurs as a result of precipitation and concentrated stream runoff originating from the San Bernardino and San Jacinto Mountains, with lesser amounts originating from the Santa Rosa Mountains. DWA operates stream diversion facilities on Snow, Falls, and Chino Creeks and captures subsurface flow from the Whitewater River Canyon for urban water supply in DWA's service area. Local surface water is also used for agricultural irrigation near Whitewater River.

2.4.5 Recycled Water

Recycled water is a reliable, locally produced and managed water supply. Figure 2-5 shows WRP locations and other wastewater treatment facilities in the Indio Subbasin. Currently, three WRPs provide recycled water for irrigation in the Indio Subbasin. Of these, two recycled water facilities are operated by CVWD (WRP-7 and WRP-10) and the DWA WRP is operated by DWA in cooperation with the City of Palm Springs. Recycled water from WRP-7 is applied to golf courses in the Sun City area and recycled water from WRP-10 is delivered for golf course irrigation and homeowners' association landscaping. The DWA WRP provides tertiary treatment for irrigation of golf courses, parks, and other landscaping in the Palm Springs area.

WRP-10 provides recycled water to large irrigation customers in the mid-Valley area.

In addition, a new wastewater treatment plant, to be operated by MSWD, has begun construction in the Garnet Hill Subarea. Upon startup, secondary treated wastewater will be percolated; later, tertiary treatment will be added and the water reused in the Mission Creek Subbasin.

For other wastewater treatment facilities in the region, treated effluent is discharged either to onsite percolation/evaporation ponds or to the CVSC that runs from Indio to the Salton Sea. However, because recycled water is a reliable source and suitable for landscape irrigation in lieu of groundwater pumping, expansion of water recycling facilities is planned (see Chapter 11, *Projects and Management Actions*). Additional water recycling in the region could be gained not only through continuing population growth but also through connecting currently unsewered areas (i.e., some rural portions of the Subbasin and urban areas that use septic tank/leachfield systems to treat and dispose wastewater).

2.5 Land Use Planning

The Indio Subbasin GSAs recognize that land use changes can affect water demand in the Plan Area and affect their ability to achieve and maintain sustainable groundwater management over this *Alternative Plan Update*'s planning and implementation horizon. To address this challenge, this *Alternative Plan Update* has included the following:

- Description of the *2010 CVWMP Update* population, growth, and demand projections as compared to historical data, followed by update in Chapter 5, *Demand Projections*.
- Description of planning assumptions used to develop water supply projections for the *2010 CVWMP Update* and a comparison of these projections to actual supply used to meet demand, followed by update in Chapter 6, *Water Supply*.
- Assessment of the existing numerical groundwater flow model, followed by an update of its water budgets and calibration to provide a reliable tool for simulation of future conditions in Chapter 7, *Numerical Model and Plan Scenarios*.

Land use development is guided by land use planning agencies, including those of California cities and counties, which are required to prepare General Plans. General Plans must include elements addressing land use, open space, conservation, and housing, among other elements. General Plans may include optional elements relating to capital improvements/public facilities, flood management, and elements regarding water. General Plans are updated through periodic review or are amended with adoption of specific plans that, for example, may provide customized planning for a defined area or a large-scale project.

In addition to cities and counties, other governmental agencies prepare similar general planning documents. Table 2-2 lists the Subbasin's pertinent land use planning agencies and presents information about the latest plan adoptions and coverage of land use planning responsibility.

Table 2-2. Land Use Planning Agencies

Agency	General Plan Adoption	Coverage Area
City of Desert Hot Springs	2020	Entire city.
City of Palm Springs	2007; Housing Element updated in 2014; limited update underway	Entire city; city acts as tribe's agent for Agua Caliente Tribal trust lands per land use agreement.
City of Cathedral City	Draft 2019	Entire city; city acts as tribe's agent for Agua Caliente Tribal trust lands per land use agreement.
City of Rancho Mirage	2017	Entire city; city acts as tribe's agent for Agua Caliente Tribal trust lands per land use agreement.
City of Palm Desert	2016	Entire city.
City of Indian Wells	Updated 2013 (Land Use updated 2007); update underway	Entire city.
City of Indio	2019	Entire city.
City of Coachella	2015	Entire city.
City of La Quinta	2013	Entire city.

Agency	General Plan Adoption	Coverage Area
County of Riverside	2015	Unincorporated land; county acts as Tribe's agent for Agua Caliente Tribal trust lands per land use agreement. All other Tribal/Reservation lands excluded.
County of Imperial	2015	2015 unincorporated land; West Shore, Hot Mineral Spa, Bombay Beach.
County of San Diego	2011	Unincorporated land; open space in Coachella Valley.
Agua Caliente Band of Cahuilla Indians	Land Use Ordinance 2013	Tribal trust lands; other lands covered by land use contracts or agreements with cities and Riverside County.
Torres Martinez Desert Cahuilla Indians	Revised 2016	Tribal/Reservation lands.
Cabazon Band of Mission Indians	1983	Tribal/Reservation lands.
Augustine Band of Cahuilla Indians	Not available	Tribal/Reservation lands.
Twenty-Nine Palms Band of Mission Indians	2017	Tribal/Reservation lands.
BLM	2002	California Desert Conservation Area—Coachella Valley Amendment
BLM	2004	Santa Rosa and Santa Jacinto National Monument
USFS	2005	San Bernardino National Forest
USFWS	2013	Coachella Valley National Wildlife Refuge
CDPR	2005	Anza Borrego Desert State Park
CDPR	2002	Mount San Jacinto State Park
CDFW	2015	State wildlife action plan
Coachella Valley Conservation Commission	2008	Coachella Valley conservation areas under Coachella Valley Multiple Species Habitat Conservation Plan

Local land use planning is governed by the plans listed in Table 2-2; general land use designations are listed below.

- **Residential**—Includes hillside, very low, low-, medium-, high-density residential, and mobile home parks
- **Commercial**—Includes general, neighborhood, shopping centers, offices, and resort hotels
- **Mixed Use**—Includes combinations of residential, commercial, and public uses
- **Industrial**—Includes business parks, light industrial, and general industrial
- **Institutional and Public Facilities**—Includes governmental offices, cultural facilities, libraries, museums, schools, hospitals, police and fire stations, utility substations as well as other public or quasi-public administrative offices or meeting spaces
- **Open Space**—Includes parks, natural open spaces, and habitat areas; golf courses, pool areas, and landscaped lands defined as private open space; and natural or man-made watercourses

- **Overlay Areas**—Includes special land use designations that provide standards in addition to those of the underlying land use; typically to protect historical areas or limit development in hazard areas
- **Agricultural**—Includes row and truck crops, nurseries, citrus and date palm groves, vineyards, ranches, poultry farms, and other agricultural related uses

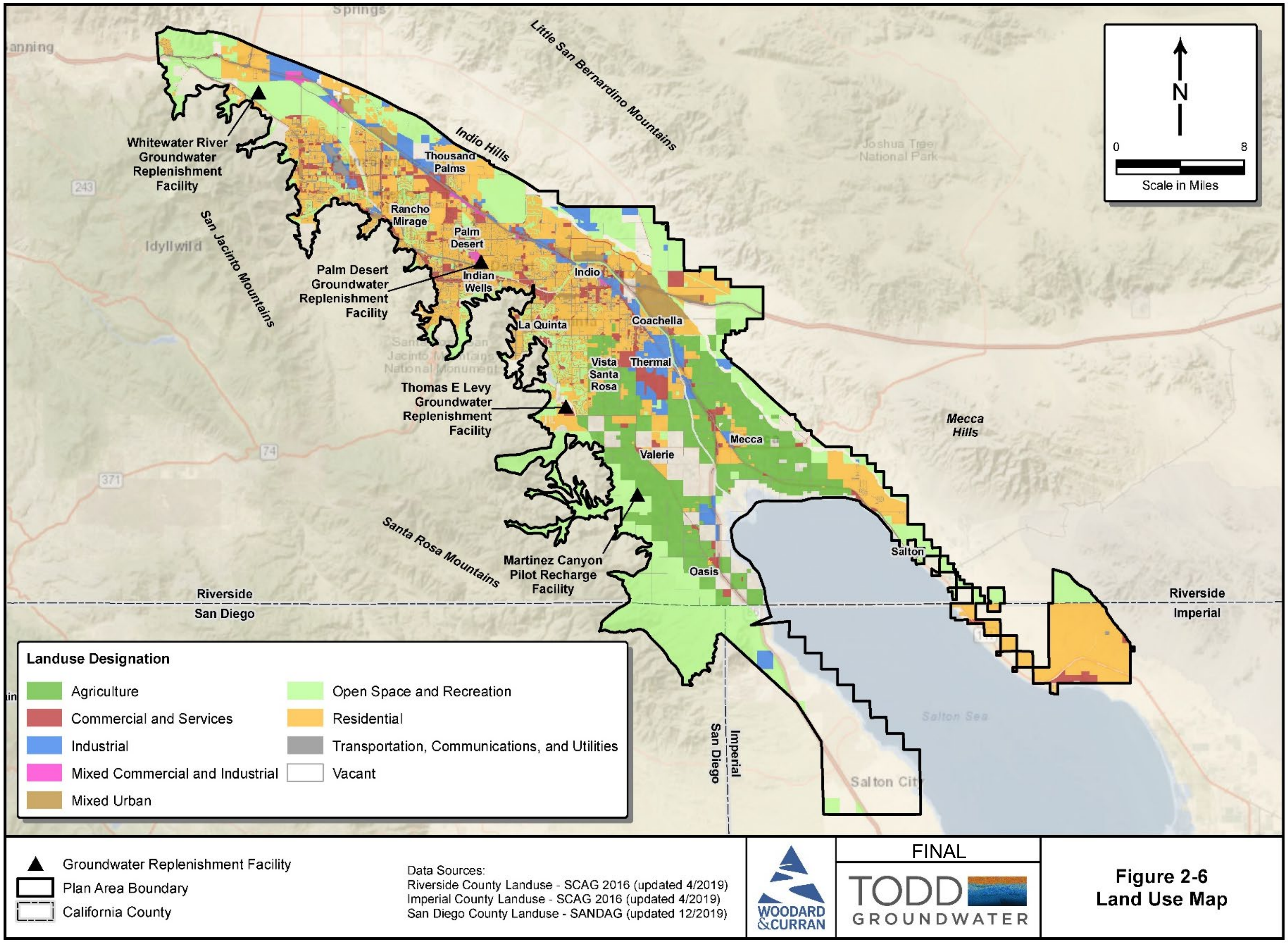
Figure 2-6 shows existing land use in the region. Detailed information about land use patterns and trends was compiled and analyzed to develop water demand projections; this is documented in Chapter 5, *Demand Projections*.

Under SGMA, water supply and land use decision-making policy was amended to require closer coordination and consultation among GSAs and land use approval agencies. SGMA aims to improve water supply planning and management and accommodate projects that may result in increased water supply demand or may impact water resource management. In the Coachella Valley, land use plans and growth forecasts are periodically reviewed by water agencies in conjunction with preparing water management plan updates like this *Alternative Plan Update* and urban water management plans (UWMPs). These activities are consistent with SGMA, which states that close coordination between water agencies and land use approval agencies is vital. SGMA requires water agencies to provide a city or county with its current GSP or Alternative Plan and other relevant information like UWMPs, capital improvements or plans, and descriptions of water supplies and demands (California Water Code Section 65352.5).

Before adopting a General Plan, or any substantial General Plan amendment, planning agencies must review and consider the approved GSP or Alternative Plan and must refer the proposed adoption or substantial amendment to any affected GSA. SGMA also requires that a GSP or Alternative Plan account for the most recent planning assumptions stated in local General Plans.

While nothing specified in SGMA or contained in a GSP can be interpreted as superseding the land use authority of cities or counties, Senate Bill (SB) 610 and SB 221 require that this information should be included in the administrative record that serves as the evidentiary basis for an approval action by a city or county for projects subject to CEQA that are of a specific size. As a result, local water agencies prepare and adopt water supply assessments and written verifications of water supply availability for large developments as required by SB 610 and SB 221.

Figure 2-6. Land Use Map



2.6 Disadvantaged Communities

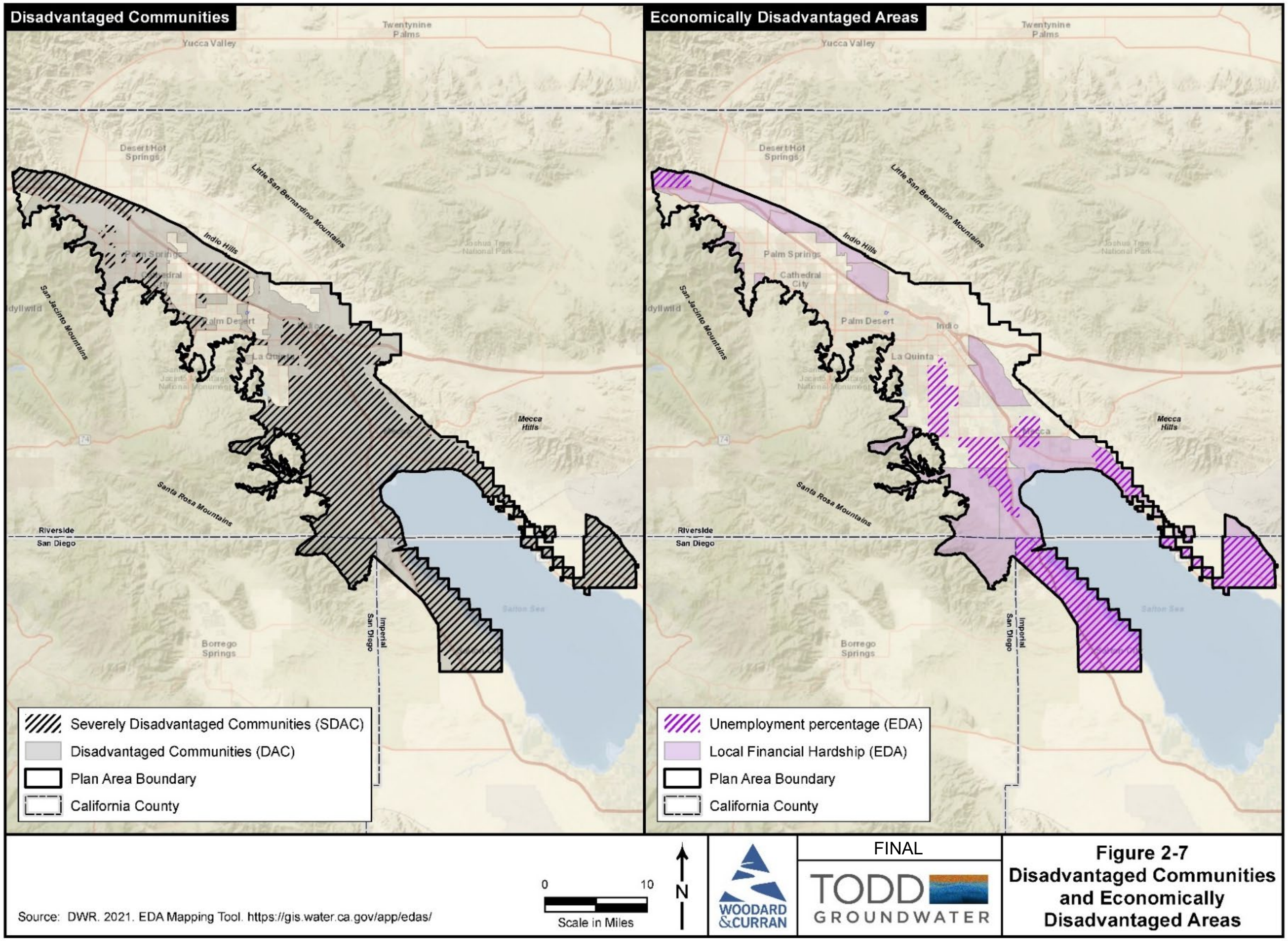
Figure 2-7 shows the extent of disadvantaged communities (DACs), severely disadvantaged communities (SDACs), and economically disadvantaged areas (EDAs) as indicated by unemployment percentage and local financial hardship. DWR maintains two mapping tools for DACs and EDAs with periodic updates based on the American Community Survey (DWR, 2021a and DWR, 2021b). In the Indio Subbasin, these communities are diverse and include farm workers, urban and rural residents, and low-income seniors. Groundwater is the water source, so ensuring that groundwater remains safe and reliable is a priority. Historically, localized water quality issues have included arsenic, chromium-6, nitrates, total dissolved solids, radionuclides, and bacteria (see Chapter 8, *Regulatory and Policy Issues*).

Organizations in the Coachella Valley have interacted and coordinated with DACs (inclusive of SDACs and EDAs) for many years. In 2007, the DAC Planning Group was formed regionally to track the progress of DAC programs under California's Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84). Since 2009, the Coachella Valley IRWM Program, which is a partnership among CVWD, CWA, DWA, IWA, MSWD, and Valley Sanitary District (VSD), has engaged in targeted outreach to DACs. The DAC Outreach Program was implemented in 2012 to improve DAC participation in the Coachella Valley IRWM process and has continued to evolve to this day. The *2018 Coachella Valley IRWM/SWR Plan* and the *2020 Colorado River Funding Area Water Needs Assessment* (Colorado River Funding Area Partners, 2020) summarizes known water and wastewater needs of DACs and includes opportunities for future engagement and projects related to system consolidations, education, safe drinking water, and wastewater treatment.

General outreach efforts conducted by the CVRWMG aim to encourage DAC participation in the Coachella Valley IRWM Program and to ensure that DAC needs and concerns are incorporated into current and future planning documents. The Coachella Valley IRWM Program has also provided increased technical, engineering, and grant support for DACs that apply for IRWM grant opportunities. Through Proposition 84 and the California Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1), the IRWM Program has provided millions of dollars to support DAC planning and construction projects.

The DAC Infrastructure Task Force, which is a collaboration between CVWD, non-profit organizations, regulatory agencies, and municipalities, meets bimonthly to secure access to safe affordable drinking water, wastewater, and flood control services in historically disadvantaged Coachella Valley regions through strategic planning, funding procurement, needs assessment, and reporting. This continued, consistent level of outreach over the years has allowed for relationship building with the DAC community.

Figure 2-7. Disadvantaged Communities and Economically Disadvantaged Areas



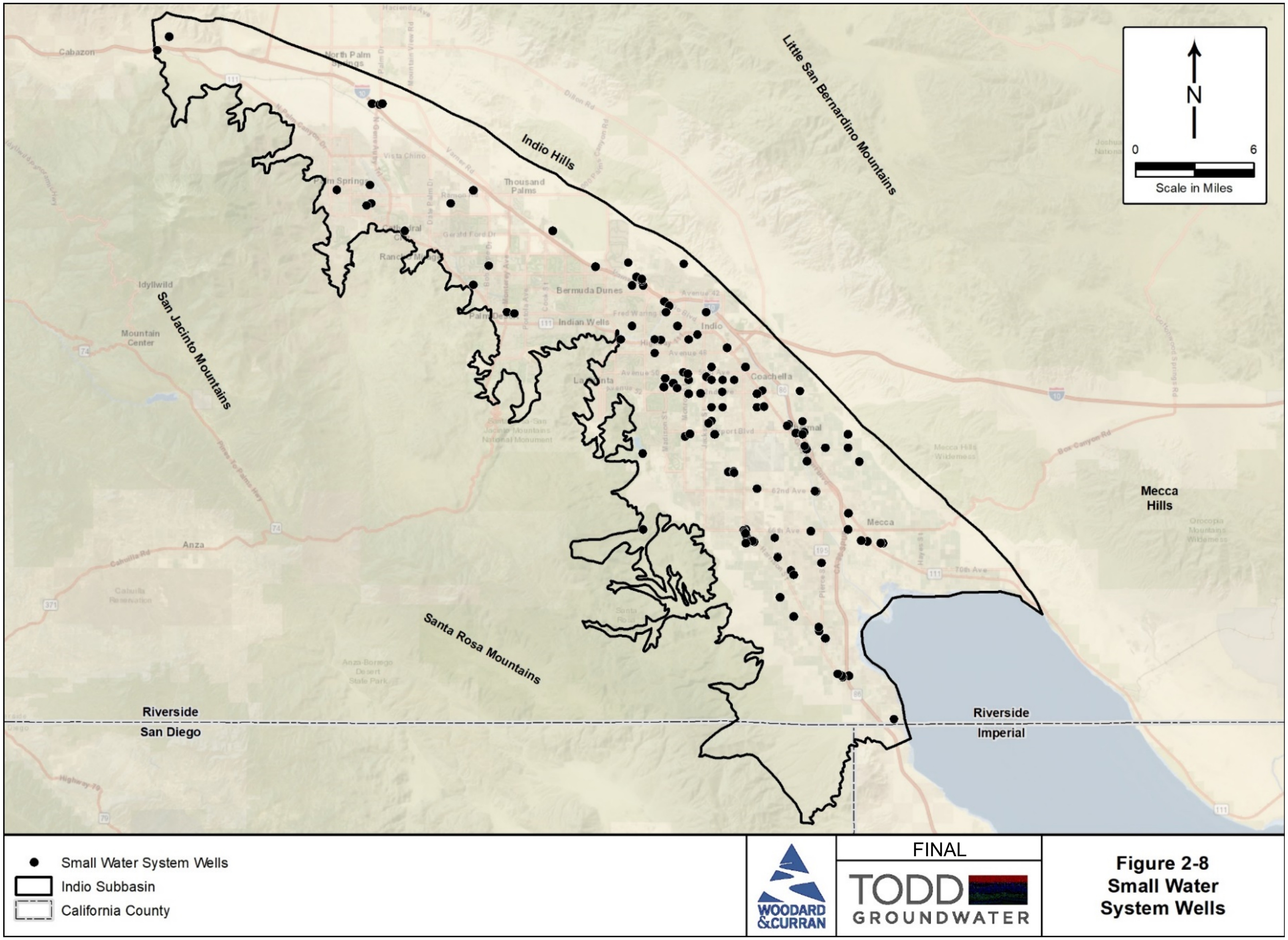
2.7 Water Use Sectors

Water use in the Plan Area includes four predominant water user groups: municipal, agriculture, golf, and other. Water demand in the Plan Area is met through a supply combination of groundwater, surface water, and non-potable water, including recycled water and imported Canal water. Major water use sectors and sources are described below; detailed information is provided in Chapter 5, *Demand Projections*.

- **Municipal**—The municipal group includes all water uses related to urban development, including residential, commercial, industrial, and institutional. Municipal water supplies predominantly consist of groundwater in the Plan Area, with some local surface water in portions of the DWA service area and non-potable water (i.e., recycled water and Canal water) for irrigation in the CVWD and IWA service areas. Supplies are generally served by the local water agencies (i.e., CVWD, CWA, DWA, and IWA). In some areas, small public water systems, private pumpers, and private mutual water companies and purveyors supply water in their services areas, with most using groundwater.
- **Golf**—The golf group consists of water uses related to golf course irrigation and maintenance. Golf courses primarily use groundwater from private wells, Canal water, or recycled water. In a few limited areas, golf courses use domestic water supply. Some golf water users also provide water stored in onsite ponds to municipal users (e.g., homeowners' associations) for irrigation.
- **Agriculture**—The agriculture group consists of water uses related to irrigation of crops and agricultural production. Canal water is the predominant agricultural water supply with some surface water use and with groundwater pumped from private wells in areas where Canal water is not available.
- **Other**–The other group consists of water uses related to recreational lakes, fish farms, duck clubs, and planned surf parks. These demands are met using Canal water, potable water, or water pumped from private wells.

In the Plan Area, a number of rural communities are not connected to the GSAs' domestic water system(s). Residents in these communities depend on individual domestic wells or private wells connected to independent small water systems to supply their drinking water. The local groundwater supplies of several small water systems have shown elevated concentrations of arsenic and other constituents that are currently regulated or may be in the near future (e.g., chromium-6). CVWD and CWA are actively pursuing consolidation of small water systems in their domestic service areas. Figure 2-8 shows the locations of small community water systems using wells, which was compiled from DWR's Groundwater Ambient Monitoring and Assessment (GAMA) Program website and cross-referenced with California State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) data.

Figure 2-8. Small Water System Wells



2.8 Water Resources Monitoring

In general, water resources monitoring addresses climate (i.e., temperature, precipitation, evaporation), streamflow, subsidence, groundwater elevations, surface water and groundwater quality, groundwater pumping, and drain flows. For this *Alternative Plan Update*, water resources monitoring discussions are focused on the Indio Subbasin. Monitoring programs are briefly described below, and Chapter 10, *Monitoring Program*, provides additional information along with recommendations for improvement.

2.8.1 Climate

Climate data are available from DWR's California Irrigation Management Information System (CIMIS) for four active CIMIS stations in the Indio Subbasin (Figure 2-9). Precipitation data have been collected for the 12 Riverside County Flood Control and Water Conservation District precipitation monitoring stations, which are also shown in Figure 2-9. Data were used to support groundwater conditions characterization and an evaluation of irrigation water demands for agricultural and golf course uses.

2.8.2 Streamflow

USGS measures streamflow at 19 locations in the Indio Subbasin, which are also shown on Figure 2-9. DWA measures surface water diversions from Snow, Falls, Whitewater, and Chino watersheds. Streamflow data are compiled annually to support tracking of Subbasin conditions as part of the Indio Subbasin Annual Reports.[3]

2.8.3 Subsidence

USGS, in cooperation with CVWD, has been studying land subsidence in the Coachella Valley since 1997, and recently completed a comprehensive report of findings (USGS, 2020) that documents historical subsidence, plus recent cessation of subsidence and uplift. Figure 2-10 shows the USGS land-subsidence monitoring network, which consists of geodetic monuments used as global positioning system (GPS) stations that can be surveyed repeatedly. This monitoring network has grown over time and currently includes 24 stations. In addition to these stations, interferometric synthetic aperture radar (InSAR) data are available that use radar images from satellites to provide broad spatial mapping of land surface vertical displacement. These InSAR data are used by USGS, as documented in the comprehensive report of findings, and are now also provided by DWR on its SGMA Data Viewer.[4]

2.8.4 Groundwater Elevations

Groundwater level monitoring data are available for selected wells in the Indio Subbasin dating back to 1910. Figure 2-11 illustrates the distribution of monitored wells as of water year (WY) 2018–2019, when levels were measured in 345 wells by the Indio Subbasin GSAs as part of their respective groundwater level monitoring programs. As shown, 52 of these wells were monitored by the Indio Subbasin GSAs and MSWD as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. DWR established the CASGEM Program in 2009 to track seasonal and long-term groundwater elevation trends in California's groundwater basins. The CASGEM Program continues today as a tool to support SGMA. In general, elevation monitoring data are used to characterize basin conditions, evaluate pumping and recharge operations, and support groundwater modeling and model calibration.

[3] https://sgma.water.ca.gov/portal/alternative/print/23; refer to Section D.
[4] https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

Figure 2-9. Climate and Streamflow Monitoring Stations

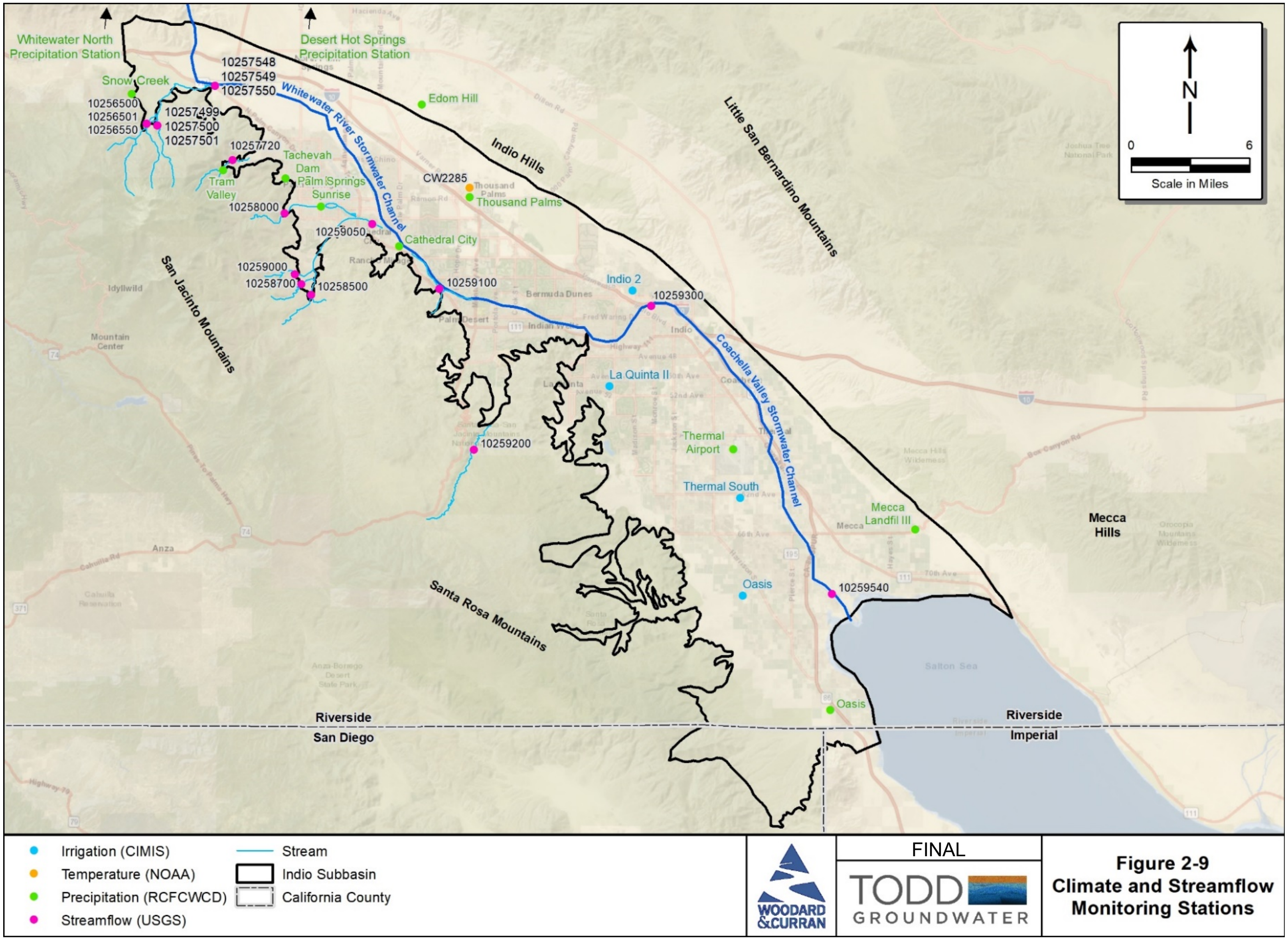


Figure 2-10. USGS GPS Stations and Wells used for Subsidence Monitoring

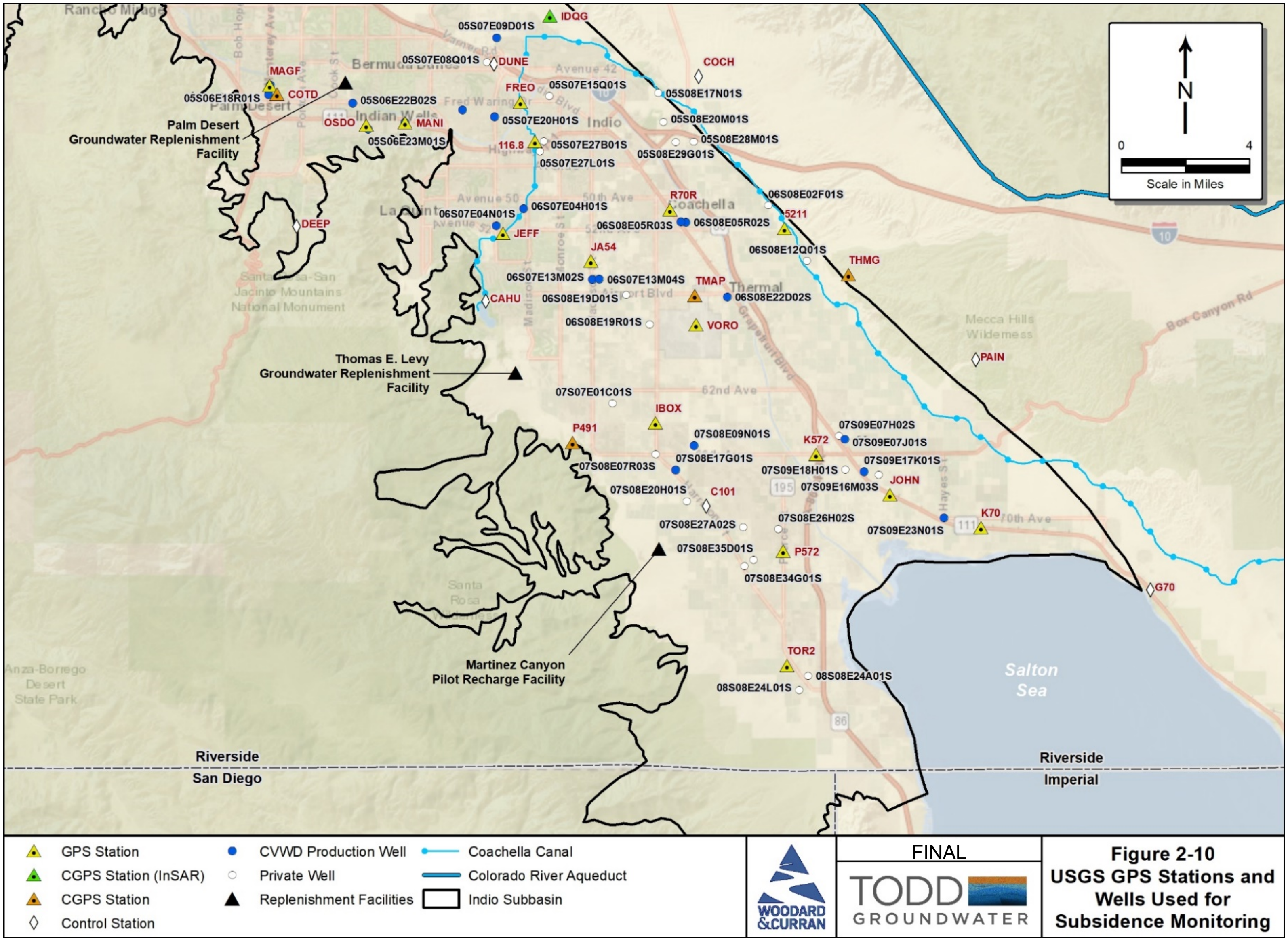
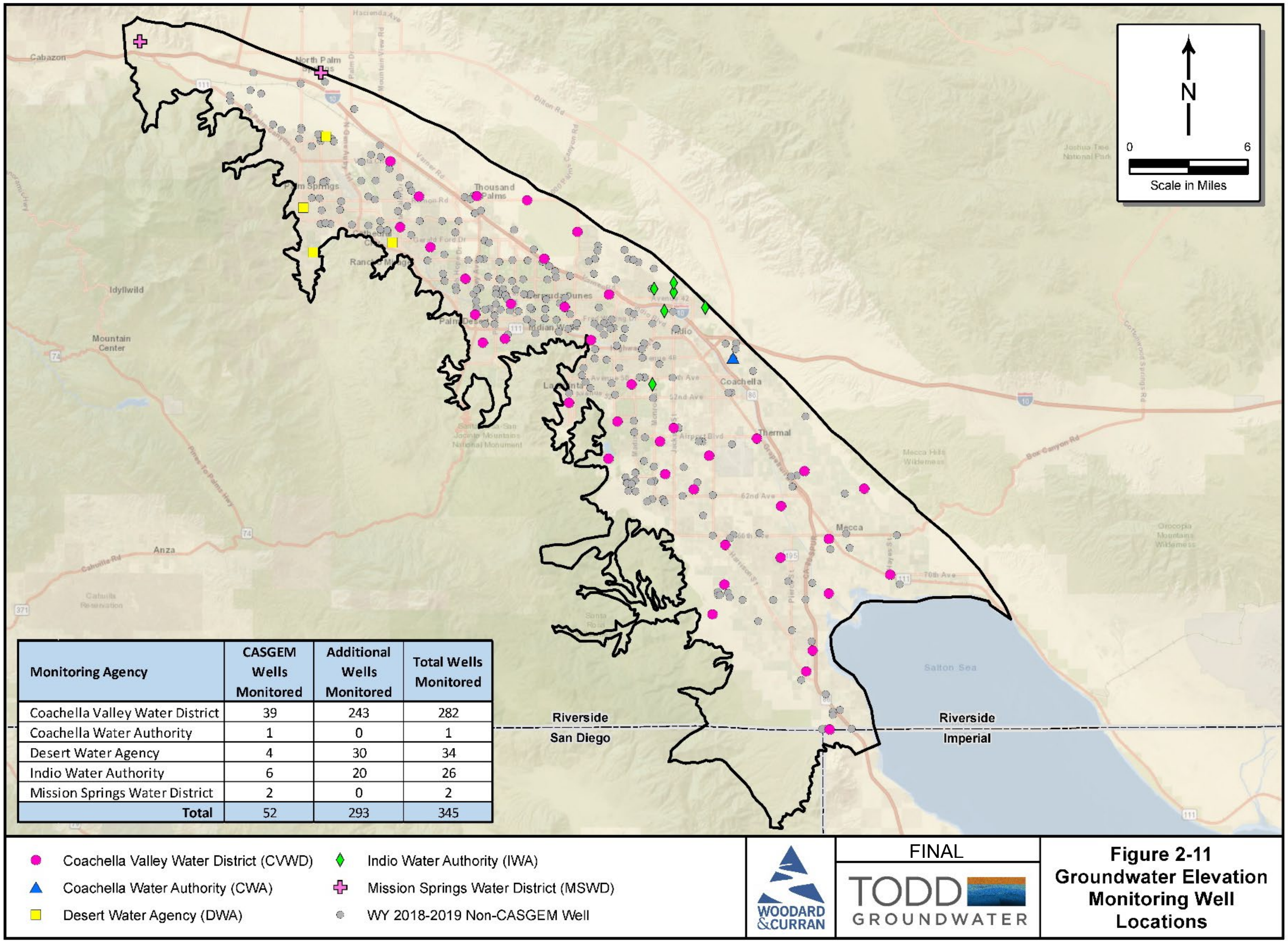


Figure 2-11. Groundwater Elevation Monitoring Well Locations



Monitoring Agency	CASGEM Wells Monitored	Additional Wells Monitored	Total Wells Monitored
Coachella Valley Water District	39	243	282
Coachella Water Authority	1	0	1
Desert Water Agency	4	30	34
Indio Water Authority	6	20	26
Mission Springs Water District	2	0	2
Total	52	293	345

2.8.5 Surface Water and Groundwater Quality

Surface water and groundwater quality monitoring is performed by multiple agencies in the Plan Area. For example, water purveyors are required by State law to monitor and report on the quality of their water sources, and report to each customer and the SWRCB DDW. These data are publicly available on the SWRCB's GAMA Program website. In addition, Tribes monitor water quality in their wells and maintain records; not all these data are publicly available. Local water agencies conduct water quality monitoring as summarized below.

- **CVWD**—CVWD monitors domestic wells and wells to monitor recharge areas, conduct special studies to address a specific parameter (such as chromium-6) or a specific area, and conducts Coachella Valley Salt and Nutrient Management Plan (CV-SNMP) monitoring
- **CWA**—CWA monitors its domestic wells and conducts CV-SNMP monitoring
- **DWA**—DWA monitors streams and its domestic wells, monitors for State emerging contaminants (e.g., per- and polyfluoroalkyl substances [PFASs]), and conducts CV-SNMP monitoring
- **IWA**—IWA monitors its domestic wells and conducts CV-SNMP monitoring

Figure 2-12 shows the locations of groundwater wells with available water quality data examined for characterization of groundwater quality as part of this *Alternative Plan Update* (i.e., wells reporting recent water quality data). These groundwater wells include supply, irrigation, and monitoring wells. These wells include those installed near GRFs and two nested monitoring wells near the Salton Sea that monitor changes in groundwater levels and quality as potential indications of saline intrusion.

Monitoring wells are sampled by the GSAs for a variety of water quality constituents.

In 2020, the GSAs – in collaboration with local water and wastewater agencies, RWQCB, and other stakeholders – initiated an update to the 2015 CV-SNMP. The process began with development of a CV-SNMP Groundwater Monitoring Program Workplan that the RWQCB approved in February 2021. The CV-SNMP process also included preparation of a CV-SNMP Development Workplan that the RWQCB approved in October 2021. These two Workplans are included as Appendix 2-A and describe the actions to be undertaken by the GSAs to monitor, evaluate, and protect groundwater quality.

2.8.6 Groundwater Pumping

Information about groundwater production is critical to Indio Subbasin management. California Water Code Division 2 Part 5 requires each well owner or operator in the counties of Riverside, San Bernardino, Los Angeles, and Ventura extracting more than 25 acre-feet per year (AFY) of groundwater to file a Notice of Extraction and Diversion of Water with the SWRCB. In addition, the enabling legislation of CVWD and DWA respectively require that all production subject to replenishment assessment must be measured, and replenishment assessment invoices based on quantities produced are billed monthly or quarterly. The reporting threshold for pumpers within CVWD's boundary is 25 AFY, while the threshold for DWA is 10 AFY. All production wells exceeding these thresholds are required to have a measuring device capable of measuring and registering the amount of water produced; 550 wells in these areas subject to the replenishment assessment are metered (Indio Subbasin GSAs, 2020). Both CVWD and DWA maintain production records for wells in their respective areas. Figure 2-13 illustrates the distribution of groundwater production wells in the Indio Subbasin.

2.8.7 Drain Flows

The CVSC and associated subsurface and open drains receive intercepted shallow groundwater from agricultural fields and convey flow to the Salton Sea. A USGS gage station measures flow in the lower CVSC near the Salton Sea (Figure 2-7), while CVWD measures drain flows at 27 sites on a monthly basis. The CVSC and drain system receive not only shallow groundwater but flows of Canal water in excess of requested deliveries (i.e., regulatory water), treated wastewater, and fish farm effluent. Drain flow data are used to track groundwater outflow and to calibrate the Subbasin's numerical groundwater flow model.

CVWD measures drain flows at 27 sites on a monthly basis.

Figure 2-12. Wells with Water Quality Data Used for *Alternative Plan Update*

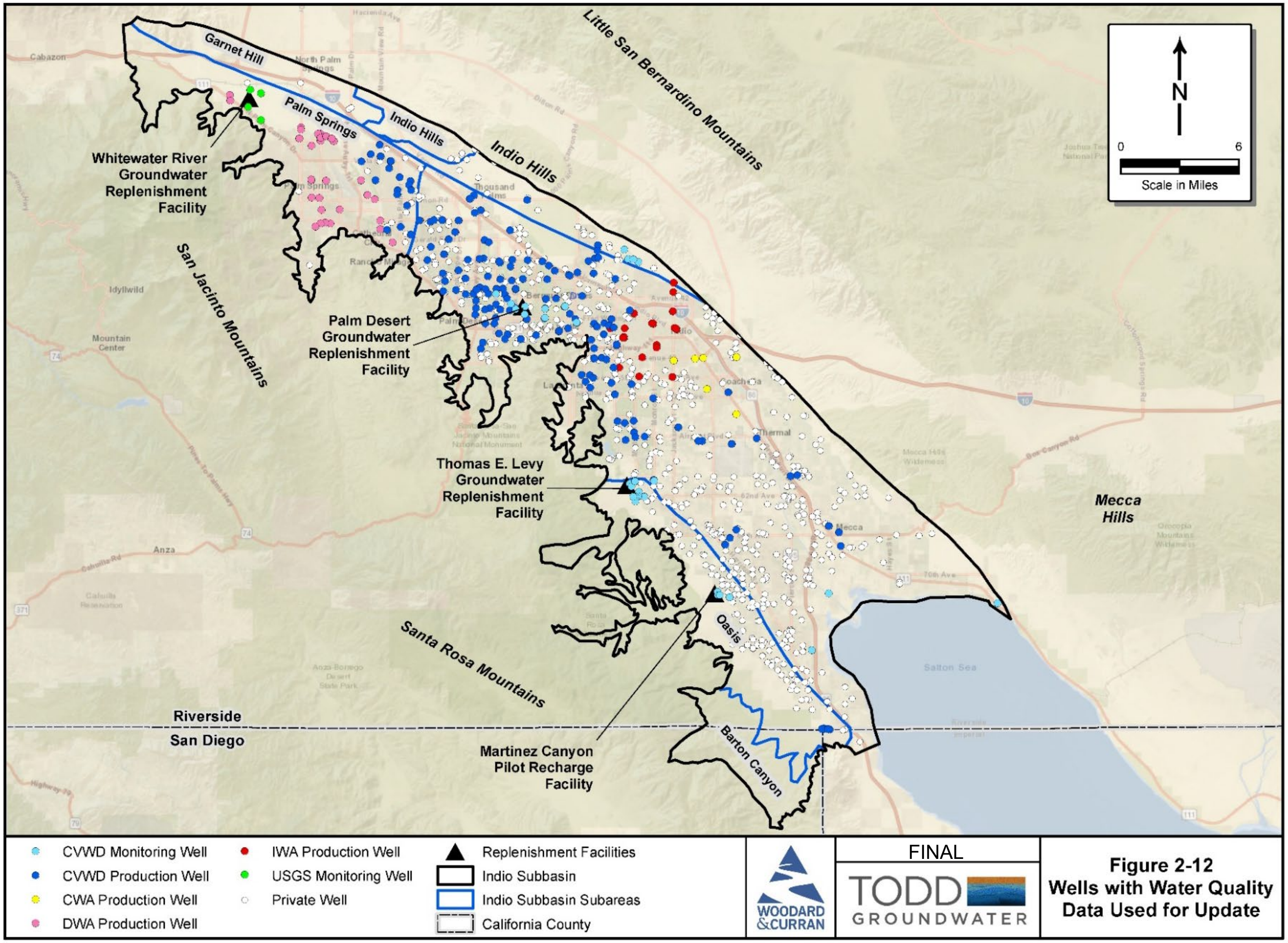
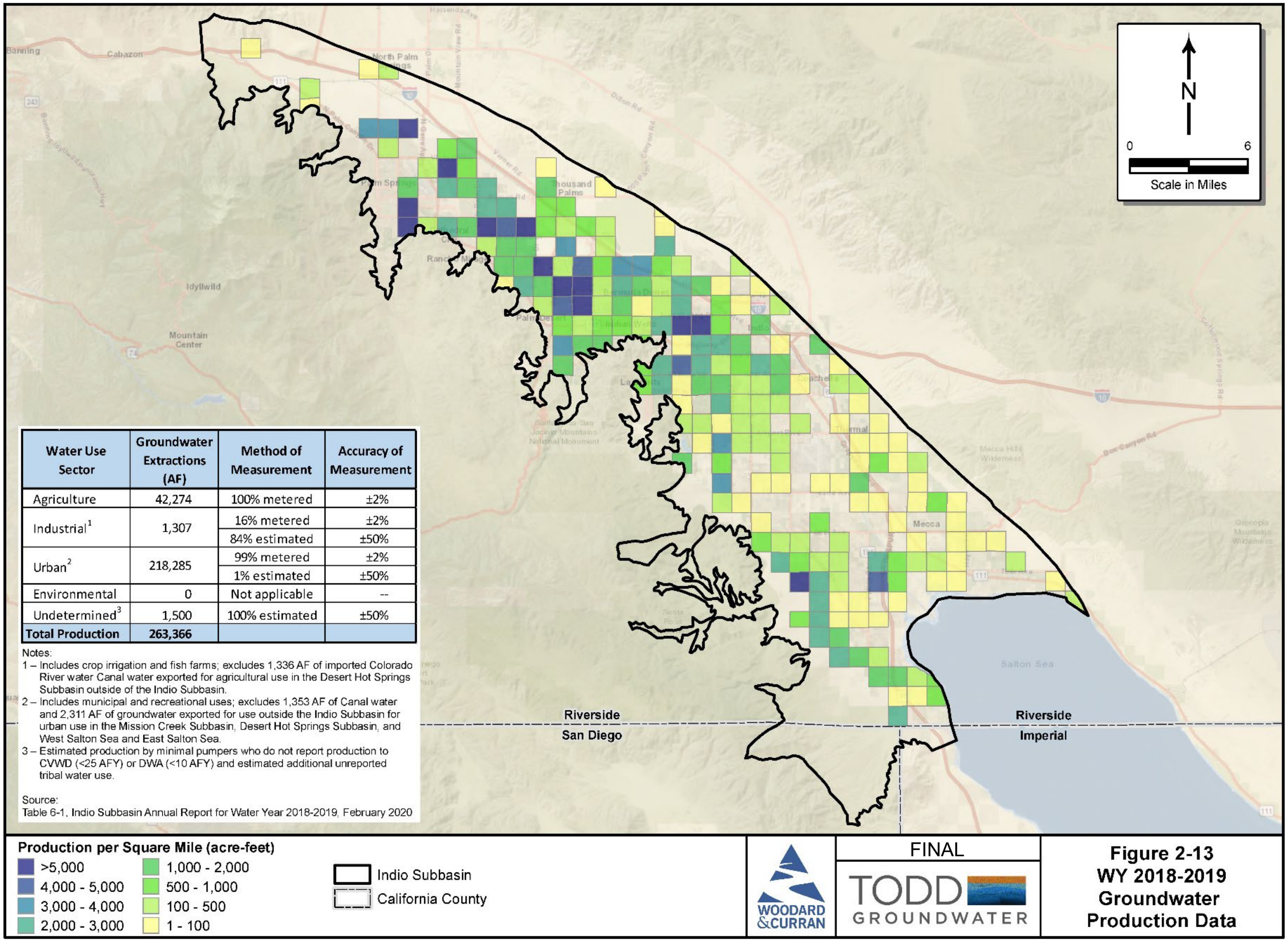


Figure 2-13. Water Year 2018–2019 Groundwater Production



Water Use Sector	Groundwater Extractions (AF)	Method of Measurement	Accuracy of Measurement
Agriculture	42,274	100% metered	±2%
Industrial[1]	1,307	16% metered	±2%
		84% estimated	±50%
Urban[2]	218,285	99% metered	±2%
		1% estimated	±50%
Environmental	0	Not applicable	--
Undetermined[3]	1,500	100% estimated	±50%
Total Production	**263,366**		

Notes:
1 – Includes crop irrigation and fish farms; excludes 1,336 AF of imported Colorado River water Canal water exported for agricultural use in the Desert Hot Springs Subbasin outside of the Indio Subbasin.
2 – Includes municipal and recreational uses; excludes 1,353 AF of Canal water and 2,311 AF of groundwater exported for use outside the Indio Subbasin for urban use in the Mission Creek Subbasin, Desert Hot Springs Subbasin, and West Salton Sea and East Salton Sea.
3 – Estimated production by minimal pumpers who do not report production to CVWD (<25 AFY) or DWA (<10 AFY) and estimated additional unreported tribal water use.

Source:
Table 6-1, Indio Subbasin Annual Report for Water Year 2018-2019, February 2020

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CHAPTER 3: HYDROGEOLOGIC CONCEPTUAL MODEL

This chapter describes the Indio Subbasin hydrogeologic conceptual model (HCM), and establishes the Plan Area's geologic framework, including hydrogeologic boundaries, geologic formations and structures, and principal aquifer units. This chapter also summarizes groundwater recharge and discharge areas, describing how and where water flows into and out of the Subbasin. An important aspect of this system is artificial recharge of groundwater (i.e., replenishment), which is conducted at Plan Area groundwater replenishment facilities (GRFs). GRF operation has been critical to halting and reversing groundwater level declines and storage depletion, which are key criteria for sustainability in the Indio Subbasin.

The HCM presented here is a summary of relevant aspects of the Subbasin hydrogeology that influence groundwater sustainability. Chapter 7, *Numerical Model and Plan Scenarios* and Chapter 9, *Sustainable Management*, refer to the technical information summarized here.

3.1 Physical Setting

Figure 3-1 shows the extent of the Coachella Valley Groundwater Basin (Basin), which encompasses more than 800 square miles and extends from the San Gorgonio Pass area in the San Bernardino Mountains to the northern shore of the Salton Sea. The Basin is bordered by the San Bernardino Mountains on the north, the San Jacinto and Santa Rosa Mountains on the west, the Little San Bernardino Mountains on the east and Salton Sea on the south. The San Bernardino, San Jacinto, and Santa Rosa Mountains impede eastward movement of storms and create a rain shadow, which results in an arid climate and greatly reduces the contribution of direct precipitation as a source of natural recharge to the Basin. Figure 3-1 also shows the GRF locations.

The Basin is composed of the San Gorgonio Pass, Mission Creek, Desert Hot Springs, and Indio Subbasins (Figure 3-1). The boundary between the San Gorgonio Pass and Indio Subbasins is a bedrock constriction and divide; otherwise, the boundaries between Subbasins within the Basin are generally defined by faults that represent barriers to the lateral movement of groundwater. This discussion focuses on the Indio Subbasin.

The western half of the Indio Subbasin is characterized by an urban resort/recreation-based economy and includes the cities of Palm Springs, Cathedral City, Thousand Palms, Rancho Mirage, Palm Desert, and Indian Wells. The eastern half has a predominantly agricultural-based economy and includes the cities of Indio, Coachella, and La Quinta, along with the unincorporated communities of Mecca, Thermal, and Oasis.

As shown in Figure 3-2, the Indio Subbasin has been described in terms of five Subareas: Garnet Hill, Palm Springs, Thermal, Thousand Palms, and Oasis.

3.2 Geologic Setting

The Indio Subbasin is bounded on its northern, northwestern, southwestern, and southern margins by uplifted bedrock; Subbasin sedimentary fill consists of thick sand and gravel sedimentary sequences eroded from the surrounding mountains. Sedimentary infill in the Indio Subbasin thickens from north to south, and depending on location within the Subbasin, is at least several thousand and as much as 12,000 feet thick. The upper approximately 2,000 feet constitute the aquifer system that is the primary source of groundwater supply (DWR, 1979). Figure 3-3 is a geologic map encompassing the Indio Subbasin.

Figure 3-1. Coachella Valley Groundwater Basin and Subbasins

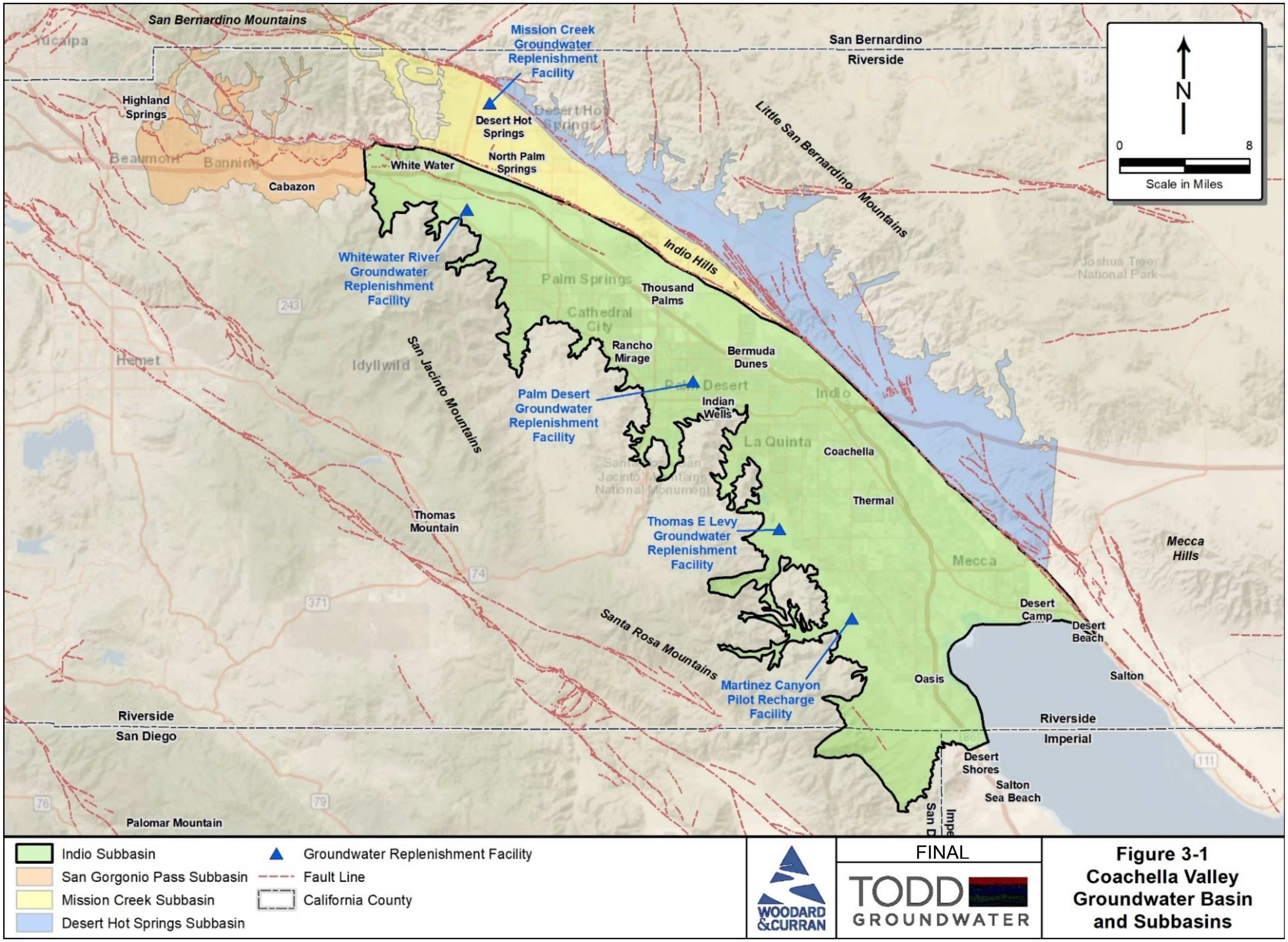
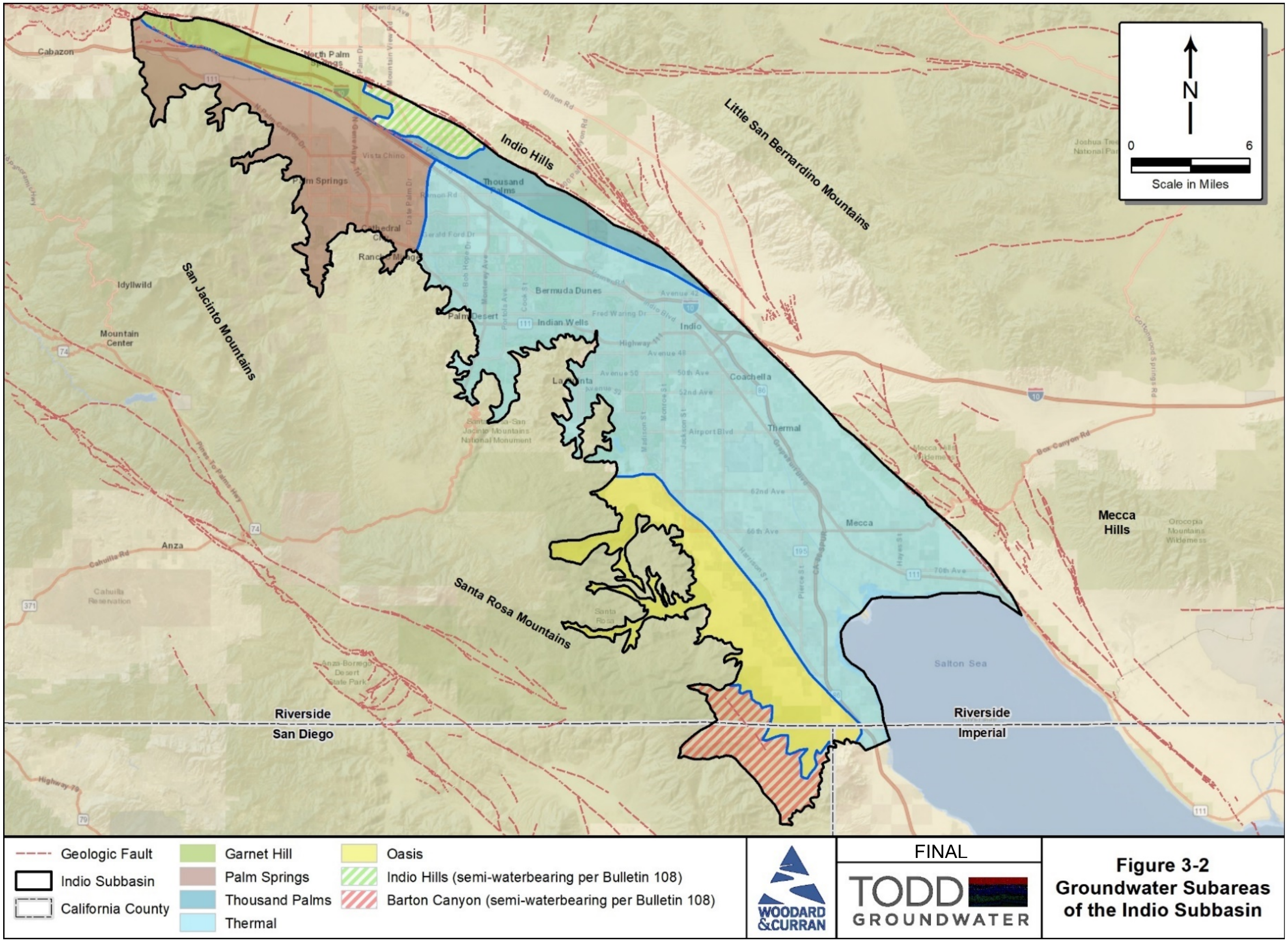


Figure 3-2. Groundwater Subareas of the Indio Subbasin



From about the City of Indio southeasterly to the Salton Sea, the Indio Subbasin is characterized by increasingly thick layers of silt and clay, especially in the shallower portions of the Indio Subbasin. These silt and clay layers are remnants of ancient lakebed deposits and impede the percolation of water applied for irrigation (DWR, 1964).

3.2.1 Garnet Hill Subarea

Water from the Colorado River Aqueduct is conveyed through the Whitewater Hydropower Plant and ultimately feeds WWR-GRF.

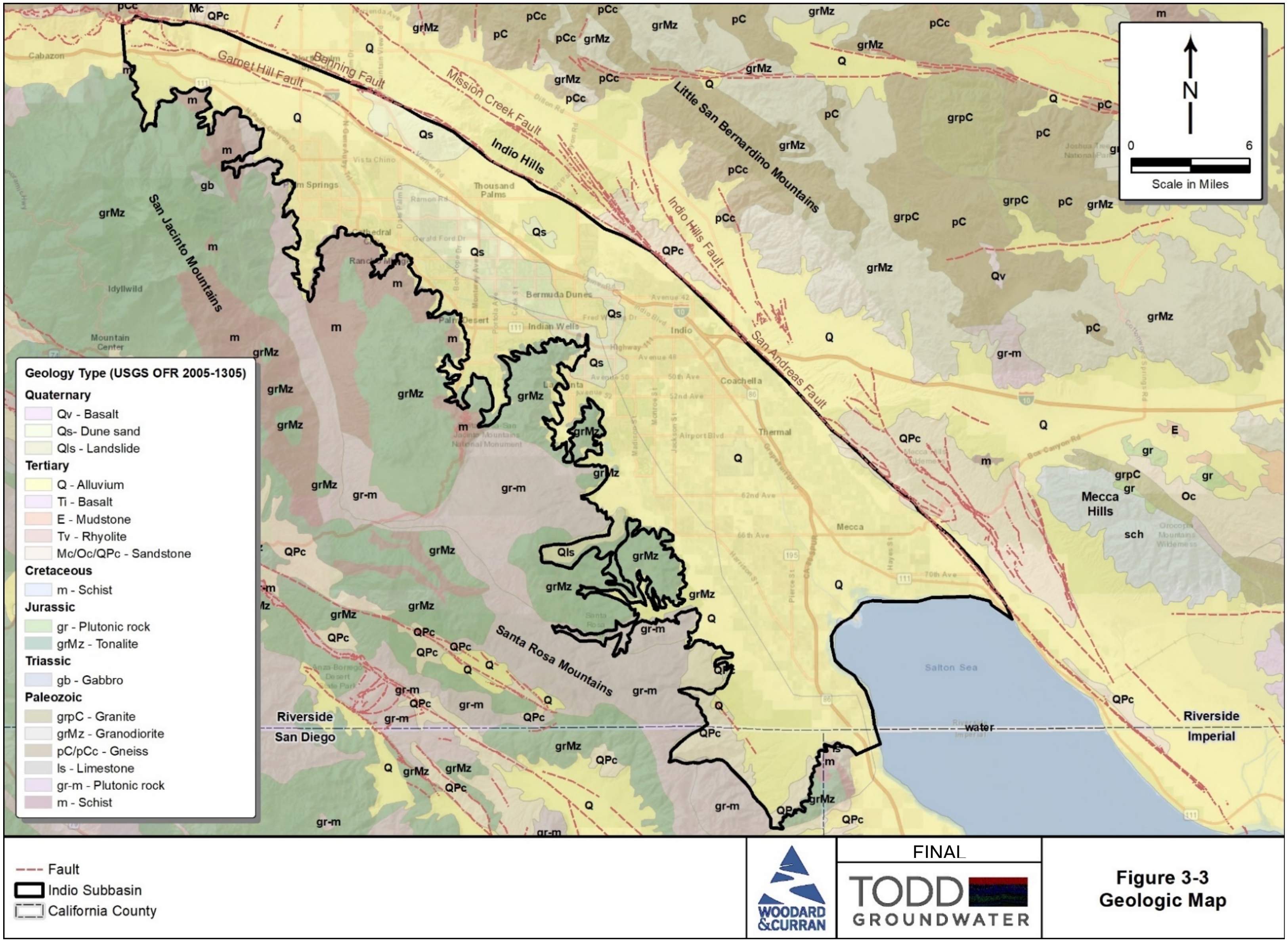
The Garnet Hill Subarea, located between the Garnet Hill Fault and the Banning Fault, is considered part of the Indio Subbasin as defined in DWR's *California's Groundwater: Bulletin 118—Update 2003* (Bulletin 118) (DWR, 2003) and as shown in Figure 3-2. The relative scarcity of wells in the Garnet Hill Subarea limits available geologic information and understanding of groundwater interactions between this Subarea and the adjoining Mission Creek and Indio Subbasins. The 2013 *Mission Creek/Garnet Hill Subbasins Water Management Plan* (CVWD, DWA, and MSWD, 2013) states that groundwater production is low in the Garnet Hill Subarea and is not expected to increase significantly in the future due to relatively low well yields compared to those in the Mission Creek Subbasin. Groundwater levels in the western and central portions of the Subarea show response to large replenishment quantities from the Whitewater River GRF (WWR-GRF), while levels are relatively flat in the eastern portion of the Subarea.

While the Garnet Hill Subarea receives subsurface inflow from Mission Creek Subbasin and some natural recharge from occasional high flows of Mission Creek and other streams, the chemical character of the groundwater and its direction of movement indicate that the main source of inflow to the Subarea comes from percolation associated with the Whitewater River (CVWD, DWA, and MSWD, 2013).

3.2.2 Palm Springs Subarea

Located in the northwestern portion of the Indio Subbasin, the Palm Springs Subarea is bounded by the Garnet Hill Fault to the north and the eastern slopes of the San Jacinto Mountains to the south and extends southeast to Cathedral City. Alluvial fan deposits consist of heterogeneous, coarse-grained sediments with a total thickness in excess of 1,000 feet. Although there is no lithologic distinction apparent based on water well driller's logs, the total thickness of recent deposits suggests that Ocotillo Conglomerate underlies recent Fanglomerate deposits at a depth ranging from 300 to 400 feet (DWR, 1964). Substantial natural and artificial recharge (i.e., replenishment) occurs through the thick sequence of coarse sediments in this Subarea.

Figure 3-3. Geologic Map



3.2.3 Thermal Subarea

Groundwater in the Palm Springs Subarea moves southeastward into the Thermal Subarea. As shown in Figure 3-2, the division between the Palm Springs Subarea and the Thermal Subarea is near the City of Cathedral City.

Figure 3-4 presents a generalized stratigraphic column of the Thermal Subarea showing local geologic units and groundwater zones. As illustrated, the hydrostratigraphy is characterized by the following:

- A shallow semi-perched and confining zone consisting of recent silts, clays, and fine sands
- An upper aquifer with unconfined (water table) conditions
- A semi-confining aquitard of fine-grained materials
- A lower aquifer with confined and artesian conditions

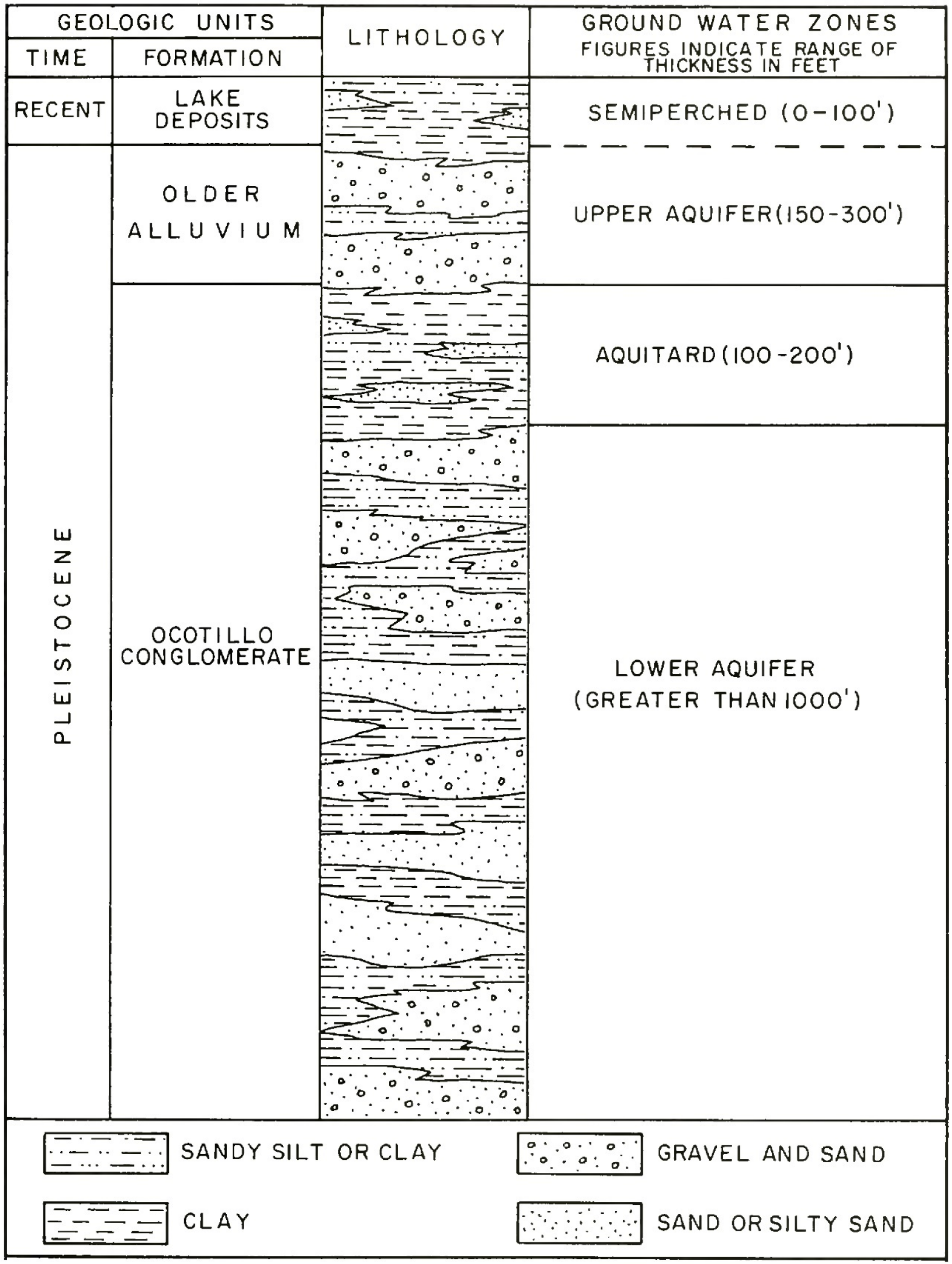
As shown on Figure 3-4, fine-grained clay deposits of the upper Ocotillo Conglomerate Formation separate the upper and lower aquifers. The clay deposits are not regionally extensive or sufficiently thick enough to completely restrict vertical groundwater flow between the upper and lower aquifer zones and are thus referred to as an aquitard.

The aquitard is absent, and no distinction between the upper and lower aquifer zones occurs, along the southwestern margins of the Thermal Subarea at the base of the Santa Rosa Mountains, such as the alluvial fans at the mouth of Deep Canyon and near the City of La Quinta.

The lower aquifer, composed of Ocotillo Conglomerate Formation, consists of silty sands and gravels with interbeds of silt and clay. The lower aquifer contains the greatest quantity of stored groundwater in the Indio Subbasin. The top of the lower aquifer occurs at a depth ranging from 300 to 600 feet below ground surface (bgs). The thickness of the zone is undetermined, as the deepest wells in the Coachella Valley do not fully penetrate the formation. Available data indicate that the zone is at least 500 feet thick and can be in excess of 1,000 feet thick. The thickness of the aquitard overlying the lower aquifer zone ranges from 100 to 200 feet, although in some areas near the Salton Sea it may be in excess of 500 feet.

Capping the upper aquifer zone in the Thermal Subarea is a shallow fine-grained zone in which semi-perched groundwater occurs (Figure 3-5). This zone consists of recent silts, clays, and fine sands and is relatively persistent southeast of the City of Indio. It ranges from 0 to 100 feet thick and is an effective barrier to deep percolation. The low permeability of the materials southeast of the City of Indio has contributed to irrigation drainage challenges in the area. Semi-perched groundwater has been maintained by irrigation water applied to agricultural lands, necessitating construction of an extensive subsurface tile drain system (DWR, 1964). North and west of the City of Indio, the zone is composed mainly of clayey sands and silts, and its effect in retarding deep percolation is limited.

Figure 3-4. Generalized Stratigraphic Column Thermal Subarea



Source: Bulletin No. 108 (DWR 1964)

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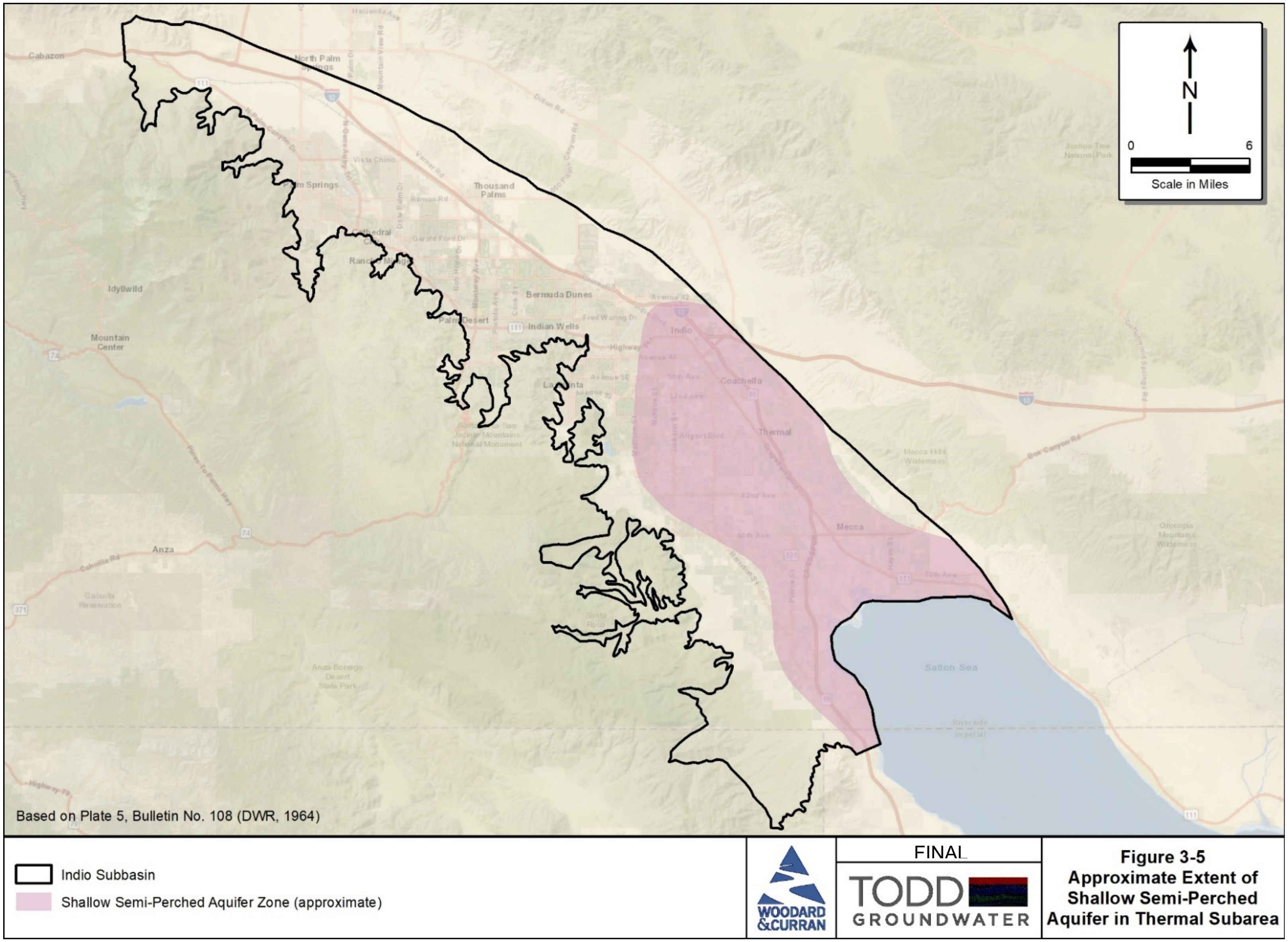
Figure 3-4
Generalized Stratigraphic Column Thermal Subbarea

Figure 3-5. Approximate Extent of Shallow Semi-Perched Aquifer in the Thermal Subarea



3.2.4 Thousand Palms Subarea

The Thousand Palms Subarea (Figure 3-2) is located along the southwest flank of the Indio Hills and is differentiated from the Thermal Subarea by groundwater quality differences (DWR, 1964). In brief, groundwater in the Thousand Palms Subarea is characterized by sodium sulfate chemistry that is distinct from the calcium bicarbonate water of the Thermal Subarea. The differences in water quality indicate that replenishment to the Thousand Palms Subarea comes primarily from the Indio Hills and is limited in supply. The relatively sharp boundary between chemical characteristics of water derived from the Indio Hills in the Thousand Palms Subarea and groundwater in the Thermal Subarea suggests there is little intermixing between the two Subareas.

The configuration of the water table north of the community of Thousand Palms is such that the generally uniform, southeasterly gradient in the Palm Springs Subarea diverges and steepens to the east along the base of Edom Hill. This steepened gradient suggests the presence of a barrier to groundwater flow in the form of a reduction in sediment permeability or a southeast extension of the Garnet Hill Fault. Gravity surveys by DWR (1964) do not indicate a subsurface fault. Accordingly, the sharp increase in gradient is attributed to lower sediment permeability to the east.

3.2.5 Oasis Subarea

Another peripheral zone of unconfined groundwater, with different chemical characteristics from water in the major Indio Subbasin areas, is found underlying the Oasis Subarea that extends along the base of the Santa Rosa Mountains. Water-bearing materials underlying the Subarea consist of highly permeable alluvial fan deposits. Although groundwater data suggest that the boundary between the Oasis and Thermal Subareas may be a buried fault extending from Travertine Rock to the community of Oasis, the remainder of the boundary is a lithologic change from the coarse fan deposits of the Oasis Subarea to the interbedded sands, gravel, and silts of the Thermal Subarea. Little information is available as to the thickness of the water-bearing materials, but it is estimated to be in excess of 1,000 feet.

3.3 Faults

The Indio Subbasin is bordered on the southwest by the Santa Rosa and San Jacinto Mountains. The boundaries between Subbasins within the Basin are generally defined by faults that serve as effective barriers to the lateral movement of groundwater. The Indio Subbasin is separated from the Mission Creek Subbasin by the Banning Fault, and from the Desert Hot Springs Subbasin by the San Andreas Fault (Figure 3-3). Both faults represent effective barriers to groundwater flow.

The Garnet Hill Subarea lies between the Garnet Hill and Banning Faults, which act as partially effective barriers to lateral groundwater movement. The Garnet Hill Fault partially impedes groundwater flow from the Garnet Hill Subarea toward the south. This effect is revealed by close inspection of groundwater level information on either side of the Garnet Hill Fault; for example, the groundwater level contour map in the *Indio Subbasin Annual Report for Water Year 2018-2019* (see Figure 3-2; Indio Subbasin GSAs, 2020) shows differences of as much as 220 feet across the Garnet Hill Fault; such elevation differences also are illustrated on the hydrogeologic cross section B-B’ (Figure 3-10). The Garnet Hill Fault does not reach the surface and is probably effective as a barrier to lateral groundwater movement only below a depth of about 100 feet (CVWD, DWA, and MSWD, 2013). A comparison of Figure 3-2 and Figure 3-3 indicates that the Palm Springs Subarea is bounded by the Garnet Hill Fault to the north.

3.4 Recharge and Discharge Areas

This section identifies groundwater inflows and outflows and describes the respective recharge and discharge areas of the Indio Subbasin. Quantification of the inflows and outflows will be described in more detail in Chapter 4, *Current and Historical Groundwater Conditions* and Chapter 7, *Numerical Model and Plan Scenarios*.

3.4.1 Groundwater Inflows

Sources of inflow (i.e., recharge) to the Indio Subbasin include the following:

- Infiltration of natural inflows through mountain-front and stream channel recharge
- Subsurface inflows
- Artificial recharge of imported water (i.e., replenishment)
- Wastewater percolation
- Return flows from municipal/domestic use, agriculture, golf courses, and other sources

From 2000 to 2019, combined return flows have represented the largest source of recharge in the Subbasin, followed by imported water recharge and natural mountain front and stream channel recharge.

3.4.1.1 Infiltration of Natural Inflows

Precipitation that falls in the San Jacinto, Santa Rosa, and Little San Bernardino Mountains is the primary source of natural recharge in the Indio Subbasin with only minor recharge from precipitation in the Little San Bernardino Mountains. Mountain-front recharge includes subsurface inflow from canyons and surface runoff from minor tributaries along the mountain fronts. The Whitewater River is the major stream channel contributing recharge with additional infiltration along other channels such as Snow and Falls Creeks in the upper valley and several smaller streams in the lower portion of the valley that only flow during wet years. The annual volume of natural recharge varies significantly as the annual volume of precipitation varies widely. During normal and wet years, mountain front recharge from these streams and smaller watersheds percolates into the Subbasin as additional subsurface flow.

3.4.1.2 Subsurface Inflows

Natural inflow to the Indio Subbasin includes subsurface inflow from the San Gorgonio Pass Subbasin through the bedrock constriction, subsurface inflow from the Mission Creek Subbasin across the Banning Fault, and subsurface inflow from Desert Hot Springs Subbasin across the Banning and San Andreas Faults. In addition, subsurface inflow occurs from beneath the Salton Sea to deep zones in the Indio Subbasin.

3.4.1.3 Artificial Recharge of Imported Water (Replenishment)

Artificial recharge is accomplished as follows:

- In the western portion of the Indio Subbasin at the WWR-GRF
- In the mid-valley at the Palm Desert Groundwater Replenishment Facility (PD-GRF)
- In the eastern portion of the Indio Subbasin at the Thomas E. Levy Groundwater Replenishment Facility (TEL-GRF) (formerly the Dike 4 Recharge Facility)

The source of replenishment water for the WWR-GRF is State Water Project (SWP) exchange water (i.e., water exchanged for Colorado River water via the Colorado River Aqueduct [CRA]), while the source of replenishment water for the Palm Desert GRF (PD-GRF) and Thomas E. Levy GRF (TEL-GRF) is Colorado River water via the Coachella Canal (Canal).

3.4.1.4 Wastewater Percolation

The urban portions of the Indio Subbasin are served primarily by municipal sewer systems that convey wastewater to municipal wastewater treatment plants. A portion of the treated wastewater that is not recycled and reused or discharged to the Coachella Valley Stormwater Channel (CVSC) is disposed to percolation/evaporation ponds.

3.4.1.5 Return Flows from Use

Deep percolation of water applied to agricultural fields, golf courses, and urban landscapes represents a major inflow to the groundwater system and is referred to as irrigation return flow. In addition to the wastewater percolation that occurs at wastewater treatment ponds, some inflow occurs from septic tank/leachfield systems that are used to treat and percolate wastewater. These are grouped with return flows because they are individually small and distributed across rural portions of the Indio Subbasin and a few urban areas without access to sewer systems. There are also some septic systems in areas with access to sewer services that have not connected.

3.4.2 Groundwater Outflows

Indio Subbasin groundwater outflows consist of the following:

- Groundwater pumping
- Subsurface and drain flows to Salton Sea
- Evapotranspiration (ET)

3.4.2.1 Groundwater Pumping

Groundwater pumping is the largest component of outflow from the Indio Subbasin. Groundwater is pumped for agricultural, municipal, golf course, and other beneficial uses within the Indio Subbasin; additional groundwater is pumped from the Indio Subbasin and exported for use within the Plan Area in adjacent Subbasins.

3.4.2.2 Subsurface and Drain Flows to Salton Sea

In the eastern Indio Subbasin, the confining unit of the upper aquifer impedes deep percolation of applied water, resulting in saturated soil conditions that reduce agricultural productivity. In the 1930s, a network of open drainage ditches was constructed to alleviate this condition. Subsurface (i.e., tile) drainage systems were installed to control high water table conditions and to intercept higher salinity, shallow groundwater. The CVSC and associated drains receive intercepted shallow groundwater from agricultural fields and convey flows to the Salton Sea. The CVSC and drain system also receive flows of Canal water that exceed requested deliveries (i.e., regulatory water), treated wastewater, and fish farm effluent.

Historically, with relatively high groundwater levels, groundwater naturally flowed toward the Salton Sea. With groundwater level declines in the southeastern Indio Subbasin, the rate of outflow to the Salton Sea decreased. Since about 2015, groundwater level increases have resulted in restoration of net outflow of groundwater to the Salton Sea (see Section 7.2.5).

3.4.2.3 Evapotranspiration

Prior to development, water outflow through ET was significant above the semi-perched aquifer in the southeastern portion of the Coachella Valley. As native landscapes were converted to agriculture, groundwater outflow to ET decreased. Additionally, a portion of the imported water used for groundwater replenishment and/or disposed as wastewater is lost to evaporation.

3.5 Hydrogeologic Cross Sections

Seven hydrogeologic cross sections were developed to illustrate hydrogeologic conditions across the Indio Subbasin. Figure 3-6 shows the locations of the cross sections along with the GRF locations. Cross sections A-A’, A’-A’’, and A’’-A’’’ (Figures 3-7 through 3-9) form a contiguous 50-mile cross section oriented along the central longitudinal axis of the Indio Subbasin, starting in the San Gorgonio Pass Subbasin in the northwest and ending at the northern shore of the Salton Sea in the southeast.

3.5.1 Longitudinal Cross Sections

Cross Section A-A’ (Figure 3-7) runs along the axis of the Indio Subbasin from the San Gorgonio Pass Subbasin to just southeast of Date Palm Drive in Cathedral City in the Palm Springs Subarea. Permeable sands and gravels comprise most of the Subbasin deposits with smaller lenses of fine sand and clay, which increase in frequency to the southeast. Depth to bedrock (bottom of Subbasin) is about 1,400 feet at the northwest edge and increases to the southeast, where depths to bedrock are greater but known only to the extent that depth to bedrock exceeds the maximum depth of local wells.

The Figure 3-7 legend indicates use of two different groundwater elevation sources. The solid triangle indicates the water year (WY) 2018-2019 groundwater elevation, which was derived from contours shown in *Indio Subbasin Annual Report for Water Year 2018-2019* (Indio Subbasin GSAs, 2020). Subsequently, the U.S. Geological Survey (USGS) has installed three new wells in the area at the northwest end of the cross section where groundwater monitoring points had been sparse. To provide a more accurate depiction of groundwater elevations in this area, groundwater elevations measured in 2019 in the three new wells were used; these are denoted in the legend as “measured 2019 groundwater elevation data from wells projected onto the section,” and are shown as open triangles. This new information provides a more accurate depiction of groundwater levels in an area characterized by substantial changes over short distances in ground surface elevation, groundwater levels, and depth to bedrock.

Groundwater flow is from northwest to southeast and groundwater elevations range from greater than 1,100 feet above mean sea level (msl) near the San Gorgonio Pass Subbasin to about 500 feet above msl near the southeast end of the section. Groundwater elevations and gradients are strongly influenced by groundwater replenishment activities at WWR-GRF.

Cross Section A’-A’’ (Figure 3-8) runs along the axis of the Subbasin continuing the A-A’ cross section through the northwest portion of the Thermal Subarea. Increasing fine sands and clay lenses are noted when compared with cross section A-A’. The approximate boundary between the upper and lower aquifer is illustrated on the cross section. As illustrated, depths to bedrock are greater than 1,300 feet based on maximum well depths.

Cross section A’’-A’’’ (Figure 3-9) runs along the axis of the Subbasin continuing the A’-A’’ cross section through the northwest portion of the Thermal Subarea to the Salton Sea. Increasing fine sands and clay lenses are noted when compared with cross section A’-A’’. The approximate boundary between the upper and lower aquifer is illustrated in the cross section. Depths to bedrock are greater than 1,500 feet based on maximum well depths.

Groundwater flow is from northwest to southeast and groundwater elevations range from nearly 1,200 feet above msl at the northwest end of the Subbasin to at or above the ground surface (at about 240 feet below msl) at the southeast end of the Subbasin. The extent of artesian conditions is shown on Figure 3-9.

Overall, these longitudinal cross sections document a down-valley progression of alluvial sediment from predominantly sand and gravel to increasing fine sands with limited clay lenses and then to the clay-dominated sediments at the Salton Sea. Highlights of this evaluation are summarized below.

- With the significant thickness of coarse sediments and depth to groundwater, the northwestern portion is the primary forebay area for substantial groundwater recharge, including artificial recharge at WWR-GRF.
- The middle portion is transitional, with increasing fine sand and silt and more clay lenses, recognition of upper and lower aquifers, and decreasing depth to groundwater.
- The distal portion shows a progression to predominant clay, the clear definition of upper and lower aquifers, and shallow groundwater and artesian conditions that would indicate Subbasin discharge under natural conditions.

Figure 3-6. Cross Section Locations

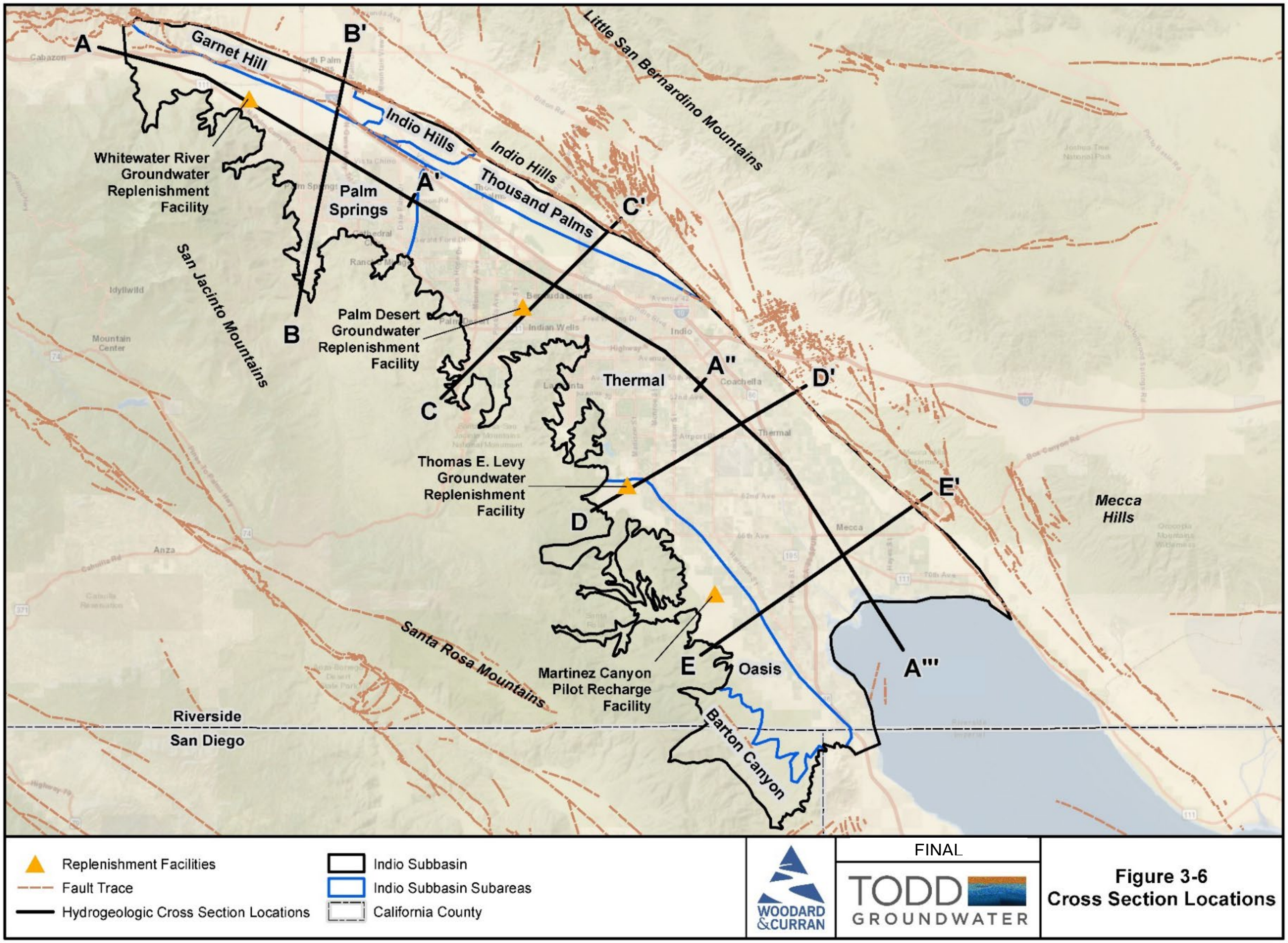


Figure 3-7. Cross Section A to A'

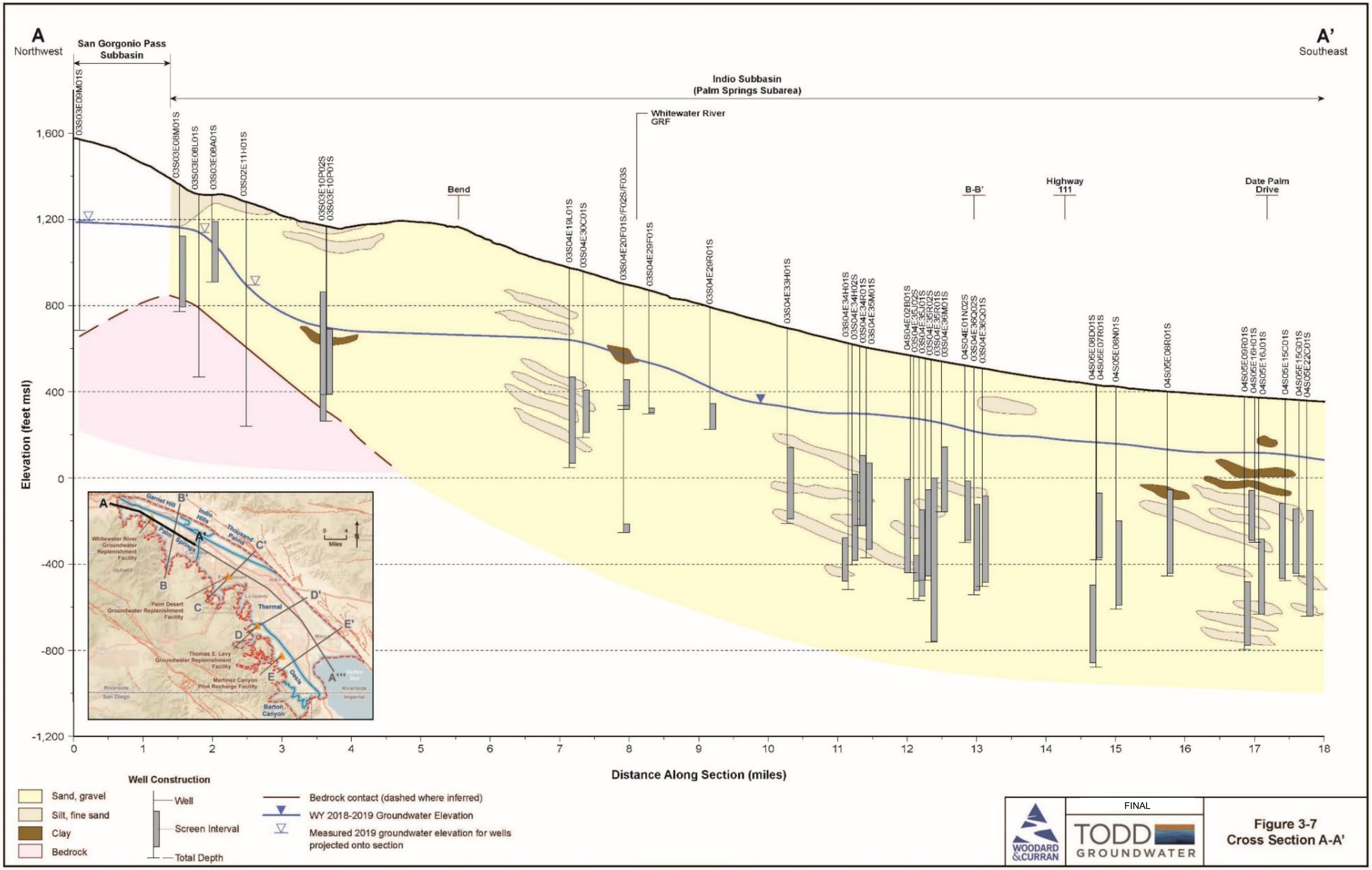


Figure 3-8. Cross Section A' to A''

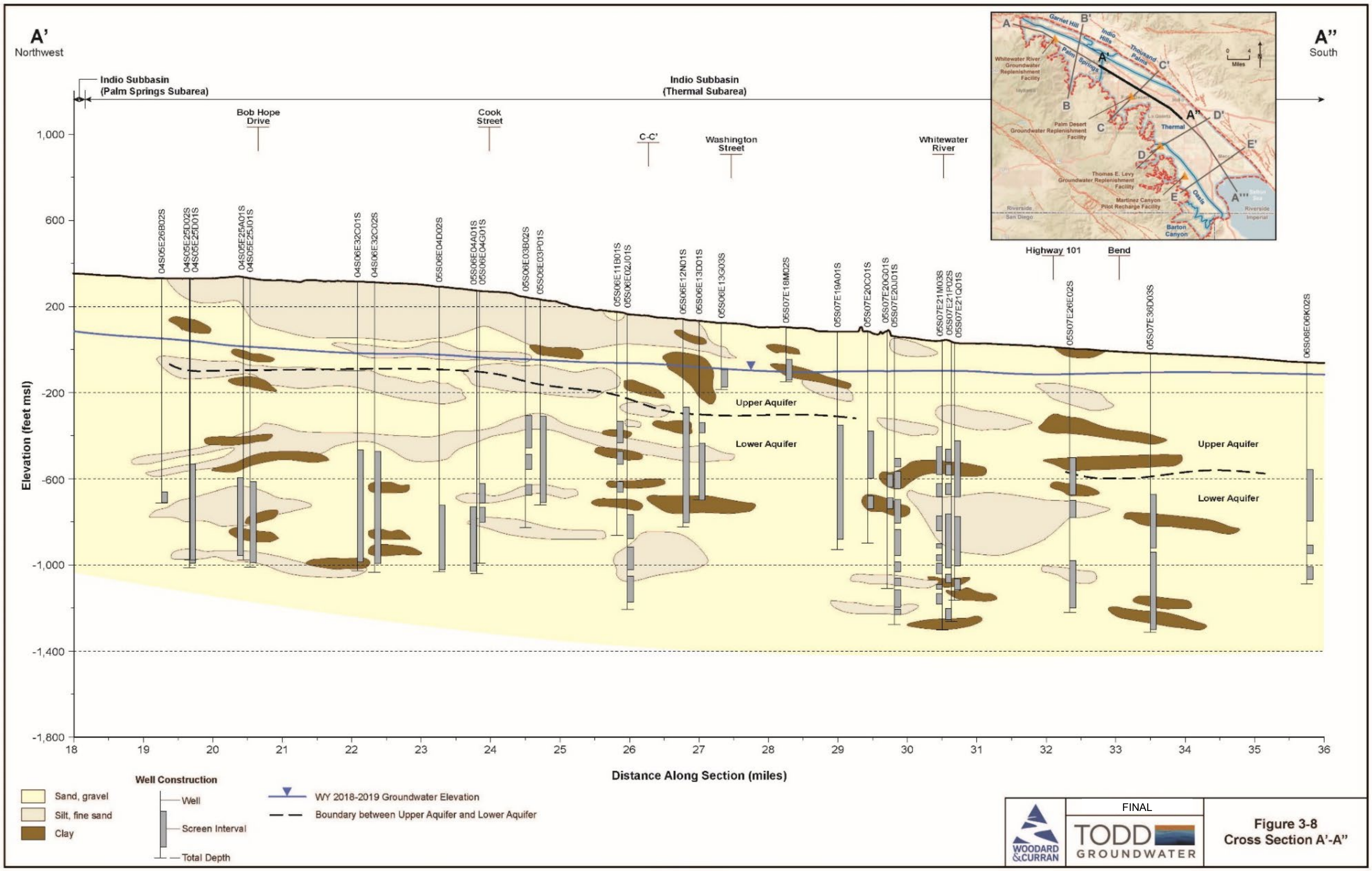
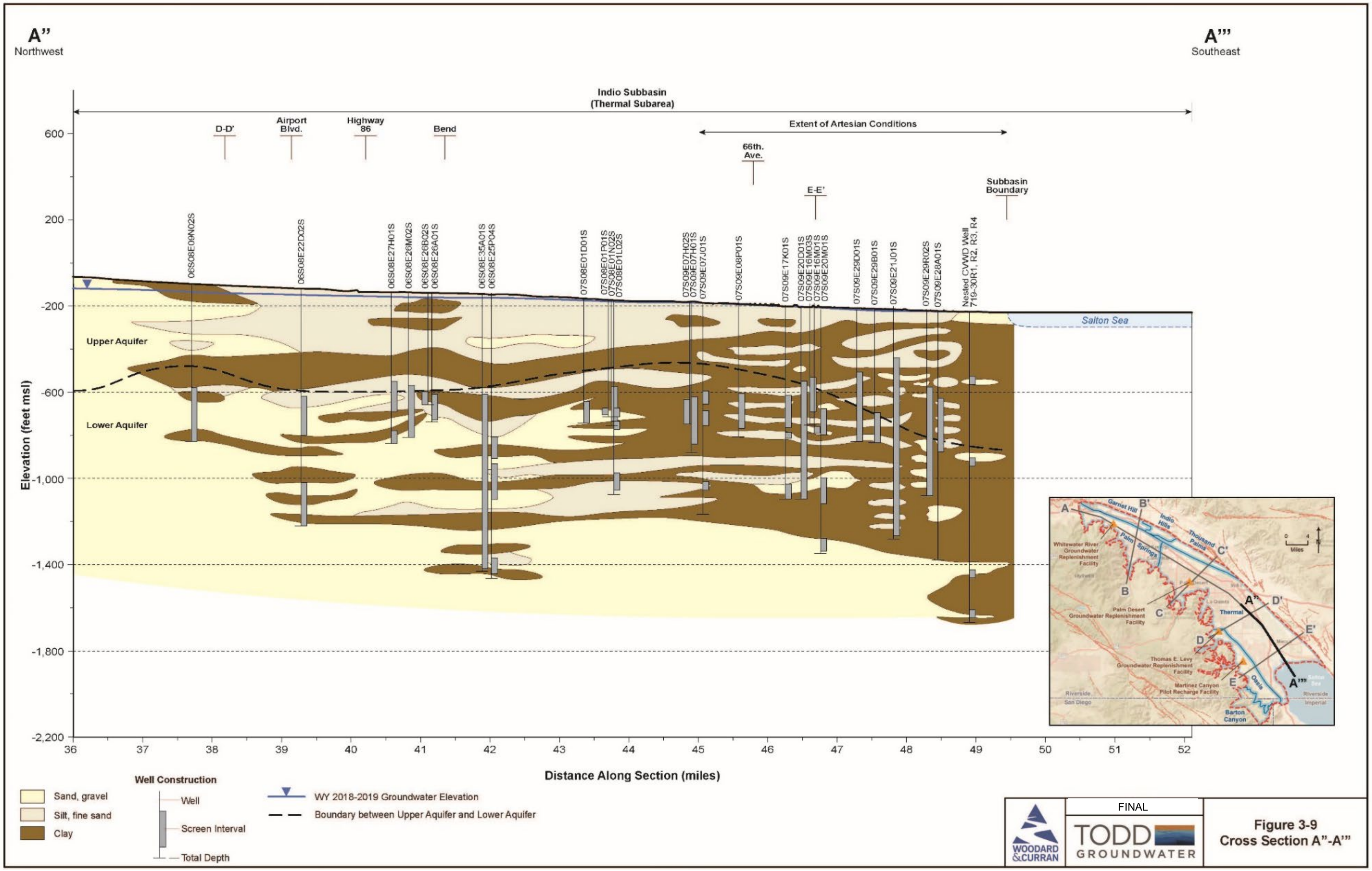


Figure 3-9. Cross Section A'' to A'''



3.5.2 Perpendicular Cross Sections

Cross sections B-B’, C-C’, D-D’, and E-E’ (Figures 3-10 through 3-13) were constructed perpendicular to the main axis of the Indio Subbasin. Collectively, these cross sections incorporate hydrogeologic information from the five main Subareas of the Indio Subbasin except the Indio Hills and Barton Canyon Subareas, which are semi-water bearing and generally lack subsurface information. The Subbasin bottom is not well defined but extends beyond the maximum depth of groundwater wells drilled in the Indio Subbasin (i.e., 1,500 feet).

Cross section B-B’ (Figure 3-10) runs roughly north-south intersecting cross section A-A’. Cross section B--B’ crosses the Palm Springs Subarea in the south and the Garnet Hill Subarea and the Mission Creek Subbasin in the north. Cross section B-B’ shows sands and gravels with fine sand and clay lenses, with deposits thickening toward the center of the Indio Subbasin. Displacements of geologic materials along the Garnet Hill and Banning Faults are shown in Figure 3-10. These faults provide the boundaries between the Palm Springs and Garnet Hill Subareas of the Indio Subbasin and between the Indio and Mission Creek Subbasins. Cross section B-B’ is roughly perpendicular to the northwest to southeast flow direction in the Indio Subbasin. Significant change in groundwater elevations is shown across the two faults confirming that the faults act as partial barriers to groundwater flow.

Cross section C-C’ (Figure 3-11) runs perpendicular to cross section A’-A’’. Cross section C-C’ crosses the Thermal and Thousand Palms Subareas of the Indio Subbasin in the southwest and the Mission Creek and Desert Hot Springs Subbasins in the northeast. Cross section C-C’ shows sands and gravels with increasing frequency of fine sand and clay lenses compared with cross section B-B’. Subbasin sediments thicken toward the center of the Indio Subbasin. Displacement of the Banning Fault provides the boundary between the Indio and Mission Creek Subbasins. Cross section C-C’ shows the boundary between the upper and lower aquifers. This cross section is roughly perpendicular to the northwest to southeast flow direction in the Indio Subbasin with depths to water of about 200 feet in the central portion of cross section C-C’.

Cross section D-D’ Figure 3-12) runs perpendicular to Cross Section A’’-A’’’. Cross section D-D’ crosses the Oasis and Thousand Palms Subareas of the Indio Subbasin in the southwest and the Desert Hot Springs Subbasins in the northeast. Cross section D-D’ shows sands and gravels with increasing frequency of fine sand and clay lenses compared with Cross Section C-C’. Basin sediments thickening toward the center of the Indio Subbasin. The San Andreas Fault provides the boundary between the Indio and Desert Hot Springs Subbasins. Cross section D-D’ shows the boundary between the upper and lower aquifers. Cross section D-D’ is roughly perpendicular to the northwest to southeast flow direction in the Indio Subbasin with shallow depths to water, typically less than 40 feet in the central portion of the cross section.

Cross section E-E’ (Figure 3-13) runs perpendicular to Cross Section A’’-A’’’. Cross section E-E’ crosses the Oasis and Thousand Palms Subareas of the Indio Subbasin in the southwest and the Desert Hot Springs Subbasins in the northeast. Cross section E-E’ shows sands and gravels with increasing frequency of fine sand and clay lenses compared with cross section D-D’. Basin sediments thicken toward the center of the Indio Subbasin. The San Andreas Fault is the boundary between the Indio and Desert Hot Springs Subbasins.

Cross section E-E’ shows the boundary between the upper and lower aquifers. The cross section is roughly perpendicular to the northwest to southeast flow direction in the Indio Subbasin with shallow depths to water. The extent of artesian conditions is shown in Figure 3-13.

The perpendicular cross sections provide additional insights into the hydrogeology of the Indio Subbasin as listed below.

- The relatively narrow, bedrock or fault-bounded character of the Indio Subbasin in the northwest
- The substantial thickness of the Subbasin that occurs along the eastern margin of the Indio Subbasin or along the Subbasin axis
- The greater proportion of coarse-grained sediments along the western mountain front and limit of regional clay to the west, indicating a narrow mountain-front forebay for natural recharge and for artificial recharge (e.g., TEL-GRF on Section D-D’, Figure 3-12).

TEL-GRF utilizes a narrow mountain-front forebay for artificial recharge.

Figure 3-10. Cross Section B to B'

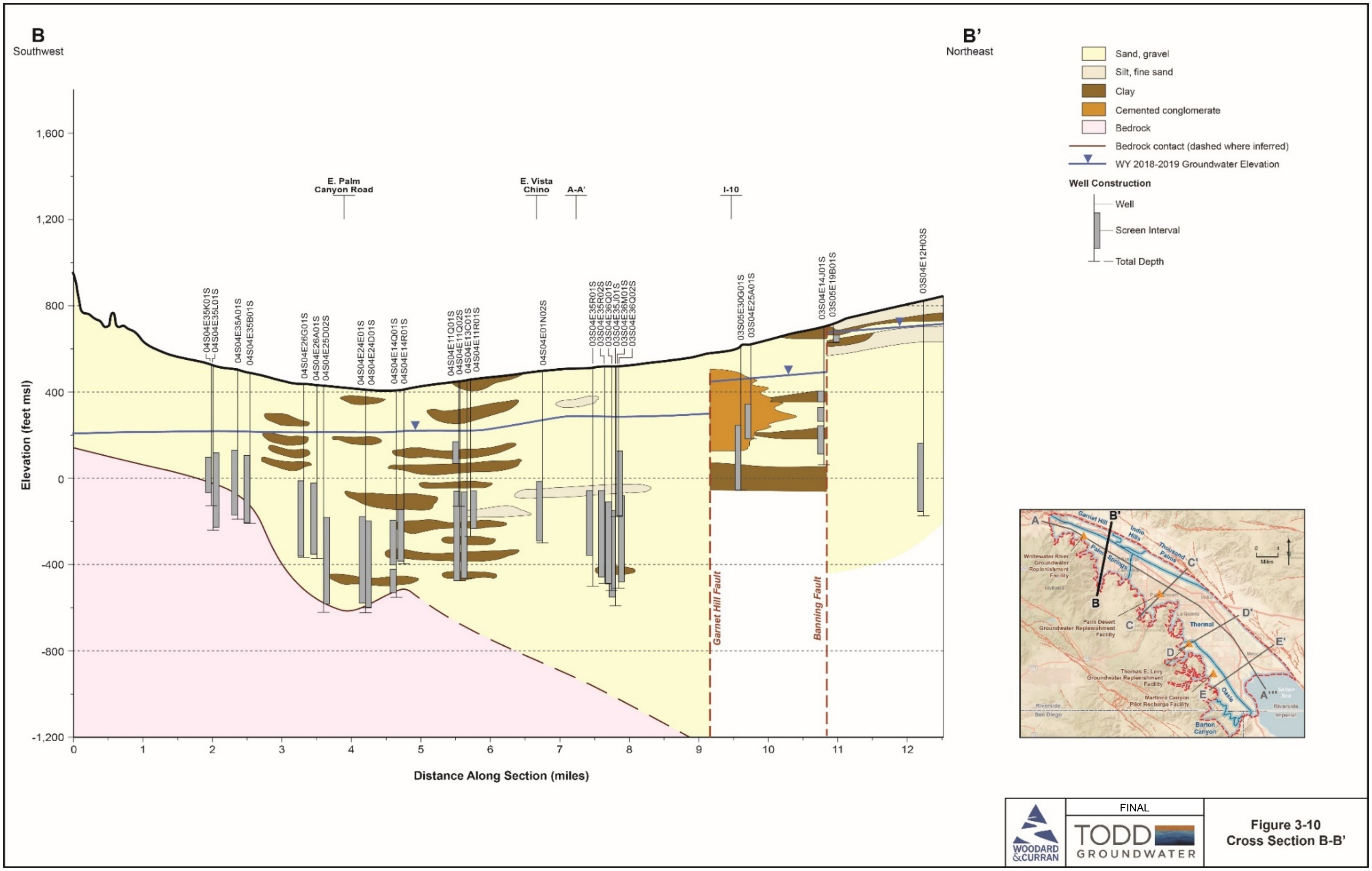


Figure 3-11. Cross Section C to C'

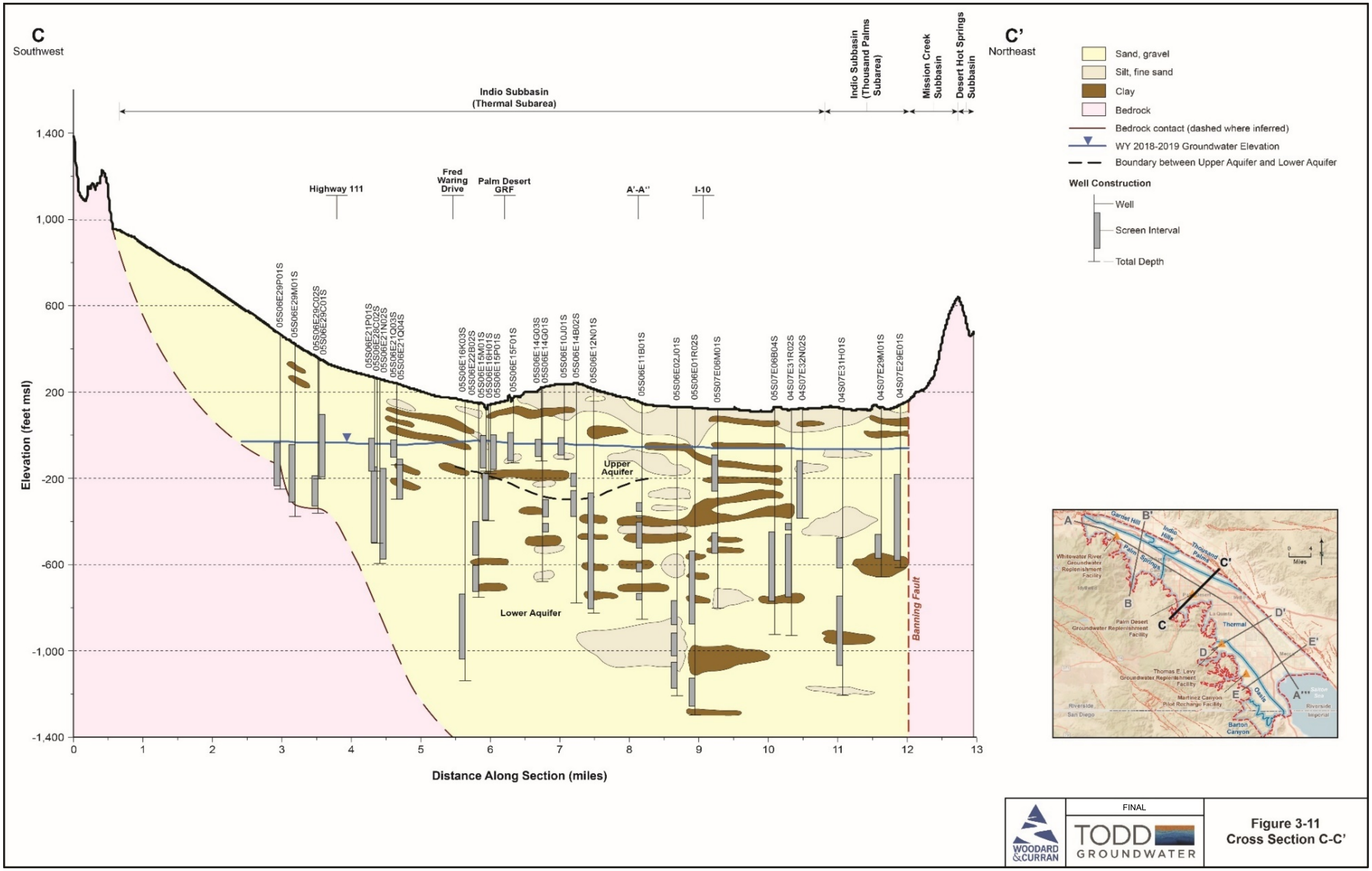


Figure 3-12. Cross Section D to D'

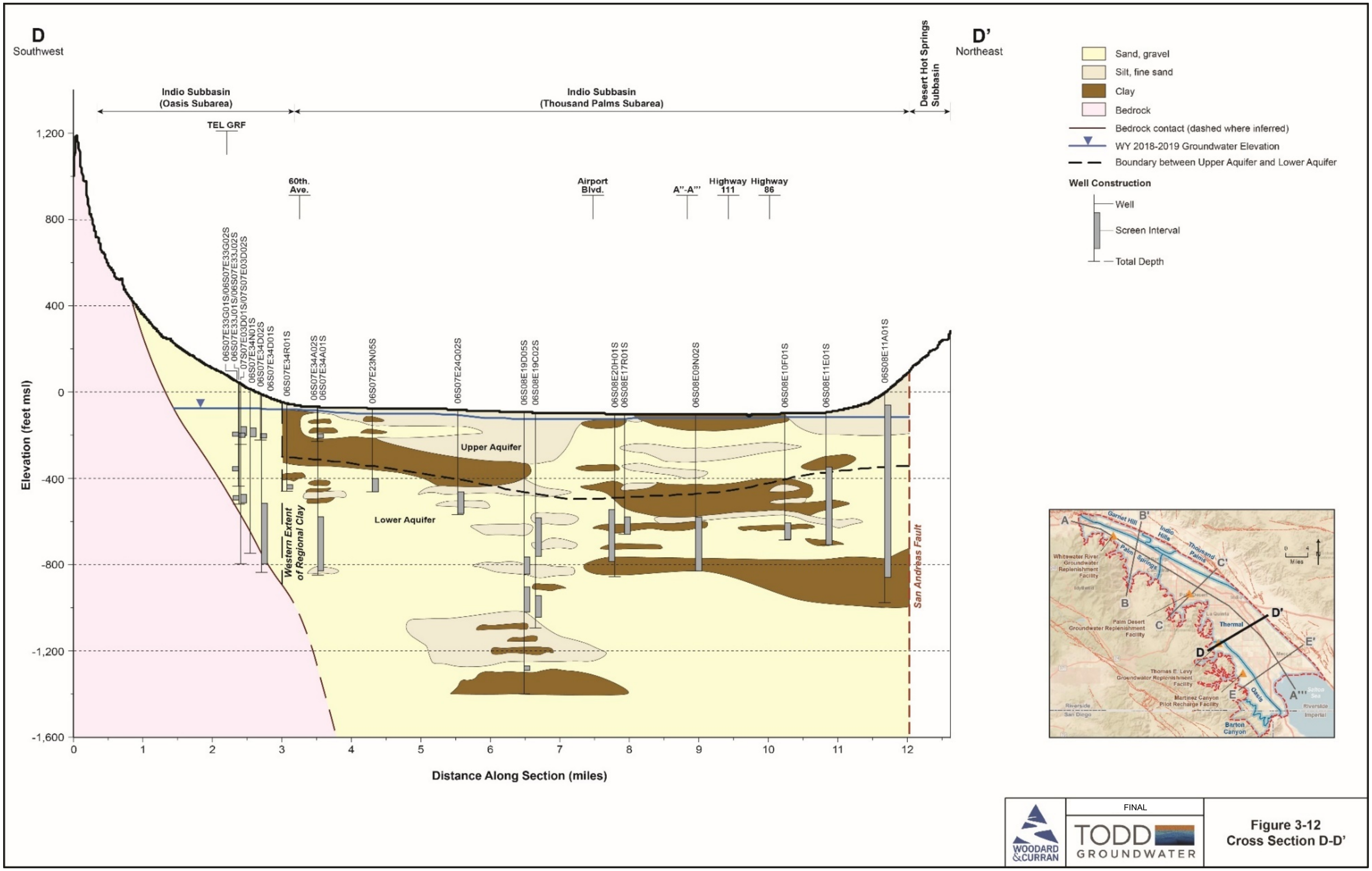
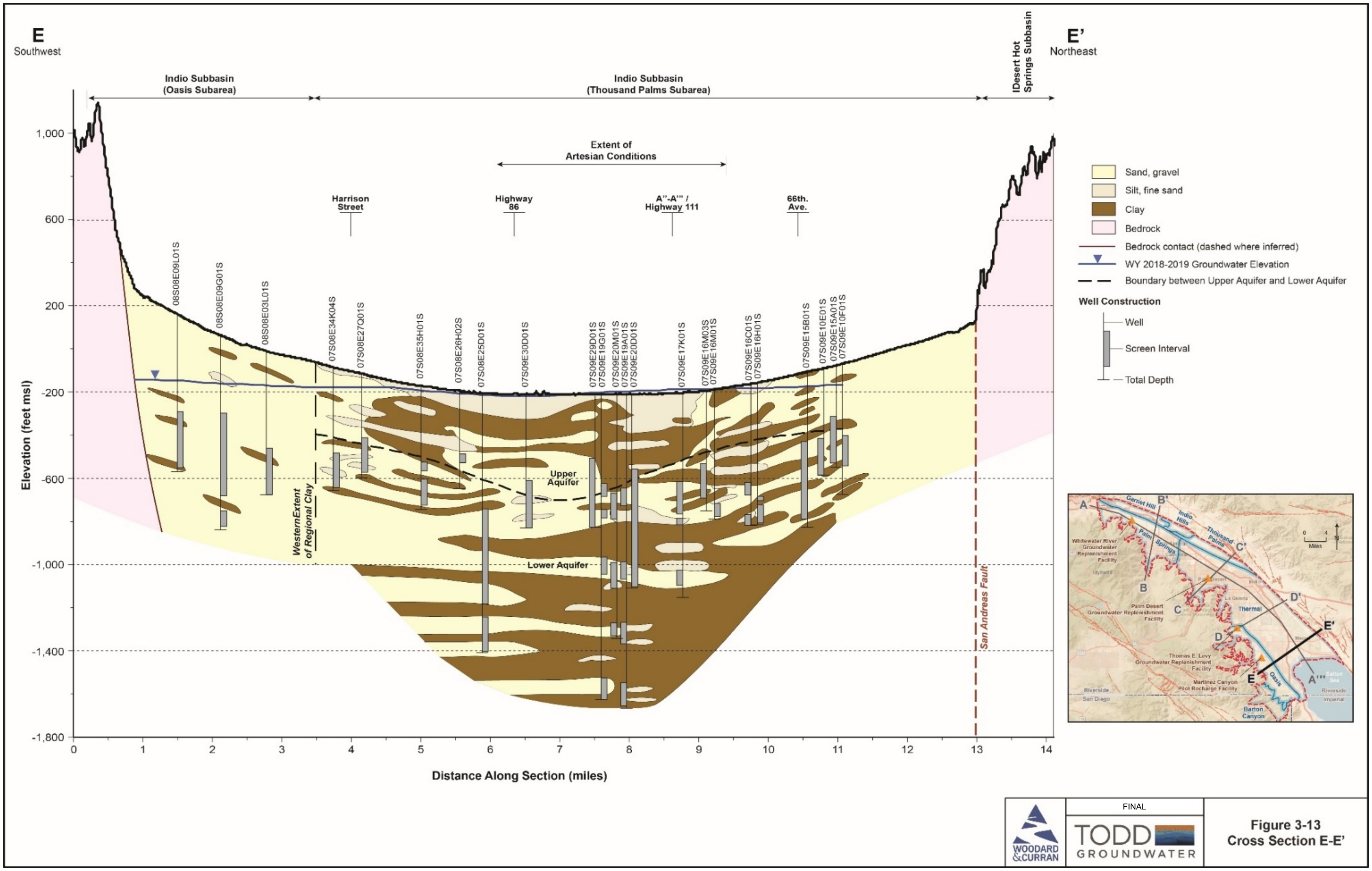


Figure 3-13. Cross Section E to E'



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CHAPTER 4: CURRENT AND HISTORICAL GROUNDWATER CONDITIONS

This chapter describes the current and historical groundwater conditions in the Indio Subbasin. The Indio Subbasin is the primary source of groundwater supply for the Plan Area (see Figure 2-1 in Chapter 2, *Plan Area*) and is a California Department of Water Resources (DWR)-designated Subbasin (No. 7-021.01) of the Coachella Valley Groundwater Basin. Adjoining groundwater basins and Subbasins are shown in Figure 1-1 in Chapter 1, *Introduction*. While the Plan Area overlies portions of the Desert Hot Springs Subbasin and the Orocopia Valley, Chocolate Valley, and West Salton Sea basins, these are not major sources of regional groundwater supply.

Groundwater conditions are described with reference to the six sustainability indicators identified in the Sustainable Groundwater Management Act (SGMA). These include:

1. Groundwater elevations
2. Groundwater storage
3. Potential subsidence
4. Groundwater quality
5. Seawater intrusion
6. Interconnected surface water and groundwater dependent ecosystems (GDEs)

Descriptions of groundwater conditions focus on the period 1990 through 2019. While historical data also are provided (for example, historical change in groundwater storage from 1970), this 30-year period encompasses varying climatic conditions (including state-wide drought) and represents current operations relative to water importation, groundwater replenishment, water recycling, and water conservation, among other management actions. This period is also consistent with the update of the numerical groundwater flow model. The original numerical model was calibrated from 1936 to 1996 and was updated through 2019 as part of this Update.

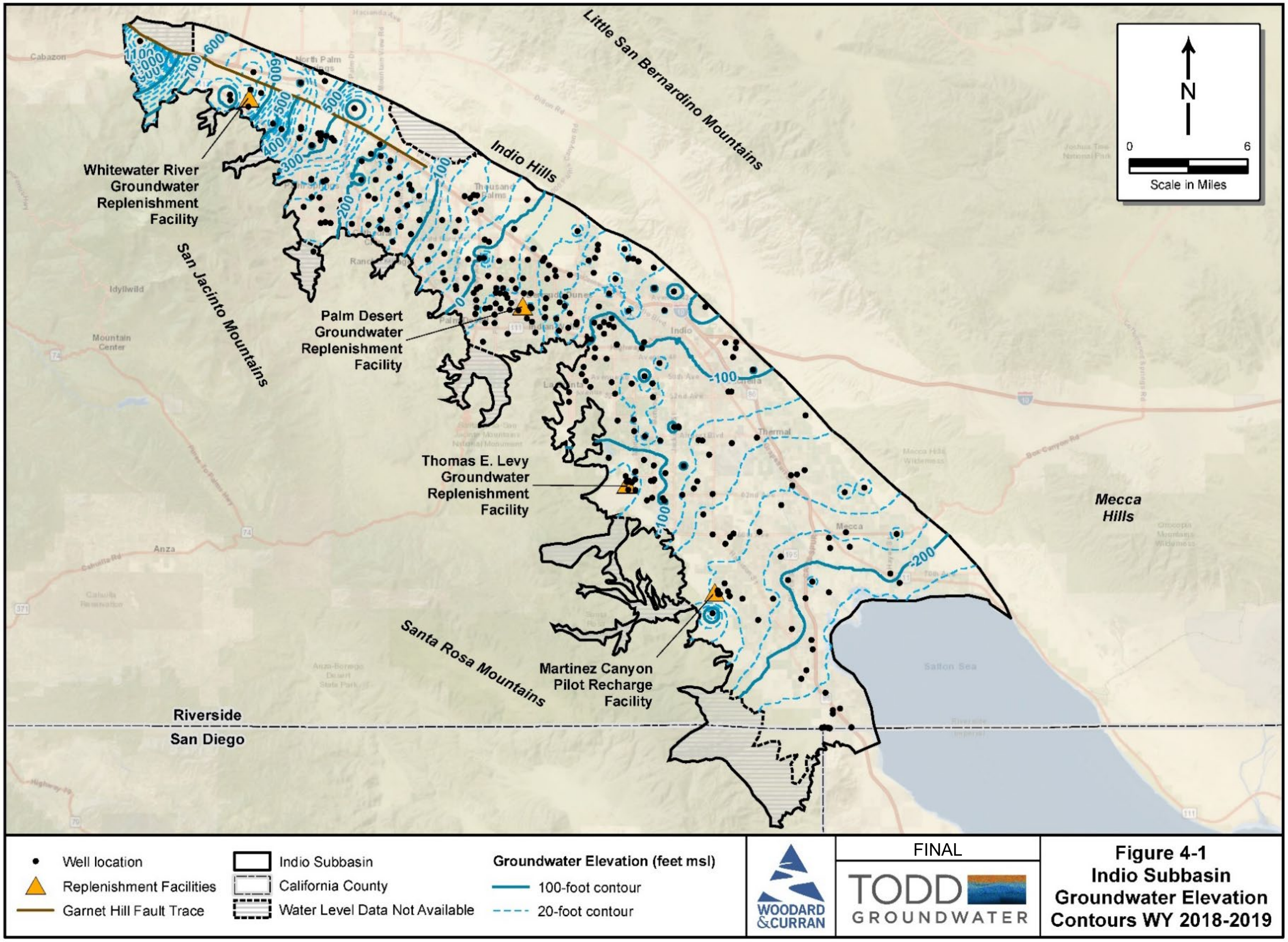
4.1 Groundwater Elevations

This section summarizes groundwater conditions in terms of elevations, flows, trends over time, vertical groundwater gradients and depth to groundwater, and regional groundwater level changes. The groundwater elevation monitoring program is described briefly in Chapter 2, *Plan Area*.

4.1.1 Groundwater Elevations, Flow, and Trends

Figure 4-1 shows the Water Year (WY) 2018-2019 groundwater elevation contour map for the Indio Subbasin. Groundwater elevations of the principal aquifer are averaged over the water year; this is most representative, as local groundwater levels do not exhibit strong seasonal trends. As shown on the figure, regional groundwater flows are in a northwest-to-southeast direction through the Indio Subbasin.

Figure 4-1. Indio Subbasin Groundwater Elevation Contours WY 2018-2019



Recharge at TEL-GRF commenced in 2009.

Groundwater elevations range from greater than 1,100 feet mean sea level (msl) near the San Gorgonio Pass Subbasin in the northwest to approximately -220 feet msl in the southeast along the northern shoreline of the Salton Sea. The hydraulic gradients across the Indio Subbasin in WY 2018-2019 were typically steeper in the northwest, flattening downgradient to the southeast. Groundwater elevations and gradients are strongly influenced by groundwater replenishment activities near the Whitewater River Groundwater Replenishment Facility (WWR-GRF) and Thomas E. Levy Groundwater Replenishment Facility (TEL-GRF). The Palm Desert Groundwater Replenishment Facility (PD-GRF) Phase 1 operations began in early 2019, and the effects on groundwater levels are only beginning to be apparent. Geological faults, constrictions, and pumping also affect localized hydraulic gradients.

Figure 4-2 shows locations of wells with long-term hydrographs. Long-term water level hydrographs for selected wells distributed across the Indio Subbasin are presented on Figures 4-3 to 4-5 to illustrate groundwater elevation trends over time in the West Valley, East Valley, and confined area. Full-sized hydrographs are provided in Appendix 4-A. The surface elevation of each well is shown in the hydrographs as a horizontal line color-coded to match the respective hydrograph. The hydrographs depict the groundwater level response to historical pumping and water management activities identified and implemented in the *2002 Coachella Valley Water Management Plan* (*2002 CVWMP*) (CVWD, 2002) and *2010 CVWMP Update* (CVWD, 2012).

Figure 4-3 shows hydrographs for wells in the West Valley area. The hydrographs show that groundwater levels have responded directly and positively to historical replenishment activities at the WWR-GRF. Groundwater elevations in the Palm Springs/Cathedral City area have remained relatively stable over time with more moderate positive responses to upgradient WWR-GRF replenishment activities. Groundwater levels in the Palm Desert area have stabilized since 2005 and increased slightly since 2010.

Figure 4-4 shows hydrographs for the East Valley, where groundwater elevations in Indio, Coachella, Bermuda Dunes, and La Quinta have stabilized since 2005 and even increased slightly in the La Quinta area since 2010. Groundwater elevations near Thermal and Mecca have responded positively to replenishment activities at the TEL-GRF since recharge commenced in 2009.

Collectively, the hydrographs illustrate the effectiveness of groundwater replenishment, source substitution, and conservation programs under varying climatic and water use conditions.

Figure 4-2. Wells with Long-Term Hydrographs

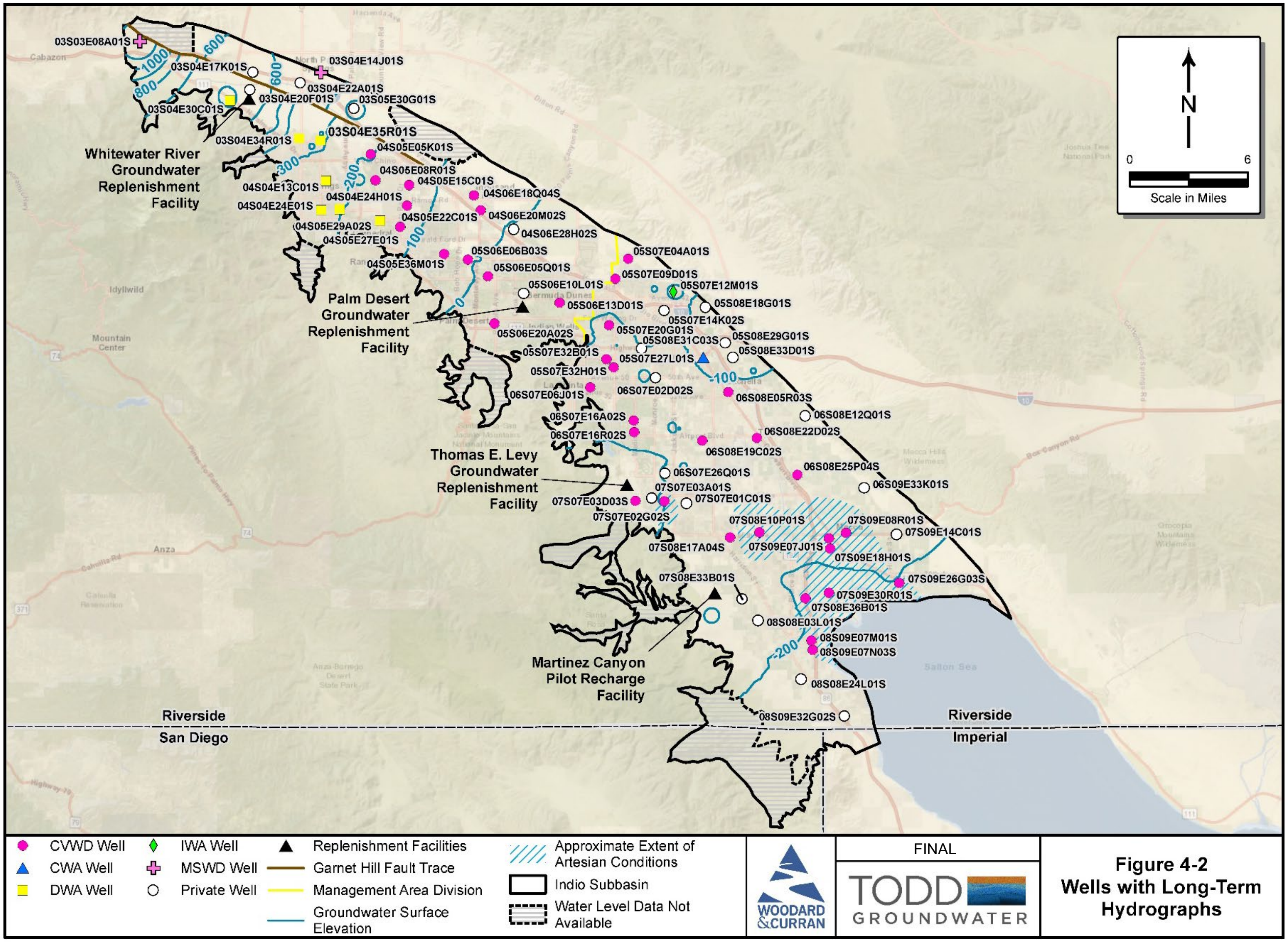


Figure 4-3. Water Level Hydrographs West Valley

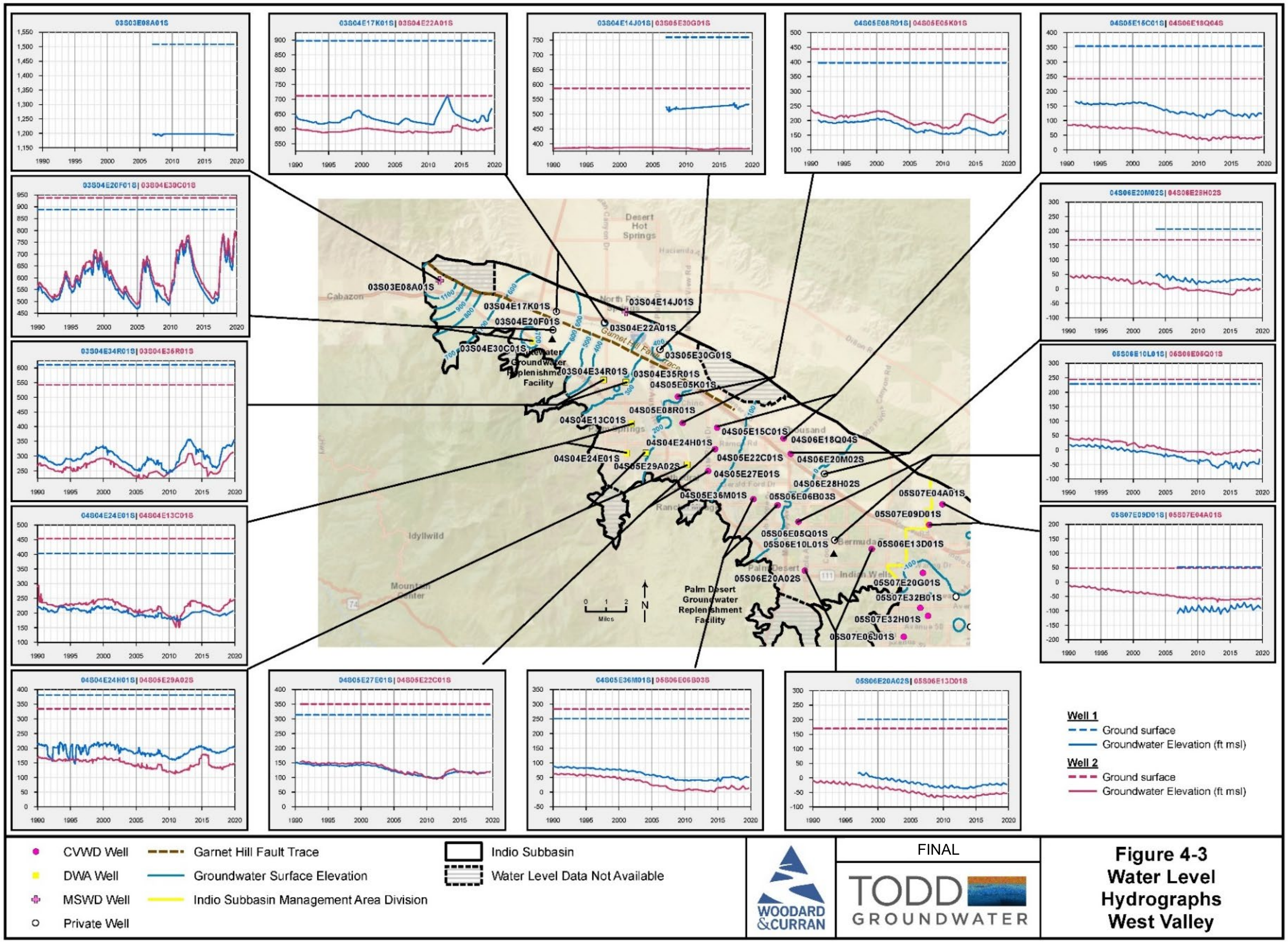
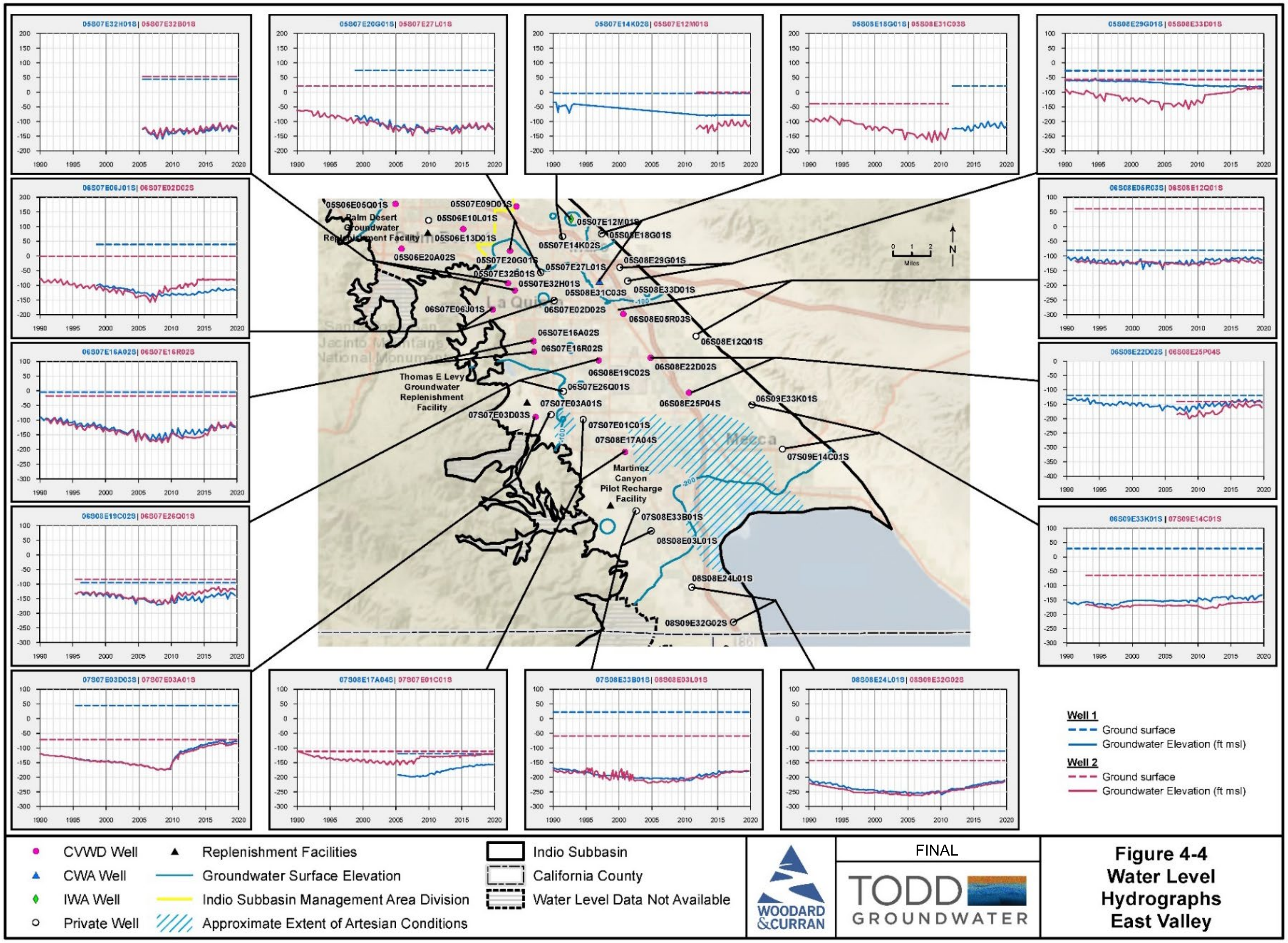


Figure 4-4. Water Level Hydrographs East Valley



4.1.2 Vertical Groundwater Gradients (Artesian Conditions)

Historically, eastern portions of the Indio Subbasin experienced artesian conditions with sufficient pressure to cause groundwater levels in wells to rise above the ground surface; such artesian-flowing wells attracted early settlers to farm in this area. Artesian conditions declined in the late 1930s as a result of increased local groundwater pumping. The completion of the Coachella Canal by the United States Bureau of Reclamation (USBR) in 1949 brought Colorado River water to the eastern Coachella Valley for agricultural irrigation purposes. Artesian conditions returned in the early 1960s through the 1980s, as imported Colorado River water was substituted for groundwater production. Beginning in the late 1980s, groundwater use increased again, resulting in declining water levels and loss of artesian conditions. Groundwater water management programs (including groundwater replenishment, source substitution, and water conservation) are restoring local groundwater levels, and artesian conditions have recurred in the eastern Indio Subbasin. Benefits associated with artesian conditions include reduced groundwater pumping costs and water quality protection of the deeper, confined production zone aquifers

Figure 4-5 shows the location of ten artesian well hydrographs through WY 2018-2019. The area of artesian conditions has remained relatively stable in comparison to WY 2017-2018. The wells show either stable groundwater levels or increasing trends since about 2010.

4.1.3 Groundwater Occurrence (Depth to Water)

Figure 4-6 shows averaged depth to water contours for the Indio Subbasin for WY 2018-19. Greatest depths to water are observed in the northwestern portion of the basin (generally greater than 200 feet). The effect of the Garnet Hill Fault is seen in the abrupt change in groundwater levels across the fault. Depths to groundwater generally decrease to about 100 to 250 feet in the mid-Subbasin area and then to zero or above the ground surface in artesian wells near the Salton Sea (see Figure 4-2 for approximate extent of artesian conditions). In addition to relatively shallow or artesian conditions in the principal aquifer, the East Valley (Thermal Subarea) is characterized by a shallow semi-perched aquifer (see extent in Figure 3-5 in Chapter 3, *Hydrogeologic Conceptual Model*). The occurrence of shallow groundwater in the East Valley led to construction of an agricultural drain system, shown in Figure 2-5 of Chapter 2, *Plan Area*. As described in the *2010 CVWMP Update*, the shallow groundwater is associated with a risk of liquefaction, a process by which sediments below the water table lose strength and deform (typically due to seismic shaking) and can cause damage to buildings. The *Riverside County General Plan* has recognized liquefaction, mapped areas of risk, and defined protective land use policies (County of Riverside, 2020).

4.1.4 Groundwater Elevation Change

Figure 4-7 shows a 10-year groundwater elevation change map for the Indio Subbasin, including two zoomed-in maps to show water level changes for the numerous wells in the mid-valley area and TEL-GRF vicinity. The change in groundwater elevation is based on the difference between the average groundwater elevations for wells monitored by Coachella Valley Water District (CVWD), Coachella Water Authority (CWA), Desert Water Agency (DWA), and Indio Water Authority (IWA) between WY 2008-2009 and WY 2018-2019 (10 years).

Figure 4-5. Water Level Hydrographs Artesian Wells

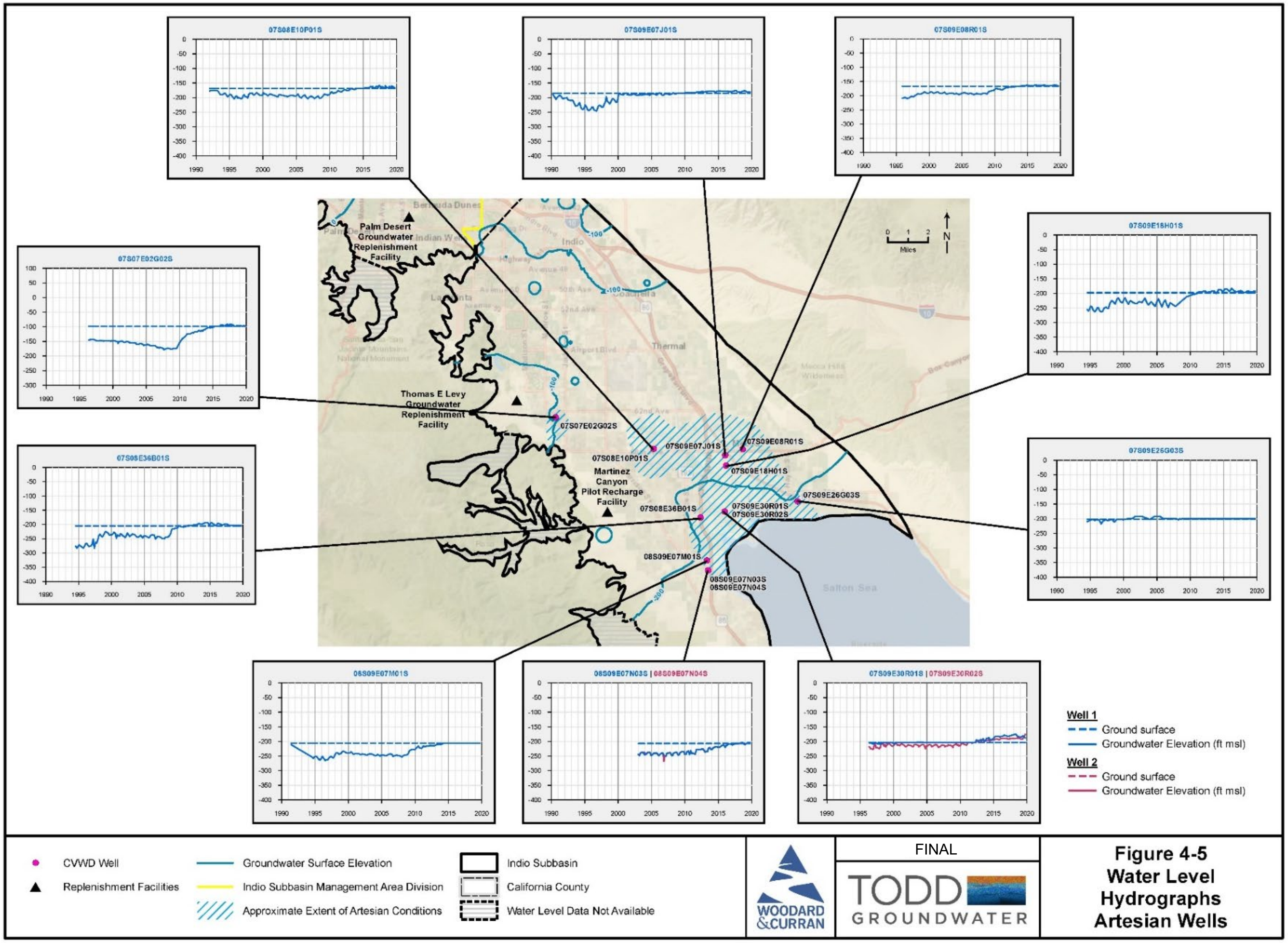


Figure 4-6. Depth to Water Contours

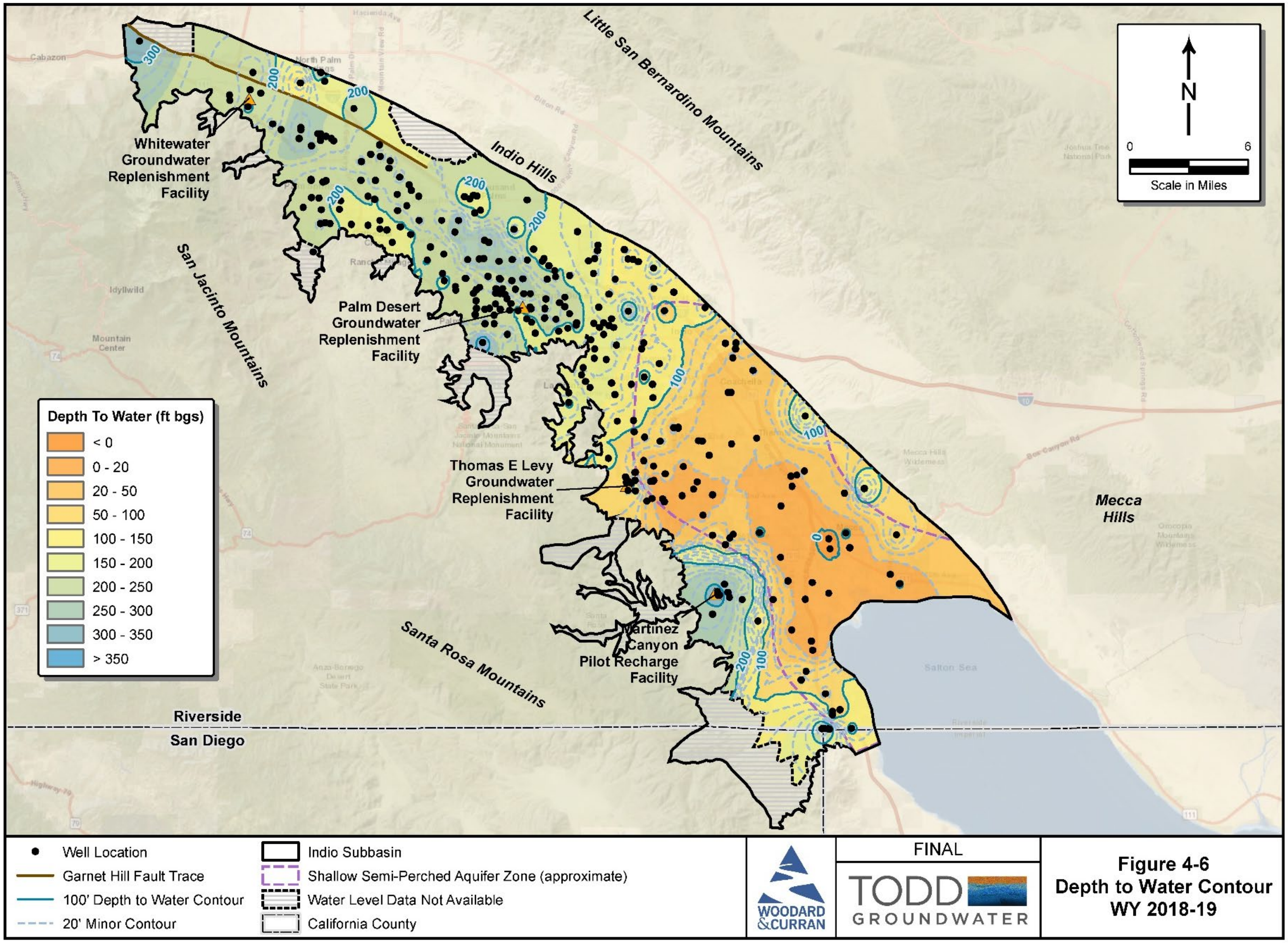
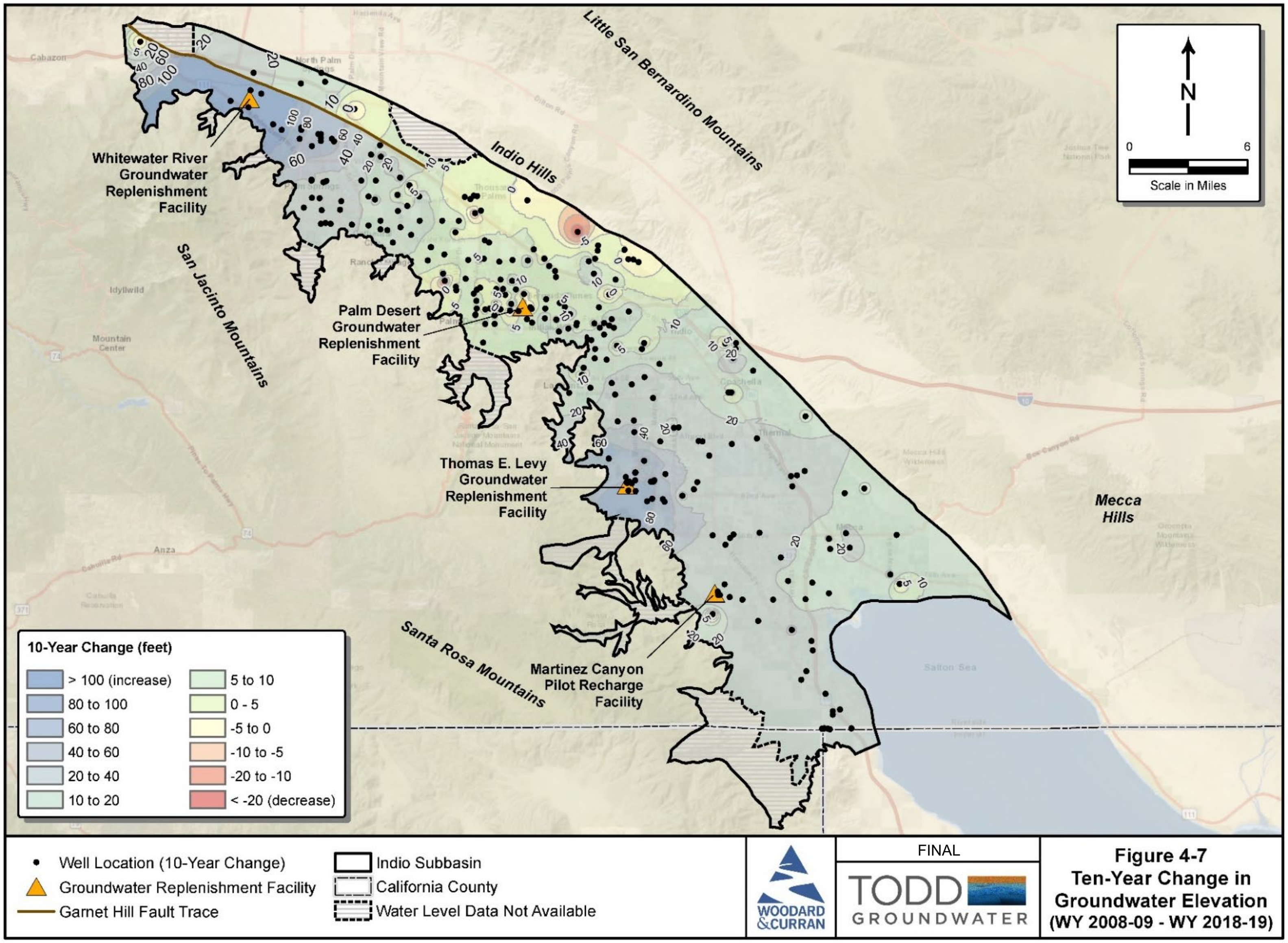


Figure 4-7. Ten-Year Change in Groundwater Elevation (WY 2008-09 to WY 2018-19)



Groundwater levels in the Indio Subbasin have increased significantly over the 10 years from WY 2008--2009 to WY 2018-2019. The largest groundwater increases are observed in the vicinity of the WWR-GRF and TEL-GRF, with water level increases as much as 200 feet and 100 feet in the immediate vicinity of the two facilities, respectively. In the mid-valley area near Palm Desert, Indian Wells, and La Quinta, groundwater level increases have ranged from 7 to 15 feet, reflecting the benefits of source substitution and conservation programs. Some localized declines in groundwater levels are observed in the Palm Desert area to northeast of Bermuda Dunes. Replenishment at the PD-GRF began in February 2019 and is expected to raise groundwater levels in the mid-valley region. Groundwater levels in the southeastern portion of the Indio Subbasin have increased between 10 and 40 feet, reflecting storage benefits from replenishment operations at the TEL-GRF and decreased pumping.

4.2 Changes in Groundwater Storage

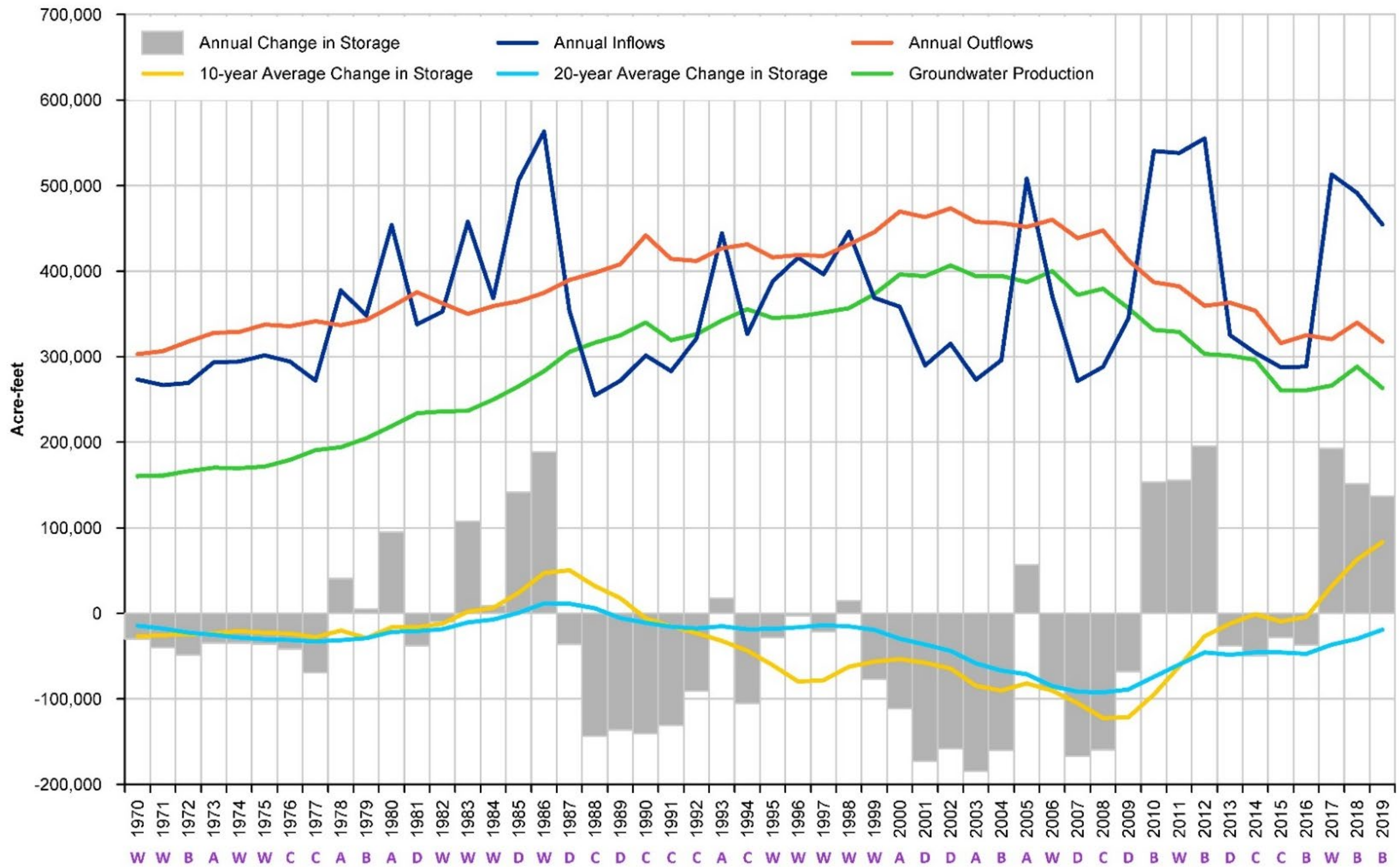
The Indio Subbasin Annual Reports and Engineer's Reports on Water Supply and Replenishment Assessment have previously assessed annual changes in groundwater storage. These assessments are intended to detect overdraft and, if overdraft were to occur, to track overdraft as a basis for sustainability planning. This section briefly defines Subbasin change in storage; a more detailed numerical description is in Chapter 7, *Numerical Model and Plan Scenarios*.

Long-term sustainability is typically assessed based on changes in groundwater storage over a historical period on the order of 10 to 20 years including wet and dry periods. Figure 4-8 shows the annual change in groundwater storage from 1970 through WY 2018-2019 (gray columns). The starting year of 1970 was selected because it is 3 years before imported water replenishment commenced in the Indio Subbasin. The data used to prepare this figure are based on calendar year until WY 2016-2017, when data sources were compiled for the water year for the first Annual Report.

Figure 4-8 also shows the annual inflows, outflows, groundwater production, and 10- and 20-year running-average changes in groundwater storage. As shown on the chart, annual inflows to the Indio Subbasin (dark blue line) are highly variable with years of high inflows generally corresponding to wet years when State Water Project (SWP) delivery volumes were greater. Higher inflows in the mid-1980s occurred when Metropolitan Water District of Southern California (MWD) commenced large-scale advanced water deliveries to the Indio Subbasin. The chart shows that after an extended period of decline, both the 10- and 20-year running average changes in storage have shown upward trends since 2009, and the 10--year running average has been positive since 2017.

Figure 4-9 shows the cumulative change in storage since 1970. The goal of the *2010 CVWMP Update* is to eliminate groundwater overdraft, not to restore the Subbasin to historical conditions. Since 2009, the Indio Subbasin has recovered approximately 840,000 acre-feet (AF) of groundwater in storage, or about 45 percent of the cumulative depletion observed from 1970 to 2009.

Figure 4-8. Historical Change in Groundwater Storage in Indio Subbasin



Note:
Values shown prior to 2017 are on a calendar year basis.
Letters below the years indicate Sacramento Valley Water Year Type:
W=Wet, A=Above Normal, B=Below Normal, D=Dry, C=Critically Dry

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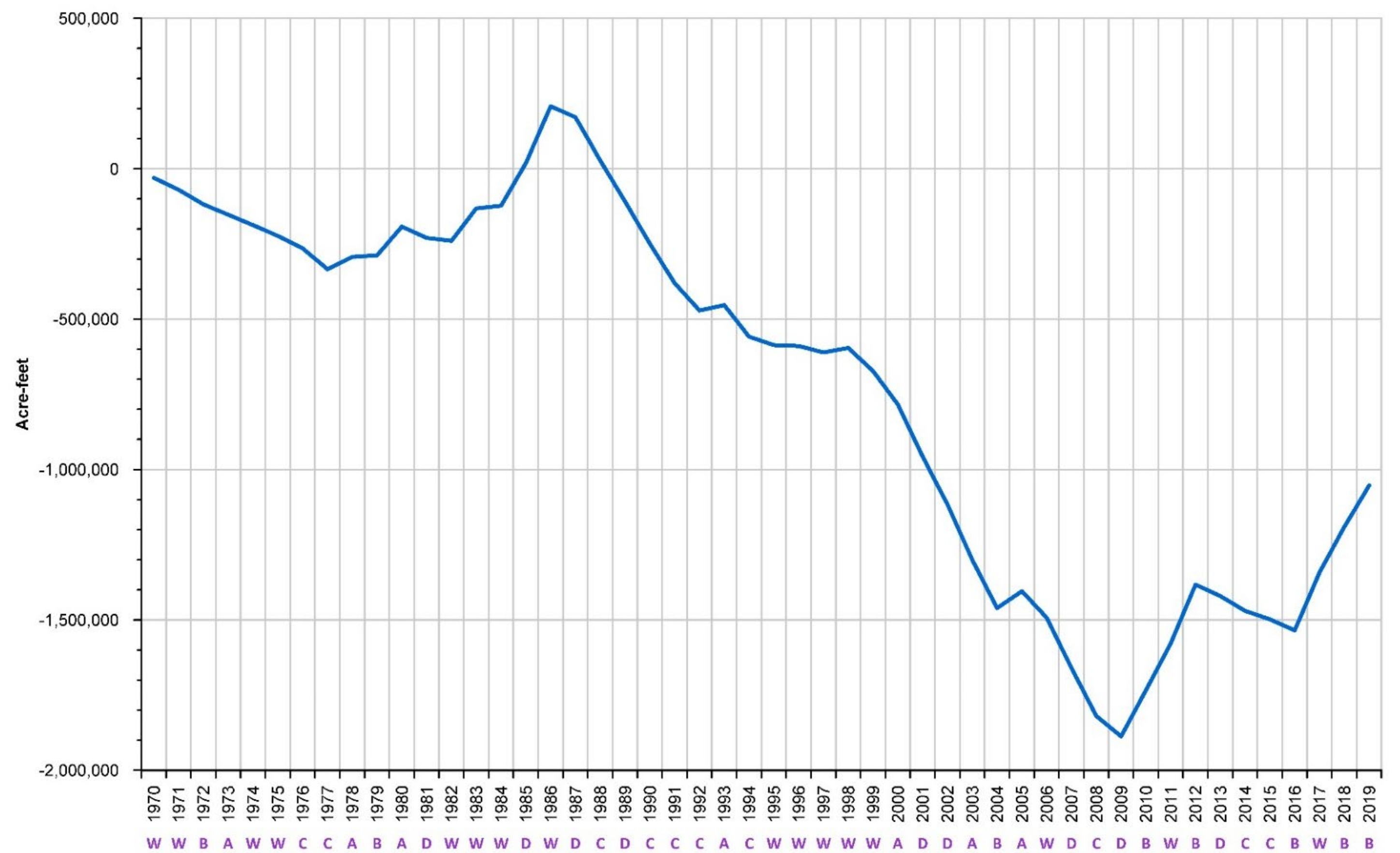
Figure 4-8
Historical Change in Groundwater Storage in Indio Subbasin

Figure 4-9. Cumulative Change in Groundwater Storage since 1970



Note:
Values shown prior to 2017 are on a calendar year basis.
Letters below the years indicate Sacramento Valley Water Year Type:
W=Wet, A=Above Normal, B=Below Normal, D=Dry, C=Critically Dry

FINAL

Figure 4-9
Cumulative Change in Groundwater Storage since 1970

4.3 Land Subsidence and Potential for Subsidence

Land subsidence is the differential lowering of the ground surface, which can damage structures and facilities. This may be caused by regional tectonism or by declines in groundwater elevations due to pumping. The latter process is relevant to Subbasin management and the Alternative Plan. As groundwater elevations decline in the subsurface, dewatering and compaction of predominantly fine-grained deposits (such as clay and silt) can cause the overlying ground surface to subside.

Land subsidence due to groundwater withdrawals can be temporary (elastic) or permanent (inelastic). Elastic deformation occurs when sediments compress as pore pressures decrease but expand by an equal amount as pore pressures increase. A decrease in groundwater elevations from groundwater pumping causes a small elastic compaction in both coarse- and fine-grained sediments; however, when compaction is small, conditions can return to normal once water levels recover. Because elastic deformation is relatively minor and fully recoverable, it is not considered an impact. Land subsidence, resulting from aquifer system compaction and groundwater level declines, has been a concern in the Coachella Valley since the mid-1990s and has been investigated since 1996 through an on-going cooperative program between CVWD and the United States Geological Survey (USGS) (Sneed and Brandt, 2020). Global Positioning System (GPS) surveying, using GNSS-Inferred Positioning System and Orbit Analysis Simulation Software (GIPSY-OASIS) and interferometric synthetic aperture radar (InSAR) methods have been used to determine the location, extent, and magnitude of the vertical land-surface changes in the Coachella Valley.

The network of GPS stations in the Subbasin is shown in Figure 2-9 in Chapter 2, *Plan Area*. The GPS measurements have been used to determine elevation changes at specific locations, while InSAR measurements have documented the geographic extent of elevation changes for the Indio Subbasin. Analysis of InSAR data collected from 1995 to 2017 by the USGS indicates that as much as 2.0 feet of subsidence occurred in the Indio Subbasin from 1995 to 2010 near Palm Desert, Indian Wells, and La Quinta (Sneed and Brandt, 2020).

Figure 4-10 shows basin-wide subsidence and uplift from December 28, 2014, to June 27, 2017. Since 2010, groundwater levels have stabilized or have been partially recovered in response to the implementation of source substitution, conservation, and groundwater replenishment programs included in the *2010 CVWMP Update*. Up to 1 inch of uplift has been measured since 2011 in the Palm Springs area, corresponding to higher groundwater levels in response to upgradient WWR-GRF recharge. In the Thermal area, the ground surface has also rebounded about 2 inches over the past 10 years, returning to elevations observed in 2001. This rebound roughly coincides with commencement of recharge operations at the TEL--GRF in 2009. The Indio Subbasin Groundwater Sustainability Agencies (GSAs) plan to continue monitoring water levels and subsidence to track the effects of management actions on land subsidence.

Water levels in wells near the subsidence geodetic monuments[1], in and near the three subsiding areas shown by InSAR, and throughout the Subbasin generally indicate longer-term stability or rising groundwater levels since about 2010. These results mark a reversal in trends of groundwater level declines during the preceding decades.

[1] Most geodetic monuments consist of flat metal disks that are anchored in the ground or to a structure and can be surveyed repeatedly.

Figure 4-10. Subsidence Map, 2014-2017

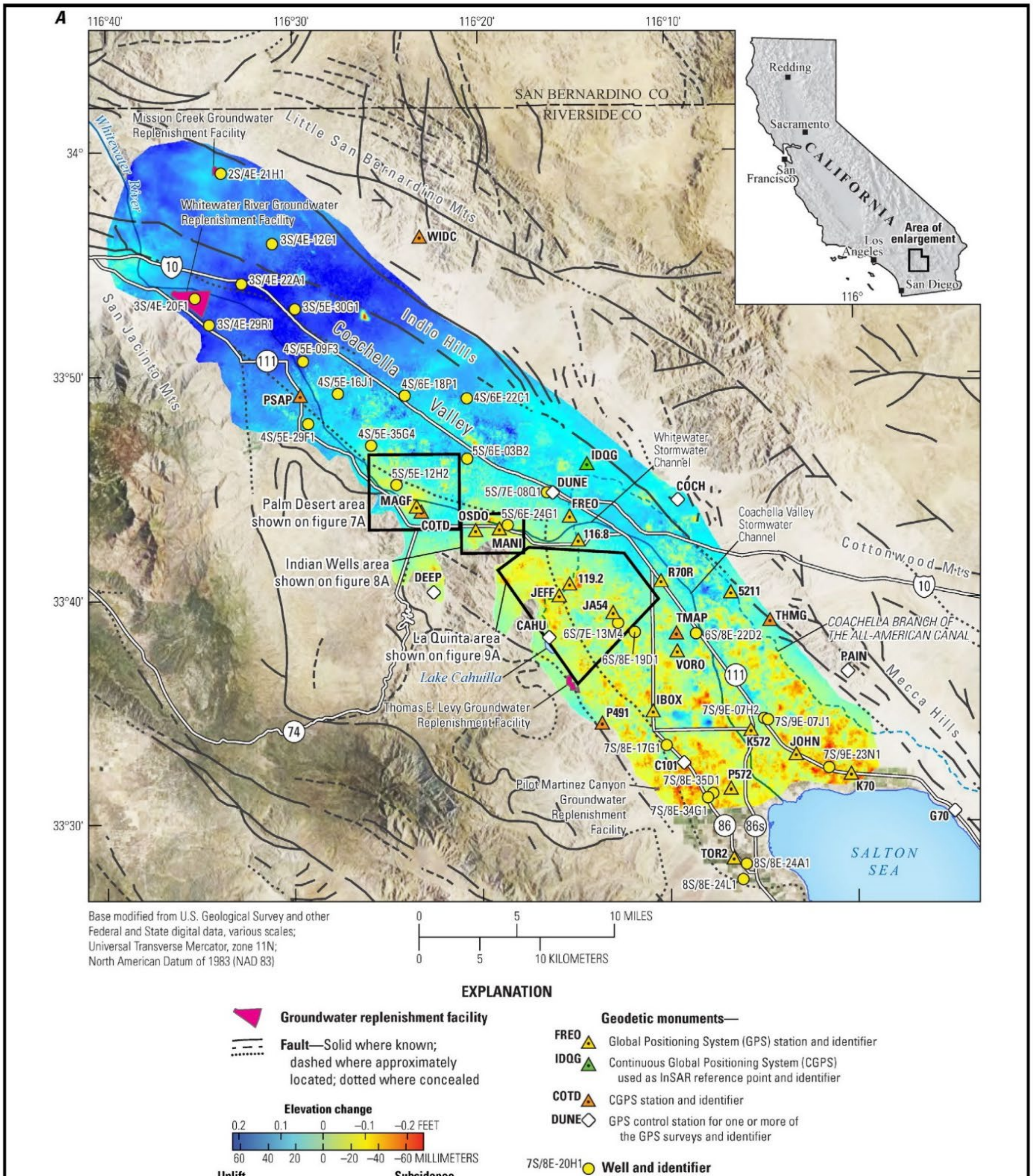


Figure 5. Areas of subsidence and uplift, Global Positioning System (GPS) stations, and continuous GPS (CGPS) stations in the Coachella Valley, California, as shown on a stacked interferogram for *A*, December 28, 2014–June 27, 2017 (excludes February 27, 2017–May 22, 2017), and *B*, June 27, 1995–June 27, 2017 (excludes November 8, 2000–November 30, 2003; September 19, 2010–December 28, 2014; and February 27, 2017–May 22, 2017).

From: USGS SIR 2020-5093 Detection and Measurement of Land Subsidence and Uplift Using GPS Surveys and InSAR, Coachella Valley, CA, 2010-17

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Figure 4-10
Subsidence Map, 2014-2017

Although many areas have stopped subsiding, and a few have even uplifted, a few areas did subside during 2010–2017, though at a slower rate, partly reflecting the character of sediments in the basin. Subsidence when groundwater levels are stable or recovering indicates that residual compaction may have occurred. At the same time, coarse-grained materials and thin aquitards may have expanded as groundwater levels recovered. The continued Subbasin-wide stabilization and recovery of groundwater levels since 2010 is likely a result of various projects designed to increase recharge or to reduce reliance on groundwater.

4.4 Groundwater Quality

The *2010 CVWMP Update* considered groundwater quality issues including salinity, nitrate, arsenic, hexavalent chromium(chromium-6), uranium, and perchlorate. In its Alternative Assessment Staff Report, DWR recommended that the *Alternative Plan Update* provide additional documentation in maps, specifying fluoride, arsenic, chromium-6, and dibromochloropropane (DBCP) distributions. This *Alternative Plan Update* has included substantial collection of water quality data into a database and evaluation of the areal extent, vertical distribution, and time trends for these selected constituents.

4.4.1 Constituents of Concern

Constituents of concern include total dissolved solids (TDS), nitrate, arsenic, chromium-6, uranium, fluoride, perchlorate, and DBCP. Elevated TDS and nitrate concentrations are linked to current and historic water and wastewater management, agricultural activity, urban land use, septic systems, and natural conditions. In the Indio Subbasin, arsenic, chromium-6, uranium, and fluoride are naturally occurring and geologically derived. DBCP is a soil fumigant historically used in agriculture. Perchlorate can be found in some fertilizers and was first detected in Colorado River water in 1997. Atmospheric deposition of perchlorate can also occur naturally with concentration in groundwater particularly in desert regions (USGS, 2014).

4.4.2 Data Sources for Water Quality Mapping

Groundwater quality data have been collected from CVWD, CWA, DWA, IWA, the USGS National Water Information System, and the California State Water Resources Control Board (SWRCB) Safe Drinking Water Information System (SDWIS) website. Data included samples from monitoring wells, public supply wells, and private agricultural and domestic wells. Monitoring wells and relatively deep public supply wells have been the source of the most frequent and recent measurements. Wells are identified on cross sections and plots using state well numbers (SWN). An abbreviation of the full SWN is used on some maps, such as vertical water quality cross sections. For this evaluation, data were used only for raw (untreated) groundwater samples, only for wells with verified locations, and only for years 1990 or later.

To best characterize conditions, available groundwater quality data were assessed spatially with plan-view maps, vertically in cross sections, and, for TDS and nitrate, temporally in time-concentration plots. The graphics are presented and then followed by a discussion of each constituent of concern.

4.4.3 Plan View Concentration Maps

Water quality maps (Figures 4-11 to 4-18) show the spatial distribution of the constituents. For each well with water quality data during the period 1990-2019, the most recent water quality measurement is shown on the plan-view maps and cross sections. The most recent measurement at each well was used, as opposed to the median or mean of a given period, because constituents of concern may show increasing or decreasing trends over time in some wells. Such trends are depicted on the time-concentration plots for TDS and nitrate.

The water quality measurements were interpolated across the Subbasin for each constituent as indicated by the color-ramping in each map legend. Some areas of the Subbasin that lack monitoring wells and data were excluded from the analysis.

Constituent concentrations typically vary with depth (see water quality cross sections). However, depth-specific data are limited and insufficient for mapping water quality of different depth zones. The mapping presented here is intended to depict water quality in vertical zones that generally provide groundwater supply to production wells. These wells are typically greater than 300 feet deep; accordingly, monitoring wells with screened intervals less than 300 feet deep were not included. Information on screened intervals is lacking for some wells, but these were included because most Subbasin wells are screened at depths greater than 300 feet. For nested wells (groups of monitoring wells at one location with a range of screened interval depths), water quality data are shown for the nested well with depth commensurate with nearby public supply wells.

Figure 4-11. TDS Concentration Map

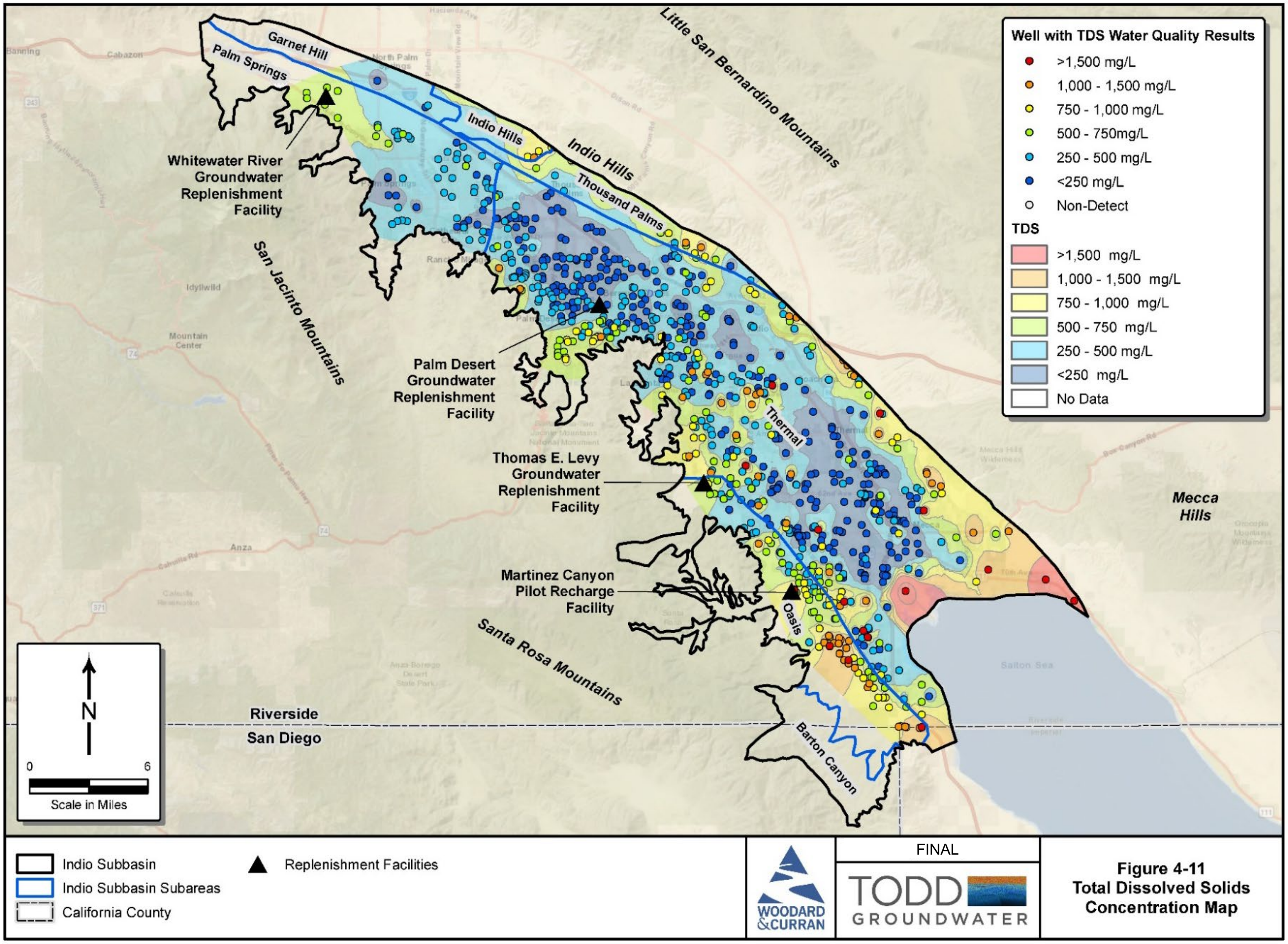


Figure 4-12. Nitrate as NO_3 Concentration Map

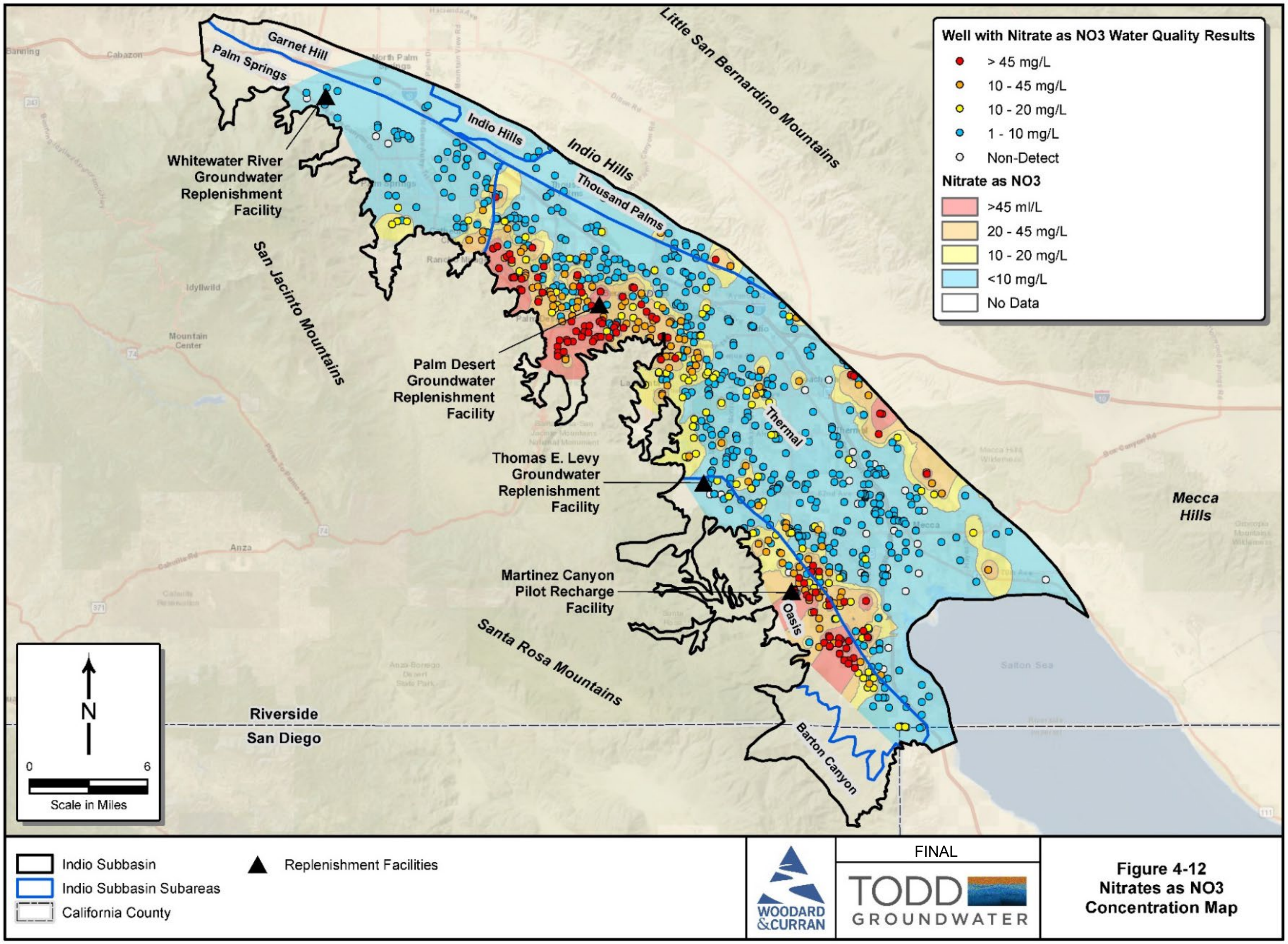


Figure 4-13. Arsenic Concentration Map

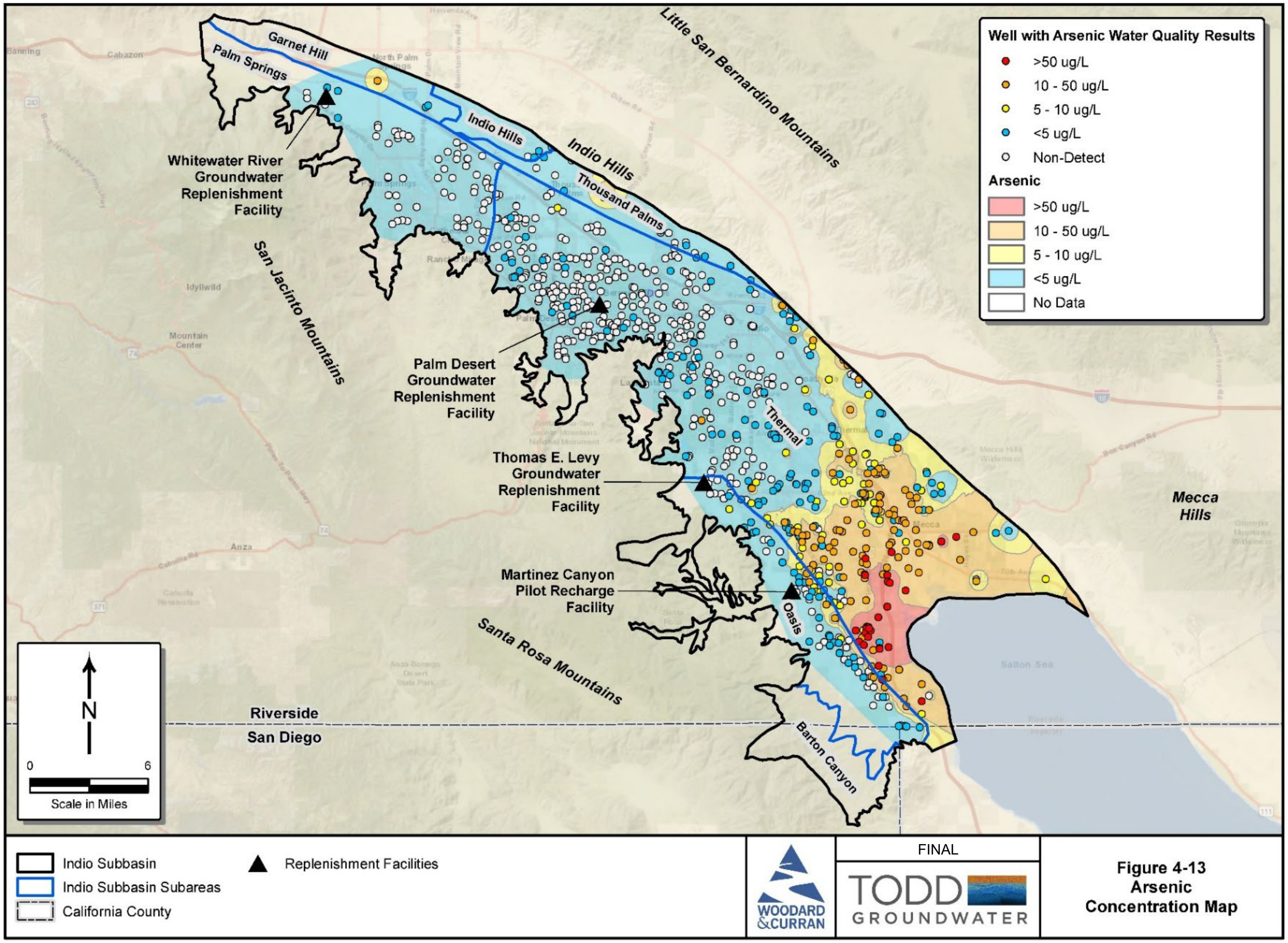


Figure 4-14. Chromium-6 Concentration Map

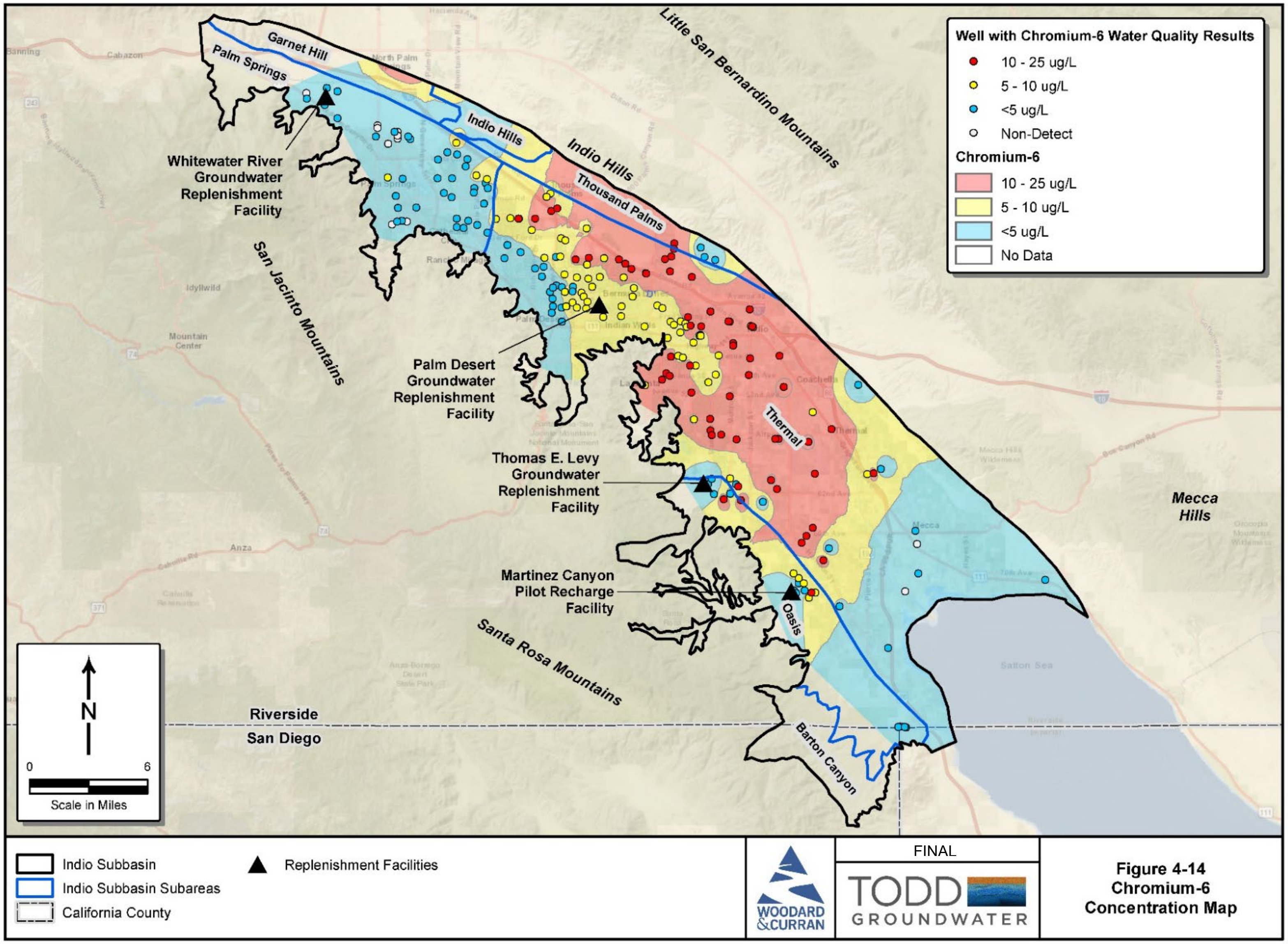


Figure 4-15. Uranium Concentration Map

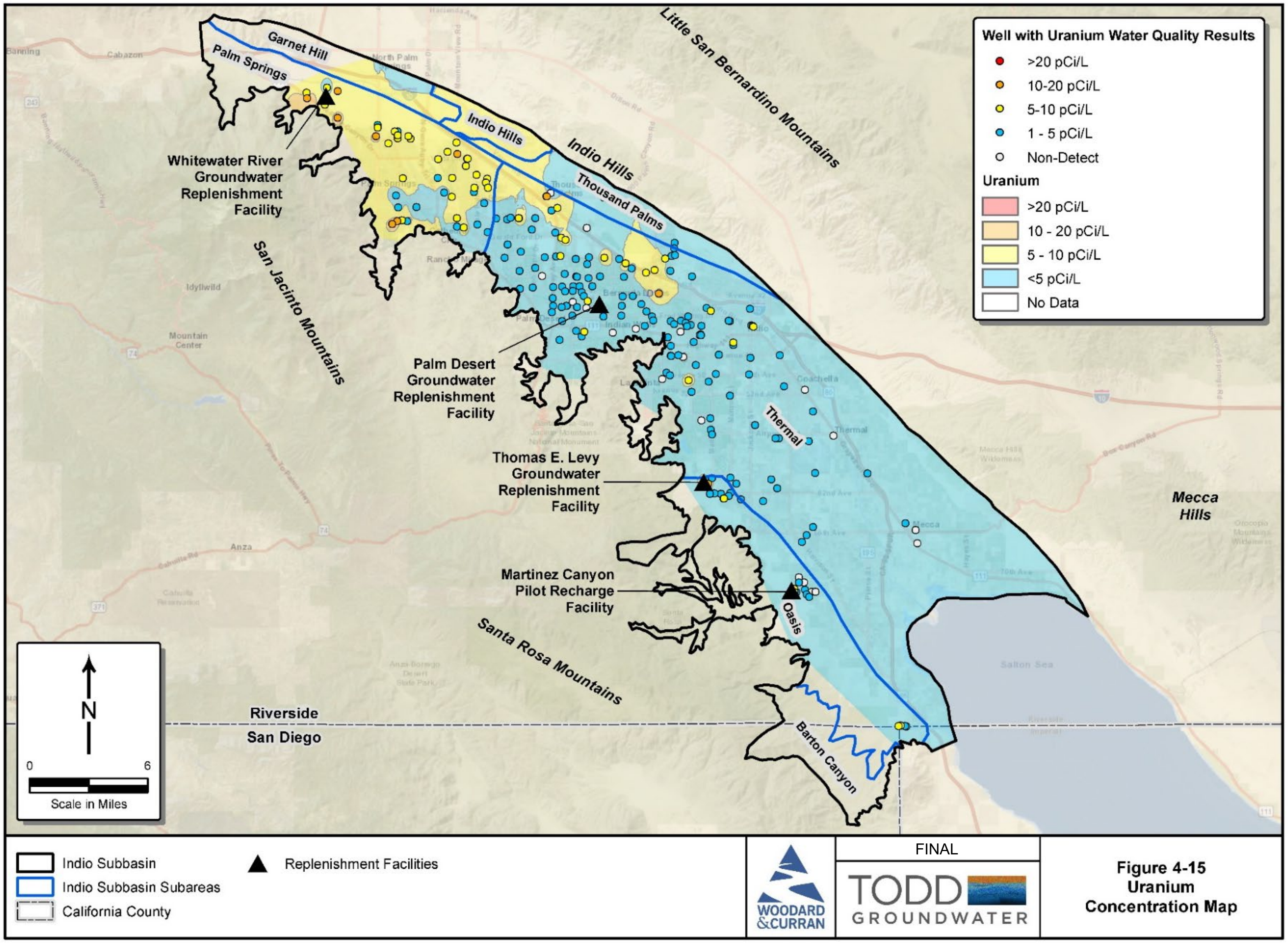


Figure 4-16. Fluoride Concentration Map

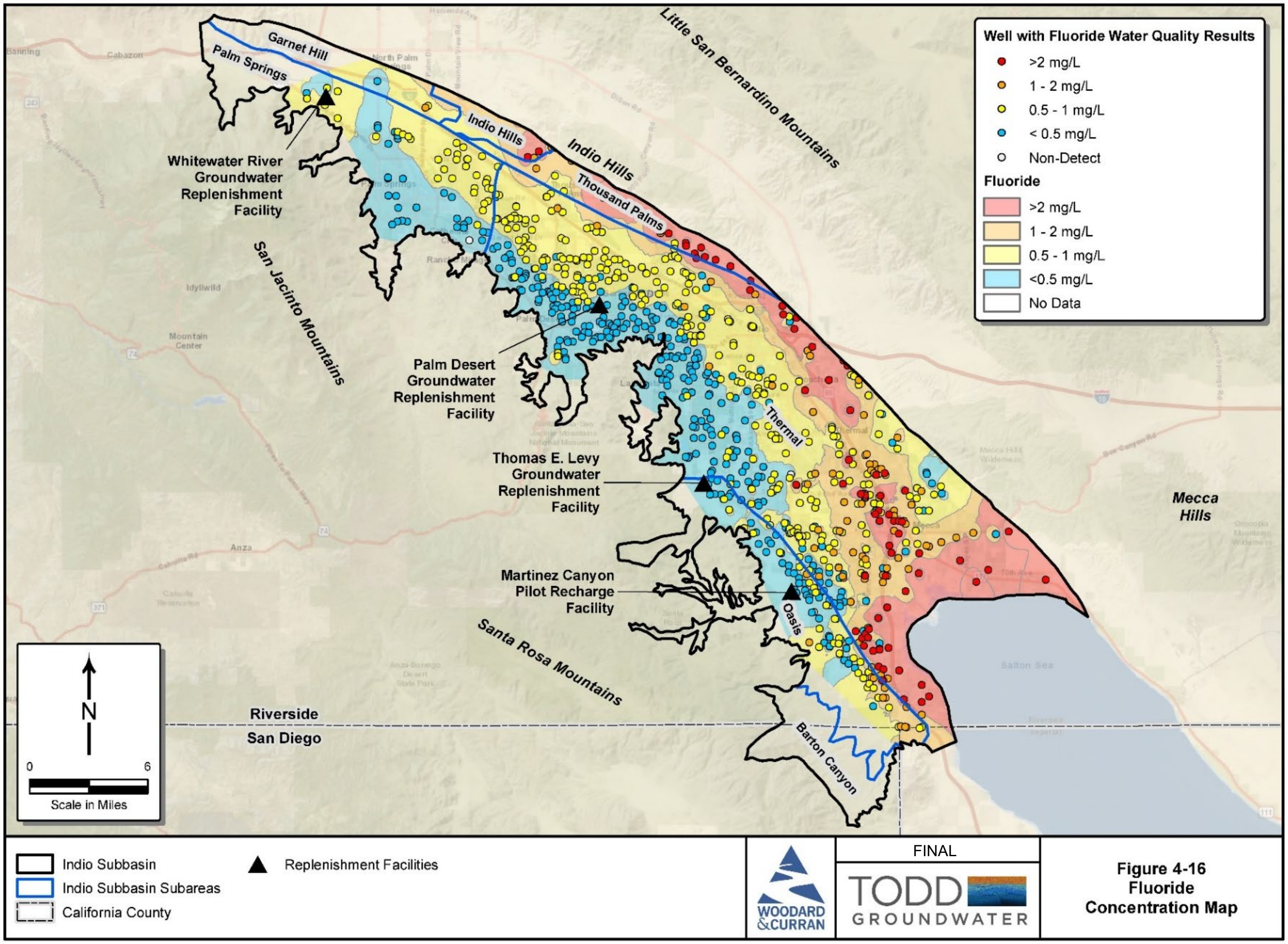


Figure 4-17. Perchlorate Concentration Map

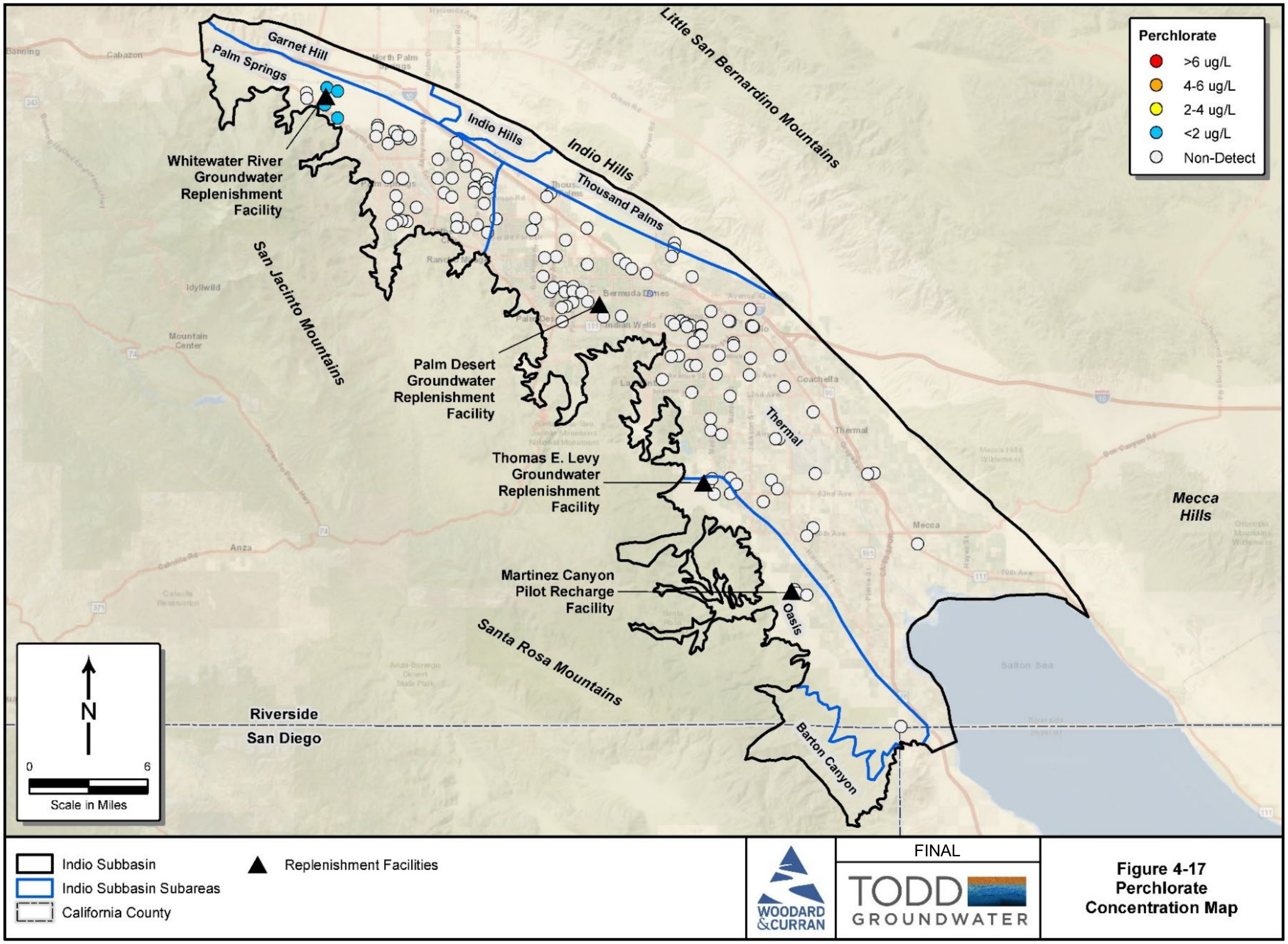
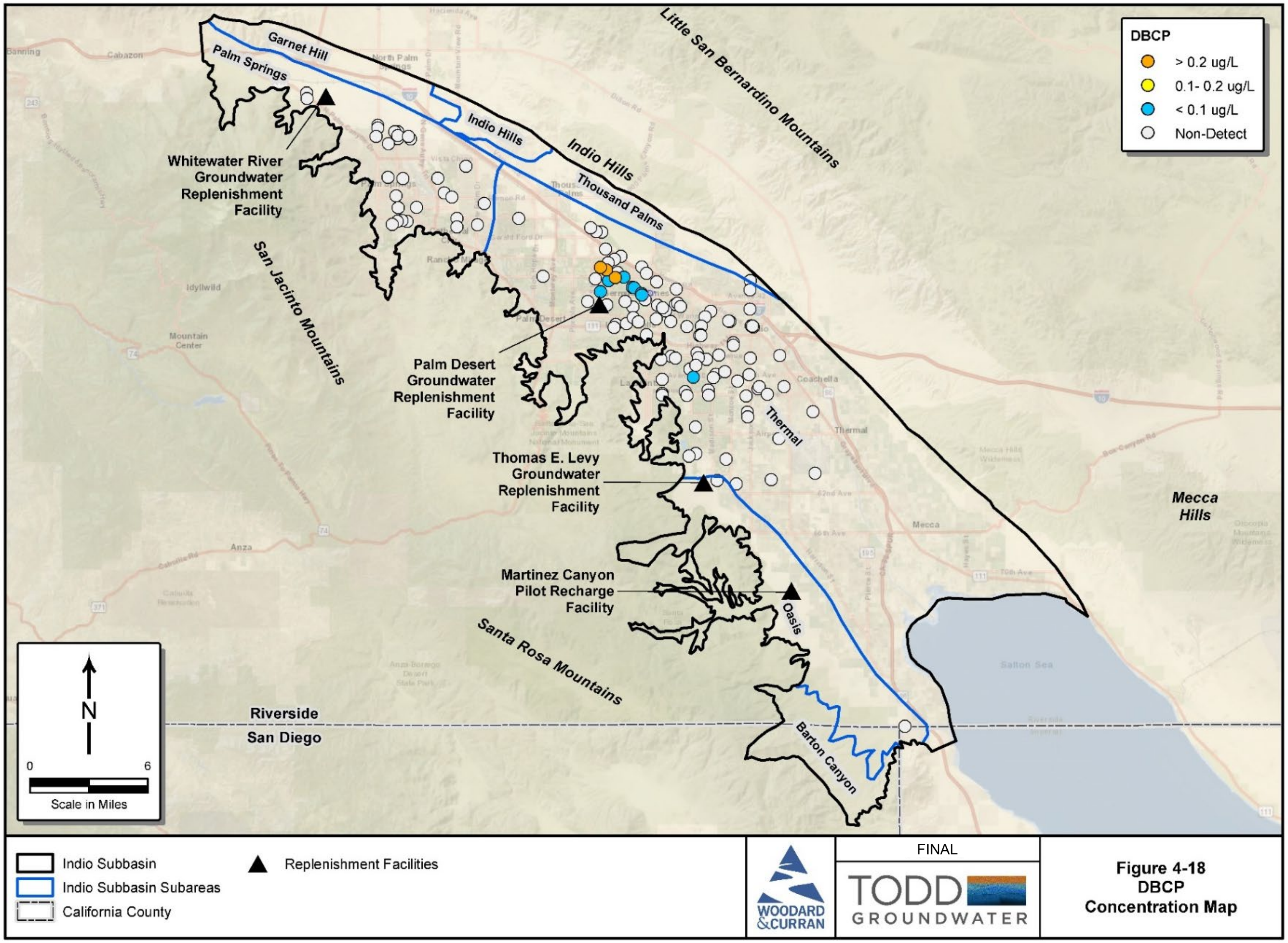


Figure 4-18. DBCP Concentration Map



4.4.4 Water Quality Cross Sections

To evaluate vertical variations in groundwater quality, 14 vertical cross sections (A-A' through N-N') were prepared. The cross-section locations are shown in Figure 4-19 and the cross sections are shown in Figures 4-20 through 4-33, each of which documents the most recent concentrations reported from 1990 to 2019 for TDS, nitrate, arsenic, and chromium-6. Because the cross sections are intended to show vertical variations, shallow monitoring wells are included. The well screens on each cross section are color-coded according to the most recent concentration, which is shown at the bottom of the well profile. Vertical scales may vary between figures.

4.4.5 Time-Concentration Plots for TDS and Nitrate

Figure 4-34 and Figure 4-35 present selected time-concentration plots that represent temporal trends in TDS and nitrate, respectively. Time-concentration plots were created for all wells with at least five TDS or nitrate measurements. These plots were then evaluated within the context of the water quality maps, water quality cross sections, and hydrogeologic cross sections to represent groundwater quality trends in various Subareas. The wells shown in the time-concentration plots were selected based on the following criteria:

- **Location** – Wells were selected to provide a broad distribution across the Subbasin.
- **Ongoing and/or recent monitoring** – Wells were prioritized with recent and frequent measurements over the 1990-2019 period.
- **Trends** – Wells that best represent groundwater quality trends in each Subarea were selected.
- **Well construction** – Wells with known screened depths were prioritized. Groups of wells with different screened intervals were selected to illustrate relationships between temporal water quality trends and depth.

In some cases, multiple wells are plotted on one chart and differentiated by different color lines. On the map the wells are circled with the corresponding chart color. Where wells are nested or are in essentially the same location, only one color is provided around the well symbol.

Figure 4-19. Water Quality Cross Section Location

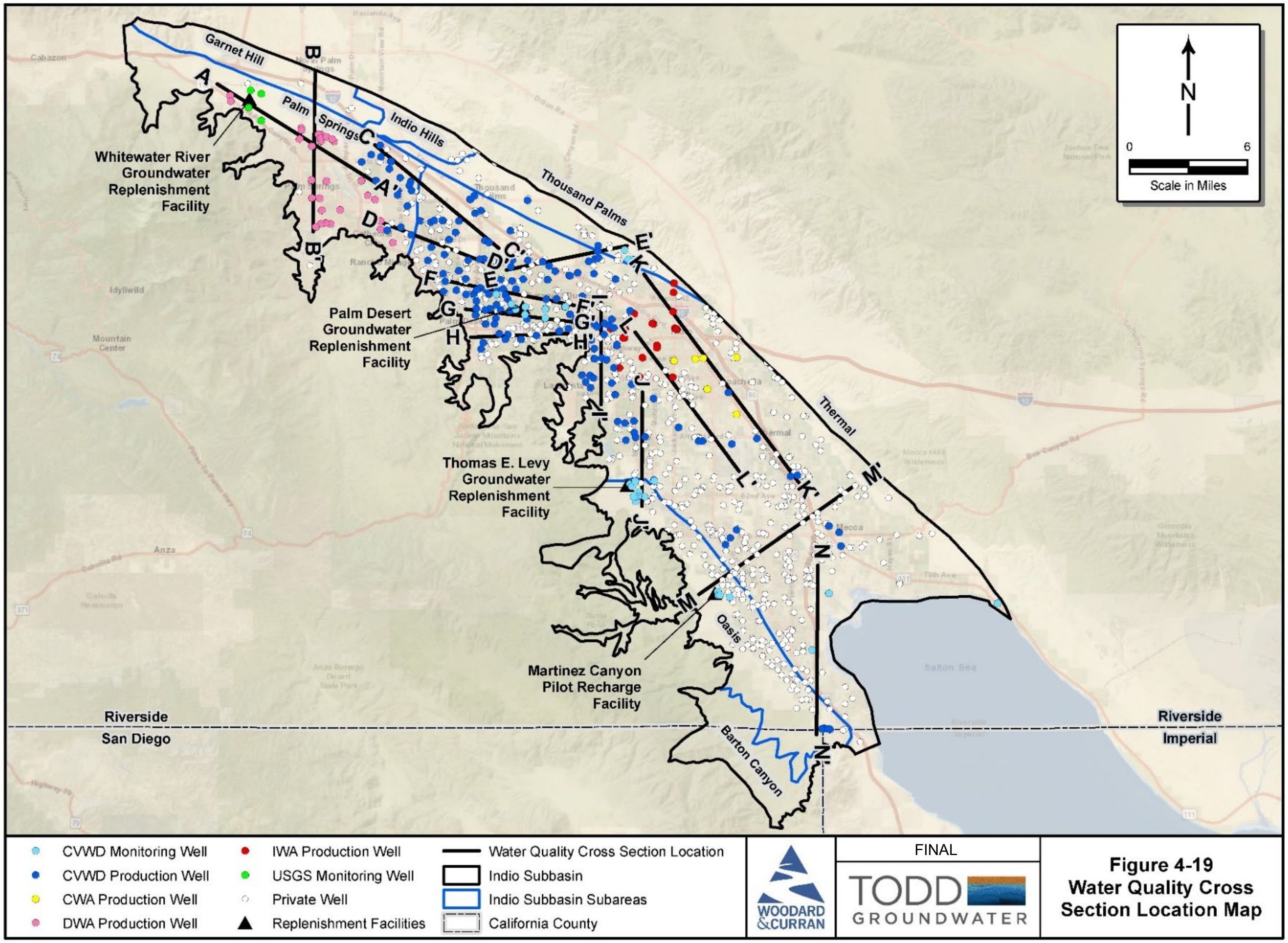


Figure 4-20. Cross Section A-A' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

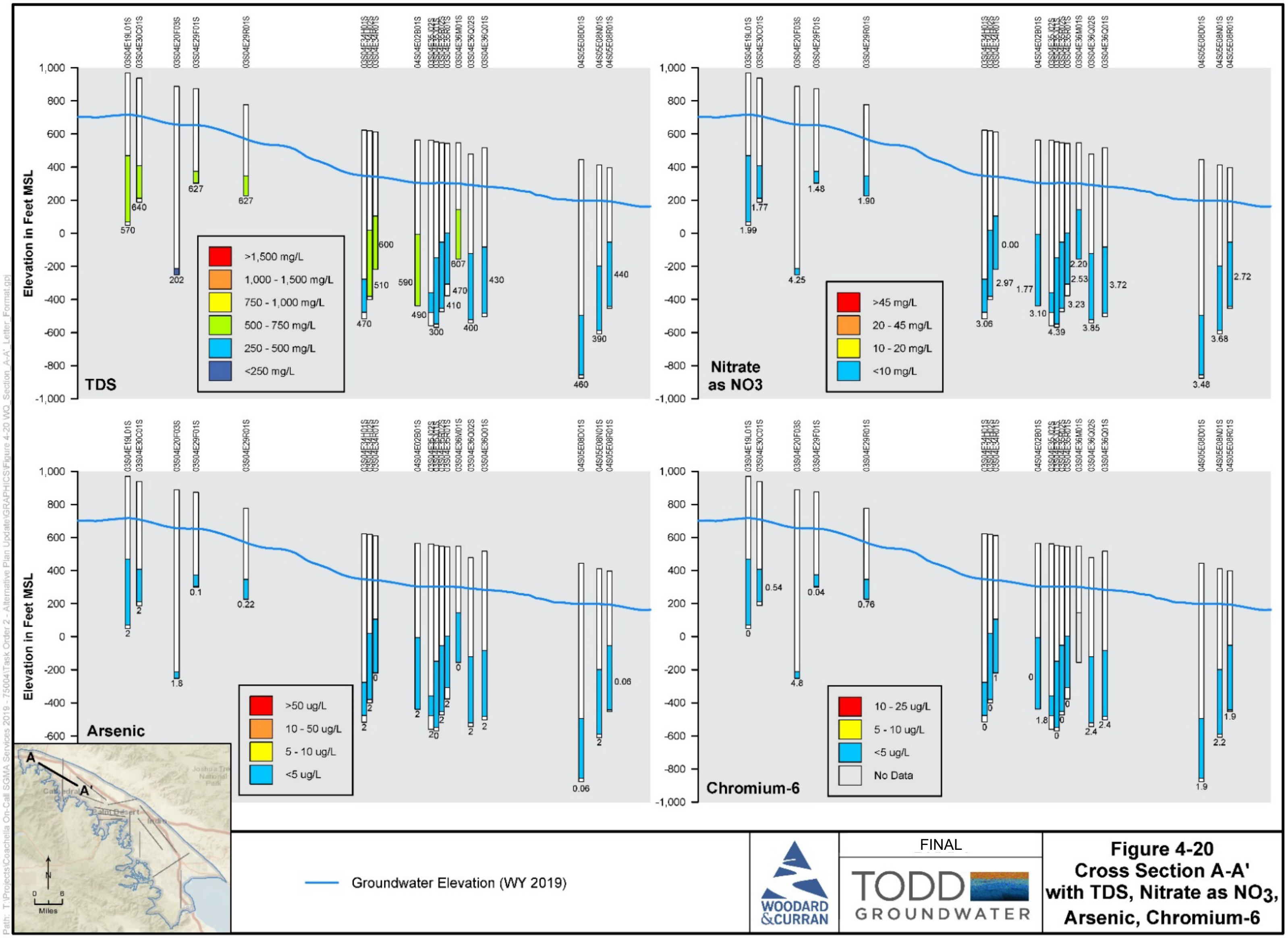


Figure 4-21. Cross Section B-B' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

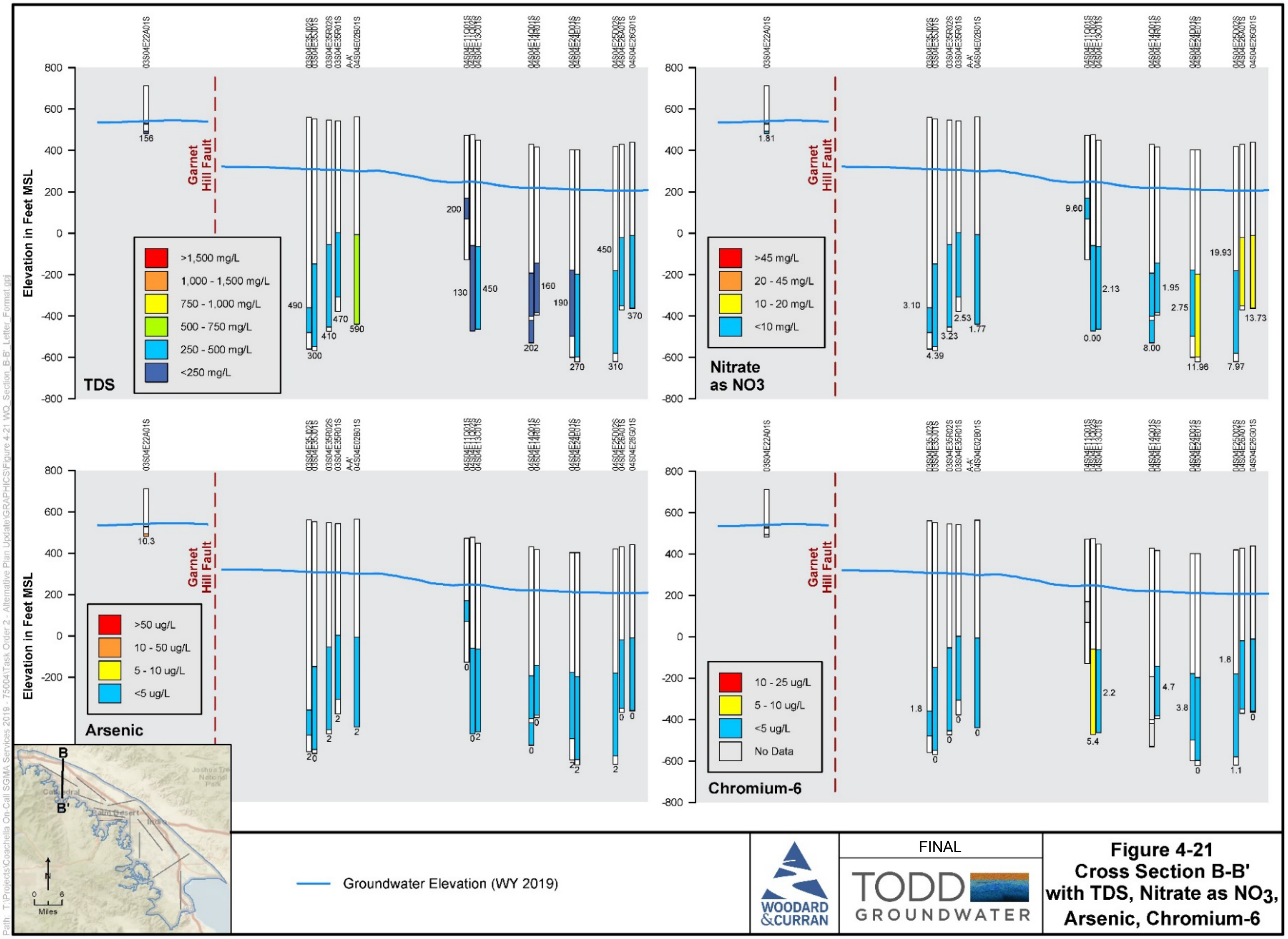


Figure 4-22. Cross Section C-C' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

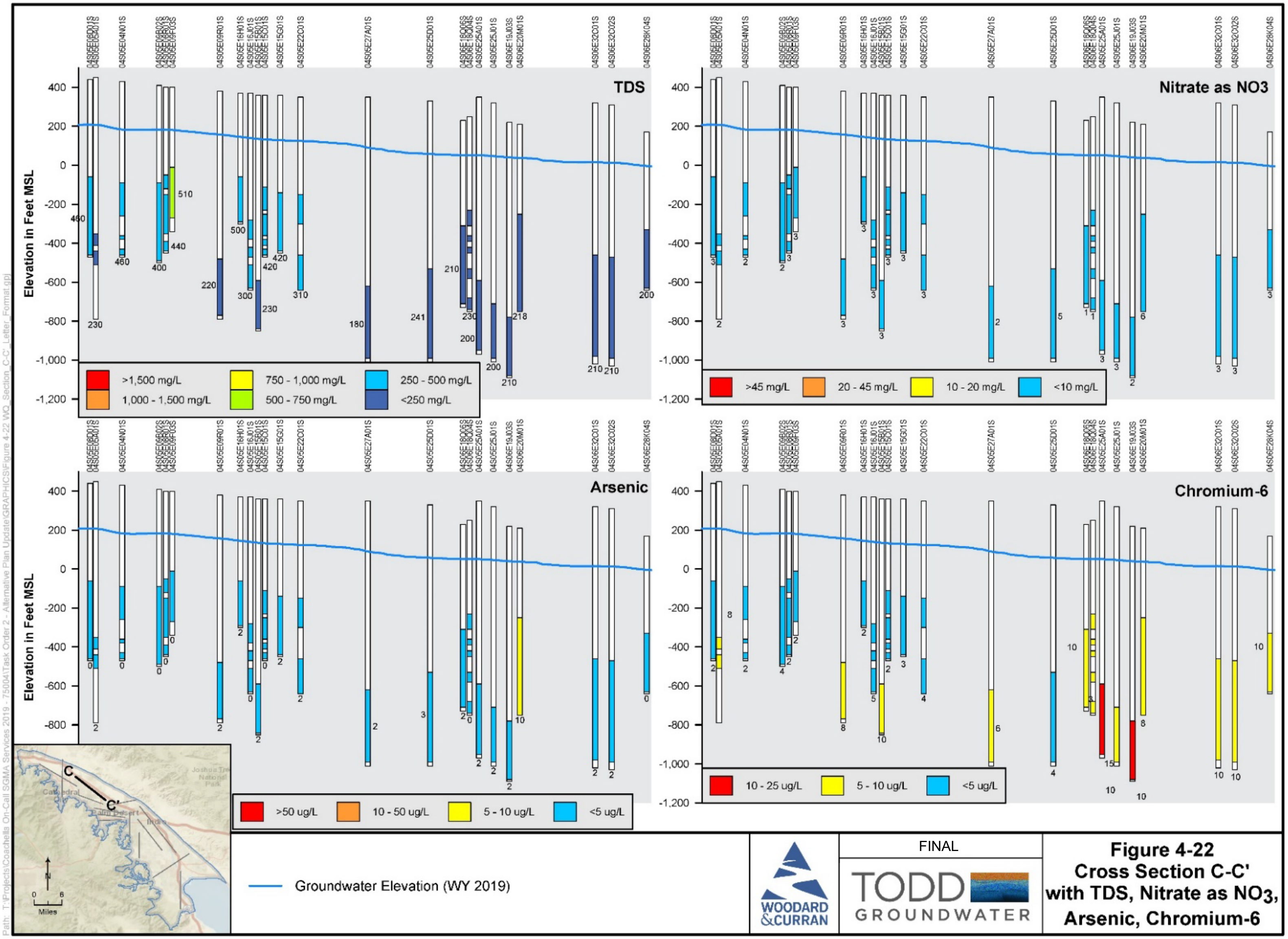


Figure 4-23. Cross Section D-D' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

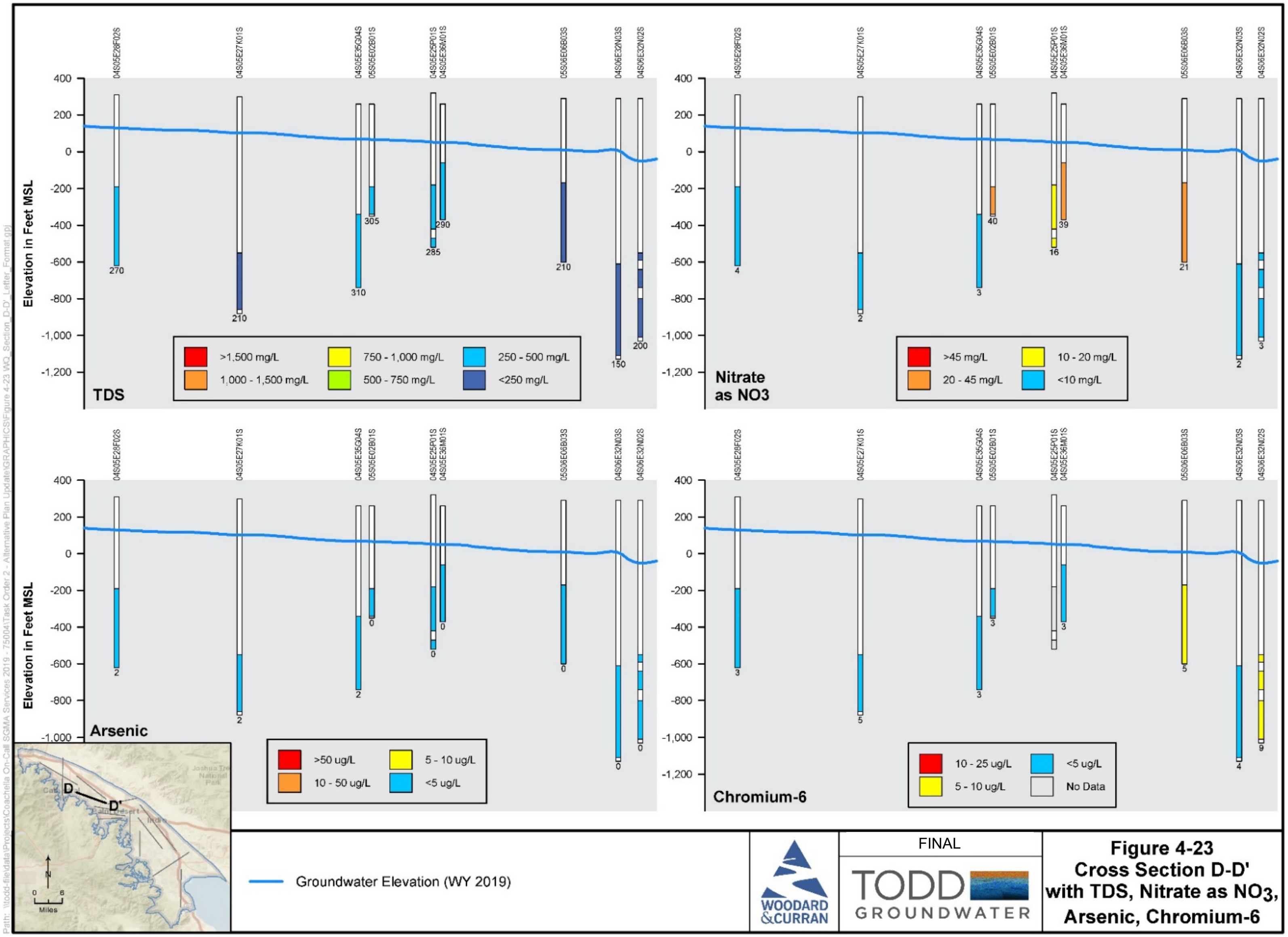


Figure 4-24. Cross Section E-E' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

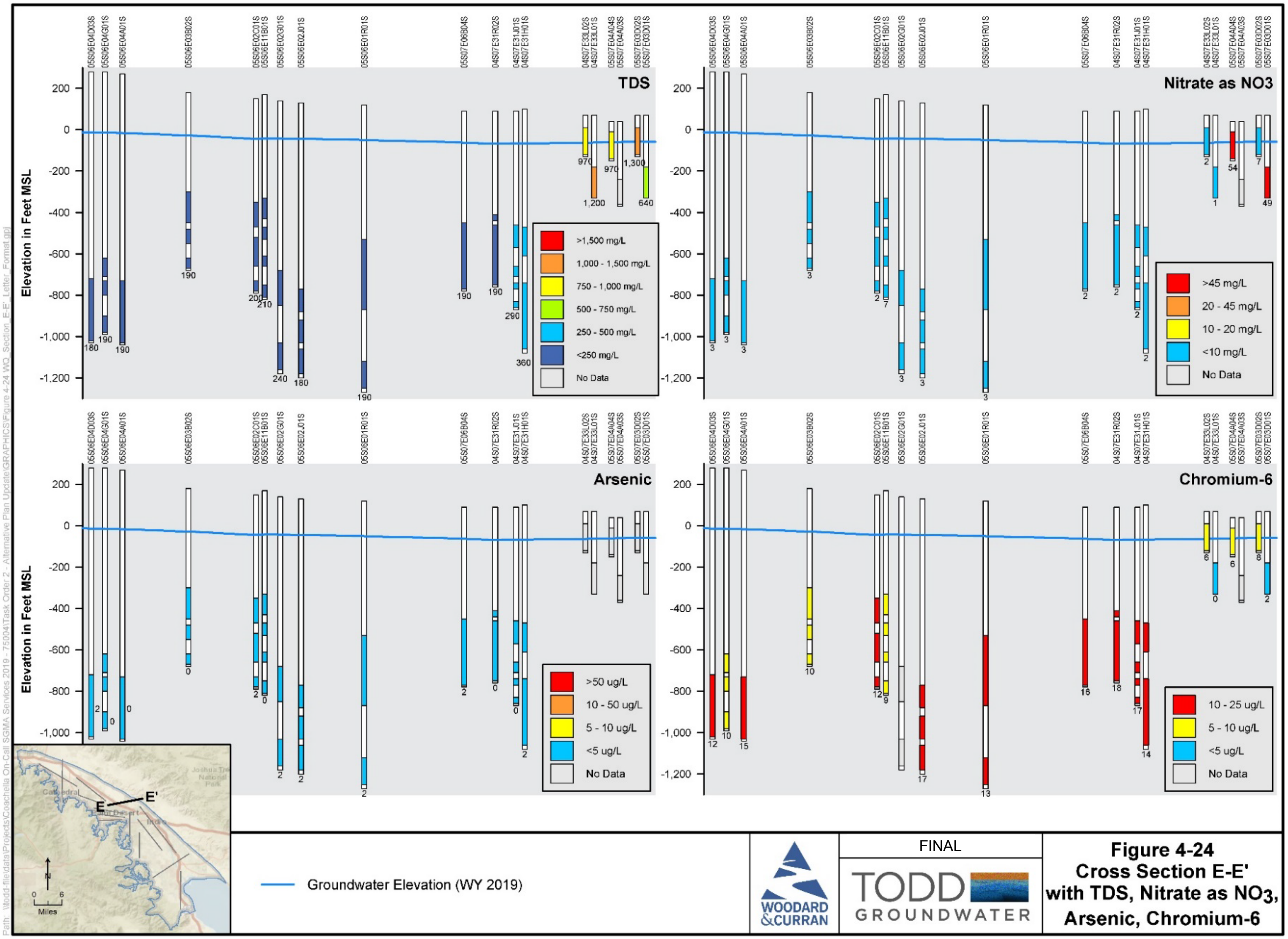


Figure 4-25. Cross Section F-F' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

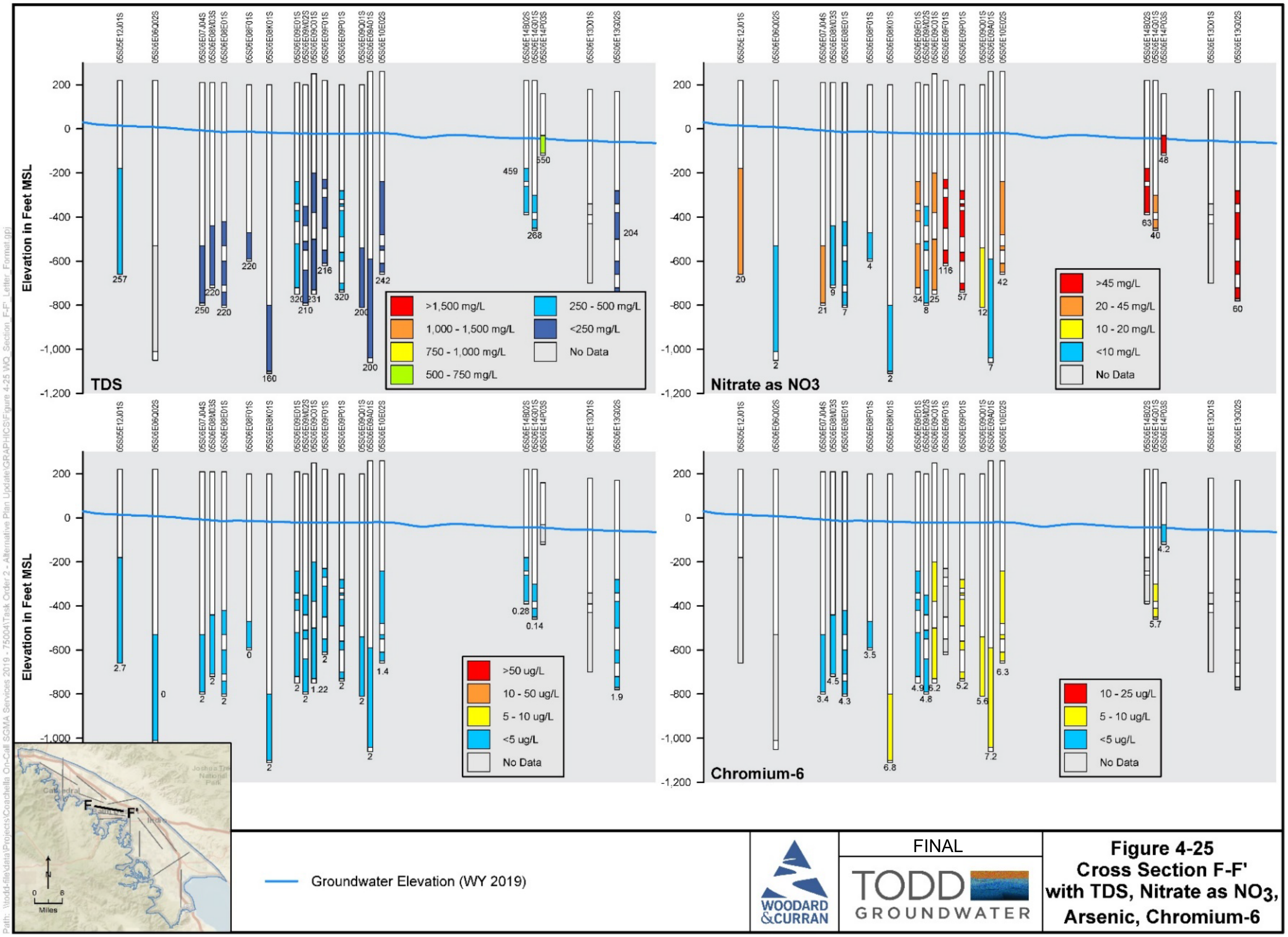


Figure 4-26. Cross Section G-G' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

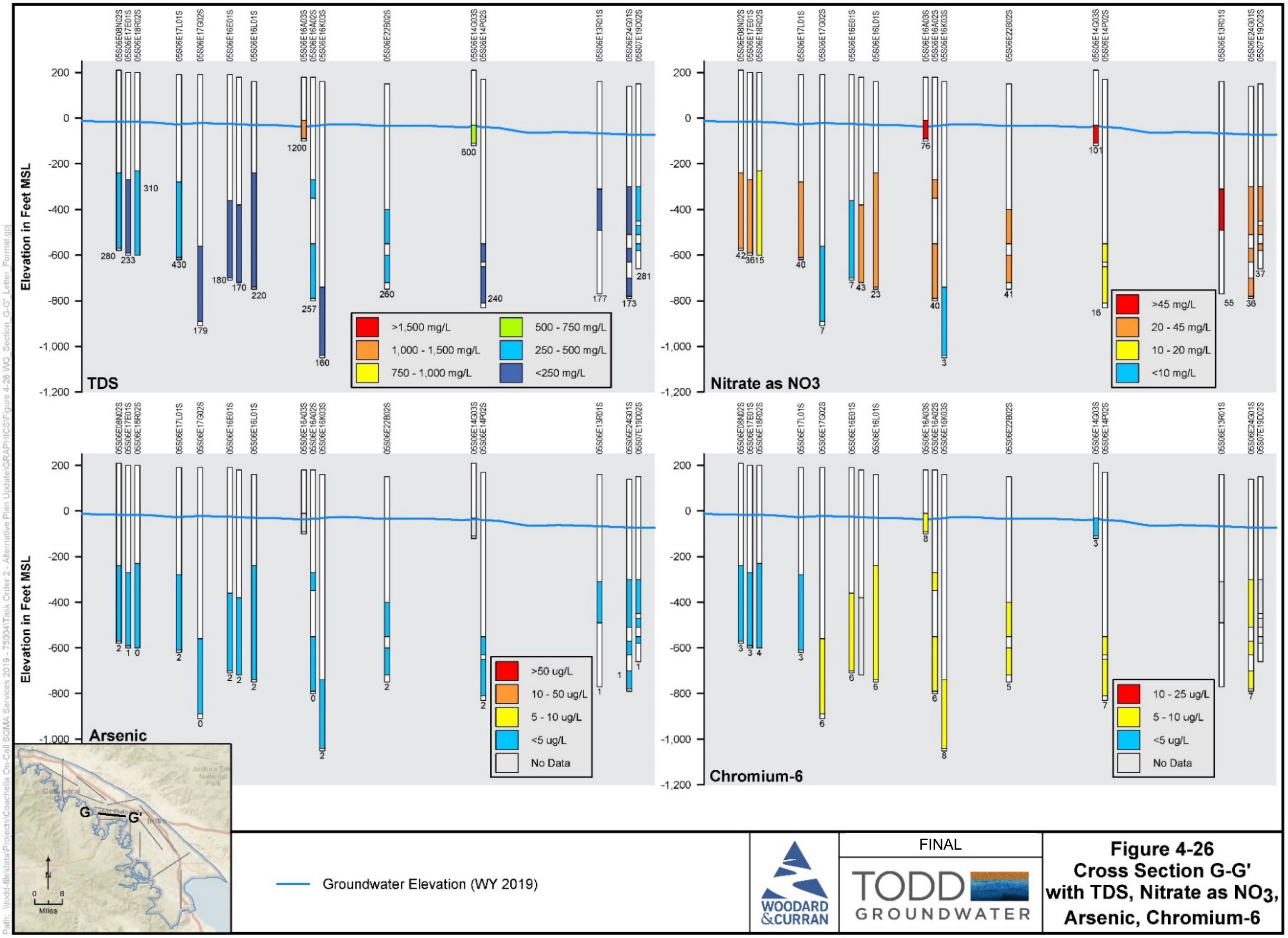


Figure 4-27. Cross Section H-H' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

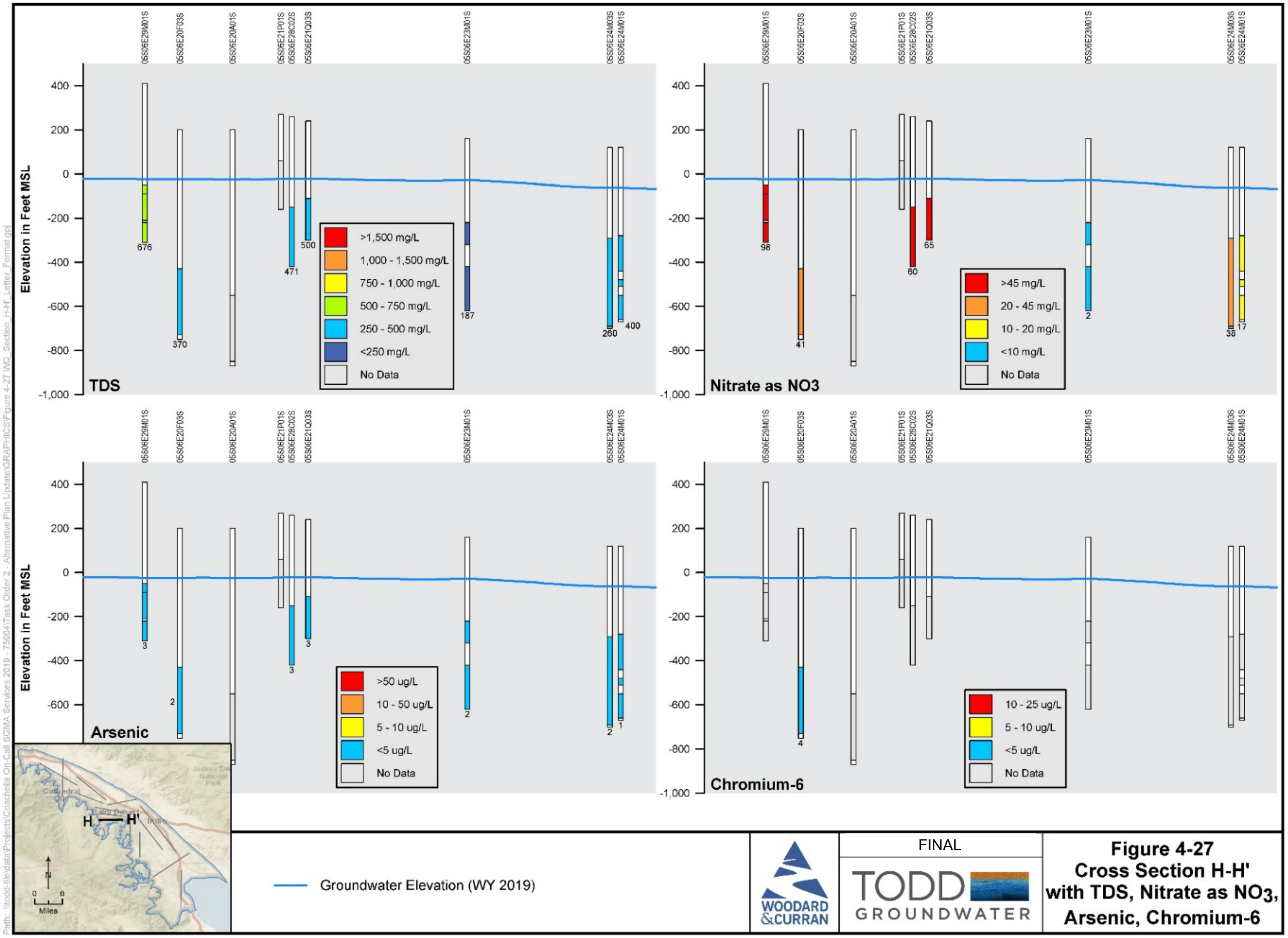


Figure 4-28. Cross Section I-I' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

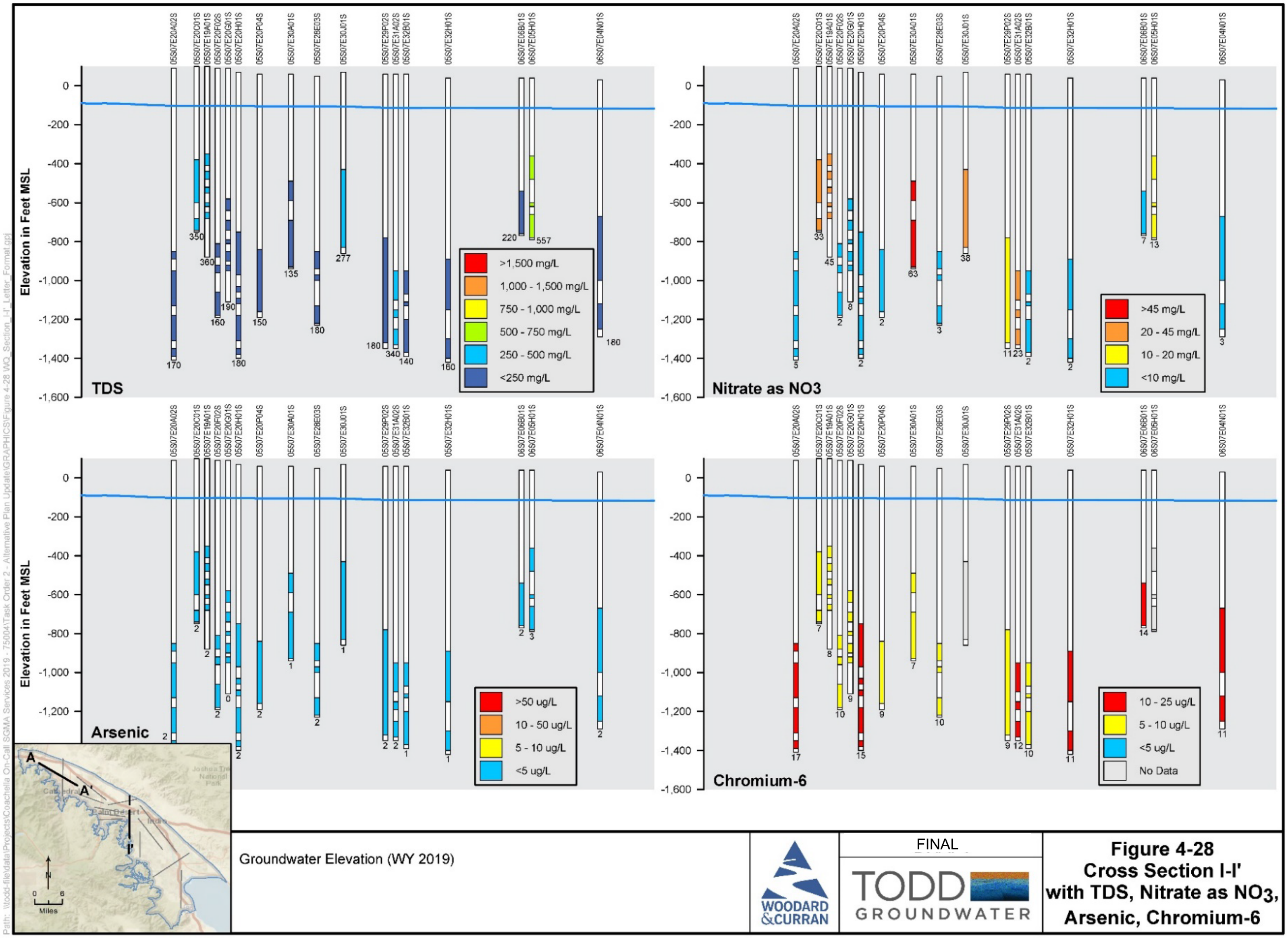


Figure 4-29. Cross Section J-J' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

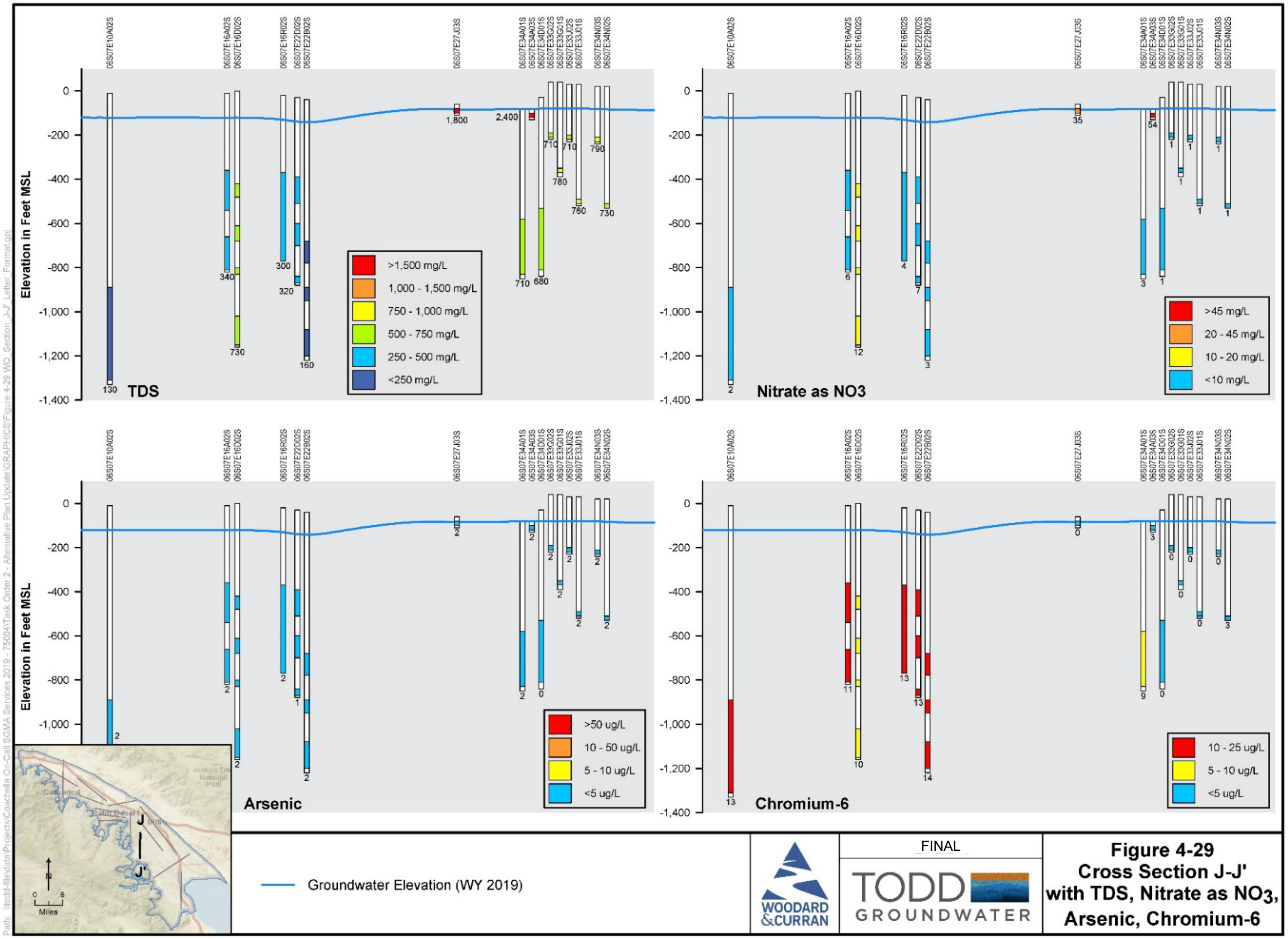


Figure 4-30. Cross Section K-K' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

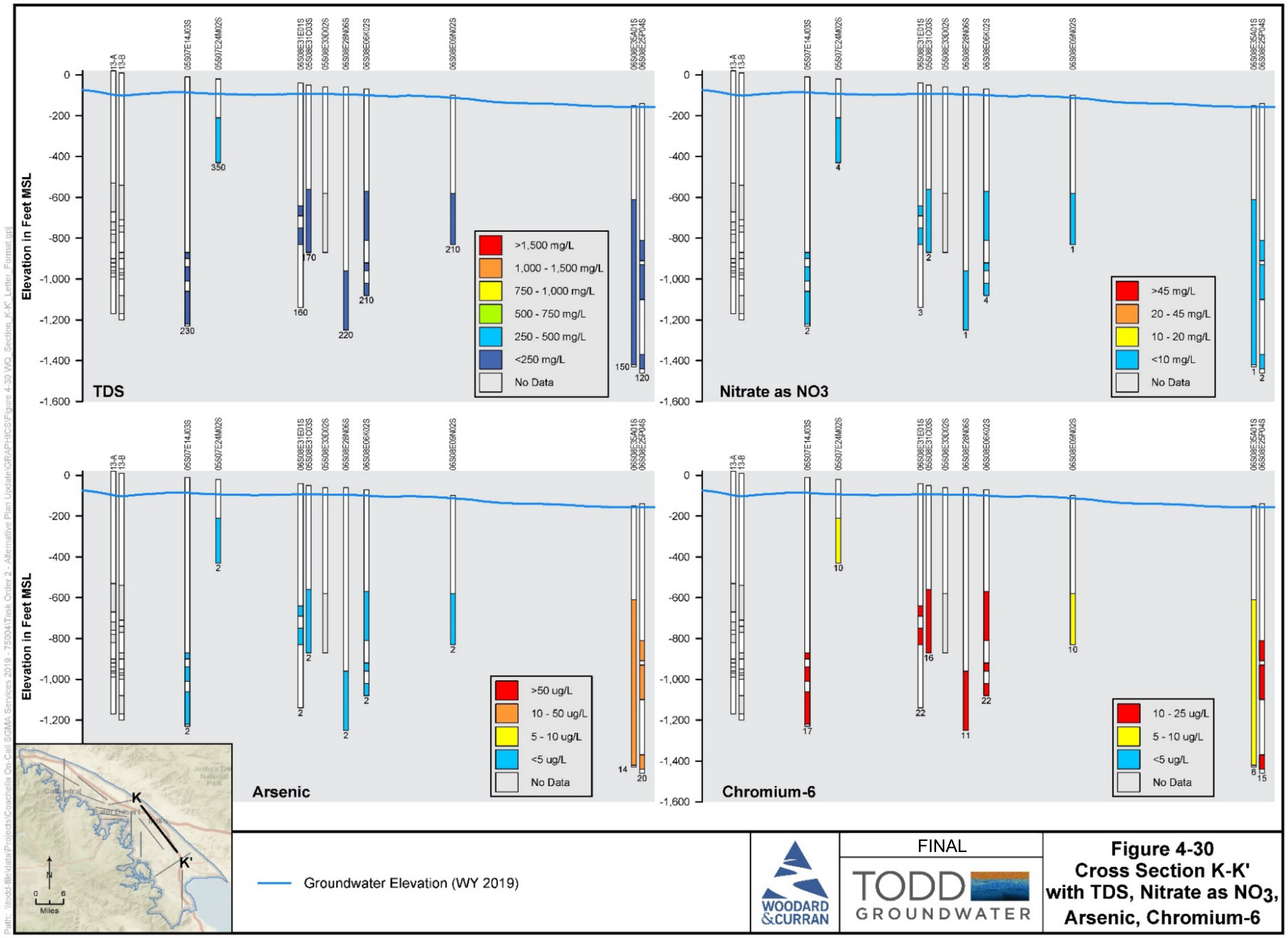


Figure 4-31. Cross Section L-L' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

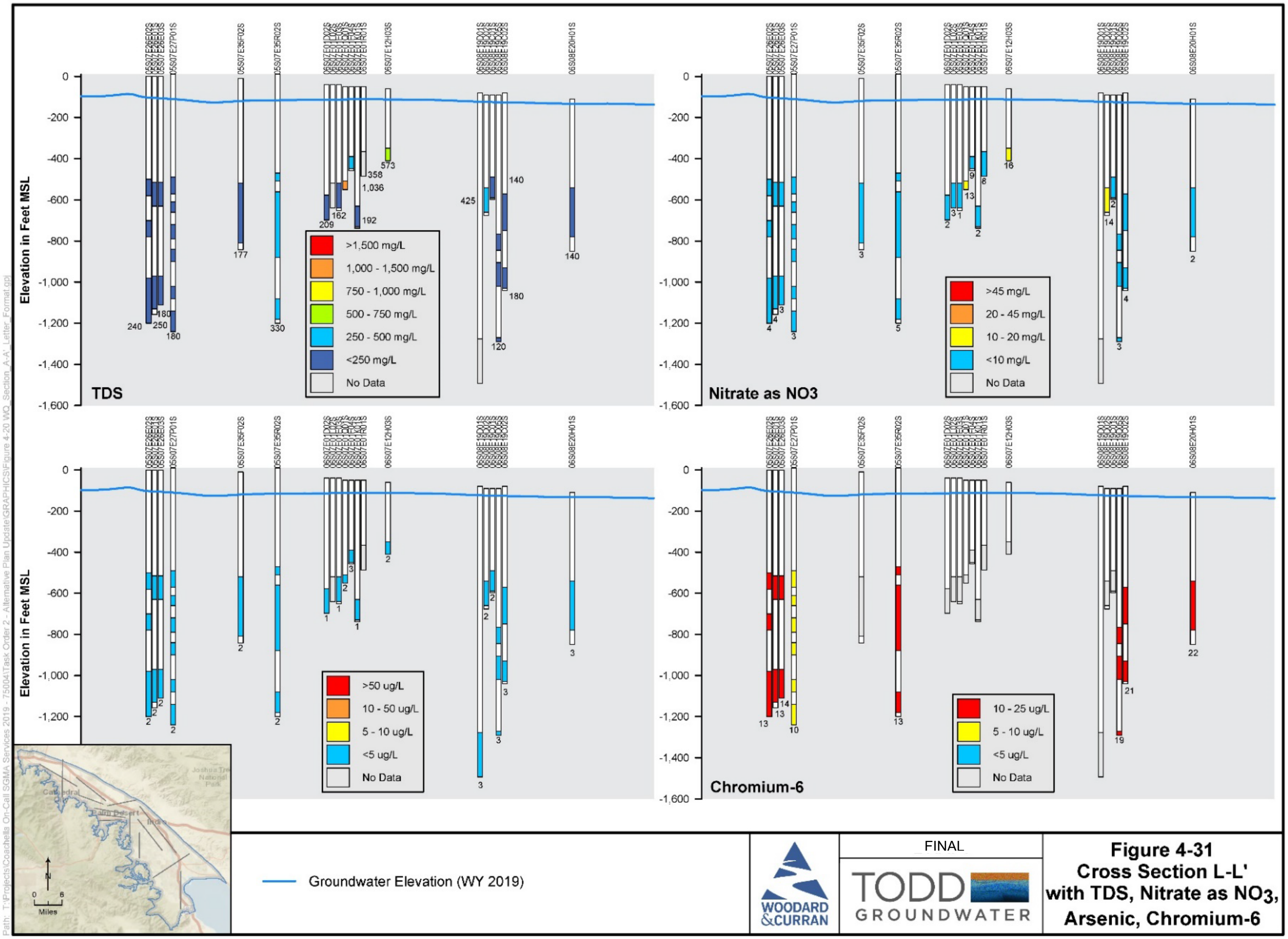


Figure 4-32. Cross Section M-M' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

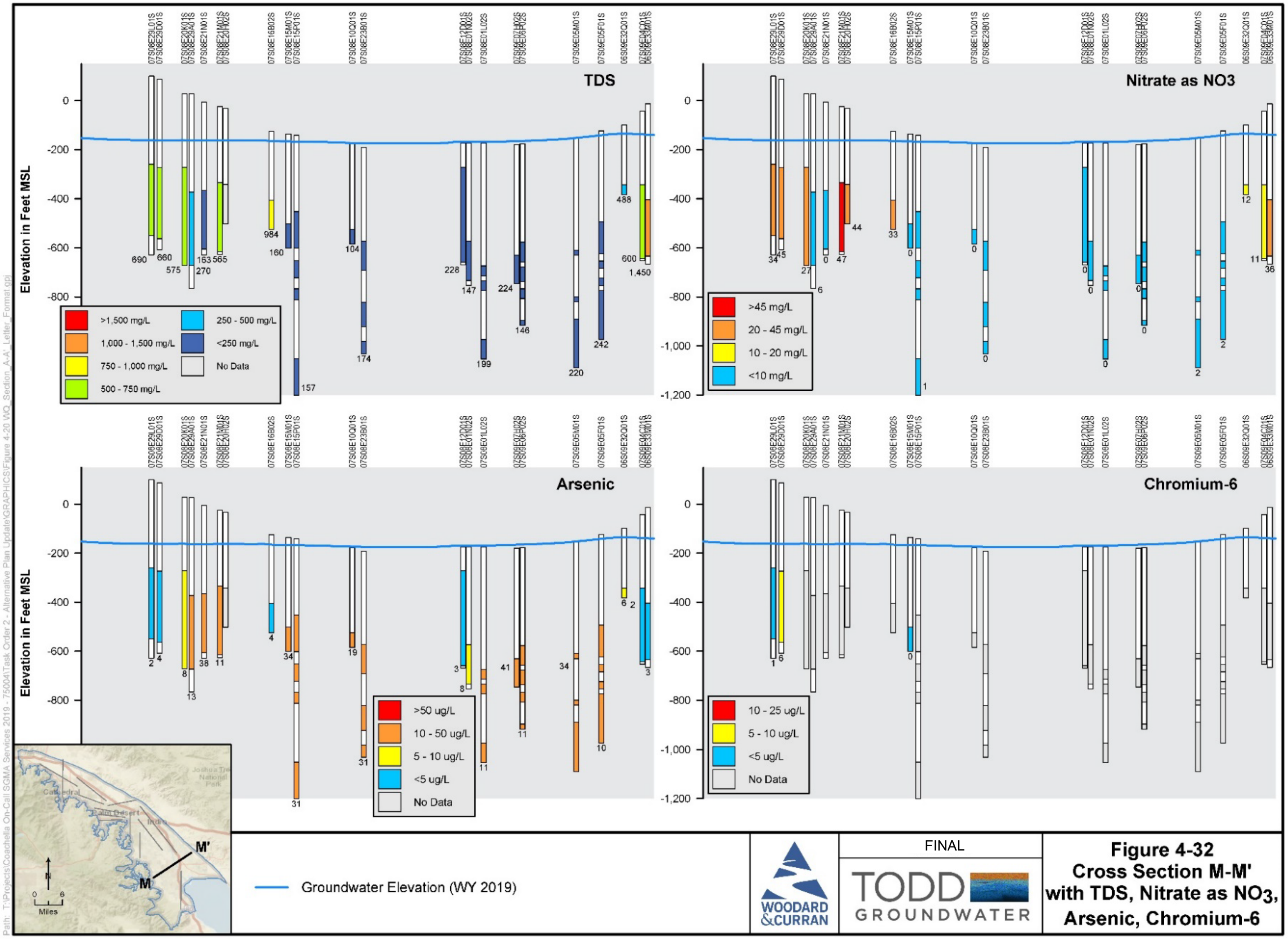


Figure 4-33. Cross Section N-N' with TDS, Nitrate as NO_3, Arsenic, and Chromium-6

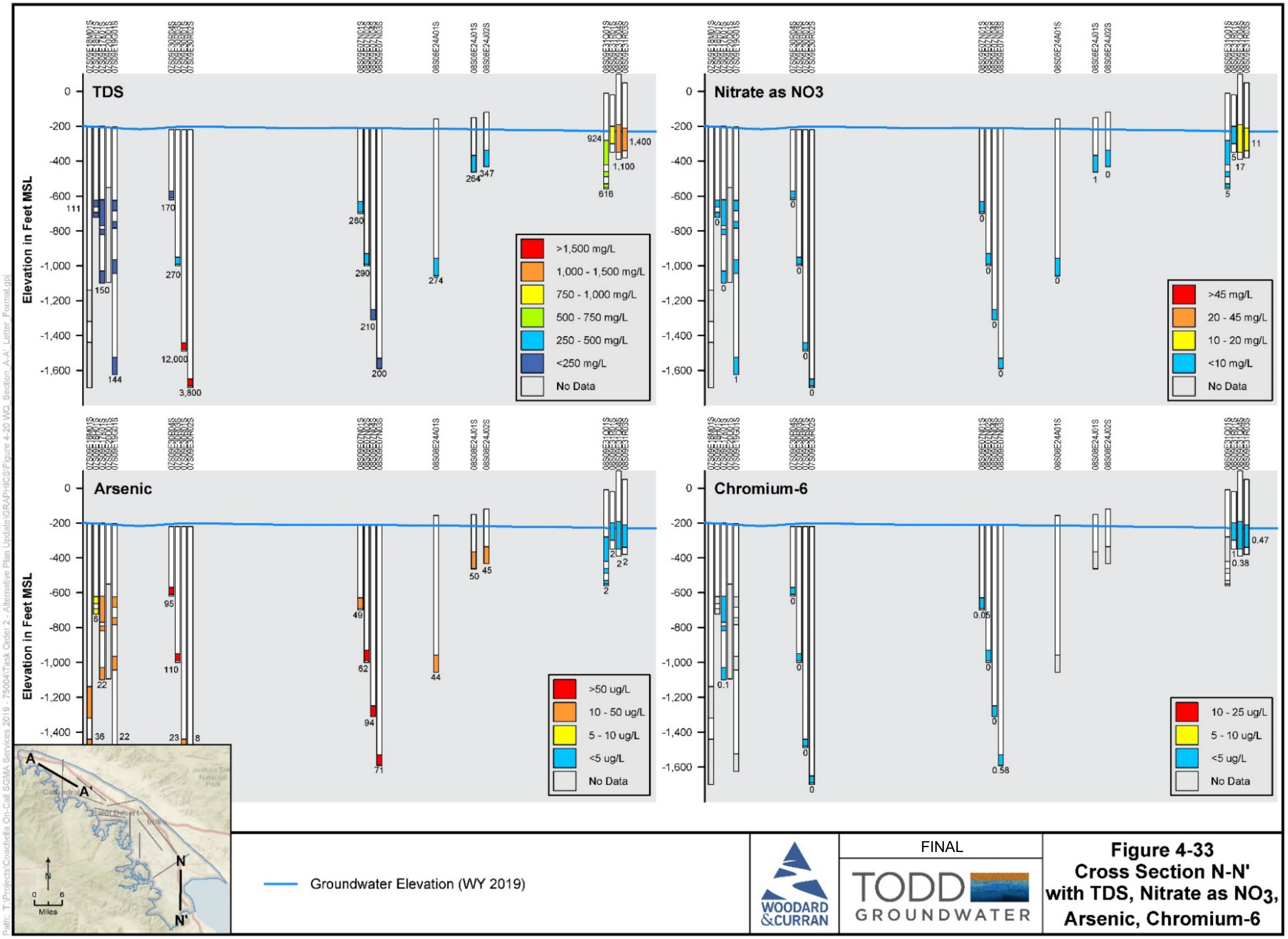


Figure 4-34. TDS Time-Concentration Plots

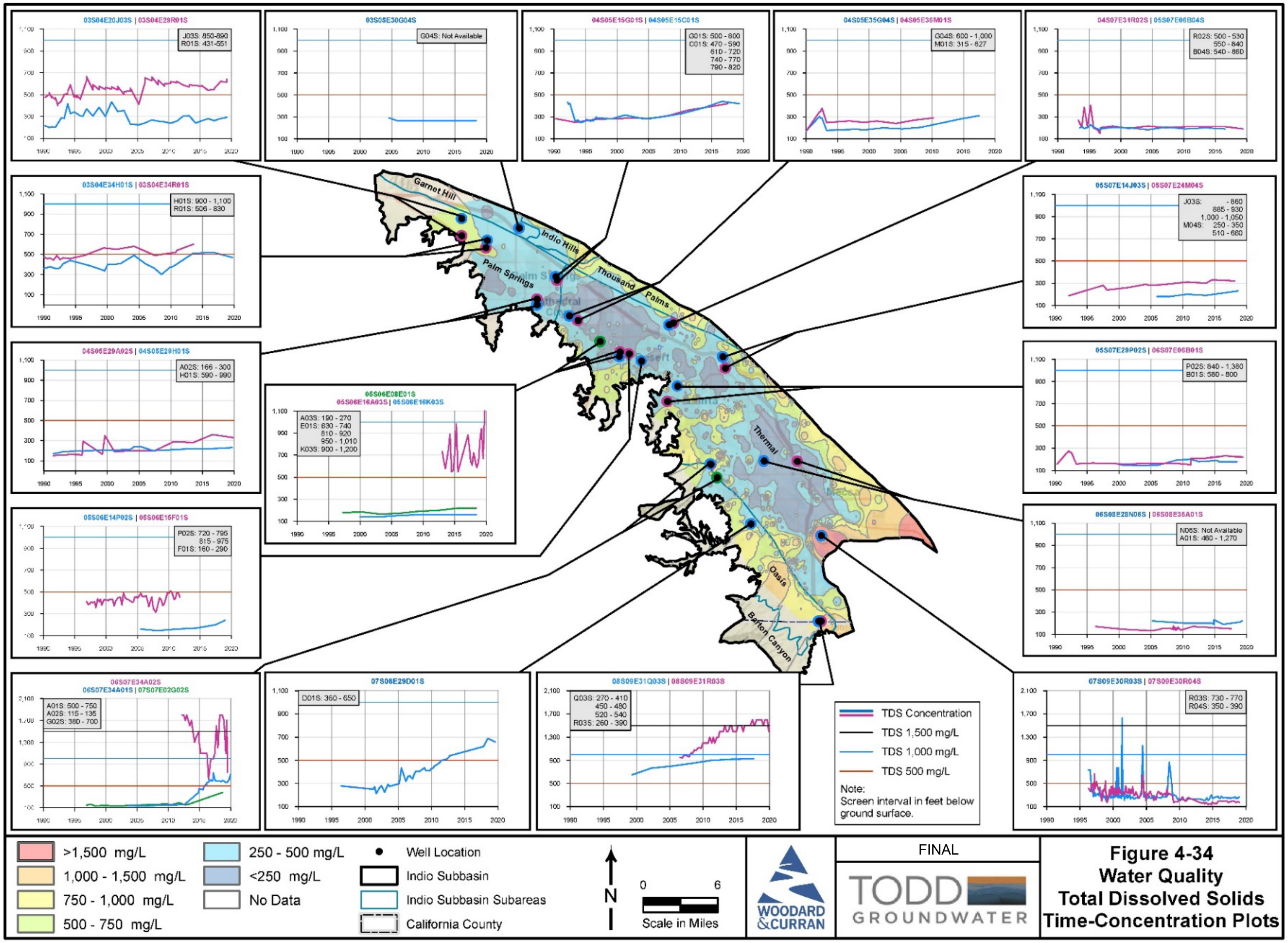
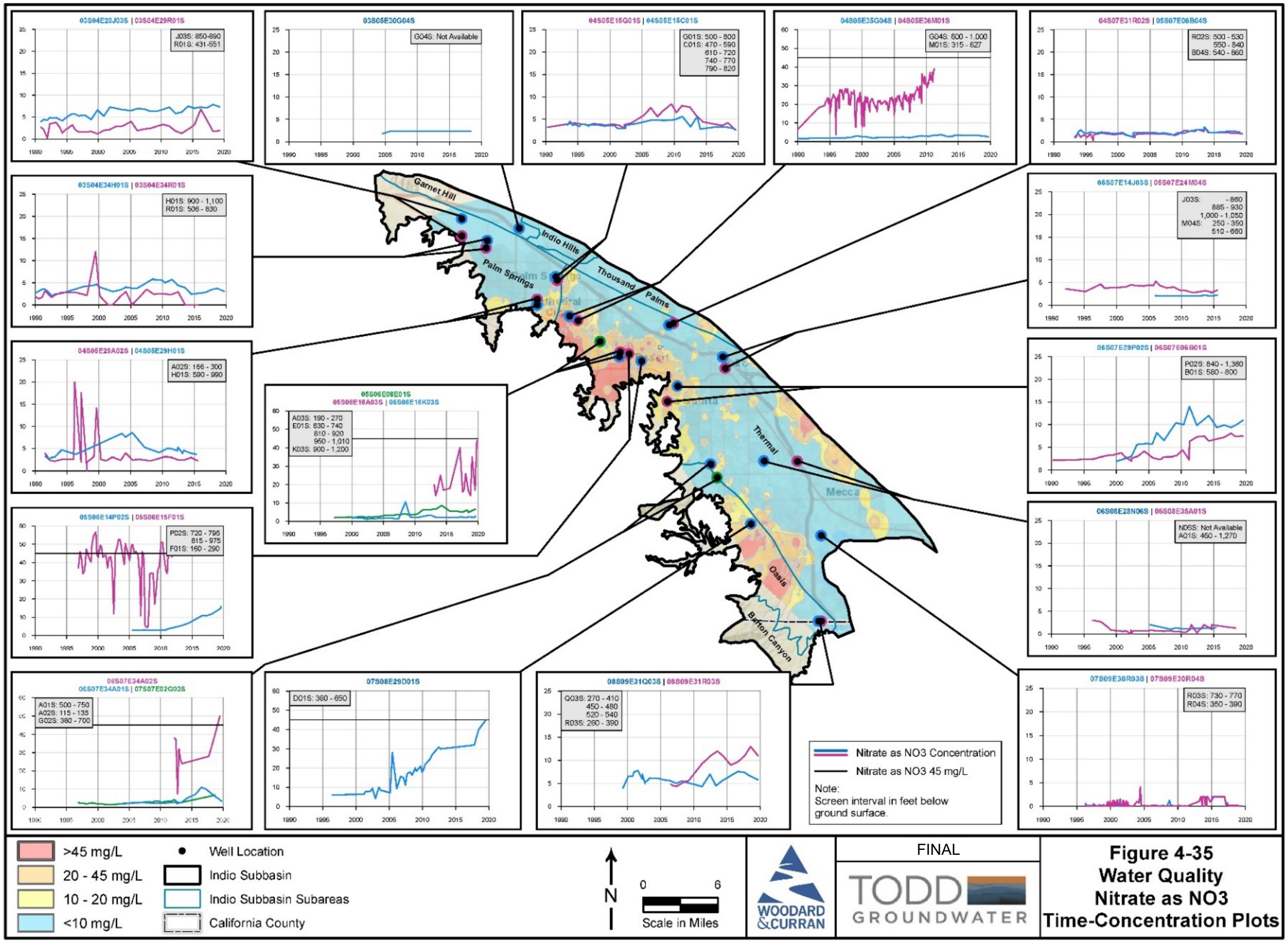


Figure 4-35. Nitrate as NO3 Time-Concentration Plots



4.4.6 Total Dissolved Solids

Groundwater in the Indio Subbasin shows a wide range of salinity, measured in terms of TDS concentrations. No fixed Consumer Acceptance Contaminant Level has been established for TDS. Instead, TDS is regulated by Secondary Maximum Contaminant Levels (SMCLs), or Consumer Acceptance Contaminant Level Ranges, set by the SWRCB: a recommended 500 milligrams per liter (mg/L) level, an upper 1,000 mg/L level, and a short-term 1,500 mg/L limit. While primary maximum contaminant levels (MCLs) are health-based standards, SMCLs, such as those for TDS, are based on aesthetic concerns such as taste, color, and odor.

4.4.6.1 Sources

TDS in the Subbasin is derived from natural sources, return flows from agricultural and landscape irrigation, recharge of imported Colorado River water, wastewater discharge (municipal and septic tanks), and subsurface inflows from adjacent Subbasins, such as the Desert Hot Springs Subbasin, which is characterized by poor water quality (DWR, 1964). Natural elevated TDS concentrations occur in the upper aquifer, typically along the Coachella Valley margins. Potential saltwater intrusion from the Salton Sea is addressed in Section 4.5.

Completion of the Coachella Canal in 1949 allowed use of Colorado River water for agricultural irrigation, with subsequent use for golf course and large landscape irrigation. As shown in the land use map (Figure 2-6 in Chapter 2, *Plan Area*) agriculture is most extensive in the East Valley. Irrigation results in evaporative concentration of TDS in shallow groundwater; the agricultural drain system helps alleviate such salt loading locally (see Figure 2-5 in Chapter 2, *Plan Area*).

Colorado River water has been used to replenish the Indio Subbasin and reverse overdraft. Deliveries have occurred from the Coachella Canal to Dike 4 (1994-2008), TEL-GRF (since 2009) and PD-GRF (since 2019), as well as from the Colorado River Aqueduct (CRA) to the WWR-GRF since 1973. The CRA supply has lower TDS concentration than the Coachella Canal supply, because it is diverted higher along the Colorado River.

Water use for domestic purposes results in salt loading to wastewater. Locations of water reclamation plants (WRPs) and other wastewater treatment facilities are shown in Figure 2-5 in Chapter 2, *Plan Area*. As described in Chapter 2, *Plan Area*, three WRPs currently provide recycled water for irrigation. For the other WRPs, treated effluent is discharged either to onsite percolation/evaporation ponds or to the Coachella Valley Storm Channel (CVSC) that conveys water to the Salton Sea. Some portions of the Subbasin (mostly rural) use septic tank/leachfield systems to treat and dispose wastewater.

4.4.6.2 Distribution and Trends

TDS concentrations in the Indio Subbasin reflect multiple factors affecting geographic and vertical distribution as well as trends. These factors have changed over time as a result of changing land uses and water and wastewater management activities.

Figure 4-11 shows the spatial distribution of the most recent TDS concentrations results from wells included in this analysis. As noted in Section 4.4.3, the map shows the most recent value for each well with water quality data between 1990 and 2019, and shallow monitoring wells were excluded.

Figure 4-11 shows that groundwater over large portions of the Indio Subbasin has TDS concentrations less than 500 mg/L. While TDS concentrations are depth-dependent in many portions of the Indio Subbasin, a few spatial patterns are observed on the map. Groundwater in the center of the Subbasin has low TDS concentrations, often less than 250 mg/L. The highest TDS concentrations (>1,500 mg/L) are observed near the Salton Sea. TDS concentrations along the perimeter of the Subbasin are frequently greater than 500 mg/L. The median TDS concentration in all wells included in the analysis is 308 mg/L. Of total wells sampled, 10 percent indicate most-recent TDS values greater than 1,000 mg/L, 32 percent indicate most-recent concentrations greater than 500 mg/L, and most wells show concentrations below 500 mg/L.

The top left portions of Figures 4-20 through 4-33 illustrate the vertical distribution of TDS concentrations for the 14 cross sections (A-A' through N-N'; see Figure 4-19 for locations). As shown, TDS concentrations generally are less than 500 mg/L and lowest concentrations occur in deep wells in the central Indio Subbasin. Several of the cross sections show shallow wells with screens at or just below the water table. These are few in number and not distributed evenly across the Subbasin but provide information on local shallow groundwater quality including in the vicinity of WRPs and groundwater replenishment facilities.

TDS trends are shown as selected time-concentration plots in Figure 4-34; note that the vertical scales mostly are 100 to 1,100 mg/L with three exceptions having scales up to 2,100 mg/L to accommodate higher concentrations. The time-concentration plots include some groupings of wells that are near one another but with screens in different vertical zones. The plots indicate that TDS concentrations in shallow zones typically are higher and more variable than in deeper zones.

As summarized in the *2002 CVWMP*, TDS concentrations in groundwater averaged less than 250 mg/L in the 1930s; and in the 1970s, groundwater typically contained 300 mg/L TDS in the shallow aquifer and 150 to 200 mg/L TDS in the deep aquifer. The *2002 CVWMP* reported then-current TDS concentrations in the shallow aquifer averaging 544 mg/L, and in the deep aquifer averaging 204 mg/L (CVWD, 2002). The *2015 Salt and Nutrient Management Plan* (SNMP, 2015) reported that the median TDS concentration was 520 mg/L in the shallow aquifer of the West Valley and 195 mg/L in the deep aquifer of the West Valley. In the East Valley, the median TDS concentration was reported as 698 mg/L in the shallow aquifer and 160 mg/L in the deep aquifer. Increases in TDS concentrations since 1990 are indicated on Figure 4-34**,** with lower rates of increase generally in deeper zones as well as in the central and eastern Thermal Subarea.

The various factors contributing to salt loading are being evaluated and managed to protect groundwater quality in the context of other sustainability criteria such as potential storage depletion, seawater intrusion, and chronic groundwater level declines. Chapter 8, *Regulatory and Policy Issues*, provides updates on salinity management, the *2015 Salt and Nutrient Management Plan*, and other salinity-related issues.

4.4.7 Nitrate

Groundwater in the Indio Subbasin shows a range of nitrate concentrations from very low background levels (less than 1 mg/L) to concentrations exceeding the drinking water standard. The drinking water standard or primary MCL for nitrate is 45 mg/L when measured as nitrate.[2]

Nitrate concentrations were reported from 932 wells between 1990 and 2019. The most recent measurements from each well show a median nitrate concentration of 3.6 mg/L. For 104 wells, or 11 percent of all wells sampled, the most recent nitrate concentrations were greater than 45 mg/L. Shallow monitoring wells (associated with local monitoring around facilities such as WRPs) are not included in this

[2] The MCL is 10 mg/L for nitrate when measured as nitrogen. All nitrate as nitrogen concentrations were converted to nitrate as nitrate for this groundwater quality assessment.

accounting because the mapping is intended to depict water quality in vertical zones that generally provide groundwater supply to production wells. In general, wells with high nitrate concentrations are relatively shallow wells. However, one well with a recent detection greater than 45 mg/L is a relatively deep well (400 feet deep well MW-4D) providing monitoring downgradient from CVWD's Water Reclamation Plant 7 (WRP-7) in an area that was historically used for agriculture.

Elevated nitrate was identified as an emerging issue in the *2010 CVWMP Update*. In Chapter 8, *Regulatory and Policy Issues*, an updated focus is on small water systems. Since 2010, nitrate as nitrogen was measured from 85 wells serving small water systems. Of these, nitrate concentrations exceeded the primary MCL in 5 wells.

Quantification of nitrate loading to the groundwater system is being addressed through the SNMP process.

4.4.7.1 Sources

Historical land uses have contributed to nitrate currently detected in groundwater. Such legacy nitrate loading has occurred from historical agriculture and agricultural development of mesquite lands as well as rural septic systems (prior to development of centralized wastewater collection, treatment, and disposal systems). Historically, portions of the now-urban Indian Wells were characterized by extensive mesquite forests (Huberty, et al., 1948). Under natural conditions, moisture was insufficient to decompose leaves and twigs and consequently, large amounts of nitrogen-containing litter accumulated under the trees. When the lands were cleared, leveled, and irrigated for agriculture, the organic matter was decomposed and nitrate was leached by irrigation return flow and migrated to the underlying water table. In addition, irrigated agriculture historically extended farther northwestward into now-urban areas (DWR, 1964, see Plate 13); assuming fertilizer use, such agriculture represents legacy loading of nitrate.

Ongoing activities that currently contribute nitrate loading include use of nitrogen-based fertilizers for agriculture, golf courses, and landscaping; septic tank percolation; and wastewater disposal through percolation.

4.4.7.2 Distribution and Trends

Nitrate concentrations in Indio Subbasin groundwater vary spatially, with depth, and temporally, as summarized in the following paragraphs.

Figure 4-12 shows the spatial distribution of most recent nitrate concentrations in groundwater. As discussed in Section 4.4.3, the map shows the most recent value for each well with water quality data between 1990 and 2019, and shallow monitoring wells were excluded.

As shown, the highest nitrate concentrations occur mostly along the western margins of the Indio Subbasin. Some of these areas, such as northwestern portions of the Thermal Subarea, have a long history of agricultural and urban development, as well as nitrate loading from multiple sources associated with native vegetation, agricultural processes, and wastewater percolation. A study was conducted in 2019 (Todd, 2019) of shallow groundwater near the WRP-10 in Palm Desert. Analysis of the groundwater using nitrate and oxygen isotopes indicated that the primary source of nitrate in groundwater near WRP-10 is soil nitrate; in other words, the nitrate derived from mesquite tree debris stored in soils. The study also revealed the isotopic signatures of nitrate from fertilizer, manure, and wastewater.

The cross sections (Figures 4-20 to 4-34) indicate that nitrate concentrations generally are higher in shallow groundwater compared with deeper groundwater. Cross Sections D-D', G-G', and I-I' particularly illustrate the contrast of high nitrate concentrations in shallow wells and lower concentrations in deeper wells. While deeper groundwater tends to be higher quality, the occurrence of nitrate loading, pumping, and the vertical transport of water through screened well intervals can cause nitrate-rich water to migrate downward.

Nitrate trends are documented in the time-concentration plots on Figure 4-35.[3] Review of the plots shows significant variability in shallow nitrate concentrations and local increases in nitrate concentrations, mostly in the western areas where concentrations are already elevated in shallow wells. The occurrence of high nitrate concentrations in shallow zones and increasing nitrate concentrations in nearby deeper wells is also revealed in Figure 4-35 (for example, see lower left plots), which suggests local downward migration.

4.4.8 Arsenic

Arsenic was identified in the *2010 CVWMP Update* as an emerging issue. An update is provided in Chapter 8, *Regulatory and Policy Issues*. Arsenic is found to have carcinogenic and non-carcinogenic effects on health if ingested at high levels over a long period of time. Both the federal and California state governments have established a primary drinking water MCL for arsenic of 10 µg/L.

Both the areal and vertical distributions of arsenic were examined. Arsenic naturally occurs in groundwater, generally derived from basin sediments, and often dissolved in groundwater with anoxic or high-pH conditions. As shown on Figure 4-13, arsenic concentrations are highest in the southern portion of the Indio Subbasin, directly northwest of the Salton Sea. Review of the cross sections indicates low arsenic concentrations except in the southernmost sections (see Figures 4-32 and 4-33). Figure 4-32 (Cross Section M-M') indicates that arsenic concentrations are higher in deeper groundwater. Arsenic could be more prevalent in deeper groundwater because the deeper groundwater has anoxic conditions, a longer residence time, or geothermal activity.

Of the most recently measured arsenic concentrations in all wells, arsenic levels were below the detection limit (ranging from 0.06 to 3.95 µg/L) in 55 percent of wells. While most arsenic concentrations are low, 153 wells, or 16.9 percent of all wells, had the most recent arsenic measurements greater than the 10 µg/L MCL. As shown in Figure 4-13, elevated arsenic concentrations occur in the eastern portion of the Indio Subbasin, near the Salton Sea. The maximum arsenic measurement observed was 136 µg/L.

Arsenic is primarily a concern for small water systems and private domestic wells. As described in Chapter 8, *Regulatory and Policy Issues*, arsenic in small water systems is being addressed by Riverside County and by CVWD's Disadvantaged Communities Infrastructure Task Force. Large public water systems are able to selectively drill wells in areas or to depths with low arsenic concentrations, decommission affected wells, or provide water treatment to remove arsenic prior to delivery. These activities are less accessible to small water systems or private domestic well owners. Only 10 out of 234 CVWD, DWA, CWA, or IWA public supply wells show arsenic concentrations greater than 10 µg/L in their most recent measurement; 4 of these 10 wells have not been sampled in the past 15 years. All four wells are CVWD wells, inactive, and no longer permitted under the SWRCB's Division of Drinking Water (DDW) program for municipal use.

[3] Note that vertical scales on Figure 4-35 are mostly 0 to 25 mg/L except five plots with scales of 0 to 60 mg/L to accommodate high nitrate concentrations along the western Subbasin margin.

CVWD has installed three treatment plants between 2004 and 2006 to reduce arsenic levels in wells serving groundwater to communities located along the eastern and northern shores of the Salton Sea including Mecca, North Shore, Bombay Beach, Hot Mineral Spa, Thermal, Oasis, and Valerie Jean.

4.4.9 Chromium-6

Chromium-6 is the oxidized form of the metal chromium and occurs in oxygen-rich groundwater near chromium-bearing rocks. It was identified in the *2010 CVWMP Update* as an emerging issue (see update in Chapter 8, *Regulatory and Policy Issues*) because of the State assessment occurring at the time to establish a lower public health goal and MCL. The total chromium (hexavalent and trivalent) MCL is 50 µg/L. In 2014, California adopted a 10 µg/L MCL for chromium-6, but this MCL was rescinded in 2017 due to a court ruling that the California Department of Public Health "had failed to consider the economic feasibility of complying with the MCL." While the MCL for total chromium currently remains at 50 µg/L, the SWRCB is evaluating relevant water treatment options and costs as a basis for establishing a MCL for chromium-6 in accordance with the court order (see discussion in Chapter 8, *Regulatory and Policy Issues*).

Both the geographic and vertical distributions of chromium-6 were examined. Figure 4-14 shows the geographic extent of elevated chromium-6 concentrations in the Indio Subbasin. While chromium-6 can be due to anthropogenic (human-caused) pollution, its extent in Indio Subbasin and its geologic occurrence in surrounding formations clearly signals that chromium is naturally occurring. Groundwater in the mid-to-southeastern portion of the Indio Subbasin often contains chromium-6 concentrations greater than 10 µg/L. Several cross-sections (see Figures 4-20 to 4-33) show higher chromium concentrations in deeper groundwater (I-I', E-E'), but others show that chromium-6 occurrence varies more horizontally (J-J', F-F', G-G').

Chromium-6 is stable in aquifers with oxidizing groundwater conditions. In some portions of California, elevated chromium-6 conditions have been linked to nitrate-rich irrigation return flow from agriculture (Hausladen et al., 2018; McClain et al., 2019). Agriculture does not appear to increase chromium concentrations in Indio Subbasin because chromium does not co-occur with high nitrate concentrations and chromium-6 concentrations are lower in shallow groundwater.

Chromium-6 concentrations are stable in most wells and have decreased in areas where Colorado River water is used to replenish natural groundwater. Chromium-6 concentrations in Colorado River water are far below the total chromium and withdrawn chromium-6 MCLs, ranging from not-detected to 0.09 µg/L in 2016 and 2018 (CAP, 2017 and 2019) at Lake Havasu (above the Colorado River Aqueduct and All-American Canal intakes). For example, the chromium-6 map (Figure 4-14) indicates an area of relatively low concentrations in the vicinity of the TEL-GRF where groundwater quality changes have been observed. Cross section J-J' (Figure 4-29) extends north-south from a high-concentration area toward TEL-GRF and shows the location and depth of CVWD Well 06S07E34A01S. While Figure 4-29 indicates a most recent chromium-6 concentration of 8.7 ug/L (from 2016) review of available total chromium data from 2017 to 2019 indicates that total chromium concentrations (and hence chromium-6 concentrations) have decreased to below detection limits as recharge water from the TEL-GRF has reached this well, and total chromium concentrations have decreased from 16 µg/L to below detection limits.

Of the most recent measurements in wells, the maximum chromium-6 concentration is 22 µg/L, and the median concentration is 6.2 µg/L. In total, 76 wells (31.5 percent of all wells with chromium-6 measurements) have their most-recent samples showing chromium-6 concentrations of at least 10 µg/L. A higher density of wells has been tested for chromium-6 in regions known to have elevated chromium-6 concentrations, which may contribute to the high observed frequency. Total chromium concentrations appear to be fully represented by chromium-6 occurrence and show a similar distribution of concentrations. A comprehensive comparison of CVWD well data showed that 102 percent of the chromium was chromium-6. The chromium-6 analytical test is more sensitive than the total chromium analytical test and is one explanation for the small difference. For most-recent measurements of total chromium, 98 wells (29.5 percent of total wells) have concentrations greater than 10 µg/L, and the median concentration is 5.45 µg/L.

Out of 180 CVWD, DWA, CWA, or IWA public supply wells, 6 wells had chromium-6 concentrations over 20 µg/L, 67 had concentrations greater than 10 µg/L, and the remainder indicate concentrations less than 10 µg/L. As discussed in Chapter 8, *Regulatory and Policy Issues*, the GSAs have anticipated a chromium-6 MCL that is lower than the total chromium MCL and have investigated possible water treatment options.

4.4.10 Uranium

Uranium has a MCL of 20 picocuries per liter (pCi/L), or about 30 µg/L. At this concentration, the effect of radiation is negligible, but the chemical properties of uranium can cause kidney damage over time.

As shown in Figure 4-15, uranium concentrations are higher in the northwestern portion of the Indio Subbasin. The *2010 CVWMP Update* discussed Colorado River water as a potential source of uranium. Recent uranium sampling at Lake Havasu, the diversion point for the CRA, has indicated the presence of uranium at levels less than 5 µg/L (Central Arizona Project, 2015, 2017, 2019). Available data indicate that the likely source of uranium in the Subbasin is from local geologic sources. Uranium is often derived from eroded granite (Jurgens et al., 2010), such as the granites to the west of the northern Indio Subbasin or the bedrock northeast of the Subbasin. Uranium often occurs in shallow, oxygen-rich groundwater and in iron oxides on the surfaces of aquifer sediment. Soluble uranium often occurs in association with calcium and bicarbonate (Jurgens et al., 2010), and groundwater in the Palm Springs Subarea has been characterized as a calcium-bicarbonate water type (DWR, 1964).

In the Indio Subbasin, uranium concentrations greater than 20 pCi/L MCL were only detected in four shallow monitoring wells, which are not considered in the basin-wide analyses because they do not represent regional conditions or production well depths. The median uranium concentration in the Subbasin is 3.34 pCi/L.

4.4.11 Fluoride

Fluoride is a naturally occurring element found in concentrations exceeding the California primary MCL (2 mg/L) in portions of the Indio Subbasin. While fluoride is a necessary component of a healthy diet to prevent dental cavities, fluoride at concentrations greater than 4 mg/L (the federal EPA MCL) can cause mottled teeth and bone disease.

As shown on Figure 4-16, elevated fluoride concentrations are observed along the eastern side of the Indio Subbasin and northern boundary of the Salton Sea. Of the most-recent fluoride measurements from wells, the median concentration is 0.6 mg/L, and the maximum concentration is 12.0 mg/L. In total, 93 wells, or 10.1 percent of all wells sampled, have their most-recent fluoride measurement greater than the 2 mg/L MCL. These higher concentrations are likely due to proximity to the San Andreas Fault and geothermally active areas near the Salton Sea. Other parts of the United States also see higher concentrations occurring near faults and geothermically active areas (McMahon et al., 2020).

Fluoride is primarily a concern for small water systems and private domestic wells. Review of available data indicate that 54 small water systems have reported fluoride data since 2010. Thirteen small water systems reported fluoride concentrations greater than 2 mg/L and six detected fluoride at concentrations greater than 4 mg/L. As summarized in Chapter 8, *Regulatory and Policy Issues*, CVWD has an active program to assist small water systems in disadvantaged areas that have water supply problems including water quality issues. Large water systems are able to selectively drill wells in areas with low fluoride concentrations or provide treatment to meet the MCL, while these activities are less accessible to small water systems or private domestic well owners. Only 3 out of 233 CVWD, DWA, CWA, or IWA public supply wells had the most recent measurement show fluoride concentrations greater than 2 mg/L in their most recent measurement. None of the three wells have been sampled in the past 15 years and they are known to be inactive.

4.4.12 Perchlorate

Perchlorate was identified in the *2010 CVWMP Update* as an emerging issue (see Chapter 8, *Regulatory and Policy Issues*), because of historical contamination in the Colorado River that originated from two manufacturing facilities. Perchlorate may also occur naturally in arid basin settings. Cleanup activities have since mitigated perchlorate levels in Colorado River water. Perchlorate loading into Las Vegas Wash has decreased more than 90 percent since 1998 and levels have consistently remained below 2 µg/L since 2009 at MWD's Lake Havasu intake (MWD, 2020). CVWD monitors the Coachella Canal at Avenue 52. Perchlorate results at this location have been below detection limits from 2017 to 2020. By way of comparison, the California MCL is set at 6 µg/L. As documented in Figure 4-17, detections of perchlorate in the Indio Subbasin have been highly localized with concentrations less than 2 µg/L.

4.4.13 Dibromochloropropane

DBCP is a pesticide banned in the United States since 1979 because it is hazardous to gastrointestinal and pulmonary health. California has an MCL of 0.2 µg/L for DBCP. While it is broken down in sunlight, it can remain in groundwater for decades; because it is denser than groundwater, it tends to sink to the bottom of aquifers. DBCP has been detected in public supply and private irrigation wells but has not been detected in public supply wells above the MCL. Three private irrigation wells have most-recent DBCP concentrations greater than 0.2 µg/L. The maximum concentration observed was 0.4 µg/L. As shown in Figure 4-18, the wells with high DBCP measurements are relatively localized in the central Thermal Subarea. The DBCP occurrence is limited to unconfined portions of the Subbasin where specific historical irrigated agricultural practices occurred.

4.5 Seawater Intrusion

The Indio Subbasin is located over 60 miles from the Pacific Ocean and is not vulnerable to seawater intrusion in the traditional sense. However, it is potentially vulnerable to saltwater intrusion from the Salton Sea. Percolation of high TDS groundwater from the shallow aquifer may also be a source of degradation to the deep aquifer. High rates of production in the lower aquifer near the Salton Sea could pull in dense, saline water, and thus degrade groundwater quality in deep portions of the aquifer. Potential saltwater intrusion along the Salton Sea northwestern boundary is monitored through two sets of nested monitoring wells, installed and managed by CVWD. Results from these monitoring wells do not suggest current groundwater degradation due to saltwater intrusion.

The Salton Sea is about 30 feet deep, 35 miles long, and 15 miles wide. Its primary source of water is agricultural drainage, transported through the Alamo River, New River, Coachella Valley Stormwater Channel, and agricultural drains. The Salton Sea has no outflowing streams, but the rate of evaporation is higher than the rate of inflows, causing a decline in the surface elevation, decrease in surface area and volume, and salinization. Salton Sea levels measured by the USGS have dropped 9.6 feet from January 2000 to January 2020, and the shoreline has retreated. Salinity levels have increased over the past two decades, and TDS levels in the Salton Sea during 2019 were greater than 69,000 mg/L (Salton Sea Authority, 2020).

While increasing salinization of the Salton Sea suggests an increased potential for saltwater intrusion, the dropping Salton Sea levels and retreating shoreline suggest a groundwater gradient from the Subbasin toward the sea and therefore less potential for intrusion from the sea. However, local groundwater gradients can change based on changes in groundwater pumping, recharge, and density differences between groundwater and Salton Sea water.

To detect and track potential saltwater intrusion, two sets of dedicated nested monitoring wells have been installed. The northernmost set of nested monitoring wells, about 2.1 miles north of the Salton Sea, was installed in 1996 with perforation depths at 300-390, 730-770, 1220-1260, and 1,430-1,470 feet below ground surface (bgs) (see Figure 4-33). All wells but the deepest well have shown stable or decreasing TDS concentrations, indicating that saltwater intrusion from the Salton Sea is not currently occurring in this region. The shallowest well (labelled 07S09E30R04S on Figure 4-34), shows a decreasing TDS trend during 1996-2019, from about 500 mg/L to under 200 mg/L. Well 07S09E30R03S, with the 730-770 feet bgs screen, has maintained TDS concentrations under 300 mg/L, excepting occasional data spikes (Figure 4-34).

High TDS concentrations are observed in the two deepest nested wells in this set (see Figure 4-33). TDS concentrations in 07S09E30R02S, with the screened interval 1,220-1,260 feet bgs, have ranged from 3,500 to 4,000 mg/L from 2016 through 2019. TDS concentrations in the deepest well, 07S09E30R01S, decreased from over 17,000 mg/L to 5,000 mg/L from 1997 through 2013. Concentrations began to increase after 2015. In recent years concentrations have increased to 12,000 mg/L. While the recent TDS concentrations have remained lower than concentrations during 1996 through 2000, the recent increase in TDS concentrations as indicative of saltwater or deep poor-quality groundwater. The deepest well is likely not representative of conditions found in the portion of the Subbasin historically containing freshwater.

The second set of nested wells is located north of Oasis and about one mile west of the Salton Sea's shore with screened intervals at 420-480, 720-780, 1035-1095, and 1315-1375 feet bgs (Figure 4-33). All four wells have maintained stable TDS concentrations of less than 500 mg/L since measurements began in 2003. The two deepest wells show TDS concentrations of less than 250 mg/L. These results indicate that saltwater intrusion is not occurring in this area.

4.6 Groundwater Dependent Ecosystems

A GDE is defined in the GSP Regulations as "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." In its Alternative Assessment Staff Report, DWR recommended that the *Alternative Plan Update* identify GDEs in the Indio Subbasin. This has been accomplished using best available information (including data available from DWR) and by applying the expertise of a professional wetland scientist.

DWR provides the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset through the online SGMA data portal. This NCCAG dataset was used for initial identification of potential GDEs in the Subbasin. Once downloaded, the data were compiled using a set of six pre-existing dataset sources; this process is explained in detail on DWR's Natural Communities Dataset Viewer (see: https://gis.water.ca.gov/app/ncdatasetviewer/sitedocs/). Because DWR's NCCAG dataset was not verified prior to public distribution, DWR recommends evaluation of NCCAG-identified locations by a licensed biologist.

For this *Alternative Plan Update*, the NCCAG dataset locations were assessed by a licensed wetlands biologist, as documented in the Technical Memorandum, *Indio Subbasin Groundwater Dependent Ecosystems Study* (Woodard & Curran, 2021), which is provided in Appendix 4-B. The study includes a review of the U.S. Environmental Protection Agency ecoregions and a preliminary review of special-status (threatened and endangered) species within the Indio Subbasin. The desktop assessment used publicly available statewide and regional data layers and involved visual review of 1,045 individual locations to determine potential GDE status. The biologist then selected 15 locations for GDE field assessment. The field study was conducted from January 11-14, 2021, at 13 sites. Two sites were not accessible at the time of field deployment and were therefore eliminated from the field assessment. Upon completion of the in-person field verification, the preliminary desktop GDE assessment was refined.

As shown on Figure 4-36, 50 (5%) of the 1,045 sites were determined to be Probable GDEs, 932 sites (89%) were determined to be Probable non-GDEs, and 63 sites (6%) were determined to be Playa Wetland Communities.

Probable GDEs consist of areas with apparent dense riparian and wetland vegetative communities along mapped drainage systems with potential for deep-rooted phreatophytes and/or visible, natural surface water flow. These Probable GDE clusters comprise hot or cold springs, seeps, and stream channels that convey snowmelt from the surrounding San Jacinto mountain front. Due to their location in upper canyons where groundwater extraction is generally not occurring, the specific areas in the Indio Subbasin where Probable GDEs were identified do not have existing groundwater data available for review (see Figure 4-5). Probable GDEs identified along the mountain-front may be associated with surface runoff, snowmelt, or springs and seeps from up-gradient sources.

Representative photo of a Probable GDE, a spring in Chino Canyon.

Probable Non-GDEs are areas that appeared incorrectly mapped based on current land development and land-use or that otherwise appeared to be dry upland areas, cultivated and/or flooded agricultural land, obvious humanmade ponds, lakes, and other features, channelized drains, and areas with no other indicators of groundwater presence near the surface. It should be noted that dry washes, arroyos, bajadas, and other ephemeral conveyances where water only flows in response to heavy precipitation events were classified as Probable Non-GDEs for this study.

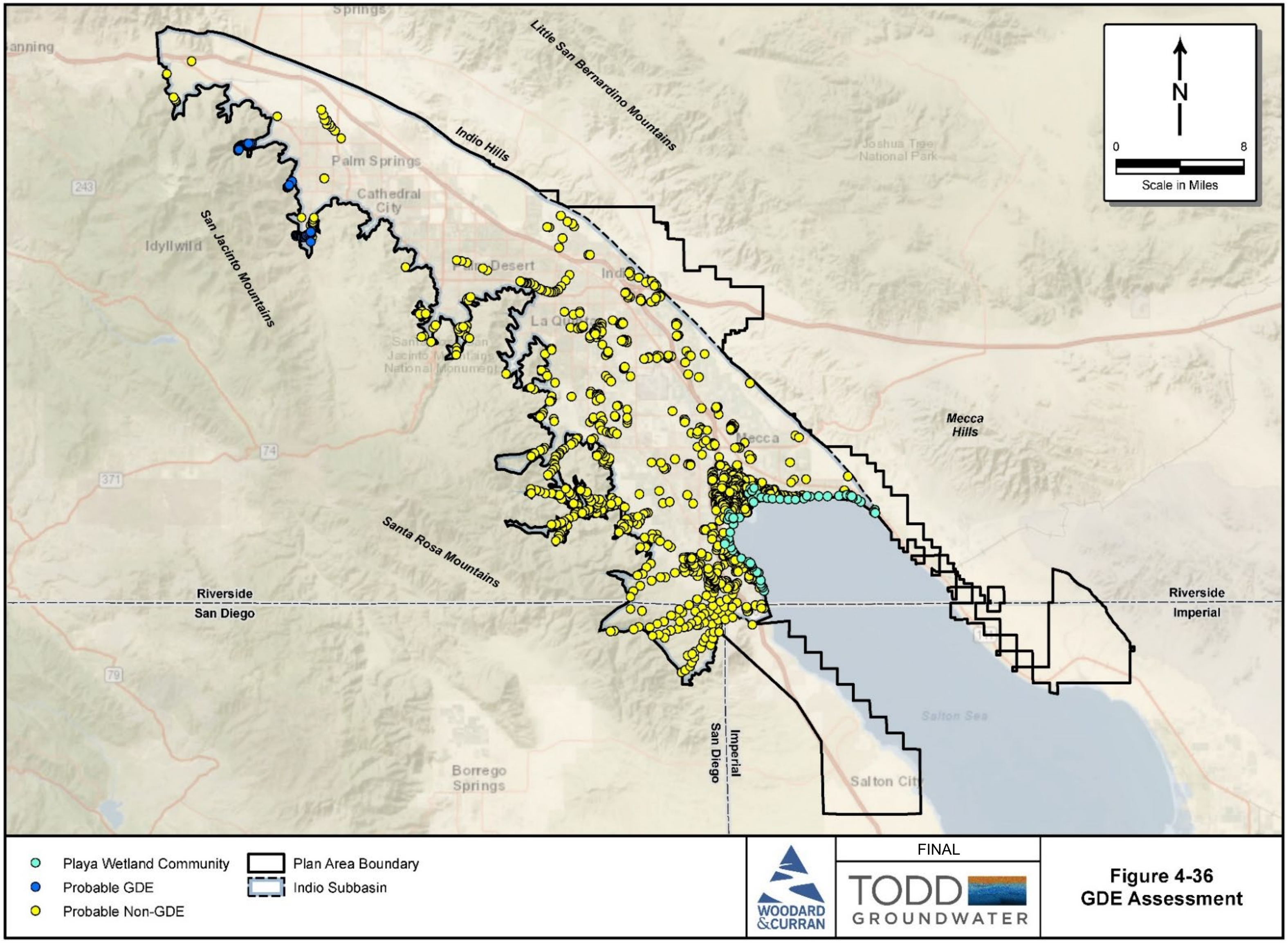
Representative photo of a Probable Non-GDE, a bajada in the southeast portion of the Subbasin.

Playa Wetland Community includes areas of wetland habitat along the Salton Sea exposed seabed (playa) generally downstream of stream, agricultural drain, or stormwater channel outlets. The receding of the Salton Sea is exposing thousands of acres of playa each year and water from irrigation ditches and other drainages that previously flowed directly into waters of the Sea now spreads out on the exposed playa of the Sea where new vegetation and wetlands currently exist as a result. As discussed in the *Indio Subbasin Groundwater Dependent Ecosystems Study,* the *Coachella Valley Multiple Species Habitat Conservation Plan* (*CVMSHCP*) (Coachella Valley Association of Governments, 2007) identifies some of these playa wetlands as part of the CVSC/Delta Conservation Area, which includes the CVSC, agricultural drains emptying into the Salton Sea that may contain desert pupfish habitat, and areas along the seashore that contain sensitive natural communities. The *CVMSHCP* acknowledges that this habitat is sustained largely by agricultural runoff and outflow in the CVSC, but that maintenance of the drains and the flood control channel periodically modifies the habitat.

Representative photo of a Playa Wetland Community along the Salton Sea exposed seabed.

The *Indio Subbasin Groundwater Dependent Ecosystems Study* in Appendix 4-B provides additional documentation, including a table of the state and federal threatened and endangered species listed for the Indio Subbasin, field assessment notes, maps, and photographs of the GDE field assessment sites.

Figure 4-36. GDE Assessment



CHAPTER 5: DEMAND PROJECTIONS

5.1 Introduction

Water resources planning requires reliable estimates of future water demands. Many factors can affect the amount of water used in the future, including local climate, existing water use patterns, population growth, seasonality, employment, economic trends, environmental needs, and water conservation efforts. As demographic changes occur within a region over time, future demand projections may also change. For example, population projections were much higher in the *2010 Coachella Valley Water Management Plan Update* (*2010 CVWMP Update*) (Coachella Valley Water District [CVWD], 2012) and have been reduced to reflect more tempered growth over the last decade (refer to Chapter 1, *Introduction*). Revising the demand forecast with updated demographic projections is important for anticipating future water use more accurately when compared to projected supplies identified in Chapter 6, *Water Supply*.

To provide an adequate long-range forecast of future water demands, this *2022 Indio Subbasin Alternative Plan Update* (*Alternative Plan Update*) uses a 25-year planning period from 2020 through 2045. Projected water demands are broken into four major categories: municipal, agricultural, golf, and other. Projections for each of these four categories were developed separately and then summed in the final section of this chapter.

5.2 Factors Affecting Future Water Demands

There are a number of uncertainties and changes in the region and state that could affect future water demands in the Plan Area. These uncertainties include the following:

- **Revised Growth Forecast—**The Southern California Association of Governments (SCAG) released new socioeconomic growth forecasts in early 2020 (*Connect SoCal*)[1] that significantly reduced previously projected increases in population, housing, and employment. The SCAG forecast was developed in coordination with City and County municipalities and was based on the land use designations in their respective adopted General Plans. *Connect SoCal* reduced projected growth in the Plan Area to levels more similar to those published in the *2002 Coachella Valley Water Management Plan* (*2002 CVWMP*) (CVWD, 2002).
- **Agricultural Land Conversions—***Connect SoCal* identified specific parcels that were currently vacant or used for agriculture but are planned for conversion to urban uses. *Connect SoCal* relied on those developable parcels, coupled with the housing and employment growth projections, to estimate increases in municipal demand and associated decreases in agricultural demand. Given changes in agricultural pumping statewide as a result of the Sustainable Groundwater Management Act (SGMA), cropped lands in the Plan Area may increase faster than expected.
- **Development on Tribal/Reservation Lands—**There are over 28,000 acres of Tribal/Reservation lands in the Plan Area. While much of the Tribal/Reservation lands in the West Valley has been developed to varying degrees, a substantial amount of Tribal/Reservation land in the East Valley is largely undeveloped. All five Tribal governments in the Plan Area were contacted by the Groundwater Sustainability Agencies (GSAs) with requests for land use and water demand

[1] https://scag.ca.gov/connect-socal

projections for their Tribal/Reservation lands. Several of the Tribes indicated that projected Tribal/Reservation land uses were already included in municipal General Plans; therefore, *Connect SoCal* adequately captures Tribal/Reservation growth. Others did not respond; for the purposes of analysis, all Tribal/Reservation lands were assumed to grow in accordance with *Connect SoCal*.

- **Long-Term Conservation Regulations—**Following the 2012–2016 drought, California passed two major pieces of conservation legislation: Assembly Bill (AB) 1668 (Friedman) and Senate Bill (SB) 606 (Hertzberg). As outlined in *Making Conservation A California Way of Life* (California Department of Water Resources [DWR] and California State Water Resources Control Board [SWRCB], 2018), the legislation requires establishing, implementing, reporting, and enforcing urban water use objectives, along with agricultural water use efficiency. These objectives and standards are currently under development and future impacts are uncertain.

5.3 Municipal Demands

This section summarizes the process used to develop the municipal water demand projections for the Plan Area, which includes the cities of Cathedral City, Coachella, Indian Wells, Indio, La Quinta, Palm Desert, Palm Springs, and Rancho Mirage, and unincorporated areas in Riverside and Imperial Counties. Water agencies serving as GSAs for this *Alternative Plan Update* include CVWD, Coachella Water Authority (CWA), Desert Water Agency (DWA), and Indio Water Authority (IWA). A small portion of the Plan Area extends into San Diego County. However, this area is not included in this analysis, which uses SCAG's population, housing, and employment forecasts that do not address San Diego County. This small area is mostly rugged uplands, contains minimal development, and is not likely to be developed further. This section documents the datasets, methodologies, and assumptions used to develop water demand projections for all municipal uses within the Plan Area boundary.

5.3.1 Municipal Demand Methodology

The municipal demand forecast used unit demands and adjustment factors based on a variety of information, including customer billing data and a geographic information system (GIS) database with parcel-level land use information. The base projection year was established as 2016 based on the availability of detailed demographic data from SCAG via *Connect SoCal*. Future water demand projections were based on SCAG growth projections for 2020,[2] 2035, and 2045. Future water demands were projected in 5-year increments with linear projections used for the other 5-year increments. The methodology used to develop municipal water demand projections was as follows:

1. **SCAG Regional Growth Forecast—**SCAG provided socioeconomic forecasts for population, households, and employment. These SCAG data served as the starting point for analysis. Additional information was required to estimate total housing units for the region.
2. **SCAG Land Use Inventories—**SCAG GIS data about local land use planning was used to ensure future growth projections did not exceed allowable land uses in the region. GIS mapping was used to identify vacant and agricultural lands identified by local jurisdictions for future development.
3. **Housing Unit Analysis—**Additional information about vacancy rates was used to estimate baseline and projected housing units for the Plan Area, including housing units used by seasonal residents

[2] 2020 forecast is a projection based on SCAG demographic data and does not reflect actual 2020 water use.

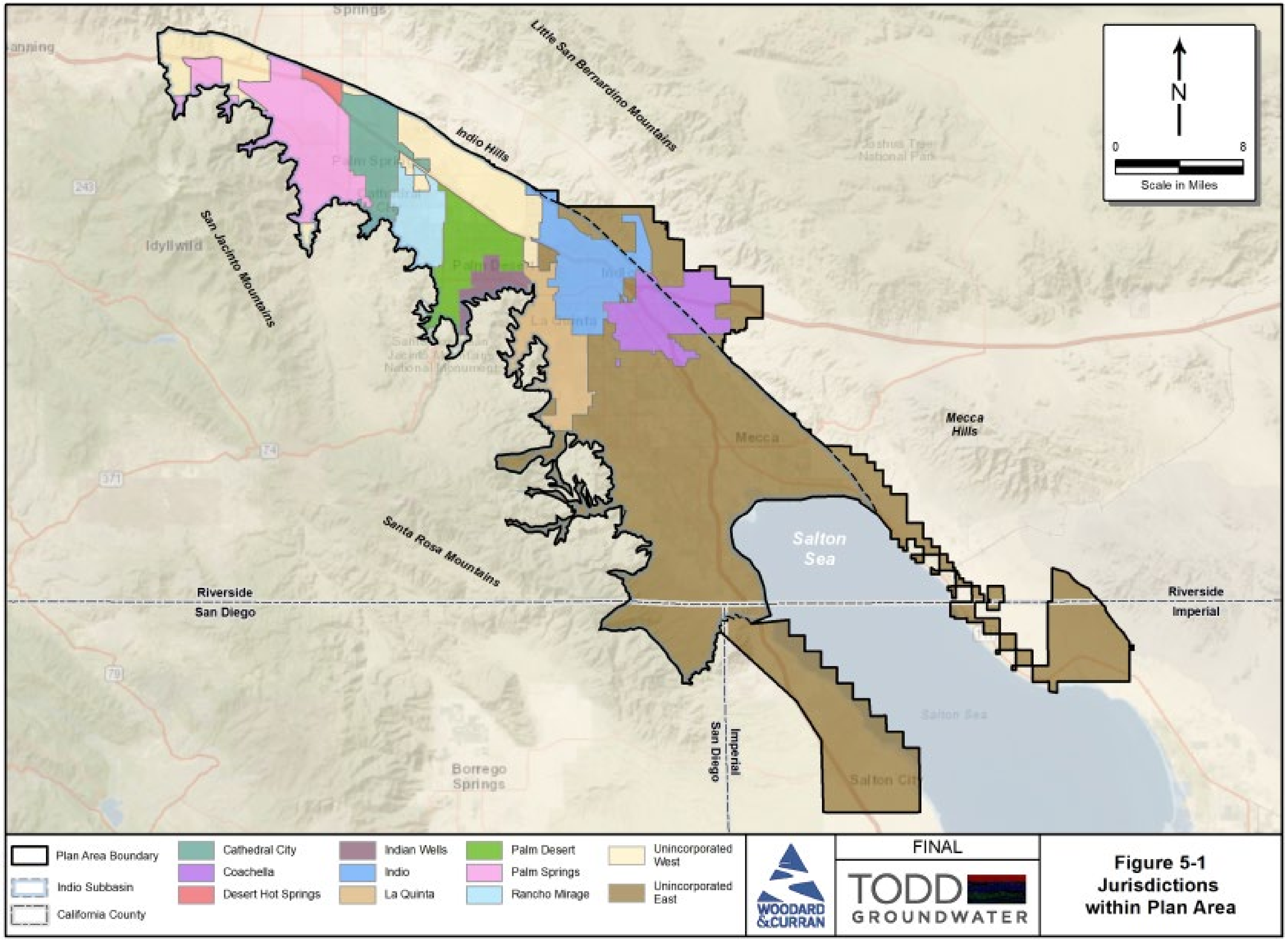
and other part-time uses. Recent development data and land use information were used to allocate future housing units into the single-family and multiple-family sectors.

4. **Employment Analysis—**SCAG employment forecasts were used to allocate future commercial, industrial, and institutional (CII) demands.
5. **Unit Demand Factors—**Customer billing data provided by the GSAs from July 2014 to June 2019 was averaged by GSA to determine baseline water demands for each GSA. The multiple-year average was used to capture annual weather variations. Water demand projections were calculated using *gallons per housing unit* for residential and landscape uses, and *gallons per employee* for CII uses.
6. **Water Loss—**Water loss estimates were based on validated Water Loss Audit reports provided by the GSAs. An average 3 years of available water loss audits (for 2016, 2017, and 2018) were used to develop a water loss estimate.
7. **Adjustment Factors—**Future demands were adjusted for indoor passive conservation based on savings from the natural replacement of indoor devices and from implementation of DWR's *2015 Model Water Efficiency Landscape Ordinance* (MWELO) (DWR, 2015) for future developments. No additional adjustments were made to reflect required AB 1668 and SB 606 implementation in the baseline demand projection.

The basic unit of municipal demand projections are jurisdictions (i.e., cities and unincorporated county areas) in the Plan Area, as shown in Figure 5-1. Within each jurisdiction, demographic factors were considered homogeneous. For example, the average vacancy rate for a city was considered the same in instances where a city was split between multiple water agencies or when a city was both inside and outside the Plan Area boundary. Unincorporated areas were separated into distinct estimates for the West Valley and the East Valley. The East Unincorporated geographic area (see Section 5.3.2 below) includes both Riverside and Imperial Counties.

For each of the GSAs, socioeconomic data and demand projections were totaled by each *GSA Area*, which is defined as being limited to the portion of the GSA's jurisdictional area in the Plan Area. For example, the *CVWD Area* includes all of CVWD's jurisdictional area in the Plan Area, whether or not those demands are currently served by their domestic water system. For customers that are not connected to the CVWD domestic water system but are in the CVWD Area, demands met by private wells or small water systems are allocated to CVWD as the overlying GSA.

Figure 5-1. Jurisdictions within Plan Area



5.3.2 SCAG Regional Growth Forecast

Socioeconomic projections of population, households, and employment were provided by SCAG, which is a joint powers authority that encompasses six counties (i.e., Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura Counties). These data were originally prepared for the *2020-2045 Regional Transportation Plan and Sustainable Communities Strategy*, also known as *Connect SoCal*.[3] Initial work on the growth forecast was based on draft materials released in November 2017 as part of SCAG's local input and envisioning process.[4] These data include base year estimates for 2016 and projections for 2020, 2035, and 2045. Forecasts for 2025, 2030, and 2040 were based on linear interpolation. The draft datasets were released in November 2018. The final socioeconomic growth projections were released with the final version of *Connect SoCal*, which was adopted by SCAG on May 7, 2020.[5] SCAG made some adjustments to the draft projections based on feedback received from local jurisdictions (for example, projections were reduced for the Cities of Indian Wells and La Quinta), and these adjustments were reflected in the final *Connect SoCal* totals.[6]

Connect SoCal's regional growth forecast is comprised of the most recent and detailed data available for the Plan Area. This regional growth forecast is based on jurisdictional General Plans and is intended to represent the most likely growth scenario considering a combination of recent and past trends and regional growth policies. In the Coachella Valley, this forecast anticipates less growth than in previous forecasts. SCAG has reduced projections downward for Coachella Valley, particularly in the unincorporated areas of Riverside County in the East Valley. Traditionally, developing previously undeveloped land on the urban fringe (i.e., greenfield development) has been the method for accommodating growth in the Coachella Valley. SCAG's recent forecasts have increasingly looked toward infill development on vacant land in urbanized areas and redeveloping land use types to accommodate future growth.

The growth forecast in the *2010 CVWMP Update* was based on *Riverside County Projections 2006* (RCP-06) (Riverside County Center for Demographic Research, 2006) and was adopted by the Coachella Valley Association of Governments and SCAG. SCAG then used this forecast to develop its *2008 Regional Transportation Plan* (SCAG, 2008). The RCP-06 forecast was prepared in late 2006 and early 2007; it was developed during a period of significant economic growth and development in the Coachella Valley before the housing market collapse and economic recession. Between 2000 and 2008, Riverside County's population increased by over 500,000, making it one of the fastest-growing metropolitan areas in the United States over that period. This rate of growth slowed following the economic recession, which impacted housing development and population growth in the Coachella Valley. Although *Connect SoCal* substantially reduced its regional growth forecast from its RCP-06 projection, the current rate of growth in *Connect SoCal* is higher on average than recent development data suggest. Despite fluctuations in projections, current Plan Area growth is consistent with long-term growth trends (i.e., the growth rate effectively averages boom and bust periods) in the Coachella Valley over the last 30 years.

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[3] https://scag.ca.gov/sites/main/files/file-attachments/0903fconnectsocal-plan_0.pdf?1606001176

[4] http ://scagrtpscs.net/Pages/DataMapBooks.aspx

[5] https://www.connectsocal.org/Pages/default.aspx

[6] 2045 population projections for the cities of Indian Wells and La Quinta were reduced by 2,900 and 1,300 persons, respectively.

SCAG growth estimates are benchmarked to the U.S. Census Bureau's (Census Bureau's) 2010 Census, which is currently more than 10 years out of date. The more current 2020 Census data are not expected to be released until mid-2021, and there have been additional delays as a result of the coronavirus disease 2019 (COVID-19) pandemic. Once 2020 Census data are released, the GSAs will be able to confirm the accuracy of SCAG's baseline estimates. In addition, the current COVID-19 pandemic has resulted in increased work-from-home patterns that may result in additional short- and long-term socioeconomic changes for the region. In the short term, water demands are likely to decrease as a result of the COVID--19 related economic downturn and decreases in recreational/tourism activity. In the long term, the Plan Area may experience an increase in population due to relocation from larger metropolitan areas where working from home is more expensive. Given the uncertainty of these potential changes, *Connect SoCal* growth projections have not been adjusted.

5.3.2.1 Seasonal Population

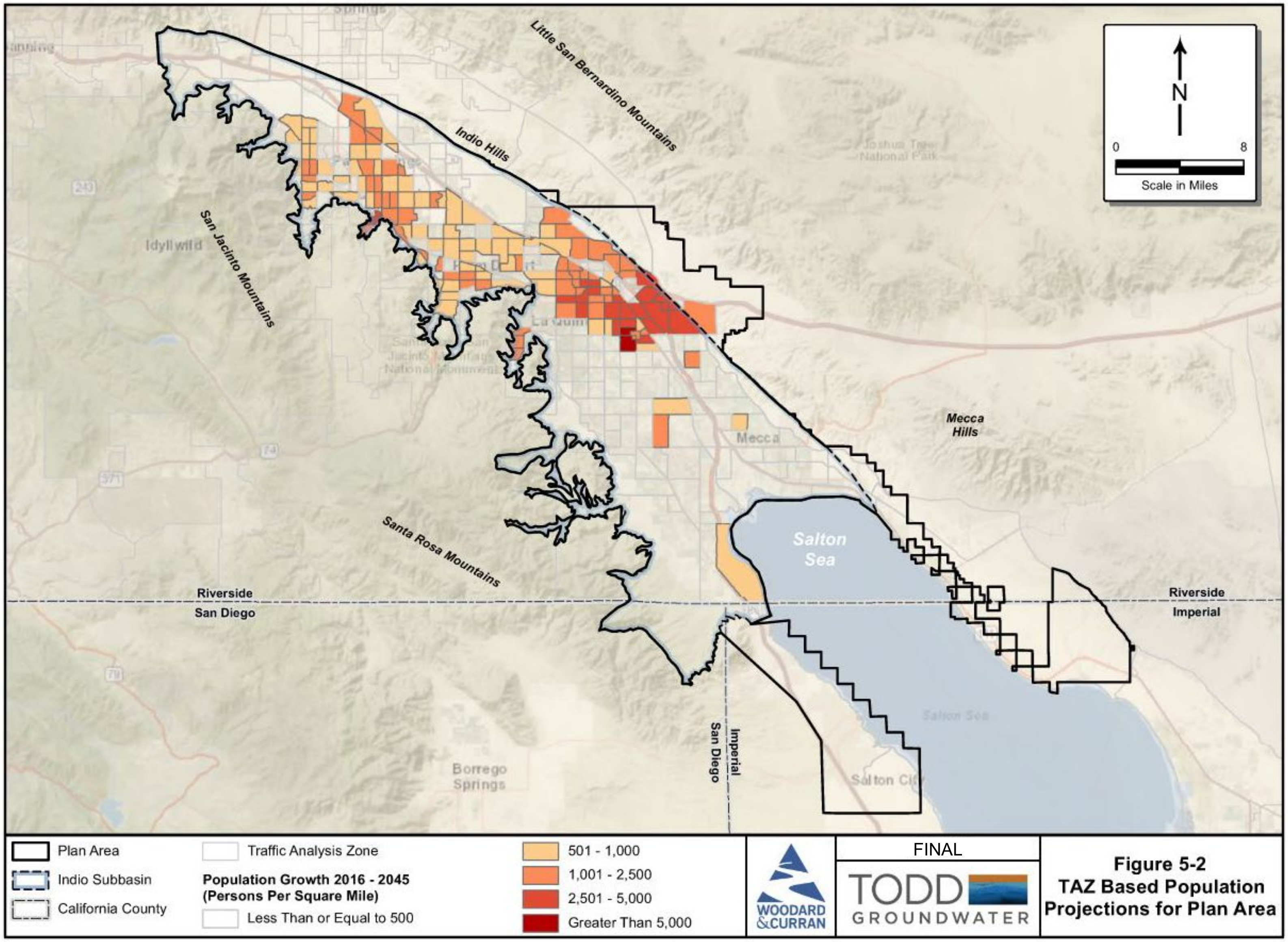
The Coachella Valley is unique in that it includes a high number of homes identified as vacant for "seasonal, recreational, or occasional uses" as defined by the Census Bureau. These homes are not the primary residence of owners or renters based on where they spend most of their time. Past reports indicate that a significant percentage of these properties are used as part-time retirement homes, with fewer units used as weekend homes or as short-term rentals. In the Coachella Valley, these include homes for people who live in one primary location, but also have a second home in a warmer location to spend winters and/or weekends. Tourism is also an important part of the region's economy, and many homes are used as short-term rentals. The emergence of the sharing economy and internet-based platforms such as Airbnb for short-term rentals has more recently resulted in changes to the short-term rental market. The region's seasonal population is not counted under the Census Bureau's definitions of households and population used by SCAG.

For the purposes of this *Alternative Plan Update*, growth in residential water demand is a function of current and projected housing units, which includes all vacant and seasonal units. Housing unit counts provide a strong correlation to water demand. Vacant housing units and other amenities such as municipal parks and common areas that serve the seasonal population have year-round water uses, particularly for outdoor irrigation. Due to the seasonality of the tourist industry and outdoor irrigation requirements in the summer, these homes often use the most water when they are vacant. SCAG's population forecast was expanded for this *Alternative Plan Update* to reflect seasonal population in the Plan Area.

5.3.2.2 Growth Forecast for the Plan Area

SCAG provided socioeconomic forecasts at various levels of geographic units, including 11,267 transportation analysis zones (TAZs), which were developed independently by SCAG and resemble the Census Bureau's block groups. These TAZs were used to split forecasts of population, households, and employment by water agency and by Plan Area. To split individual TAZs, data were clipped along jurisdictional boundaries for further analysis using parcel-level land use data. Using land use data provided greater precision when locating population centers. Figure 5-2 is a map of the Plan Area showing the largest growth in population by TAZ.

Figure 5-2. TAZ Based Population Projections for Plan Area



Socioeconomic Forecast for the Plan Area

Table 5-1 lists the socioeconomic population, household, and employment forecasts for the GSAs in the Plan Area as developed by SCAG. SCAG population estimates do not include seasonal population. Appendix 5-A contains tables of the complete projections for each GSA by jurisdiction. In the Plan Area, the cities with the largest projected net increases in population are Coachella, with an increase of 84,000 persons (i.e., a 185-percent increase), and Indio, with an increase of 41,200 persons (i.e., a 47 -percent increase). As a result, CWA and IWA have the fastest-growing populations among the GSAs.

Table 5-1. Socioeconomic Growth Forecast for GSAs Within Plan Area

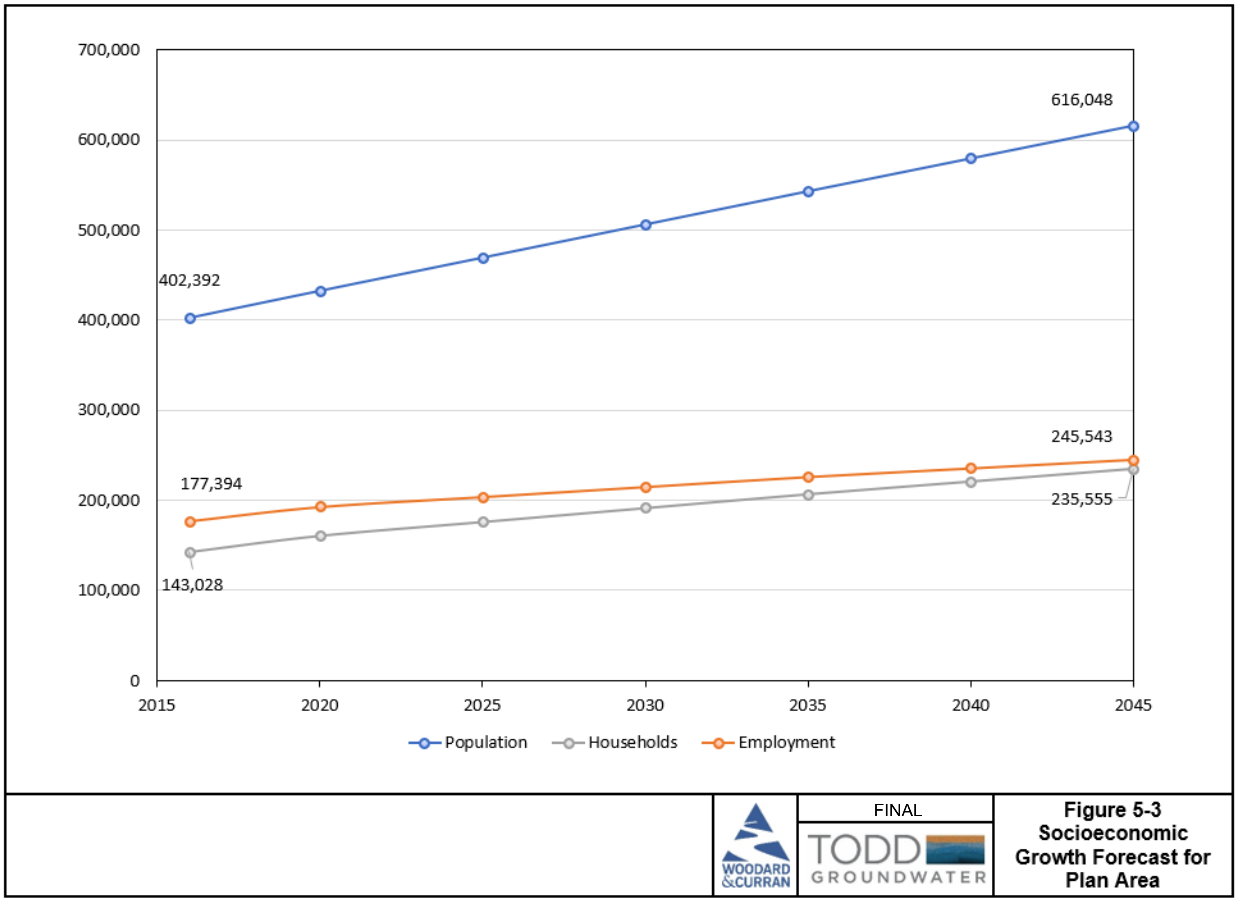
Water Provider	Permanent Population		Households		Employment	
	2016	2045	2016	2045	2016	2045
Coachella Valley Water District	221,065	311,500	84,390	129,132	105,736	138,001
Coachella Water Authority	44,417	115,504	9,460	32,539	8,599	23,582
Desert Water Agency	53,763	71,693	25,516	35,331	35,529	45,989
Indio Water Authority	83,147	117,351	23,662	38,553	27,530	37,971
Plan Area Total	**402,392**	**616,048**	**143,028**	**235,555**	**177,394**	**245,543**

Note: SCAG population estimates do not include seasonal population.
Source: SCAG Connect SoCal

Figure 5-3 shows that overall Plan Area population is projected to grow by 213,656 (53 percent) by 2045. The higher growth rate of 92,527 households (65 percent) indicates a general long-term decline in the number of persons per household, which is the result of an overall aging population and increases in seasonal/part-time occupancy. Employment is also anticipated to grow slower than population or households, with 68,149 new employees (38 percent) by 2045. This is a result of net travel out of the region for work, as well as a large number of retirees in the Plan Area.

The Coachella Canal runs adjacent to agriculture fields in the East Valley.

Figure 5-3. Socioeconomic Growth Forecast for Plan Area



Forecast Population with Seasonal Residents

For the purposes of analysis, SCAG's socioeconomic forecast was used to project the region's total population, including seasonal residents. The projection used vacancy rates and persons per household estimates from State of California Department of Finance (DOF) for cities and Census Bureau American Community Survey (ACS) (Table B25004) for unincorporated areas (see Section 5.3.4), along with an assumed 50-percent occupancy rate for seasonal residents. By definition, these seasonal residents would spend less than half the year in these housing units. However, vacant housing units and other amenities that serve seasonal residents would have year-round water uses, such as outdoor irrigation. Table 5-2 provides a forecast of Plan Area population with seasonal residents.

Table 5-2. Total Plan Area Population with Seasonal Residents

Water Provider	2016	2020	2025	2030	2035	2040	2045
Coachella Valley Water District	267,136	287,987	308,015	328,042	348,069	364,297	380,523
Coachella Water Authority	45,828	54,736	66,488	78,241	89,993	105,175	120,357
Desert Water Agency	66,755	70,451	74,164	77,878	81,591	85,576	89,561
Indio Water Authority	91,366	96,107	103,429	110,751	118,072	124,408	130,743
Plan Area Total	471,085	509,281	552,096	594,912	637,725	679,456	721,184

5.3.3 SCAG Land Use Inventories

Land use information was used during analysis to ensure that municipal water demand projections were consistent with local General Plans and did not exceed allowable land uses in the Plan Area. This land use information was also used to quantify future development of agricultural land. Land use data were retrieved from SCAG's *2016 Combined Land Use Datasets for Riverside County*.[7] SCAG then encoded this data layer into GIS. These data are available in various formats, including SCAG's GIS Open Data Portal.[8] SCAG's land use data include existing land uses, adopted General Plan land use, Specific Plan land use, and adopted zoning codes for each jurisdiction as of 2016. Since each jurisdiction in the region has their own approach to categorizing land uses, SCAG aggregated these categories into their own land use definitions. These land use data were then reviewed by local jurisdictions beginning in summer 2017, and SCAG's final dataset reflects each jurisdiction's local input.

5.3.3.1 Parcels Identified for Development

Future land use projections were based on future development of parcels identified as vacant, agricultural, or under construction as of 2016 in SCAG's existing land use database. SCAG identified existing land uses by using the most recent County Assessor's property information. These data represent the best available estimate of current land uses at a regional level.

Parcels identified as remaining vacant, agricultural, or identified as undevelopable or protected in local General Plans, or as part of a conservation area, were excluded from analysis and not considered developable. While some redevelopment of existing parcels is anticipated in the region, SCAG land use data do not provide estimates about the extent to which existing land uses would be available for redevelopment. This information would need to be developed through additional participation from City planning departments.

Table 5-3 and Figure 5-4 show the availability of land identified for development by jurisdiction. Vacant land accounts for 71 percent of land identified for development in the Plan Area, with future development in the West Valley being primarily on vacant land. Agricultural land accounts for 25 percent of the land identified for development, with most of that land in the East Valley. The cities of Coachella and Indio have the largest acreage in agriculture identified for development. These cities are also projected to be the fastest growing in the region. Portions of Imperial County in the Plan Area were excluded from the calculated agricultural to urban conversion, as projected development in Imperial County was assumed to occur on vacant land.

[7]http://gisdata.scag.ca.gov/Pages/GIShome.aspx

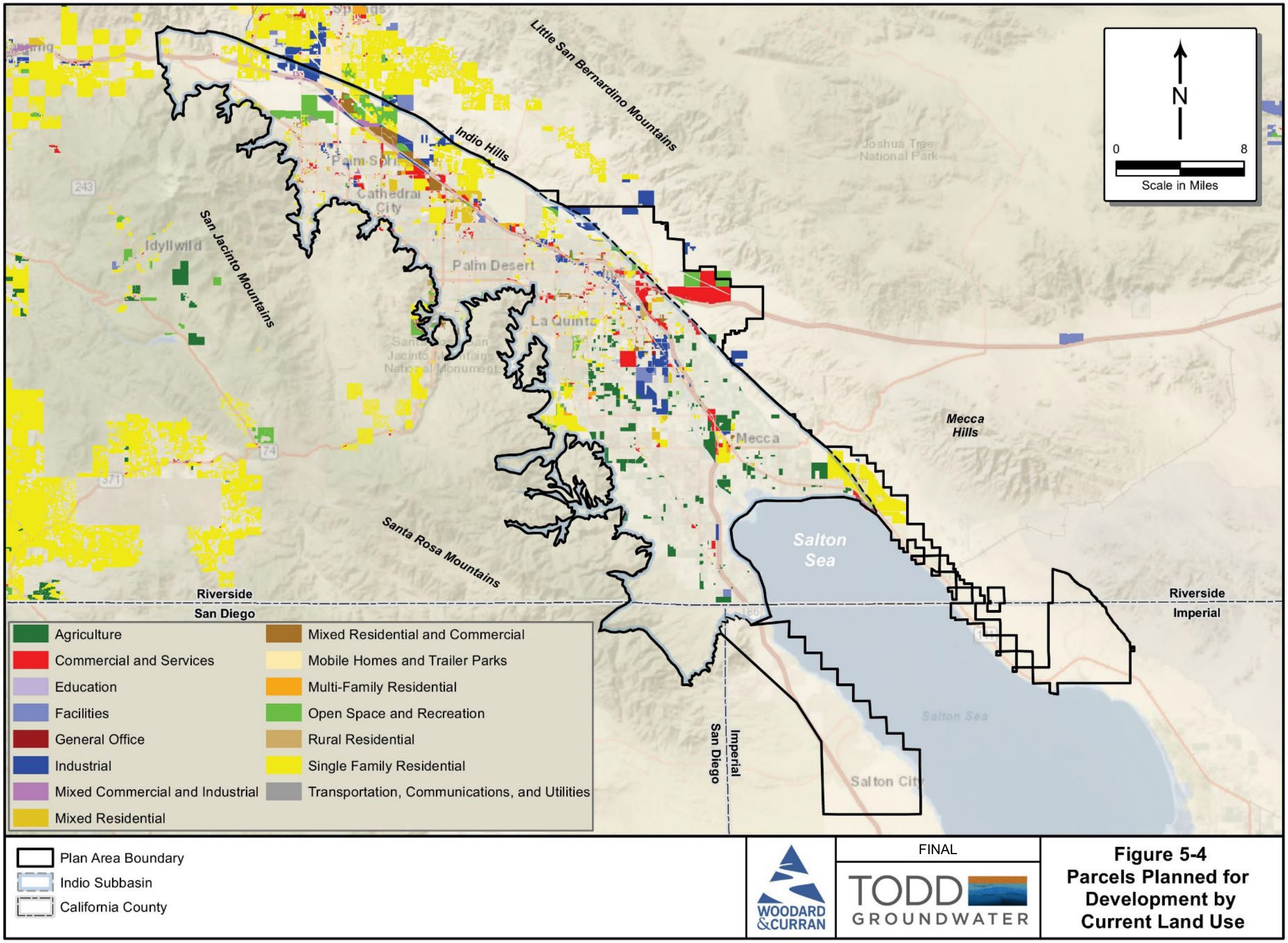
[8]http://gisdata-scag.opendata.arcgis.com/

Table 5-3. Land Available for Future Development (Acres)

Jurisdiction	Vacant	Agriculture	Under Construction	Total
West Valley				
Cathedral City	3,282	2	173	3,457
Indian Wells	164	116	117	397
Palm Desert	1,862	0	105	1,967
Palm Springs	4,130	99	311	4,540
Rancho Mirage	2,147	1	1	2,149
Unincorporated	5,093	93	398	5,584
East Valley				
Coachella	8,041	3,977	139	12,157
Indio	3,117	3,057	1,061	7,235
La Quinta	1,719	337	180	2,236
Unincorporated	11,490	6,537	24	18,051
Total	**41,045**	**14,219**	**2,509**	**57,773**

Note: Totals may not sum due to rounding

Figure 5-4. Parcels Planned for Development by Current Land Use



5.3.3.2 Future Residential Land Uses

For each of the parcels identified for future development, a General Plan or Specific Plan land use was specified based on local land use planning. Under SCAG's land use definitions, single-family dwelling units are defined as detached dwellings, and multi-family dwelling units are defined as attached residences, apartments, condominiums, or townhouses. Appendix 5-A provides information about allowable densities by General Plan land use and allowable densities by Specific Plan land use. Specific Plan land uses were only applied in the analysis if the Specific Plan was adopted after the most recent General Plan update in each jurisdiction. Densities are measured as *dwelling units per acre*.

Table 5-4 provides the projected buildout of residential land uses by acre for cities in the Plan Area. SCAG's growth projections are controlled to not exceed the maximum density specified in local General Plans. Therefore, the maximum allowable density was assumed to estimate buildout conditions in a manner consistent with SCAG's methodology.

Table 5-4. Projected Buildout of Residential Land Uses (Housing Units)

Jurisdiction	Single-Family	Multiple-Family
West Valley		
Cathedral City	6,069	11,821
Indian Wells	819	0
Palm Desert	6,246	3,396
Palm Springs	3,318	5,554
Rancho Mirage	2,127	2,798
Unincorporated	9,849	3,372
East Valley		
Coachella	24,733	38,183
Indio	11,592	9,722
La Quinta	4,510	4,464
Unincorporated	19,655	8,368
Total	**88,918**	**87,678**

Residential mixed-use categories in General Plans include mixed residential, which are a combination of single-family detached and multi-family dwellings of any type occurring together, and mixed residential and commercial, which are a mixture of residential and commercial uses occurring in a specified area. These categories can be a mix of adjacent uses or a mix of uses in a single structure or parcel, such as commercial uses on the ground floor of a building with residential use above. In April and May 2020, the GSAs conducted outreach to City planning departments to determine analysis assumptions for these categories. Responses varied, but based on the feedback, analysis assumed that 75 percent of the units in the "mixed residential" category would be single-family residential, and 25 percent of the acres in the mixed residential and commercial category would include residential multiple-family units.

5.3.4 Housing Unit Projections

The growth forecast for residential and landscape used in this *Alternative Plan Update* is based on a forecast of total housing units. SCAG's *Connect SoCal* provides socioeconomic projections of households, or occupied housing units, which exclude all vacant units. Additional information about vacancy rates and housing type was used to transform SCAG projections into estimates of total housing units and to separate housing units into the categories of single-family, multiple-family, and mobile home. Additional housing data for the Plan Area are based on the following data sources:

- DOF E-5 Population and Housing Estimates for Cities, Counties and the State—January 1, 2011–2020. Sacramento, California, May 2020.
- ACS, 2018 American Community Survey 5-Year Estimates (2014–2018)

For the Plan Area cities of Cathedral City, Coachella, Indian Wells, Indio, La Quinta, Palm Desert, Palm Springs, and Rancho Mirage, DOF provides the most current and most accurate annual estimates of vacancy rates and total housing units by type. For unincorporated areas in Riverside and Imperial Counties, the most current estimates are from ACS, which derived from an annual survey conducted by the Census Bureau. Unlike the 2010 Census, the ACS is based on a sample and has a margin of error. Multi-year estimates are also provided as part of the ACS to increase statistical reliability. The most current ACS estimates are the 5-year estimates from 2014 to 2018.

ACS data are based on census place, which includes cities and census-designated places (CDPs) in the region. CDPs are concentrations of population defined by the Census Bureau for statistical purposes. Unincorporated areas in Riverside County include the Bermuda Dunes, Desert Palms, Thermal, Thousand Palms, and Vista Santa Rosa CDPs in the West Valley, and the Mecca, North Shore, and Oasis CDPs in the East Valley. Unincorporated areas of Imperial County include Bombay Beach, Desert Shores, Salton City, and Salton Sea Beach.

5.3.4.1 Vacancy Rates

SCAG's *Connect SoCal* counts are limited to occupied households and had to be increased to account for vacant housing units. Vacancy rates were applied to SCAG household projections for each jurisdiction to develop estimates of total housing units for the 2016 base year. Vacancy rates were then used to calculate total housing units based on the formula shown in Equation 5-1.

Equation 5-1. Calculation of Total Housing Units

$$\text{Housing Units} = \frac{\text{Households}}{\text{(1-Vacancy Rate)}}$$

Vacancy rates were used instead of a vacant unit count to account for jurisdictions that were split between water agencies or that were both inside and outside of the Plan Area. It was also assumed these vacancy rates would remain constant for each jurisdiction across future projections. A review of historical data from DOF indicate that vacancy rates have been stable over time. According to *Connect SoCal*, the fastest growing areas have lower average vacancy rates, and as a result, the vacancy rate for new units is lower than the average for the Plan Area.

For cities in the Plan Area, Table 5-5 provides the most recent estimates of households, housing units, and vacancy rates from DOF. The cities of Coachella and Indio have the largest share of growth and have lower seasonal vacancy rates. The cities of Indian Wells, Rancho Mirage, and La Quinta have higher seasonal vacancy rates, but lower rates of overall growth. The overall vacancy rate for Plan Area cities is 29.5 percent. This total is also consistent with the ACS dataset. According to the ACS, seasonally vacant units account for 77 percent of the vacant units among Plan Area cities.

Table 5-5. DOF Vacancy Rates for Plan Area Cities (2016)

City	Households	Housing Units	Vacancy Rate
West Valley			
Cathedral City	17,048	21,080	19.1%
Indian Wells	2,827	5,262	46.3%
Palm Desert	24,107	38,167	36.8%
Palm Springs	23,191	35,490	34.7%
Rancho Mirage	9,167	14,403	36.4%
East Valley			
Coachella	9,769	10,397	6.0%
Indio	25,978	31,449	17.4%
La Quinta	15,318	24,432	37.3%
Total	**127,405**	**180,680**	**29.5%**

Source: DOF, 2020; Table E-5

Table 5-6 provides the most recent ACS 5-year (i.e., 2014 to 2018) estimate of seasonally vacant units for unincorporated areas in the Plan Area. The subtotals for all CDPs were used to determine vacancy rates for these jurisdictions. For the West Valley's unincorporated CDPs, the overall vacancy rate is 25 percent. For the East Valley's unincorporated CDPs, the overall vacancy rate is 12 percent in Riverside County and 37 percent in Imperial County.

Table 5-6. ACS Vacancy Rates for Unincorporated Areas (2014–2018)

Census Designated Place	Households	Housing Units	Vacancy Rate
West Valley			
Bermuda Dunes	2,818	3,746	25%
Desert Palms	4,010	5,191	23%
Thermal	472	693	32%
Thousand Palms	2,728	3,813	28%
Vista Santa Rosa	855	1,022	16%
Subtotal	**10,883**	**14,465**	**25%**
East Valley (Riverside County)			
Mecca	1,955	2,191	11%
North Shore	915	915	0%
Oasis	1,028	1,340	23%
Subtotal	**3,898**	**4,446**	**12%**
East Valley (Imperial County)			
Bombay Beach	161	467	66%
Desert Shores	323	475	32%
Salton City	1,876	2,833	34%
Salton Sea Beach	141	212	33%
Subtotal	**2,501**	**3,987**	**37%**

Source: ACS, 2018; Table B25004

5.3.4.2 Baseline Housing Units by Type

For the baseline housing unit estimate, additional housing data were used to split housing units into categories of single- and multiple-family units to align with customer billing data. For cities in the Plan Area, this information was derived from DOF estimates, as shown in Table 5-7. For unincorporated areas, this information was derived from the ACS 5-year estimate (2014–2018), as provided in Table 5-8. DOF provides estimates for housing units, and the ACS provides estimates for households. The ACS does not identify a share of vacant units by housing unit type, so vacant units were assigned based on their existing proportion in the subject unincorporated area.

Table 5-7. Housing Unit Type for Plan Area Cities (2016)

City	Single-Family	Multiple-Family	Mobile Home
West Valley			
Cathedral City	69%	19%	12%
Indian Wells	88%	12%	0%
Palm Desert	69%	22%	10%
Palm Springs	61%	33%	6%
Rancho Mirage	83%	11%	6%
East Valley			
Coachella	74%	20%	6%
Indio	72%	18%	10%
La Quinta	88%	11%	1%

Source: DOF, 2020; Table E-5

Table 5-8. Housing Unit Type for Unincorporated Areas (2014–2018)

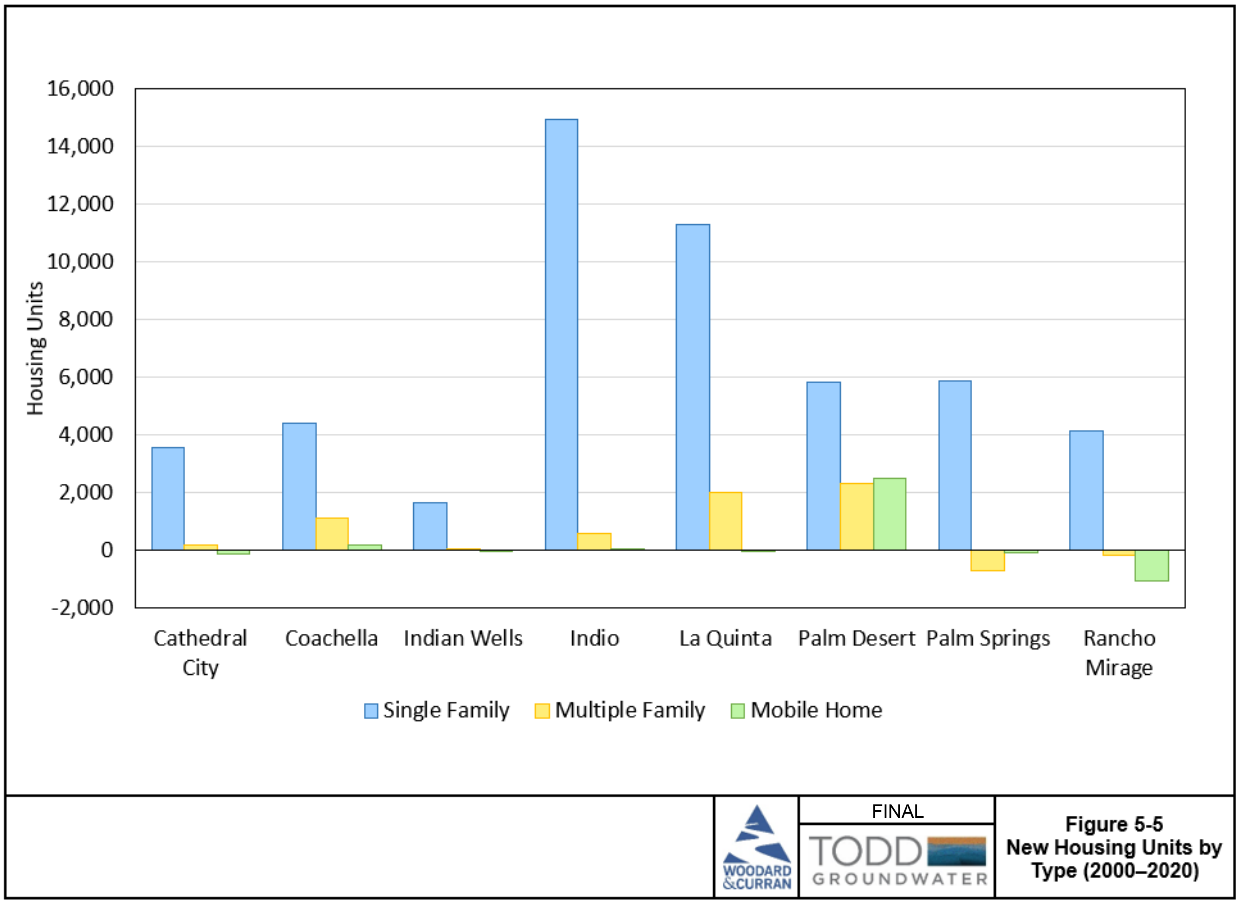
Census Designated Places	Single-Family	Multiple-Family	Mobile Home
West Valley			
Bermuda Dunes	55%	45%	0%
Desert Palms	100%	0%	0%
Thermal	51%	12%	37%
Thousand Palms	58%	8%	34%
Vista Santa Rosa	79%	4%	17%
East Valley (Riverside County)			
Mecca	48%	32%	20%
North Shore	65%	0%	35%
Oasis	27%	0%	73%
East Valley (Imperial County)			
Bombay Beach	18%	17%	65%
Desert Shores	45%	11%	44%
Salton City	89%	0%	11%
Salton Sea Beach	33%	0%	67%

Source: ACS 2018; Table B25124

5.3.4.3 Future Housing Units by Type

Historical development patterns in the Plan Area were used as the basis for projecting future development. DOF provides annual housing information for cities in California.[9] Figure 5-5 shows the number of new housing units by type from 2000 to 2020 for cities in the Coachella Valley. A review of ACS data indicate that unincorporated areas represented a small portion of total development. Over that period, single-family homes accounted for 85 percent of new housing units. This trend was generally consistent across the Plan Area. There were fewer multiple-family developments, and there was a net loss of mobile homes in the region over this period. This is in contrast to the City General Plans, many of which anticipate a significant number of future multiple-family developments. DOF estimates are not available for unincorporated areas in Riverside and Imperial Counties. A review of ACS data indicate that unincorporated areas represented a small portion of total development over this period.

Figure 5-5. New Housing Units by Type (2000–2020)



[9] State of California, Department of Finance, Tables E-4 and E-5

For analysis, all new housing units in the Plan Area were allocated into housing unit types using a stock and flow model that used the land use inventory of housing units and the historical rate of growth by housing type to match customer billing data. Equation 5-2 is an example formula for allocating single-family housing units. The formula allows recent housing trends to continue in the short term and allows a shift toward other planned land uses over time based on buildout conditions and local land use planning.

Equation 5-2. Calculation of Single-Family Housing Units

$$HU^{SF} = HU^{T} \div \left[INV^{SF} + \left(INV^{MF} \times \frac{\rho^{MF}}{\rho^{SF}} \right) \right] \times INV^{SF}$$

Where:

HU = total new housing units by type for a projection year
INV = current land use inventory in total housing units by housing type
ρ = ratio of historical development by type divided by the ratio of historical inventory by type
SF = single-family sector
MF = multiple-family sector
T = total

Table 5-9 lists the final projected allocation of new housing units into housing types. In the short term, 85 percent of new housing units are single-family developments. In the long term, there is a shift toward planned multiple-family developments based on the inventory of available land uses. No new mobile home developments were assumed in the region. There are small number of planned mobile home developments in the Plan Area, and for this municipal demand projection, they are captured under the multiple-family category.

Table 5-9. New Units in Plan Area by Housing Type

Housing Type	2020	2025	2030	2035	2040	2045
Single-Family	85%	82%	78%	72%	63%	47%
Multiple-Family	15%	18%	22%	28%	37%	53%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

According to SCAG's *Connect SoCal*, much of the planned growth in the region is projected to occur within existing cities. As a result, several of the cities in the projection such as Cathedral City, Indio, Palm Springs, and Rancho Mirage were constrained on the continued trend of building primarily single-family homes. Rather than produce individual estimates by jurisdiction, buildout conditions were aggregated for the entire Plan Area. Several cities in the region have a sphere of influence that could let them expand their service areas into currently unincorporated areas. In addition, cities facing growth constraints could use redevelopment of existing land uses or additional updates to their General Plans as a mechanism to accommodate future growth. For these reasons, jurisdictional-level land use analysis would likely underestimate the potential number of single-family homes.

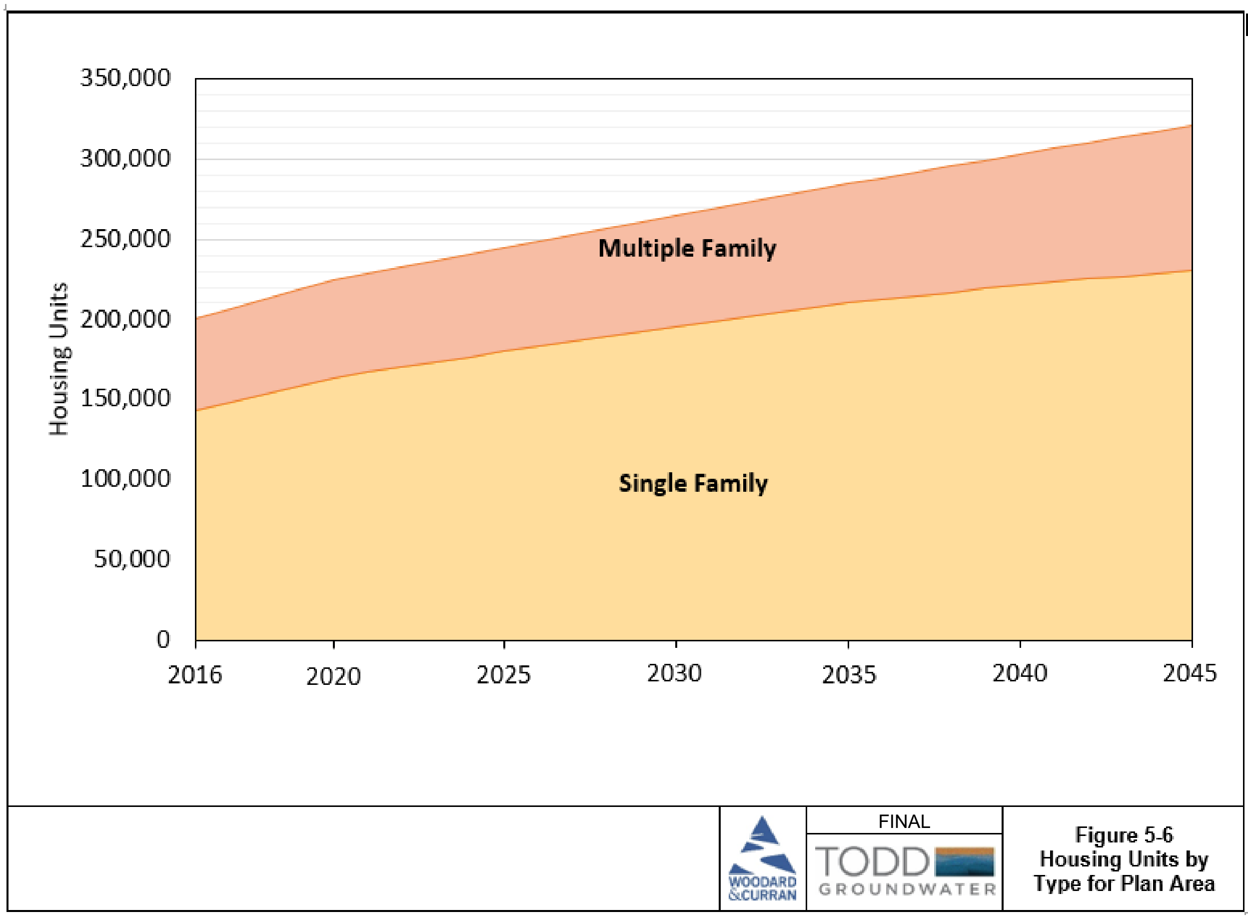
5.3.4.4 Final Housing Unit Projection

Table 5-10 and Figure 5-6 provide the total number of projected housing units by type for the Plan Area. These were used as the basis for developing demand factors and other projections. Overall, the Plan Area is projected to grow by 120,698 housing units (i.e., 60 percent) by 2045. The mix of new housing units in the projection is similar to the mix of existing housing stock over the long term, with more single-family homes being built in the short term shifting to multiple-family developments over time.

Table 5-10. Housing Units by Type for the Plan Area

Housing Type	2016	2020	2025	2030	2035	2040	2045
Coachella Valley Water District							
Single-Family	91,513	103,616	112,313	120,617	128,328	133,810	137,925
Multiple-Family	31,696	33,874	35,825	38,166	41,101	44,311	48,889
Subtotal	**123,209**	**137,490**	**148,138**	**158,783**	**169,429**	**178,121**	**186,814**
Coachella Water Authority							
Single-Family	7,413	11,062	14,135	17,070	19,795	22,623	24,746
Multiple-Family	2,655	3,312	4,001	4,829	5,866	7,522	9,884
Subtotal	**10,068**	**14,374**	**18,136**	**21,899**	**25,661**	**30,145**	**34,630**
Desert Water Agency							
Single-Family	23,709	26,269	28,115	29,878	31,516	32,998	34,111
Multiple-Family	14,543	15,004	15,418	15,915	16,538	17,406	18,644
Subtotal	**38,252**	**41,273**	**43,533**	**45,793**	**48,054**	**50,404**	**52,755**
Indio Water Authority							
Single-Family	20,486	22,824	25,511	28,078	30,461	32,163	33,441
Multiple-Family	8,159	8,580	9,183	9,907	10,814	11,810	13,232
Subtotal	**28,645**	**31,404**	**34,694**	**37,985**	**41,275**	**43,973**	**46,673**
Plan Area							
Single-Family	143,121	163,771	180,074	195,643	210,100	221,594	230,223
Multiple-Family	57,053	60,770	64,427	68,817	74,319	81,049	90,649
Plan Area Total	**200,174**	**224,541**	**244,501**	**264,460**	**284,419**	**302,643**	**320,872**

Figure 5-6. Housing Units by Type for Plan Area



5.3.5 Employment Projection

Connect SoCal employment estimates were used to project future CII water use. SCAG projects regional employment across 20 broad industry sectors as established by the North American Industry Classification System (NAICS). These sectors are based on a set of national employment forecasts and a region's share of the nation's employment. For the Coachella Valley, employment is projected to grow at a slower rate than the overall population. This is a result of net travel out of the region for work, as well as the large number of retirees in the Plan Area. Table 5-11 provides employment projections for the GSA Areas in the Plan Area. These employment projections are anticipated to be impacted by the COVID-19 pandemic and resulting economic downturn and the decrease in recreational/tourism activities. Once long-term impact and recovery from the COVID-19 pandemic is better understood, the GSAs will be able to confirm the accuracy of SCAG's employment forecast.

Table 5-11. Baseline and Forecast Employees by GSAs

Water Provider	Baseline 2016	2020	2025	2030	2035	2040	2045
Coachella Valley Water District	105,736	112,240	116,761	121,284	125,806	131,903	138,001
Coachella Water Authority	8,599	12,209	14,884	17,560	20,235	21,909	23,582
Desert Water Agency	35,529	38,435	40,418	42,402	44,387	45,188	45,989
Indio Water Authority	27,530	30,177	32,108	34,039	35,970	36,970	37,971
Plan Area Total	**177,394**	**193,061**	**204,171**	**215,285**	**226,398**	**235,970**	**245,543**

5.3.6 Unit Demand Factors

Municipal water demand in the growth projection was calculated using a per-housing unit demand factor (*gallons per housing unit per day*) for residential and landscape uses and a per-employee demand factor (*gallons per employee per day*) for non-residential uses. A benefit of this approach over typical per-capita unit water use approaches was the ability to better estimate water uses associated with land use features, such as lot sizes and building footprints not directly associated with population. Housing unit counts also account for the significant number of seasonal residents not captured in federal and state population data. In addition, given that the 2010 Census is now 10 years out of date, there is more potential uncertainty in population estimates, while housing unit counts are recorded by County Assessor property information. Residential uses were divided into single- and multiple-family housing unit types to align with customer billing categories. Demand factors were calculated using a 5-year average of water demand from customer billing data provided by Plan Area water providers. Indoor and outdoor landscape use was estimated to adjust for landscape water use in new developments.

5.3.6.1 Historical Billing Data

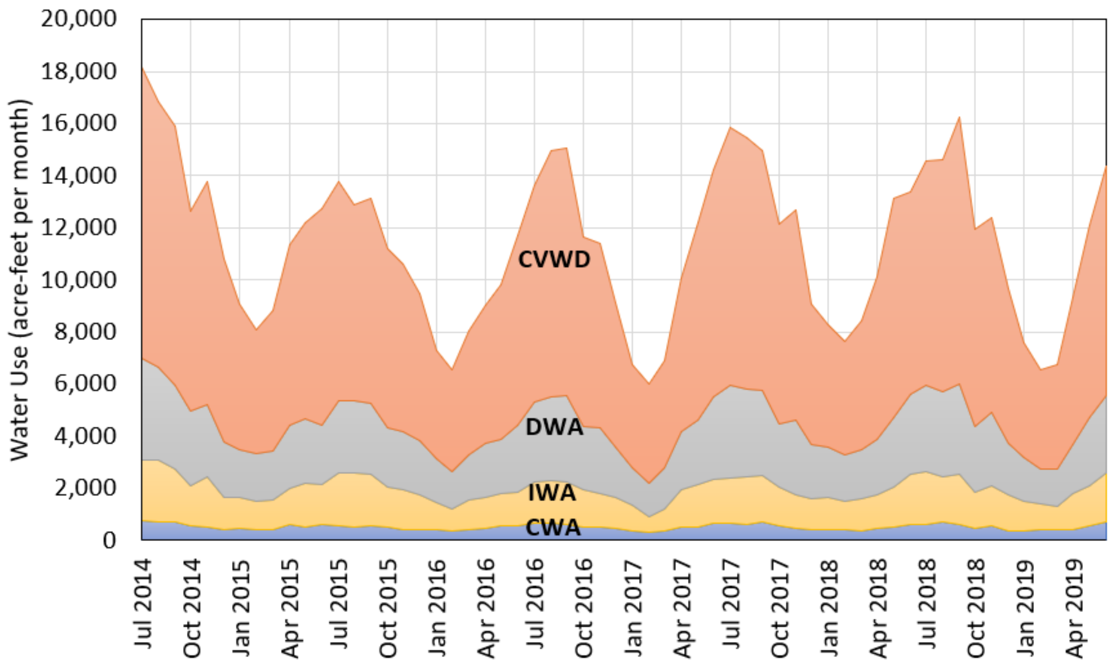
Table 5-12 lists the total annual domestic water use for each Plan Area GSA. Baseline water use was based on a 5-year average measured from July 2014 to June 2019. The 5-year average was selected to account for annual variations in water use from weather, as well as other irregularities that can occur over shorter time periods.

Table 5-12. Baseline Domestic Water Use for Plan Area GSAs (Acre-Feet per Year)

GSA	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	5-Year Average
Coachella Valley Water District	93,077	74,078	81,144	86,191	82,782	**83,454**
Coachella Water Authority	6,590	5,650	6,067	6,140	6,063	**6,102**
Desert Water Agency	30,599	25,499	28,024	30,357	28,729	**28,642**
Indio Water Authority	19,399	17,299	15,943	17,546	17,855	**17,608**
Plan Area Total	**149,665**	**122,526**	**131,178**	**140,234**	**135,429**	**135,806**

Figure 5-7 shows a graph of the monthly baseline water use for each GSA. The baseline period includes California's drought state of emergency, which ran from January 2014 to April 2017. As indicated in Table 5-12, the highest water use was in fiscal year (FY) 2015 (e.g., FY 2015 is July 2014 through June 2015) and the lowest water use was in FY 2016. Since the end of the drought emergency, water use has continued at a rate that is lower than pre-drought levels. Through June 2019, there has been no indication of a rebound in water use, and given the effects of climate change, drought periods, and new conservation legislation that will be implemented during the planning horizon, further downward pressure on water demand is expected. For the GSAs, 5-year average water use is consistent with the most recent water use data.

Figure 5-7. Baseline Water Use by GSA (Acre-Feet per Month)



WOODARD & CURRAN | FINAL TODD GROUNDWATER | Figure 5-7 Baseline Water Use by GSA (Acre-Feet per Month)

Other Water Suppliers in the Plan Area

CVWD and DWA have populations that are both within their service area boundaries and outside their domestic water service areas; these are served by private wells or other water systems, such as mutual water companies and small water systems. For CVWD, this includes Myoma Dunes Water Company (MDWC) and several small water systems. For DWA, this population includes a portion of the DWA jurisdictional area overlapping with Mission Springs Water District (MSWD) and several small water systems. MSWD provides municipal water service to these customers, which includes a small number of customers in the northwest of the Indio Subbasin (i.e., the Garnet Hill Subarea). IWA and CWA serve all customers in their service areas.

For customers in CVWD's jurisdictional area that are served via domestic water service from other water systems, water demand factors were based on CVWD billing data for unincorporated areas in Riverside County. For customers in DWA's jurisdictional area served by MSWD, water demand factors were based on the 5-year average water use per MSWD billing data as provided by DWA staff (dated September 30, 2020).

Non-Domestic Water Supplies in the Municipal Demand Projection

Baseline water use includes urban water demands met by a water source other than GSA domestic production, including private wells, recycled water, surface water diversions, and Coachella Canal water. Although these demands are not currently met by the GSAs' domestic water supplies, they are still considered municipal demands and are accounted for in the municipal demand forecast. This water is used primarily for turf and landscape irrigation. The demands shown in Table 5-13 are based on 2019 water use for CVWD and IWA and are based on the 5-year average for DWA. For IWA, this water was supplied by CVWD for use in IWA's service area.

Table 5-13. Non-Domestic Water for Landscape Use (Acre-Feet)

Water Provider	Acre-Feet
Coachella Valley Water District	6,496
Desert Water Agency	740
Indio Water Authority	2,758

5.3.6.2 Baseline Demand Factors

For analysis, billing data from each GSA were aggregated into five generic customer sectors, as shown in Table 5-14. Each of these customer sectors was associated with an output from the regional growth forecast to develop a unit factor. For the single- and multiple-family sectors, future water demand was based on single- and multiple-family housing units, respectively. For the landscape sector, future water demand was based on total housing units using the assumption that future landscape uses, such as common areas and parks, are driven by future residential development. For the CII sector, future water demand was based on the total number of employees, using the assumption that CII use primarily occurs indoors. The other sector, which includes water uses such as temporary construction meters, was driven by total housing units.

Table 5-14. Variables Used in Unit Factors Calculation

Customer Sector	Output from Growth Forecast
Single-Family Residential	Single-Family Housing Units
Multiple-Family Residential	Multiple-Family Housing Units
Landscape	Total Housing Units
Commercial, Industrial, and Institutional	Employees
Other	Total Housing Units

Table 5-15 lists the baseline unit factor calculations for each GSA, and the values used to calculate them (i.e., water use and growth forecast). These unit factors were applied to growth forecasts to develop a baseline municipal demand projection before conservation or unaccounted-for water. CWA and IWA have a higher number of persons per housing unit and fewer seasonally vacant units compared to CVWD and DWA. This results in higher water use as measured in gallons per housing unit per day (gphud) when compared to traditional measurement of gallons per capita per day (gpcd).

Table 5-15. Baseline Unit Factor Calculations

Sector	Calculation	Unit	CVWD	CWA	DWA[a]	IWA
Single-Family[b]	Water Use	million gallons per day	42.78	3.62	13.44	9.68
	Growth Forecast	single-family housing units	86,678	7,413	23,469	20,486
	Unit Factor	gphud	494[c]	489	572	473
Multiple-Family[b]	Water Use	million gallons per day	5.02	0.63	1.49	1.56
	Growth Forecast	single-family housing units	29,477	2,655	14,441	8,159
	Unit Factor	gphud	170	239	103	192
Landscape	Water Use	million gallons per day	25.50	0.53	3.02	4.44
	Growth Forecast	total housing units	116,155	10,068	37,910	28,645
	Unit Factor	gphud	220	52	80	155
CII	Water Use	million gallons per day	5.46	0.65	8.23	2.47
	Growth Forecast	employees	100,495	8,599	35,328	27,530
	Unit Factor	gallons per employee per day	54	76	233	90
Other	Water Use	million gallons per day	0.96	0.01	0	0.004
	Growth Forecast	total housing units	116,155	10,068	37,910	28,645
	Unit Factor	gphud	8.3	1.1	0	0.1

[a] DWA's historical billing data are not segregated into the five generic customer sectors. Recent billing data (2019) was used to determine the estimated split for prior years.

[b] Baseline housing units used to calculate unit factors were based on 2016 estimates of housing.

[c] CVWD's single-family demand factor was calculated separately on a jurisdictional basis in Table 5-16. 494 gphud is an average across all of CVWD's jurisdictional area.

CVWD Single-Family Demand Factors

The CVWD single-family residential demand factor was projected by jurisdiction, as demands and growth rates in CVWD's service area differ regionally. Table 5-16 lists the demand factors by housing unit for cities in CVWD's service area. These totals were calculated by matching CVWD's customer-level database information with SCAG housing information.

Table 5-16. CVWD Single-Family Demand Factors by City

Jurisdiction	Single-Family Water Use (millions of gallons)	Single-Family Housing Units	Single-Family Unit Factor (gphud)
Cathedral City	6.3	12,491	501
Coachella	0.003	5	514
Indian Wells	3.5	4,405	798
Indio	1.1	2,121	521
La Quinta	10.7	20,357	523
Palm Desert	9.5	24,666	387
Palm Springs	0.01	15	482
Rancho Mirage	7.5	11,538	651
Unincorporated	4.2	11,080	379

Demand Factors for Private Wells and Other Water Systems

Table 5-17 lists the baseline unit factor calculations for customers served by private wells and other water systems. For customers in CVWD's GSA area, unit factors were based on CVWD billing data in unincorporated areas of Riverside County. For customers in DWA's GSA Area, unit factor calculations were based on billing data provided by MSWD. For the small number of residential homes in the MSWD service area served by private wells or other water systems, there were few multiple-family homes, so the single- and multiple-family factors were combined.

Table 5-17. Baseline Unit Factor Calculations for Private Wells and Other Water Systems

Sector	Unit Factor	CVWD	DWA
Single-Family	gallons per housing unit per day	370	283
Multiple-Family	gallons per housing unit per day	129	283
Landscape	gallons per housing unit per day	47	28
CII	gallons per employee per day	54	445
Other	gallons per housing unit per day	11	4

5.3.6.3 Indoor and Outdoor Water Use Estimates

Outdoor water use was estimated to distinguish landscape water savings in new developments. For some customers, water used for landscaping is not directly metered. An industry standard approach to measuring outdoor use, referred to as the minimum month method, is to assume all winter use is categorized as indoor consumption. This method underestimates outdoor use because of winter irrigation in dry climates such as the Coachella Valley.

The method used for this forecast documented the pattern of seasonal variation from dedicated irrigation meters and applied it to other sectors with mixed meters. With dedicated irrigation meters, winter irrigation is directly measured, and seasonal irrigation patterns could be applied to other sectors. Figure 5-8 is an example plot comparing baseline landscape irrigation and single-family residential water use for CVWD. As shown, the seasonal variation of dedicated landscape meters correlates to single-family water use.

Figure 5-8. Indoor Water Use Estimation

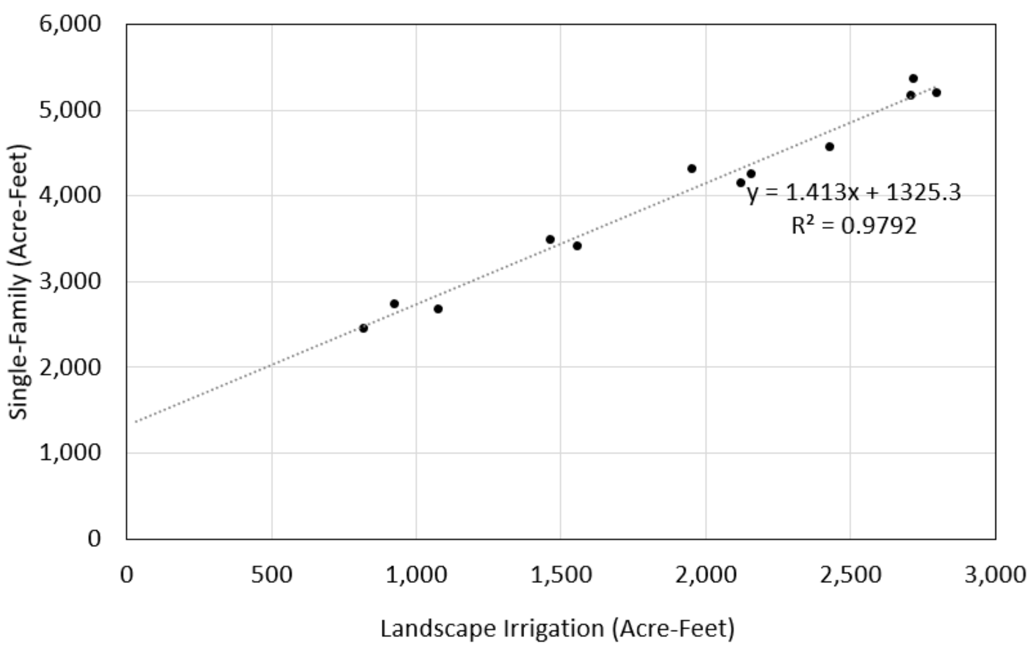


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Figure 5-8
Indoor Water Use Estimation

Table 5-18 lists the resulting outdoor water factors developed through analysis of each GSA's data. These values are an average based on the 5-year billing data used. It is likely indoor/outdoor water use percentages vary across each agency's jurisdictional area. DWA's combined billing category of single-family, multiple-family, and landscape water use is disaggregated using the same method used for developing DWA's demand factors (described above). The other category is not assumed to have outdoor use.

Table 5-18. Outdoor Water Use Percentages for GSAs

Water Provider	Single-Family	Multiple-Family	CII	Landscape	Other
Coachella Valley Water District	67	34	38	100	0
Coachella Water Authority	50	17	35	100	0
Desert Water Agency	69	69	69	100	0
Indio Water Authority	58	33	54	100	0

5.3.7 Baseline Forecast

Table 5-19 shows the baseline municipal demand forecast for the Indio Subbasin. This is projected municipal water use before considering passive conservation and system water loss.

Table 5-19. Municipal Demand Forecast for the Plan Area (acre-feet)

Category	2016 Baseline	2020	2025	2030	2035	2040	2045
Baseline Forecast	148,438	167,102	181,873	196,397	210,550	222,393	233,241

5.3.8 Water Loss

Water loss includes real loss, which is physical water lost from a utility's storage tanks and pressurized distribution system up to the point of customer consumption (e.g., at the water meter) and apparent loss, which include customer metering inaccuracies and data handling errors. As of 2015, SB 555 requires California urban water suppliers to submit an annual water loss audit to DWR. This audit attempts to quantify all inputs and outputs of a supplier's potable distribution system along with many other factors related to quantifying water losses. SB 555 also directed the SWRCB to develop performance standards for volumetric water loss by July 2020. As of September 2021, the SWRCB has not completed final rulemaking about performance standards but has proposed using a Microsoft Excel-based economic model to calculate a unique volumetric standard for each water supplier. The performance standard is proposed to be quantified in units of real losses per service connection per day (i.e., *gallons per connection per day*). This value is a performance indicator that is automatically calculated as an output of the American Water Works Association Water Loss Audit prepared annually by urban water suppliers, which is also submitted to DWR.

Three years of available validated Water Loss Audit reports were retrieved from DWR's Water Use Efficiency (WUE) Data Portal.[10] Water Loss Audits calculate water loss based on the difference between production and consumption, which averaged approximately 10 percent across the Plan Area. For this analysis, real water loss was projected on a per-connection basis. The number of service connections included both active and inactive service lines are connected to water mains and fire hydrant laterals. Table 5-20 lists real losses, apparent losses, and service connections from the most recent water loss audits available at the WUE Data Portal. The only validated Water Loss Audit reports for other small water systems in the service area are from MDWC. These values were used for all other small water systems.

[10] https://wuedata.water.ca.gov/

Table 5-20. Water Loss Reporting by Water Provider (3-Year Average)

Water Provider	Real Losses (gal/conn/day)	Apparent Losses (gal/conn/day)	Baseline Service Connections
Coachella Valley Water District	43.3	46.0	104,048
Coachella Water Authority	31.7	8.0	8,319
Desert Water Agency	86.5	16.3	24,469
Indio Water Authority	30.5	10.4	23,130
Other Small Water Systems	49.1	40.2	2,543

Table 5-21 shows the water loss projection for the Plan Area. The number of service connections were escalated from the baseline period using the growth in total housing units, resulting in an average 9.4 percent water loss in 2045. Additionally, it was assumed real losses would be reduced by 10 percent over the planning period based on a minimum potential estimate of water savings based on activities required by SB 555.

Table 5-21. Water Loss Projection for Plan Area (AFY)

--	2016 Baseline	2020	2025	2030	2035	2040	2045
Water Loss	15,567	17,366	18,459	19,494	20,470	21,183	21,847
Percent of Municipal Demands	10.5	10.4	10.1	9.9	9.7	9.5	9.4

5.3.9 Adjustment Factors

The municipal water demand projection used an inventory growth and replacement model and historical and projected housing units for cities in the Plan Area to estimate water savings rates for single-family residential, multi-family residential, and non-residential plumbing fixtures and appliance inventories. The models were implemented in Microsoft Excel with separate models for outdoor water use, toilets, clothes washers, and urinals. Future outdoor water uses were reduced based on an adjusted outdoor use estimate for new developments. Additional active (conservation program) savings are anticipated but were not included as part of municipal demand projections.

5.3.9.1 Indoor Passive Conservation Savings

The municipal water demand forecast estimates conservation that occurs as a result of changes in state and federal water efficiency requirements for plumbing fixtures, sometimes referred to as passive conservation. These standards have resulted in a significant reduction of indoor water use over time. Going forward, codes and standards for fixtures and appliances will continue to reduce indoor water demand through the replacement of existing fixtures, and more efficient technologies used in new developments.

Passive conservation savings are based on a demographically driven growth and replacement model that accounts for fixtures from new construction and natural replacement using the same demographic data used in *Connect SoCal*. Savings estimates are provided for the single-family residential, multi-family residential, and non-residential sectors. The passive conservation model estimates water savings for toilets, showerheads, clothes washers, dishwashers, and urinals. The model estimates the stock of different types of water fixtures annually from 1990 to 2045.

Table 5-22 shows the historical and current water efficiency standards used to estimate indoor passive conservation savings. Water fixtures installed in new construction were assumed to comply with plumbing codes in effect when the new construction occurred. Natural replacement rates vary by device and are linked to the expected life of the device. When devices fail and are replaced, when spaces are remodeled, or for other reasons, new devices were assumed to comply with plumbing codes in effect when the replacement occurred.

Table 5-22. State and Federal Plumbing Codes

Fixture/Appliance	Maximum Flow Rate	Law/Regulation	Effective Year
Residential Toilets			
All Models	≤ 3.5 gpf	California Statute	1978
All Models	≤ 1.6 gpf	California Statute	1992
All Models	≤ 1.28 gpf	California (AB715) 2007	2014
Residential Showerheads			
All Models	2.5 gpm	California (CEC) 1992	1994
All Models	2.0 gpm	Federal (CEC Title 20) 2015	2016
All Models	1.8 gpm	Federal (CEC Title 20) 2015	2018
Residential Clothes Washers			
Standard	≤ 9.5 IWF	Federal Energy Independence and Security Act of 2007	2011
Top Loading, Standard	≤ 8.4 IWF	Federal Standard (DOE) 2012	2015
Top Loading, Standard	≤ 6.5 IWF	Federal Standard (DOE) 2014	2018
Top Loading, Compact (less than 1.6 ft^3 capacity)	≤ 14.4 IWF	Federal Standard (DOE) 2012	2015
Top Loading, Compact (less than 1.6 ft^3 capacity)	≤ 12 IWF	Federal Standard (DOE) 2014	2018
Front Loading, Standard	≤ 4.7 IWF	Federal Standard (DOE) 2012	2015
Residential Dishwashers			
Regular	6.5 gal/cycle	Federal Energy Independence and Security Act of 2007	2010
Regular	5 gal/cycle	Federal Standard (DOE) 2012	2013
Compact	4.5 gal/cycle	Federal Energy Independence and Security Act of 2007	2010
Compact	3.4 gal/cycle	Federal Standard (DOE) 2012	2013
Non-Residential Toilets			
All Models	≤ 3.5 gpf	California Statute	1978
All Models	≤ 1.6 gpf	California Statute	1992
All Models	≤ 1.28 gpf	California (AB715) 2007	2014
Non-Residential Urinals			
Standard	1.0 gpf	Energy Policy Act of 1992	1994
Standard	0.5 gpf	California (AB 715) 2007	2014
Wall-Mounted Urinals	0.125 gpf	California (CEC) 2015 Executive Order (EO B-29-15)	2018

gpf = gallons per flush
gpm = gallons per minute at a pressure of 80 psi.
IWF = integrated water factor expressed in gallons per cycle per cubic foot

Table 5-23 lists the natural replacement rate for indoor plumbing fixtures. Useful life and associated annual replacement rates were based on standard industry estimates, estimates from plumbing fixture saturation studies, and the best management practice reports from the California Water Efficiency Partnership (see: https://calwep.org/).

Table 5-23. Parameters Used in Indoor Water Savings Fixtures

Sector	Fixture	Useful Life (Years)	Replacement Rate (% per Year)
Residential	Toilets	25	4
Residential	Showerheads	8	12
Residential	Clothes Washers	14	8.3
Residential	Dishwashers	13	8
Non-Residential	Toilets	40	2.5
Non-Residential	Urinals	40	2.5

Table 5-24 lists the frequency of water use per fixture and sector**.** This information was obtained from focused end-use studies. Residential fixture water use was based on *2016 Residential End Uses of Water, Version 2* (Water Research Foundation [WRF], 2016). Non-residential fixture water use was based on *Commercial and Institutional End Uses of Water* (WRF, 2000). These studies are the current industry benchmarks for residential and non-residential water uses. These factors were applied on a per-housing unit basis as described below.

Table 5-24. Parameters Used in Indoor Water Savings Fixtures

Sector	Fixture	Frequency of Use
Residential	Toilets	4.9 flushes per person per day
Residential	Showerheads	7.8 minutes per use 0.7 uses per person per day
Residential	Clothes Washers	3.5 cubic feet per load 0.3 cycles per person per day
Residential	Dishwashers	0.1 cycles per person per day
Non-Residential	Toilets	2.6 flushes per employee per day 4 flushes per occupied hotel room per day
Non-Residential	Urinals	1.25 flushes per employee per day

Table 5-25 lists the projected residential indoor passive conservation savings (in AF) for new and existing developments in the Plan Area by GSA. Indoor passive conservation savings were estimated at 8.1 gpcd by 2045 when compared to 2016 savings rates for single-family homes, and 6.4 gpcd savings rates for multiple-family homes. CII savings are 2 gallons per employee per day. Water savings are measured relative to baseline water use. Water use savings by device are converted into gallons per housing unit per day using historical and projected values for vacancy rates and estimates of persons per household. CII savings include estimates of hotel savings based on occupancy information from the Greater Palm Springs Convention and Visitors Bureau. Chapter 11, *Projects and Management Actions* describes the Plan Area's active conservation programs that incentivize indoor water conservation.

Table 5-25. Indoor Passive Savings in the Plan Area (Acre-Feet)

Water Provider	2020	2025	2030	2035	2040	2045
Coachella Valley Water District	547	1,414	1,965	2,393	2,718	2,986
Coachella Water Authority	118	345	528	695	873	1,040
Desert Water Agency	131	335	464	563	642	707
Indio Water Authority	198	512	714	872	993	1,094
Plan Area Total	**994**	**2,606**	**3,671**	**4,523**	**5,226**	**5,827**

5.3.9.2 Outdoor Water Use Adjustment

Unit factors for future uses were adjusted to account for implementation of the MWELO (DWR, 2015). MWELO sets a minimum standard for outdoor water conservation in California and applies to new construction projects with landscape areas of 500 square feet or more. The size threshold for existing landscapes that are being rehabilitated has not changed from the original 2010 MWELO, remaining at 2,500 square feet. The 2015 MWELO also allows for special landscape areas (SLAs) that allow for extra water in non-residential areas for specific landscape functions such as recreation or for areas irrigated with recycled water.

The demand forecast assumes desert landscaping in new residential developments, in accordance with GSA policies.

Table 5-26 lists the Plan Area's outdoor passive water savings adjustment factor. Passive water savings resulting from implementation of the 2015 MWELO were based on an evapotranspiration adjustment factor (ETAF), which when applied to reference evapotranspiration, adjusts for plant water requirements and irrigation efficiency. The current ETAF for new residential landscapes is 0.55 and the ETAF for non-residential landscapes is 0.45. Existing landscapes were assumed to have an ETAF of 0.7, meaning that new residential landscapes were assumed to use 21 percent less water, and new non-residential landscapes were assumed to use 36 percent less water. It was also assumed that 25 percent of dedicated landscape meters were categorized as SLAs such as sports fields, and therefore no savings were assumed to come via MWELO requirements. No savings were assumed from existing landscapes, as these projections typically receive incentives under conservation programs, and are not considered a passive savings. Chapter 11, *Projects and Management Actions* describes active conservation programs that incentivize outdoor water use efficiency.

Table 5-26. Outdoor Passive Water Savings Within the Plan Area (Acre-Feet)

Water Provider	2020	2025	2030	2035	2040	2045
Coachella Valley Water District	1,981	3,439	4,873	6,275	7,399	8,439
Coachella Water Authority	326	600	867	1,125	1,395	1,630
Desert Water Agency	509	872	1,228	1,575	1,838	2,072
Indio Water Authority	340	717	1,088	1,449	1,721	1,972
Plan Area Total	**3,156**	**5,628**	**8,056**	**10,424**	**12,353**	**14,113**

5.3.10 Water Demands on Tribal/Reservation Lands

In the Plan Area, much of the Tribal/Reservation lands in the West Valley has been developed to varying degrees while a substantial amount of Tribal/Reservation lands in the East Valley is largely undeveloped. To accurately project water demand on Tribal/Reservation lands, Tribal/Reservation outreach was conducted by the GSAs throughout the planning process consistent with DWR's *Draft Guidance Document for the Sustainable Management of Groundwater: Engagement with Tribal Governments* (DWR, 2017). The GSAs have established communications with Tribes in the Plan Area via the SGMA Tribal Workgroup, which meets quarterly, and Tribal/Reservation email lists. Tribal/Reservation data request letters and follow-up letters were sent to the Tribal/Reservation chairs and Tribal/Reservation administrators on May 1, 2020, and May 14, 2020, respectively. Outreach included follow-up emails and phone calls. Tribal/Reservation data requested included information about land use, population and housing, water demand, and water conservation. During preparation of this *Alternative Plan Update*, the Tribes indicated that projected Tribal/Reservation land uses are generally included in municipal General Plans; therefore, *Connect SoCal* adequately captures Tribal/Reservation growth. As such, Tribal/Reservation2012 water demands were not included here in a separate category for analysis; rather, they are included in this municipal demand forecast.

5.3.11 Final Municipal Demand Forecast

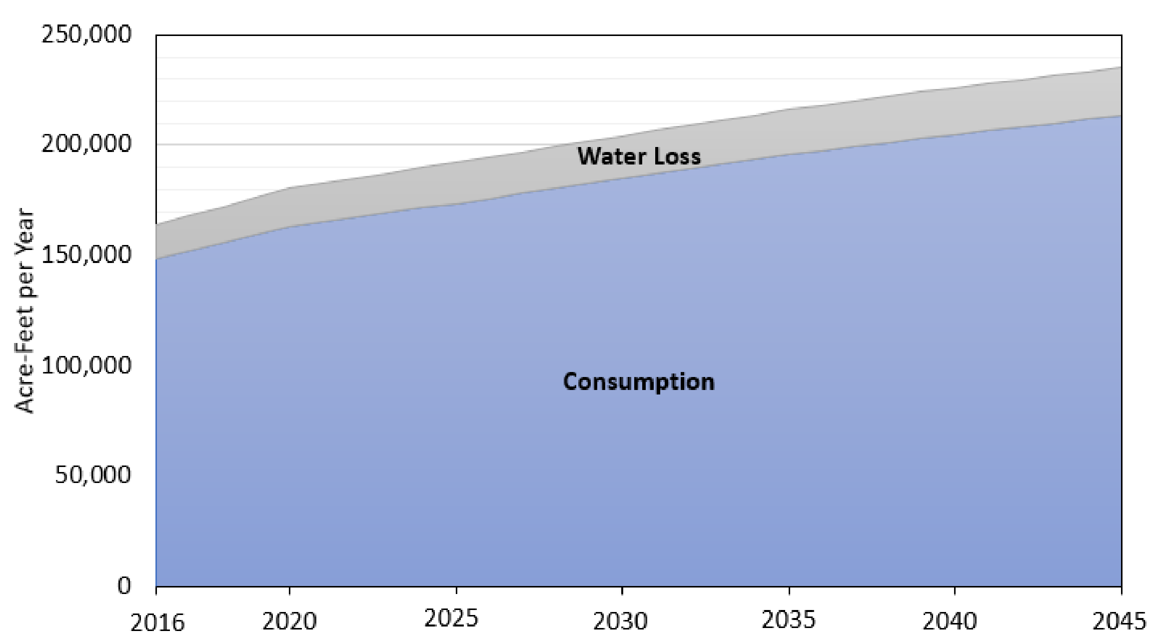
Table 5-27 and Figure 5-9 show the municipal demand forecast with future passive conservation for the Plan Area. Indoor water conservation adjustment factors for new and existing developments included toilets, clothes washers, and urinals. The outdoor water conservation adjustment included implementation of 2015 MWELO for new developments. The total conservation adjustment came to 5,827 acre-feet by 2045 for indoor uses and 14,113 acre-feet by 2045 for outdoor uses. The total consumption estimate for the Plan Area is 235,148 acre-feet in 2045, which is an increase of 71,143 acre-feet (i.e., 43 percent). This 43 percent increase in municipal water demand compares to a projected 53 percent increase in Plan Area population.

Table 5-27. Municipal Demand Forecast for the Plan Area (Acre-Feet)

Category	2016 Baseline	2020	2025	2030	2035	2040	2045
Baseline Forecast	148,438	167,102	181,873	196,397	210,550	222,393	233,241
Passive Conservation	-	-994	-2,606	-3,671	-4,523	-5,226	-5,827
Outdoor Adjustment	-	-3,156	-5,628	-8,056	-10,424	-12,353	-14,113
Consumption in Plan Area	148,438	162,952	173,639	184,670	195,603	204,814	213,301
Water Loss	15,567	17,366	18,459	19,494	20,470	21,183	21,847
Municipal Demand Totals	**164,005**	**180,318**	**192,098**	**204,164**	**216,073**	**225,997**	**235,148**

Note: Passive conservation savings and outdoor adjustment are compared against baseline period.

Figure 5-9. Municipal Demand Forecast for Plan Area



FINAL

Figure 5-9
Municipal Demand
Forecast for Plan Area

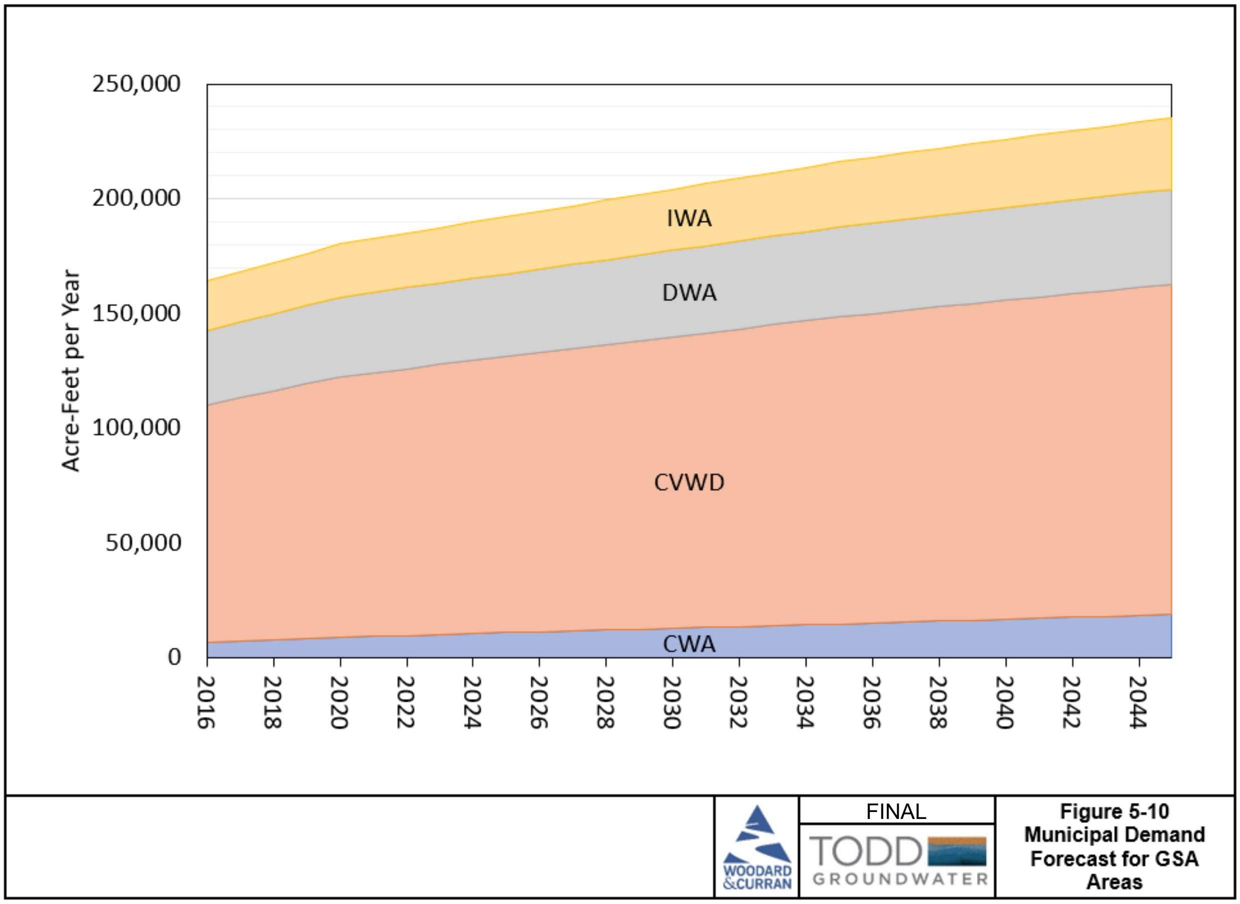
Table 5-28 and Figure 5-10 show a forecast of total water supplied by GSA area in the Plan Area**.** Appendix 5-A contains the final, more detailed municipal water demand forecast by GSA area.

Table 5-28. Total Municipal Demand Forecast for GSA Areas (Acre-Feet)

Category	2016 Baseline	2020	2025	2030	2035	2040	2045
Coachella Valley Water District							
Consumption	92,411	100,994	106,835	112,888	118,908	123,731	128,225
Water Loss	11,292	12,606	13,375	14,102	14,788	15,218	15,615
Total Demand	103,703	113,600	120,210	126,990	133,696	138,949	143,840
Coachella Water Authority							
Consumption	6,102	8,396	10,215	12,045	13,843	15,798	17,600
Water Loss	371	529	654	774	888	1,021	1,147
Total Demand	6,473	8,925	10,869	12,819	14,731	16,819	18,747
Desert Water Agency							
Consumption	29,558	31,657	33,055	34,492	35,903	37,043	38,033
Water Loss	2,845	3,070	3,173	3,270	3,360	3,449	3,532
Total Demand	32,403	34,727	36,228	37,762	39,263	40,492	41,565
Indio Water Authority							
Consumption	20,366	21,905	23,534	25,244	26,950	28,242	29,444
Water Loss	1,059	1,161	1,257	1,348	1,434	1,495	1,553
Total Deman	21,425	23,066	24,791	26,592	28,384	29,737	30,997
Plan Area Total							
Consumption	148,438	162,952	173,639	184,670	195,603	204,814	213,301
Water Loss	15,567	17,366	18,459	19,494	20,470	21,183	21,847
Total Demand	164,005	180,318	192,098	204,164	216,073	225,997	235,148

Notes:
Consumption is calculated as the baseline forecast minus passive indoor and outdoor conservation.
GSA area totals may not sum to Plan Area totals due to rounding error.

Figure 5-10. Municipal Demand Forecast for GSA Areas



5.4 Agricultural Demands

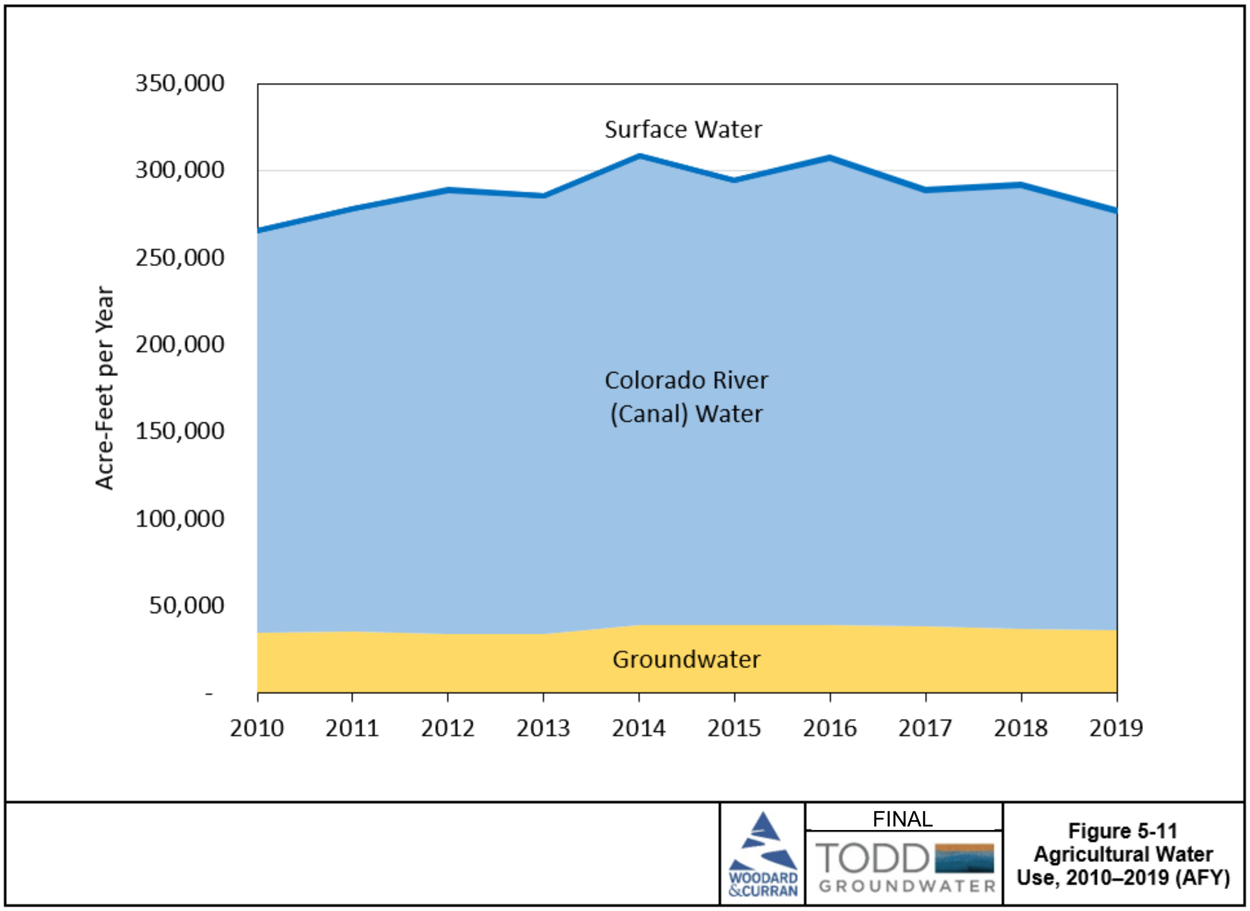
Agriculture is an essential part of the Coachella Valley economy, generating an average of $625 million per year from 2014 to 2018 (County of Riverside, 2018). Agricultural water demand is met via Colorado River (Coachella Canal) water, groundwater, and surface water. Agricultural demand varies by farmed parcel, depending on crop type and sequencing (e.g., many farmers use trimester cropping). Per the *2019 Crop Report* (CVWD, 2019a), the average agricultural water demand was 5.2 AFY per cropped acre and accounted for half of Plan Area water use. Figure 5-11 shows agricultural water use from 2010 to 2019.

Agriculture is an essential part of the Coachella Valley economy.

Average agricultural demand for the during this timeframe was 292,150 AFY, which was approximately 51 percent of total demand in the Plan Area during that period.

The *2010 CVWMP Update* assumed agricultural demand decreased in proportion to the increase in urban demand. SCAG's *Connect SoCal* identifies conversion of specific parcels from agriculture to urban land uses through 2045. This *Alternative Plan Update* accounts for reduced agricultural water use associated with the conversion of those parcels, while the municipal demand forecast accounts for new urban demands associated with parcel buildout.

Figure 5-11. Agricultural Water Use, 2010–2019 (AFY)



5.5 Agricultural Land Conversion

SCAG land use data were used to determine the reduction in agricultural parcels over time as they are developed for urban uses. To evaluate projected land conversion, potentially developable agricultural lands from the SCAG *Connect SoCal* dataset were overlaid with data from the *2019 Crop Census* showing farmed and idle lands. Table 5-29 lists available agricultural lands in the Plan Area and the proportion that were cropped in 2019.

Table 5-29. Agricultural Acres by Geographic Unit (Acres)

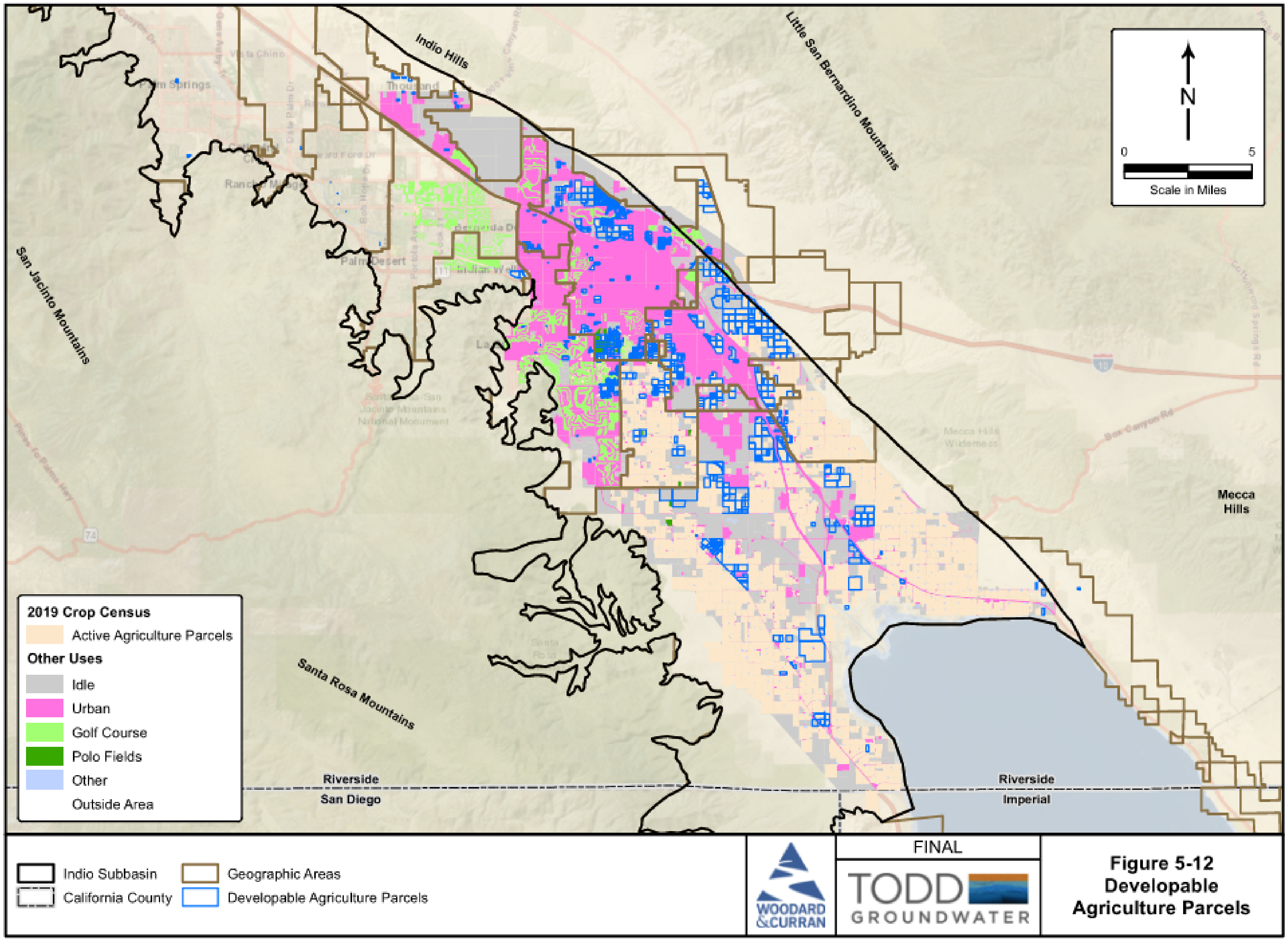
Geographic Units	Agricultural Parcels	2019 Cropped Parcels	Agricultural Lands that are Cropped
Cathedral City	2	2	100%
Coachella	4,088	2,819	69%
Indian Wells	116	116	100%
Indio	3,129	1,007	32%
La Quinta	341	87	26%
Palm Desert	0	0	0%
Palm Springs	11	0	0%
Rancho Mirage	1	1	100%
Unincorporated West	1,333	713	53%
Unincorporated East	5,268	2,265	43%
Plan Area Total	**14,289**	**7,010**	**49%**

Figure 5-12 shows that 51 percent of projected agricultural conversions would be on currently farmed parcels (i.e., 7,010 acres currently farmed out of 14,289 acres of available agricultural lands). This anticipated change in agricultural acreage was used to calculate changes in agricultural water use by geographic unit. In contrast to the projected urbanization of 5,973 acres of existing farmed lands, there may also be interest in expanding agricultural production within the planning horizon. To refine the agricultural demand forecast, the GSAs conducted outreach to Growing Coachella Valley, a local farming organization. Constraints on water availability and farming practices in California's Central Valley may increase commercial interest in local farmlands. This demand forecast assumed an increase of 950 acres of new farming production in the East Valley in 2025. Table 5-30 shows projected net acres of agricultural parcels assumed to be converted to urban uses in 5-year increments through 2045. A GIS analysis was performed of CVWD's crop data in conjunction with these assumed conversions to determine total acres of cropped land.

Table 5-30. Conversion of Agricultural to Urban by Geographic Unit (Acres)

Geographic Units	2020	2025	2030	2035	2040	2045
Cathedral City	0	0	0	0	1	1
Coachella	163	326	489	651	852	1,053
Indian Wells	3	5	8	10	24	38
Indio	365	730	1,095	1,460	1,880	2,300
La Quinta	19	38	57	75	101	127
Palm Desert	0	0	0	0	0	0
Palm Springs	5	11	16	21	29	36
Rancho Mirage	0	0	1	1	1	1
Unincorporated West	65	131	196	261	298	334
Unincorporated East	371	741	1,112	1,482	1,783	2,083
Plan Area Total	**991**	**1,982**	**2,974**	**3,961**	**4,969**	**5,973**

Figure 5-12. Developable Agricultural Lands



5.5.1 Agricultural Demand Factors

The agricultural demand factors used for projecting agricultural demands, in acre-feet per acre of cropped land, is based on the 5-year average (i.e., 2015–2019) agricultural water use in each geographic unit. The crop demand factor considered trimester cropping practices in the Plan Area, as defined in the *2019 Crop Report (CVWD, 2019a)*. Demand factors were modeled section by section and were rolled up into the 10 geographic units described in Section 5.3, *Municipal Demands*. Agricultural water supply was calculated based on the 5-year average for groundwater pumping and Canal deliveries and is approximately 30 percent higher than crop consumptive use. Table 5-31 lists the agricultural demand factor for each geographic unit**.** For Palm Springs and Rancho Mirage, which contain negligible agricultural lands, this analysis assumed other vacant lands would be urbanized and no agricultural lands would be affected.

Table 5-31. Agricultural Demand Factors (Based on 2015–2019 Average)

Geographic Units	Agricultural Lands (Acres)[a]	Crop Demand (AFY)	Agricultural Water Supply (AFY)	Demand Factor (AF/Acre)
Cathedral City	-	-	0	0.0
Coachella	4,064	12,813	18,150	4.5
Indian Wells	43	220	312	7.3
Indio	904	2,747	3,894	4.3
La Quinta	328	1,675	2,368	7.2
Palm Desert	76	394	559	7.3
Palm Springs	-	-	-	0.0
Rancho Mirage	-	-	-	0.0
Unincorporated West	10,660	44,295	62,817	5.9
Unincorporated East	38,357	145,968	207,050	5.4
Plan Area Totals	**54,432**	**208,112**	**295,150**	**--**

[a] Acreage includes the physical size of agricultural parcels but does not include multiple harvests for non-permanent crops.

5.5.2 Agricultural Conservation

In 2014, U.S. Department of the Interior Bureau of Reclamation (USBR) initiated a Pilot System Conservation Program to fund voluntary water conservation projects to benefit the Colorado River system. As part of that program, CVWD continued to offer rebates to agricultural customers to convert farmed land from a flood/furrow system to drip irrigation through 2019. However, efforts to convert from flood irrigation to drip irrigation have flattened, as users with the financial ability to undertake the conversion have already done so. The remaining users still using a flood/furrow system are mostly small farmers who do not have the necessary infrastructure to implement a conversion. As such, most passive water conservation savings associated with increased irrigation efficiency have already been realized, and the region has experienced demand hardening in agricultural water conservation. For example, Figure 5-11 (above) shows that agricultural water demands from 2010 to 2019 have been relatively flat, indicating demand hardening. Additional passive conservation is anticipated to be negligible moving forward and none was assumed for the agricultural demand forecast. Instead, participation in active agricultural conservation, such as CVWD's Agricultural Irrigation Efficiency Program, was considered (refer to Chapter 11, *Projects and Management Actions*).

5.5.3 Final Agricultural Demand Projections

The agricultural demand factors presented above were applied to agricultural acreage anticipated to remain in production over time. Total agricultural demands were calculated based on 2019 cropped acreage, and then water demands associated with lands anticipated for agriculture to urban conversion (totaling 5,973 acres) were subtracted out in 5-year increments. For the 950 acres that are anticipated to convert from idle to cropped, approximately 4,900 AFY were added to the forecast in 2025.

Total agricultural demand in the Plan Area is projected to decline from 295,150 AFY in the baseline (i.e., a 5-year average) to 280,243 AFY in 2045, which is a 5 percent decrease. Table 5-32 lists projected agricultural demand through 2045.

Table 5-32. Projected Agricultural Water Demand (AFY)

Jurisdiction	5-Year Average (2015–2019)	2020	2025	2030	2035	2040	2045
Cathedral City	0	0	0	0	0	0	0
Coachella	18,150	17,423	16,696	15,968	15,241	14,345	13,449
Indian Wells	312	293	275	256	238	134	31
Indio[a]	3,894	2,323	751	0	0	0	0
La Quinta	2,368	2,232	2,095	1,959	1,822	1,638	1,453
Palm Desert	559	559	559	559	559	559	559
Palm Springs	0	0	0	0	0	0	0
Rancho Mirage	0	0	0	0	0	0	0
Unincorporated West	62,817	62,432	62,047	61,662	61,277	61,063	60,848
Unincorporated East	207,050	205,050	208,189	206,188	204,188	202,566	200,944
Plan Area Total	**295,150**	**290,312**	**287,092**	**284,693**	**283,045**	**281,644**	**280,243**

[a] City of Indio forecast assumes all actively used agricultural parcels will be converted.

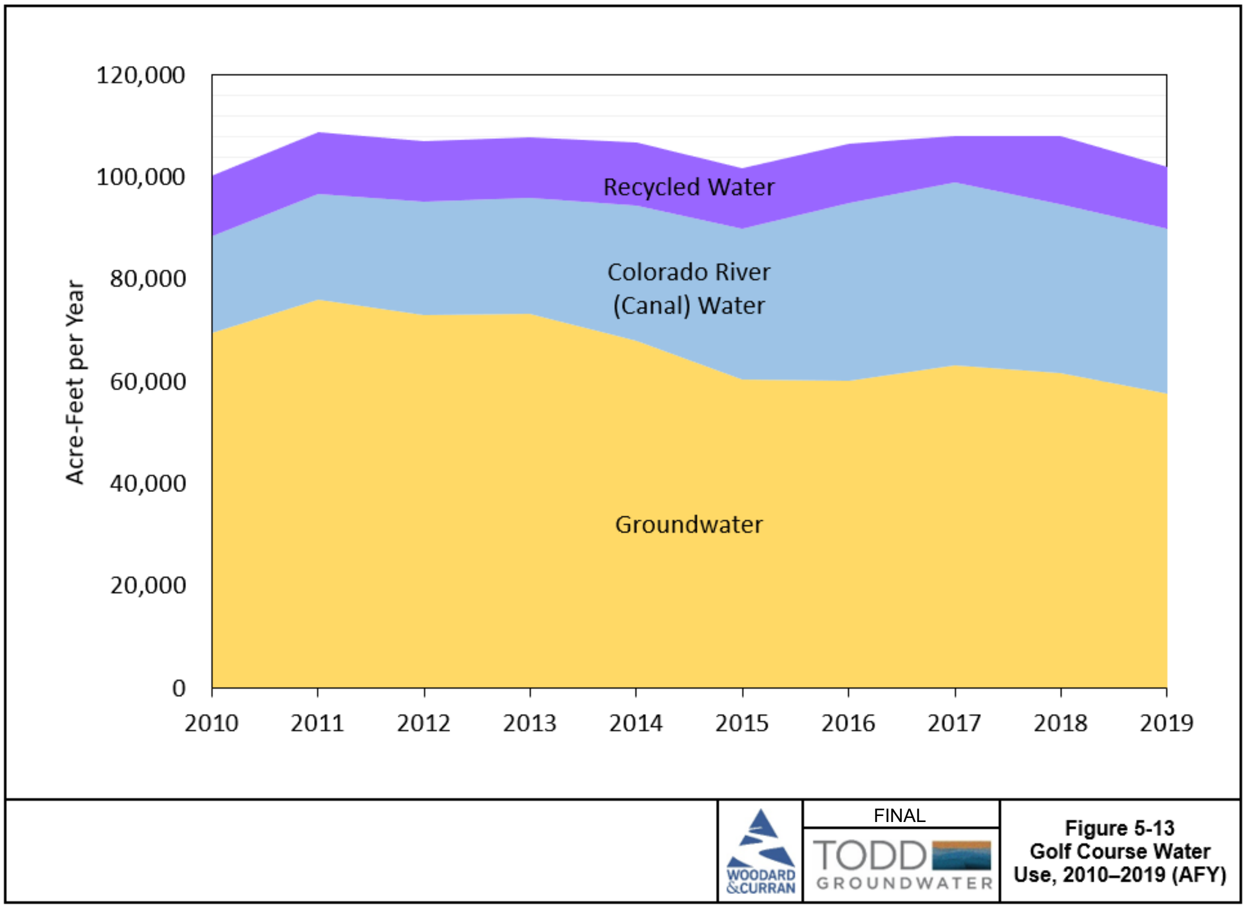
5.6 Golf Demand

The golf industry represents a significant water demand sector in the Plan Area, comprising over 18 percent or an average 105,300 AFY of Plan Area water use between 2015 and 2019. Demand for golf course irrigation is met with groundwater, Coachella Canal water, and recycled water. Figure 5-13 shows golf water use over the 2010–2019 timeframe. The *2010 CVWMP Update* assumed a proportional increase in golf courses to population growth. Anticipated golf water demand projected in this *Alternative Plan Update* is based on an assumed continuation of existing golf courses, and minimal growth based on trends in golf course construction over the last 10 years per conversations with the Golf Task Force and Southern California Golf Association, and a review of planned golf courses in approved Water Supply Assessments.

A 5-year average from 2015 to 2019 was used to calculate a golf industry demand baseline of 105,300 AFY. Three future golf courses were assumed when developing golf industry demand projections, based on a list of approved Water Supply Assessments provided by CVWD staff (dated July 23, 2020) for upcoming development approvals. These three new 18-hole golf courses were assumed to comply with CVWD's *Ordinance No. 1302.4: An Ordinance of the Coachella Valley Water District Establishing Landscape and Irrigation System Design Criteria* (Landscape Ordinance) (CVWD, 2019b), which mandates golf course water use efficiency (see discussion below). Assuming three new golf courses would be approximately 150 acres in size, analysis projected water use for each golf course under the Landscape Ordinance at 775 AFY per course or 2,324 AFY total.

CVWD WRP-10 recycled water serves golf demands in the mid-Valley area.

Figure 5-13. Golf Course Water Use, 2010–2019 (AFY)



5.6.1 Golf Conservation

New golf course development and retrofitted landscape water efficiency standards are governed by DWR's MWELO. All water supply agencies must adopt, implement, and enforce MWELO or a more stringent ordinance. As guidance, MWELO includes a water budget calculation called the Maximum Applied Water Allowance that depends on estimates of evapotranspiration and establishes the upper limit of annual applied water for landscaped areas. Any areas of activity with intense foot or vehicular traffic in the CVWD service area, including golf courses, must comply with CVWD's Landscape Ordinance. The Landscape Ordinance was developed in conjunction with CVAG, Riverside County, Coachella Valley cities, and major water purveyors. Similar to and based on MWELO, a golf course's area of irrigated turf used for tees, fairways, greens, and practice areas is limited for all new courses, and in additions or renovations to existing golf courses. Under the Landscape Ordinance, the total turf area of golf courses is limited to a maximum of 4 irrigated acres average per golf hole, and practice areas such as driving ranges and short game areas must not exceed 10 acres of turf. The Landscape Ordinance defines a recreational turf grass ETAF of 0.82. This ETAF adjusts for the additional stress of high traffic on recreational turfgrass and the higher irrigation efficiencies of long-range rotary sprinklers. This ETAF for golf courses in the CVWD service area was estimated by dividing 0.7, which is the seasonal average factor for a mixed cool/warm season turfgrass, by 0.85, which is the irrigation efficiency of long-range sprinklers.

During analysis, Landscape Ordinance requirements were considered when estimating future golf course demand. The MWELO Maximum Applied Water Allowance for a 150-acre golf course site (assuming 82 acres turf and 68 acres of other landscaped areas) is 775 AFY.

The golf course demand projection (Table 5-33) assumed no passive conservation on existing golf courses, as CVWD and DWA do not anticipate future golf course renovations unless they associated with their Golf Rebate Program. Chapter 11, *Projects and Management Actions* discusses the Golf Rebate Program, which is considered active conservation. The Golf Rebate Program provides financial support for turf removal on golf courses.

5.6.2 Final Golf Industry Demand Projections

The total golf industry demand estimate for the Plan Area is 105,300 acre-feet in 2020, increasing to 107,625 acre-feet by 2035, which is an increase of 2,325 acre-feet (2 percent). Table 5-33 lists the golf industry demand projection through 2045.

Table 5-33. Golf Course Demand Projection (AFY)

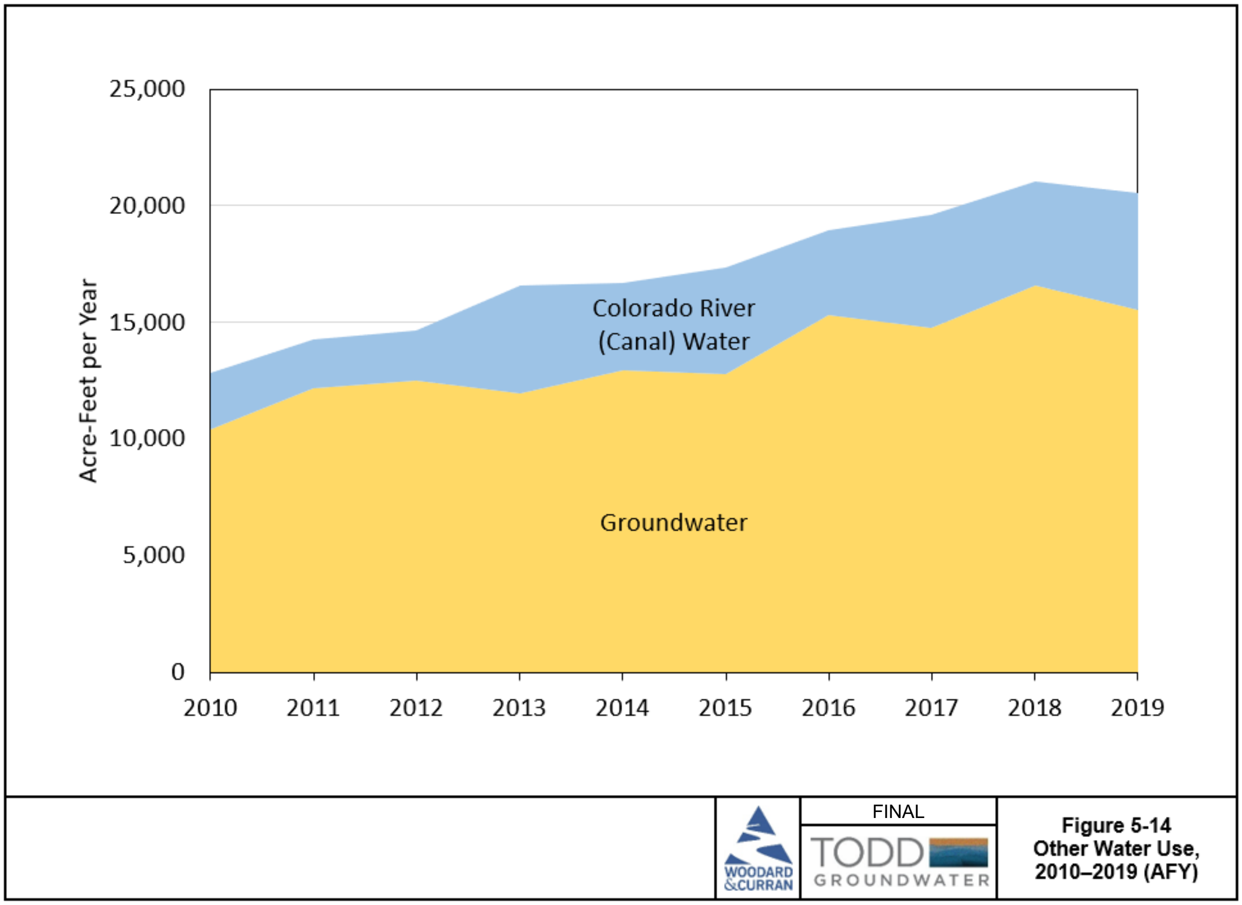
--	2020	2025	2030	2035	2040	2045
Plan Area Total	**105,300**	**106,075**	**106,850**	**107,625**	**107,625**	**107,625**

5.7 Other Demands

The Plan Area's other water demands have been historically composed of those from fish farms and duck clubs, along with polo/turf irrigation and environmental water (i.e., Coachella Canal lining mitigation, which occurred from 2013 to 2015). These demands are relatively small, comprising 3 percent (19,500 AFY) of Plan Area water use over the 5-year period from 2015 to 2019. Figure 5-14 shows other water use over the 2010 to 2019 timeframe. These demands were met with groundwater and Coachella Canal water supplies.

Water demand projections in the *2010 CVWMP Update* assumed that fish farm and duck club water use would decrease as some of large fish farm owners ceased operation, and replacement use at these farms was expected to have significantly lower water demand. However, some of these fish farms came back into operation with the economic upturn.

Figure 5-14. Other Water Use, 2010–2019 (AFY)



A 5-year average (i.e., 2015 to 2019) of 18,900 AFY, which excludes temporary environmental water used to mitigate for the Coachella Canal lining, was used as the baseline for projecting other demands for existing users through 2045. For this *Alternative Plan Update*, water demand projections for existing other uses were assumed to be flat. These estimates include no future passive conservation savings for these existing other uses. Future demand also assumes several new recreational lakes and surf parks, along with water use by the Salton Sea Restoration North Shore pilot project.

Four projects in the CVWD Area with approved Water Supply Assessments include large water features categorized as lakes, beaches, or surf parks. These four water features have a total projected demand of 500 AFY. The Salton Sea Restoration North Shore pilot project assumes 2,200 AFY of Coachella Canal water would be diverted to support wetland habitats. These demands are assumed to come online between 2020 and 2025.

5.7.1 Final Other Demand Projections

Total other demand is estimated for the Plan Area at 18,893 AFY in 2020 and 21,593 AFY by 2045, which is an increase of 2,700 AF (14 percent). Table 5-34 lists the other demand projection through 2045. This *Alternative Plan Update* assumes that all additional Other demands (2,700 AFY) are served by Canal water.

Table 5-34. Other Demand Projection (AFY)

--	2020	2025	2030	2035	2040	2045
Plan Area Total	**18,893**	**21,593**	**21,593**	**21,593**	**21,593**	**21,593**

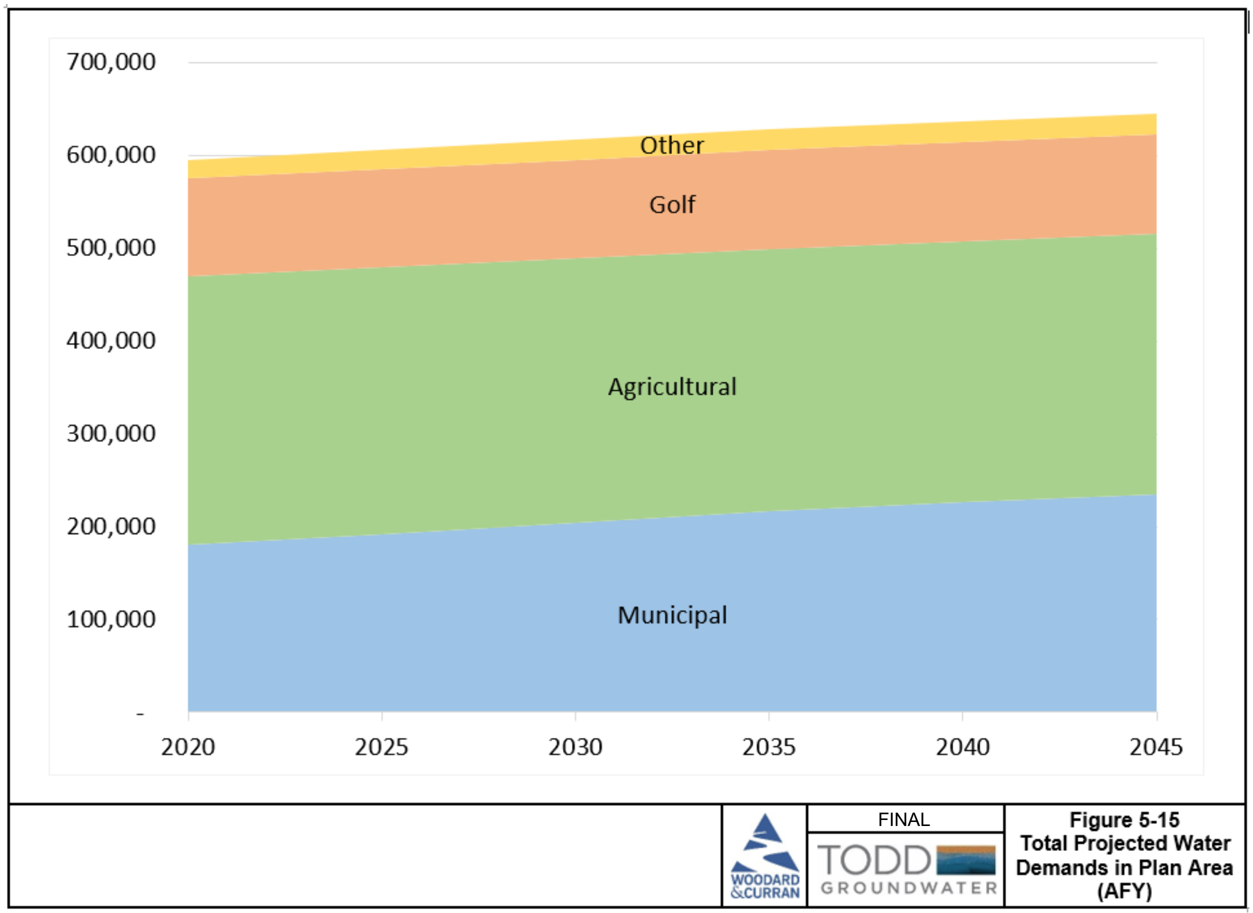
5.8 Total Water Demands

Table 5-35 and Figure 5-15 present the updated water demand projections for the Plan Area. Total water demand projected for 2045 using the assumptions described above is approximately 644,610 AFY. Projected water demand for 2045 is about 240,800 AFY lower than the 885,400 AFY originally projected for 2045 in the *2010 CVWMP Update*. This reduction is a direct result of significantly reduced sociodemographic growth projections, along with conservation savings that have been achieved by Indio Subbasin water users over the last decade and are assumed for the future through passive conservation.

Table 5-35. Total Projected Water Demands in Plan Area (AFY)

Water Demand Type	2020	2025	2030	2035	2040	2045
Municipal	180,318	192,098	204,163	216,074	225,997	235,148
Agricultural	290,312	287,092	284,693	283,045	281,644	280,243
Golf	105,300	106,075	106,850	107,625	107,625	107,625
Other	18,893	21,593	21,593	21,593	21,593	21,593
Plan Area Total	**594,823**	**606,858**	**617,299**	**628,337**	**636,859**	**644,610**

Figure 5-15. Total Projected Water Demands in Plan Area (AFY)



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CHAPTER 6: WATER SUPPLY

6.1 Overview of Water Supply

The Plan Area relies on a combination of local groundwater, Colorado River water, State Water Project (SWP) exchange water, local surface water, and recycled water to meet water demands. This chapter describes the existing water supplies available to the Plan Area and discusses the key assumptions associated with each water supply source. For the purposes of discussion in this chapter, separate accounting is provided in the following subsections for local groundwater (Section 6.2), local surface water (Section 6.3), Colorado River water (Section 6.4), SWP exchange water (Section 6.5), and recycled water (Section 6.6). Plan scenarios, which assume variable supply assumptions to meet future demands, are described in Chapter 7*, Numerical Model and Plan Scenarios*.

6.2 Local Groundwater

Mountain-front runoff and Whitewater River flows replenish the Indio Subbasin.

Groundwater from the Indio Subbasin represents a source of supply for domestic, agricultural, and municipal water demands. In this arid region, natural recharge to groundwater is limited and groundwater supply historically has been insufficient to satisfy local water demands without leading to overdraft. However, groundwater remains a key part of the supply portfolio for the Plan Area. Moreover, the Indio Subbasin serves an important role in providing storage capacity that is replenished when surface water is available and then utilized when needed, such as during drought or shortage. The Indio Subbasin also serves to convey water through groundwater flow from areas of recharge to areas of discharge, including production wells. For example, the Indio Subbasin receives substantial replenishment with imported water at three Groundwater Replenishment Facilities (GRFs) and distributes this water through the aquifer to production wells.

The overall purpose of the Sustainable Groundwater Management Act (SGMA) is to establish a plan for basin management that achieves long-term groundwater sustainability. A sustainable groundwater basin is one in which the groundwater use is balanced with the replenishment from natural sources, return flows, and artificial recharge. The Indio Subbasin is described in detail in Chapter 3, *Hydrogeologic Conceptual Model* and Chapter 4*, Current and Historical Groundwater Conditions*.

6.2.1 Uses of Groundwater

Local groundwater was the principal source of not only municipal and rural domestic supply, but also of agricultural water supply, until construction of the Coachella Canal in 1949. Groundwater continues to supply municipal, agriculture, golf courses, and other demands such as fish farms and duck clubs (see Chapter 5, *Demand Projections*). Managed aquifer recharge with imported water at the GRFs ensures an adequate supply for users extracting groundwater through numerous production wells. Chapter 2*, Plan Area,* briefly describes the uses of groundwater, and Figure 2-13 illustrates the distribution of groundwater production wells across the Indio Subbasin.

6.2.2 Groundwater Supply

Groundwater has been a principal source of water supply in the Coachella Valley since the early part of the 20th century. Management of groundwater resources requires knowledge of the groundwater balance which is an estimate of the inflows (gains) and outflows (losses) from the groundwater system. Historically, the demand for groundwater annually exceeded the limited natural inflows of the arid Indio Subbasin. Sources of natural inflow to the Indio Subbasin average approximately 60,000 acre-feet per year (AFY) from watershed runoff and subsurface inflows from adjacent Subbasins. Limited natural recharge has been supplemented with imported water supplies beginning with the delivery of Colorado River water through the Coachella Canal in 1949. Imported water is now a major component of the inflows to the groundwater balance of the Indio Subbasin through return flows of applied Colorado River water and managed aquifer recharge. This section discusses the sources of inflows and outflows of the Indio Subbasin and compares the average groundwater balance for the 10-year periods of 2000 to 2009 and 2010 to 2019.

6.2.2.1 Groundwater Inflows

The groundwater inflows to the Indio Subbasin consist of a combination of sources, as listed below.

- **Watershed runoff** including subsurface inflow from mountain front areas and surface runoff from the Whitewater River, Snow and Falls Creek channels, minor tributaries along the San Jacinto, Santa Rosa, and Little San Bernardino mountain front, and several smaller streams that flow during wet years (excluding outflow to Salton Sea and surface water diversions);
- **Subsurface inflows** from the San Gorgonio Pass and Mission Creek Subbasins (note that the Desert Hot Springs Subbasin is a no-flow boundary);
- **Return flow of applied water, treated wastewater, and septic** including deep percolation of water applied to agricultural fields, golf courses, and urban landscapes; septic tanks/leachfield systems, which are distributed across rural portions of the Indio Subbasin and some urban areas; and treated wastewater from municipal wastewater treatment plants; and
- **Imported water recharge** using Colorado River and SWP Exchange supplies, as described in Sections 6.4 and 6.5 below.

Of the above, irrigation return flows and imported water recharge are now the major source of inflows to the Indio Subbasin. Table 6-1 below provides an overview of estimated groundwater inflows comparing the 10-year periods of 2000 to 2009 and 2010 to 2019. Chapter 7*, Numerical Model and Plan Scenarios,* provides estimates of future groundwater inflows for various management scenarios.

6.2.2.2 Groundwater Outflows

Groundwater outflows are part of the Subbasin's water balance, as listed below.

- **Net drain flow and subsurface outflows** including subsurface flow from the agricultural tile drain system to the Coachella Valley Stormwater Channel (CVSC) or directly to the Salton Sea and subsurface outflows to the Salton Sea at the Subbasin boundary; and

- **Groundwater production** for municipal, agricultural, golf and other users who are not served by direct delivery of other sources (non-potable, Canal, or surface water).

Of the above, drain flows are a significant source of outflow from the Indio Subbasin, as tabulated in Table 6-1. The *2010 CVWMP Update* discussed the historical correlation between higher groundwater levels in the East Valley and increased drain flows. The upward gradient resulting from increased groundwater levels serves to flush the more saline water in the shallow and semi-perched aquifers into the drain system. Conversely, groundwater level declines in the deep aquifer could result in a downward gradient that could allow more irrigation return flow to recharge the groundwater basin rather than flow to the drains. Chapter 9, *Sustainable Management,* describes this relationship between groundwater levels, drain flows, and groundwater quality. Chapter 11, *Projects and Management Actions,* includes a proposed study of the correlation between groundwater levels, vertical gradients, drain flow volume, and salinity export.

Table 6-1 provides an overview of estimated average groundwater inflows and outflows over the 10-year periods from 2000-2009 and 2010-2019. The groundwater balance for the 2010-2019 period shows average gains of 49,100 AFY compared to the 2000-2009 period when the basin was losing 110,000 AFY on average. As described in Chapter 4, *Current and Historical Groundwater Conditions*, implementation of the *2010 CVWMP Update* has reversed decades of declining groundwater levels. The groundwater balance over the last decade has been positive, contributing to increasing storage in the Subbasin. Chapter 7, *Numerical Model and Plan Scenarios,* provides estimates of future groundwater inflows and outflows across the various management scenarios.

Table 6-1. Indio Subbasin Groundwater Balance (2000-2009 and 2010-2019)

--	2000-2009 Average (AFY)[a]	2010-2019 Average (AFY)[b]
Groundwater Inflow		
Natural Infiltration[c]	29,000	28,800
Subsurface inflows[d]	11,000	11,800
Return flow of applied water, treated wastewater, and septic[e]	240,000	162,000
Imported water recharge[f]	51,000	178,400
Total Groundwater Inflow	**331,000**	**381,500**
Groundwater Outflow		
Net drain flow and subsurface outflows[g]	52,000	46,800
Groundwater production	389,000	285,600
Total Groundwater Outflow	**441,000**	**332,400**
Change in Storage (10-Year Average)	**-110,000**	**+49,100**

[a] 2000-2009 averages from *2010 CVWMP Update*.
[b] 2010-2019 averages are based on historical conditions as measured or simulated in the numerical model.
[c] Natural infiltration of watershed runoff excludes surface diversions and net stormwater outflow through the CVSC to the Salton Sea.
[d] Subsurface inflows are simulated using the numerical model described in Chapter 7, *Numerical Model and Plan Scenarios*.
[e] Return flows from applied water, septic system, and treated wastewater percolation minus evapotranspiration.
[f] Imported water recharge minus evaporation.
[g] Net drain flow includes subsurface outflow from the agricultural complex and excludes discharges from wastewater treatment plants and regulatory water.

6.2.3 Groundwater Storage

The geologic framework of the Indio Subbasin is described in Chapter 3, *Hydrogeologic Conceptual Model*. This framework defines the Subbasin's storage capacity, namely its lateral basin boundaries (bedrock boundaries and faults), depth of the basin bottom (insofar as data are available), and water-storing characteristics of the aquifer materials in the Subbasin. In 1964, DWR estimated that the Subbasins in the Coachella Valley Groundwater Basin contained approximately 39,200,000 acre-feet (AF) of water in the first 1,000 feet below the ground surface, of which 29,800,000 AF is in the Indio Subbasin. The capacities of the individual Subareas of the Indio Subbasin are shown in Table 6-2.

Table 6-2. Indio Subbasin Groundwater Storage Capacity

Subarea	Groundwater Storage (AF)[a]
Garnet Hill Subarea	1,000,000
Oasis Subarea	3,000,000
Palm Springs Subarea	4,600,000
Thermal Subarea	19,400,000
Thousand Palms Subarea	1,800,000
Indio Subbasin Total	**29,800,000**

[a] Storage volume in first 1,000 feet below the ground surface (DWR, 1964).

While use of this groundwater in storage has practical limitations (for example, by the depth of production wells), the significant water storage capacity in the Indio Subbasin provides flexibility for the management of groundwater resources. In brief, storage capacity in the Indio Subbasin allows for local storage of water supplies when available and use of stored water supplies when needed. Sustainable management requires that inflows and outflows to the Subbasin are balanced over the long term such that net storage remains stable.

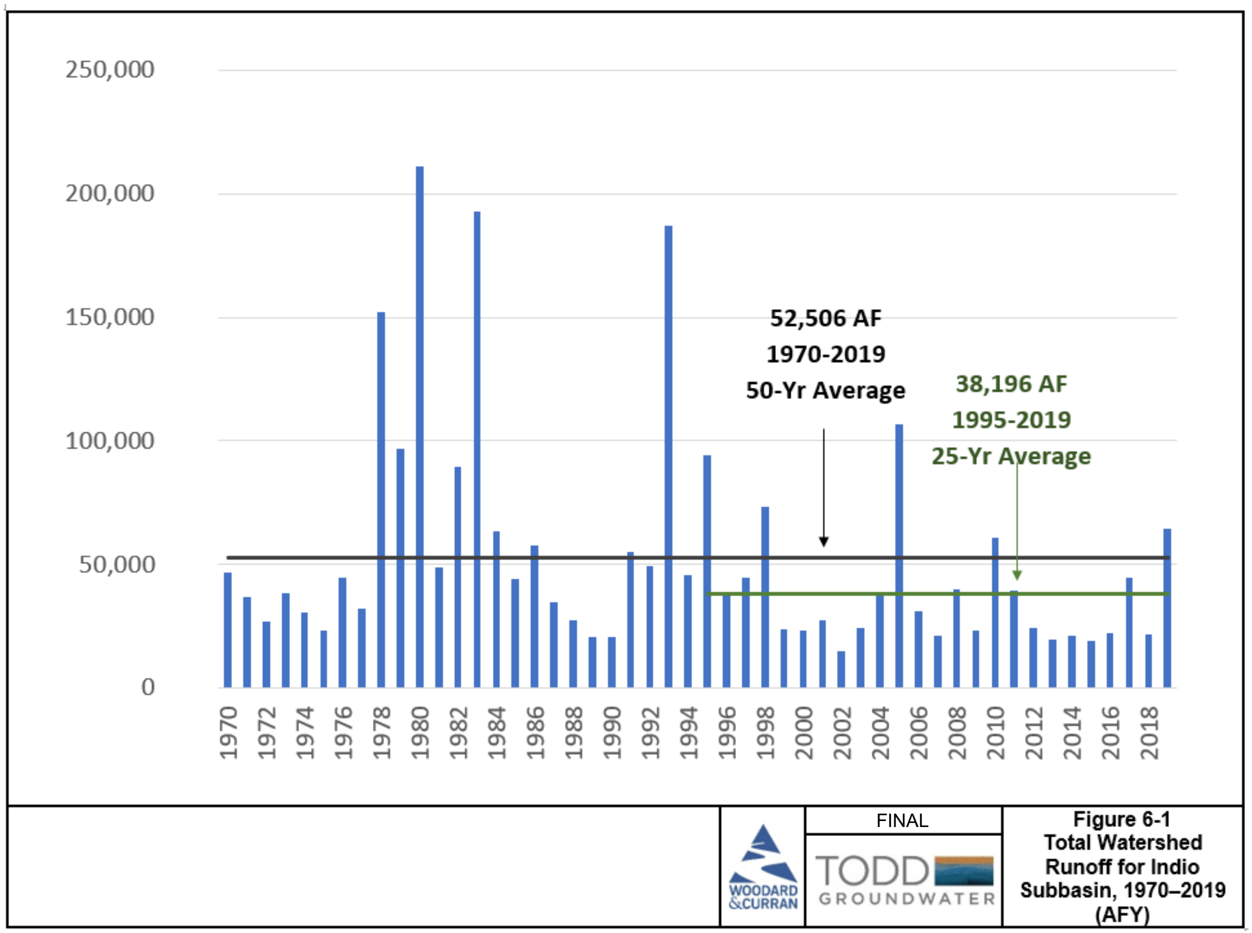
The Indio Subbasin was at its minimum storage in 2009, with a calculated storage loss of 1,890,000 AF from 1970 to 2009 (see Chapter 4*, Current and Historical Groundwater Conditions,* and Figure 4-9). This represents use of stored groundwater until the management actions identified in the *2002 CVWMP* and *2010 CVWMP Update* resulted in cessation of overdraft, a positive Subbasin groundwater budget, and groundwater storage increases. Since 2009, groundwater pumping has decreased and replenishment activities have increased, leading to the observed recovery of groundwater in storage. The GSAs' management activities have resulted in replacement of approximately 840,000 AF of groundwater in storage, or about 45 percent of the cumulative depletion observed from 1970 to 2009.

This *Alternative Plan Update* builds on recent management activities for a long-term sustainable groundwater supply. The remainder of this Chapter 6, *Water Supply,* documents the local and imported water supplies that provide water for direct use and for replenishment to help sustain the Indio Subbasin groundwater supply. Chapter 7*, Numerical Model and Plan Scenarios,* describes the Subbasin's water budget.

6.3 Surface Water

Natural surface water flow in the Coachella Valley occurs as a result of precipitation, precipitation runoff, and stream flow originating from the San Bernardino and San Jacinto Mountains, with lesser amounts from the Santa Rosa Mountains. This watershed runoff is diverted for use, percolates into streambeds, or is captured in mountain-front percolation basins where it recharges the groundwater basin. As shown in Figure 6-1, the 50-year hydrologic period from 1970 to 2019 had an annual average watershed runoff of 52,506 AFY (calculated from U.S. Geological Survey (USGS) stream gages, precipitation, and ungaged tributary estimates), with approximately 43,300 AFY in natural infiltration when accounting for surface water diversions, ET loss, and outflows to Salton Sea. Runoff during the 25-year period from 1995 to 2019 was below average, with 38,196 AFY in watershed runoff and 29,200 AFY in natural infiltration. This 25-year hydrologic period contained multiple drought cycles with below average rainfall.

Figure 6-1. Total Watershed Runoff for Indio Subbasin, 1970–2019 (AFY)



DWA and CVWD both hold State of California surface water rights. CVWD's rights[1] total up to 328,591 AFY for Whitewater River and multiple tributaries, which exceeds the long-term average watershed runoff of 52,506 AFY. These rights allow CVWD to capture available watershed runoff for replenishment of the groundwater basin.

[1] Whitewater River: A001122 (400 cfs up to 289,591 AFY); Creeks: A002922 (up to 39,000 AFY)

DWA diverts surface water from Snow Creek.

DWA's rights[2] total up to approximately 13,309 AFY for Chino, Snow, Falls Creek, and Whitewater River flow. DWA acquired the water rights of the Whitewater River Mutual Water Company for 10 cubic feet per second (cfs) from Whitewater River in 2008. Local surface water is diverted by DWA for use in its domestic water supply system. Because surface water supplies are affected by variations in annual precipitation, however, the annual supply is highly variable. Since 1960, the historical surface water diversions have ranged from approximately 1,400 to 8,500 AFY. For the period of 2010 to 2019, DWA's average annual surface water diversions from all sources totaled 1,960 AFY. The remaining undiverted surface water has historically been recharged into the Indio Subbasin through natural streambeds.

DWA's existing surface water diversions include the following:

- **Chino West**—This diversion serves the domestic water needs of the Palm Springs Aerial Tramway from a small reservoir, which overflows back into the stream. The diversion only provides water supply needs to the Tramway.
- **Chino North**—This diversion operates by discharging and then recharging the water further downstream nearer to the Whitewater River. This diversion was destroyed in a February 2019 storm, so diversions have not occurred since then.
- **Snow Creek/Falls Creek**—This diversion involves two separate diversion dams, but the flow is combined before it is diverted for delivery. The diversion is delivered to urban users in the Palm Springs area. A February 2019 storm damaged the Falls Creek diversion, so this dam had zero diversions in 2019 and 2020. Additionally, water is diverted to WWR-GRF for use in DWA's domestic water supply system.
- **Whitewater Canyon**—This diversion is an old water distribution system, purchased from the no longer operating Whitewater River Mutual Water Company, which diverts subsurface stream water using wells that are less than 50 feet deep. This diversion is delivered within Palm Springs to a ranch owned and operated by Agua Caliente Band of Cahuilla Indians for agricultural purposes, to Caltrans for landscape irrigation of freeway right of ways, to a rock supply company for dust suppression, and periodically to other entities for non-potable water use. Additionally, water is diverted to WWR-GRF for use in DWA's domestic water supply system.

6.3.1 Use of Surface Water Supply

Please use: DWA plans to divert as much surface water within its water rights as may be available and deliver that diverted surface water for direct use, and for replenishment into the Indio Subbasin and subsequent extraction for use in DWA's domestic water supply system. This *Alternative Plan Update*

[2] Snow Creek: A004752 (1.5 cfs); Snow Creek: A013067 (4 cfs); Falls Creek: A008957 (1.5 cfs with 640 AFY cap); Chino West: G331035 (2 cfs); Whitewater Canyon (10 cfs): G330840, G330841, G330842, G330843, G330846, and G331466

assumes DWA will increase annual surface water diversions to 6,000 AFY in 2023. Although only a small portion of the current watershed runoff is diverted for municipal and agricultural use, the Indio Subbasin still benefits from the natural infiltration of watershed runoff that is not diverted. This *Alternative Plan Update* assumes approximately 96 percent of undiverted flows recharge the groundwater aquifer, while four percent outflows to the Salton Sea, based on calculation of outflow at the Indio gage on the Whitewater River (USGS 10259300).

This *Alternative Plan Update* considers two local hydrology scenarios:

1) **Historical hydrology conditions** – Natural infiltration based on the 50-year historical average (1970 to 2019) of 52,500 AFY for watershed runoff, minus outflows to the Salton Sea and surface water diversions. With projected surface water diversions at 6,000 AFY after 2023, natural infiltration is estimated to average 43,300 AFY through the planning horizon. These assumptions are used only in the baseline scenario in Chapter 7, *Numerical Model and Plan Scenarios*.
2) **Climate change conditions** – Natural infiltration based on the drier 25-year hydrologic period (1995 to 2019) that includes reoccurring droughts and aligns with climate change forecasts that predict increasingly drier conditions. Watershed runoff for the 25-year hydrologic period averaged 38,200 AFY. With projected surface water diversions at 6,000 AFY after 2023, natural infiltration is estimated to average 29,200 AFY through the planning horizon. These assumptions are used in all future project scenarios in Chapter 7, *Numerical Model and Plan Scenarios*.

6.4 Colorado River Water

Colorado River water has been a significant water supply source for the Indio Subbasin since the Coachella Canal was completed in 1949. CVWD is the only agency in the Indio Subbasin that receives Colorado River water allocations.

The Colorado River is managed and operated in accordance with the *Law of the River,* a collection of interstate compacts, federal and state legislation, various agreements and contracts, an international treaty, a U.S. Supreme Court decree, and federal administrative actions that govern the rights to use Colorado River water within the seven Colorado River Basin states. The *1922 Colorado River Compact* apportioned the waters of the Colorado River Basin between the Upper Colorado River Basin (i.e., Colorado, Wyoming, Utah, and New Mexico) and the Lower Basin (i.e., Nevada, Arizona, and California) (USBR, 1922). The *1922 Colorado River Compact* allocates 15 million AFY of Colorado River water as follows: 7.5 million AFY to the Upper Basin and 7.5 million AFY to the Lower Basin, plus up to 1 million AFY of surplus supplies. The Lower Basin's water was further apportioned among the three Lower Basin states by the 1928 *Boulder Canyon Project Act* (USBR, 1928) and the 1931 *Boulder Canyon Project Agreement* (USBR, 1931), typically called the 1931 *Seven Party Agreement,* which allocates California's apportionment of Colorado River water among Palo Verde Irrigation District (PVID), Imperial Irrigation District (IID), Coachella Valley Water District (CVWD), Metropolitan Water District of Southern California (MWD), City of Los Angeles, City of San Diego, and County of San Diego. The 1964 U.S. Supreme Court decree in *Arizona v. California* established Arizona's basic annual apportionment at 2.8 million AFY, California's at 4.4 million AFY, and Nevada's at 0.3 million AFY. Mexico is entitled to 1.5 million AFY of the Colorado River under the *1944 United States-Mexico Treaty for Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande* (U.S. Government Printing Office, 1946). However, this treaty did not specify a required quality for water entering Mexico. In 1973, the United States and Mexico signed *Minute No. 242* of the International Boundary and Water Commission (IBWC) requiring certain water quality standards for water entering Mexico (IBWC, 1973).

California's Colorado River supply is protected by the *1968 Colorado River Basin Project Act* (USBR, 1968), which provides that in years of insufficient supply on the main stem of the Colorado River, supplies to the Central Arizona Project shall be reduced to zero before California will be reduced below 4.4 million AF in any year. This assures full supplies to the Coachella Valley, except in periods of extreme drought.

The Coachella Canal is a branch of the All-American Canal that brings Colorado River water into the Imperial and Coachella Valleys. Under the *1931 Seven Party Agreement* (USBR, 1931), CVWD receives 330,000 AFY of Priority 3A Colorado River water diverted from the All-American Canal at the Imperial Dam. The Coachella Canal originates at Drop 1 on the All-American Canal and extends approximately 123 miles, terminating in CVWD's Lake Cahuilla. The service area for Colorado River water delivery under CVWD's contract with the U.S. Department of the Interior Bureau of Reclamation (USBR) is defined as Improvement District No. 1 (ID-1), which encompasses 136,400 acres covering most of the East Valley and a portion of the West Valley north of Interstate 10. Under the *1931 Seven Party Agreement*, CVWD has water rights to Colorado River water as part of the first 3.85 million AFY allocated to California. CVWD is in the third priority position along with IID.

The Coachella Canal extends approximately 123 miles to terminate in Lake Cahuilla.

6.4.1 2003 Quantification Settlement Agreement (QSA)

In 2003, CVWD, IID, and MWD successfully negotiated the *2003 Quantification Settlement Agreement* (*2003 QSA*) (CVWD, 2003), which quantifies Colorado River allocations through 2077 and supports the transfer of water between agencies. Under the *2003 QSA*, CVWD has a base entitlement of 330,000 AFY. CVWD negotiated water transfer agreements with MWD and IID that increased CVWD supplies by an additional 123,000 AFY. CVWD's net QSA supply will increase to 424,000 AFY by 2026 and remain at that level until 2047, decreasing to 421,000 AFY until 2077, when the agreement terminates (Secretary of the Interior, 2003). CVWD's available Colorado River diversions through 2045, this *Alternative Plan Update* horizon, are shown on Table 6-3.

As of 2020, CVWD's available Colorado River water diversions at Imperial Dam under the QSA were 394,000 AFY. This includes the base entitlement of 330,000 AFY, the MWD/IID Transfer of 20,000 AFY, IID/CVWD First Transfer of 50,000 AFY, and IID/CVWD Second Transfer of 23,000 AFY. CVWD's QSA diversions also deducts the -26,000 AFY transferred to San Diego County Water Authority (SDCWA) as part of the Coachella Canal Lining Project and the -3,000 AFY transfer to Indian Present Perfected Rights.

Additionally, under the 2003 QSA, MWD transferred 35,000 AFY of its State Water Project (SWP) Table A Amount to CVWD. This SWP water is exchanged for Colorado River water and can be delivered at Imperial Dam for delivery via the Coachella Canal to the eastern portion of the Indio Subbasin or at Lake Havasu for delivery via the Colorado River Aqueduct to the western portion of the Indio Subbasin at the WWR-GRF. The 2019 Second Amendment (CVWD, 2019b) guaranteed delivery of the 35,000 AFY from 2019 to 2026, for a total of 280,000 AFY of water to the WWR-GRF during that timeframe. MWD can deliver the water through CVWD's Whitewater Service Connections (for recharge at WWR-GRF) or via the Advance Delivery account.

The Colorado River Aqueduct conveys water to the western portion of the Indio Subbasin at the WWR-GRF.

The MWD/IID Transfer originated in a 1989 agreement with MWD to receive 20,000 AF of its Colorado River supply. The *2019 Amended and Restated Agreement for Exchange and Advance Delivery of Water* (CVWD, 2019a) defined the exchange and delivery terms between MWD, CVWD, and DWA. The *2019 Second Amendment to Delivery and Exchange Agreement* (CVWD, 2019b) reduced CVWD's annual delivery of the MWD/IID Transfer to 15,000 AFY, for a total of 105,000 AF, if taken at the Whitewater Service Connections (for recharge at WWR-GRF) between 2020 and 2026. For those seven years, MWD keeps the remaining 5,000 AFY, after which CVWD's allocation increases back up to 20,000 AFY. In this *Alternative Plan Update*, both the 15,000 AFY MWD/IID Transfer and the 35,000 AF QSA MWD SWP Transfer are assumed to be delivered to WWR-GRF through 2026. CVWD's total allocations under the QSA, including MWD's transfer of 35,000 AFY and the MWD/IID Transfer, will increase from 424,000 AFY in 2020 to 459,000 AFY by 2026 and remain at that level for the remainder of the 75-year term of the QSA.

6.4.2 Colorado River Water Consumptive Use

Each year, CVWD submits its water order to USBR for its total QSA entitlement. USBR provides an annual Colorado River Accounting and Water Use Report that provides diversions, return flows, and consumptive use of water diverted from the mainstream of the Colorado River below Lee's Ferry (USBR, 2020). For the eight years between 2013 and 2020, CVWD consumed less than its QSA allotment by an average of 25,574 AFY. CVWD can transfer up to 20,000 AF of the *1989 Approval Agreement* water to MWD, to help mitigate the lower consumption. Despite minor annual variability, CVWD anticipates full consumptive use of its QSA entitlement by 2030. Payback for the over consumption that occurred in years 2001 and 2002 has been completed; no additional payback is assumed during the planning horizon.

Assumptions regarding Colorado River (Canal water) supplies available for use are based on CVWD's delivery schedule from the QSA, minus estimated Canal conveyance losses (see discussion below). Table 6-3 and Figure 6-2 provides CVWD's contracted Colorado River water entitlement through 2045. Note that due to the IID/CVWD Second Transfer, CVWD's Colorado River supplies continue to increase by 5,000 AFY per year through 2027 before reaching a total volume of 424,000 AFY. Table 6-3 lists total Colorado River entitlements under existing agreements. However, this *Alternative Plan Update* does not assume full QSA ramp up volumes will be available due to ongoing drought and forecasted climate change on the Colorado River system. Section 6.4.4 describes the Colorado River volumes assumed in baseline and climate change.

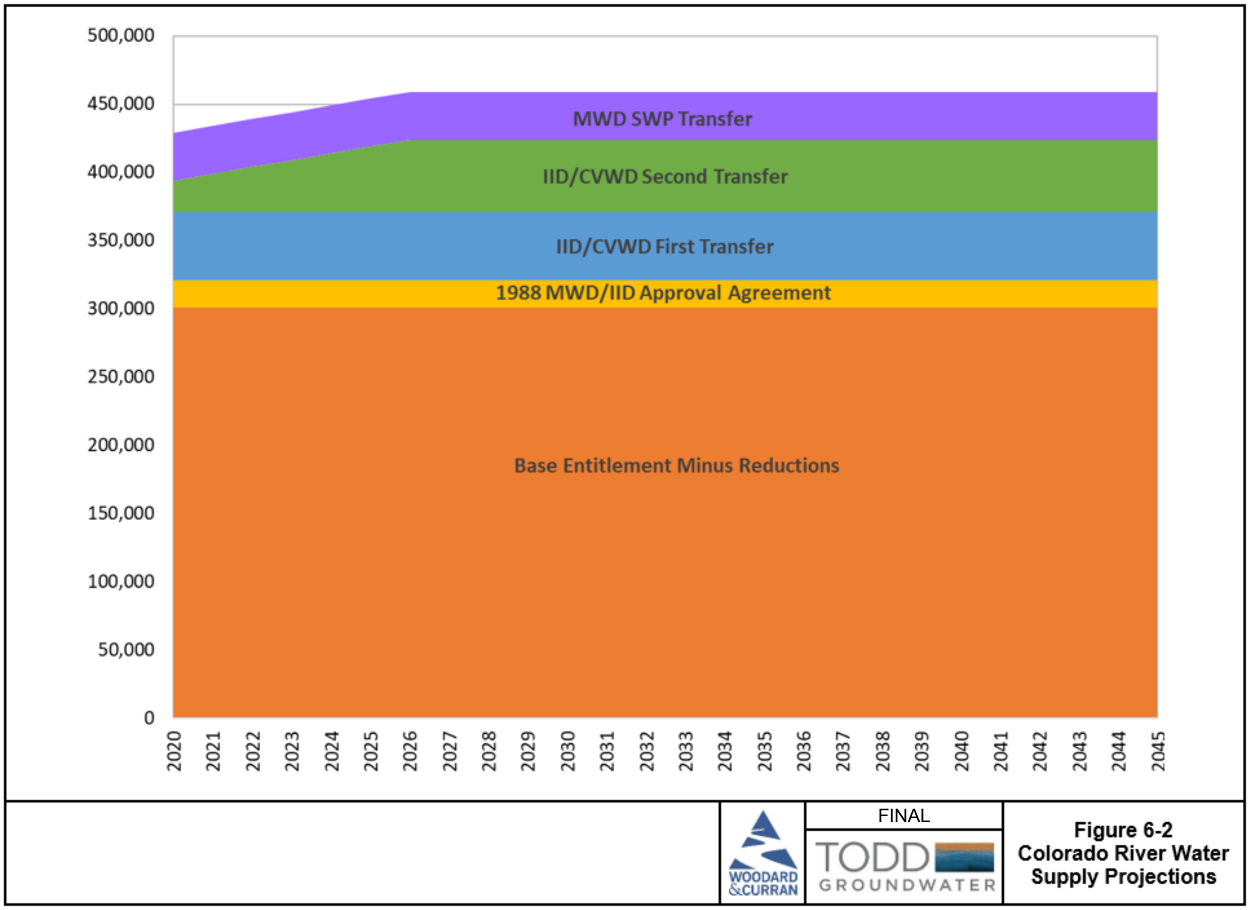
Table 6-3. Colorado River Water Entitlements (AFY)

Diversion	2020	2025	2030	2035	2040	2045
Base Entitlement	330,000	330,000	330,000	330,000	330,000	330,000
1988 MWD/IID Approval Agreement	20,000	20,000	20,000	20,000	20,000	20,000
IID/CVWD First Transfer	50,000	50,000	50,000	50,000	50,000	50,000
IID/CVWD Second Transfer	23,000	48,000	53,000	53,000	53,000	53,000
Coachella Canal Lining	-26,000	-26,000	-26,000	-26,000	-26,000	-26,000
Indian Present Perfected Rights Transfer	-3,000	-3,000	-3,000	-3,000	-3,000	-3,000
QSA Diversions	**394,000**	**419,000**	**424,000**	**424,000**	**424,000**	**424,000**
MWD SWP Transfer	35,000	35,000	35,000	35,000	35,000	35,000
Total Diversions	**429,000**	**454,000**	**459,000**	**459,000**	**459,000**	**464,000**
Assumed Conveyance Losses (5%)	-21,200	-22,700	-22,950	-22,950	-22,950	-22,950
MWD/IID Approval Agreement Transfer[1]	-5,000	-5,000	0	0	0	0
Total Available Deliveries	**402,800**	**426,300**	**436,050**	**436,050**	**436,050**	**436,050**

[1] Accounts for -5,000 AFY reduction in MWD/IID Approval Agreement deliveries from 2020–2026 per the 2019 Amendments with MWD.

Source: Colorado River Water Delivery Agreement (https://www.usbr.gov/lc/region/g4000/crwda/crwda.pdf, Exhibit B)

Figure 6-2. Colorado River Water Supply Projections



Note: This graphic reflects total Colorado River water diversions and does not reflect conveyance and transfer losses.

6.4.2.1 Conveyance Losses

Conveyance losses, which are defined as the loss of water to evaporation, seepage, or other similar cause resulting from any transportation or delivery of water, are also factored into the water available for delivery. Conveyance losses in the Coachella Canal are estimated to be approximately five percent annually based on the percentage annual average conveyance losses from 2014 to 2019. Regulatory water is defined as metered releases of excess water from the Canal water delivery system needed to meet scheduled deliveries in the gravity flow irrigation water delivery system. Regulatory water is released into the open drain system and flows to the Salton Sea. Although regulatory water is metered, it is considered a loss and not accounted for in the direct deliveries.

6.4.3 Supply Reliability

Colorado River supplies face a number of challenges to long-term reliability including the extended Colorado River Basin drought and shortage sharing agreements, endangered species and habitat protection, and climate change. Due to both California's and CVWD's high-priority position regarding Colorado River allocations, CVWD's Colorado River supply is expected to be reliable.

6.4.3.1 QSA Litigation

The *2010 CVWMP Update* cautioned against the reliability of CVWD's Colorado River supplies because of ongoing QSA litigation at the time. However, the QSA has held up to scrutiny under several unsuccessful legal challenges in state and federal court. Immediately following passage of the QSA, in November 2003, IID filed a complaint in Imperial County Superior Court to confirm the validity of the QSA and 12 of the 34 QSA-related agreements. The case was coordinated for trial with other lawsuits challenging QSA environmental and regulatory approvals in the Sacramento County Superior Court. CVWD, IID, MWD, SDCWA, and the State defended these suits, which sought validation of the contracts. In February 2010, a California Superior Court judge ruled that the QSA and 11 related agreements were invalid because the QSA-JPA Agreement created an unconditional obligation for the State to pay for excess environmental mitigation costs, in violation of California's constitution. The court declined, for jurisdictional reasons, to validate the thirteenth agreement, the IID-CVWD Salton Sea Flooding Settlement Agreement.

The QSA parties appealed this decision. In March 2011, the California Court of Appeal, Third Appellate District issued a temporary stay of the trial court judgment. In December 2011, the California Court of Appeal reversed the lower court ruling and remanded the case back to trial court for decision on the environmental challenges to the QSA Program EIR. In July 2013, a Sacramento Superior Court entered a final judgment validating the QSA and rejecting all of the remaining legal challenges. In May 2015, the California Court of Appeal issued a ruling that dismissed all remaining appeals.

6.4.3.2 Colorado River Interim Guidelines

Since 2000, drought conditions in the Colorado River basin have led to significant fluctuations and decreases in water elevations at key Colorado River reservoirs. Each year, the Secretary of the Interior is required to declare the Colorado River water supply availability conditions for the Lower Basin States in terms of normal, surplus, or shortage. In 2007, USBR adopted *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead* (*2007 Interim Guidelines*). These *2007 Interim Guidelines* will remain in effect for determinations to be made through December 2025 regarding water supply and reservoir operating decisions through 2026 and provide guidance for development of the Annual Operating Plan (AOP) for Colorado River reservoirs (USBR, 2007).

The purposes of the *2007 Interim Guidelines* are to:

- Improve USBR's management of the Colorado River by considering trade-offs between the frequency and magnitude of reductions of water deliveries and considering the effects on water storage in Lake Powell and Lake Mead. USBR will also consider the effects on water supply, power production, recreation, and other environmental resources;
- Provide mainstream U.S. users of Colorado River water, particularly those in the Lower Basin states, a greater degree of predictability with respect to the amount of annual water deliveries in future years, particularly under drought and low reservoir conditions; and
- Provide additional mechanisms for the storage and delivery of water supplies in Lake Mead to increase the flexibility of meeting water use needs from Lake Mead, particularly under drought and low reservoir conditions (USBR 2007).

In October 2020, USBR released a *Review of the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead* (*7D Review*; USBR 2020a). The *7D Review* acknowledged the operational stability provided by the *2007 Interim Guidelines* and the cooperation of participating agencies in providing information to inform the post-2026 operations of Lake Powell and Lake Mead. Negotiations began in 2021 for the *2027 Interim Guidelines* that may affect available supplies of Colorado River water.

6.4.3.3 Lower Basin Drought Contingency Plan

In May 2019, CVWD entered into the *Lower Basin Drought Contingency Plan Agreement* (USBR, 2019) to provide an additional mechanism to prevent Lake Mead from reaching critically low elevations by establishing that certain Colorado River users in the Lower Basin make Drought Contingency Plan (DCP) contributions if Lake Mead reaches certain elevations. The *Implementation Agreement* (CVWD 2019c) explains that the *Lower Basin Drought Contingency Plan (Lower Basin DCP*) provides that USBR's annual 24-month study's projection of Lake Mead's January 1 elevation will determine the amount of California DCP contributions for the subsequent year, if any. CVWD's portion of California DCP contributions under the *Lower Basin DCP* is seven percent (which is approximately 14,000 to 24,500 AFY). CVWD will implement its portion of the *Lower Basin DCP* contributions by storing water in MWD’s Lake Mead DCP Intentionally Created Surplus (ICS) account and/or by CVWD reducing its call for the 35,000 AFY MWD SWP Transfer (refer to description above). MWD will then reduce its USBR water order by an equivalent amount in that year to cover CVWD’s contribution. The *Lower Basin DCP* is a short-term plan that will end when the 2027 Interim Guidelines are implemented.

6.4.4 Use of Colorado River Water

This *Alternative Plan Update* considers the QSA ramp up to ensure that all available supply is used. This requires balancing direct uses and replenishment deliveries against the available Colorado River supply (less conveyance and regulatory water losses). This *Alternative Plan Update* considers two Colorado River delivery scenarios:

1) **Historical hydrology conditions** – Full ramp up of the *2003 QSA* entitlement, along with transfers where there are agreements in place. These assumptions are used only in the baseline scenario in Chapter 7, *Numerical Model and Plan Scenarios*.
2) **Climate change conditions** – Full ramp up of the *2003 QSA* entitlement and transfers, minus CVWD’s portion of California’s *Lower Basin DCP* contribution increasing from 14,500 AFY to 24,500 AFY. These assumptions are used in all future project scenarios in Chapter 7, *Numerical Model and Plan Scenarios*.

To fully utilize the Colorado River water entitlement, the GSAs propose several source substitution (replacing existing groundwater pumping with Canal water deliveries) and replenishment projects that can be found in Chapter 11*, Projects and Management Actions*.

6.5 SWP Exchange Water

The SWP is managed by the California Department of Water Resources (DWR) and includes 705 miles of aqueduct and conveyance facilities extending from Lake Oroville in Northern California to Lake Perris in Southern California. The SWP has contracts to deliver 4.172 million AFY to the State Water Contractors. The State Water Contractors consist of 29 public entities with long-term contracts with DWR for all, or a portion of, their water supply needs. In 1962 and 1963, DWA and CVWD, respectively, entered contracts with the State of California for a total of 61,200 AFY of SWP water.

SWP water has been an important component of the region's water supply mix since CVWD and DWA began receiving and recharging SWP exchange water at the WWR-GRF. Starting in 1973, CVWD and DWA began exchanging their SWP water with MWD for Colorado River water delivered via MWD's Colorado River Aqueduct. Because CVWD and DWA do not have a physical connection to SWP conveyance facilities, MWD takes delivery of CVWD's and DWA's SWP water, and in exchange, delivers an equal amount of Colorado River water to the Whitewater Service Connections (for recharge at WWR-GRF and MC-GRF). The exchange agreement was most recently re-established in the 2019 *Amended and Restated Agreement for Exchange and Advance Delivery of Water* (CVWD, 2019a).

6.5.1 SWP Table A Amounts

Each SWP contract contains a "Table A" exhibit that defines the maximum annual amount of water each contractor can receive excluding certain interruptible deliveries. DWR uses Table A amounts to allocate available SWP supplies and some SWP project costs among the contractors. Each year, DWR determines the amount of water available for delivery to SWP contractors based on hydrology, reservoir storage, the requirements of water rights licenses and permits, water quality, and environmental requirements for protected species in the Sacramento-San Joaquin River Delta (Delta). The available supply is then allocated according to each SWP contractor's Table A amount.

SWP exchange water is recharged at the WWR-GRF.

CVWD's and DWA's collective increments of Table A water are listed in Table 6-4. Original Table A SWP water allocations for CVWD and DWA were 23,100 AFY and 38,100 AFY, respectively, for a combined amount of 61,200 AFY. CVWD and DWA obtained a combined 100,000 AFY transfer from MWD under the 2003 Exchange Agreement. In 2004, CVWD purchased an additional 9,900 AFY of SWP Table A water from the Tulare Lake Basin Water Storage District (Tulare Lake Basin) in Kings County (DWR, 2004). In 2007, CVWD and DWA made a second purchase of Table A SWP water from Tulare Lake Basin totaling 7,000 AFY (DWR, 2007a and 2007b). In 2007, CVWD and DWA also completed the transfer of 16,000 AFY of Table A Amounts from the Berrenda Mesa Water District in Kern County (DWR, 2007c and 2007d). These latter two transfers became effective in January 2010. With these additional transfers, the total SWP Table A Amount for CVWD and DWA is 194,100 AFY.

Previously, the 100,000 AFY MWD Transfer obtained under the *2003 Exchange Agreement* included a "Call Back" component that allowed MWD to call-back the 100,000 AFY and assume the entire cost of delivery if it needed the water. In 2019, the *Amended and Restated Agreement for Exchange and Advance Delivery of Water* (CVWD, 2019a) ended MWD's right to call back that 100,000 AFY of Table A water.

Table 6-4. SWP Table A Amounts (AFY)

Agency	Original SWP Table A	MWD Transfer	Tulare Lake Basin Transfer 1	Tulare Lake Basin Transfer 2	Berrenda Transfer	Total
CVWD	23,100	88,100	9,900	5,250	12,000	138,350
DWA	38,100	11,900	-	1,750	4,000	55,750
Total	**61,200**	**100,000**	**9,900**	**7,000**	**16,000**	**194,100**

In some years, DWA and CVWD carry over SWP water to the following year by storing it in San Luis Reservoir. This carryover water is SWP water that is allocated to a State Water Contractor and approved for delivery in a given year but was not able to be delivered to the Contractor by the end of that year. This water is exported from the Delta, but instead of being delivered to the Contractor, it is stored in the SWP's share of San Luis Reservoir south of the Delta, when space is available, for the Contractor to use in the following year. This variability is reflected in the historical delivery values but does not affect supply projections.

6.5.2 Other SWP Water Types

There are other types of SWP water that can be purchased, such as individual water purchase opportunities and transfers/exchanges. These may be conveyed to CVWD and DWA as available, but no commitments exist.

6.5.2.1 Yuba Accord

In 2008, CVWD and DWA entered into separate agreements with DWR for the purchase and conveyance of supplemental SWP water under the Yuba River Accord Dry Year Water Purchase Program (Yuba Accord). This program provides dry year supplies through a water purchase agreement between DWR and Yuba County Water Agency, which settled long-standing operational and environmental issues over instream flow requirements for the lower Yuba River. The amount of water available for purchase varies annually and is allocated among participating SWP contractors based on their Table A amounts. CVWD and DWA may purchase up to 1.72 percent and 0.69 percent, respectively, of available Yuba Accord water, in years it is made available.

Yuba Accord deliveries have varied from zero in multiple years to a total of 2,664 AFY to CVWD and DWA in 2013. Over the 10-year period from 2010-2019, the average annual amount of Yuba Accord water purchased by the GSAs was 651 AFY. This *Alternative Plan Update* assumes the same 10-year average of Yuba Accord deliveries annually through 2045.

6.5.2.2 Article 21

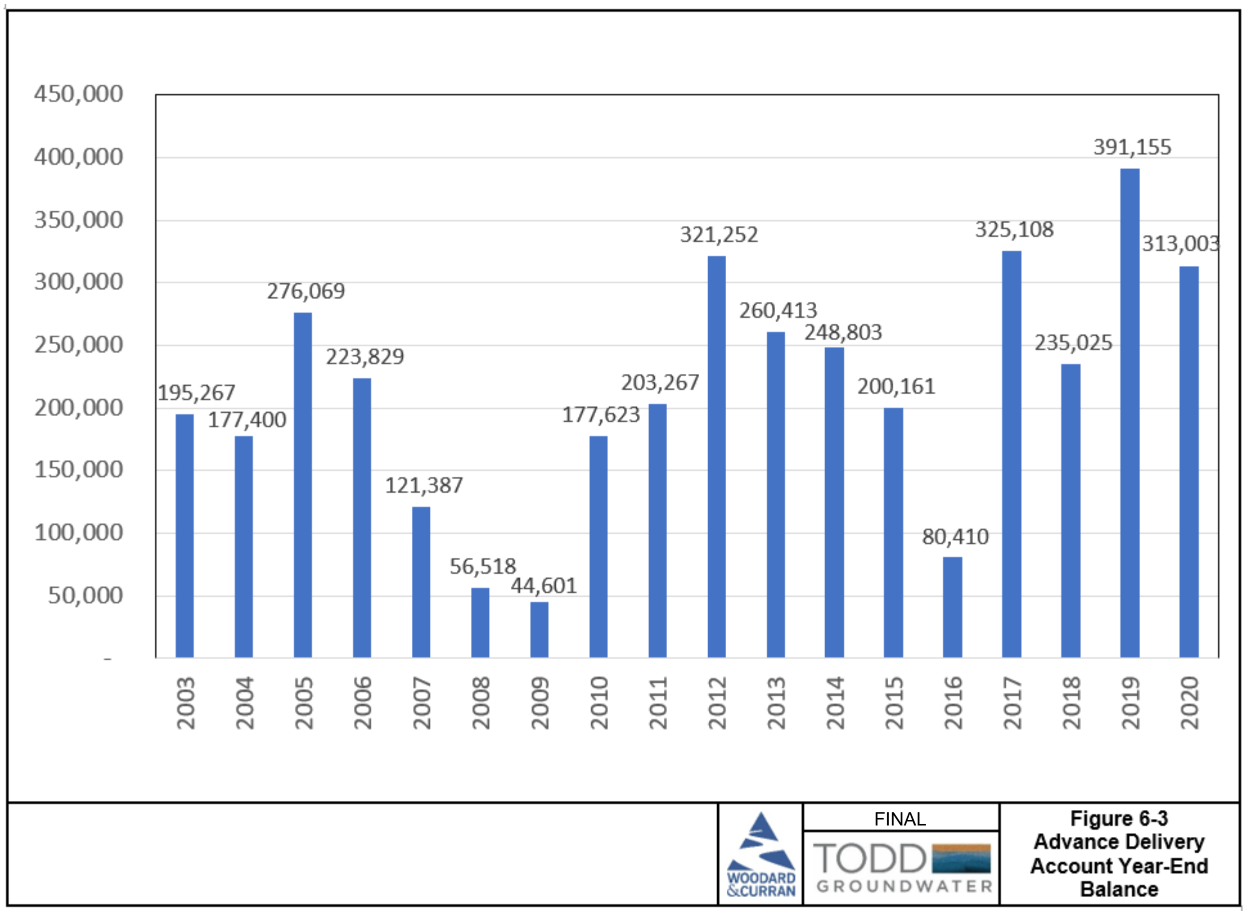
Article 21 water (described in Article 21 of the SWP water contracts), "Interruptible Water", is water that State Water Contractors may receive on a short-term basis in addition to their Table A water if they request it in years when it is available. Article 21 water is used by many Contractors to help meet demands in low allocation years. Article 21 water is not available every year, amounts vary when it is available, and is proportionately allocated among participating Contractors. The availability and delivery of Article 21 water cannot interfere with normal SWP operations and cannot be carried over for delivery in a subsequent year.

The State Water Contractors believe that as reliability increases over time with operation of the Delta Conveyance Facility (see description below), that Article 21 water will become more available to Contractors for purchase. This *Alternative Plan Update* assumes that once the Delta Conveyance Facility is constructed, approximately 10,600 AFY in Article 21 will be made available to DWA and CVWD annually.

6.5.3 Advance Deliveries

The 1984 *Advance Delivery Agreement* (amended in 2019 by the *Amended and Restated Agreement for Exchange and Advance Delivery of Water* [CVWD 2019a]) allows MWD to deliver up to 800,000 AFY of Colorado River water to be credited against its future SWP exchange water obligations. Advance deliveries of exchange water are highly variable and concentrated in wet years, with the Indio Subbasin providing the majority of storage. Figure 6-3 shows the year-end Advance Delivery Account balance for 2003 to 2020, with increases representing MWD's advance deliveries (water in excess of SWP exchange obligations) and decreases representing deductions taken from the account when MWD delivers previously stored water in lieu of SWP exchange water. As of January 2020, there was 353,946 AF stored in MWD's Advance Delivery account in the Indio Subbasin.

Figure 6-3. Advance Delivery Account Year-End Balance



6.5.4 Supply Reliability

SWP supplies vary annually due to weather and runoff variations in Northern California and regulatory limitations on exports from the Delta.

6.5.4.1 Delta Exports

The SWP's and Central Valley Project's (CVP; managed by USBR) exports from the Delta have decreased since 2005 due to several key environmental decisions. While the SWP primarily serves the State's population and economic growth, the CVP serves the State's agricultural industry. In 2005, the U.S. Fish and Wildlife Service (USFWS) released a Biological Opinion that Delta export (combined SWP and CVP) pumping operations would not jeopardize the continued existence of the Delta smelt, a small, endangered fish endemic to the Delta. Environmental groups challenged the action and in May 2007, federal Judge Oliver Wanger ruled that the Biological Opinion was faulty in its assumptions and needed to be performed again. In 2008, the USFWS and National Marine Fisheries Service (NMFS) released a new Biological Opinion that addressed Delta fisheries, restricting operations of the SWP and CVP diversion pumps. In 2009, Wanger struck down the USBR acceptance of the new Biological Opinion, saying USBR failed to comply with the National Environmental Policy Act (NEPA) related to cutbacks in water exports for Central Valley farmers.

In 2009, the *Sacramento-San Joaquin Delta Reform Act of 2009* (Delta Reform Act) established the Delta Stewardship Council to create a comprehensive, long-term, legally enforceable plan to guide management of the Delta's water and environmental resources. *The Delta Plan* (Delta Stewardship Council, 2013) includes policies and recommendations to achieve the "coequal goals," which means the two goals of providing more reliable water supply for California *and* protecting, restoring, and enhancing the Delta ecosystem. In 2016, USBR and DWR developed the California WaterFix, a twin-tunnels alternative for conveying flows across the natural channels of the Delta, focused on conveyance and ecosystem improvements to significantly reduce reverse flows and fish species impacts associated with the existing south Delta intakes. In 2019, USFWS and NMFS issued revised *Biological Opinions* (USFWS, 2019) to address California WaterFix. Concurrently, USBR issued the *2018 Addendum* (USBR, 2018) to the *1986 Coordinated Operations Agreement* (USBR, 1986) with accompanying SWP and CVP operations changes which reduced SWP exports and increased CVP exports, along with more conservative operation of Lake Oroville. Most recently, in 2019, Governor Newsom directed state agencies to proceed with modernizing Delta conveyance with a single tunnel project (see DCF description below).

6.5.4.2 SWP Reliability

State Water Contractors are required to submit annual delivery schedules to the DWR for a suite of potential water allocations; for example, 15 percent, 30 percent, 50 percent, 60 percent, and 100 percent were provided for calendar year 2021. DWR makes an initial SWP Table A allocation for planning purposes, typically in December, prior to the start of each calendar year. Throughout the year, as additional information regarding water availability becomes available and DWR performs hydrologic analyses, the SWP allocation and delivery estimates are updated. Typically, the final SWP allocation for the year is derived by June, and although not typical, can still be updated into the Fall. Table 6-5 presents the historical draft and final Table A allocations over the past 20 years (i.e., 2002 to 2021). Note that CVWD's and DWA's contracted Table A amounts increased substantially in 2005 and again in 2010.

Final SWP allocations between 2002 and 2021 have ranged from a high of 100 percent in 2006 to a low of five percent in 2014 and again in 2021. Figure 6-4 shows the variability of Table A allocations for the period

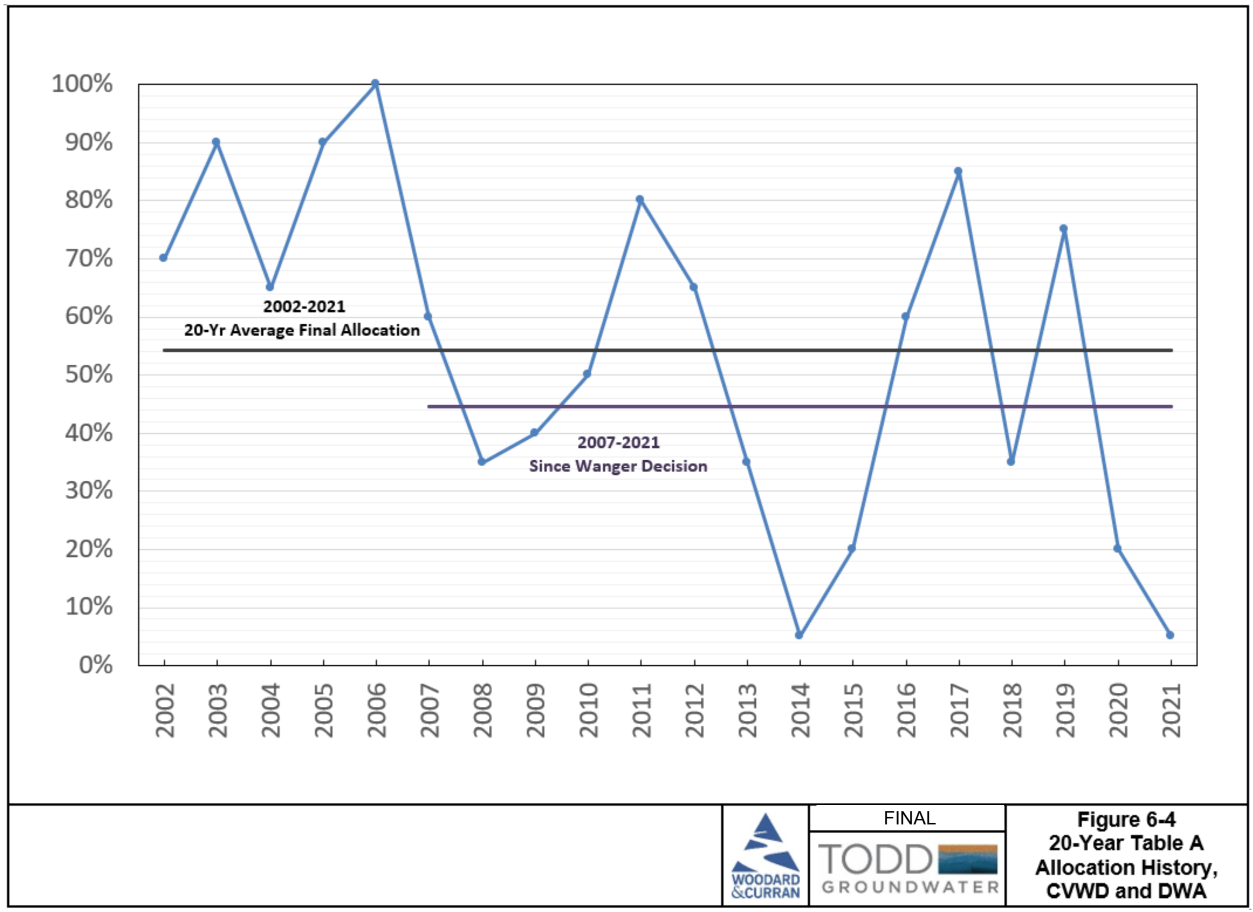
2002 through 2021. The reliability of SWP deliveries has declined since 2007 when Judge Wanger overturned the Biological Opinion regarding Delta export pumping operations. This decision significantly impacted DWR's ability to convey SWP supplies across the Delta for export. Since the 2007 Wanger decision, SWP final allocations have averaged 45 percent annually. This period has also been marked by six critically dry years.

Table 6-5. Historical SWP Table A Allocations, CVWD and DWA (2002-2021)

Year	100% Table A Volume Max Contract (AFY)[a]	Water Year Type	SWP Initial Allocation (%)	SWP Final Allocation (%)
2002	61,200	Dry	20%	70%
2003	61,200	Above Normal	20%	90%
2004	71,100	Below Normal	35%	65%
2005	171,100	Above Normal	40%	90%
2006	171,100	Wet	55%	100%
2007	171,100	Dry	60%	60%
2008	171,100	Critically Dry	25%	35%
2009	171,100	Dry	15%	40%
2010	194,100	Below Normal	5%	50%
2011	194,100	Wet	25%	80%
2012	194,100	Above Normal	60%	65%
2013	194,100	Critically Dry	30%	35%
2014	194,100	Critically Dry	5%	5%
2015	194,100	Critically Dry	10%	20%
2016	194,100	Above Normal	10%	60%
2017	194,100	Above Normal	20%	85%
2018	194,100	Critically Dry	15%	35%
2019	194,100	Above Normal	10%	75%
2020	194,100	Below Normal	10%	20%
2021	194,100	Critically Dry	5%	5%
20-year Average	**--**	**--**	**24%**	**54%**
14-Year Average Since Wanger	**--**	**--**	**20%**	**45%**

[a] Source: DWR 2018, Bulletin 132-18, Appendix B Table B-4
[b] Source: DWR 2018, Bulletin 132-18, Appendix B Table B-5B

Figure 6-4. 20-Year Table A Allocation History, CVWD and DWA



DWR's *Final SWP Delivery Capability Report 2019* (DWR, 2020a) was released in August 2020. The delivery reliability of water from the SWP system is an important component for the SWP Contractors' water supply planning. SWP delivery amounts were modeled for the *2019 SWP Delivery Capability Report* using the CalSim II simulation model that incorporates the historical range of hydrologic conditions from Water Years 1922 through 2003. DWR's analysis determined that long-term average SWP deliveries across all water years through 2015 was 2,414,000 AF, or 58 percent of the maximum of the 4,133,000 AFY available for export from the Delta. [3] Table 6-6 provides a summary of the SWP delivery amounts for existing conditions using the CalSim II modeling for the *2019 SWP Delivery Capability Report*. By using this 82-year historical flow record, the delivery estimates modeled for existing conditions reflect a reasonable range of potential hydrologic conditions from wet years to critically dry years.

[3] While 4,173,000 AFY is the current combined maximum Table A mount, 4,133,000 AFY is the SWP's maximum Table A water available for export from the Delta excluding Butte County and Yuba City (DWR, 2020a).

Table 6-6. Estimated Average, Wet-, and Dry-Period Deliveries of SWP Table A Water

	Estimated SWP Table A Deliveries (AFY)	Percent of Maximum SWP Table A for Export (4,133,000 AFY)
Long-term Average	2,414,000	58%
Wet Periods		
Single Wet Year (1983)	4,008,000	97%
2-Year (1982-1983)	3,750,000	91%
4-Year (1980-1983)	3,330,000	81%
6-Year (1978-1983)	3,210,000	78%
10-Year (1978-1987)	2,967,000	72%
Dry Periods		
Single Dry Year (1977)	288,000	7%
2-Year Drought (1976-1977)	1,311,000	32%
4-Year Drought (1931-1934)	1,228,000	30%
6-Year Drought (1987-1992)	1,058,000	26%
8-Year Drought (1929-1936)	1,158,000	28%

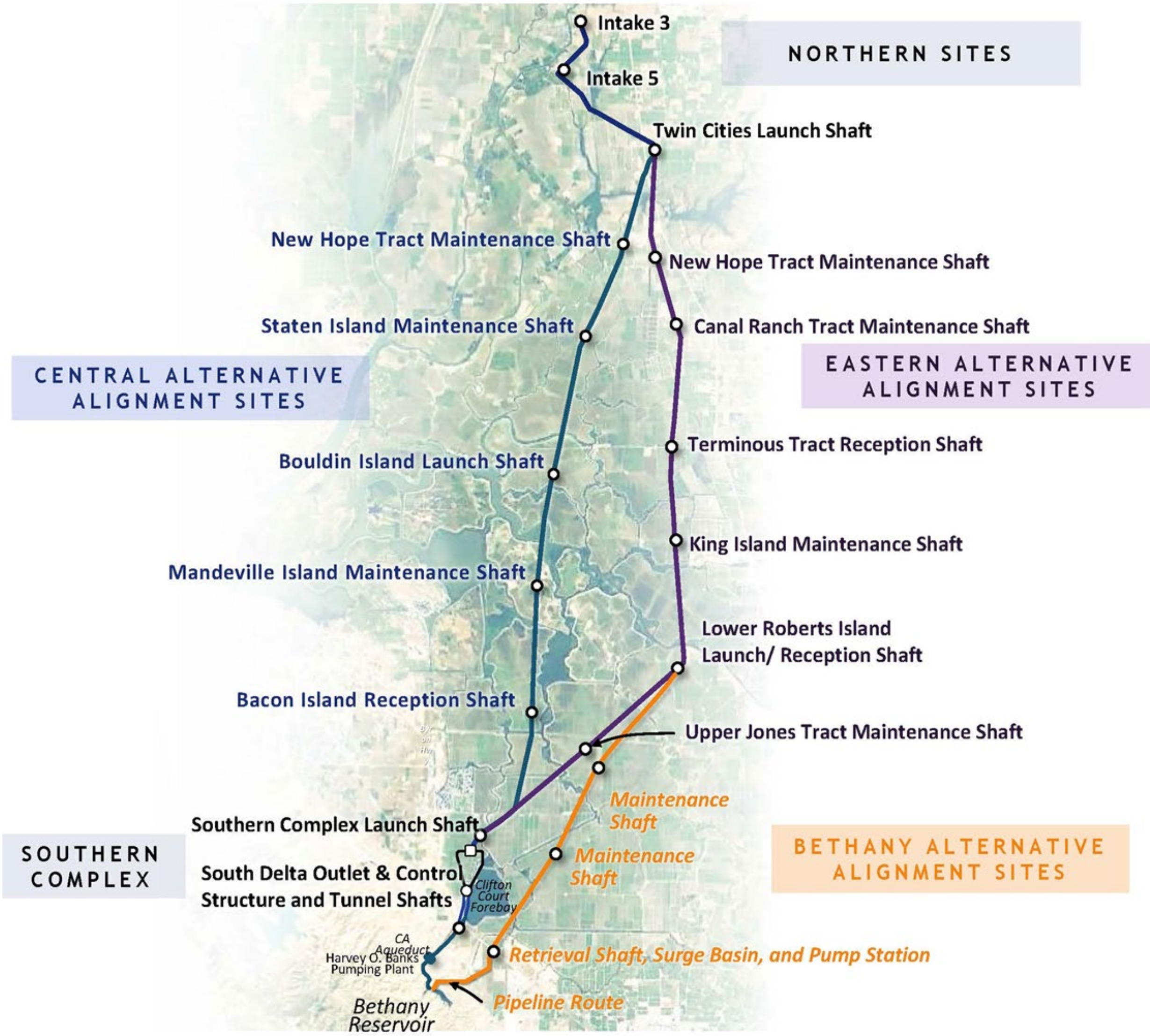
Source: 2019 SWP Delivery Capability Report (DWR, 2020a)

DWR's analysis further showed a decreasing trend seen in the future long-term average. The *Technical Addendum to the 2019 SWP Delivery Capability Report* (DWR, 2020b) provides a "Future Conditions with Climate Change and 45 cm Sea Level Rise Scenario" which projects a further decrease in SWP delivery over time. Although the *2019 SWP Delivery Capability Report* estimates delivery reliability of 58 percent based on the long-term average, this *Alternative Plan Update* recognizes the significant reduction in reliability associated with climate change and Delta export litigation and instead assumes 45 percent reliability through the planning horizon.

6.5.5 Delta Conveyance Facility

The Delta Conveyance Facility (DCF) is a DWR project that would improve SWP reliability and result in increased deliveries in the future. The existing SWP water conveyance facilities in the Delta, which include Clifton Court Forebay and the Banks Pumping Plant, enable DWR to divert water to the California Aqueduct. The DCF project includes the construction and operation of new conveyance facilities in the Delta, primarily a new tunnel to bypass existing natural channels used for conveyance. New intake facilities would be located in the north Delta along the Sacramento River between Freeport, California, and the confluence with Sutter Slough. A new tunnel would convey water from the new intakes to the existing Banks Pumping Plant and potentially the federal Jones Pumping Plant, both in Byron, California, in the south Delta. The new facilities would provide an alternate location for diversion of water from the Delta and would be operated in coordination with the existing south Delta pumping facilities (see Figure 6-5).

Figure 6-5. Delta Conveyance Facility – Proposed Corridor Options



Source: DCA Board of Directors Special Meeting, February 2021

Construction of the DCF will improve water supply reliability for State Water Contractors by addressing in-Delta conveyance, with its myriad of constraints. Because the SWP currently relies on the Delta's natural channels to convey water, it is vulnerable to earthquakes, climate change, and pumping restrictions established to protect in-stream species and habitats. Certain pumping restrictions in the south Delta can prevent the SWP from reliably capturing water when it is available, especially in wet weather. The DCF would add new diversions in the north Delta to promote a more resilient and flexible SWP in the face of unstable future conditions. Combined with the current through-Delta method, the addition of DCF is referred to as the "dual conveyance" system.

CVWD and DWA have approved a 2-year agreement to advance their share of funding for DCF planning and design costs. The *Agreement in Principle for the Delta Conveyance Facility* was approved in November 2020, as outlined in Table 6-7 below. A very preliminary estimate of the DCF benefits is 500,000 AFY. DWA and CVWD approved their participation levels of 1.52 percent and 3.78 percent, respectively. This restores

26,500 AFY in SWP deliveries to CVWD and DWA over and above current conditions, allocated between 60 percent to Table A and 40 percent to Article 21. With DCF construction, SWP reliability is anticipated to increase to 59 percent as an annual average. DCF deliveries are assumed to begin in year 2040.

Table 6-7. DCF Supply Amounts

Description	CVWD	DWA	Total
DCF Additional Supply (%)	3.78%	1.52%	5.30%
Annual Estimate (AFY)	**18,900**	**7,600**	**26,500**
Table A Supply (AFY)	11,340	4,560	15,900
Article 21 Supply (AFY)	7,560	3,040	10,600

6.5.6 Lake Perris Dam Seepage Recovery Project

In 2017, MWD and DWR began preliminary planning for recovery of seepage below the Lake Perris Dam and delivery of the recovered water to MWD in addition to its current allocated Table A water. The project is composed of installing a series of five pumps placed down-gradient from the face of the Lake Perris Dam that will pump water that has seeped from the lake into the groundwater. The recovered water will be pumped into a collection pipeline that discharges directly into MWD's Colorado River Aqueduct south of Lake Perris.

CVWD and DWA were invited to partner in the project with MWD, and the parties signed an agreement with DWR in 2021 for funding of environmental analysis, planning, and preliminary design. An additional agreement (or amendment to the existing *Exchange Agreement*) will be needed to exchange a proportional share of the recovered seepage water, as outlined in Table 6-8 below, for Colorado River water delivered by MWD to WWR-GRF and MC-GRF (MWD, 2020) through MWD's Colorado River Aqueduct. The project is estimated to recover approximately 7,500 AFY, with 2,752 AFY for delivery to CVWD and DWA, and is anticipated to begin delivery in 2023.

Table 6-8. Lake Perris Seepage Recovery Amounts

Description	MWD	CVWD	DWA	Total
Percent of Lake Perris Dam Seepage Recovery (%)	63.30%	32.3%	4.4%	100%
Annual Estimate (AFY)	4,747	2,425	328	7,500

6.5.7 Sites Reservoir Project

The Sites Reservoir Project would capture and store stormwater flows from the Sacramento River for release in dry years. Sites Reservoir would be situated on the west side of the Sacramento Valley, approximately 10 miles west of Maxwell, CA. When operated in coordination with other Northern California reservoirs such as Shasta, Oroville, and Folsom, which function as the backbone to both the SWP and the Central Valley Project, Sites Reservoir would increase flexibility and reliability of statewide water supplies in drier periods.

In 2019, CVWD and DWA both entered into an agreement with the Sites Project Authority for the next phase of planning for the Sites Reservoir (Sites Project Authority, 2019; 2020). The Sites Project Authority's goals are to make water supply and storage capacity available to water purveyors within the Sacramento River watershed, and in other areas of California, who are willing to purchase water supply from the Sites

Reservoir Project. CVWD and DWA are participating members at 10,000 AFY and 6,500 AFY levels, respectively, as shown in Table 6-9. This *Alternative Plan Update* assumes approximately 30 percent conveyance losses, for total delivery of 11,550 AFY to CVWD and DWA beginning in 2035.

Table 6-9. Sites Reservoir Supply Amounts

Description	CVWD	DWA	Total
Percent of Sites Reservoir Supply (%)	5.2%	3.4%	8.6%
Annual Estimate (AFY)	10,000	6,500	16,500

6.5.8 SWP Delivery to Subbasins

All SWP Exchange water delivered to DWA and CVWD is recharged at WWR-GRF in the Indio Subbasin and at MC-GRF in the Mission Creek Subbasin. According to the *2014 Mission Creek Water Management Agreement* (CVWD and DWA, 2014), this includes any water that is paid for or planned to be paid for by the SWP tax or split between the RAC paid by groundwater producers in the West Whitewater River Subbasin Management Area (which includes CVWD's West Whitewater River Subbasin Area of Benefit [AOB] and DWA's West Whitewater River Subbasin AOB) and the Mission Creek Subbasin Management Area (which includes CVWD's Mission Creek Subbasin AOB and DWA's Mission Creek Subbasin AOB). As such, this includes Table A, Article 21, and Yuba Accord water, in addition to any future increase in Table A reliability (i.e., DCF), Lake Perris Seepage, and Sites Reservoir. Available SWP Exchange water allocated to MC-GRF and WWR-GRF is based on proportional assessable production between the Mission Creek Subbasin Management Area and the West Whitewater River Subbasin Management Area, to be balanced over a 20-year period beginning December 2004. In 2020, total assessable production in the Mission Creek Subbasin Management Area (inclusive of CVWD's Mission Creek AOB and DWA's Mission Creek AOB) was 14,244 AF, while total assessable production in the West Whitewater River Subbasin Management Area (again inclusive of CVWD's West AOB and DWA's West AOB) was 153,979 AF (CVWD 2020). Based on a cumulative total of 168,223 AF in assessable production between the two management areas, this resulted in an 8 percent/92 percent split between the Mission Creek and West Whitewater River management areas in 2020. As shown in Table 6-10, the projected allotment of SWP exchange water to the two management areas was calculated as 8 to 10 percent to MC-GRF and 90 to 92 percent to WWR-GRF. Urban growth and associated water demand in the Mission Creek Subbasin will result in slightly more SWP Exchange water being delivered to that Subbasin over time. This *Alternative Plan Update* is coordinated with the *Mission Creek Subbasin Alternative Plan Update* to establish production estimates and associated SWP delivery estimates for the two management areas through 2045 planning horizon.

Table 6-10. Forecast Split of SWP Delivery to WWR-GRF and MC-GRF Based on Production

Assessable Production	2020	2025	2030	2035	2040	2045
West WWR Management Area (AFY)	150,336	155,338	160,640	165,955	170,754	175,202
% West WWR Management Area	92%	92%	91%	91%	91%	90%
Mission Creek Management Area (AFY)	13,281	14,369	15,455	16,543	17,717	18,892
% Mission Creek Management Area	8%	8%	9%	9%	9%	10%
Total West WWR + Mission Creek (AFY)	**163,617**	**169,707**	**176,095**	**182,498**	**188,471**	**194,093**

6.5.9 Use of SWP Exchange Water

This *Alternative Plan Update* accounts for all anticipated SWP Exchange water to be recharged at WWR-GRF and MC-GRF (as described above) to ensure that all available supply is used. In order to fully use available SWP exchange supplies, the GSAs will continue to replenish groundwater at maximum delivery levels and pursue additional SWP supplies as they become available. This *Alternative Plan Update* considers two SWP Exchange delivery scenarios:

1) **Historical hydrology conditions** – Table A deliveries at 45 percent through 2045 based on average SWP reliability since the 2007 Wanger decision and uncertainty about the future of Delta exports. These assumptions are used only in the baseline scenario in Chapter 7, *Numerical Model and Plan Scenarios*.
2) **Climate change conditions** – Table A deliveries at 45 percent in 2020 based on the 2007 Wanger decision, then reduced by -1.5 percent through straight line projection from 2020 to 2045 due to forecast climate changes. These assumptions are used in all future project scenarios in Chapter 7, *Numerical Model and Plan Scenarios*.

Scenario modeling described in Chapter 7, *Numerical Model and Plan Scenarios,* assumes annual variability of Table A deliveries associated with different projected climate years. However, Yuba Accord, Lake Perris Seepage, Sites Reservoir, and DCF supplies are assumed at their full anticipated amounts each year. The projected estimates for all potential SWP Exchange supplies are shown in Table 6-11.

Table 6-11. Forecast of SWP Table A Supplies to WWR-GRF and MC-GRF

Existing SWP Supplies	2020	2025	2030	2035	2040	2045
Table A Amount	194,100	194,100	194,100	194,100	194,100	194,100
Assumed SWP Reliability	45%	45%	45%	45%	45%	45%
Average Table A Deliveries w/Assumed SWP Reliability	**87,345**	**87,345**	**87,345**	**87,345**	**87,345**	**87,345**
Yuba Accord	651	651	651	651	651	651
Sum of Existing SWP Supplies	**87,996**	**87,996**	**87,996**	**87,996**	**87,996**	**87,996**
Estimated Replenishment (AFY)[a]						
WWR-GRF Replenishment	80,853	80,546	80,273	80,019	79,724	79,431
MC-GRF Replenishment	7,143	7,450	7,723	7,977	8,272	8,565
Future SWP Supplies						
Lake Perris Seepage	0	2,752	2,752	2,752	2,752	2,752
Sites Reservoir	0	0	0	11,550	11,550	11,550
Delta Conveyance Facility (Additional SWP Table A/Article 21)	0	0	0	0	0	26,500
Sum of Existing + Future SWP Supplies	**88,647**	**91,399**	**91,399**	**102,949**	**102,949**	**129,449**
Estimated Replenishment (AFY)[a]						
WWR-GRF Replenishment	81,451	83,660	83,377	93,617	93,272	116,849
MC-GRF Replenishment	7,196	7,739	8,022	9,332	9,677	12,600

[a] Additional 35,000 AFY MWD/SWP Transfer under the QSA is accounted for under Colorado River water above (see Table 6-3) and though replenished at WWR-GRF, that supply is not accounted for in replenishment volumes in this table.

6.6 Recycled Water

Recycled water is a reliable local resource that can be used to help offset groundwater pumping. Recycled water has been used for golf course irrigation in the Indio Subbasin since the late 1960s. There are currently eight wastewater treatment plants (WWTPs) or water reclamation plants (WRPs) within the Plan Area, with a ninth in construction by Mission Springs Water District (MSWD). Table 6-12 lists the projected wastewater flow at each of the nine facilities within the planning horizon. Within each treatment plant's tributary area, projected wastewater flows are generally equal to an average 31 percent return-to-sewer ratio for projected municipal water demands, which are described in Chapter 5*, Demand Projections*. This return-to-sewer ratio is based on the most recent 5-year average (2015-2019) of each WRP's municipal demands and wastewater flows. CVWD and DWA currently deliver recycled water from three of the WRPs for municipal and golf course irrigation use in the East and West Valley.

Table 6-12. Projected Wastewater Flow in Plan Area (AFY)

WWTP/WRP[a]	2020	2025	2030	2035	2040	2045
MSWD Regional WRF	0	1,000	1,600	2,200	2,800	3,360
Palm Springs WWTP/DWA WRP	6,100	6,600	7,200	7,800	8,400	9,000
CVWD WRP-10	9,800	10,800	11,600	12,300	13,100	14,000
CVWD WRP-7	3,800	4,200	4,500	4,800	5,100	5,400
CVWD WRP-4	6,200	6,700	7,400	8,200	8,800	9,500
CVWD WRP-2	14	14	14	14	14	14
Coachella WRP[b]	3,700	4,600	5,500	6,500	7,500	8,500
VSD WWTP	7,100	7,700	8,300	8,900	9,300	9,700
Kent SeaTech	6,640	6,640	6,640	6,640	6,640	6,640
Total	**43,354**	**48,254**	**52,754**	**57,354**	**61,654**	**66,114**

[a] Wastewater from areas outside of current WRP tributary areas are accounted for in return flows from septic systems.
[b] Coachella WRP includes decommissioning of agricultural ponds in 2025 (380 AFY).

CVWD operates WRP-7 and WRP-10, which currently generate recycled water for irrigation of golf courses and large landscaped areas. DWA's WRP treats secondary supply from the City of Palm Springs WWTP for delivery to irrigation customers. Table 6-13 provides a summary of recycled water currently in use based on the 2-Year average from 2018 to 2019.

Table 6-13. Recycled Water Supply Based on 2018-2019 Wastewater Flows (AFY)

--	Palm Springs WWTP/ DWA WRP[a]	CVWD WRP-10	CVWD WRP-7	Total
AFY of Tertiary Capacity	11,200	16,800	2,800	30,800
Wastewater Treated	6,613	9,884	3,261	19,757
Recycled Water Use (Delivery + Onsite)	4,599	7,783	2,201	14,584

[a] DWA WRP recycled water use does not reflect conversion of two golf courses in 2020 from recycled water to groundwater. Recycled water use after those conversions is estimated at 3,413 AFY.

6.6.1 MSWD Regional WRF

MSWD has completed design of the Regional WRF to treat wastewater flows to secondary levels including nitrification and denitrification. The Regional WRF will be located in the Garnet Hill Subarea and will divert some wastewater flows from existing WWTPs located in the Mission Creek Subbasin that are at capacity. The Regional WRF will have an initial capacity of 1.5 million gallons per day (mgd) (1,680 AFY) with construction beginning in 2021. The Regional WRF will start receiving flow in 2022 and is projected to reach 1.5 mgd treatment capacity by approximately 2030. Wastewater flows will be from existing sewered customers and from the septic to sewer conversions in the Desert Hot Springs Subbasin, Mission Creek Subbasin, and Garnet Hill Subarea of the Indio Subbasin.

Treated wastewater will be discharged to evaporation/percolation ponds in the Garnet Hill Subarea. Growth projected by 2045 is expected to provide wastewater flows to a buildout capacity of 3 mgd (3,360 AFY) available for recycling. However, future use of recycled water from the Regional WRF is expected to occur in the Mission Creek Subbasin.

6.6.2 Palm Springs WWTP/DWA WRP

DWA WRP has a tertiary treatment capacity of 10 mgd (11,200 AFY).

DWA WRP, located in the City of Palm Springs, has a tertiary treatment capacity of 10 mgd (11,200 AFY). DWA provides tertiary treatment of secondary treated supply from the City of Palm Springs's WWTP for irrigation of parks and greenscapes in the Palm Springs area. The average annual wastewater flow from 2018 to 2019 was approximately 6,613 AFY, while recycled water demand totaled 4,599 AFY. With existing wastewater flows and available tertiary treatment capacity, this facility could produce approximately 2,014 AFY of additional recycled water supply. In 2020, two existing 18-hole golf courses converted from using recycled water to groundwater, which reduced DWA's recycled water demands to approximately 3,200 AFY and increased DWA's availability of wastewater flows for recycling to 3,413 AFY. Growth projected by 2045 is expected to provide an increase of 1,566 AFY of additional wastewater flow available for recycling, based on projected indoor water use.

6.6.3 CVWD WRP-10

CVWD WRP-10 is located in the City of Palm Desert. The plant is a 18.0 mgd secondary treatment facility with a current tertiary treatment capacity of 15 mgd (16,800 AFY). The plant consists of an activated sludge treatment plant, a tertiary wastewater treatment plant, a lined holding basin, 6 storage basins and 21 infiltration basins. WRP-10 delivers recycled water for irrigation of golf courses and homeowner's associations (HOAs) landscaping. The average annual wastewater flow from 2018 to 2019 was approximately 9,884 AFY, while recycled water demand averaged 7,783 AFY. With existing wastewater flows and available tertiary treatment capacity, this facility could produce approximately 2,100 AFY of additional recycled water supply. Growth projected by 2045 is expected to provide an increase of

5,828 AFY of additional wastewater flow available for recycling, based on projected indoor water use, but would require expansion of the non-potable water distribution system with new connections.

6.6.4 CVWD WRP-7

CVWD's WRP-7 is located in north Indio. The plant is a 5.0 mgd secondary treatment facility with current tertiary treatment capacity of 2.5 mgd (2,800 AFY). The tertiary treated wastewater is used for irrigation of golf courses at Sun City in north Palm Desert and Shadow Hills in north Indio. The plant consists of aeration basins, circular clarifiers, and polishing ponds. Recycled water not used for irrigation is percolated at on-site and off-site percolation ponds. The average annual wastewater flow from 2018 to 2019 was approximately 3,261 AFY, while recycled water demand averaged approximately 2,200 AFY. With existing wastewater flows and available tertiary treatment capacity, this facility could produce approximately 600 AFY of additional recycled water supply (tertiary capacity is the limiting factor). Growth projected by 2045 is expected to provide an increase of 3,016 AFY of additional wastewater flow available for recycling, based on projected indoor water use, but would require expansion of the tertiary capacity of the WRP-7 plant and expansion of the non-potable water distribution system with new connections.

CVWD is planning to expand its WRP-7 tertiary treatment capacity by 3 mgd (5.5 mgd or 6,150 AFY total) with the addition of flocculation tanks, chemical feed, gravity multi-media filters, and associated pumps. Design is underway for the WRP-7 expansion, with construction anticipated in 2025. The WRP-7 expansion is described in Chapter 11, *Projects and Management Actions*. However, given that new connections have not yet been identified for this supply, delivery of the recycled water has not been assumed in this supply forecast.

6.6.5 CVWD WRP-4

CVWD's WRP-4 has a secondary treatment capacity of 9.9 mgd (11,090 AFY) and has a planned tertiary expansion.

CVWD WRP-4 is a 9.9 mgd (11,090 AFY) secondary treatment facility located in the unincorporated community of Thermal. The average annual wastewater flow from 2018 to 2019 was approximately 5,482 AFY. WRP-4 provides secondary treatment consisting of pre-aeration ponds, aeration lagoons, polishing ponds, and disinfection. The treated effluent is currently discharged to the CVSC pursuant to a National Pollution Discharge Elimination System (NPDES) permit. However, CVWD has submitted a Change Petition (WW0093) and plans to construct tertiary treatment and begin delivery of recycled water. Growth projected by 2045 is expected to provide a total of 11,082 AFY of wastewater flow that could be tertiary treated and reused within the Planning Area, but would require construction of both tertiary treatment and new non-potable system connections.

CVWD is planning to construct WRP-4 tertiary treatment capacity in phases starting at 2.5 mgd (2,800 AFY) in 2025, then increasing to 5.0 mgd (5,600 AFY) in 2028 and 10.0 mgd (11,200 AFY) by 2031. Design is underway for the WRP-4 tertiary expansion, with construction anticipated in 2025. The WRP-4 expansion is described in Chapter 11*, Projects and Management Actions*. CVWD has filed a wastewater change petition with the State Water Resources Control Board (WW0093) pursuant to Water Code section 1211. The petition seeks authorization to cease the discharge of treated wastewater from WRP-4 to the CVSC. CVWD plans to initiate project-specific environmental review in 2022 to support this change petition.

6.6.5.1 CVWD WRP-2

CVWD WRP-2 is a small treatment plant serving the nearby community of North Shore. WRP-2 has a secondary treatment capacity of 0.18 MGD (202 AFY). Because this WRP serves an existing built-out community, wastewater flows are expected to remain the same as the 2018 to 2019 average of 14 AFY through 2045.

6.6.6 Valley Sanitary District WWTP

Valley Sanitary District (VSD) owns and operates an 11 mgd (12,320 AFY) capacity wastewater treatment facility that serves most of the City of Indio. The average annual wastewater flow from 2018 to 2019 was approximately 6,644 AFY. Secondary treatment is provided by three process trains – activated sludge, oxidation ponds, and wetlands treatment. Effluent from the oxidation ponds and the wetlands is either routed to pasture irrigation or blended with activated sludge effluent, disinfected, dechlorinated, and discharged to the CVSC. Growth projected by 2045 is expected to provide a total of 8,052 AFY of wastewater flow that could be tertiary treated and reused within the Planning Area but would require construction of both tertiary treatment and new non-potable system connections.

VSD and IWA have established a joint powers authority, East Valley Reclamation Authority (EVRA), to implement water reuse in the Indio area. EVRA is currently evaluating the feasibility of developing a potable reuse project that would replenish the Indio Subbasin with 5,000 AFY of advance treated recycled water beginning in 2030. The EVRA potable reuse project is described in Chapter 11, *Projects and Management Actions*.

6.6.7 Coachella Sanitary District WWTP

The City of Coachella through its Coachella Sanitary District owns and operates a 4.5 mgd (5,040 AFY) secondary treatment wastewater facility utilizing activated sludge and oxidation ditch processes. Treated wastewater is discharged to the CVSC. The average annual wastewater flow from 2018 to 2019 was approximately 3,007 AFY. Growth projected by 2045 is expected to provide a total of 9,667 AFY of wastewater flow that could be tertiary treated and reused within the Planning Area but would require construction of both tertiary treatment and new non-potable system connections. The City of Coachella currently has no plans to pursue water recycling.

6.6.7.1 Kent SeaTech

Kent SeaTech is a fish farm with total design flow of 10.5 mgd. The current wastewater treatment system consists of a channel stocked with tilapia to remove solids, and an earthen “constructed wetland” system that provides further nitrification, denitrification, fine solids polishing, alkalinity restoration, and temperature buffering. The wetland is bypassed from the treatment process during the colder winter months to maintain system-wide warm temperatures for fish production. Water that is not recirculated, reused, or land applied is discharged to the CVSC. The average annual wastewater flow discharged to CVSC from 2018 to 2019 was approximately 6,639 AFY.

6.7 Planned Water Reuse

Table 6-14 below provides forecasted recycled water deliveries at the three WRPs that currently reuse water. These estimates are based on existing tertiary capacity and planned recycled water connections listed in the GSAs 5-year capital programs and include current water reuse plus increases in wastewater flows anticipated with municipal growth (described in Chapter 5*, Demand Projections*). These potential supplies would require construction of new non-potable distribution pipelines and facilities (see Chapter 11*, Projects and Management Actions*).

Table 6-14. Planned Water Reuse at WRPs with Tertiary Capacity (AFY)

WWTP/WRP	2020	2025	2030	2035	2040	2045
Palm Springs WTP/DWA WRP	3,413	3,413	3,413	3,413	3,413	3,413
CVWD WRP-10	7,783	10,800	11,600	12,300	13,100	14,000
CVWD WRP-7	2,201	2,800	2,800	2,800	2,800	2,800
Total	**13,398**	**17,013**	**17,813**	**18,513**	**19,313**	**20,213**

CVWD's goal is to recycle all wastewater that is currently percolated at its WRPs, except for WRP-2 serving an isolated community. CVWD's planned non-potable connections will expand deliveries from WRP-10 and WRP-7 within existing tertiary capacity and are reflected in Table 6-14 above. CVWD also has tertiary expansions planned for WRP-7 and WRP-4. In collaboration with VSD, IWA plans to advance treat and recycle 5,000 AFY of wastewater from the VSD WWTP for groundwater replenishment and reuse. MSWD plans to develop recycled water connections and groundwater recharge facilities in the Mission Creek Subbasin and convey treated recycled water from the Regional WRF to that Subbasin. Chapter 7, *Numerical Model and Plan Scenarios* describes these modeled future projects. Table 6-15 provides forecasted wastewater at the region's WWTPs and WRPs that may be available for recycling with addition of future treatment or distribution system expansions.

Table 6-15. Projected Wastewater Remaining for Future Reuse (AFY)

WWTP/WRP	2020	2025	2030	2035	2040	2045
MSWD Regional WRF	0	1,000	1,600	2,200	2,800	3,360
Palm Springs WTP/DWA WRP	2,687	3,187	3,787	4,387	4,987	5,587
CVWD WRP-10	2,017	0	0	0	0	0
CVWD WRP-7	1,599	1,400	1,700	2,000	2,300	2,600
CVWD WRP-4	6,200	6,700	7,400	8,200	8,800	9,500
CVWD WRP-2	14	14	14	14	14	14
Coachella WRP	3,700	4,600	5,500	6,500	7,500	8,500
VSD WWTP	7,100	7,700	8,300	8,900	9,300	9,700
Kent SeaTech	6,639	6,639	6,639	6,639	6,639	6,639
Total	**29,956**	**31,241**	**34,941**	**38,841**	**42,341**	**45,901**

6.7.1 Use of Recycled Water

The *Alternative Plan Update* recognizes the potential local water supply available in recycling wastewater. By 2045, a total of 62,753 AFY of wastewater flow could be available for recycling if the GSAs and other regional partners were to construct the necessary treatment and conveyance facilities. Full use of this potential recycled water supply would require construction of plant expansions or upgrades, along with distribution pipelines and facilities (see Chapter 11*, Projects and Management Actions*). Recycled water is considered a drought-proof supply that is not limited under climate change conditions. Recycled water deliveries are assumed to be the same in historical hydrology conditions and climate change conditions.

Water reuse can develop a new source of supply for non-potable irrigation demands and when highly treated for groundwater recharge, and offset pumping of groundwater that is the source of municipal supply. Where wastewater was disposed to land and percolated to groundwater, recycled water development offsets groundwater pumping, but reduces net return flows to the groundwater basin. Besides water supply availability benefits, reuse projects can also contribute to improving water quality in receiving groundwater and surface water bodies. For example, application of recycled water for agricultural and landscape irrigation can provide a source of nutrients that lessens the need to apply synthetic fertilizers. CVWD continues to pursue the goal of fully reusing urban wastewater for non-potable applications.

Recycled water (or blended non-potable water) is used on parks and open space in the Plan Area.

6.8 Other Supplies

CVWD and DWA, along with other local agencies, have investigated and will continue to pursue other water transfer opportunities.

6.8.1 Rosedale-Rio Bravo

In 2008, CVWD entered into an agreement with Rosedale-Rio Bravo Water Storage District (Rosedale Rio-Bravo) for a one-time transfer of 10,000 AF of Glorious Lands Company (GLC) water intended for a property development located in Riverside County within CVWD's boundary. In 2012, CVWD entered into an Assignment Agreement with GLC to take over GLC's water rights for the term of the 2005 Water Supply Agreement between GLC and Rosedale Rio-Bravo. The Assignment Agreement provides a total of 252,500 AF to CVWD from Rosedale Rio-Bravo through 2035. CVWD also entered into a letter agreement with MWD in 2012 for the delivery and exchange of up to 16,500 AFY of non-Table A SWP water that Rosedale Rio-Bravo provides to CVWD (CVWD, 2019a). The water from Rosedale Rio-Bravo is delivered to CVWD as exchange water from MWD at the WWR-GRF. In 2020, CVWD finalized a supplemental letter agreement with Rosedale Rio-Bravo and a Point of Delivery Agreement with DWR that increased the limit on the amount Rosedale Rio-Bravo can deliver to CVWD in any one year (from 16,500 to 20,000 AFY) but does not change the total volume delivered during the life of the agreement through 2035.

The balance of Rosedale Rio-Bravo water due to CVWD from 2020 to 2035 is 169,000 AFY or an annual average of 10,563 AFY. This is greater than the 10-year average of Rosedale Rio-Bravo deliveries, which is 7,750 AFY based on the 2010 to 2019 period. Rosedale Rio-Bravo deliveries are assumed to be the same in historical hydrology conditions and climate change conditions. No Rosedale Rio-Bravo supplies are assumed after year 2035.

6.9 Supply Risks and Uncertainties

The existing water supplies used in the Planning Area face risks and uncertainties that could affect long-term supply reliability. These risks and uncertainties include the extended drought in the southwestern United States and legal/regulatory decisions affecting vital contracts and water deliveries. In addition, climate change could impact both supplies and demands. Climate change is discussed in Chapter 8, *Regulatory and Policy Issues.*

6.9.1 Colorado River

Although CVWD's Colorado River supply has historically been fully reliable, the extended Colorado River drought prompted the seven Colorado River Basin states and entitlement holders to develop Drought Contingency Plans (DCPs) to reduce the risk of Colorado River reservoirs declining to critically low levels. The period of 2000 – 2019 was the lowest 20-year period in the historical natural flow record, which dates back to 1906 (USBR 2020a). As of 2019, the combined storage in key Colorado River Basin reservoirs, Lakes Powell and Mead, were at their lowest levels (around 30th percentile) since Lake Powell initially began filling in the 1960s. The Lower Basin DCP was designed to: a) require Arizona, California, and Nevada to contribute additional water to Lake Mead storage at specified reservoir elevations, and b) incentivize voluntary conservation of water to be stored in Lake Mead (USBR 2020a).

Implementation of the *Lower Basin Drought Contingency Plan Agreement* (*Lower Basin DCP*; USBR, 2019) may affect Colorado River water supply through the year 2026. In addition to criteria set in the *2007 Interim Guidelines*, the *Lower Basin DCP* establishes that certain Colorado River users in the Lower Basin, including CVWD, make DCP contributions if specific triggers are met between 2020 and 2026. CVWD agrees to contribute between 14,000 AF and 24,500 AF if the elevation of Lake Mead drops to between 1,045 feet and 1,030 feet before 2026. Negotiations of the *2027 Interim Guidelines* that will revisit and may extend these voluntary contributions began in 2021.

CVWD contributes approximately 60 percent of the overall Indio Subbasin water supply from the Colorado River. In the 5-year period from 2015-2019, Colorado River deliveries averaged 343,200 AFY, while water demands totaled 574,500 AFY. Participation in the *Lower Basin DCP* could reduce the amount of water available for groundwater recharge in the Plan Area. During the term of the *Lower Basin DCP*, if CVWD is asked to cutback, the cutback will be satisfied by reducing deliveries to the TEL-GRF.

CVWD will continue to monitor the supply conditions on the Colorado River, make appropriate adjustments to its operations, and actively participate in efforts to augment the water supplies of Colorado River.

6.9.2 SWP Exchange

DWR estimates the long-term average reliability of the SWP to be 58 percent declining to 52 percent by 2040 (DWR, 2020a). This decline will likely continue in the absence of programs to balance Delta environmental concerns and water supply needs. A majority of California's water originates in the Sierra Nevada Mountains as snowpack, eventually flowing through the Delta, where it is delivered to municipal and agricultural users. At the same time, the hundreds of miles of river channels that crisscross the Delta's farmed islands provide a migratory pathway for Chinook salmon and other native fish species. *The Delta Plan* (Delta Stewardship Council, 2013) has the "coequal goals" of providing more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The shift by the State of California from the twin-tunnels project (California WaterFix) to the single tunnel alternative (DCF) in early 2020 marks a compromise between environmental and water supply interests.

Implementation of the DCF is likely to increase SWP supply reliability by addressing climate resiliency, environmental and habitat protection, and seismic risk. The GSAs receive nearly 20 percent of overall Indio Subbasin water supply from the SWP. In the 5-year period from 2015-2019, SWP deliveries (minus Advance Deliveries) averaged 109,400 AFY while water demands totaled 574,500 AFY. DWR filed a Notice to Proceed for the DCF project in January 2020, is currently in the environmental review process, and expects a Final Environmental Impact Report (FEIR) in 2023. CVWD and DWA approved advancing their share of funding for the planning phase (2021 to 2024) of the project.

At this time, CVWD and DWA will continue participating in the DCF through the *Agreement in Principle for the Delta Conveyance Facility,* approved in November 2020, which will be used to create a Delta Conveyance Contract Amendment. The dual conveyance approach to SWP delivery supports the goals of Delta health and water supply reliability.

6.9.3 Surface Water

Surface water, including natural infiltration of watershed runoff, represents about 7 percent of the Indio Subbasin water supply. Although CVWD and DWA retain water rights to most of this surface water, there is uncertainty about potential changes in precipitation in the Whitewater River watershed due to climate change. DWR's modeled climate scenarios have indicated that the Whitewater River watershed will receive less watershed runoff under climate change conditions, reducing total runoff from 99 percent in 2030 to 92 percent in 2070. In this *Alternative Plan Update*'s climate change scenarios (see Chapter 7*, Numerical Model and Plan Scenarios*), additional reductions to surface water availability were based on recent local hydrologic conditions to assess impacts of climate change.

6.9.4 Recycled Water

Recycled wastewater has historically been used for irrigation of golf courses and urban landscaping in the Indio Subbasin. The existing WRPs that have tertiary wastewater treatment for recycled water supply currently deliver approximately two percent of the Subbasin's water supply (13,260 AFY of recycled water delivered over 2015-2019 period). The amount of wastewater available for reuse in the future primarily depends on growth in the Valley, along with the agencies' plans for construction of tertiary treatment and conveyance. However, the level of water conservation implemented in the future – particularly under the long-term conservation regulations anticipated from Assembly Bill 1668 (Friedman) and Senate Bill 606 (Hertzberg) – could reduce the amount of wastewater generated and available for reuse. Future waste discharge requirements will also dictate the level of treatment, and potentially volume of ongoing discharge, that would be required at the treatment plants. Thus, future growth, conservation, and water quality regulations will all dictate the amount of recycled water supply produced in the Indio Subbasin.

This *Alternative Plan Update* also acknowledges the financial challenges associated with expansion of the non-potable water treatment and distribution systems. Expansion of the recycled water systems throughout the Indio Subbasin is primarily dependent on availability of grant and loan funding for capital improvements. Despite this challenge, the GSAs will continue to pursue water reuse projects that reduce groundwater pumping and maximize use of local water.

6.10 Summary

The Indio Subbasin has both imported water and local water sources in its current water supply portfolio. This available water supply portfolio will be used to meet growing demands – municipal, agriculture, golf, and other demands as described in Chapter 5, *Demand Projections* – and to achieve groundwater sustainability. The water budgets described in Chapter 7*, Numerical Model and Plan Scenarios,* provide a deeper understanding of some of the demand and supply uncertainties and associated management actions that will help to meet growing demand and achieve groundwater sustainability. Chapter 11*, Projects and Management Actions,* summarizes the management actions and capital projects that may need to be implemented to achieve basin sustainability and meet future demands. After Plan adoption, the GSAs will prepare Annual Reports to evaluate their demands, supplies, and groundwater conditions to understand when those projects must be implemented.

A summary of the projected currently available and future water supplies is presented in Table 6-16**.** The Indio GSAs are committed to achieving sustainability under changing climate conditions and is planning for supply limitations anticipated for both local and imported supplies. Figure 6-6 shows the supply projection with available supplies under climate change conditions. Figure 6-7 shows the supply projection with potential future supplies under climate change conditions. This summary documents available imported and local surface water supplies and does not include the groundwater supply; the available groundwater supply will vary under different management conditions and is quantified in Chapter 7*, Numerical Model and Plan Scenarios*. The uncertainties surrounding both imported and local water supplies make it important that this *Alternative Plan* Update continue to implement a management strategy that sustainably manages the groundwater basin through new supplies and source substitution.

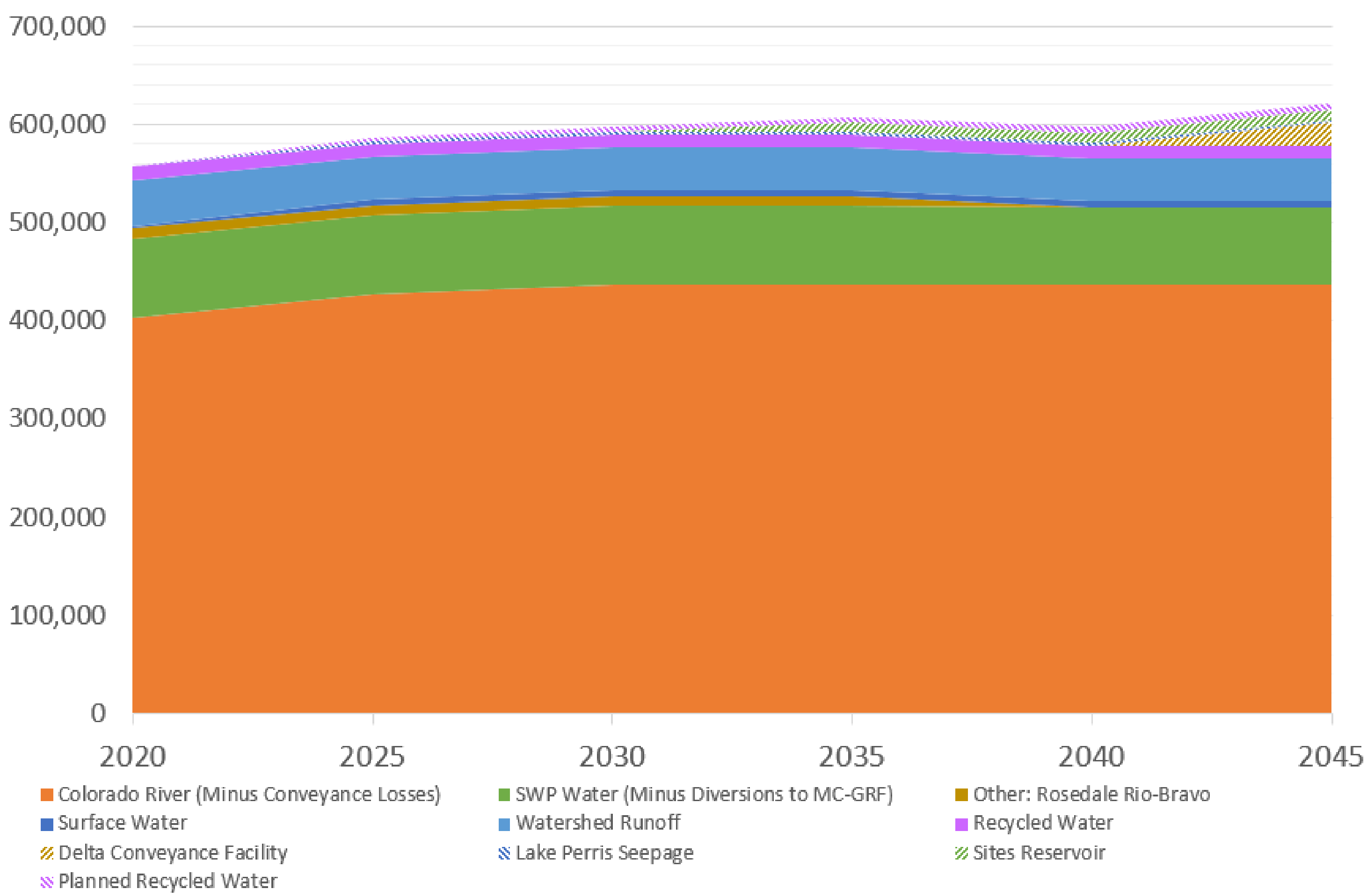
Table 6-16. Summary of Projected Non-Groundwater Supplies (AFY)

Available Supplies	2020[a]	2025	2030	2035	2040	2045
Historical Hydrology Conditions						
Surface Water Infiltration[b]	46,670	43,300	43,300	43,300	43,300	43,300
Surface Water Diversions[c]	2,630	6,000	6,000	6,000	6,000	6,000
Colorado River Water[d]	402,800	426,300	436,050	436,050	436,050	436,050
SWP Exchange Water[e]	80,853	80,546	80,273	80,019	79,724	79,431
Recycled Water[f]	13,398	13,398	13,398	13,398	13,398	13,398
Other: Rosedale Rio-Bravo	10,563	10,563	10,563	10,563	0	0
Historical Hydrology Subtotal	**556,914**	**580,107**	**589,584**	**589,330**	**578,472**	**578,179**
Climate Change Conditions						
Surface Water Infiltration[g]	32,570	29,200	29,200	29,200	29,200	29,200
Surface Water Diversions[h]	2,630	6,000	6,000	6,000	6,000	6,000
Colorado River Water[i]	388,050	411,800	411,550	411,550	411,550	411,550
SWP Exchange Water[j]	80,853	80,306	79,795	79,305	78,775	78,248
Recycled Water[k]	13,398	13,398	13,398	13,398	13,398	13,398
Other: Rosedale Rio-Bravo	10,563	10,563	10,563	10,563	0	0
Climate Change Subtotal	**528,064**	**551,267**	**550,506**	**550,016**	**538,923**	**538,396**
Projected Future Supplies						
Delta Conveyance Facility[l]	0	0	0	0	0	23,562
Lake Perris Seepage[m]	0	2,519	2,510	2,503	2,493	2,484
Sites Reservoir[n]	0	0	0	10,503	10,464	10,426
Planned Recycled Water[o]	0	3,615	4,415	5,115	5,915	6,815
Projected Future Supplies Subtotal	**0**	**6,134**	**6,925**	**18,121**	**18,872**	**43,287**
Total Available + Projected Supplies under Historical Hydrology	**556,914**	**586,241**	**596,509**	**607,451**	**597,344**	**621,466**
Total Available + Projected Supplies under Climate Change	**528,064**	**557,401**	**557,431**	**568,137**	**557,795**	**581,683**

[a] 2020 values are projected; they are not actuals.
[b] Natural infiltration of watershed runoff is based on 50-year (1970 to 2019) historical average and excludes anticipated future diversions. See Chapter 7*, Numerical Model and Plan Scenarios* for detail on groundwater inflows and outflows.
[c] Surface water diversions in year 2020 are projected; actual 2020 diversions totaled 1,960 AFY.
[d] Colorado River water accounts for base entitlement and transfers listed in Table 6-3 and excludes 5 percent conveyance losses.

[e] SWP exchange water includes Yuba Accord and excludes transfers to the MC-GRF. SWP values are average annual deliveries based on 45 percent reliability assumption.
[f] Recycled water includes existing annual average deliveries as of 2020 (13,398 AFY).
[g] Natural infiltration of watershed runoff is based on 25-year (1995 to 2019) historical average run backward-forward and excludes anticipated future diversions and outflow to Salton Sea. See Chapter 7, *Numerical Model and Plan Scenarios,* for detail on groundwater inflows and outflows.
[h] Surface water diversions in year 2020 are projected; actual 2020 diversions totaled 1,960 AFY.
[i] Colorado River water excludes 5 percent conveyance losses and *Lower Basin DCP* contributions (-14,500 AFY 2020-2026 and -24,500 AFY 2027-2045).
[j] SWP exchange water includes Yuba Accord and excludes transfers to the MC-GRF. SWP values are average annual deliveries based on 45 percent reliability assumption, with -1.5 percent reduced deliveries by 2045 due to climate change.
[k] Recycled water includes existing annual average deliveries as of 2020 (13,398 AFY).
[l] DCF values are average annual deliveries based on reliability assumptions and excludes transfers to the MC-GRF. DCF is anticipated to begin operation in 2042.
[m] Lake Perris supplies exclude transfers to the MC-GRF. Values are declining because Mission Creek Subbasin Management Area assessable production and associated diversions to MC-GRF are forecast to increase over time.
[n] Sites Reservoir excludes 30 percent conveyance losses and transfers to the MC-GRF. Values are declining because Mission Creek Subbasin Management Area assessable production and associated diversions to MC-GRF are forecast to increase over time.
[o] Projected future recycled water includes planned non-potable connections at WRP-7 and WRP-10 up to current tertiary capacities. Additional future non-potable expansions at WRP-7, WRP-10, and WRP-4, and East Valley Reclamation Authority's potable reuse project at VSD WRP, are described in Chapter 11, *Projects and Management Actions*, but are still in planning phases and not included in the supply projection at this time. Total additional wastewater flow potentially available for water reuse by 2045 equals 42,540 AFY, as shown in Table 6-14.

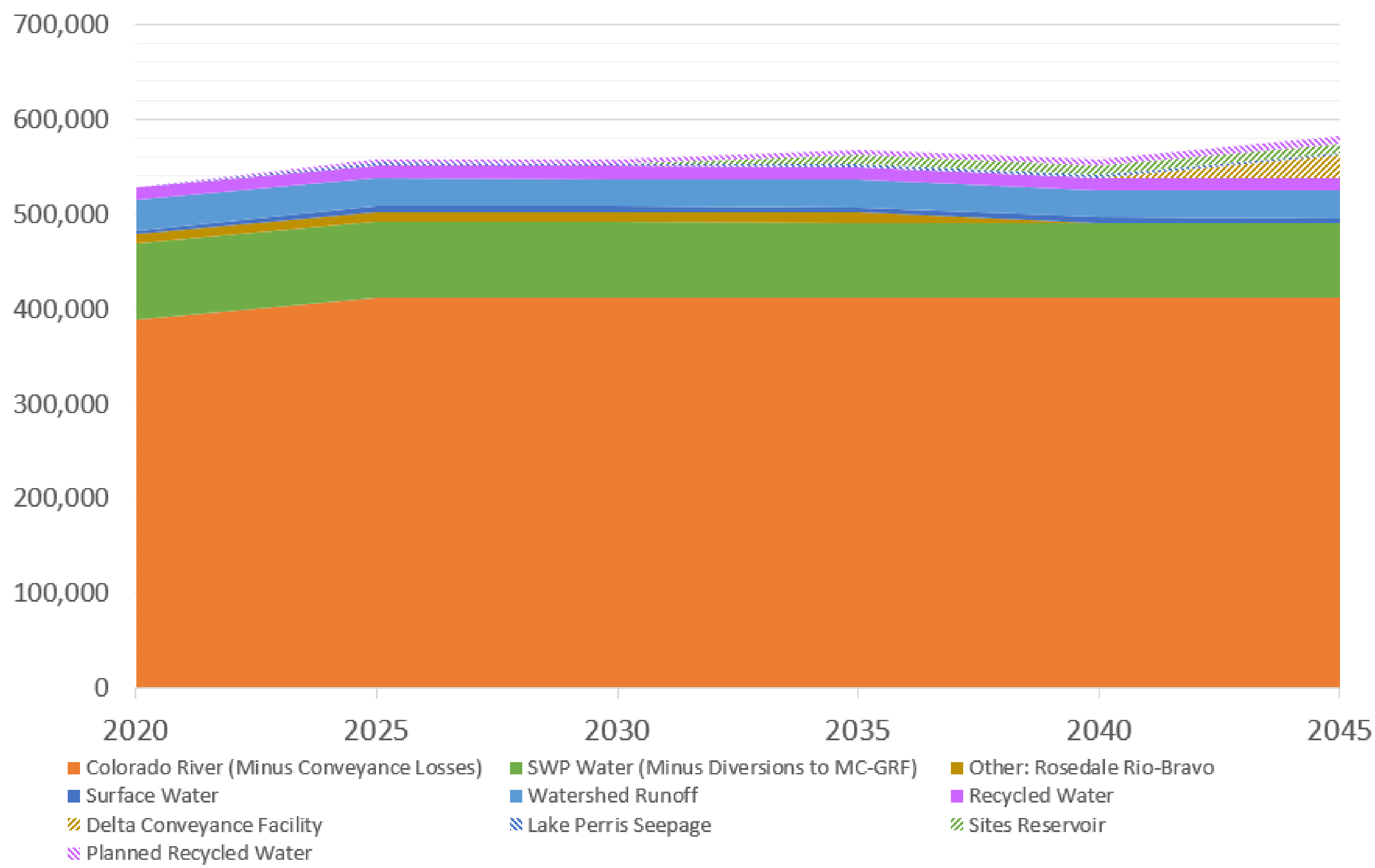
Figure 6-6. Projected Future Supplies with Historical Hydrology



FINAL

Figure 6-6
Projected Future Supplies with Historical Hydrology

Figure 6-7. Projected Future Supplies with Climate Change Hydrology



	WOODARD & CURRAN	FINAL TODD GROUNDWATER	**Figure 6-7 Projected Future Supplies with Climate Change Hydrology**

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CHAPTER 7: NUMERICAL MODEL AND PLAN SCENARIOS

This chapter describes the MODFLOW groundwater flow model, the Indio Subbasin water budget, and the Plan Scenarios developed to assess future groundwater conditions and sustainability under different planning assumptions. The Indio Subbasin water budget (or balance) and groundwater flow model are closely linked in that some Indio Subbasin inflows and outflows (including various sources of recharge and well pumping) have been developed using measurements and estimates and then used as input to the groundwater flow model. Other water budget components (including amounts of evapotranspiration, drain flow, Salton Sea inflow and outflow, and changes in groundwater storage) are outputs of the groundwater model and are used as a part of the Indio Subbasin water budget. Water budgets are provided for each of the Plan scenarios, as described in Section 7.5. Model characteristics are summarized including model area and boundaries, layers, aquifer properties, sources and amounts of basin recharge and discharge, and methodologies to develop the inflow and outflow amounts used as model inputs. Previous and updated model performance results are presented, along with Subbasin water budgets for the period 1997 to 2019. The model is well calibrated and capable of accurately simulating groundwater conditions throughout the Subbasin and over the simulation period.

7.1 MODFLOW Model Description

The numerical groundwater flow model was constructed using the U.S. Geological Survey (USGS) MODFLOW code. It simulates transient three-dimensional groundwater flow within and between the shallow and deep aquifer zones, includes various sources of subbasin recharge, discharge to production wells, evapotranspiration, flow to drains, and flow to and from the Salton Sea.

7.1.1 Previous Versions of the Indio Subbasin MODFLOW Model

Several versions of the Indio Subbasin model were developed prior to this version for the *Alternative Plan Update*:

1. The original MODFLOW model was developed by Graham Fogg (Fogg) in the mid-1990s and calibrated for a 61-year historical period from 1936 to 1996.
2. The original model was subsequently extended by Fogg as a part of the 2002 *Coachella Valley Final Water Management Plan (2002 CVWMP)* for the Indio Subbasin (Coachella Valley Water District [CVWD], 2002) and the *Coachella Valley Water Management Plan 2010 Update (2010 CVWMP Update)* (CVWD, 2012) and used to simulate future Subbasin management scenarios beginning in 1997 through a future planning period. The *2010 CVWMP Update* version of the model used the best available estimates of groundwater inflows and outflows through 2008; inflow amounts for 2009 and future years were synthesized using assumed future water supply and demand projections.

Other intermediate versions of the model were developed by CVWD for specific purposes, but the *2010 CVWMP Update* version was used as the basis for the *Alternative Plan Update*.

Historical calibration quality of the original 1936 to 1996 model and *2010 CVWMP Update* version (through 2008) was good, as documented in a Fogg (2000) Technical Memorandum and in Technical Memorandum No. 2 prepared for the Indio Subbasin GSAs in 2020 (see Appendix 1-A). The original and

2010 CVWMP Update models accurately simulated regional and local groundwater flow conditions and changes over time (as indicated by low observed-versus-simulated head error residuals).

For this *Alternative Plan Update*, the *2010 CVWMP Update* model input data were updated through 2019 using available data. After updating the model recharge and discharge inputs, a calibration check was performed for the period 1997 to 2019.

For future management alternative scenarios evaluation, new estimates of future recharge, pumping, and other boundary conditions are synthesized for predictive simulations of future conditions, as described in Section 7.5.

7.1.2 Changes Made to Model for *Alternative Plan Update*

Using newly available data, the *2010 CVWMP Update* model was updated and revised for the *Alternative Plan Update*. The major changes were updates to recharge and discharge boundary conditions for the simulation period of 2009 to 2019. Other model input parameters also modified include:

- Replaced top of Model Layer 1 elevation surface with updated digital elevation model (DEM)
- Added bathymetry of Salton Sea to top of Model Layer 1 elevation surface
- Corrected 1997 initial conditions in the Garnet Hill Subarea
- Adjusted Hydraulic Flow Barrier conductance values along the southern portion of the Garnet Hill Fault
- Updated 1997 to 2019 subsurface flux boundary inflow rates from Mission Creek Subbasin
- Adjusted 1997 to 2019 pumping in the Garnet Hill Subarea
- Updated Salton Sea general head boundary elevations for 2009 to 2019
- Updated streamflow and mountain front recharge rates for 2009 to 2019
- Updated municipal golf and agriculture irrigation return and septic rates for 2009 to 2019
- Updated wastewater percolation rates for 2009 to 2019
- Updated groundwater replenishment rates for 2009 to 2019
- Updated Whitewater River Groundwater Replenishment Facility (WWR-GRF) and Thomas E. Levy GRF (TEL-GRF) recharge basin areas
- Added Palm Desert Groundwater Replenishment Facility (PD-GRF)
- Updated production well pumping data sets for 2009 to 2019
- Adjusted model timesteps from 10 to 12 per annual stress period
- Created new shallow and deep aquifer observation well groups for calibration assessment

In general, the original model grid, layering, horizontal and vertical hydraulic conductivity, and aquifer storage parameters were unchanged from the *2010 CVWMP Update* model version. The MODFLOW computer program uses subroutines called packages that read specific individual input data files for site features such as wells or drains, depending on the types being simulated. The same MODFLOW Packages were used in the historical and updated model versions.

For the 1997 to 2019 update, most of the inflow and outflow input data used in the *2010 CVWMP Update* version for the period 1997 to 2008 were retained, but actual measurements and better estimates of recharge and discharge were used for the simulation period of 2009 to 2019. Exceptions to this included the annual subsurface boundary inflow rates from the Mission Creek Subbasin, where the entire 1997 to 2019 simulation period was updated using inflow rates simulated by the Mission Creek MODFLOW model, which overlaps the Indio Subbasin model (Wood, 2021). Adjustments were also made to the 1997 model initial conditions and 1997 to 2008 production well pumping in the Garnet Hill Subarea to improve model calibration.

Changes were also made to how the model input data are pre- and post-processed, and how the model is managed and run. The original and *2010 CVWMP Update* versions of the model used a series of spreadsheets and FORTRAN programs to format the input data into standard MODFLOW package input files and to post-process the results. Model input was generated as MODFLOW Package ASCII files that were read by an executable table version of the MODFLOW FORTRAN program.

For the *Alternative Plan Update*, the *2010 CVWMP Update* MODFLOW input files were imported to the Aquaveo Groundwater Modeling System (GMS), a MODFLOW pre- and post-processing computer program that was used to update, run and post-process the model. Some inflow and outflow model input data were pre-processed using the project GIS database and spreadsheets, and the input data were imported and stored within GMS, allowing for efficient processing of model runs. Updated model input files are organized in a GMS data management system that includes GIS layers, 'map-based' inputs including points, arcs, and polygons of input data, and model grid-based datasets. Model output including simulated water level maps, hydrographs, and water budget output are also stored and post-processed using the GMS software.

7.2 Model Input and Construction

The groundwater model area is shown on Figure 7-1. The upstream and downstream ends of the model are near the San Gorgonio Pass area in the northwest and the northern portion of the Salton Sea in the southeast, respectively. The southwest edge of the model represents the interface between the unconsolidated sedimentary aquifers of the Indio Subbasin and the consolidated to semi-consolidated rocks of the San Jacinto and Santa Rosa Mountains. The northeast flank of the model represents the interface between the unconsolidated aquifers of the Subbasin and consolidated to semi-consolidated rocks of the Little San Bernardino Mountains, Indio Hills, and Mecca Hills, and the Mission Creek and Desert Hot Springs Subbasins. The adjacent San Gorgonio Pass, Mission Creek and Desert Hot Springs Subbasins are not included in the active model area, but subsurface outflow from these Subbasins into the Indio Subbasin is included in the boundary conditions.

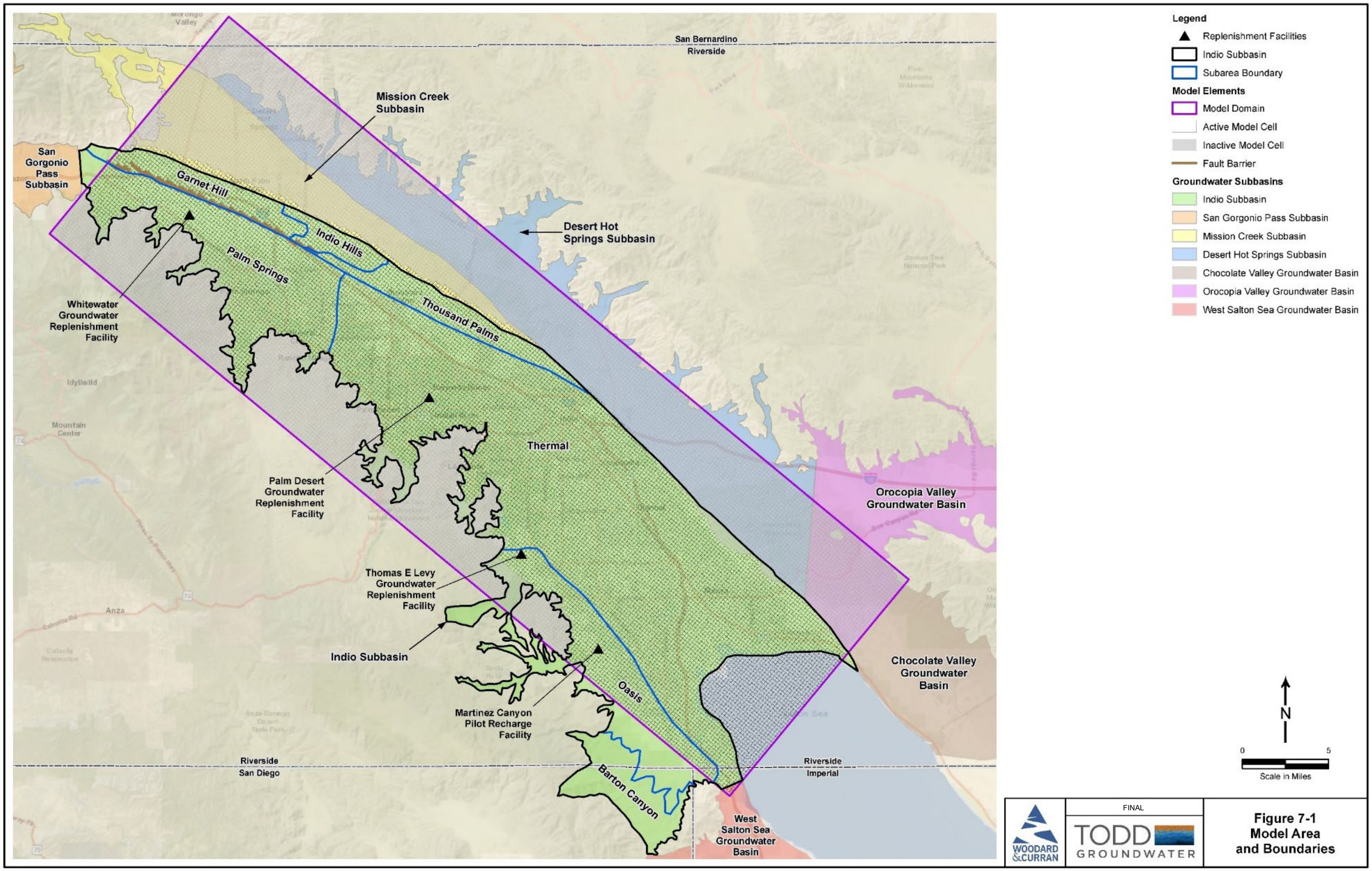
7.2.1 MODFLOW Code and Input Packages

The original Indio Subbasin model was constructed using the USGS 'MODFLOW 88' code. For the *2010 CVWMP Update* and *Alternative Plan Update* versions of the model, the code was updated to 'MODFLOW 2005'.

The model utilizes the following standard MODFLOW Packages:

- BASIC (BAS)
- BLOCK CENTERED FLOW (BCF)
- HORIZONTAL FLOW BARRIER (HFB)
- WELL (WEL)
- RECHARGE (RCH)
- DRAIN (DRN)
- EVAPOTRANSPIRATION (EVT)
- GENERAL HEAD BOUNDARY (GHB)
- PRECONDITIONED CONJUGATE-GRADIENT (PCG) Solver

Figure 7-1. Model Area and Boundaries



7.2.2 Model Grid and Layers

The model consists of a three-dimensional, finite-difference grid of blocks called cells, the locations of which are described in terms of the 270 rows, 86 columns, and 4 layers. At the center of each cell there is a point called a node at which groundwater elevation (head) is calculated. Inflows and outflows through each model cell, through Subareas, and within the entire model grid are also calculated. The Indio Subbasin model has a node spacing of 1,000 ft in the x-y plane, and variable vertical node spacing representing variable thicknesses of the corresponding aquifer or aquitard intervals. The grid is oriented from northwest to southeast along the length of the valley, coinciding with the principal direction of regional groundwater flow (Figure 7-1).

The MODFLOW model comprises four layers, representing the following hydrostratigraphic units:

- Layer 1 – semi-perched aquifer in East Valley and upper shallow aquifer in West Valley
- Layer 2 – shallow aquifer zone
- Layer 3 – regional aquitard in East Valley and shallow-deep transition zone in West Valley
- Layer 4 – deep aquifer

The elevation of the tops and bottoms of the model layers are referenced to land surface elevations and reflect aquifer and hydrostratigraphic unit thickness as inferred from borehole data across the basin. Figure 7-2 shows the elevations of the base of each of the four model layers. The model layer elevations in the *Alternative Plan Update* model are unchanged from the original and *2010 CVWMP Update* versions of the model. The top of Layer 1 is represented by the ground surface elevation and elevation of the bottom of the Salton Sea. The bottoms of each layer generally dip to the southeast, subparallel to the ground surface. In the East Valley, model layer thickness follows geologic characterizations by the California Department of Water Resources (DWR) (1979) that were corroborated by analysis of subsurface data. For example, Model Layer 1 approximately corresponds with the semi-perched zone (100 ft thick), Layer 2 with the upper aquifer unit (80 to more than 260 ft thick), Layer 3 with the regional aquitard (80 to more than 270 ft thick), and Layer 4 with a lower aquifer unit (1,000 ft thick). In the West Valley, aquifer thickness estimated by USGS (Reichard and Meadows, 1992) was initially used and later revised during model calibration.

7.2.3 Aquifer Properties and Horizontal Flow Barrier

Distributions of aquifer hydraulic properties including aquifer transmissivity, horizontal and vertical hydraulic conductivity, and unconfined and confined storage coefficients were developed as a part of the original 1936 to 1996 model to simulate the aquifer and aquitard units in the shallow and deep aquifer zones. The aquifer hydraulic properties in the *Alternative Plan Update* model are unchanged from the original Layer 2 of the *2010 CVWMP Update* versions of the model.

Figure 7-2. Base of Model Layer Elevations

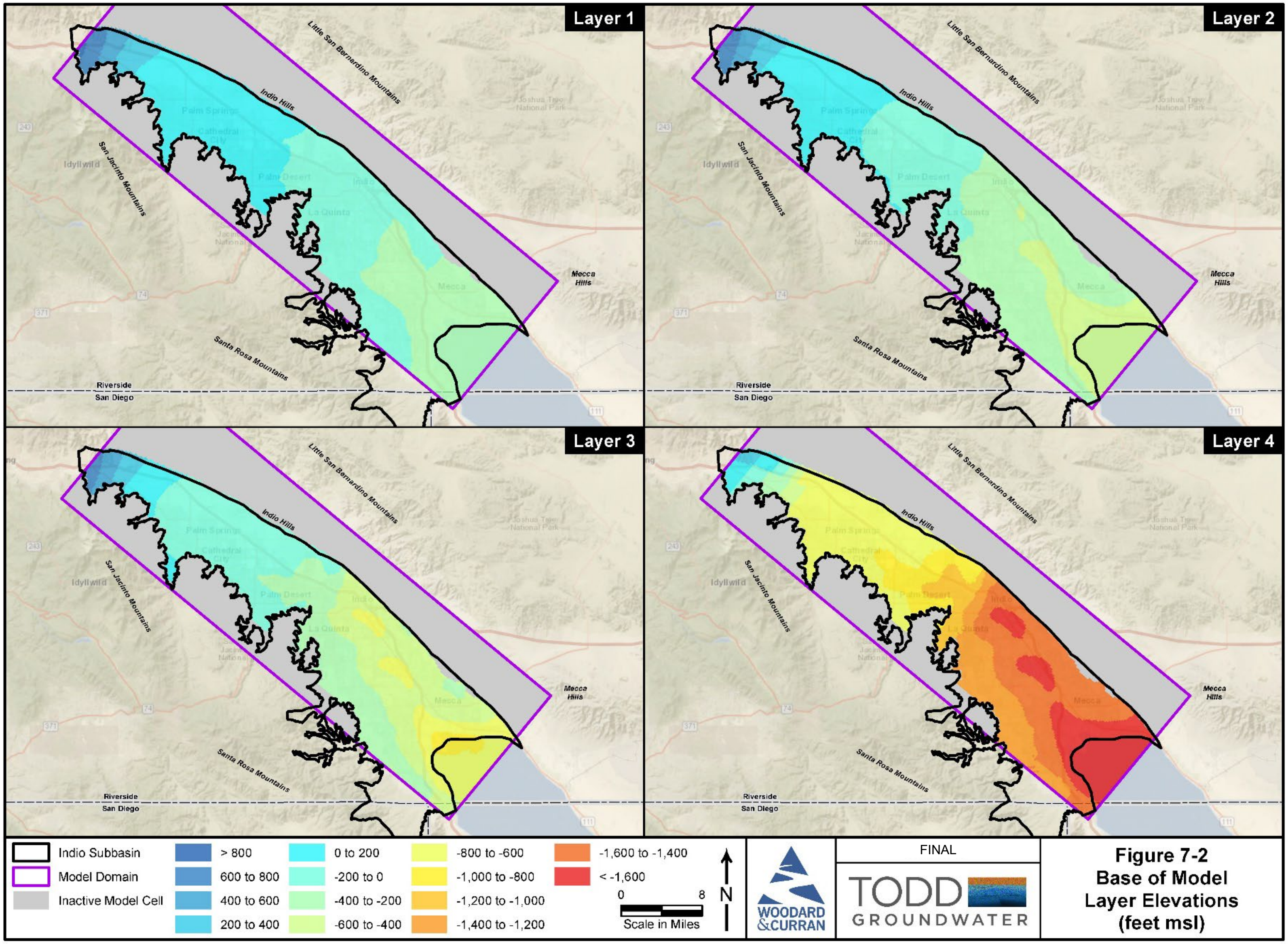


Figure 7-2
Base of Model Layer Elevations (feet msl)

Aquifer hydraulic properties control the rates of groundwater flow, amounts of water in storage, and aquifer responses to recharge and pumping. Initial estimates of transmissivity (T) were obtained in part from previously calibrated values used in an early groundwater model constructed by Reichard and Meadows (1992) for the West Valley, some pumping test results for the East Valley, and abundant specific capacity data for the entire valley. Hydraulic conductivity (K) of the confining bed was estimated based on the sediment texture and heterogeneity and was treated as a calibration parameter.

Heterogeneity was treated as a calibration parameter in the original 1936 to 1996 model. Similarly, vertical K (Kv) of the aquifer zones was based on the degree of fine-grained bedding present in electric and drillers logs. This parameter was also adjusted in the original model calibration.

7.2.3.1 Hydraulic Conductivity and Storage Coefficients

Figure 7-3 shows the distribution of horizontal hydraulic conductivity in each model layer. Most model cells were assigned moderate to high hydraulic conductivities, based on the pumping test and specific capacity data, and reflect the properties of the coarse sand and gravel deposits that predominate in the subsurface. Hydraulic conductivities are higher on the southwest margins of the West Valley grading to lower values in the East Valley. Permeabilities also generally decrease southeastward toward the Salton Sea. Southeast of the City of Indio, tight silts and clays up to 100 feet thick are present in the upper aquifer and create a semi-perched zone. Lower permeabilities were assigned to these model cells within Model Layer 3.

The specified ratio of horizontal to vertical hydraulic conductivity varies between 10 and 100 throughout the model, based on the degree of fine-grained bedding present in electric and drillers logs.

Figure 7-4 shows the distribution of aquifer storage coefficients in each model layer (specific yield for Model Layer 1 and specific storage for Layers 2-4). Distribution of specific yield (Sy) from Reichard and Meadows (1992) was initially used in the upper valley for Model Layer 1; these values were subsequently modified slightly during the original model calibration. Similar specific yield values were initially estimated for the unconfined areas and semi-perched zone in the lower valley; these values were later adjusted during calibration. Layers 2, 3, and 4 are convertible (unconfined/confined), and use two storage coefficients: specific yield for unconfined conditions when the simulated water level drops below the top of the layer, and specific storage when the layer is confined. The specific yield values for Layers 2-4 are the same as those used for Layer 1. Specific storage (Ss) values were estimated for each of the Model Layers 2, 3 and 4, and were multiplied by layer thickness to obtain storage coefficient (S) for each model layer. Ss varied in confined versus unconfined areas. Storage coefficients of the aquifer system are much greater in the upper unconfined alluvium than in the deeper confined units.

7.2.3.2 Horizontal Flow Barrier

The Garnet Hill Fault forms a partial barrier to flow between the Garnet Hill and Palm Springs Subareas. The MODFLOW Horizontal Flow Barrier (HFB) Package was used to simulate the barrier effects of this fault. The fault is simulated as an HFB in each of Model Layers 1-4. Different conductance values were assigned along different segments of the HFB and adjusted during 1936-1996 original model calibration. For the *Alternative Plan Update* model and 1997-2019 calibration update, additional adjustments were made to the southern portion of the Garnet Hill Fault HFB to improve calibration in the Garnet Hill Subarea. Several model calibration runs were made using different distributions of conductance along the HFB segments until simulated 1997 to 2019 water levels in both the Garnet Hill and Palm Springs Subareas were calibrated.

Figure 7-3. Model Layer Hydraulic Conductivities

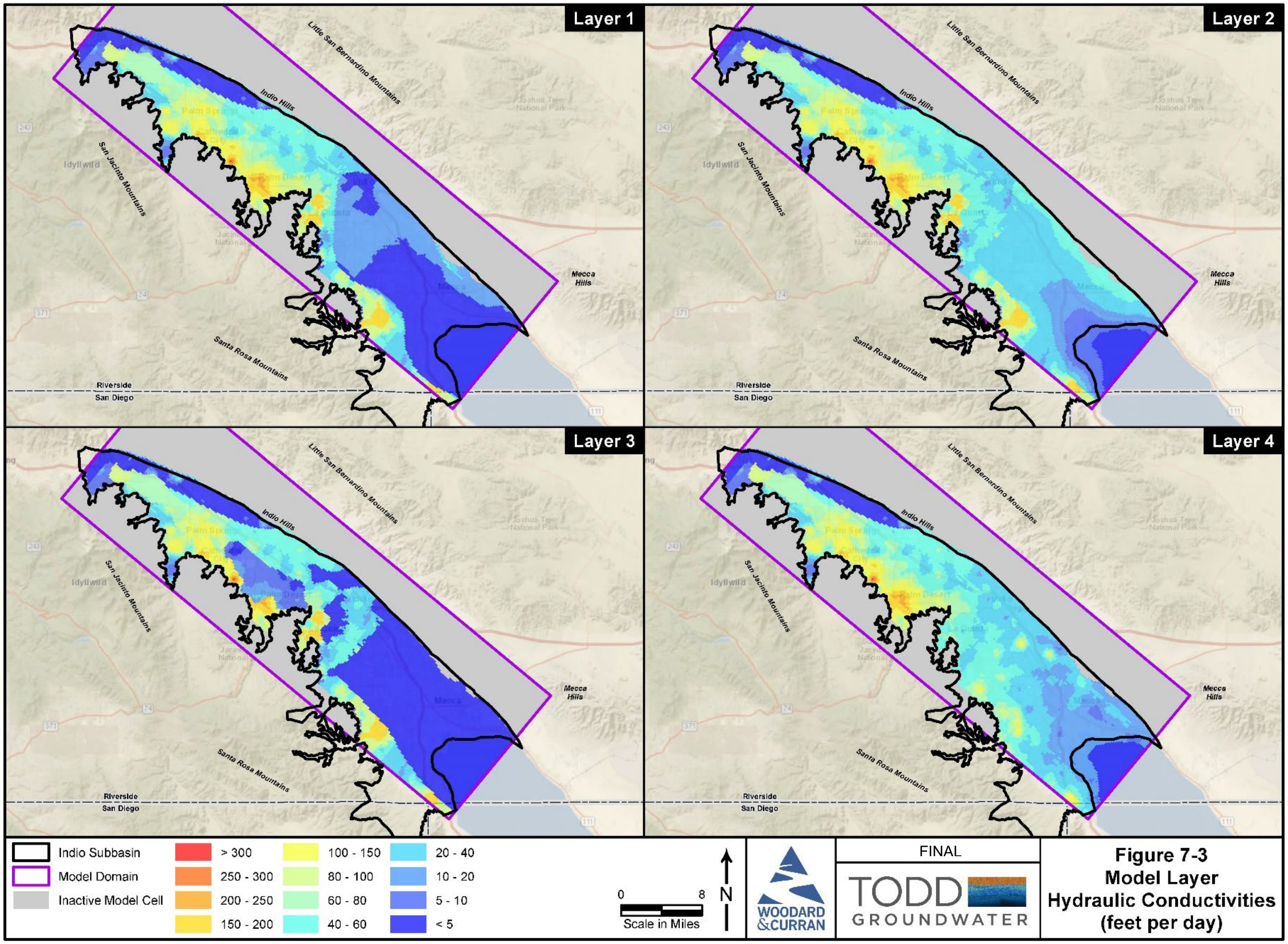
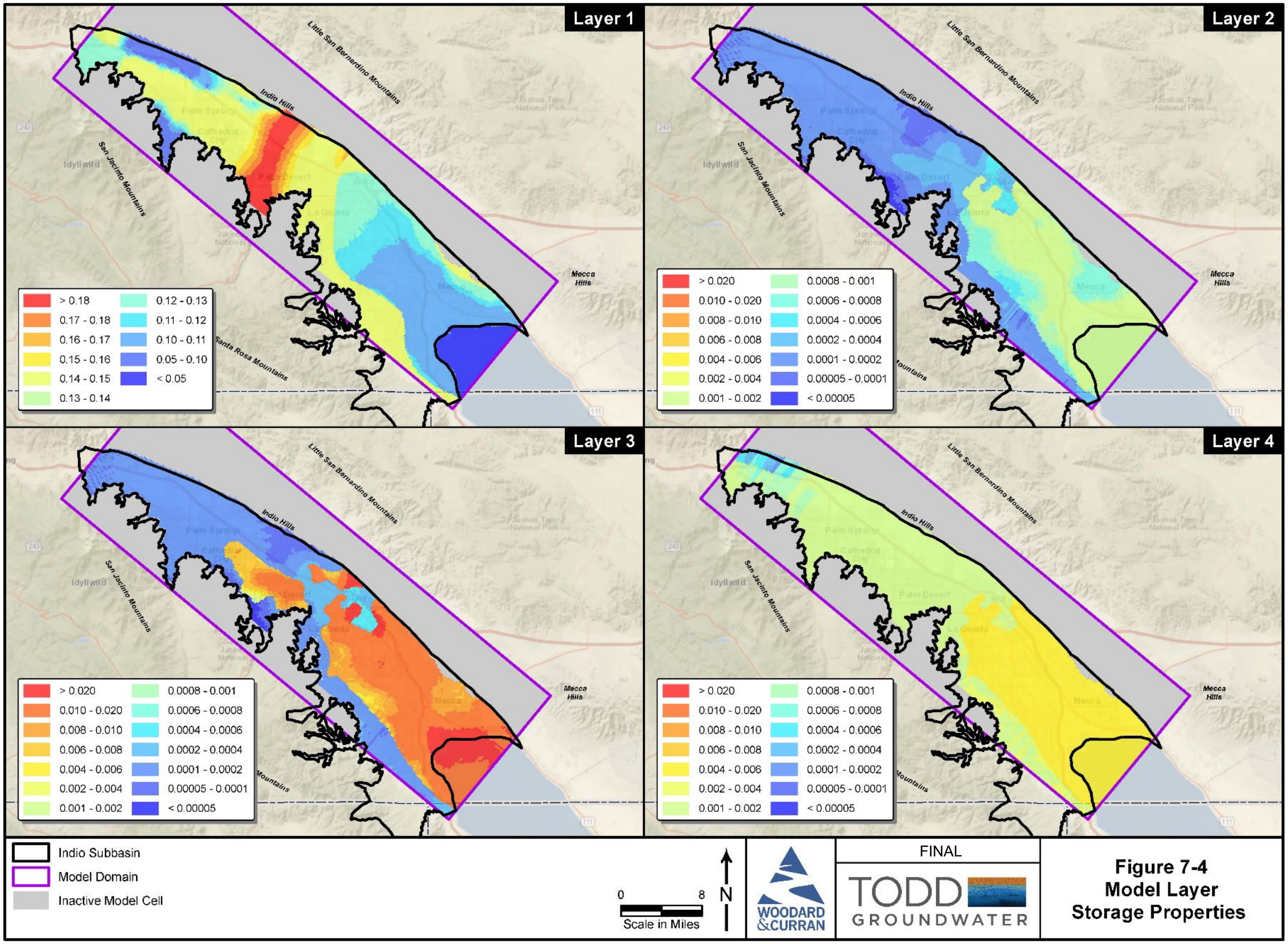


Figure 7-4. Model Layer Storage Properties



7.2.4 Initial Conditions

Initial head conditions in the *2010 CVWMP Update* model are based on the final computed heads for each cell at the end of the 1936 to 1996 calibration simulation, corresponding to the beginning of calendar year 1997. This approach maintains consistency between the model-computed heads and flows from the original calibrated model, as well as continuity between the calibration and predictive models.

Figure 7-5 shows the 1997 initial conditions used in Model Layers 2 and 4, representing the shallow and deep aquifers, respectively. For the 1997 to 2019 model update, the initial conditions used for most of the model area are the same as in the *2010 CVWMP Update* model. However, local adjustments were made to the initial conditions in the Garnet Hill Subarea, to correct observed-simulated head offsets at the beginning of the 1997 to 2019 simulation. These adjustments, along with changes in HFB conductance and inflow rates from the Mission Creek Subbasin, improved calibration quality in the Garnet Hill Subarea for the updated 1997 to 2019 simulation.

7.2.5 Inflows

The Indio Subbasin is recharged through a combination of natural inflows of surface water and groundwater, recharge of imported water, wastewater percolation, and irrigation return flows. Sources of recharge to the Subbasin include:

- Subsurface inflow from the San Gorgonio Pass, Mission Creek, and Desert Hot Springs Subbasins
- Mountain front and stream channel recharge
- Artificial recharge of imported water
- Wastewater percolation
- Return flows from irrigation (municipal/domestic, agricultural, and golf course) and septic systems

Inflows from the Salton Sea have also been assessed in order to provide a comprehensive accounting of the water budget. As discussed in Section 7.4, inflows from the Salton Sea have been small and groundwater outflows to the Salton Sea also occur. Net groundwater flow has been toward the Salton Sea since 2015.

Figure 7-6 shows the locations of the point sources of recharge including subsurface inflow, mountain front, stream channel, groundwater replenishment, and wastewater percolation. Additional recharge of irrigation return flows is distributed across large areas of the model. For the 1997 to 2019 update, most of the recharge amounts simulated in the *2010 CVWMP Update* for the period 1997 to 2008 were unchanged, but new recharge rates for the period 2009 to 2019 were calculated and used as model recharge input.

Subsurface inflow from the Mission Creek Subbasin was updated for the entire 1997 to 2019 period, based on values recently generated from the Mission Creek Subbasin MODFLOW model (Wood, 2021). Subsurface inflow from the San Gorgonio Pass Subbasin was not changed from the *2010 CVWMP Update* model, as updated values were not available from the San Gorgonio model for this *Alternative Plan Update.* Subsurface inflows from the Mission Creek and San Gorgonio Subbasins used in the 1997 to 2019 model update are shown on Figure 7-7. Subsurface inflows are simulated using the MODFLOW WEL Package.

Figure 7-5. Model Initial Conditions 1997

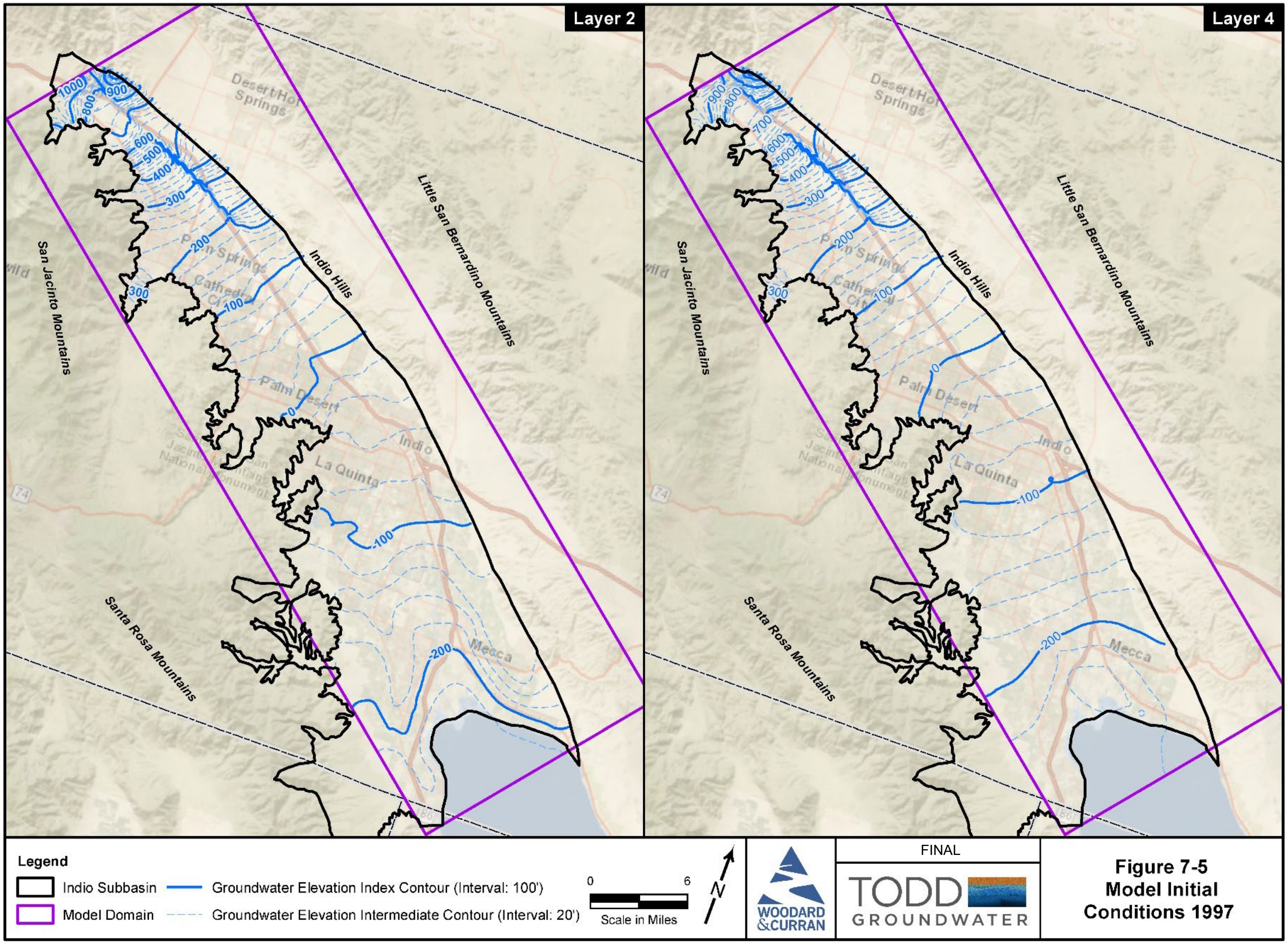


Figure 7-6. Model Recharge Sources

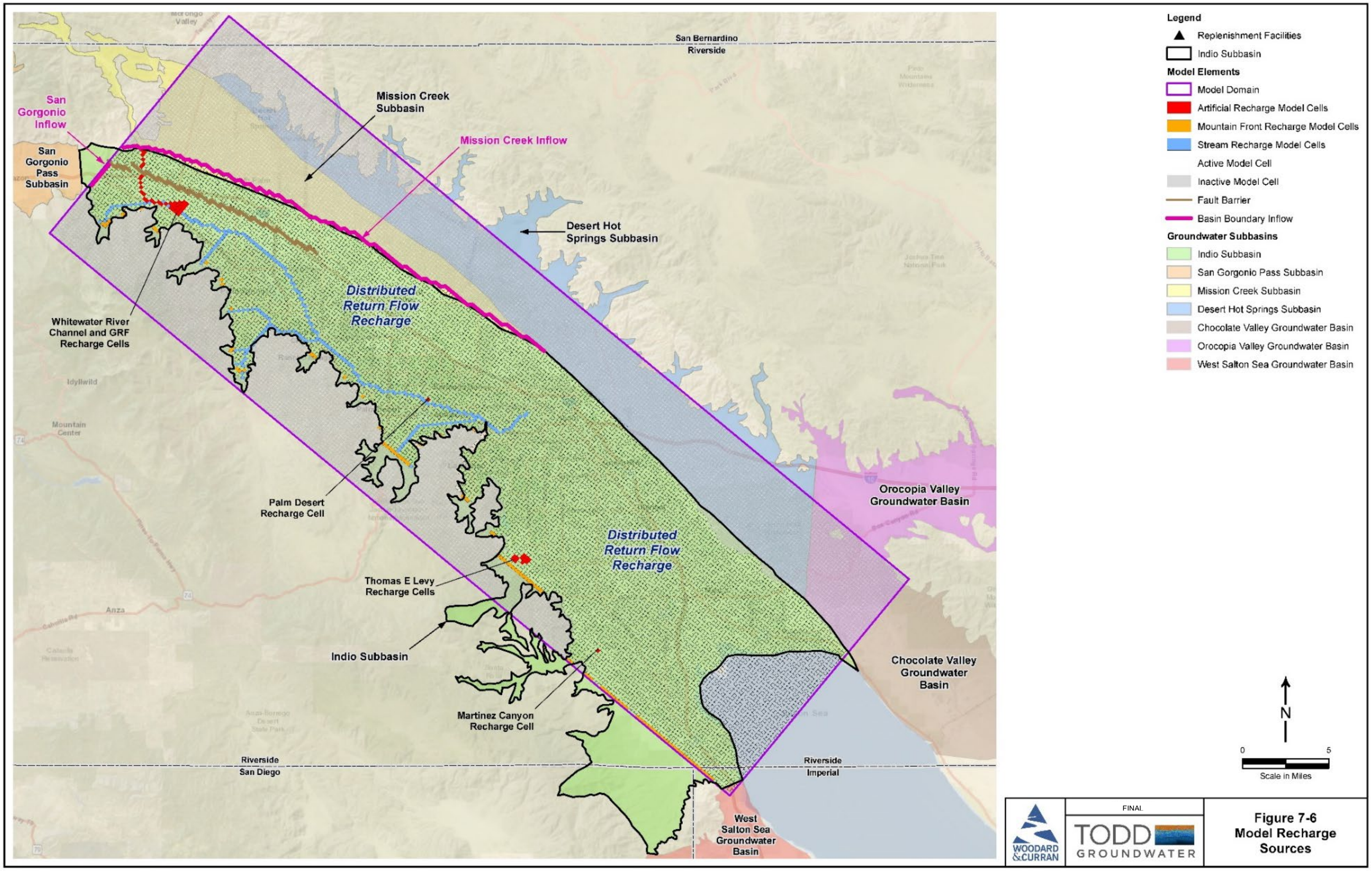
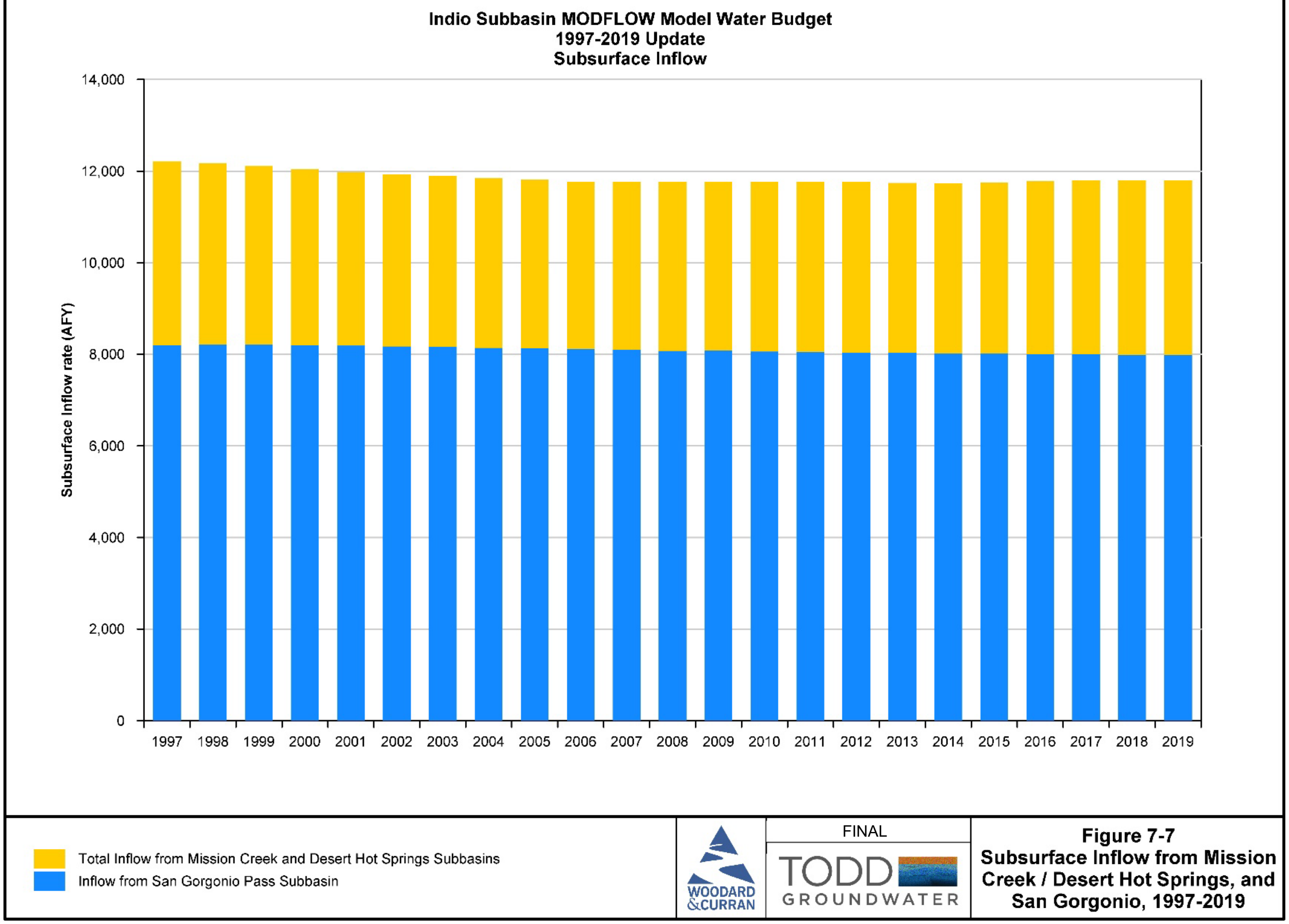


Figure 7-7. Subsurface Inflow from Mission Creek/Desert Hot Springs and San Gorgonio, 1997-2019



WOODARD &CURRAN | FINAL TODD GROUNDWATER | **Figure 7-7 Subsurface Inflow from Mission Creek / Desert Hot Springs, and San Gorgonio, 1997-2019**

Each of the other sources of recharge was estimated individually, then accumulated into a combined MODFLOW RCH Package. Recharge rates over time were accumulated on a model grid cell basis, accounting for cell areas to preserve total recharge amounts, and applied as recharge to the uppermost active model layer (primarily Model Layer 1, except where this layer is dry). The MODFLOW RCH Package also was used to simulate mountain front and stream channel recharge rather than one of the MODFLOW Streamflow Routing Packages, which are sometimes used to simulate groundwater-stream interactions.

Figure 7-8 shows the annual contribution of each source of recharge from 1997 to 2019. For the period 1997 to 2008, the total recharge is the same as was used in the *2010 CVWMP Update* model. For this period, the model inputs are only available as mountain front and stream channel recharge, artificial recharge, and total recharge rates. Mountain front and stream channel recharge are combined on Figure 7-8 as natural infiltration, and artificial recharge is shown as managed aquifer recharge (MAR). While the data for various recharge sources are available, the *2010 CVWMP Update* model input for 1997 to 2008 is not separated by recharge source. Because the model area does not cover the entire Indio Subbasin area, the allocation by source to the total model recharge input (as shown on the figure) was estimated. The allocation of other recharge inputs in the model (including return flows specified on the graph) was estimated based on water balance information from Indio Subbasin annual reports (see Todd Groundwater and Woodard & Curran, 2021).

The following sections describe each of the sources of recharge to the Subbasin.

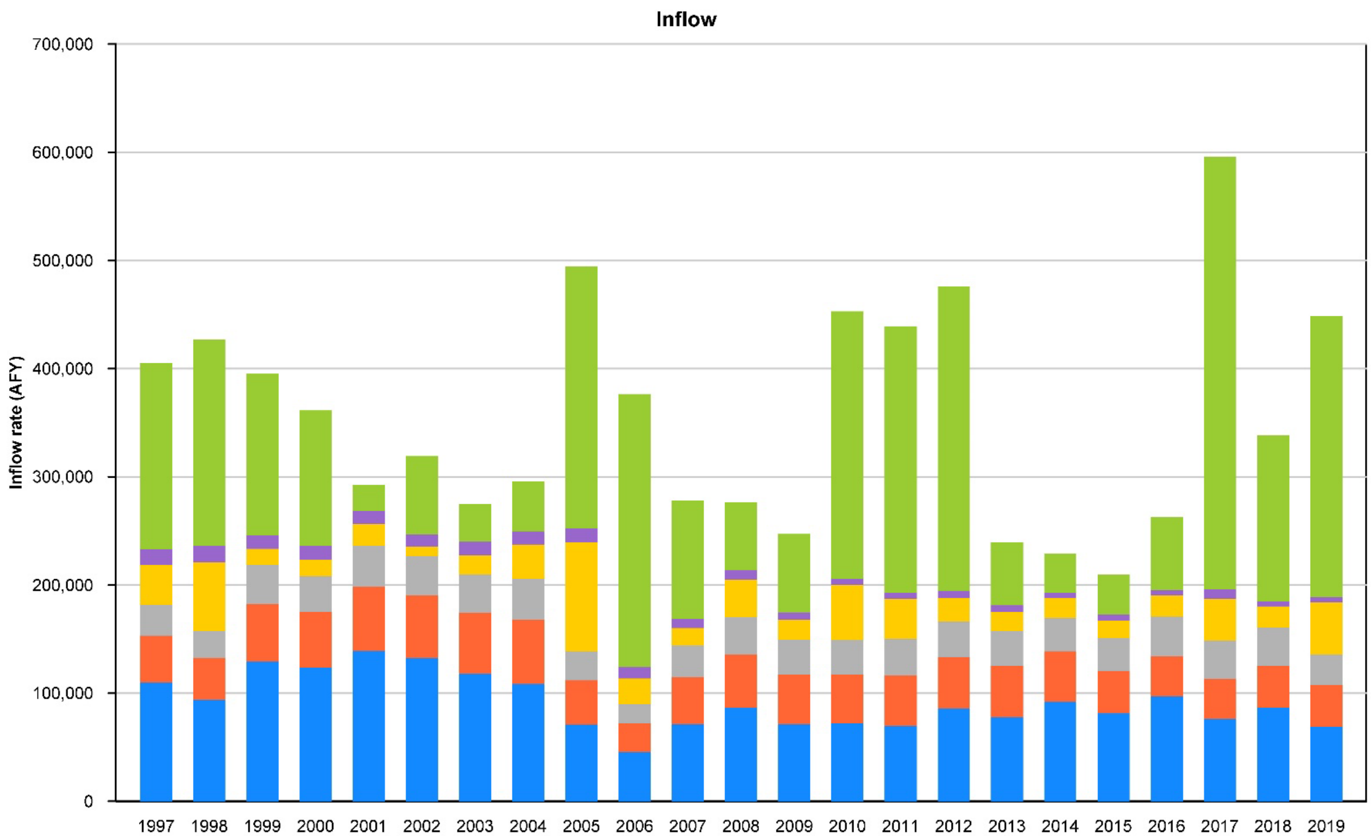
7.2.5.1 Subsurface Inflows

Figure 7-6 shows the locations of subsurface inflows specified in the northwestern and eastern boundaries of the model. These boundaries simulate inflow from San Gorgonio Pass (SGP) and Mission Creek (MC) Groundwater Subbasins. Flux estimates for each boundary were applied to Model Layers 1 through 4.

In the original historical model, the amounts of flow from the SGP Subbasin were computed by the model with a time-dependent specified head boundary using the MODFLOW CHD Package. In the *2010 CVWMP Update* model, the boundary condition was changed from a CHD boundary to a specified flux boundary, which is used to represent the long-term average inflow for each cell. The amount of inflow was based on a running average of the historical fluxes estimated using the CHD boundary and was set to a value of approximately 8,200 AFY in the *2010 CVWMP Update* model, decreasing slightly between 1997 and 2019 (Figure 7-7).

Uncertainty exists in the actual amounts of inflow from the SGP Subbasin. A Groundwater Sustainability Plan and calibrated MODFLOW model are currently in preparation for the SGP Subbasin (that Plan also will be submitted to DWR in January 2022). The SGP GSAs also acknowledge that the quantity of subsurface outflow at the SGP Subbasin eastern boundary with the Indio Subbasin represents one of the largest unknowns in the SGP water budget and groundwater modeling. Based on the preliminary SGP model, historical subsurface outflow from the SGP Subbasin ranged from approximately 18,000 to 29,000 AFY between 1997 and 2019, with an average outflow of around 25,000 AFY. These values are higher than the amounts used as boundary inflow in the historical Indio model.

Figure 7-8. Inflow by Source 1997-2019



Notes:
1. 1997-2008 breakdown is based on Annual Report recharge values adjusted to match model input.
2. Inflow values reflect active model area only, inflow in areas of the basin outside the model area are not included.

Agriculture Return Flow
Municipal Return Flow
Golf Return Flow
Natural Infiltration
Wastewater
Managed Aquifer Recharge

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Figure 7-8
Inflow by Source
1997-2019

The Indio and SGP Subbasin GSAs have discussed this discrepancy, and plan to reconcile the differences as a part of the next 5-Year Plan update. The outflow/inflow amounts will be refined based on the following planned tasks:

- Sensitivity and Uncertainty Analysis using the San Gorgonio Pass Subbasin MODFLOW model
- Review of upcoming data from three nested monitoring well clusters installed in 2019 by the USGS near the Subbasin boundary, followed by evaluation and model calibration to recent (and future) water level trends
- Sensitivity simulations for the Indio Subbasin model using a range of subsurface inflows.

The SGP Subbasin GSAs also are reportedly considering a potential groundwater tracer study near the boundary between the SGP and Indio Subbasins to further estimate the flow amounts.

It is anticipated that these refined evaluations and continued collaboration will allow reconciliation of historical and predicted future subsurface out/inflows between the Subbasins. Subsurface inflow also occurs from the Mission Creek and Desert Hot Springs Subbasins into the Indio Subbasin, across the Banning and San Andreas faults.[1] These faults consist of several parallel faults and form the northeasterly boundary of the Indio Subbasin. Groundwater level differences across the Banning Fault in this area were historically on the order of 200-250 feet. The estimated flow across the Banning Fault into the Garnet Hill Subarea and Indio Subbasin in the *2010 CVWMP Update* model was set to a constant value of approximately 2,000 acre-feet per year (AFY). For the 1997 to 2019 update, these flows were defined through a collaborative effort between Mission Creek and Indio Subbasin modelers. The rates of inflow to Indio Subbasin over time were updated using annual values obtained from the Mission Creek Subbasin model (Wood, 2021). The inflow rates vary slightly over time (Figure 7-7), and were allocated by Mission Creek modelers over four boundary segments: from Mission Creek Subbasin to Garnet Hill Subarea across the Banning Fault, from Mission Creek Subbasin to Indio Hills West (the portion of Indio Hills within Indio Subbasin), from Indio Hills East (the portion of Indio Hills outside Indio Subbasin) to Indio Hills West, and from Indio Hills East to the Indio Subbasin across the Banning Fault. Total inflow from the Mission Creek and Desert Hot Springs Subbasins into the Garnet Hill Subarea and Indio Subbasin is relatively constant at approximately 4,000 AFY.

The Garnet Hill Fault also forms a partial barrier to flow and demarcates the Garnet Hill and Palm Springs Subareas internal to the model. This barrier was simulated using the MODFLOW HFB Package as previously described and allows variable flow between the Subareas.

7.2.5.2 Surface Water Inflows

Recharge from mountain front inflow and from percolation of stream flows into the Indio Subbasin was estimated for 24 watersheds and stream channels along the southwest edge of the model, along the interface between the Indio Subbasin and the consolidated rocks of the San Jacinto and Santa Rosa Mountains. Many of these watersheds are gaged; gage locations are shown on Figure 2-9 in Chapter 2, *Plan Area*.

Figure 7-6 shows the locations of the model cells used to represent mountain front and stream channel recharge. No explicit mountain front and stream channel recharge is assumed along the eastern boundary

[1] Refer to Figures 3-1 and 3-2 in Chapter 3, *Hydrogeologic Conceptual Model*, for Subbasins and Subareas. The Indio Hills West area is within the Indio Subbasin and Indio Hills East is in the Mission Creek Subbasin.

of the model. However, subsurface inflow in this area from the Mission Creek and Desert Hot Springs Subbasins is accounted for as described in the previous section.

The same methodologies used in the original and *2010 CVWMP Update* models (Fogg, 2000) were applied to estimate annual mountain front and stream channel recharge for the 1997 to 2019 model update. Previously estimated values for 1997 to 2008 used in the *2010 CVWMP Update* model were retained, and new estimates of mountain front and stream channel recharge were developed for 2009 to 2019. Total available water from each neighboring watershed was calculated based on annual precipitation, and gaged streamflow (where available). If streamflow was not gaged at a watershed, a rating factor was developed to compare the gaged precipitation and watershed area of a nearby watershed with gaged data. Total watershed runoff was calculated for each watershed on an annual basis. Surface water diversions from the Snow, Falls, Whitewater, and Chino watersheds were accounted before available streamflow was routed through the Subbasin. Figure 7-8 shows the annual amounts of mountain front and stream channel recharge between 1997 and 2019 (labeled as natural infiltration).

Stream Flow

For stream percolation, it is assumed that 95 percent of the total watershed runoff is available for stream percolation with a portion of that available stream percolation leaving the basin in wet years through surface water flow to the Salton Sea. Watershed runoff is estimated using all available precipitation and stream gauge measurements from the tributary watersheds located along the western edge of the model. The expected runoff and routing, as well as the recharge locations, use the same methodology as the original and *2010 CVWMP Update* models.

The model cells receiving streamflow percolation are shown in blue on Figure 7-6. The resulting available stream flow (95 percent of total watershed runoff) less diversions and subsurface flow for the upper valley (Snow, Falls, and Whitewater streams) is expected to completely percolate to the basin. In a change from the original model, water is routed down the upper portion of the Whitewater River in all years. Previously, all available stream recharge in dry years was assumed to recharge the model at the edge of the basin, causing increased simulated water levels over observed water levels in some years.

Further down the valley, only selected watersheds are assumed to recharge the basin in wet years along streams tributary to the Whitewater River (Andreas, Chino, Dead, Deep, Murray, Palm, Tahquitz, and Unnamed Watershed #2). In wet years, the available streamflow is routed through stream cells such that the resulting simulated flow at the Whitewater River gauge at Indio matches the observed volume. This means that in extremely wet years, up to 12,800 acre-feet (AF) flows from the lower valley watersheds through the Whitewater River into the Coachella Valley Stormwater Channel and enters the Salton Sea.

The flow of each surface waterway was distributed over the model cells using a stream channel routing factor, one for the upper valley streams and one for streams further down the valley. The respective routing factors were calculated for each wet year, such that flow recharges the model over the course of the surface waterway in the upper valley. The stream routing results in a calculation of the volume of water that percolates and the volume that remains as surface water for each cell of the surface waterway. The remaining surface water flow at the location of the USGS Indio gage is equal to the monitored flow at that gage. In short, the available streamflow less flow out of the basin percolates along the surface waterways.

Mountain Front Recharge

In addition to the streamflow percolation, the available watershed runoff also recharges the Indio Subbasin as subsurface inflow via fractured bedrock along the perimeter of the alluvial aquifer. The locations in the model for such mountain front recharge is shown as the green model cells on Figure 7-6. Mountain front recharge has been estimated using total watershed runoff and assuming that an additional 10 percent of the 4-year moving average of total watershed runoff is available for subsurface flow. This is an estimate based on the expected runoff and relative difference of hydraulic properties between the facture bedrock and permeable basin (Fogg, 2000). The longer timeframe acknowledges that subsurface flow is slower than surface water flow and affected by hydrologic conditions of previous years. The annual volume of recharge from stream flow and mountain front recharge is shown on Figure 7-8 as natural infiltration.

7.2.5.3 Artificial Recharge

The annual volumes of artificial recharge were compiled and applied to the locations of the GRFs shown on Figure 7-6. These include the WWR-GRF, TEL-GRF (formerly called Dike 4), the Martinez Canyon Pilot Project location, and the recently-completed Palm Desert GRF (PD-GRF). While Mission Creek GRF is also used for artificial recharge, it is not in the model domain. Evaporative losses were assumed to be four percent of recharged volume for the WWR-GRF and two percent for all other locations, reflecting the larger surface area and windier conditions at the WWR-GRF. These estimates are consistent with evaporative losses estimated in previous planning reports. Total annual recharge volumes at the replenishment facilities are shown on Figure 7-8, indicated as MAR.

7.2.5.4 Wastewater Discharges

There are eight wastewater treatment plants/water reclamation plants (WWTPs and WRPs) currently operating in the Indio Subbasin, with another under construction (see Figure 2-5 for locations). Eight of these are within the active area of the model. Four of these (WRP-2, WRP-4, WRP-7, and WRP-10) are operated by CVWD, and a fifth, WRP-9, was decommissioned in 2015. WWTPs also are operated by City of Palm Springs (Palm Springs WWTP/Desert Water Agency [DWA] WRP), Valley Sanitation District (VSD), and Coachella Sanitation District (CSD). A new Regional WRF is currently under construction by Mission Springs Water District (MSWD) in the Garnet Hill Subarea. Four wastewater plants currently discharge to disposal ponds (Palm Springs WWTP and CVWD WRP-2, WRP-7, and WRP-10), and the MSWD Regional WRF plans to do so at start-up in 2022. The ponds have evaporative losses, calculated by the area of ponds and expected annual evaporation. The remaining volume percolates into the Subbasin, as shown on Figure 7-8. It should be noted that, as percolated wastewater is recycled for use, groundwater pumping deceases, but net return flows to groundwater are reduced.

The other wastewater plants (CVWD WRP-4, VSD, and CSD) discharge to the Coachella Valley Stormwater Channel (CVSC), and no percolation to the Subbasin is assumed from the stormwater channel.

7.2.5.5 Applied Water Return Flows

In areas with irrigated crops, golf courses, and municipal landscaping, irrigation is assumed to be applied when soil moisture falls below a certain threshold. When soil moisture exceeds the root zone storage capacity, the excess irrigation becomes deep percolation to the aquifer. Rainfall and irrigation water comingle in the root zone and in deep percolation. For the purposes of displaying an itemized water balance, the amount of deep percolation derived from each type of irrigation is estimated as a percentage of the simulated irrigation quantity.

Agricultural Return Flow

This inflow component accounts for the portion of irrigation water that is applied in excess of the evapotranspiration (ET) of the crop, as well as excess precipitation that either percolates directly or runs off and percolates in nearby areas (defined herein as irrigation return flows). For agricultural areas, individual crops are associated with different amounts of irrigation and therefore different return flows based on crop ET and irrigation efficiencies.

Because irrigation is not 100 percent efficient, water is applied in excess of the ET demand. Irrigation efficiency, the percentage of applied water needed beyond the ET demand of the crop, can vary significantly depending on factors including geographic setting, irrigation method, and crop types. Agricultural deliveries of imported water and groundwater pumping are accounted for and compared with the total crop consumptive use on an annual basis to estimate the irrigation return flows.

The basic methodology used to develop agricultural demand was to calculate crop consumptive use and compare that with total agricultural water use. Land use maps from DWR, annual conservation reports, as well as the trimester CVWD Crop Censuses and interviews with larger growers in the area were used to develop monthly crop acreages. Crop consumptive use was calculated from the ET needs of the specific crops, accounting for irrigation efficiency and effective precipitation in order to estimate applied water per acre. The ET needs of a crop can be estimated as ETc = Kc * ETo, where ETc is the ET demand of the crop, Kc is the crop coefficient, and ETo is the reference ET of the geographic area. The daily reference ET and precipitation were downloaded from the California Irrigation Management Information System (CIMIS) for the local Thermal Springs station.

Monthly crop coefficients (Kc) and growing season information for over 63 crops have been derived from the DWR irrigation estimation tool CPU M+ version 6.9 (DWR 2021). The ET needs of bare soil are accounted in the DWR crop coefficient estimate; if the ET demands of bare soil are higher than those for the crop during a growing season, then the applied water would need to meet the bare soil demand. According to interviews with local growers, the growing season for each crop type was applied to the CPU crop coefficients (DWR, 2021). In addition, many growers apply irrigation for certain crops in non-growing seasons for climate modification (e.g., frost protection) and/or leaching. The crop coefficient was used to account for some ET, but the remainder is assumed in the surplus of supply to crop demand, thus increasing the return flow volumes. The ETc values were similar to previous values used in CVWD planning (Stantec, 2019), but the DWR method allows for more flexibility in the specific growing seasons and irrigation practices of the Subbasin.

The monthly ET needs of a crop can be satisfied by either applied irrigation or through natural precipitation. Total irrigation was estimated to be the ET demand of the crop less precipitation. Although the amounts in the Indio Subbasin are small, precipitation that exceeds the daily ET demand of a crop is assumed to percolate and is also included in the agricultural return flow estimate.

The comparison of crop consumptive use and delivered agricultural supply was used to calculate an annual return flow percentage. Agricultural supply totals are available for groundwater and surface water deliveries and aggregated on a Township Range Section basis to compare with crop consumptive use.

The Conservation Reports estimated an irrigation efficiency of 72 percent each year (Stantec, 2019), while the annual supply and demand analysis indicates that annual irrigation efficiency varies from 67 to 74 percent, with an average irrigation efficiency of 71 percent of water supply for the period 2009-2019. The remaining agricultural irrigation use (29 percent) becomes return flow. The return flows were distributed throughout the model area based on the crop demand and applied by Township Range. Total annual return flows for agricultural irrigation are shown on Figure 7-8.

Golf Course Return Flow

Like agricultural return flows, irrigation water applied in excess of golf course water demand will result in return flow. Golf courses in the Indio Subbasin are supplied through a variety of sources including imported water, recycled water, potable water from water systems, and onsite groundwater wells. Irrigation demand for a golf course is dependent on the number of holes, the type and area of turf, and other landscaping. CVWD estimates irrigated area for some golf courses in their service area (for example, in reports on non-potable water). The approximate irrigated area for each golf course was digitized from aerial photos and compared to CVWD estimates (if available) to help calculate the estimated irrigation demand.

The irrigation supply for each golf course was totaled on an annual basis and compared to annual demand. The results were averaged by municipal area by year, yielding an average golf course return flow range of 21 to 44 percent. The percentage of golf course demand that results in return flow varies over the basin. The volume of return flow for golf was totaled for each planning Subarea (Subareas are defined in the Water Demand section) and then applied to the digitized irrigated areas of golf within that Subarea. Previous planning documents have estimated golf course irrigation efficiency, assuming a constant 38 percent average over Irrigation District 1 (Stantec, 2019). The supply and demand methodology varies by time and Subarea, but the basin wide average amounted to 34 percent from 2009 to 2019, similar to previous estimates. Figure 7-8 shows the estimated annual golf course return flow over the model period.

Municipal and Domestic Return Flow

Municipal and domestic return flows to the groundwater basin can result from indoor use (septic tank effluent), outdoor use (landscaping irrigation returns in excess of evapotranspiration), and system losses (pipe leaks). Accordingly, a key indicator for return flows is the relative amount of water used indoors versus outdoors. This varies geographically. For example, landscape irrigation is a significant water use in the West Valley and less so in the East Valley. In addition, the extent of sewer systems and conversely, reliance on septic systems are variable across the Subbasin. For these reasons, this analysis included assessment for each planning Subarea of 1) the percent of outdoor demand that is expected to result in irrigation return flow and 2) the volume that is expected to flow to the septic system. Annual outdoor demand estimates by Subarea were developed as documented in Chapter 5, *Demand Projections*. The volume of septic system flow was assessed in Chapter 6, *Water Supply,* for future use based on the sewersheds. Available information on estimated septic return flow was available for 2020 and was projected for 2025 to 2045. Expansion of sewered areas over the past ten years and estimated projection over the next ten years were assumed to be similar.

Municipal return flows were averaged over the entire Subarea. However, no municipal return flow was applied to areas of the basin with little to no development. Municipal return flow averaged 27 percent of total demand basin-wide but ranged on geographic areas from 15 to 40 percent. Figure 7-8 shows the estimated municipal and domestic return flow.

7.2.6 Outflows

Outflows include groundwater production from agricultural, municipal, golf course, and other pumping wells, drain flows, ET, and groundwater outflows to the Salton Sea.

7.2.6.1 Groundwater Production

For the original and *2010 CVWMP Update* models, annual estimates were made of agricultural, municipal, golf course, and other pumping for each Township Range section using the consumptive use method. Pumping for municipal and domestic use was compiled from available State Water Resources Control Board (SWRCB), USGS, CVWD, and DWA records and estimated for areas with insufficient records. For the updated model, CVWD and DWA metered pumping for municipal and domestic use, and all available metered municipal, agricultural, golf course, and fish farm pumping, were included for years 2009 to 2019.

For the model update, pumping estimates for 1997 to 2009 were not changed except for pumping in the Garnet Hill Subarea, where pumping records from DWA indicated that the *2010 CVWMP Update* model overestimated historical pumping.

For homesteads/small water systems in the East Valley that pump less than 25 acre-feet per year and are exempt from well metering required for replenishment assessments, an additional 1,000 AFY was distributed to hypothetical Layer 2 wells at each water system and estimated location of private wells. Wells were added to Layer 2 to reflect the relatively shallow depths of domestic wells. For West Valley unincorporated areas, an additional 500 AFY of pumping was distributed to hypothetical wells across the area.

Groundwater production is the largest outflow from the Indio Subbasin.

Figure 7-9 shows the location of all simulated pumping wells. Wells were simulated using the standard MODFLOW WEL Package and assigned a code for row, column, and layer in the model. Pumping wells are simulated as being located at the respective center of each model cell. For the 1997 to 2008 period, the same model cells used in the *2010 CVWMP Update* model WEL Package were retained. For 2009 to 2019, new annual well datasets were developed using available records of metered pumping for known municipal, agricultural, golf, and other known production wells in the Subbasin. If more than one production well is located within the same model cell, the annual pumping rates are accumulated. Wells are assigned to model layers based on known or inferred depths. For wells completed (screened) in multiple model layers, total annual pumping from each layer was allocated based on layer transmissivity-based weighting. Most pumping occurs from the deep aquifer (Model Layer 4).

Total annual pumping amounts simulated between 1997 and 2019 are shown on Figure 7-10. As shown, groundwater production has decreased significantly since the mid-2000s, reflecting reduced demands from water conservation and source substitution including increased direct delivery of Colorado River water and recycled water for irrigation uses.

Figure 7-9. Location of Production Wells Known to be Active, 1997-2019

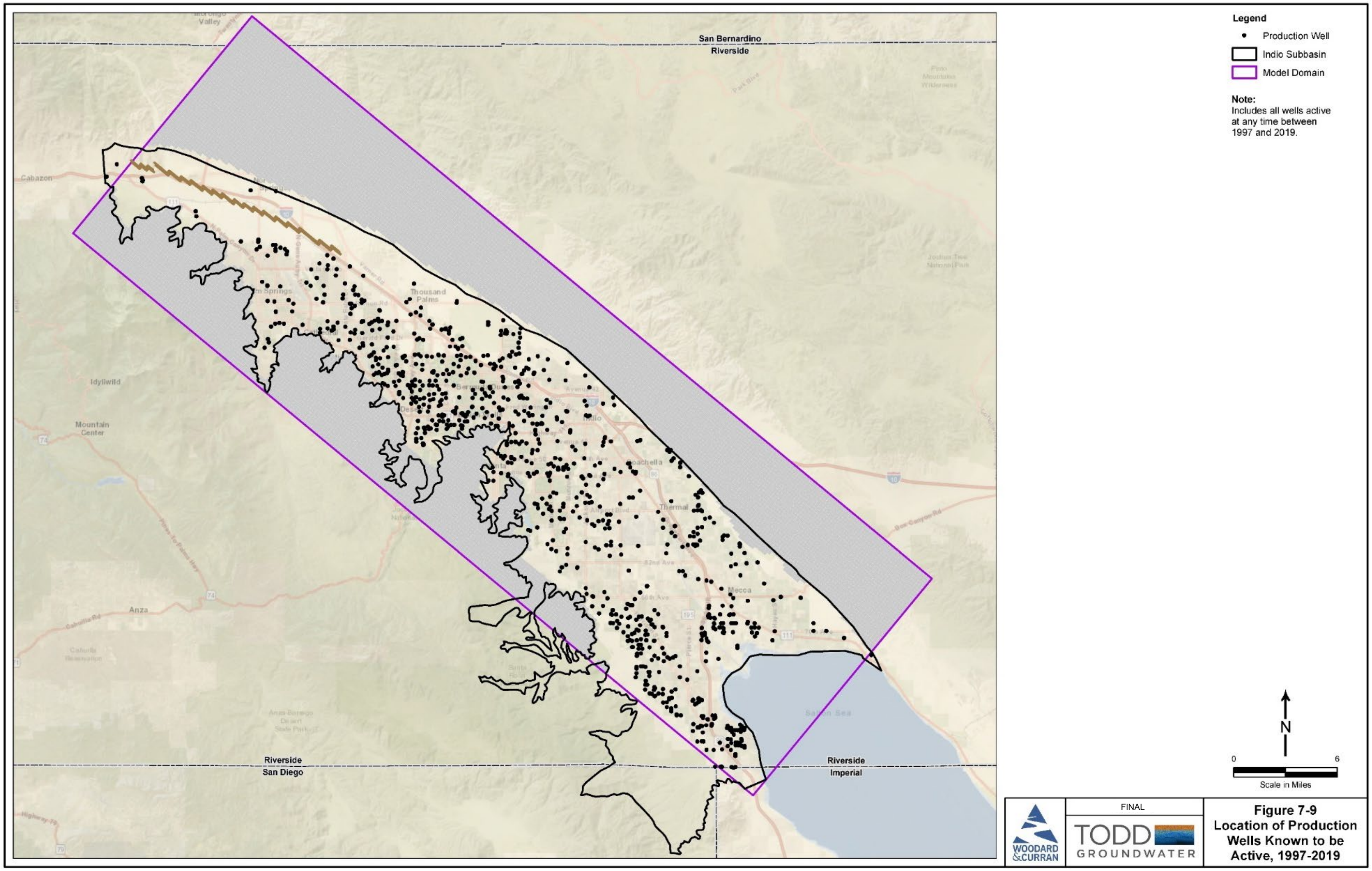


Figure 7-10. Groundwater Production, 1997-2019

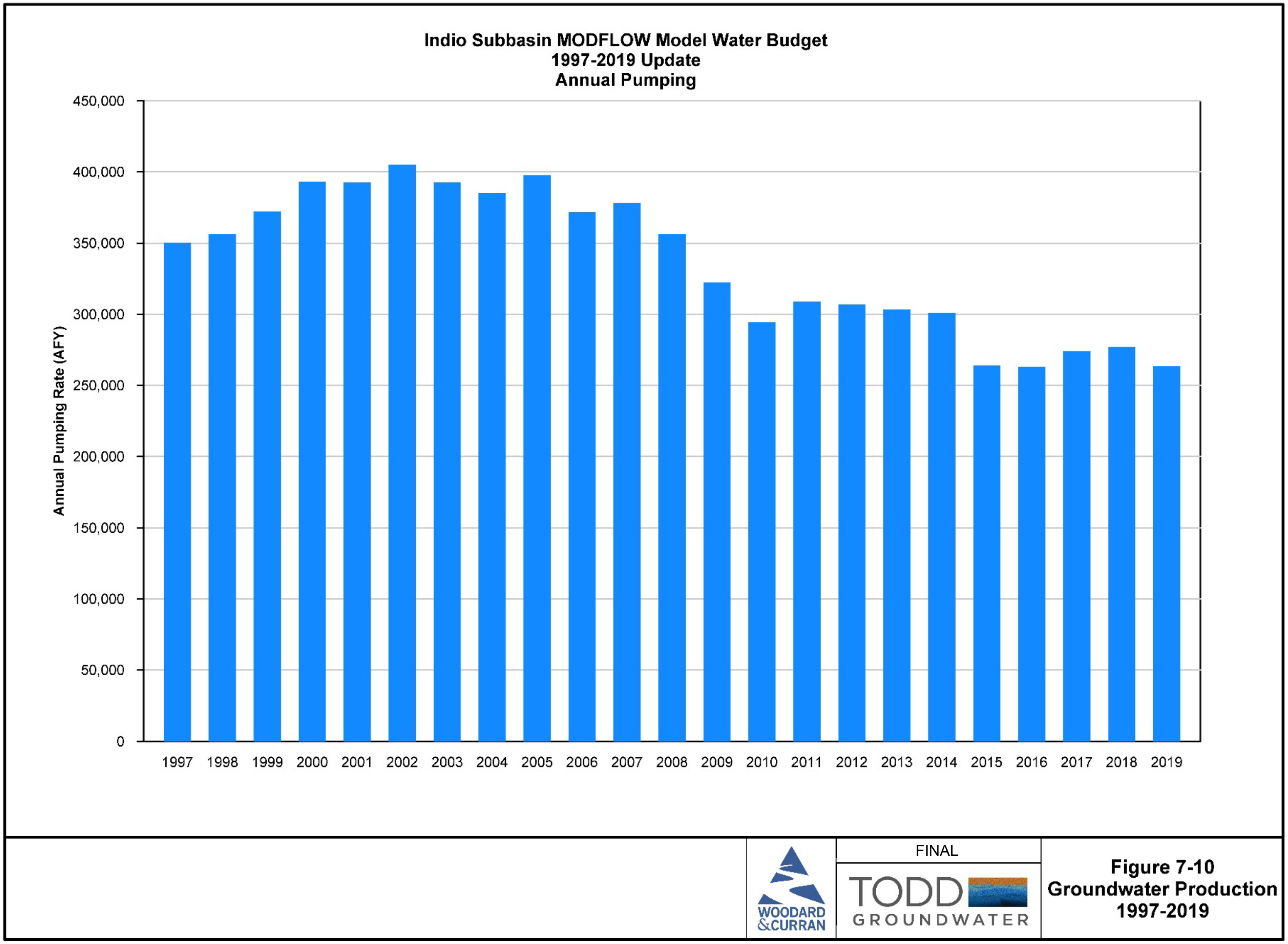


Figure 7-10
Groundwater Production
1997-2019

7.2.6.2 Drain Flows

Shallow groundwater drainage systems have been installed over a large portion of the East Valley (see Figure 2-5 for locations) where they serve to maintain the water table below crop rooting depths. The model simulates drains in Layer 1 using the MODFLOW EVT Package, with drain locations and elevations based on their construction records. On-farm drains are constructed at approximately 6-foot depths and are connected to CVWD drains that are typically installed at depths of 8 to 10 feet. The model calculates the amounts of drain flow based on the drain elevations, adjacent groundwater elevations, and aquifer/drain conductance (a permeability parameter). Flow from the drains goes either into the CVSC or into a network of open drains that flow directly into the Salton Sea. The drain boundary conditions in the model are maintained at the 1997 configuration.

7.2.6.3 Evapotranspiration

Evapotranspiration from shallow groundwater is simulated in the eastern portion of the model using the MODFLOW EVT Package. Note that the package only estimates ET losses from shallow groundwater levels; other ET and surface water evaporation losses are calculated separately as part the methodology for other components, including applied water return flows, groundwater replenishment, wastewater percolation, and watershed runoff. An ET boundary condition was initially assigned to all cells within the semi-perched zone (see Figure 3-5) in the original historical simulation. As land within the semi-perched zone was developed for agriculture, in locations where drains were installed, the ET boundary was replaced with a drain boundary. Because no additional drain systems were installed after 1997, the ET boundaries were maintained at their 1997 conditions in the model. Inclusion of such ET in the model ensures a complete water budget and acknowledges the hydrologic possibility of phreatophyte ET, including potential GDEs but also non-GDE vegetation around agricultural fields and along drainage channels. ET amounts are calculated based on specified plant rooting depths, reference ET values, and simulated shallow groundwater elevations.

7.2.6.4 Salton Sea

The Salton Sea is simulated as a general head boundary (GHB) with time-varying elevations. For the historical and *2010 CVWMP Update* models, actual Salton Sea elevations were used for the periods 1936 to 1999, then held constant at 1999 levels. For the updated 1997-2019 model, actual Salton Sea elevations were simulated through 2019, with sea elevations dropping around 10 feet over the period (Figure 7-11).

Both groundwater outflow to the Sea and inflow from the Sea are simulated, depending on location, time period, and hydraulic gradients between the shallow aquifer and the Sea. Simulated net flow between the Sea and groundwater system is relatively small and inflow from the Sea has been decreasing, as discussed in Section 7.4.

Figure 7-11. Salton Sea Elevations, 1997-2019

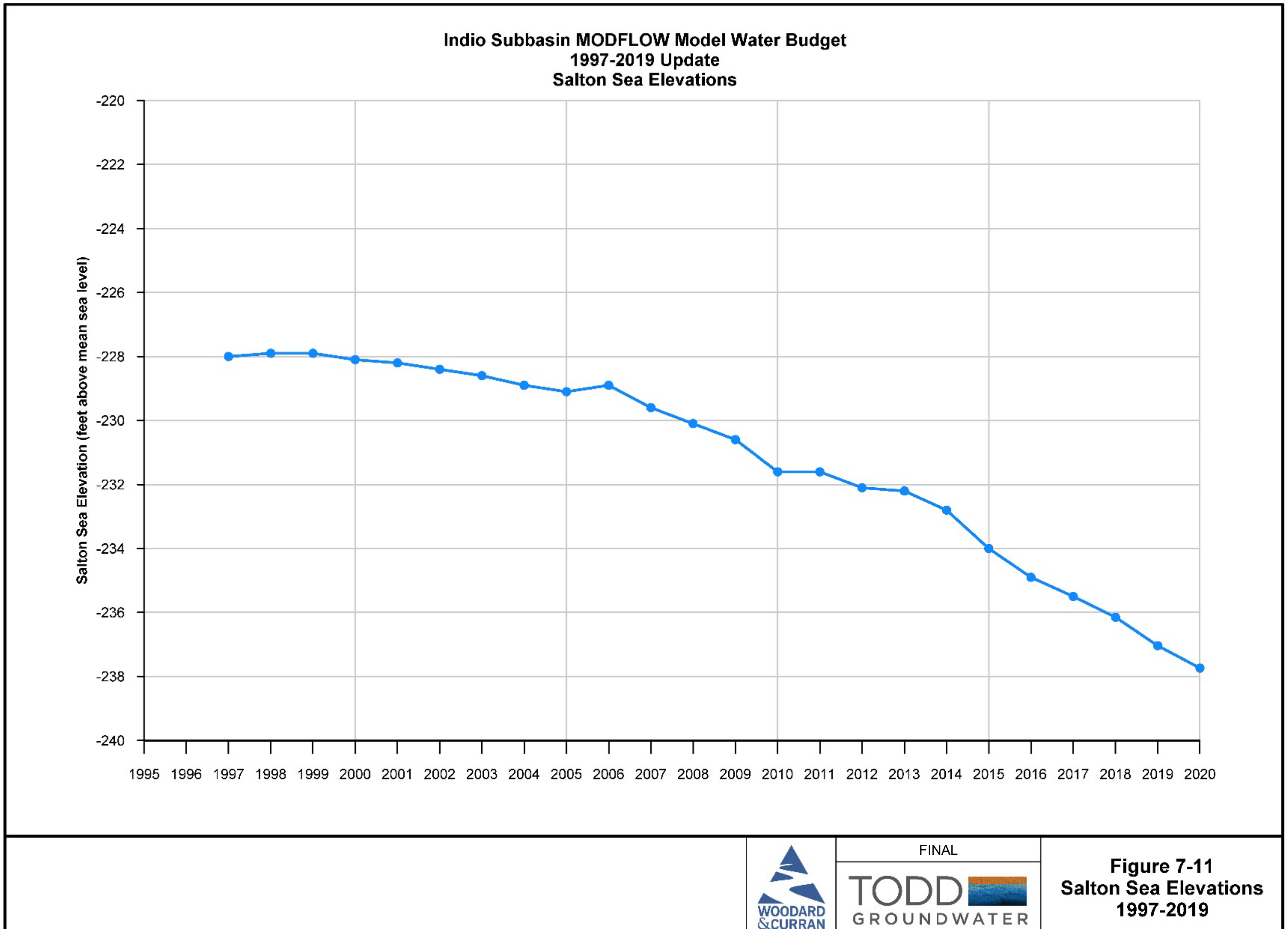


Figure 7-11
Salton Sea Elevations
1997-2019

7.3 Model Update Process and Results

This section documents the model calibration results of the original and *2010 CVWMP Update* models, and the performance of the updated 2022 *Alternative Plan Update* model, along with the updated model water budget. The original and updated models were calibrated to historical groundwater elevation trends in shallow and deep wells. Estimated drain flow rates were also evaluated as a calibration target. The primary objective of the calibration update was accurate replication of the dynamic water level conditions in shallow and deep wells across the Indio Subbasin, including recent trends since 2009. For the 1997 to 2019 update, only minor "recalibration" via adjustment of input parameters was performed. Rather, the original 1936 to 1996 and *2010 CVWMP Update* models were extended using measurements and better estimates of inflows and outflows primarily for the period after 2008. Minor recalibration was performed in the Garnet Hill Subarea, where selected input parameters were adjusted. These included initial conditions, boundary conditions, historical pumping, and HFB conductance.

The simulated groundwater flow and water budget conditions for the *Alternative Plan Update* model were compared with measurements and evaluated. This included preparation of maps of simulated shallow and deep aquifer groundwater elevations over time and hydrographs of observed and simulated changes in water levels in the shallow and deep aquifer across the Subbasin. Water budget conditions were also evaluated to assess groundwater inflow and outflow and storage changes.

In general, the *Alternative Plan Update* model of the Indio Subbasin is well calibrated with observed groundwater elevation and drain flow trends for both the historical and updated periods. In some areas, calibration is better for the recent 2009 to 2019 period than in earlier periods, confirming that the updated input data and water budget are accurate representations of the Indio Subbasin.

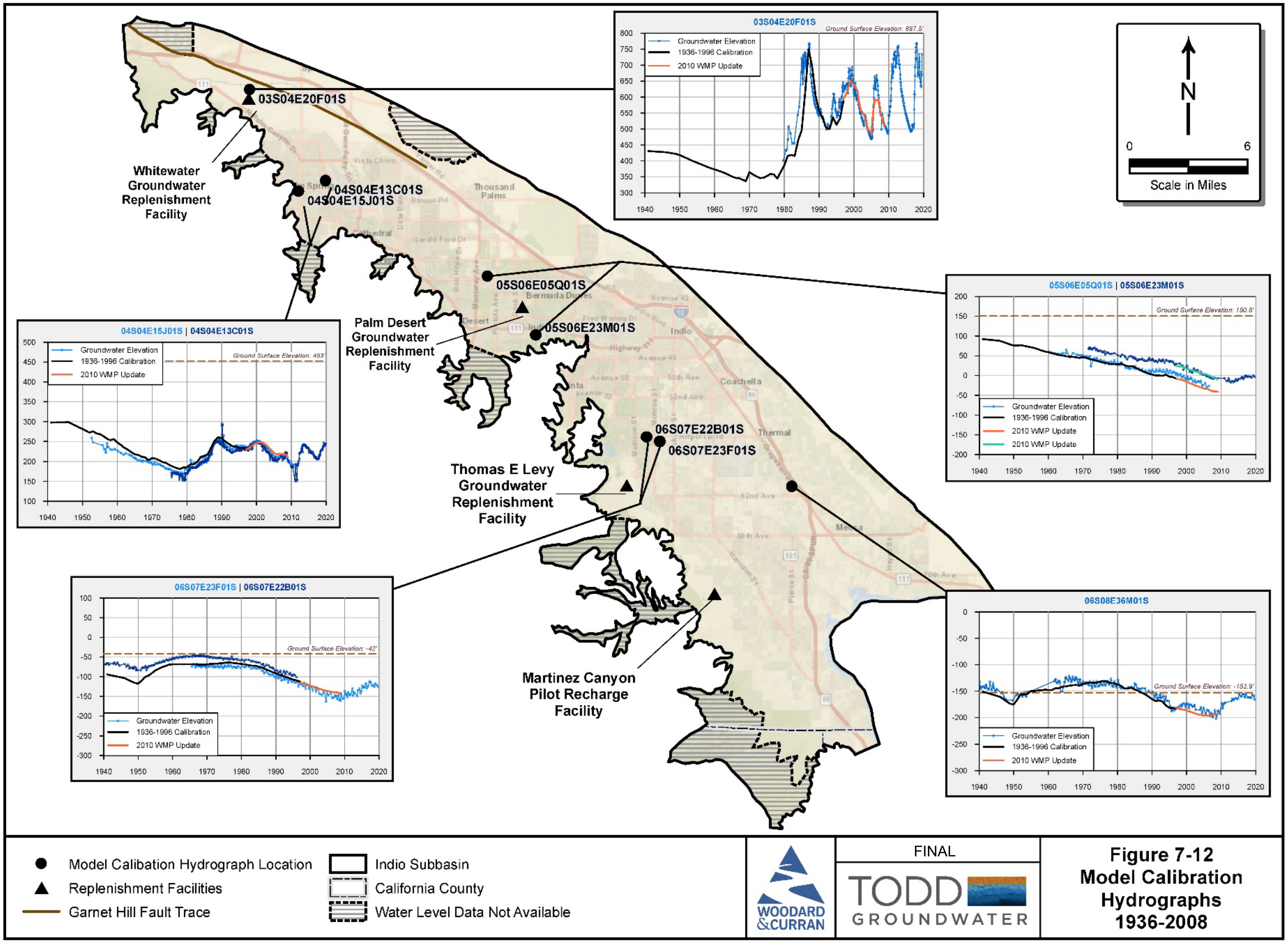
7.3.1 Historical Model Calibration Results

The original 1936 to 1996 and *2010 CVWMP Update* models were well calibrated to measured groundwater elevation and water budget trends across the basin. Errors between observed and simulated groundwater elevations were generally low, and simulated drain flow amounts over time corresponded to measured and estimated drain flows after the drains were installed.

Figure 7-12 shows 1936 to 2008 model calibration hydrographs for five wells representative of groundwater level conditions across the Subbasin, which have also been monitored for many years. Note the original 1936 to 1996 simulated levels are shown with the black lines on the hydrograph, while the 1997 to 2008 simulated levels from the *2010 CVWMP Update* model are shown with orange lines.

The hydrographs shown on Figure 7-12 indicate good overall calibration across the Indio Subbasin. Model-computed drain flows were also compared with measured agricultural drain flows. The very good agreement from the 1950s through the early 2000s showed that the model can simulate real trends in both water levels and flow rates. Moreover, the high calibration quality justifies the use of 1997 simulated groundwater elevations from the historical model as initial conditions for the 1997 to 2019 model update.

Figure 7-12. Model Calibration Hydrographs, 1936-2008



7.3.2 1997-2019 Model Update Process

The *2010 CVWMP Update* dataset was developed during 2008 to 2010 and included measured pumping and recharge data that were readily available at that time, generally through 2008. However, for the simulation period from 2009 to 2019, for which data were not yet available, various modeling assumptions (pertaining to natural and artificial recharge, municipal, resort and irrigation pumping demands, as well as included CVWMP projects) were used to estimate future pumping and recharge amounts and their distributions in the model. Accordingly, for this *Alternative Plan Update*, model inflows and outflows for the period 2009 to 2019 were updated and the model re-run to confirm calibration quality for this period.

The initial model update runs indicated that the model continues to exhibit good calibration quality for most of the Subbasin. However, simulated water levels in the updated Garnet Hill Subarea were not well calibrated with observed levels in some wells. This appeared to be due to a combination of factors, including offsets in simulated initial conditions (as compared with observed levels in 1997), inaccuracies in the simulated amounts of pumping in the Garnet Hill Subarea, uncertainty in inflow rates from the Mission Creek Subbasin, and characterization of the HFB representing the Garnet Hill Fault. Adjustments of each of these parameters were made to the *Alternative Plan Update* model to improve calibration in this Subarea. Calibration quality in the Garnet Hill Subarea was improved significantly after these adjustments.

After the initial model update runs, minor adjustments in urban irrigation return flow recharge distributions were also made in the Palm Springs and Indio geographic areas used in the demand forecast. The total estimated urban return flow volumes developed in Chapter 6, *Water Supply,* were maintained, but the spatial distributions were adjusted to better align with undeveloped and urban areas. These adjustments also improved local calibration quality.

7.3.3 Water Level Calibration Results

The updated Indio Subbasin model meets both qualitative and quantitative calibration goals. The simulated shallow aquifer (Model Layer 1 and 2) and deep aquifer (Model Layer 4) water level trends throughout the Subbasin are consistent with observed groundwater flow directions and hydraulic gradients characterized in the Subbasin conceptual model and groundwater conditions. An aquitard (Model Layer 3) is locally present between the shallow and deep aquifers. The model reacts well to the large fluxes of recharge and, particularly the dynamic and very large water level mounding response to WWR-GRF and TEL-GRF artificial recharge operations. Long-term trends in shallow and deep aquifer water levels and vertical hydraulic gradients are accurately simulated, as further described below.

Model calibration is also demonstrated by quantitative calibration statistics, which are summarized in Table 7-1. For the quantitative assessment, water level data from 30 shallow and deep monitoring and production wells were used to calculate water level residuals (differences between observed and simulated levels). These wells were selected to be representative of the Subbasin. The summary statistics below are for all model layer water level measurements between 1997 and 2019.

Table 7-1. Model Calibration Summary Statistics 1997 – 2019

Calibration Measure	Calibration Results
Mean Residual (Head)	-12.15 feet
Mean Absolute Residual (Head)	17.97 feet
Root Mean Squared Residual (RMS-Head)	24.47 feet
Groundwater Elevation Range	1,583 feet
Mean Residual/Range	0.77 %
RMS/Range	1.55 %

The American Society for Testing and Materials (ASTM) recommendations for Mean Residual/Range and RMS/Range are less than 5 percent and 10 percent, respectively (ASTM, 1994, 1998). The Indio Subbasin model calibration quality exceeds these ASTM recommendations.

In the Indio Subbasin model, there are several sources of apparent head residuals that are unrelated to potential inaccuracies in conceptualization of the hydrogeologic system or simulated amounts of inflow and outflow. These include the following.

- The model uses annual stress periods, meaning that the amounts of recharge, pumping, and other inflows and outflows are averaged over each year. In actuality, operations of some of the water supply facilities (such as GRF operations and groundwater production well pumping) and natural inflow sources are not constant at the same rates throughout the year, resulting in some averaging errors in simulated levels.
- Simulated groundwater levels are calculated at the node or center of each model cell containing an observation well. The actual observation wells may be located anywhere within the 1,000 x 1,000-foot model cell, resulting in offsets of as much as 700 feet between the simulated and observed calibration well location.
- The simulated head within the 1,000 x 1,000-foot cell represents the model-calculated average level in the cell. Hydraulic gradients near recharge sources or pumping wells can cause steep local gradients and variable actual elevations within areas simulated by the model cells.
- Some observation wells are completed (screened) in multiple aquifers and model layers, resulting in composite observed level or levels that are reflective of a particular aquifer zone, depending on the local vertical flow conditions.

Regardless of these approximations, the model accurately simulates groundwater conditions through the Subbasin and simulation period, as further documented below.

7.3.3.1 Simulated Groundwater Elevation Contour Maps

Figure 7-13 and Figure 7-14 show simulated shallow and deep groundwater elevations in January 2010, near the middle of the updated simulation period, and in January 2020, at the end of the updated simulation period. Visual comparison of the simulated 2020 levels with the most recent measured levels (shown on Figure 4-1) reveals that simulated levels are generally well matched with measured levels.

Figure 7-13. Simulated Shallow and Deep Groundwater Elevations, 2010

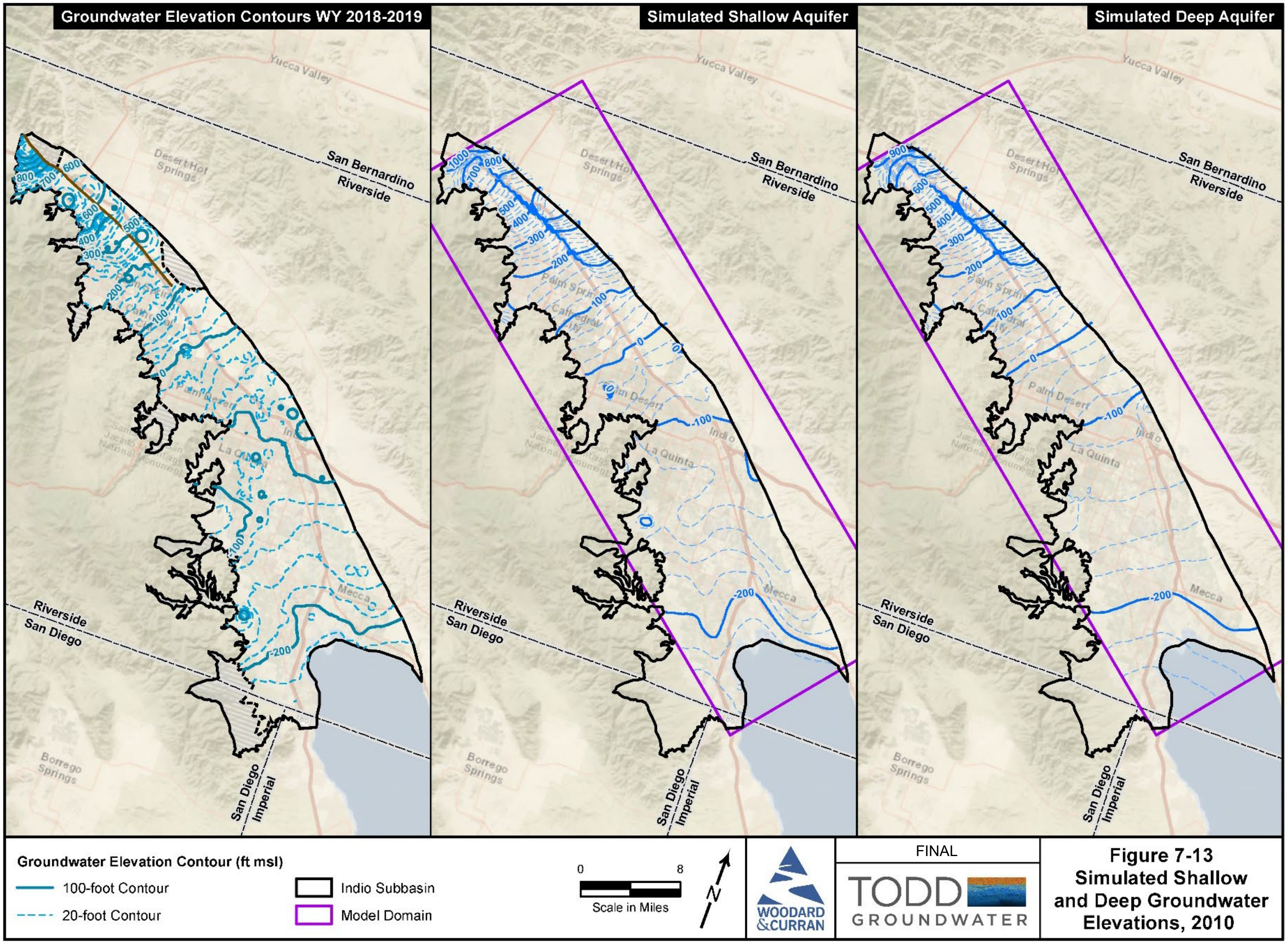
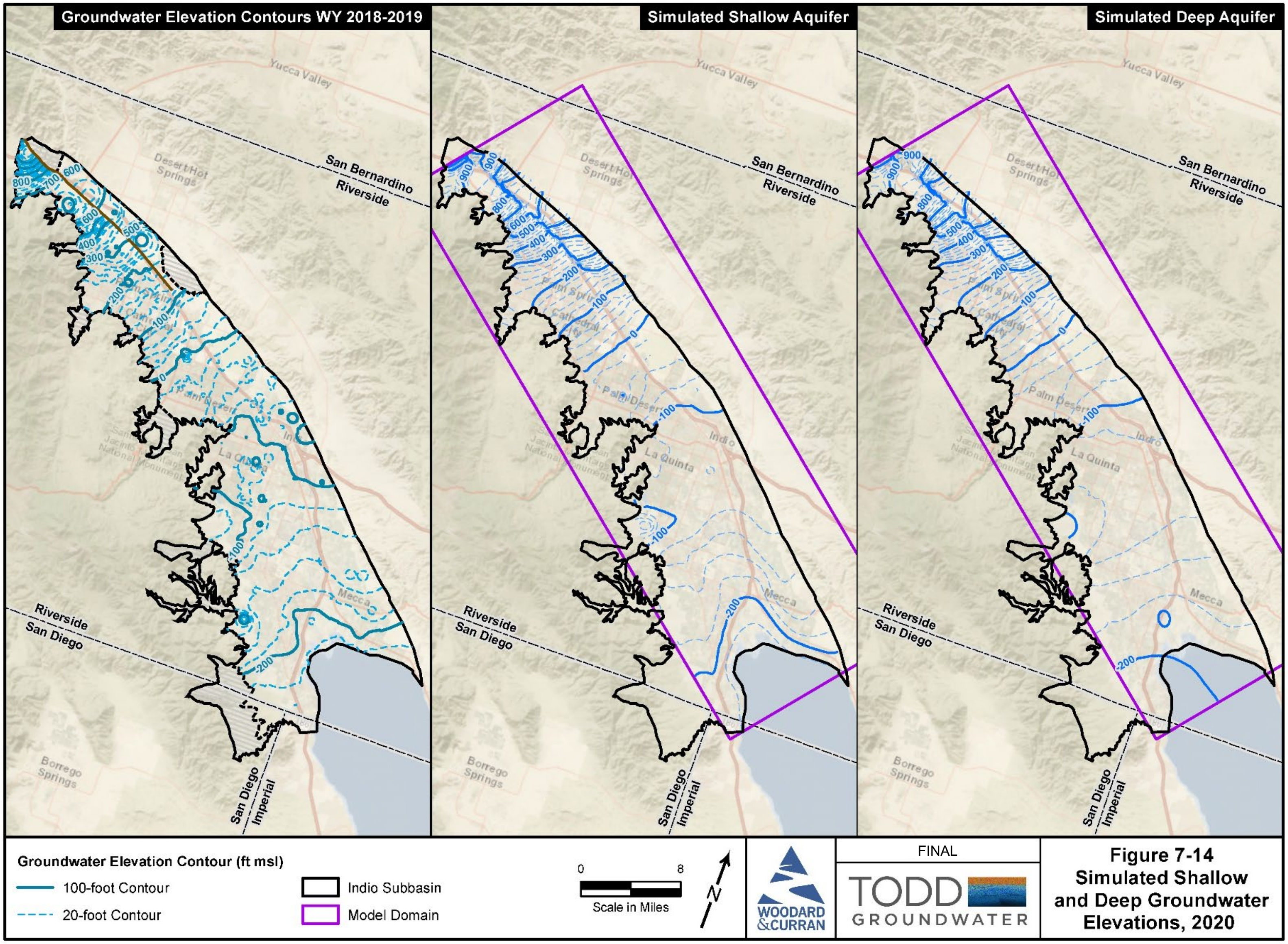


Figure 7-14. Simulated Shallow and Deep Groundwater Elevations, 2020



As shown on Figure 7-13, groundwater flow directions in 2010 in the shallow and deep aquifers are northwest-to-southeast across the Subbasin. The hydraulic gradients in both zones are non-uniform with higher gradients in the upper West Valley than in the East Valley. A recharge mound is apparent in the shallow aquifer in the area of TEL-GRF, in response to initiation of recharge in 2009. Comparison of the simulated 2010 levels with the 1997 initial conditions reveals that water levels in both aquifer zones dropped during this period. This decline occurred in several areas of the Indio Subbasin and is also apparent in the observed and simulated hydrographs and water budget change in storage, described below.

Simulated shallow and deep groundwater levels in January 2020 show the same general flow directions and hydraulic gradients as 2010, but local increases in groundwater levels are simulated over this 10-year period. The largest increases are simulated in the upper West Valley and the East Valley, with more stable levels simulated in the mid-valley between 2010 and 2020. The groundwater elevation patterns in the East Valley change dramatically following 10 years of TEL-GRF operation. Groundwater mounding is simulated beneath and downgradient of the TEL-GRF as evidenced by concentric contours.

7.3.3.2 Observed vs. Simulated Hydrographs

Water level data from the 30 monitoring and production wells used for model calibration assessment were plotted on hydrographs and compared with simulated levels. Figure 7-15 shows the locations and aquifer designations of the calibration target wells, and full-size hydrographs are in Appendix 7-A. Water level measurements between 1997 and 2019 are available for the majority of the wells, although a few monitoring wells were not installed until the 2000s and only have water level data after their installation dates.

Figure 7-16 and Figure 7-17 show the observed and simulated groundwater elevation hydrographs in the West Valley and East Valley, respectively. Observed levels are shown as black points on the graphs, while simulated levels are shown as the orange lines. All hydrographs use a 200-foot elevation range, except two wells near the WWR-GRF that use a 400-foot range on the hydrographs. The simulated water levels are generally very well matched with the observed groundwater trends for all shallow and deep wells across the Indio Subbasin, as described below.

West Valley/Palm Springs Subarea

The five calibration wells in the upper West Valley/Palm Springs Subarea (hydrographs along left side of Figure 7-16) show dynamic fluctuations associated with recharge events at the WWR-GRF, with water level mounding and recovery cycles decreasing in magnitude down the valley. The northwesternmost wells nearest the WWR-GRF exhibit fluctuations of over 300 feet in response to very large recharge years. Model-simulated levels in these wells are very closely matched with observed levels, both with respect to peak and valley magnitudes and timing. The mounding and recovery responses are progressively muted further down valley, but observed and simulated levels remain well-calibrated.

Figure 7-15. Shallow and Deep Model Calibration Wells

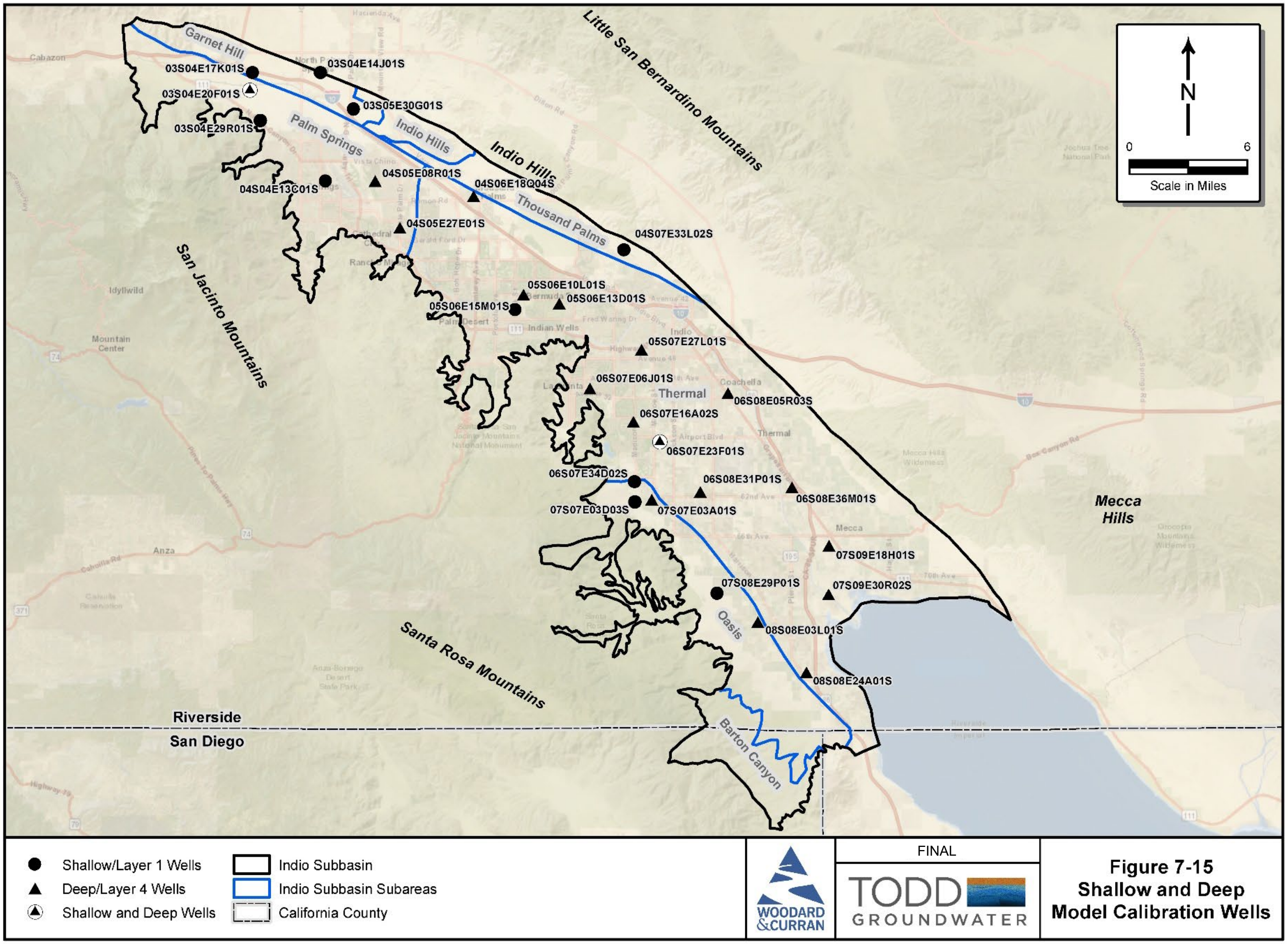


Figure 7-16. Model Calibration Hydrographs, West Valley 1997-2019

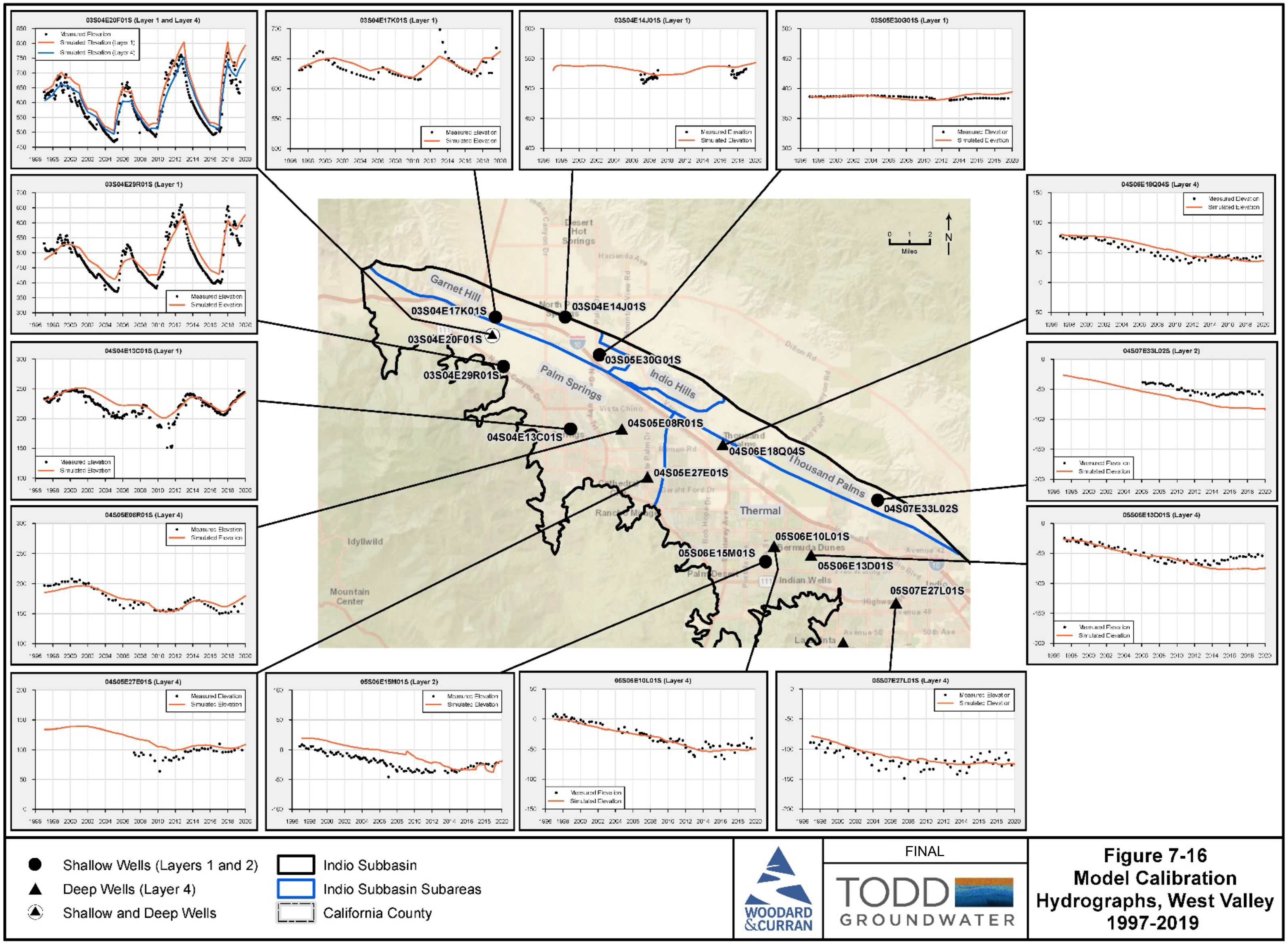
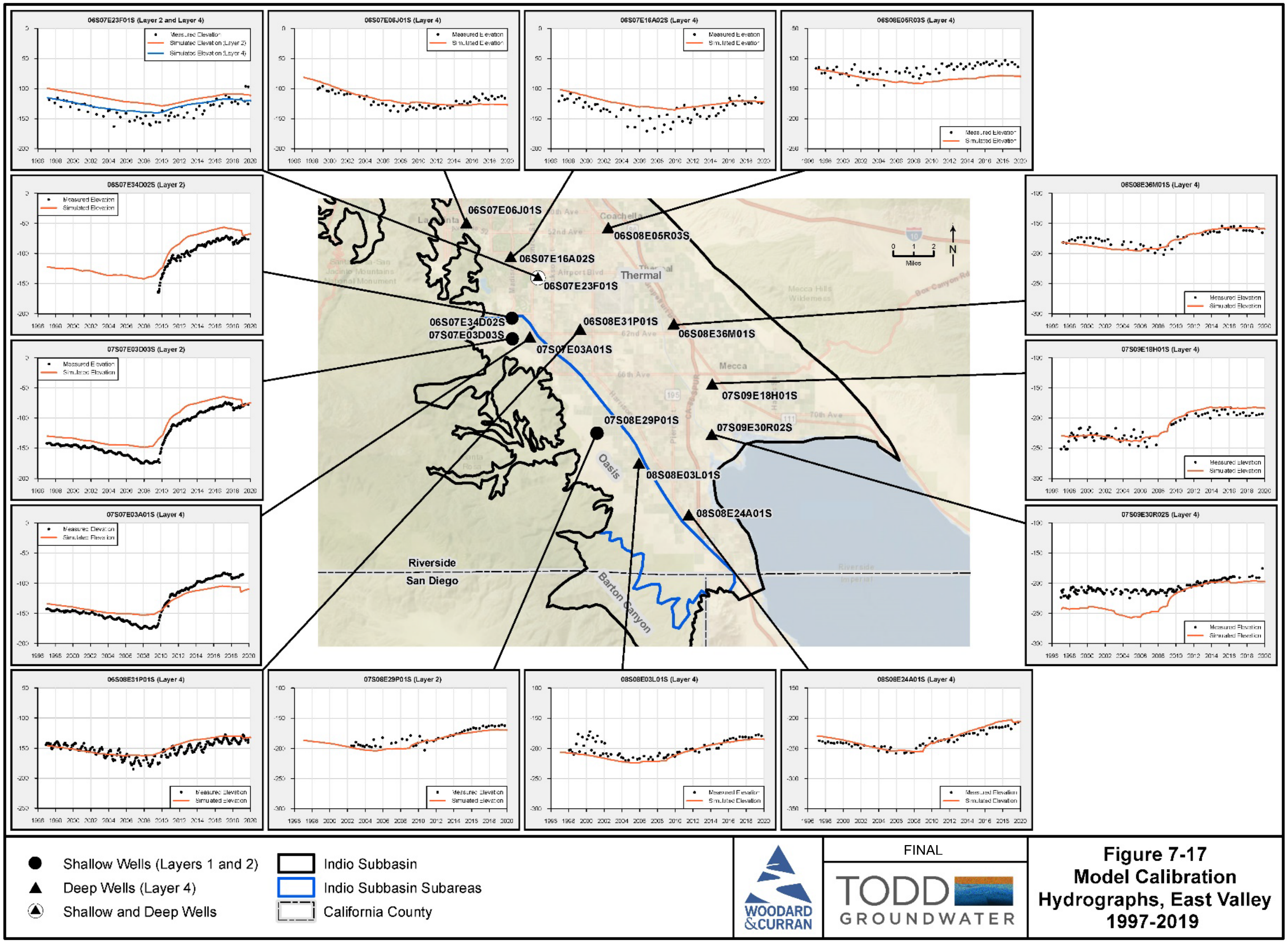


Figure 7-17. Model Calibration Hydrographs, East Valley 1997-2019



West Valley/Garnet Hill Subarea

Three calibration wells are in the Garnet Hill Subarea (hydrographs along the upper side of Figure 7-16). The northernmost of these wells is near the WWR-GRF and shows mounding and recovery in response to WWR-GRF recharge, even though it is on the eastern side of the Garnet Hill fault and HFB. The model reproduces the rising and declining water levels observed in this well between 1997 and 2019. The two other calibration wells in Garnet Hill show more stable levels, and the model is well matched with these trends.

Mid-Valley/Thousand Palms to Indian Wells Area

Six calibration wells are in the Thousand Palms to Indian Wells area (hydrographs along the right and bottom sides of Figure 7-16). Observed levels in these wells exhibited declines from 1997 through around 2010, then were characterized by relatively stabilized levels through 2019. The model simulates these trends generally well, although simulated levels are lower than observed in two of the wells near the City of Indio at the end of the simulation. This could be due to the previously mentioned sources of error in the numerical simulation, underestimation of return flow recharge in local areas, or inaccuracies in other model parameters. However, the model generally captures the measured levels in this area showing declines through 2010 followed by stable trends.

East Valley/La Quinta, Coachella, and Thermal Areas

Four calibration wells are around the La Quinta, Coachella, and Thermal areas (hydrographs along the top of Figure 7-17). Observed levels in these wells exhibited declines from 1997 through around 2010, then stabilized or increased through 2019. The model simulates these trends well, although simulated levels in one well near Coachella are lower than observed near the end of the simulation, similar to the previously mentioned simulation trend in the two wells near the City of Indio.

East Valley/TEL-GRF Area

Four calibration wells are in the East Valley near the TEL-GRF (hydrographs along the left side of Figure 7-17). Observed levels in these wells exhibited declines from 1997 through around 2009, then rapidly increased through 2019 in response to initiation of TEL-GRF operations. The model simulates these trends well, with simulated levels in the three wells nearest the GRF rising rapidly and exhibiting the same curve shapes as observed levels. Two of the wells have slightly higher simulated levels than observed while one has slightly lower simulated levels than observed. The model responds to the TEL-GRF recharge operations and simulated levels are well-matched with observed. This is notable because the original Indio Subbasin model was developed prior to TEL-GRF operations and was not calibrated to the strong recharge source, yet still simulates the addition of this source accurately.

East Valley/Mecca, Oasis, and Salton Sea Areas

Six calibration wells are in the East Valley in the Mecca, Oasis, and Salton Sea areas (hydrographs along the bottom and right sides of Figure 7-17). Observed levels in these wells were relatively stable between 1997 through around 2010, then increased through 2019, likely in response to source substitution and in response to initiation of TEL-GRF operations. The model simulates these trends well, with simulated levels in all six wells increasing after 2010 and exhibiting the same trend as observed levels.

7.3.4 Drain Flow Calibration Results

As an independent calibration target, estimated agricultural drain flow rates were compared with model-simulated drain flows, as shown on Figure 7-18. Model-computed drain flow provides a calibration check for the model, because CVWD has measured flows in the agricultural drains for many years. The measured versus simulated drain flows show good agreement between 1997 and 2002, then diverge slightly between 2003 and 2011, with lower model-predicted drain flows than measured. The differences then decrease between 2012 and 2019, with almost identical estimated and predicted amounts in 2018. Both the estimated and simulated drain flow trends are consistent with observed water level trends, with declining East Valley water levels and drain flows in the 1990s and 2000s, followed by stabilized or slightly increasing levels and drain flows in the 2010s. The generally well-matched drain flows show that the model is capable of simulating real trends in both water levels and flow rates.

7.4 Water Budget

7.4.1 1997-2019 Water Budget

Figure 7-19 shows the transient simulated water budget for all components in the model from 1997 to 2019. Similar results were provided for the historical model period from 1936 to 1996 in documentation provided by Graham Fogg and Associates (Fogg, 2000).

The water budget components include specified recharge, pumping, and subsurface inflows from the San Gorgonio Pass and the Mission Creek Subbasins, along with model-computed flows to ET, drains, and subsurface flow to and from the Salton Sea. The water budget reveals that discharges exceeded recharges for most years between 1997 and 2009, after which time total inflows exceeded outflows for most years between 2010 and 2019. These trends decreased, then increased groundwater storage in the Indio Subbasin, and as previously described, corresponding decreases and increases in water levels were simulated with the model.

7.4.1.1 Evapotranspiration

Transient ET is simulated in the model from 1997 to 2019. The ET rates are relatively uniform over this period, ranging from 4,100 to 5,300 AFY. As discussed in Section 7.2.6.3, this only includes ET losses from shallow groundwater and other ET losses are calculated separately. ET loss from shallow groundwater is mainly in the perched aquifer area in the East Valley.

7.4.1.2 Salton Sea

Figure 7-20 shows the transient simulated flow between the shallow aquifer and Salton Sea from 1997 to 2019. Both groundwater outflow to the Sea and inflow from the Sea are simulated, depending on location, time period, and hydraulic gradients between the shallow aquifer and sea, as illustrated on Figure 720. Note the simulated flows are for the northern portion of the Sea included in the model domain, and do not include any inflows or outflows in the southern portion of the Sea beyond the Indio Subbasin. Simulated net flow between the Sea and groundwater system is relatively small, always remaining below 3,000 AFY.

Figure 7-18. Simulated vs. Measured Drain Flows, 1997-2019

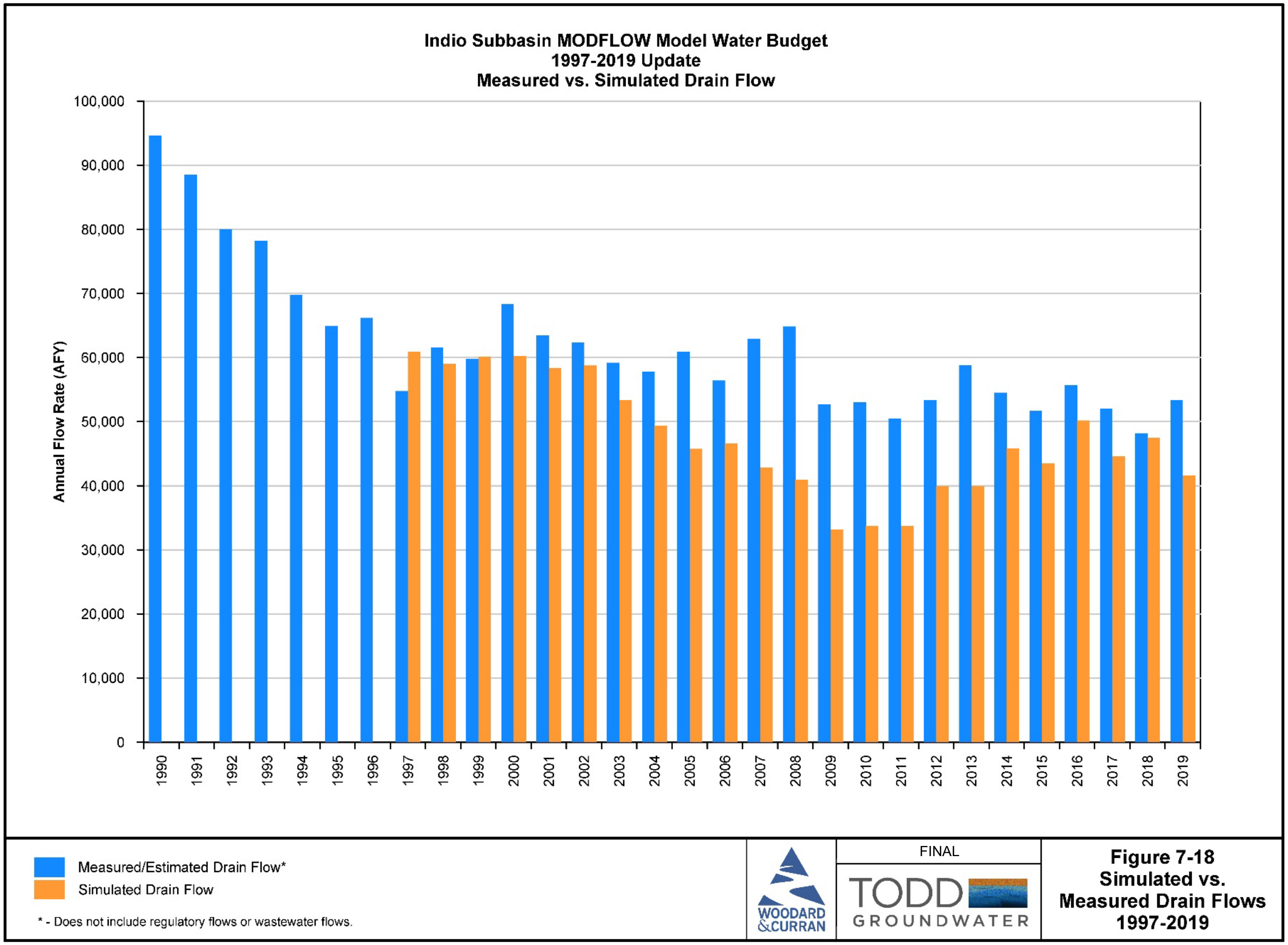


Figure 7-19. Annual Model Water Budget, 1997-2019

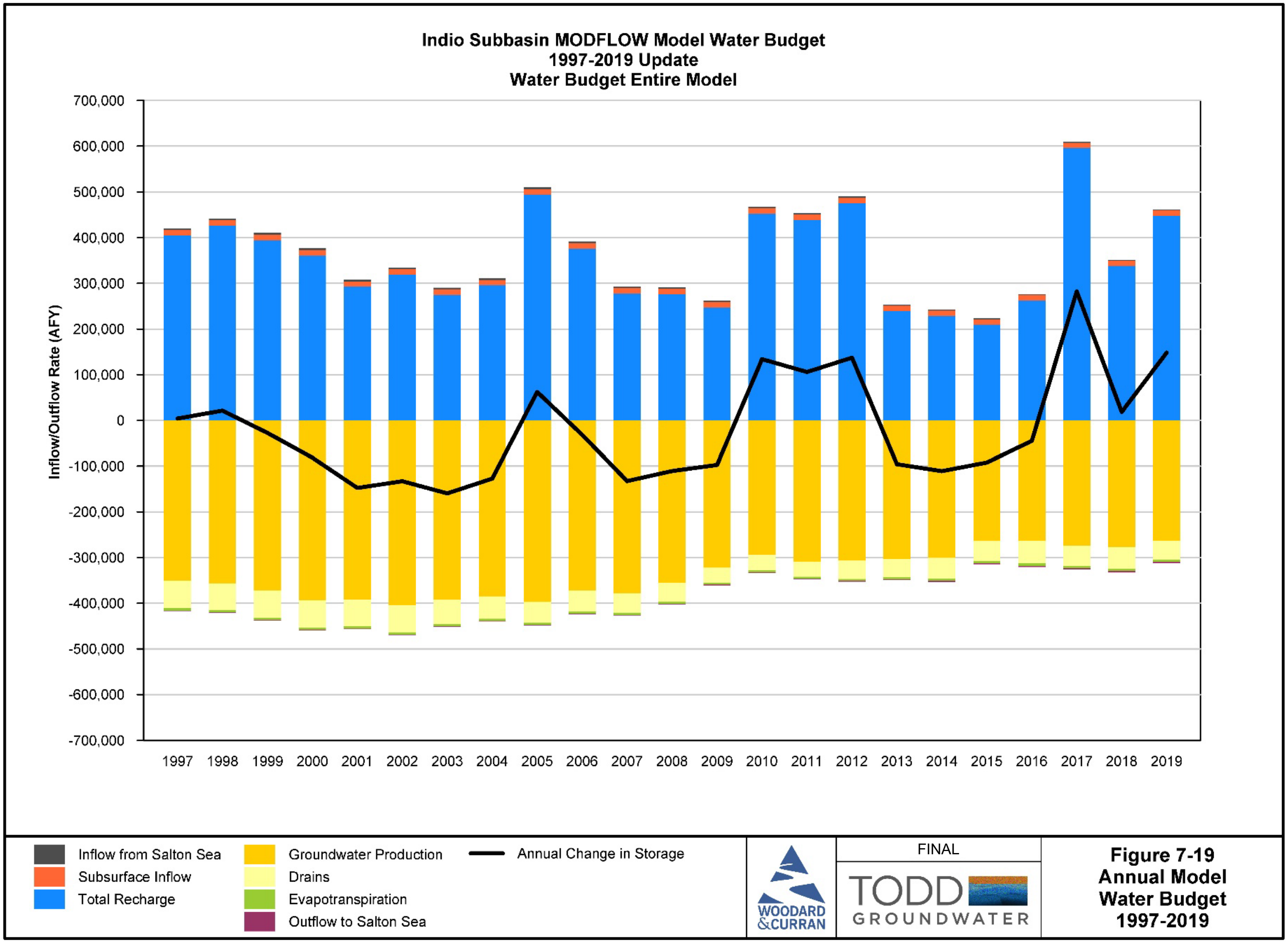
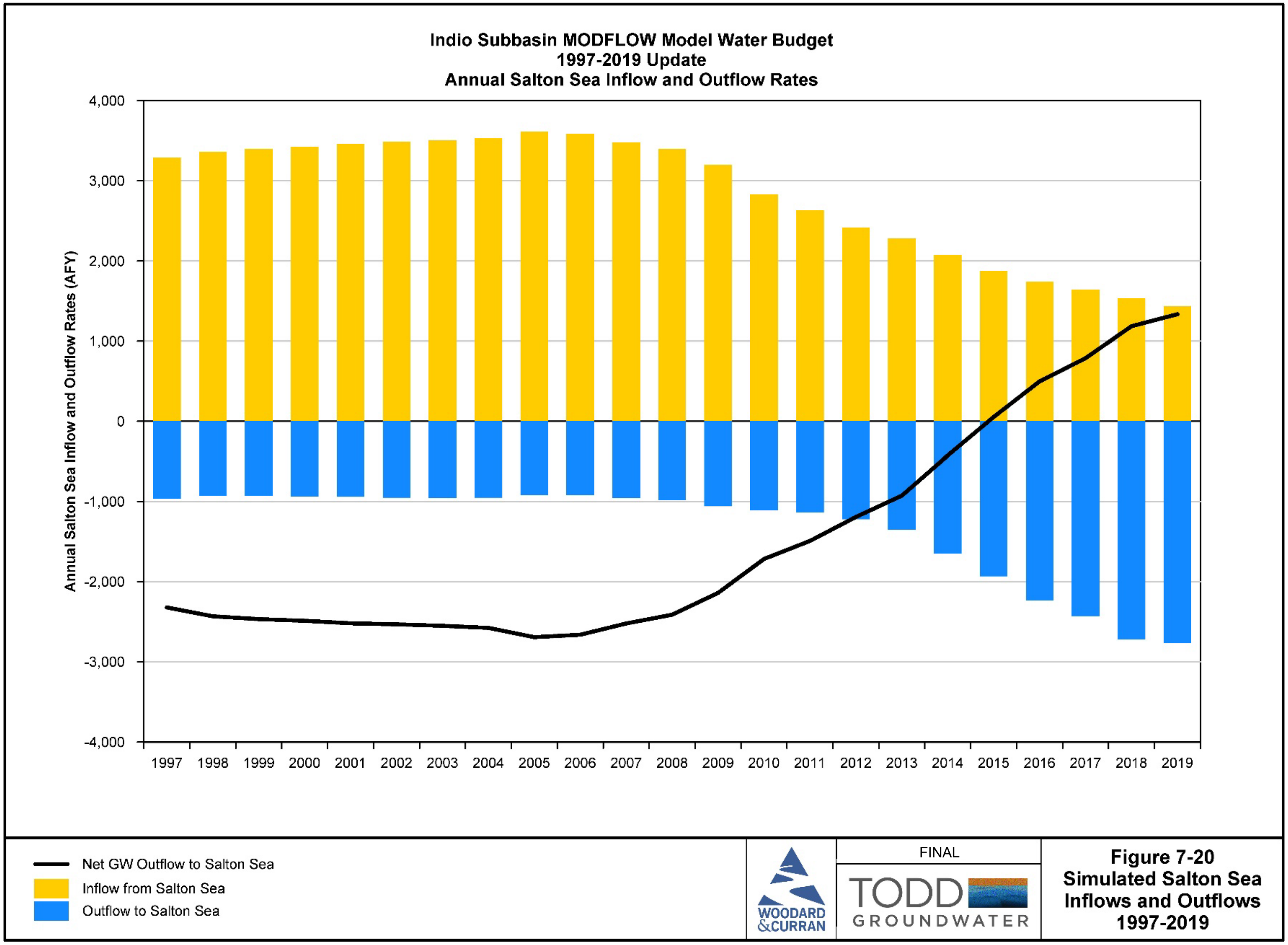


Figure 7-20. Simulated Salton Sea Inflows and Outflows, 1997-2019



During 1997 to 2014, the model had simulated net inflow from the Sea to the Indio Subbasin, but in 2015 and in subsequent years groundwater outflow to the Sea exceeded inflow from the Sea. This is due to the combination of declining sea levels and increasing shallow groundwater levels over time, resulting in reversals of the hydraulic gradients between the water bodies. As shown on Figure 7-17, the very good calibration of wells 08S08E24A01S, 08S08E03L01S, 07S09E30R02S, 07S09E18H01S, and 07S08E29P01S near the Salton Sea indicates the model is an accurate tool to estimate inflow and outflow rates and directions between the sea and groundwater. Net outflow of groundwater to the Salton Sea is desirable in that it minimizes the potential for saline water intrusion into the aquifer.

7.4.1.3 Change in Groundwater Storage

Accumulation of the inflows and outflows results in changes in groundwater storage. Figure 7-21 shows the annual model-predicted changes in storage between 1997 and 2019. The model-predicted changes in storage can be compared with the empirical water budget described in Chapter 4, *Current and Historical Groundwater Conditions,* and shown on Figure 4-9. Note that the numerical model results are for calendar years, whereas the empirical method values are for water years. In addition, slightly different methods are used between the two methods to develop the change in storage values. The model uses changes in simulated heads between years at each of the model cells, multiplied by a specific yield value, while the empirical method uses a water balance approach accounting for all inflows and outflows. Regardless, both methods to estimate annual changes in storage yield similar results, and in particular show the losses in storage experienced during the 2000s followed by the gains in storage during the 2010s.

Production wells are located throughout the Subbasin.

As documented in Section 7.3, *Model Update Process and Results*, the model accurately simulates groundwater conditions throughout the Subbasin and simulation period.

Figure 7-21. Simulated Change in Storage, 1997-2019

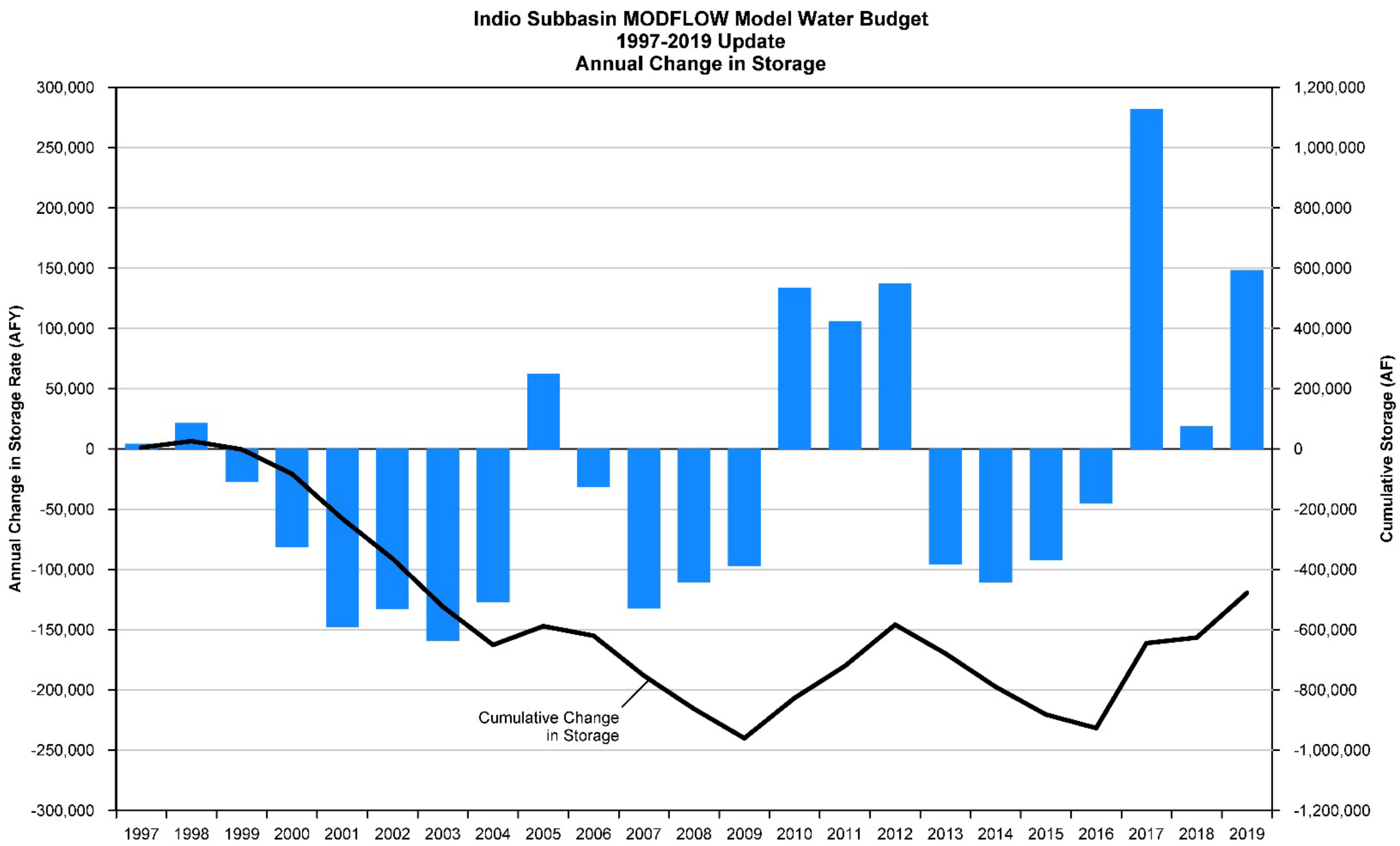


Figure 7-21
Simulated Change in Storage
1997-2019

7.5 Plan Scenarios

Scenarios for the *Alternative Plan Update* were developed, including baseline scenarios and future scenarios addressing potential future water supply conditions, changes in land use, and implementation of water management projects including source substitution and new water supply projects. Except for the Baseline scenario, climate change conditions were assumed for all Plan scenarios, described in Section 7.5.1 below, reflecting that the Indio GSAs are committed to achieving sustainability under changing climate conditions. Additional discussion of climate change is presented in Section 8.5 and scenarios without climate change are described in Appendix 7-B.

Each scenario was simulated over a 50-year period consistent with SGMA requirements. However, the planning assumptions were only projected for the first 25 years to the 2045 planning horizon. Thereafter, growth and supply assumptions were assumed to continue at the same rate for the second 25 years of the simulation. While extending beyond foreseeable land use and water resource planning projections, the second 25-year projections allow long-term evaluation of water supply and demand conditions, effectively testing Indio Subbasin sustainability under long-term hydrologic variability over 50 years.

The following scenarios are described in this chapter:

1. **Baseline (No New Projects):** No new supply or management projects or changes to historical hydrology. This scenario is described for comparison purposes only and will never happen, because new projects are in the process of being implemented. However, a baseline is useful to assess the other scenarios.

2. **Baseline with Climate Change**: Baseline conditions, along with assumptions of the impact of climate change on local hydrology and imported water supplies (climate change hydrology). As with the Baseline, this scenario is described for comparison purposes only and will never happen but is useful to assess the other scenarios.

3. **5-Year Plan with Climate Change**: Baseline conditions plus supply and management projects included in the GSA agencies' 5-year capital improvement plans (CIPs), along with potential climate change hydrology.

4. **Future Projects with Climate Change:** 5-Year Plan conditions plus implementation of additional supply and management projects that are projected to be completed in the 25-year planning horizon, along with potential climate change hydrology.

5. **Expanded Agriculture with Climate Change:** Future Projects conditions plus expansion of agriculture resulting in increased water demands, along with potential climate change hydrology.

Additional scenarios developed through the *Alternative Plan Update* process (including 5-Year Plan, Future Projects, and Expanded Agriculture scenarios under historical hydrology) are described in Appendix 7-B.

7.5.1 Climate Change

To simulate the range of possible future conditions, two different hydrological cycles were used and applied to the Plan scenarios. For the Baseline scenario, the observed hydrology for the Whitewater River watershed from 1970 to 2019 was repeated. In other words, the next 50 years are simulated exactly like the past 50 years. To simulate climate change conditions, a different cycle was selected: the last 25 years was repeated twice – first in reverse and then forward. The result of the climate change cycle is that the most recent observed drought (2013 to 2017) is included twice early in the simulation. In addition, the long-term average is significantly different for the last 50 years (43,319 AFY) compared with the last 25 years (29,204 AFY). Future climate change is simulated similar to the observed conditions over the last 25 years, a period marked with reoccurring drought and below average rainfall.

The availability of imported water is also expected to be impacted by climate change. As discussed in Chapter 6, *Water Supply*, SWP reliability is assumed to be 45 percent annually, which is 13 percent lower than DWR's *2019 SWP Delivery Capability Report* estimate of 58 percent, but which captures the more recent drier hydrology and Delta export limitations within the SWP system. Under climate change, SWP deliveries are further reduced by an additional 1.5 percent as compared to Baseline conditions by 2045. For CVWD's Colorado River entitlement, the climate change scenarios assume the CVWD will contribute from 14,500 to 24,500 AFY of California's contribution under the *Lower Basin Drought Contingency Plan*. Both are conservative assumptions and result in reduced imported water delivered to the Subbasin. In some scenarios with climate change, the decreased volume of imported water results in decreased groundwater replenishment.

This representation of climate change simulates drier future conditions than the climate change recommendations from DWR. Changes to Indio Subbasin streamflow were calculated using change factors for 2030 and 2070 provided by DWR for unimpaired flow within the Salton Sea watershed (HUC 18100200). Change factors are values multiplied by historical monthly or annual streamflow values to calculate probable discharge rates and variability under climate change. In brief, climate change impacts were assessed using DWR data and methodologies and were found to be small, within 10 percent of the 1995 historical value (DWR 2018). Over the 1970 to 2019 hydrological cycle, observed watershed runoff was estimated to be 52,506 AFY, under the DWR recommended climate change projection would be 50,540 AFY, whereas repeating the 1995 to 2019 cycle (our climate change projection) results in the total watershed runoff of 38,196 AFY.

Planning for climate change is important to maintain groundwater sustainability. Future scenarios with projects are presented here with the climate change hydrology to ensure the GSAs can manage the groundwater under changing future conditions. While the Baseline scenario without climate change is discussed in Section 7.6 to illustrate the effects of climate change, all other future scenarios without climate change are presented in Appendices 7-B and 7-C.

7.5.2 Baseline (No New Projects)

The Baseline scenario includes only those supplies and facilities currently in place to support Indio Subbasin management and assumes that no new projects or water supplies will be implemented. The Baseline propagates current conditions into the future to use as a basis for comparing 'with and without' future project conditions. Figure 7-22 provides a flow chart that shows the water balance (inflows and outflows) of the Subbasin under Baseline in year 2045, as well as the supplies used to meet demands. The demand forecast for the Plan Area totals 644,610 AFY in year 2045 (see Chapter 5, *Demand Projections*). Table 7-2 provides a summary of Baseline supplies used to directly meet demand and Table 7-3 provides a summary of supplies used for replenishment. Other model inflows and outflows (septic system flows, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, and watershed runoff) including groundwater pumping are discussed in Section 7.6. A summary of the assumptions for each supply source is provided below.

The Baseline scenario assumes that passive conservation savings, surface water diversions, and GRF operations will continue to be implemented, along with potable water and sewer consolidations.

Table 7-2. Baseline (No New Projects) Scenario - Modeled Deliveries for Direct Use (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Groundwater[a]	296,089	308,643	321,483	334,169	344,092	353,244
Colorado River[b]	285,337	284,818	282,419	280,771	279,370	277,969
Recycled Water	13,397	13,397	13,397	13,397	13,397	13,397
Total Direct Use Supplies	**594,823**	**606,858**	**617,299**	**628,337**	**636,859**	**644,610**

[a] Simulated groundwater pumping in the model scenarios is within 0.03 percent; the slight difference is due to the differences in model area vs. Subbasin extent and numerical precision.

[b] Colorado River deliveries decrease over time due to conversion of agriculture that receives Canal deliveries to urban uses.

Table 7-3. Baseline (No New Projects) Scenario – Modeled Deliveries for Replenishment (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Colorado River[a]	97,000	97,000	82,000	82,000	82,000	82,000
SWP Exchange[b]	60,527	60,297	60,092	59,903	79,724	79,431
Other: Rosedale Rio-Bravo	10,563	10,563	10,563	10,563	0	0
Surface Water Diversions[c]	2,630	6,000	6,000	6,000	6,000	6,000
Total Replenishment	**170,720**	**173,860**	**158,655**	**158,466**	**167,724**	**167,431**

Note: Groundwater inflows and outflows (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, watershed runoff) are described in Section 7.6.

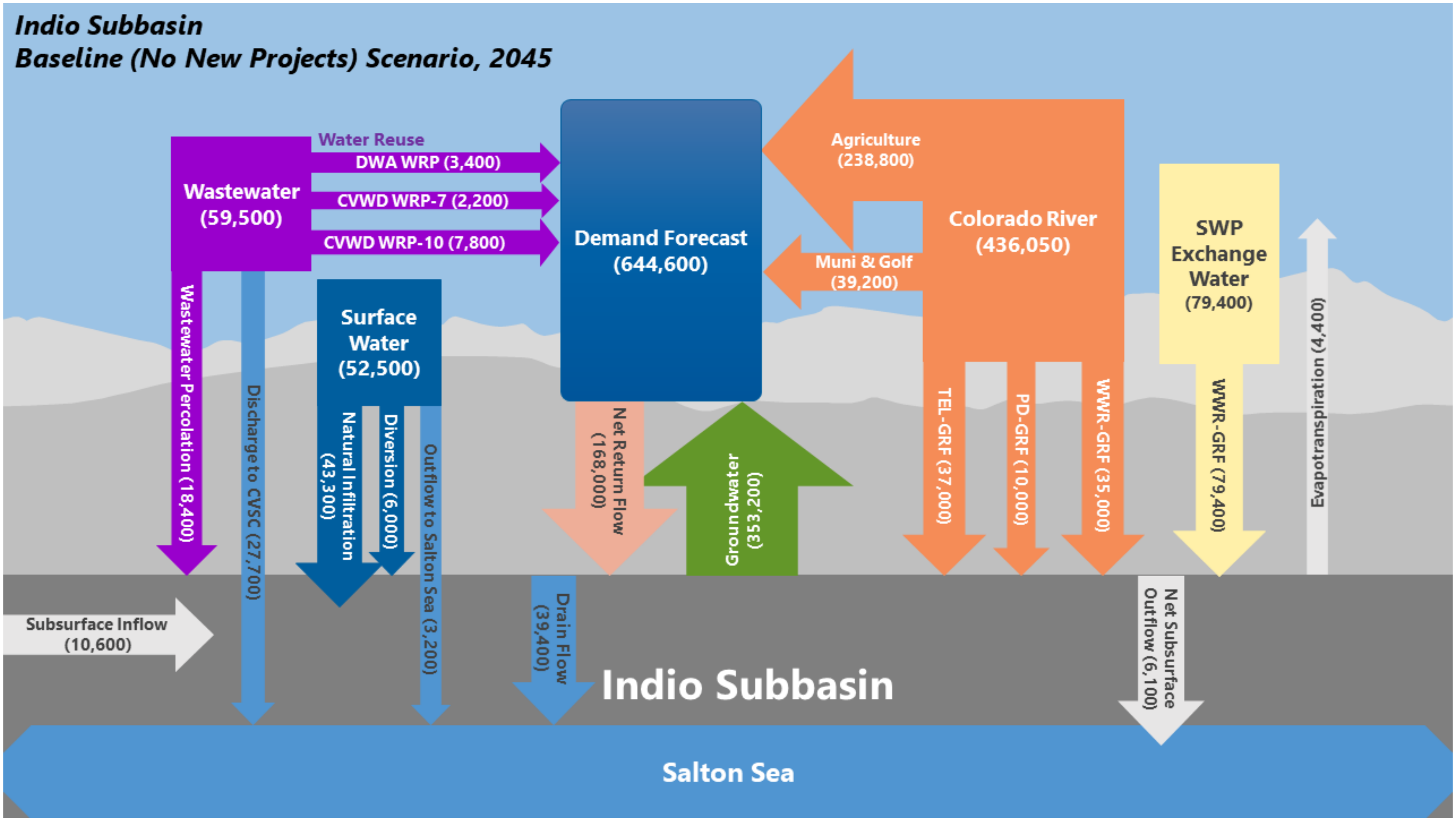
[a] Colorado River volumes assume that 15,000 AFY MWD-SWP transfer ends in 2027.

[b] SWP Exchange volumes assume Advanced Delivery credit from 2002 to 2035. This assumption is used so as not to double count advanced deliveries in future SWP deliveries.

[c] Surface water diversions include a small fraction of direct deliveries; for simplicity, all diversion volumes are assumed herein to be directed to WWR-GRF for recovery.

Local Inflows, Outflows, and Supplies: As illustrated in Figure 7-22, inflows to groundwater include subsurface inflow, mountain front recharge, surface water runoff that is diverted for replenishment or percolates along the mountain front or in local channels (minus losses to the Salton Sea), wastewater percolation, and return flows from use (which include septic system percolation). Total surface water runoff from local watersheds is estimated based on the 50-year hydrologic period from 1970 to 2019 and simulated into the future. Runoff inflows are assumed to vary annually, with estimated natural infiltration of watershed runoff (minus diversions and outflows to the Salton Sea) amounting to an annual average of 43,300 AF for the 50-year hydrologic period. Septic system inflow is 8,800 AFY in 2020 and decreases to 4,600 AFY by 2045 due to the connection of septic systems to sewers. Wastewater percolation serves as an inflow to the Subbasin and occurs at five wastewater treatment facility sites (Palm Springs WWTP, CVWD WRP-2, CVWD WRP-7, CVWD WRP-10, and MSWD Regional WRF). Wastewater percolation is assumed to provide an average Subbasin inflow of 6,316 AFY in 2020 and to ramp up to 18,377 AFY by 2045. Return flows from municipal, agricultural, and golf course demands are based on estimates of outdoor water use, as described in Section 7.2.5.5.

Figure 7-22. Baseline (No New Projects) Supply and Demand Flow Chart, 2045



Note: Values in this graphic are rounded to the nearest hundred and may not sum to totals. Colorado River volumes do not sum to total due to underrun under Baseline scenario with no new projects assumption.

Outflows from the Indio Subbasin include drain flow, evapotranspiration, and subsurface outflow. Subsurface inflow, drain flow, evapotranspiration, and subsurface outflow are derived from the MODFLOW model as described in Section 7.2.5.1 above.

As shown in Table 7-3, local supplies used for replenishment include surface water diversions. Under Baseline, local surface water diversions increase from 2,630 AFY in 2020 to 6,000 AFY by 2023, all of which is diverted to WWR-GRF subsurface storage and then recovered for delivery.

Colorado River: Colorado River water supplies available under Baseline include CVWD's base entitlement under the 2003 Quantification Settlement Agreement (see Chapter 6, *Water Supply*), along with transfers where there are agreements in place. Baseline assumes that diversions under the QSA ramp up from 394,000 AFY in 2020 to 424,000 AFY between 2027 and 2045 in 5,000 AFY increments. This ramp-up will allow the CVWD to fully utilize available Colorado River water at its maximum entitlement. The Colorado River supplies used in Baseline include a 15,000 AFY transfer from Metropolitan Water District of Southern California (MWD) delivered to WWR-GRF (MWD retains the remaining 5,000 AFY) and 35,000 AFY of SWP transfer with MWD per the 2003 QSA (described in Chapter 6, *Water Supply*). Baseline also assumes annual Canal conveyance losses of 5 percent. Under the Baseline scenario, a portion of available Colorado River supply is not able to be beneficially used without the construction of new projects.

Colorado River supplies are assumed to be used for replenishment and direct use, as follows:

- Colorado River Water replenishment:
  - TEL-GRF: Recharge limited to current recharge of 37,000 AFY
  - PD-GRF: Recharge limited to Phase I capacity of 10,000 AFY
  - WWR-GRF: Recharge of 15,000 AFY of MWD transfer from 2020 to 2026 (totaling 105,000 AF) and recharge of 35,000 AFY of QSA MWD transfer through the planning horizon.
- Colorado River Water direct deliveries: Delivery to current agricultural, East Valley golf courses, other recreation, WRP-7, WRP-10, and MVP direct users at current levels equaling 278,000 AFY, less reduced agricultural demands due to urban conversion.

SWP Exchange: Average annual SWP Exchange supplies under Baseline are based on the reliability of SWP deliveries received by CVWD and DWA since 2007 when Federal Judge Wanger overturned the Biological Opinion authored by USFWS and USBR concerning Delta export pumping operations. As described in Chapter 6, *Water Supply,* this decision significantly impacted DWR's ability to convey SWP supplies across the Delta for export. Baseline applies an average 45 percent reliability to SWP deliveries.

Additionally, MWD's Advance Delivery account had 353,946 AF in storage as of January 2020. Baseline assumes that MWD will credit SWP deliveries against the Advance Delivery account at 22,122 AF annually from 2020-2035 so as not to double count these deliveries. Additional SWP Exchange water is available through Yuba Accord deliveries (see Chapter 6, *Water Supply*) and is assumed to have a 10-year average of 651 AFY.

SWP Exchange supplies modeled under Baseline are varied annually based on the historical variability of SWP Table A deliveries received by the CVWD and DWA, as described in Chapter 6, *Water Supply*. Final SWP allocations between 2007 and 2021 have ranged from a high of 85 percent in 2017 to a low of 5 percent in 2014 and again in 2021. Baseline applies an annual variability factor that mimics the variability of deliveries associated with different climate years. The variability factors were developed based on the same water years (1970 to 2019) as local hydrology.

SWP Exchange water is assumed to be used for replenishment at WWR-GRF and MC-GRF, and the split of water between these replenishment facilities is to be consistent with the 2004 Settlement Agreement between DWA, CVWD, and MSWD.

Other Supplies: One additional supply is included under Baseline: Rosedale-Rio Bravo deliveries of 10,563 AFY from 2020 to 2035.

Recycled Water: Recycled water supplies are currently produced at three locations: Palm Springs WWTP/DWA WRP, CVWD WRP-7, and CVWD WRP-10. Recycled water supply availability is expected to increase due to development driving an increase in indoor water use and associated wastewater flows within the Plan Area. Total recycled water use is expected to remain at 13,397 AFY as no new projects or non-potable connections are assumed to be implemented under Baseline.

7.5.3 Baseline with Climate Change

The Baseline with Climate Change scenario includes only those supplies and facilities currently in place to support Subbasin management and assumes that no new projects or water supplies will be implemented. Baseline with Climate Change propagates current management practices into the future under assumptions of future climate conditions and associated supply impacts. Table 7-4 provides a summary of Baseline with Climate Change supplies used to directly meet demand and Table 7-5 provides a summary of supplies used for replenishment. Other model inflows and outflows (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, and watershed runoff) including groundwater pumping are discussed in Section 7.6. Figure 7-23 provides a flow chart that shows the water balance of the Subbasin under Baseline with Climate Change for year 2045, as well as the supplies used to meet demands. The demand forecast for the Plan Area totals 644,610 AFY in year 2045 (see Chapter 5, *Demand Projections*). A summary of the assumptions applied to each supply source is provided below.

The Baseline with Climate Change scenario assumes that passive conservation savings, surface water diversions, and GRF operations will continue to be implemented, along with potable water and sewer consolidations.

Table 7-4. Baseline with Climate Change Scenario – Modeled Deliveries for Direct Use (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Groundwater[a]	296,089	308,643	321,483	334,169	344,092	353,244
Colorado River[b]	285,337	284,818	282,419	280,771	279,370	277,969
Recycled Water	13,397	13,397	13,397	13,397	13,397	13,397
Total Direct Use Supplies	**594,823**	**606,858**	**617,299**	**628,337**	**636,859**	**644,610**

[a] Simulated groundwater pumping in the model scenarios is within 0.03 percent; the slight difference is due to the differences in model area vs. Subbasin extent and numerical precision.

[b] Colorado River deliveries decrease over time due to conversion of agriculture that receives Canal deliveries to urban uses.

Table 7-5. Baseline with Climate Change Scenario – Modeled Deliveries for Replenishment (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Colorado River[a]	97,000	97,000	82,000	82,000	82,000	82,000
SWP Exchange[b]	60,527	60,057	59,614	59,188	78,775	78,248
Other: Rosedale Rio-Bravo	10,563	10,563	10,563	10,563	0	0
Surface Water Diversions[c]	2,630	6,000	6,000	6,000	6,000	6,000
Total Replenishment	**170,720**	**173,620**	**158,177**	**157,751**	**166,775**	**166,248**

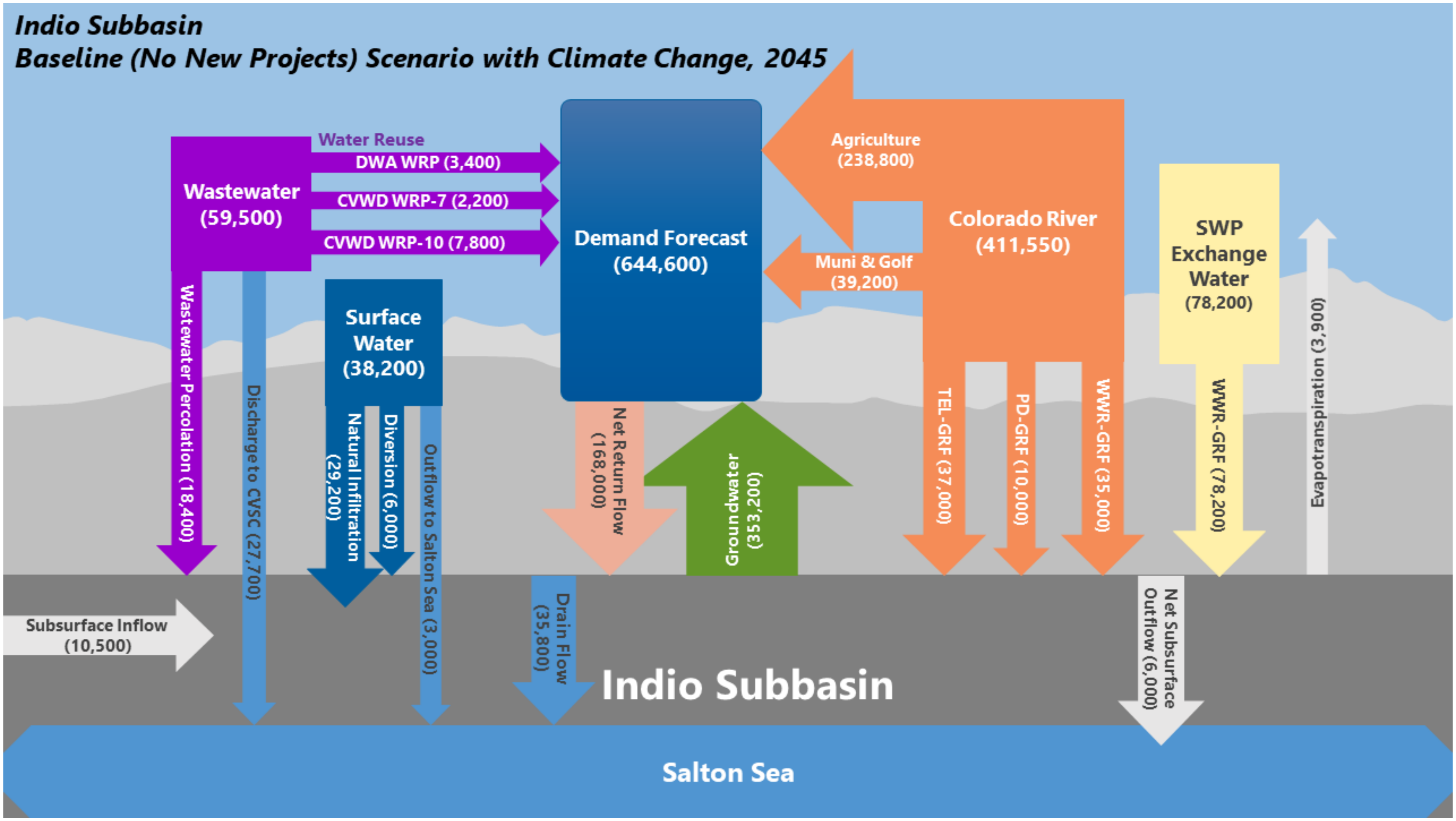
Note: Groundwater inflows and outflows (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, watershed runoff) are described in Section 7.6.

[a] Colorado River volumes assume that 15,000 AFY MWD-SWP transfer ends in 2027.

[b] SWP Exchange volumes assume Advanced Delivery credit from 2002 to 2035. This assumption is used so as not to double count advanced deliveries in future SWP deliveries.

[c] Surface water diversions include a small fraction of direct deliveries; for simplicity, all diversion volumes are assumed herein to be directed to WWR-GRF for recovery.

Figure 7-23. Baseline (No New Projects) with Climate Change Supply and Demand Flow Chart, 2045



Note: Values in this graphic are rounded to the nearest hundred and may not sum to totals. Colorado River volumes do not sum to total due to underrun under Baseline with Climate Change scenario with no new projects assumption.

Local Inflows, Outflows, and Supplies: As illustrated in Figure 7-23, inflows to groundwater include subsurface inflow, surface water runoff (diverted for replenishment or percolating along local channels minus losses to the Salton Sea), wastewater percolation, and return flows from use (which include septic system percolation). However, total watershed runoff is estimated based on the drier 25-year hydrologic period from 1995 to 2019. As shown in Figure 7-23, estimated average natural infiltration of watershed runoff (minus diversions and outflows to the Salton Sea) amounts to 29,204 AFY, approximately 14,000 AFY less than in the Baseline scenario due to the drier climate change assumptions.

In the Baseline with Climate Change scenario, return flows, wastewater percolation, and septic system inflow are the same as in Baseline because the demands, which contribute to these flows, are assumed to remain unchanged. Subsurface inflow, drain flow, evapotranspiration, and subsurface outflow are derived from the MODFLOW model described in Section 7.2.5 above. As with Baseline, available local water inflows also include surface water diverted for replenishment. As with Baseline, local surface water diversions increase from 2,630 AFY in 2020 to 6,000 AFY by 2023, all of which is diverted to WWR-GRF subsurface storage and then recovered for delivery.

Colorado River: Colorado River water supplies available under Baseline with Climate Change use the same planning assumptions as Baseline, except with an assumed reduction in Canal deliveries based on the *Lower Basin Drought Contingency Plan* (*Lower Basin DCP*). According to the *Lower Basin DCP*, CVWD is responsible for a portion of California's contribution to demand reduction on the Colorado River (see Chapter 6, *Water Supply*). Under Baseline with Climate Change, Canal deliveries are assumed to be reduced by 14,500 AFY from 2020 to 2026, and by 24,500 AFY after 2026. Colorado River water demand for direct deliveries and recharge capacities are expected to remain the same as in Baseline. Under the Baseline with Climate Change scenario, a portion of available Colorado River supply is not able to be beneficially used.

SWP Exchange: SWP Exchange supplies available under Baseline with Climate Change are the same as under Baseline in terms of 45 percent average annual reliability, variability factors applied based on water years, and Advance Delivery credits applied for 2020 to 2035. Under anticipated climate conditions, reliability is assumed to be reduced by an additional -1.5 percent as compared to Baseline by 2045, as modeled by DWR in its *2019 SWP Delivery Capability Report* (DWR, 2020).

SWP Exchange water is assumed to be used for replenishment at the WWR-GRF and MC-GRF, and the allocation of water between these replenishment facilities is consistent with the 2004 Settlement Agreement.

Recycled Water: Recycled water supplies under the Baseline with Climate Change are identical to the Baseline planning assumptions, remaining at 13,397 AFY.

Other Supplies: Rosedale-Rio Bravo deliveries of 10,583 AFY from 2020 to 2035 assume no loss due to climate change.

7.5.4 5-Year Plan with Climate Change

The 5-Year Plan with Climate Change scenario includes supplies and facilities currently in place to support Subbasin management, along with new projects planned to be completed as part of the GSAs' 2020 5-year capital improvement programs (5-year CIPs) and supplies under the control of GSAs. This scenario assumes that climate change will impact imported water and local water supplies. Table 7-6 provides a summary of 5-Year Plan with Climate Change supplies used to directly meet demand and Table 7-7 provides a summary of supplies used for replenishment. Supply inputs used for the model (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, and watershed runoff) and groundwater pumping are discussed in Section 7.6. Figure 7-24 provides a flow chart that shows the water balance of the basin under 5-Year Plan with Climate Change in year 2045, as well as the supplies used to meet demands. The demand forecast for the Plan Area totals 644,610 AFY in year 2045 (see Chapter 5, *Demand Projections*). A summary of the assumptions applied to each supply source is provided below.

The 5-Year Plan with Climate Change scenario assumes that passive conservation savings, surface water diversions, and GRF operations will continue to be implemented, along with potable water and sewer consolidations. New supply from Lake Perris Seepage project becomes available in 2023. Planned non-potable expansions from WRP-7 and WRP-10 will deliver Canal and recycled water, along with Canal deliveries to East Valley golf courses and the Oasis Distribution System. Additionally, PD-GRF expansion will allow for greater Subbasin replenishment.

Table 7-6. 5-Year Plan with Climate Change Supply Scenario – Modeled Deliveries for Direct Use (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Groundwater[a]	296,089	271,914	284,754	297,440	307,362	316,514
Colorado River[b]	285,337	317,932	314,733	312,385	310,184	307,883
Recycled Water	13,397	17,013	17,813	18,513	19,313	20,213
Total Direct Use Supplies	**594,823**	**606,858**	**617,299**	**628,337**	**636,859**	**644,610**

[a] Simulated groundwater pumping in the model scenarios is within 0.03 percent; the slight difference is due to the differences in model area vs. Subbasin extent and numerical precision.

[b] Colorado River deliveries increase over time due to new non-potable connections.

Table 7-7. 5-Year Plan with Climate Change Scenario – Modeled Deliveries for Replenishment (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Colorado River[a]	97,000	93,868	96,817	97,000	97,000	97,000
SWP Exchange[b]	60,527	62,576	62,125	61,690	81,268	80,733
Other: Rosedale Rio-Bravo	10,563	10,563	10,563	10,563	0	0
Surface Water Diversions[c]	2,630	6,000	6,000	6,000	6,000	6,000
Total Replenishment	**170,720**	**173,007**	**175,505**	**175,253**	**184,268**	**183,733**

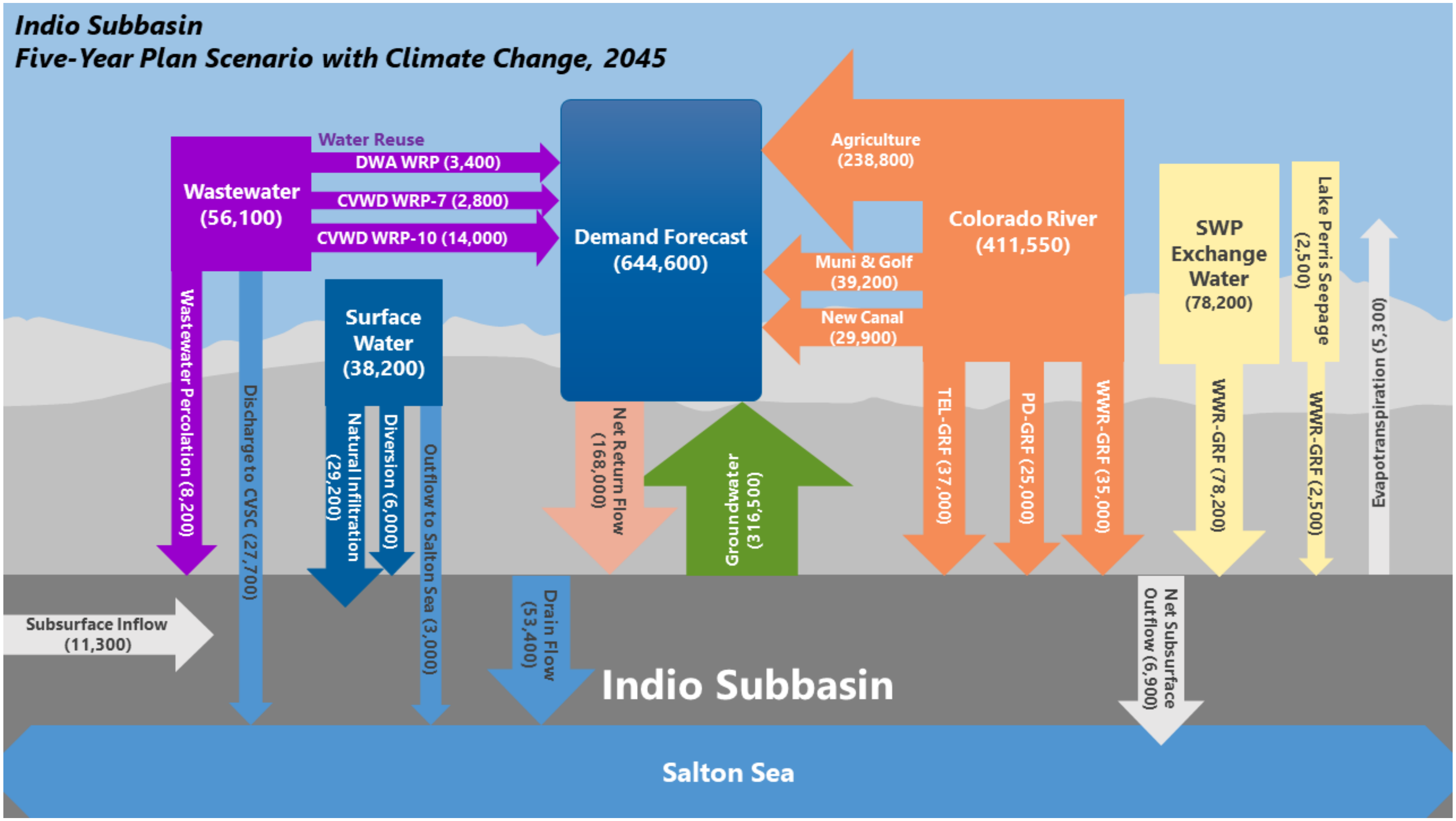
Note: Groundwater inflows and outflows (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, watershed runoff) are described in Section 7.6.

[a] Colorado River volumes assume that 15,000 AFY MWD-SWP transfer ends in 2027.

[b] SWP Exchange volumes assume Advanced Delivery credit from 2002 to 2035. This assumption is used so as not to double count advanced deliveries in future SWP deliveries.

[c] Surface water diversion include a small fraction of direct deliveries; for simplicity, all diversion volumes are assumed herein to be directed to WWR-GRF for recovery.

Figure 7-24. 5-Year Plan with Climate Change Supply and Demand Flow Chart, 2045



Note: Values in this graphic are rounded to the nearest hundred and may not sum to totals. Colorado River volumes do not sum to total due to underrun under Baseline with Climate Change scenario with no new projects assumption.

Local Inflows, Outflows, and Supplies: Surface water hydrology under 5-Year Plan with Climate Change is the same as Baseline with Climate Change, as are return flows and septic system inflows. Wastewater percolation is expected to be reduced due to an increase in recycled water use (described below). In this scenario, wastewater from the MSWD Regional WRF is transferred north for use in the Mission Creek Subbasin starting in 2027. Subsurface inflow, drain flow, evapotranspiration, and subsurface outflow are derived from the MODFLOW model described in Section 7.2.5.

Colorado River: Colorado River water supplies available under the 5-Year Plan with Climate Change are assumed to remain the same as under Baseline with Climate Change (assuming reductions due to *Lower Basin DCP*); however, available supply use increases due to planned expansions to replenishment facilities and direct deliveries. Under 5-Year Plan with Climate Change, the PD-GRF is planned to expand to allow for recharge to increase from 10,000 AFY in 2020 to 25,000 AFY in 2023. By expanding recharge at the PD-GRF and reducing the supply available under climate change conditions, the Colorado River supplies used for recharge at the WWR-GRF are reduced from 2023 to 2045 as the supply is utilized for recharge at PD-GRF, additional non-potable connections in the East Valley and mid-Valley, and by the Oasis In-lieu Project. Increases in Colorado River direct deliveries begin in 2022 at 1,122 AFY and total 36,729 AFY by 2025. As available Colorado River supply is fully utilized in the Mid- and East Valley areas, CVWD will reduce replenishment at the GRFs. The increase in direct deliveries results in a reduction in replenishment of CVWD's 2003 QSA entitlement at WWR-GRF to 22,645 AFY beginning in 2027.

SWP Exchange: SWP Exchange supplies available under 5-Year Plan with Climate Change are the same as under Baseline with Climate Change, with 45 percent reliability varied annually and -1.5 percent reduction due to climate change. SWP Exchange water is assumed to be used for replenishment at the WWR-GRF and MC-GRF, consistent with the *2004 Settlement Agreement*. New supplies (2,500 AFY) from the Lake Perris Seepage Recovery project come online in 2023.

Recycled Water: Recycled water availability is expected to increase due to increased recycled water production and deliveries to new non-potable connections. WRP-7 deliveries increase from 2,201 AFY in 2020 to 2,800 AFY in 2025. WRP-10 deliveries increase from 7,783 AFY in 2020 to 14,000 AFY in 2045. Any recycling of wastewater from WRP-10 and WRP-7 disposed to percolation ponds would offset groundwater pumping, but reduce net return flows to groundwater.

Other Supplies: Rosedale-Rio Bravo deliveries remain the same as in Baseline.

7.5.5 Future Projects with Climate Change

The Future Projects with Climate Change Scenario (Future Projects with Climate Change) includes supplies and facilities currently in place to support Subbasin management, along with projects for new supplies and facilities that are planned by the GSA agencies within the 25-year planning horizon. Supply constraints associated with climate changes are assumed for local and imported supplies. Table 7-8 provides a summary of Future Projects with Climate Change supplies used to directly meet demand and Table 7-9 provides supplies used for replenishment. Other inflows and outflows to the model (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, and watershed runoff) including groundwater pumping are discussed in Section 7.6. Figure 7-25 provides a flow chart that shows the water balance of the Subbasin under Future Projects with Climate Change in year 2045, as well as the supplies used to meet demands. The demand forecast for the Plan Area totals 644,610 AFY in year 2045 (see Chapter 5, *Demand Projections*). A summary of the assumptions applied to each supply source is provided below.

The Future Projects with Climate Change Scenario assumes that passive conservation savings, surface water diversions, and GRF operations will continue to be implemented, along with potable water and sewer consolidations. Participation in the DCF will restore SWP supply reliability to 59 percent, and Sites Reservoir and Lake Perris Seepage will come online in 2023 and 2035, respectively, and continue through the planning horizon. Planned non-potable expansions from WRP-7 and WRP-10 will deliver increased Canal and recycled water, along with increased Canal deliveries to Mid-Valley Pipeline connections, East Valley golf courses, and the Oasis Distribution System (as compared to the 5-Year Plan scenario). The EVRA potable reuse project will be implemented.

Table 7-8. Future Projects with Climate Change Scenario – Modeled Deliveries for Direct Use (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Groundwater[a]	296,088	271,914	266,364	261,423	267,252	276,404
Colorado River[b]	285,337	317,932	333,122	348,401	350,294	347,993
Recycled Water	13,397	17,013	17,813	18,513	19,313	20,213
Total Direct Use Supplies	**594,823**	**606,858**	**617,299**	**628,337**	**636,859**	**644,610**

[a] Simulated groundwater pumping in the model scenarios is within 0.03 percent; the slight difference is due to the differences in model area vs. Subbasin extent and numerical precision.

[b] Colorado River deliveries increase over time due to new non-potable connections.

Table 7-9. Future Projects with Climate Change Scenario – Modeled Deliveries for Replenishment (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Colorado River[a]	97,000	93,868	78,428	63,149	61,256	63,557
SWP Exchange[b]	60,527	62,576	62,125	72,193	91,732	114,720
Other: Rosedale Rio-Bravo	10,563	10,563	10,563	10,563	0	0
Indirect Potable Reuse	0	0	5,000	5,000	5,000	5,000
Surface Water Diversions[c]	2,630	6,000	6,000	6,000	6,000	6,000
Total Replenishment	**170,720**	**173,007**	**162,116**	**156,905**	**163,988**	**189,277**

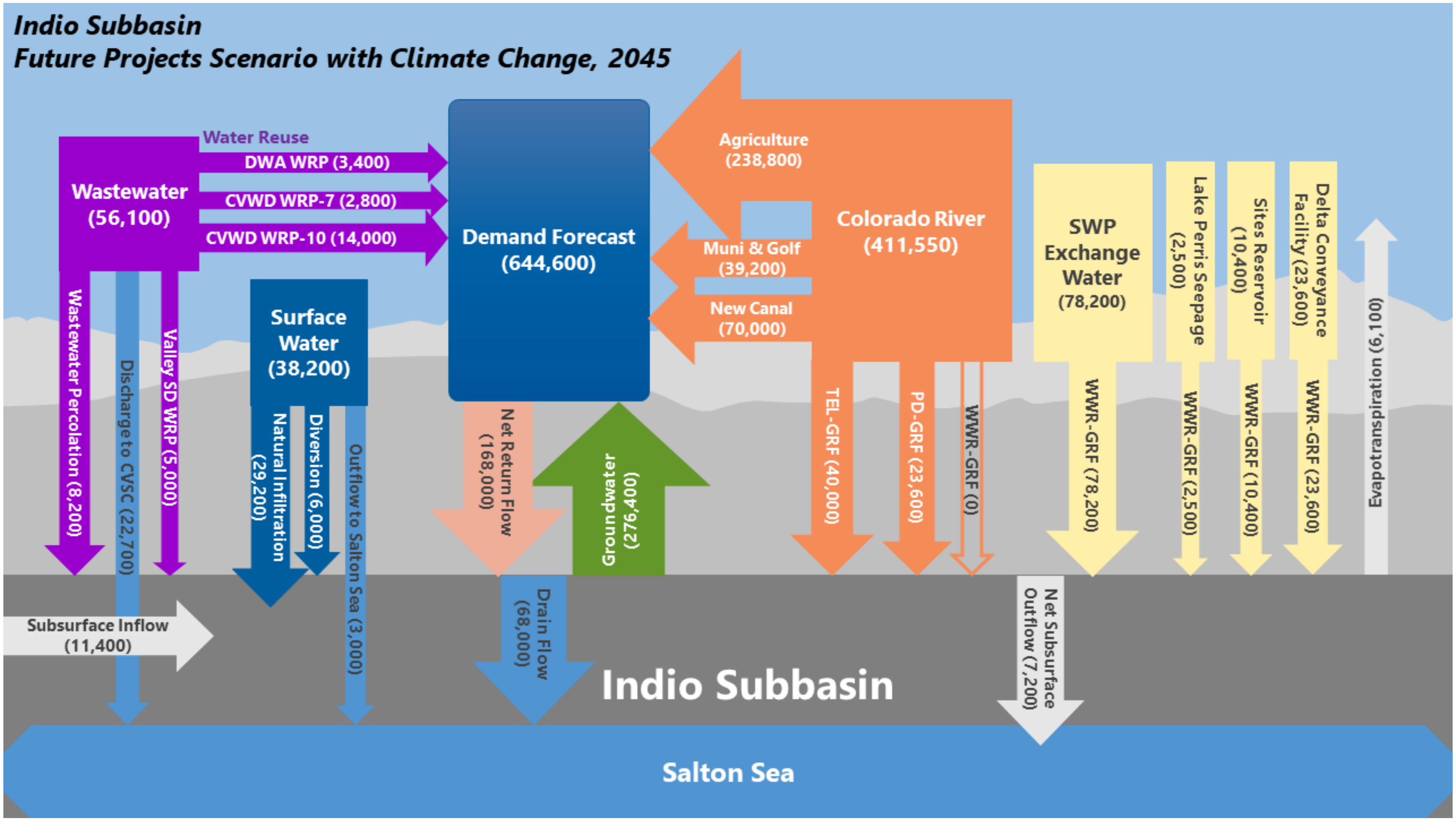
Note: Groundwater inflows and outflows (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, watershed runoff) are described in Section 7.6.

[a] Colorado River volumes assume that 15,000 AFY MWD-SWP transfer ends in 2027.

[b] SWP Exchange volumes assume Advanced Delivery credit from 2002 to 2035. This assumption is used so as not to double count advanced deliveries in future SWP deliveries. SWP Exchange includes future supplies from DCF, Sites Reservoir, and Lake Perris Seepage as described below.

[c] Surface water diversions include a small fraction of direct deliveries; for simplicity, all diversion volumes are assumed herein to be directed to WWR-GRF for recovery.

Figure 7-25. Future Projects with Climate Change Supply and Demand Flow Chart, 2045



Note: Values in this graphic are rounded to the nearest hundred and may not sum to totals.

Local Inflows, Outflows, and Supplies: Surface water hydrology under Future Projects with Climate Change is the same as Baseline with Climate Change, as are return flows and septic system inflows. Wastewater percolation is expected to be reduced due to an increase in recycled water use (described below), along with the transfer of MSWD Regional WRF flows to the Mission Creek Subbasin starting in 2027. Subsurface inflow, drain flow, evapotranspiration, and subsurface outflow are derived from the MODFLOW model described in Section 7.2.5.

Colorado River: Colorado River water supplies available under Future Projects with Climate Change are assumed to remain the same as under the 5-Year Plan with Climate Change, but with additional direct deliveries. Under Future Projects with Climate Change, in addition to the replenishment facility expansions discussed under the 5-Year Plan, the TEL-GRF will expand from a capacity of 37,000 AFY in 2020 to 40,000 AFY in 2025. Increases in Colorado River direct deliveries begin in 2022 at 1,122 AFY and amount to 76,839 AFY by 2045. As available Colorado River supply is fully utilized in the Mid- and East Valley, CVWD will reduce replenishment at WWR-GRF and PD-GRF. The increase in direct deliveries results in a reduction in replenishment of CVWD's 2003 QSA entitlement at PD-GRF beginning in 2031 to a low of 4,535 AFY in 2045. Under this scenario, QSA water is not available for recharge at WWR-GRF starting in 2031.

SWP Exchange: SWP Exchange supplies available under Future Projects with Climate Change include the Table A deliveries (45 percent reliability varied annually based on water year and -1.5 percent reduction due to climate change) assumed under Baseline with Climate Change, with the addition of the following projects:

- Delta Conveyance Facility (DCF) to increase the reliability of SWP deliveries by 26,500 AFY (to 59% of Table A) in 2040 due to improvements in Delta conveyance, reduced by the volume diverted to MC-GRF under the *2014 Mission Creek Water Management Agreement* (see Chapter 6, *Water Supply*).
- Lake Perris Dam Seepage Recovery Project to provide 2,754 AFY, reduced by the volume diverted to MC-GRF. Lake Perris Seepage will come online in 2023 and continue through the planning/modeling horizon.
- Sites Reservoir Project to provide 11,550 AFY, reduced by the volume diverted to MC-GRF. Sites Reservoir will come online in 2035 and continue through the planning/modeling horizon. 30 percent conveyance loss is applied to this supply.

Recycled Water: Recycled water supplies under Future Projects with Climate Change are further expanded from those shown under the 5-Year Plan with Climate Change, including an increase in recycled water deliveries by 6,815 AFY in 2045 and with 5,000 AFY of potable reuse from Valley Sanitary District's WRP (referred to as the EVRA Potable Reuse Project).

Other Supplies: Rosedale-Rio Bravo deliveries remain the same as in Baseline.

7.5.6 Expanded Agriculture with Climate Change

The Expanded Agriculture with Climate Change Scenario (Expanded Agriculture with Climate Change) includes increased agricultural demands, along with the same suite of planned future projects described under the Future Projects with Climate Change Scenario. This scenario assumes 8,000 acres of additional farmland (inclusive of 1,500 AFY in baseline demand forecast). This scenario assumes that new agricultural growth occurs due in part to expanded availability of Canal water to currently idle lands. The scenario allocates 85 percent of new agricultural demands to Canal water and 15 percent to groundwater.

Table 7-10 provides a summary of Expanded Agriculture with Climate Change supplies used to directly meet demand and Table 7-11 provides a summary of supplies used for replenishment. Other inflow and outflows to the model (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, and watershed runoff) including groundwater pumping are discussed in Section 7.6. Figure 7-26 provides a flow chart that shows the water balance of the Indio Subbasin under Expanded Agriculture with Climate Change in year 2045, as well as the supplies used to meet demands. The demand forecast for the Expanded Agriculture with Climate Change scenario includes an additional 8,000 acres of agricultural production and totals 679,696 AFY in year 2045 (assuming 15 percent of additional crop demand served by groundwater and 85 percent by Canal water). All water supplies and projects described under Future Projects with Climate Change are applied to this scenario.

The Expanded Agriculture with Climate Change scenario assumes the same projects and supplies as the Future Projects scenario. Planned non-potable expansions from WRP-7 and WRP-10 will deliver increased Canal and recycled water, along with increased Canal deliveries to Mid-Valley Pipeline connections, East Valley golf courses, and the Oasis Distribution System (as compared to the 5-Year Plan scenario). The EVRA potable reuse project will be implemented.

Table 7-10. Expanded Agriculture with Climate Change Scenario – Modeled Deliveries for Direct Use (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Groundwater[a]	296,088	272,967	268,470	264,581	271,463	281,667
Colorado River[b]	285,337	323,896	345,051	366,295	374,152	377,816
Recycled Water	13,397	17,013	17,813	18,513	19,313	20,213
Total Direct Use Supplies	**594,823**	**613,876**	**631,334**	**649,389**	**664,928**	**679,696**

[a] Simulated groundwater pumping in the model scenarios is within 0.03 percent; the slight difference is due to the differences in model area vs. Subbasin extent and numerical precision.

[b] Colorado River deliveries increase over time due to new non-potable connections.

Table 7-11. Expanded Agriculture with Climate Change Scenario – Modeled Deliveries for Replenishment (AFY)

Supply (Acre-Feet)	2020	2025	2030	2035	2040	2045
Colorado River[a]	97,000	87,904	66,499	45,255	37,398	33,734
SWP Exchange[b]	60,527	62,576	62,125	72,193	91,732	114,720
Other: Rosedale Rio-Bravo	10,563	10,563	10,563	10,563	0	0
Indirect Potable Reuse	0	0	5,000	5,000	5,000	5,000
Surface Water Diversions[c]	2,630	6,000	6,000	6,000	6,000	6,000
Total Replenishment	**170,720**	**167,043**	**150,187**	**139,011**	**140,130**	**159,454**

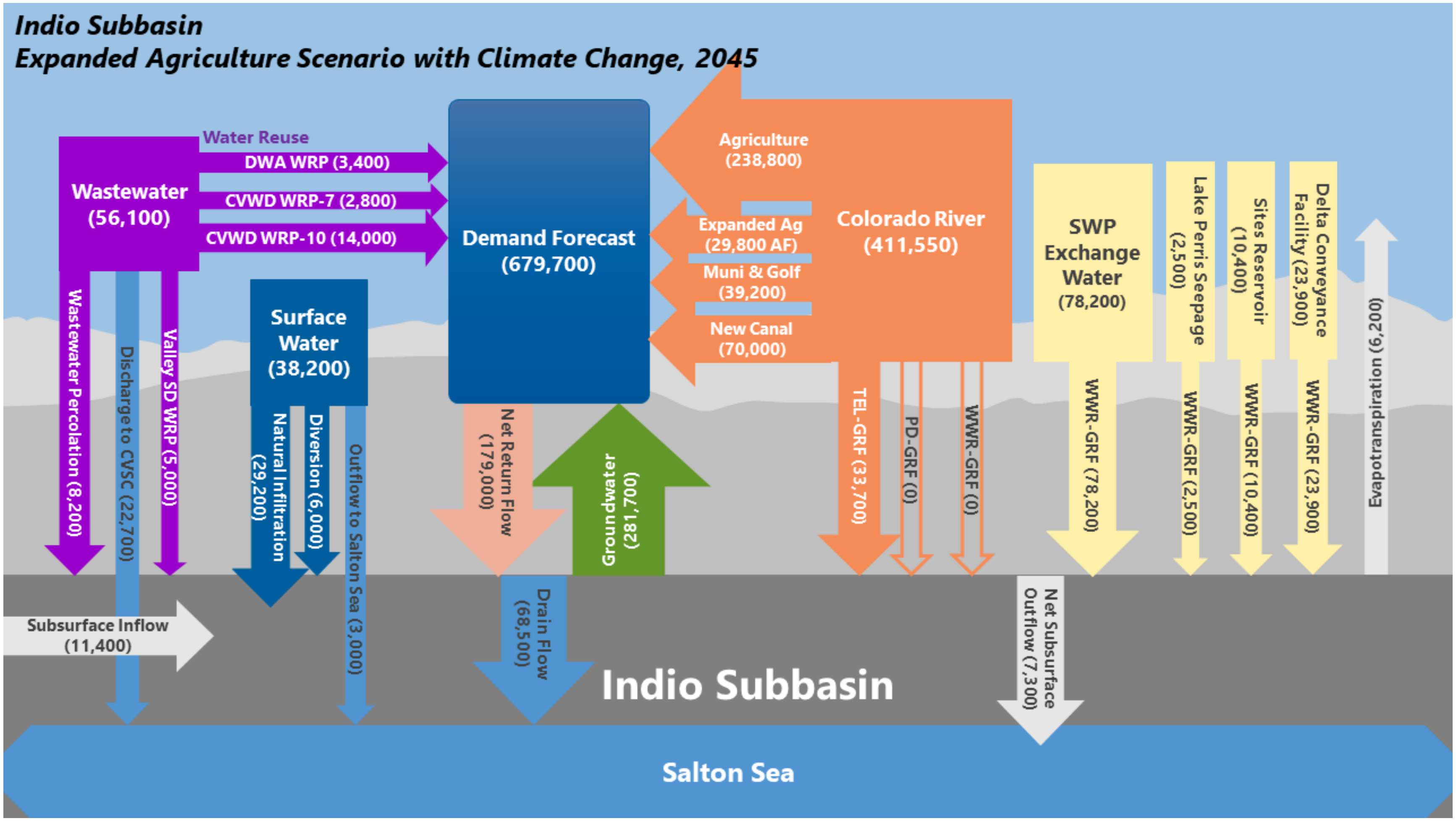
Note: Groundwater inflows and outflows (septic systems, return flows, subsurface inflow and outflow, drain flows, evapotranspiration, watershed runoff) are described in Section 7.6.

[a] Colorado River volumes assume that 15,000 AFY MWD-SWP transfer ends in 2027.

[b] SWP Exchange volumes assume Advanced Delivery credit from 2002 to 2035. This assumption is used so as not to double count advanced deliveries in future SWP deliveries. SWP Exchange includes future supplies from DCF, Sites Reservoir, and Lake Perris Seepage as described below.

[c] Surface water diversions include a small fraction of direct deliveries; for simplicity, all diversion volumes are assumed herein to be directed to WWR-GRF for recovery.

Figure 7-26. Expanded Agriculture with Climate Change Supply and Demand Flow Chart, 2045



Note: Values in this graphic are rounded to the nearest hundred and may not sum to totals.

Local Inflows, Outflows, and Supplies: Surface water hydrology under Expanded Agriculture with Future Projects and Climate Change is the same as Baseline with Climate Change, as are return flows and septic system inflows. Wastewater percolation is expected to be reduced due to an increase in recycled water use (described below), along with the transfer of MSWD Regional WRF flows to the Mission Creek Subbasin starting in 2027. Subsurface inflow, drain flow, evapotranspiration, and subsurface outflow are derived from the MODFLOW model described in Section 7.2.5.

Colorado River: Colorado River water supplies available under Expanded Agriculture with Future Projects and Climate Change are assumed to remain the same as under the Future Projects with Climate Change, but with additional expansions of direct deliveries. Increases in Colorado River direct deliveries begin in 2022 at 1,122 AFY and amount to 106,663 AFY by 2045. As available Colorado River supply is fully utilized in the Mid- and East Valley, CVWD will reduce replenishment at the GRFs. This results in a reduction in replenishment of CVWD's 2003 QSA entitlement at TEL-GRF beginning in 2031 to a low of 14,712 AFY in 2045, along with ending QSA deliveries at WWR-GRF in 2028 and PD-GRF in 2031.

SWP Exchange: SWP Exchange supplies are the same as under Future Projects with Climate Change and include Table A deliveries (45 percent reliability varied annually based on water year and -1.5 percent reduction due to climate change) along with DCF, Lake Perris Dam Seepage Recovery Project, and Sites Reservoir Project.

Recycled Water: Recycled water supplies are the same as under Future Projects with Climate Change.

Other Supplies: Rosedale-Rio Bravo deliveries remain the same as in Baseline.

7.6 Scenario Implementation

The calibrated Indio Subbasin MODFLOW model was used to simulate water budgets and groundwater level changes over a future 50-year period, from January 2020 to December 2069. The same model area, boundaries, layering, aquifer characteristics, drains, and evapotranspiration areas used in the historical model were maintained in the future predictive model. Only model inflow and outflow amounts, and selected model boundary conditions, were changed for the scenario simulations. Model inflow and outflow sources and rates were estimated for five scenarios, as described in Section 7.5. Annual model stress periods and 12 timesteps per stress period were used, as with the updated historical model. Predicted groundwater level changes over time (along with future changes in Subbasin storage, drain flows, and flows to the Salton Sea) were evaluated to assess overall groundwater Subbasin response, local changes, and effectiveness of the potential management actions for each modeled scenario. The methods used to extend the estimates of each element of the water budget and model input are described in detail below.

7.6.1 Inflows

The Indio Subbasin is recharged through a combination of natural inflows of surface water and groundwater, replenishment of imported water, wastewater percolation, and irrigation return flows. Each of these sources was updated to reflect the specific future conditions in each scenario, as described in Section 7.5 above.

Figure 7-27 shows the average water balance by element for each scenario. Figure 7-27 and Table 7-12 shows the average water balance by element for each scenario. The bar chart summarizes each scenario by the average annual contribution by water balance element over the future planning period (2020 to 2045). The following sections describe each of the sources of inflow to the Indio Subbasin.

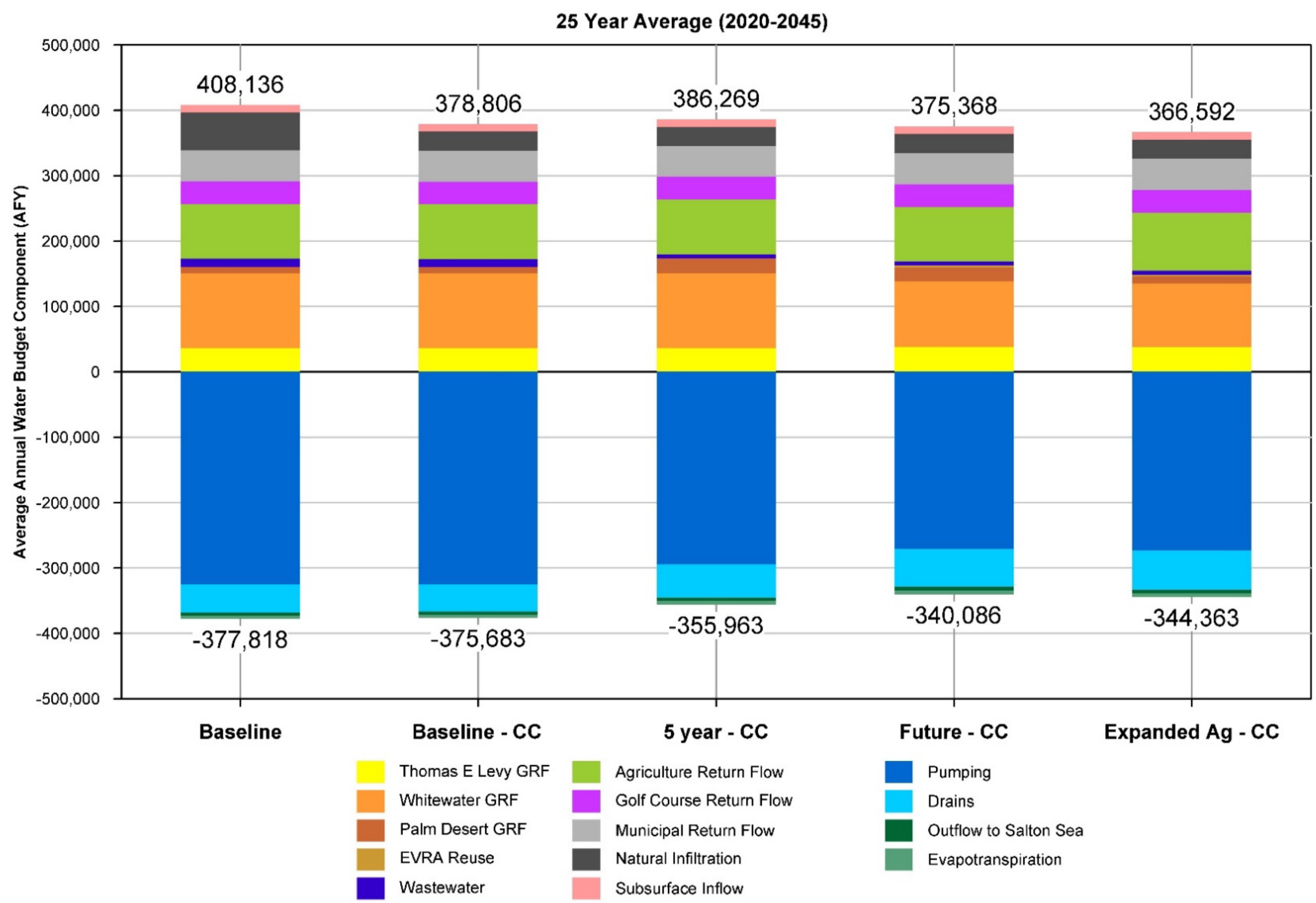
Table 7-12. Simulated Inflows and Outflows, 25-Year Average (2020-2045) (AFY)

	Baseline with Climate Change (AFY)	5-Year Plan with Climate Change (AFY)	Future Projects with Climate Change (AFY)	Expanded Agriculture with Climate Change (AFY)
Inflow				
Whitewater River-GRF[a]	114,775	114,843	100,019	97,637
Thomas E Levy-GRF	36,260	36,260	38,612	37,784
Palm Desert-GRF	9,800	22,736	21,352	10,723
Indirect Potable Reuse	-	-	2,940	2,940
Wastewater Percolation	12,077	6,244	6,244	6,244
Agricultural Return Flow	83,727	83,727	83,727	88,789
Golf Course Return Flow	34,348	34,348	34,348	34,348
Municipal Return Flow	47,626	47,626	47,626	47,626
Natural Infiltration	29,204	29,204	29,204	29,204
Subsurface Inflow	10,990	11,283	11,297	11,298
Total Inflows	**378,806**	**386,269**	**375,368**	**366,592**
Outflow				
Groundwater Pumping	(325,477)	(294,397)	(271,165)	(273,695)
Drain Flows	(40,903)	(50,980)	(57,781)	(59,416)
Evapotranspiration (from Shallow Groundwater)	(4,480)	(5,273)	(5,643)	(5,730)
Outflow to Salton Sea	(4,823)	(5,313)	(5,497)	(5,522)
Total Outflows	**(375,683)**	**(355,963)**	**(340,086)**	**(344,363)**
Average Annual Change in Storage (AFY)	**+3,122**	**+30,306**	**+35,282**	**+22,229**

Note: Totals may not sum due to rounding.

[a] Replenishment estimates for Whitewater River-GRF include imported water and surface water diversions.

Figure 7-27. Model Inflows and Outflows by Scenario



Note:
CC = Climate Change

FINAL

TODD GROUNDWATER

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Figure 7-27
Model Inflows and Outflows By Scenario

7.6.1.1 Subsurface Inflows

Subsurface inflow from the Mission Creek Subbasin was updated for the entire future period, based on values recently generated from the Mission Creek Subbasin MODFLOW model (Wood, 2021). Predicted subsurface outflows from the Mission Creek Subbasin for future scenarios (corresponding to the Indio Subbasin scenarios) were used as subsurface inflow to the Indio Subbasin. For the Expanded Agriculture with Climate Change scenarios, the Future Projects with Climate Change inflows were used. Flows were allocated to five model boundary segments along the Banning/San Andreas Fault at the eastern edges of the Garnet Hill, Indio Hills, and Thousand Palms Subareas (Figure 7-6). Average annual inflows for the future scenarios range from approximately 2,000 AFY for the Baseline with Climate Change scenario to 2,300 AFY for the Future Projects with Climate Change scenario. Subsurface inflow from the San Gorgonio Pass Subbasin was not changed from the *2010 CVWMP Update* model and was kept at the long-term average of approximately 9,000 AFY used in the calibrated historical model, shown on Figure 7-27**.** As described in Section 7.2.5, uncertainty exists in the historical and potential future amounts of inflow from the San Gorgonio Pass Subbasin. The Indio and San Gorgonio Pass Subbasin GSAs have discussed the discrepancy in simulated amounts of subsurface flow between the Subbasins, and plan to reconcile the differences as a part of the next 5-Year Plan update.

7.6.1.2 Surface Water Inflows

As discussed in Section 7.1, recharge from mountain front inflow and from percolation of stream flows into the Indio Subbasin was estimated for 24 watersheds and stream channels along the southwest edge of the model. Streamflow percolation and mountain front recharge are inflows to the model and vary widely from wet to dry years. As discussed in Section 7.5.1, two hydrological cycles were used for future scenarios, one with Climate Change and one without. Climate change would result in decreased rainfall and therefore decreased mountain front recharge and percolation of stream flows. The long-term average for surface water inflow ranges from 43,319 AFY without climate change and 29,204 AFY with climate change over the entire 50-year simulation. Natural infiltration is shown as dark grey on Figure 7-27**.**

7.6.1.3 Replenishment

The annual volumes of replenishment were compiled and applied to the locations of the GRFs based on the suite of projects included in each scenario as described in Section 7.5. These include the WWR-GRF, TEL-GRF, and the recently completed PD-GRF. The total volume at each location is a result of the available imported water for replenishment and the capacity of the facility. The available imported water in turn is controlled by the contracts, projects, agreements, and hydrological conditions. The assumptions used to develop the future replenishment amounts were described in Section 7.5. Evaporative losses were assumed to be four percent of recharged volume for the WWR-GRF and two percent for all other locations, reflecting the larger surface area and windier conditions at the WWR-GRF. Total annual recharge volumes at the replenishment facilities are shown as yellow, light orange, and dark orange on Figure 7-27**.**

7.6.1.4 Wastewater Discharges

Four wastewater plants discharge to disposal ponds (Palm Springs WWTP and CVWD WRP-2, WRP-7, and WRP-10). In addition, a new MSWD Regional WRF will soon be completed in Garnet Hill. Under the Baseline conditions, wastewater will be percolated at this location, but under 5-Year Plan and Future scenarios, wastewater percolation does not continue past 2025 and recycled water from the plant is delivered to Mission Creek Subbasin. The future percolation volumes for all plants were calculated based on expected inflow and recycled water deliveries. For future conditions, evaporative losses were assumed at two percent of the recharged volume. The ponds have evaporative losses, calculated by the area of ponds and expected annual evaporation. The remaining volumes percolated into the Subbasin are shown as cobalt blue on Figure 7-27**.**

7.6.1.5 Applied Water Return Flows

Irrigation needs are expected to follow the increases (or decreases) in demands for each of the major categories – agricultural, golf, and municipal. The demands are documented in Chapter 5, *Demand Projections,* and expected return flows are calculated with the same methodology as the historical model. Agricultural change, both the conversion of agricultural parcels to urban in some areas and the increase in acreage in others, is detailed in Chapter 5, *Demand Projections*. Expected return flows were increased or decreased based on the percentage of expected change in agricultural acreage (either conversion to municipal uses or conversion from idle land to active agriculture) by geographic area. Future agricultural demand projections are the same in all scenarios, with the exception of the expanded agricultural scenario. The areal distribution was the same as the historical model which used the CVWD crop censuses to identify specific crop areas, only the volumes adjusted based on land use changes.

Municipal return flow is estimated using the percent of outdoor irrigation expected to result in return flow and the volume of septic system return flow by geographic area. The expected future outdoor municipal demand and septic system flow is documented in Chapter 5, *Demand Projections,* and the percent resulting in return flow is the same by geographic area as used in the historical model calculations, which relied on the most recent crop census, Section 7.2.5.5.

Return flow from golf courses was based on the calculated return flow in the historical model using the demand and supply at the locations of the existing courses (Section 7.2.5.5). Additional return flow (34 percent of expected demand of each golf course) was added for the three expected new golf courses based on the timing and location of those projects (refer to Chapter 5, *Demand Projections*).

Municipal return flows also include expected septic system return flow. For all but the Expanded Agriculture with Climate Change scenario, return flows remain the same for each scenario. Agricultural, golf, and municipal return flows are shown green, magenta, and light grey, respectively on Figure 7-27**.**

As described in Section 7.5 above, the Expanded Agriculture with Climate Change scenario includes an additional 8,000 acres of irrigated agricultural land in the East Valley. Additional agricultural demand was estimated by applying the average applied water rate in the East Valley (5.4 AFY/acre). The irrigation source was assumed to be 15 percent additional groundwater pumping and 85 percent new direct delivery connections. Return flows associated with the additional agricultural were increased relative to the expected demand increase and applied over areas with existing agriculture in the East Valley.

7.6.2 Outflows

For each scenario, the only prescribed outflow was groundwater pumping. The remaining outflows (drain flows, ET, and groundwater outflows to the Salton Sea) are dependent on the simulated water levels of the model.

7.6.2.1 Groundwater Production

For the future scenarios, pumping was assumed to continue from the same distribution of wells in the Subbasin as the historical model. Increased water demands were identified on a geographic area and the volume of pumping for that area was increased to meet the total expected volume (current plus increased demand). The increase in demand is detailed in Chapter 5, *Demand Projections*. For all but the Expanded

Agriculture with Climate Change scenario, forecasted water demands remain the same, but depending on what projects are implemented, the source of supply differs by individual scenario (e.g., groundwater pumping may shift to Canal direct deliveries). The Expanded Agriculture with Climate Change scenario includes an increase in agricultural water demand, 15 percent of which is assumed to be met by groundwater pumping.

The Baseline and Baseline with Climate Change scenarios reflect the current level of pumping, plus the expected change in demand from municipal, golf, and agricultural uses (it was assumed the increase in demands for the "Other" category is satisfied by other water sources). For the scenarios with planned source substitution projects, pumping volumes are reduced by the expected direct delivery volumes. Most notably, the planned Oasis project will supply up to 32,000 AFY of imported water to growers in the East Unincorporated area, about 25,000 to 27,000 AFY which previously relied on groundwater and therefore pumping in the area is reduced by an equal amount. Groundwater pumping amounts are shown dark blue on Figure 7-27.

7.6.3 Other Predictive Model Inputs

In addition to the inflow and outflow model input datasets, several other model input parameters and future boundary conditions were defined for the future scenario simulations.

- The model grid initial groundwater elevation conditions for all predictive scenarios, beginning on January 1, 2020, were set to the values from the final historical simulation ending December 31, 2019.
- The Salton Sea, simulated as a MODFLOW General Head Boundary, was assigned future sea elevations for 2020 to 2069, based on the modified Salton Sea Accounting Model (Tetra Tech and Salton Sea Authority, 2016). Sea level elevations are predicted to decline from -238 ft msl in 2020 to -250 ft msl in 2069, and this decline was applied to the GHB representing the Sea.
- Drains and evapotranspiration zones were unchanged relative to the historical model for all scenarios simulated.

In addition, a subset of 12 monitoring wells (see Chapter 10, *Monitoring Program*) were used as future observation wells for the predictive model simulations. The wells are distributed in the West Valley, Mid Valley, and East Valley areas, and future simulated water levels for each scenario are plotted in a series of hydrographs for each well) (see Section 7.7.1.2).

7.7 Results

Modeling results are presented first in Section 7.7.1 for the Baseline and Baseline with Climate Change scenarios, allowing direct evaluation of the effect of simulated climate change on groundwater levels and storage. Results are shown in terms of the respective water balances, cumulative change in storage, selected hydrographs, and groundwater level change maps.

Section 7.7.2 presents modeling results for all four scenarios with climate change: Baseline with Climate Change, 5-Year Plan with Climate Change, Future Projects with Climate Change, and Extended Agriculture with Climate Change. Results of these scenarios are shown together to allow comparison in terms of model inflows, simulated pumping, simulated drain flow, simulated net outflow to Salton Sea, hydrographs, and maps showing change in groundwater levels.

7.7.1 Baseline Scenarios - Impact of Climate Change

As discussed in 7.5.1, two separate future hydrological periods were developed so that the GSAs could assess the impacts of climate change. The Baseline scenario was run assuming no change in hydrologic conditions (repeated local hydrology of 1970 to 2019). A second simulation was run for Baseline with Climate Change (repeated local hydrology 1995 to 2019 two times - first backward and then forward). The availability of imported water is also impacted by expected climate change. As discussed in Section 7.5.2 and 7.6.1, SWP reliability is assumed to be reduced by an additional -1.5 percent and Colorado River water deliveries are assumed to be reduced by 24,500 AFY under the climate change scenario as compared to Baseline by 2045.

7.7.1.1 Water Budget – Baseline Scenarios

Figure 7-28 shows the water balances for the scenarios of Baseline and Baseline with Climate Change for the 50-year period 2020 to 2069.

The Baseline scenario (upper Figure 7-28) reflects the expected inflows from natural infiltration and imported water based on the repeated hydrologic conditions of the past 50 years. Mountain front and stream recharge observed over the past 50 years was repeated as model input, and imported water was reduced by an additional -1.5 percent to account for decreased availability of SWP supplies, and Colorado River supplies were reduced by -24,500 AFY, as discussed in Section 7.5.1 and 7.5.2. The chart shows the simulated total annual inflows and outflows between 2020 and 2069 by source, along with simulated annual (black line on the chart) and cumulative (orange line on chart) change in storage. A key difference between the Baseline scenario and Baseline Scenario with Climate Change is the hydrological variability. The Baseline scenario is characterized by a high average inflow due in part to several wet years that occurred in the 50-year period. These wet years, which occur early in the simulation, provide an increase in storage that serves as a buffer for the end of the model simulation when drought conditions reduce change in storage. Over the planning period, the model simulation shows a 486,000 AF increase in storage by the end of 2045.

In contrast, Baseline with Climate Change (lower Figure 7-28) simulates a drier period of record, with the last 25 years repeated twice and with reductions in imported water (Section 7.5.2). The climate change scenario begins the simulation with drier conditions and does not include the very wet years previously observed in the basin. Without the wet years, the annual change in storage remains close to zero and inflows and outflows generally balance, but cumulative storage does not increase in the early years as in the Baseline. In fact, by the end of the 25-year planning period after drought conditions are repeated, the model shows a cumulative decline in storage amounting to 96,000 AF. Climate change is also assumed to impact imported water availability. While all scenarios assume 45 percent reliability of SWP supplies, the climate change scenarios assume an additional reduction in reliability of -1.5 percent by year 2045. Further, given the tendency to recurring drought in climate change conditions, those scenarios assume CVWD will contribute to California's *Lower Basin DCP* allotment for Colorado River water.

Figure 7-29 shows the cumulative change in groundwater storage for Baseline and for Baseline with Climate Change. The impact of additional inflow in the early part of the simulation in the baseline scenario is evident. By 2033, the Baseline scenario has an additional 553,000 AFY more groundwater in storage over Baseline with Climate Change and by 2044, the Baseline scenario has a cumulative change in storage of 631,000 AFY more than the Baseline with Climate Change. For the rest of the model simulation, 2045 to 2069 when hydrology is the same for both scenarios, this difference in cumulative storage is maintained because both simulations use the observed data from most recent 25 years for this period.

Figure 7-28. Annual Model Water Budget for Baseline with Climate Change

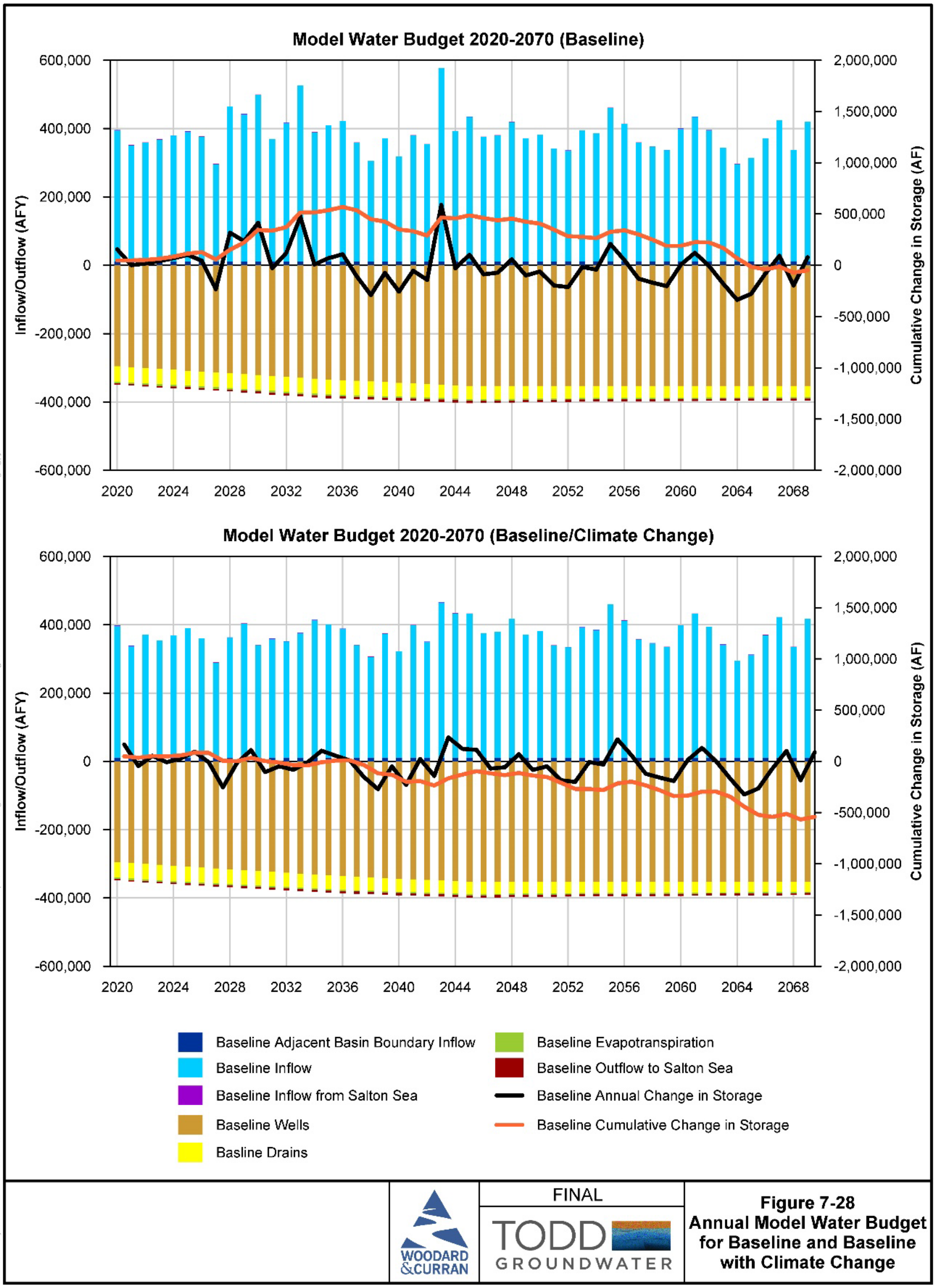
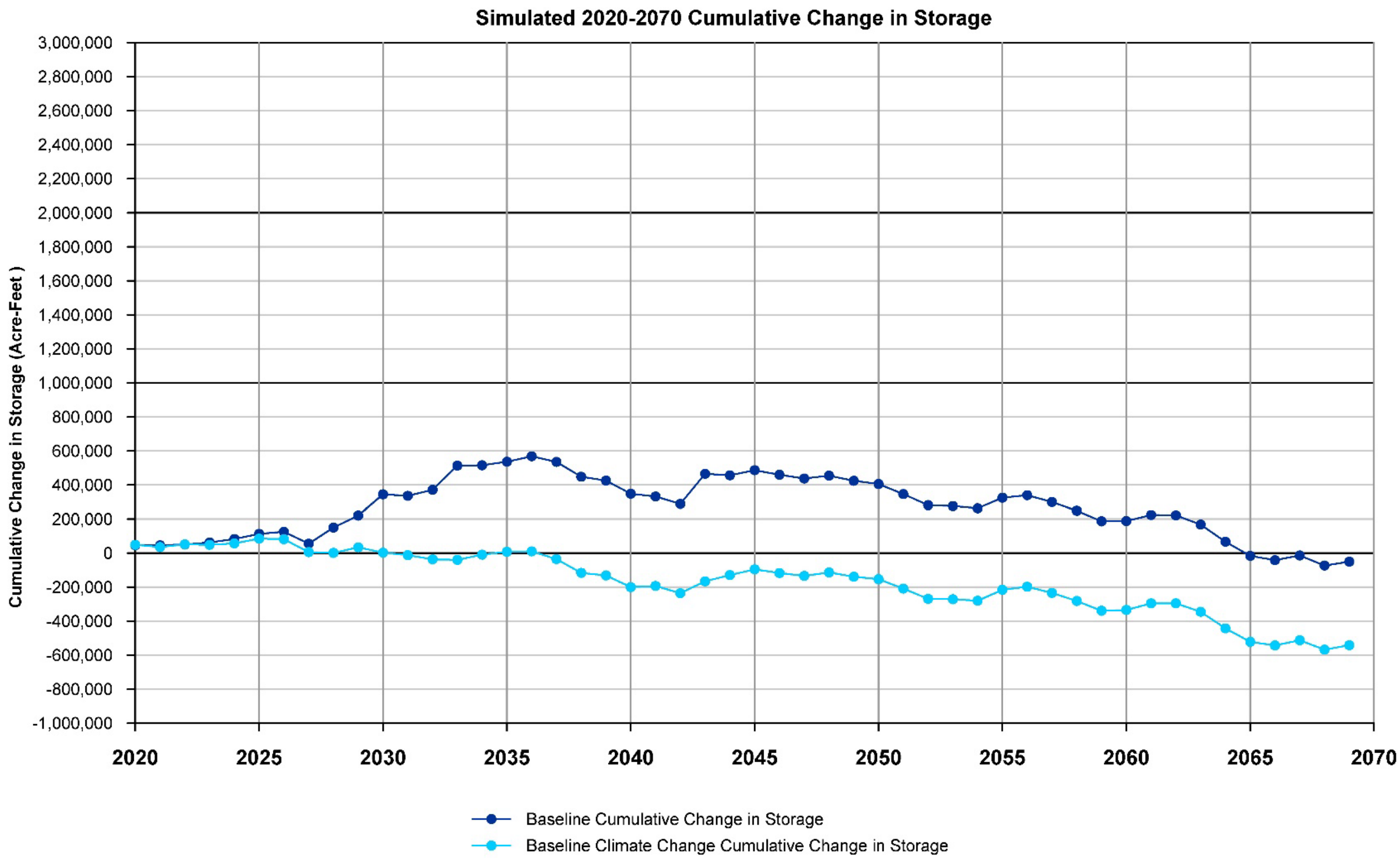


Figure 7-29. Cumulative Change in Storage for Baseline and Baseline with Climate Change



WOODARD &CURRAN | FINAL TODD GROUNDWATER | **Figure 7-29 Cumulative Change in Storage for Baseline and Baseline with Climate Change**

These scenarios reflect the same management actions and existing projects. The only difference is the projected hydrology with and without climate change, which is beyond the control of the GSAs. Because the actual future hydrology is unknown and will likely be affected by climate change, it is critical that GSAs assess their existing and planned projects assuming constraints to local and imported surface water supplies. Simulating the management actions and projects under a range of hydrologic conditions helps to evaluate the effectiveness of these actions.

7.7.1.2 Simulated Hydrographs – Baseline Scenarios

Simulated water levels from the 12 model observation wells were used to illustrate the predicted groundwater level changes for Baseline and Baseline with Climate Change. Simulated 1997 to 2019 water levels for the wells are included to provide context for the future scenarios.

Figure 7-30 and Figure 7-31 show the simulated groundwater elevation hydrographs for Baseline and Baseline with Climate Change scenarios in the West Valley and East Valley, respectively. Historical groundwater levels are shown in black. Baseline conditions are shown with solid blue lines on the graphs, while Baseline with Climate Change levels are shown as the dashed lines. All hydrographs use a 300-foot elevation range on the hydrographs.

West Valley/Palm Springs Subarea

The three observation wells in the Upper West Valley/Palm Springs Subarea (hydrographs along the left side of Figure 7-30) show dynamic fluctuations associated with recharge events at the WWR-GRF, with water level mounding and recovery cycles muted in wells located down the valley. For both scenarios, the larger fluctuations are observed in Well 03S04E20F01S near the WW-GRF, as was observed in historical level trends. Predicted fluctuations in well 03S04E34R01S in Palm Springs are lower but still reflect water level fluctuations associated with the wet/dry replenishment cycles at the WW-GRF and show a net rise of around 50 feet by 2045, followed by a decrease from 2045 to 2070. Well 04S05E17Q02S farther southeast shows increases of around 40 feet by 2045 with minor dampened fluctuations possibly associated with the WWR-GRF, but also potentially influenced by simulated replenishment at PD-GRF to the south. Predicted groundwater elevations for Baseline for well 03S04E34R01S in Palm Springs are around 60 feet higher than for Baseline with Climate Change at 2045, while predicted levels in Well 04S05E17Q02S are around 30 feet higher in 2045. Levels in both wells show a slight increasing trend between 2020 and 2045, then a stable or slight declining trend for 2045-2070, reflecting the later lower inflow amounts. Overall groundwater levels in this Subarea are proportional to the groundwater recharge. Future conditions mirror future recharge– in wet years water levels rise and in dry years water levels decline.

West Valley/Garnet Hill Subarea

The two observation wells in the Garnet Hill Subarea (hydrographs along the top of Figure 7-30) show increasing water level trends for both scenarios. Water levels in Well 03S04E17K01S in the northern portion of Garnet Hill and Well 03S05E30G01S in the southern portion of Garnet Hill are predicted to rise 60 to 80 feet by 2045. Part of the water level rise is due to the MSWD Regional WRF that is expected to percolate treated water in the Baseline scenario.

Figure 7-30. Model Baseline Scenario Hydrographs, West Valley 2020-2069

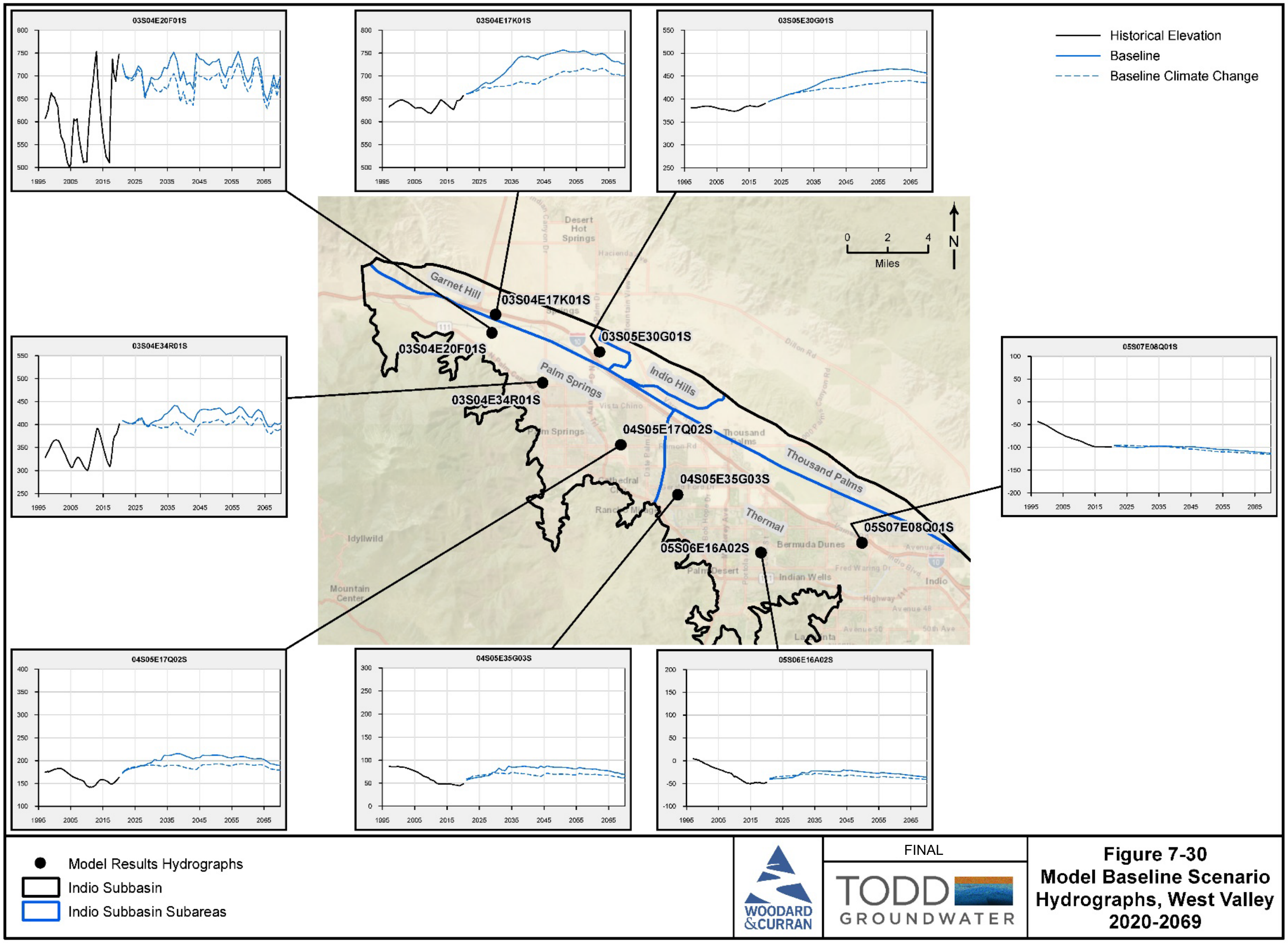
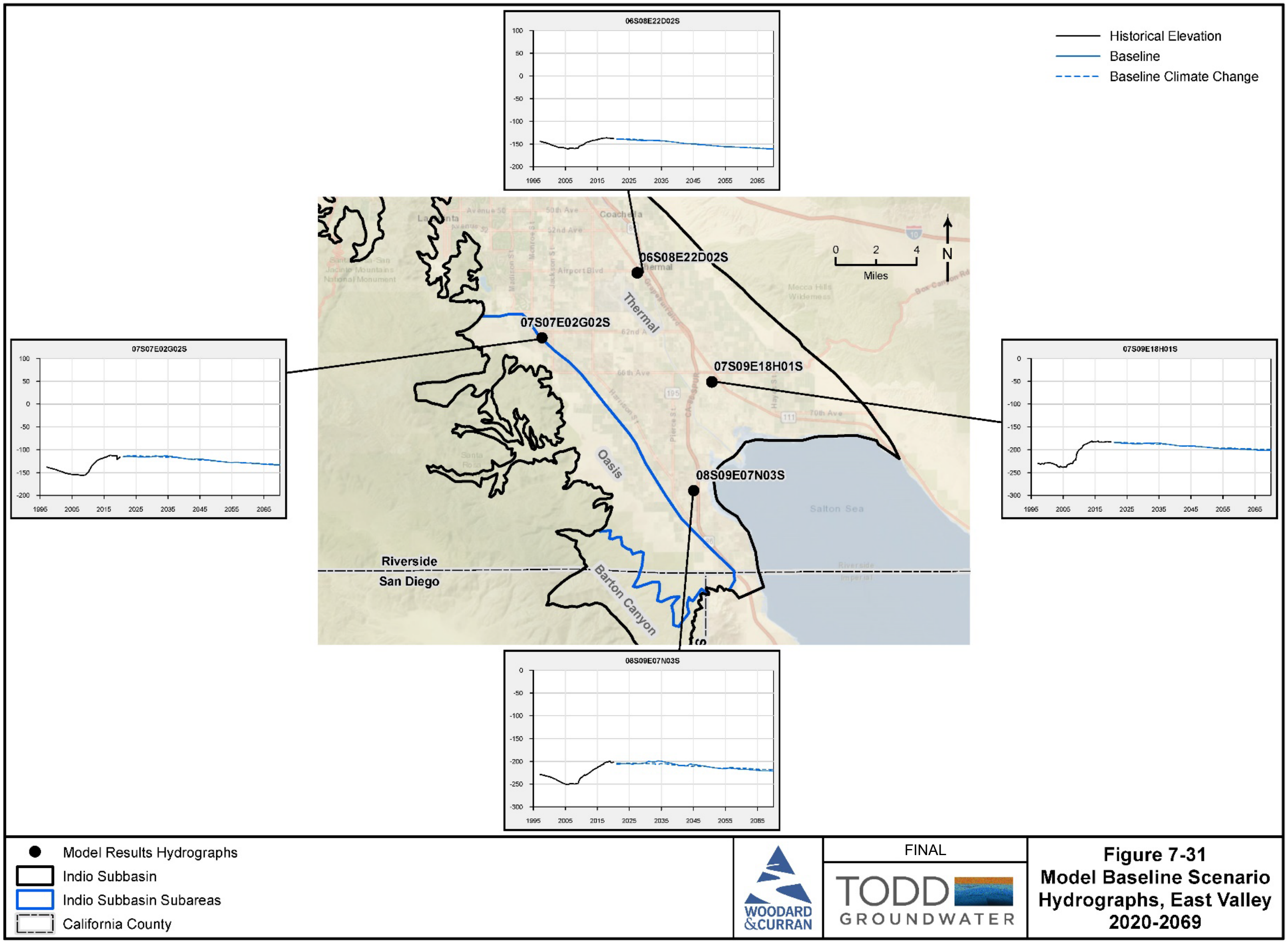


Figure 7-31. Model Baseline Scenario Hydrographs, East Valley 2020-2069



West-Valley/Cathedral City to Indio Area

Predicted water levels in the three observation wells in the mid- and lower-West Valley/ Cathedral City to Indio area (hydrographs along the bottom of Figure 7-30) show slightly increasing to stable trends for the Baseline scenario. Water levels in Wells 04S05E35G03S and 05S06E16A02S in the Rancho Mirage and Palm Desert areas show increasing levels of around 40 feet, in part due to replenishment at WWR-GRF and PD-GRF. Baseline levels in Indio Well 05S075E08Q01S are predicted to be relatively stable from 2020 to 2070. For Baseline with Climate Change, predicted levels in all four wells are around 20 feet lower than for Baseline, the result being only modest increases in levels in the Rancho Mirage and Palm Desert wells, and slightly declining levels in Indio between 2045 and 2070.

East Valley/La Quinta, Thermal, Mecca, and Oasis Areas

Predicted water levels in the four observation wells in the East Valley areas (Figure 7-31) show stable to slightly decreasing trends for the Baseline scenario. Only minor differences are observed in the simulations for the Baseline with Climate Change scenario.

7.7.1.3 Simulated Change in Water Level Maps – Baseline Scenarios

Simulated changes in water levels for the Baseline and Baseline with Climate Change scenarios between 2009 and 2045 are shown (Figure 7-32 and Figure 7-33)**.** 2009 was selected as the period for comparison because it generally reflects historically low groundwater elevations in most of the Subbasin, and these values are used as sustainability criteria for groundwater levels. As detailed in Section 7.5, the Baseline scenarios reflect no new additional projects and the two model simulations simulate different future hydrologic conditions to assess the range of possible outcomes of this no project scenario.

These color-fill contour maps illustrate predicted spatial trends in water level declines or increases across the Subbasin for the scenarios. Simulated changes in water levels are shown for Model Layer 4, representing the deep aquifer. Figure 7-32 shows the predicted change in groundwater levels between the recent historical low, 2009, and the end of the planning period, 2045, for the Baseline scenario and reveals that minor declines (less than 25 feet) would occur in a small area north of the Mid-Valley around Indio. Groundwater level increases would occur in the uppermost West Valley, Garnet Hill, and most of the lower East-Valley areas.

Figure 7-33 shows the predicted changes in levels for Baseline with Climate Change and shows that larger declines (up to 50 feet) would occur under this scenario in the Mid-Valley area north of Palm Springs. Smaller groundwater level increases are predicted in the uppermost West Valley, Garnet Hill, and most of the lower East-Valley areas, as compared with the Baseline scenario.

Figure 7-32. Change in Groundwater Levels, 2009-2045 Baseline Scenario

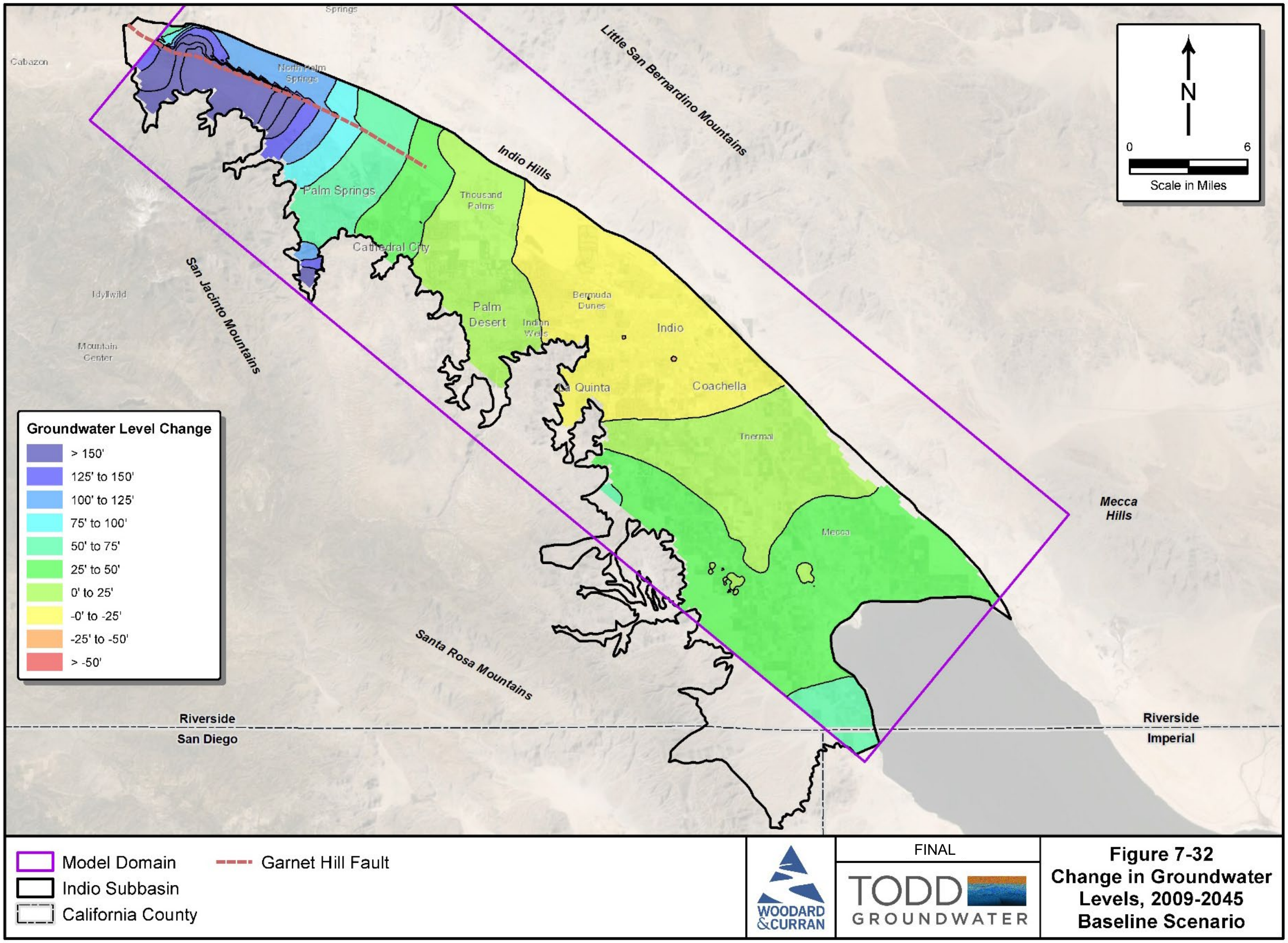
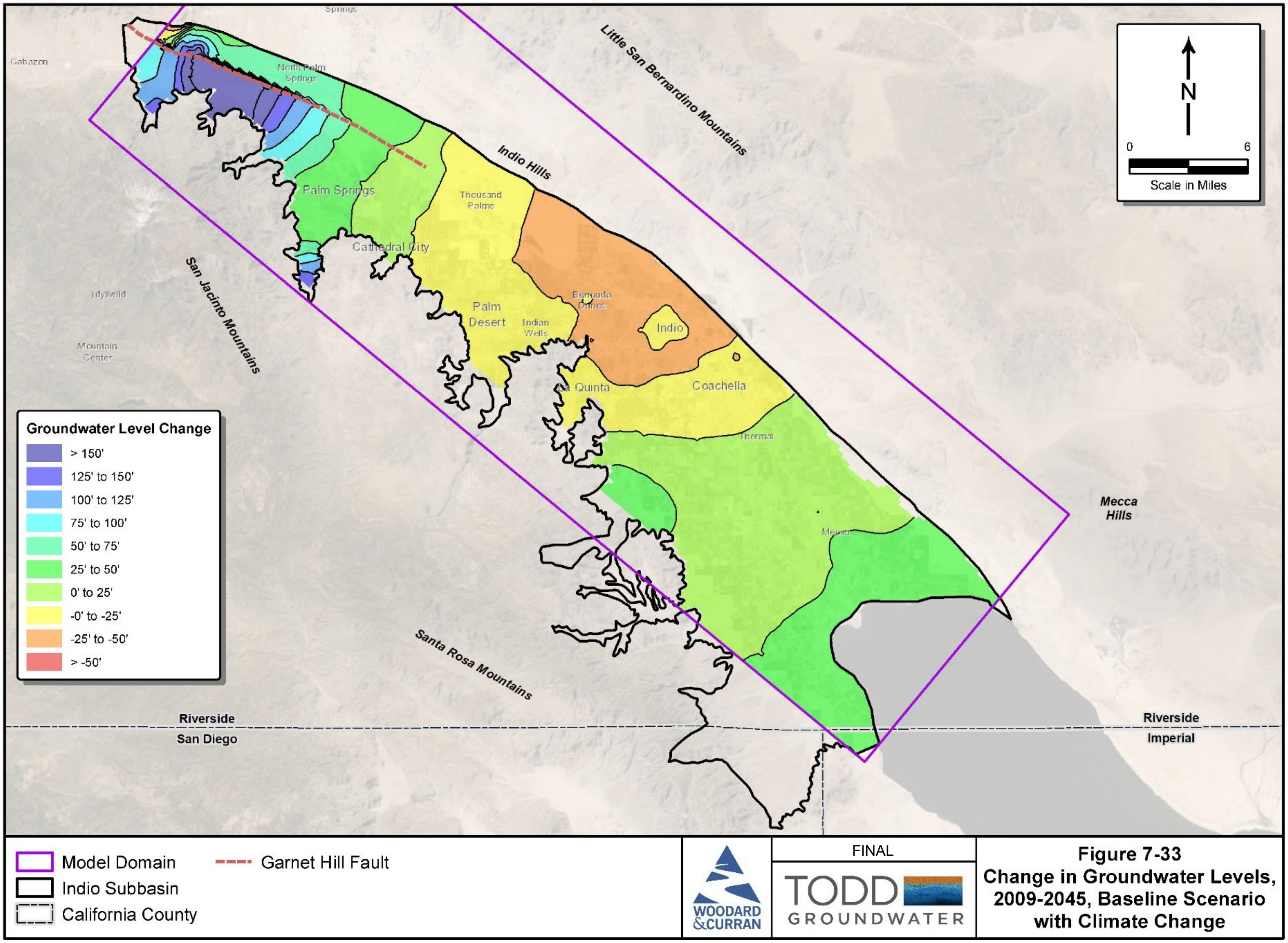


Figure 7-33. Change in Groundwater Levels, 2009-2045, Baseline Scenario with Climate Change



7.7.1.4 Baseline Scenarios Summary

Collectively, the simulated hydrographs and changes in water levels maps for the Baseline and Baseline with Climate Change scenarios indicate that both local increases in future groundwater levels and decreases in levels are predicted. The local differences may be due in part to assumptions regarding the future distributions of replenishment at the GRFs, return flows, and pumping. Regardless, a net increase in Subbasin-wide storage is predicted for the Baseline scenario, while a decrease in total Subbasin storage is predicted for Baseline with Climate Change. In the climate change scenario, simulated groundwater levels are up to 25 feet lower in portions of the Mid-Valley with smaller increases in levels in the West and East Valley than in the baseline scenario without climate change.

The baseline scenarios with and without climate change simulate the same management scenarios under different future hydrology. The differences in water levels and the water budget scenarios highlight the potential range of response under different hydrology, a variable that is not controlled by the GSAs. The baseline scenario with climate change indicates a negative change in storage and does not meet the sustainability goals defined by the GSA. To prepare for an uncertain future, the GSAs are planning for impacts from climate change by assessing future management scenarios under the climate change hydrology and also through adaptive management that will assess the changing groundwater basin.

7.7.2 Climate Change Scenarios – Baseline and with Projects

In addition to the Baseline with Climate Change scenario, three other scenarios were simulated to assess planned projects and supply conditions in the near-term (5 years) and planning horizon (25 years) on the Subbasin. These four scenarios were simulated with both the 50-year hydrology and the climate change hydrology. Only the climate change versions of those scenarios are presented here, as the Indio GSAs are committed to achieving sustainability under changing climate conditions.

7.7.2.1 Water Budget – Scenarios with Climate Change

As described in Section 7.5, additional future scenarios were developed to simulate projects included in the GSAs’ 5-year capital improvement plans, future projects, and potential expanded agricultural areas. Natural inflow, municipal return flows, and golf return flow amounts remain the same for each scenario. As shown on Figure 7-27, average inflow for groundwater replenishment and wastewater percolation differs between scenarios, reflecting the addition of projects that utilize imported and recycled water for direct use rather than indirect use through replenishment and percolation. Of the scenarios simulated with climate change, the Baseline with Climate Change scenario simulated the greatest average annual inflow to the Subbasin (more than 408,000 AFY) because of increased direct use under other scenarios, while Expanded Agriculture with Climate Change simulates the least inflow (367,000 AFY). However, the difference between these scenarios for the planning period (2020 to 2045) is only ten percent of the total inflow.

Figure 7-34 shows total inflow for all scenarios with climate change assumptions. Note the peaks and valleys are a product of simulating annual variability for wet and dry years. Hydrology plays a critical role for basin inflows because natural infiltration varies based on year type and the volume of available SWP exchange water also varies greatly based on year type. As shown on Figure 7-27, the Future Projects with Climate Change scenario has less average inflow in the first 25 years than Baseline, Baseline with Climate Change, and 5-Year Plan with Climate Change scenarios; this reflects the assumed new source substitution projects coming online to deliver Canal water directly to users. The Expanded Agriculture shows the least total inflow because additional imported water is delivered to users to meet the increased demand, rather than recharged at GRFs.

Figure 7-35 shows the differences in pumping between the scenarios. As described above, planned source substitution projects will increase the volume of direct deliveries of imported and recycled water and offset a comparable volume of pumping. As described in Section 7.5, these volumes differ among scenarios based on simulated projects. The Baseline scenario assumes expected increases in demand will be satisfied by increased pumping. For the 5-Year Plan with Climate Change and Future Projects with Climate Change scenarios, the new direct delivery connections decrease pumping. The Expanded Agriculture with Climate Change scenario shows a slight increase in pumping over the Future Projects with Climate Change scenario, reflecting an expected increase in agricultural pumping due to the increase in demand. Fifteen percent of the new irrigated agricultural area is assumed to be served by groundwater, with the rest served through direct delivery of Canal water.

Figure 7-36 shows the cumulative change in groundwater storage for the four climate change scenarios. In the Future Projects with Climate Change scenario, decreased pumping and similar levels of inflow to the other climate change scenarios result in an increase in groundwater storage of 1,394,000 AF at the end of the 50-year simulation. The Expanded Agriculture with Climate Change scenario shows less cumulative storage change due to increased agriculture pumping and reduced groundwater replenishment as increased demands are met by direct delivery of Canal water. The change in storage for Expanded Agriculture with Climate Change is 588,000 AF at the end of the 50-year simulation, while the cumulative storage change for the 5-Year Plan with Climate Change scenario is 691,000 AF. Baseline with Climate Change is the only scenario that results in a negative cumulative change in storage after the 50-year simulation, approximately 542,000 AF is expected to be removed from storage. All scenarios show a net increase in storage at the end of the 25-year planning horizon, followed by declining storage through 2069 for Baseline with Climate Change only, net stable storage for 5-Year Plan with Climate Change projects, and increasing storage for Future Projects with Climate Change and Expanded Agriculture with Climate Change.

Simulated drain flow for the four climate change scenarios is shown Figure 7-37, along with the historical simulated and observed volumes for comparison context. The volume of drain flows is calculated by the model based on defined drain locations, depths, and hydraulic conductance parameter, and predicted groundwater levels at the drains. When groundwater is simulated as rising to or above the drain elevation, groundwater is removed via the drains, with larger amounts of drain flow predicted for higher groundwater elevations. For the Baseline with Climate Change scenario, drain flows are predicted to decline from around 45,000 to 30,000 AFY. The Future Projects with Climate Change scenario involve a decrease in pumping in the East Valley that results in an increase in drain flow, up to 70,000 AFY. For the Expanded Agriculture with Climate Change scenario, groundwater replenishment is reduced in the scenario at Whitewater and Palm Desert GRF facilities in the East Valley to meet the increased direct delivery demands. This reduction of replenishment, especially at TEL-GRF, results in a decrease of drain flows after 2040 relative to the Future Projects with Climate Change scenario. This can be seen on Figure 7-37 when the volume percolated at TEL-GRF is first reduced, and hydrographs of wells near TEL-GRF (e.g., Well 07S07E02G02S) and drain flows both exhibit declines.

Figure 7-34. Total Model Inflow for Future Scenarios

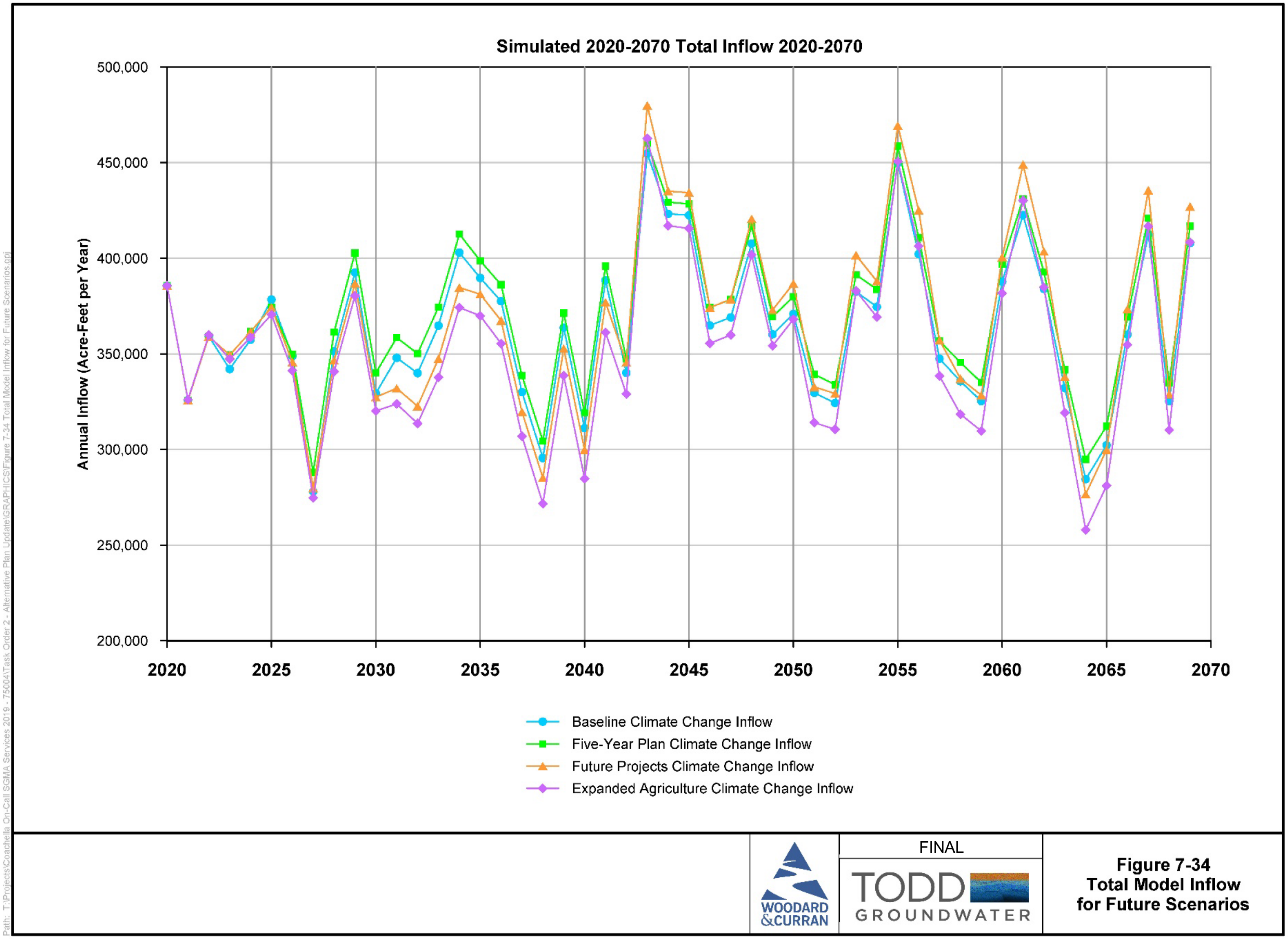
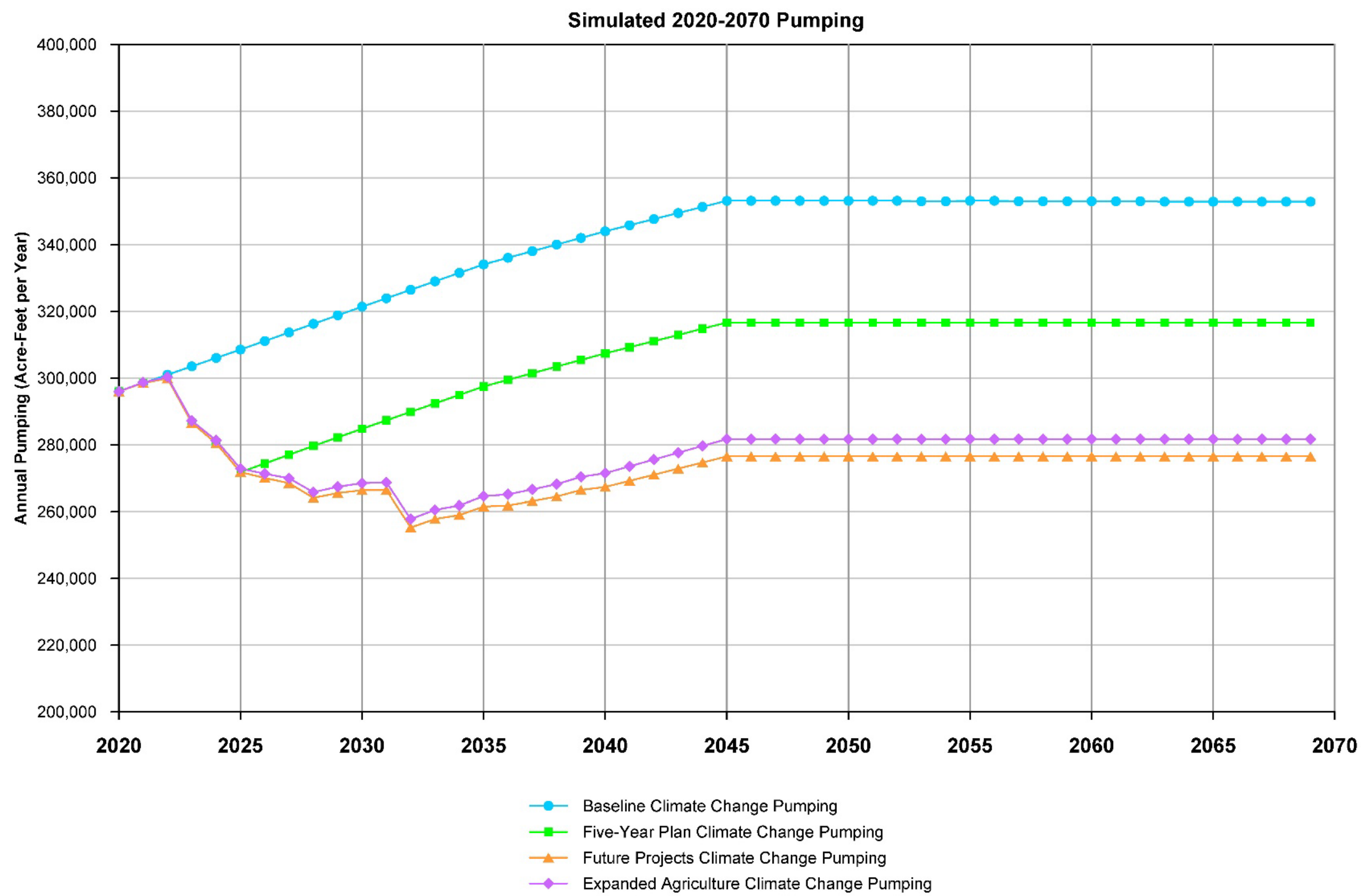


Figure 7-35. Simulated Pumping for Future Scenarios



FINAL

Figure 7-35
Simulated Pumping
for Future Scenarios

Figure 7-36. Cumulative Change in Storage for Future Scenarios

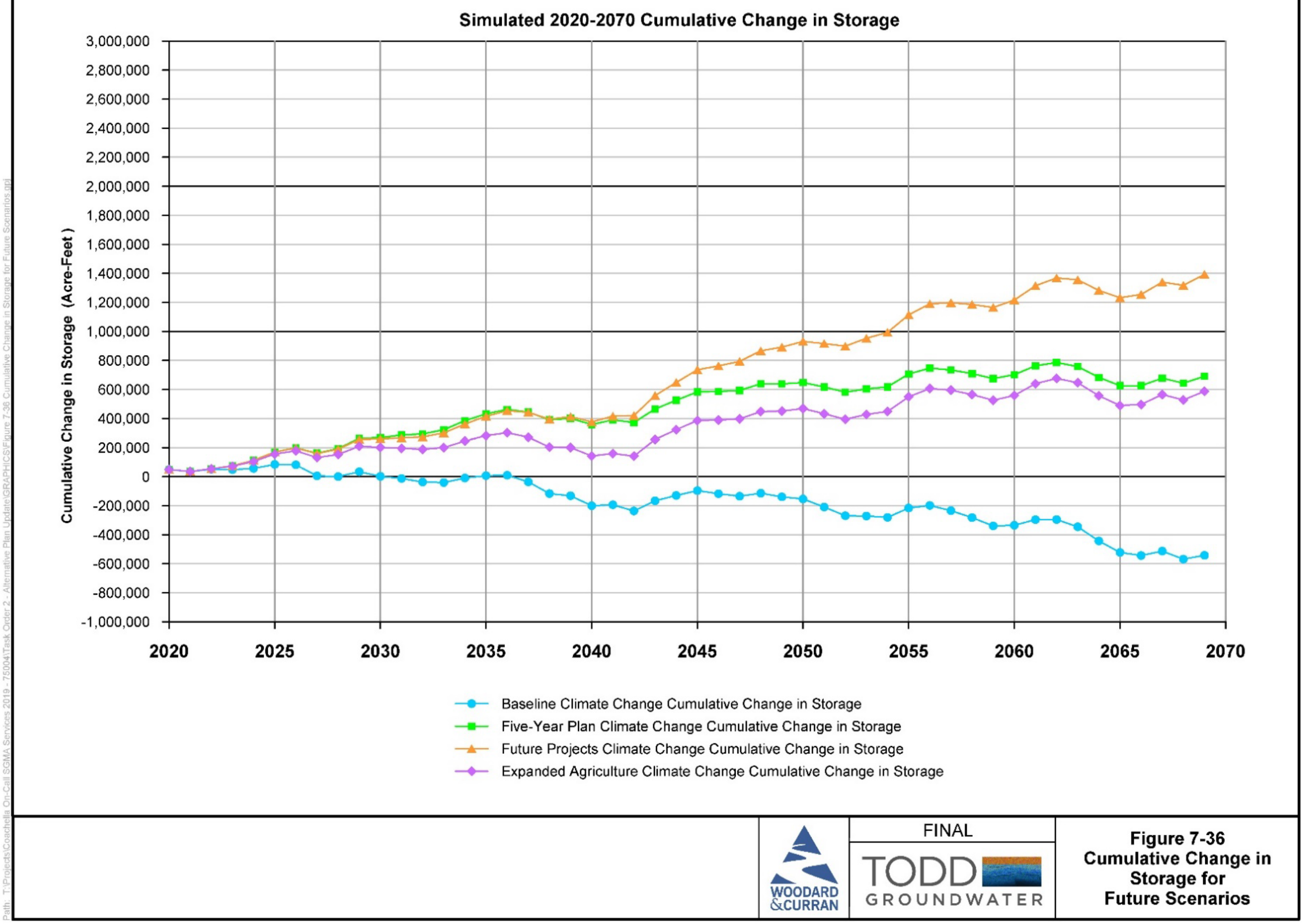


Figure 7-36
Cumulative Change in Storage for Future Scenarios

Figure 7-37. Simulated Drain Flow for Future Scenarios

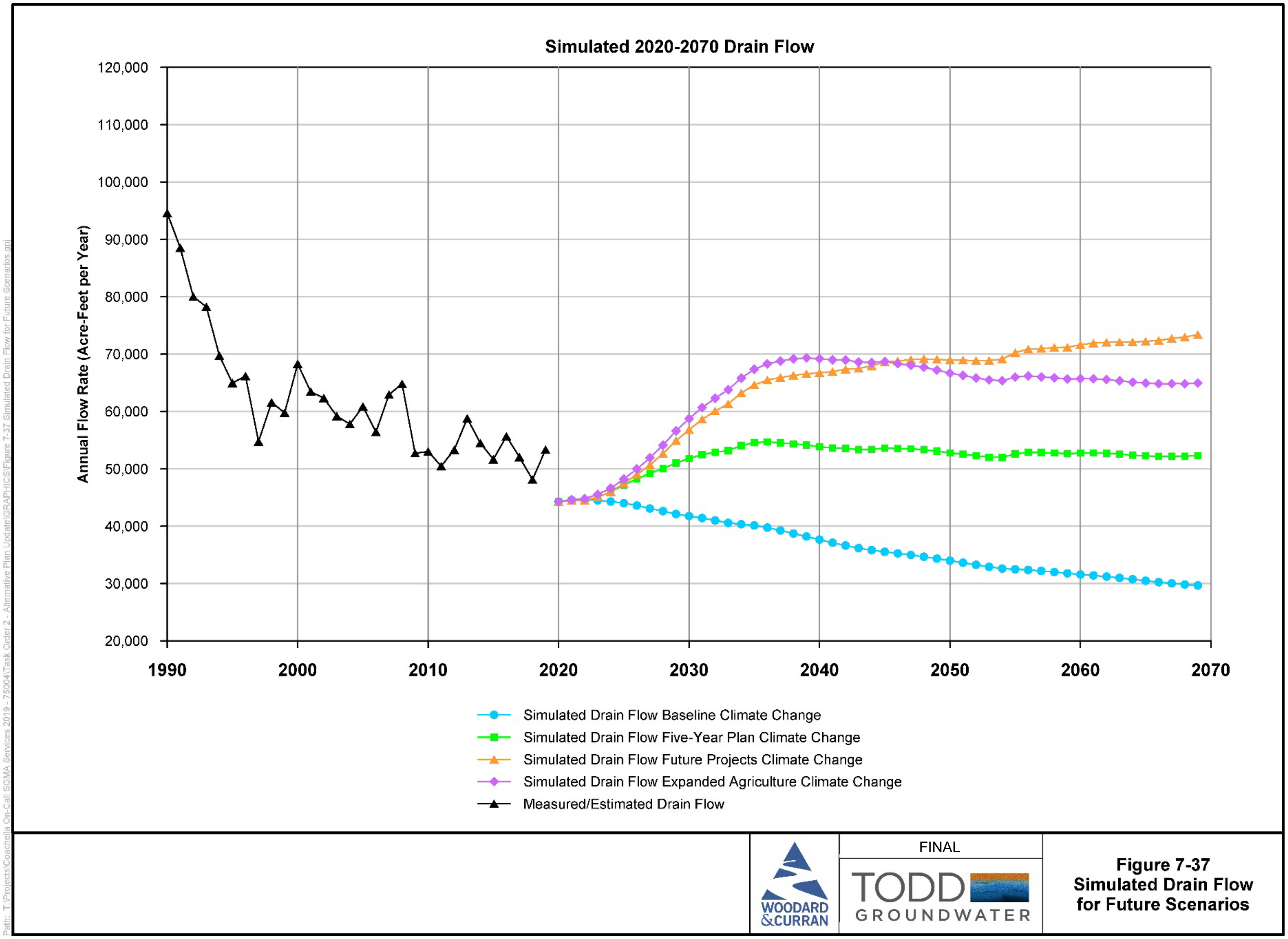


Figure 7-38 shows the net groundwater discharge to the Salton Sea for the four climate change scenarios. Predicted groundwater discharge amounts increase between 2020 and 2045, then stabilize or slightly decline. Discharge at 2045 ranges from approximately 4,800 AFY for Baseline with Climate Change to 5,500 AFY for Future Projects with Climate Change and Expanded Agriculture with Climate Change. The amounts do not vary much between the scenarios, because flow is limited by the relatively low conductance value assigned to the Sea boundary condition and because groundwater levels in the area north of the Sea are partially controlled by the drain system.

7.7.2.2 Simulated Hydrographs – Future Scenarios with Climate Change

Figure 7-39 and Figure 7-40 show the simulated groundwater elevation hydrographs for the four climate change scenarios in the West Valley and East Valley, respectively. Baseline with Climate Change conditions are shown with blue lines on the graphs, 5-Year Plan with Climate Change as the magenta lines, Future Projects with Climate Change as orange lines, and Expanded Agriculture with Climate Change as the green lines.

West Valley/Palm Springs Subarea

The three observation wells in the Upper West Valley/Palm Springs Subarea (hydrographs along the left side of Figure 7-39) show dynamic fluctuations associated with recharge events at the WWR-GRF for all scenarios, with water level mounding and recovery cycles decreasing in magnitude down the valley. The highest groundwater levels in Well 03S04E20F01S near the WW-GRF and in Well 03S04E34R01S in Palm Springs are predicted for the Future Projects with Climate Change scenario, with the lowest levels simulated for the Expanded Agriculture with Climate Change scenario. By the end of the future simulation, Well 04S05E17Q02S farther southeast shows the lowest levels for the Expanded Agriculture with Climate Change scenario.

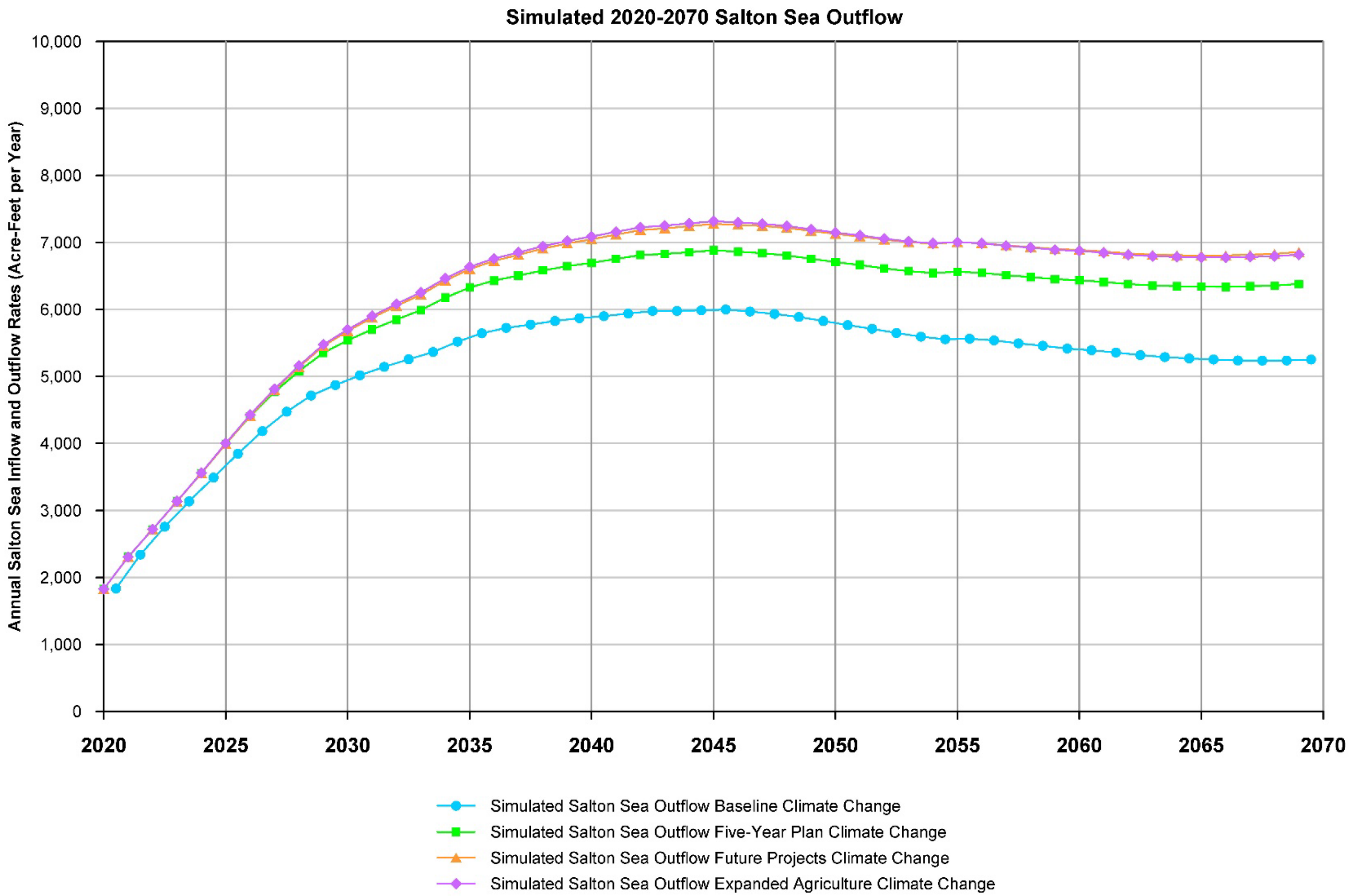
West Valley/Garnet Hill Subarea

The two observation wells in the Garnet Hill Subarea (hydrographs along the top of Figure 7-39) show increasing water level trends for all scenarios. Water levels in Well 03S04E17K01S in the northern portion of Garnet Hill and Well 03S05E30G01S in the southern portion of Garnet Hill are predicted to rise 30 to 60 feet by 2070, with the largest rises simulated for the Five-Year Plan with Climate Change scenario.

Mid-Valley/Cathedral City to Indio Area

Predicted water levels in the three observation wells in the Mid-Valley/ Cathedral City to Indio area (hydrographs along the bottom of Figure 7-39) show slightly to moderately increasing to stable trends for all scenarios, except the Baseline with Climate Change scenario. Groundwater levels in Well 04S05E35G03S near Rancho Mirage increase 80 feet for the Future Projects Scenario, with Wells 05S06E16A02S in Palm Desert and Well 05S075E08Q01S in Indio also showing the greatest increases for Future Projects with Climate Change. Simulated levels for the 5-Year Plan with Climate Change and Extended Agriculture with Climate Change scenarios also rise in all wells, while levels decline slightly in all wells for the Baseline with Climate Change scenario.

Figure 7-38. Simulated Salton Sea Net Outflow for Future Scenarios



WOODARD & CURRAN | FINAL TODD GROUNDWATER | **Figure 7-38 Simulated Salton Sea Net Outflow for Future Scenarios**

Figure 7-39. Model Future Scenario Hydrographs, West Valley 2020-2069

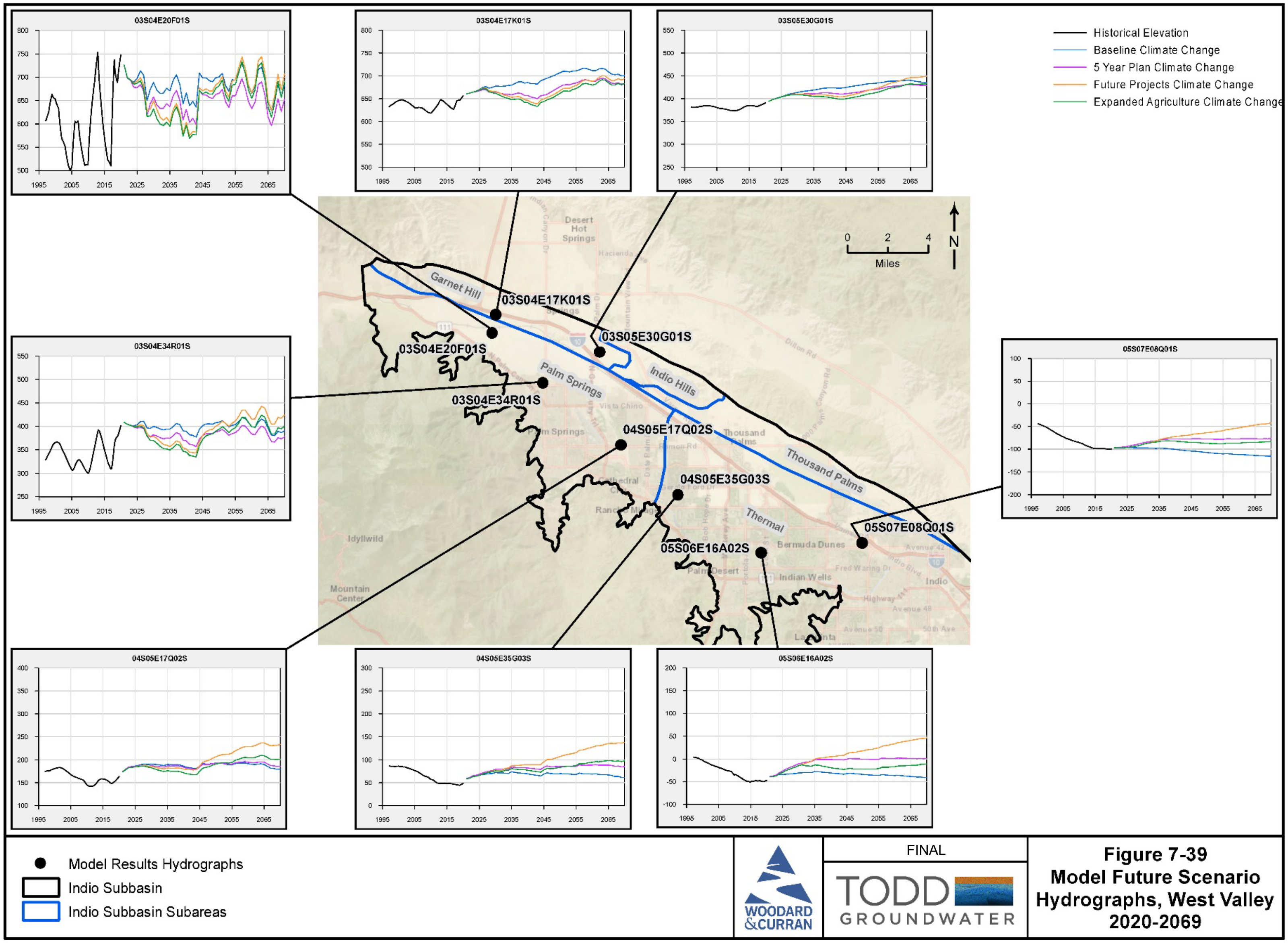
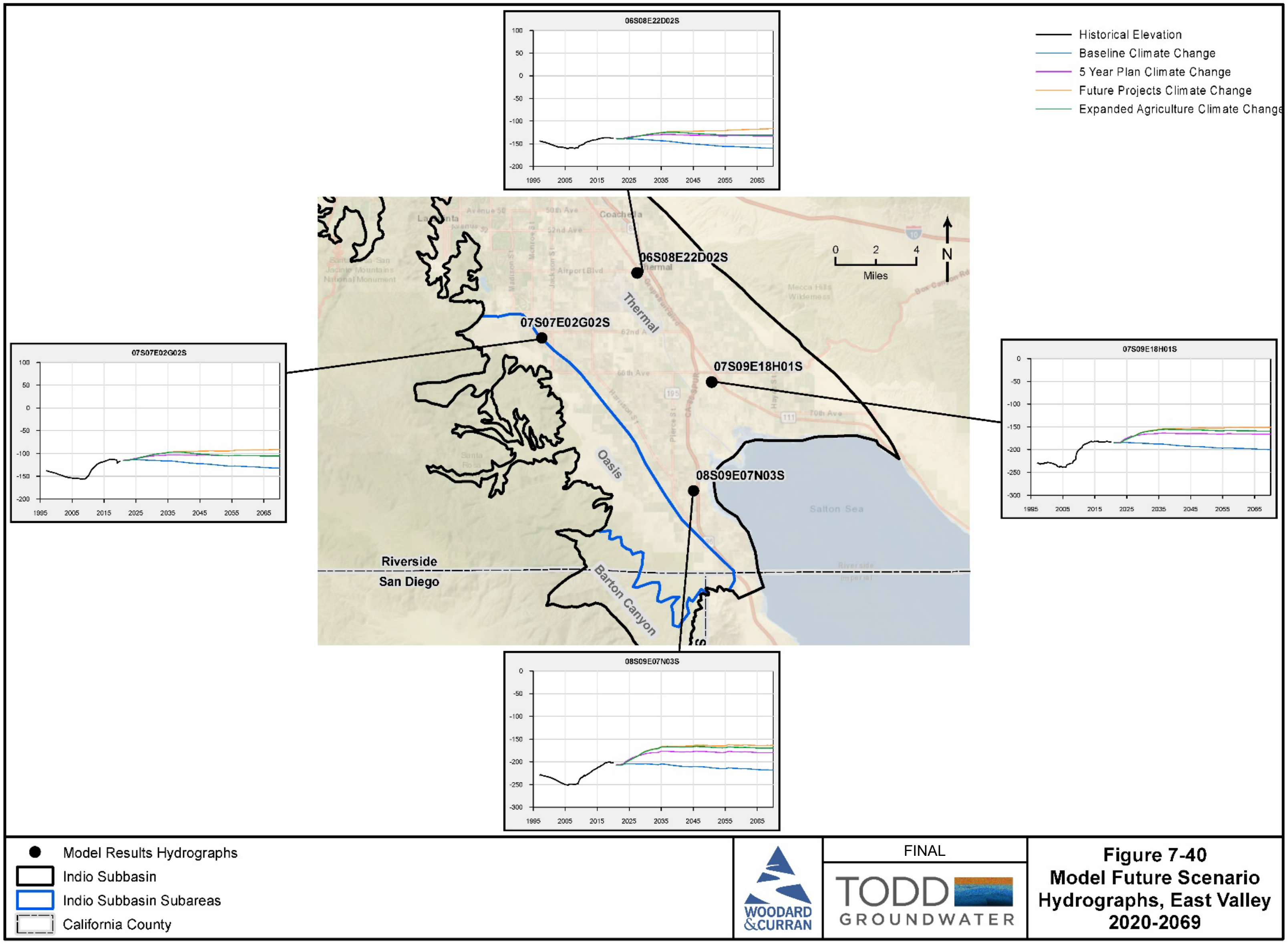


Figure 7-40. Model Future Scenario Hydrographs, East Valley 2020-2069



East Valley/La Quinta, Thermal, Mecca, and Oasis Areas

Predicted water levels in the four observation wells in the East Valley areas (Figure 7-40) show slightly decreasing trends for the Baseline with Climate Change and Extended Agriculture with Climate Change scenarios, while levels rise in all wells for Future Projects with Climate Change and 5-Year Plan with Climate Change scenarios.

7.7.2.3 Simulated Change in Water Level Maps – Future Scenarios

Simulated changes in water levels for the Future Projects with Climate Change, 5-Year Plan with Climate Change, and Extended Agriculture with Climate Change scenarios between 2009 and 2045 are shown on Figure 7-41 through Figure 7-43. Figure 7-41 shows the predicted change in groundwater levels between 2009 and 2045 for the 5-Year Plan with Climate Change scenario and reveals that minor declines (less than 25 feet) are occur in this scenario in a small area near the City of Coachella in the East Valley area. Level increases are predicted in the uppermost West Valley, the southern portion of Garnet Hill, and most of the Mid-Valley and East Valley areas. Level rises in the Mid-Valley may be associated with simulated operation of the PD-GRF.

Figure 7-42 shows the predicted changes in levels for the Future Projects with Climate Change scenario and similar changes occur for this scenario in the West- and Mid-Valley areas. No declines are predicted except in a very small area where the Whitewater River enters the subbasin.

Figure 7-43 shows the predicted change in groundwater levels between 2020 and 2045 for the Expanded Agriculture with Climate Change scenario. Minor declines (less than 25 feet) occur in this scenario in small areas near the Cities of Indio and Coachella. This decline is likely due to the reduction in groundwater replenishment as expanded agriculture increases the direct delivery of imported water. Level increases are predicted in the Upper West Valley and southern portion of the East Valley. These increases in the Upper West Valley are similar to the groundwater elevation rises observed in all scenarios, a result of continued groundwater replenishment at WWR-GRF.

Figure 7-41. Change in Groundwater Levels, 2009-2045, 5-Year Plan Projects Scenario with Climate Change

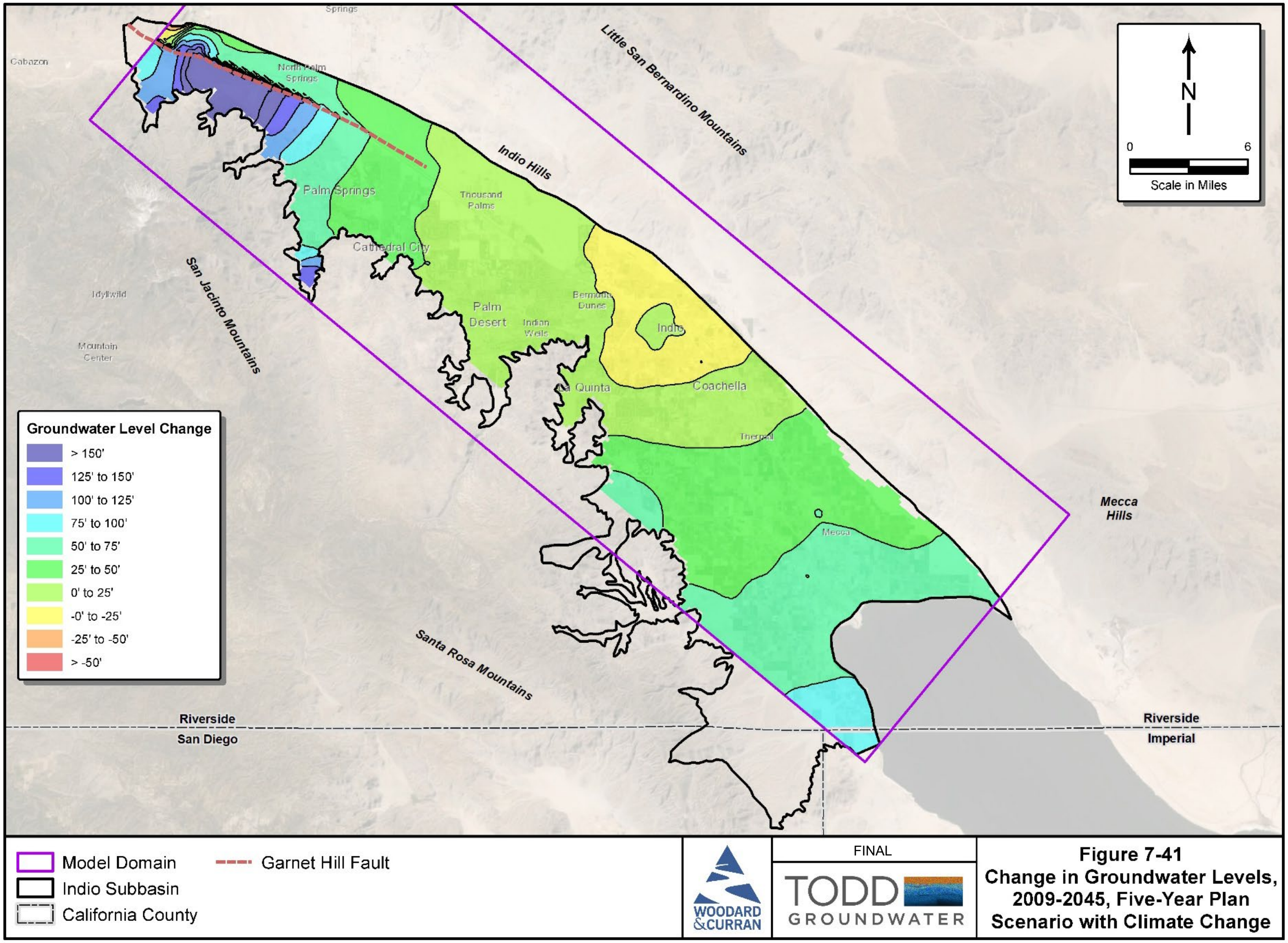


Figure 7-42. Change in Groundwater Levels, 2009-2045, Future Projects Scenario with Climate Change

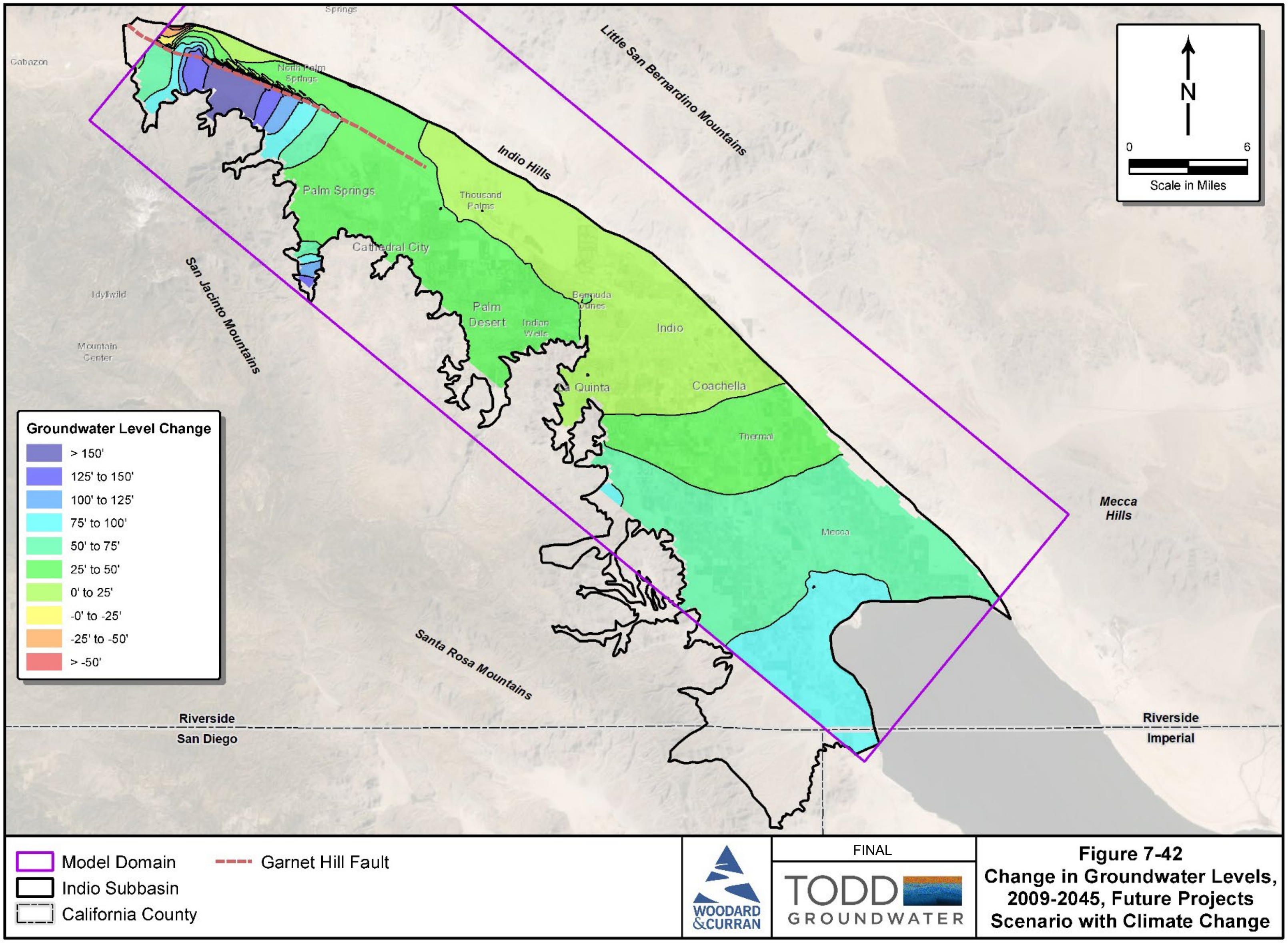
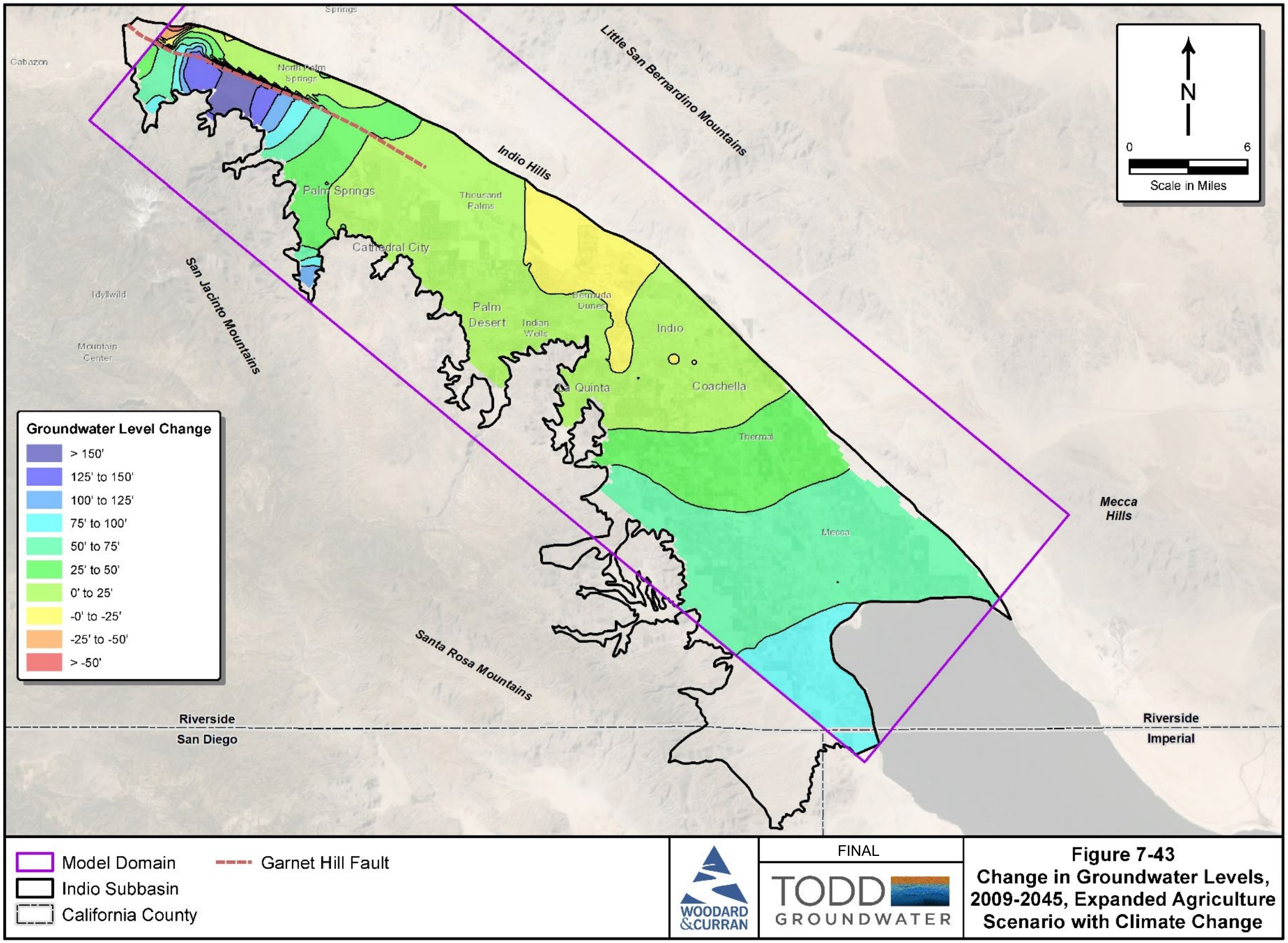


Figure 7-43. Change in Groundwater Levels, 2009-2045, Expanded Agriculture Scenario with Climate Change



7.8 Conclusions

Simulation of the Baseline (No New Projects) and Baseline with Climate Change scenarios allows direct evaluation of the effect of simulated climate change on groundwater conditions. As indicated in this chapter, a net increase in Subbasin-wide storage is predicted for the Baseline scenario, but a net decrease in Subbasin storage is predicted for Baseline with Climate Change. With climate change, not implementing new projects is not sustainable.

The major conclusion from simulation of the other three Plan scenarios—5-Year Plan with Climate Change, Future Projects with Climate Change, and Expanded Agriculture with Climate Change—is that the Indio GSAs can maintain a sustainable Subbasin water balance with planned projects for the near-term and future. The three Plan scenarios involve varying project implementation and/or agricultural demands. For all three of these scenarios, simulation results show a net increase in storage at the end of the 25-year planning horizon and continuing stability through the end of the modeling timeframe. The three scenarios show storage increases in the Mid-Valley and most of the East Valley and varying levels of water level declines in the West Valley, which are an artifact of wet and dry year cycles and the subsequent rapid response of groundwater levels near WWR-GRF. These results demonstrate the importance to the Indio Subbasin balance of a portfolio of projects and management actions that allow adjustments through time and across the Subbasin.

Simulation of the 5-Year Plan with Climate Change scenario shows that already-planned projects and management actions can maintain the water balance, even with climate change, while the Future Projects with Climate Change scenario demonstrates that future projects can address uncertainty in water supply, water demand, and other circumstances and maintain the Subbasin water balance.

While the GSAs have a suite of potential projects that can maintain the Indio Subbasin water balance, adaptive management will be critical when planning for future conditions to ensure the most effective projects are implemented in areas where additional resources are needed.

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CHAPTER 8: REGULATORY AND POLICY ISSUES

This chapter describes regulatory and policy issues that could affect implementation of this *2022 Indio Subbasin Alternative Plan Update* (*Alternative Plan Update*). While these issues may represent challenges, the intent of this chapter is to define the issue, identify potential solutions, and consider opportunities. The *2010 Coachella Valley Water Management Plan Update* (*2010 CVWMP Update*) (Coachella Valley Water District [CVWD], 2012) identified emerging issues and these are updated below; some are updated briefly only in this chapter, and some are discussed in detail in other chapters of this *Alternative Plan Update*.

This *Alternative Plan Update* has included recognition of additional issues including:

- Availability of suitable water supply for small community water systems, some of which may lack access to safe and adequate water supplies (see Section 8.4)
- Potential occurrence and adverse effects on water supply of per- and polyfluoroalkyl substances (PFAs), a group of man-made chemicals that are persistent in the environment and in the human body, where they can lead to adverse human health effects (see Section 8.2.7)

8.1 Water Quality Policies and Planning

The *2010 CVWMP Update* described emerging issues regarding the Colorado River Basin Plan, anti-degradation policy, recycled water policy, Salt and Nutrient Management Plan (SNMP), salinity management, brine management, and agricultural discharge requirements. While no longer emerging issues, the policies and regulations of the State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB) are the subject of continuing review and update by state agencies, and accordingly, warrant regular review by the Groundwater Sustainability Agency (GSAs).

8.1.1 Basin Plan

California's 1969 Porter-Cologne Water Quality Act established the SWRCB and the nine RWQCBs to preserve and enhance all beneficial uses of the state's water. The RWQCBs develop basin plans that identify beneficial uses for groundwater and surface water within their hydrologic units, establish water quality objectives (WQOs) to protect beneficial uses, and define implementation programs to achieve WQOs. The *Basin Plan for the Colorado River Basin Region* (Colorado River RWQCB 1993; 2006; as amended) was first prepared and adopted by the Colorado River Basin RWQCB in 1993 and with subsequent amendments. Prepared in accordance with the Porter-Cologne Water Quality Control Act, the Federal Clean Water Act, and other state and federal rules and regulations, the Basin Plan provides guidelines for optimizing use of state waters within the region by preserving and protecting water quality.

The *2010 CVWMP Update* reviewed the Basin Plan adopted in 2006 (Colorado River Basin RWQCB, 2006). This review addressed updates on the Clean Water Act 303(d) list of impaired water bodies, Total Maximum Daily Loads (TMDLs) for surface water bodies, and high priority issues identified as part of the 2007 Triennial Review. These issues mostly were surface water related, including for example, surface water bacteriological objectives, stormwater channel flow, and agricultural wastewater. The current 303(d) list, TMDLs, and selected topics of the most recent Triennial Review are summarized in this section.

8.1.1.1 303(d) List and TMDLs

Section 303(d) of the federal Clean Water Act requires states, territories, and authorized tribes to prepare a list of water bodies that do not or are not expected to attain water quality standards after application of required technology-based controls. The 303(d) list includes the size of the water body, the sampled pollutants affecting designated beneficial uses, the source of the pollutant, and the water body's priority status relative to TMDLs. TMDLs are established to limit discharged pollutants and help overcome water quality impairment. TMDLs are implemented through amendments to the Basin Plan or an alternative TMDL plan may be put in place. The 303(d) lists are prepared as part of the Water Quality Assessment of the State's major waterbodies and meet a requirement of Section 303(d) of the Clean Water Act.

Table 8-1 summarizes approved TMDLs for the Coachella Valley Stormwater Channel (CVSC), while Table 8-2 lists TMDLs under development for the CVSC. Table 8-3 summarizes TMDLs under development for the Salton Sea Watershed.

Table 8-1. Approved TMDLs for the CVSC

Indicator Parameter	30-Day Geometric[a] Mean	Maximum Instantaneous
E. coli	126 MPN[b]/100ml	400 MPN/100ml
Fecal coliform	200 MPN/100ml	---[c]
Enterococci	33 MPN/100ml	100 MPN/100ml

[a] Based on a minimum of no less than 5 samples equally spaced over a 30-day period.

[b] Most probable number.

[c] No more than 10 % of total samples during any 30-day period exceed 400 MPN per 100 ml.

Source: Amendment to Water Quality Control Plan for the Colorado River Basin Region

Table 8-2. TMDLs Under Development for CVSC

TMDL Project Title	Impairments	Completion Date	Comments
Coachella Valley Stormwater Channel - Organochlorine Compounds TMDL Alternatives	Dichlorodiphenyl-trichloroethane (DDT)	June 2022 - November 2022	The CVSC is 303(d) listed for multiple impairments. The SWRCB is working on a TMDL Alternative that will be a part of the Coachella Valley Agricultural General Order.
	Dieldrin		
	Polychlorinated biphenyl (PCB)		
	Toxaphene		
Coachella Valley Stormwater Channel - Ammonia, Dissolved Oxygen, and Toxicity TMDLs	Ammonia	September 2024 - February 2025	The CVSC is 303(d) listed for multiple impairments. The SWRCB is working on a TMDL Plan to address these issues.
	Dissolved Oxygen		
	Toxicity		

Source: Water Quality Control Plan for Colorado River Basin Triennial Review 2020 Appendix B

Table 8-3. TMDLs Under Development for the Salton Sea Watershed

TMDL Project Title	Impairments	Completion Date[a]	Comments
Salton Sea - Dissolved Oxygen and Nutrients TMDLs	Dissolved Oxygen	December 2023 - May 2025	The Salton Sea is 303(d) listed for multiple impairments. The SWRCB is working on a TMDL Plan for the entire watershed.
	Nutrients		
Salton Sea - Watershed Ammonia TMDL	Ammonia	48 - 54 months[b]	The Salton Sea is 303(d) listed for ammonia. The SWRCB is proposing a TMDL for the entire watershed.
Salton Sea - Toxicity TMDL	Toxicity	30 - 36 months[b]	The Salton Sea is 303(d) listed for toxicity. The SWRCB is proposing a TMDL at the Salton Sea.
Salton Sea - DDT and DDE TMDLs	Dichlorodiphenyl-trichloroethane (DDT)	24 - 30 months[b]	The Salton Sea is 303(d) listed for DDT and DDE. The SWRCB is proposing a TMDL for the Salton Sea.
	Dichlorodiphenyl-dichloroethylene (DDE)		
Salton Sea Watershed -Bacteria TMDL	Enterococcus	36 - 42 months[b]	The Salton Sea is 303 (d) listed for indicator bacteria. The SWRCB is proposing a TMDL for the entire watershed.

[a] For ongoing projects, the completion date is the expected implementation date of the TMDLs.

[b] For these new projects, no completion date is available until the project commences. The duration is the expected amount of time it will take for the TMDL to go into effect once the project commences.

Source: Water Quality Control Plan for Colorado River Basin Triennial Review 2020 Appendix B

8.1.1.2 Triennial Review

The Federal Clean Water Act requires states to conduct public review of water quality standards at least once every three years. Accordingly, the RWQCB conducts a public review process and updates the Basin Plan at least once every 3 years – a process known as "triennial review." The triennial review may result in amendments to the Basin Plan over the course of the 3-year review cycle.

The most recent Triennial Review for the Colorado River Basin Region was conducted in 2020 (RWQCB, 2020b). Recent triennial reviews are presented on the RWQCB website[1] including the Staff Report and Appendices B and C that list and rank proposed projects (Colorado River Basin RWQCB, 2020). During this Triennial Review, 29 projects have been listed and ranked. Three projects (as numbered by RWQCB) with particular bearing on local water management are summarized below.

Project 9 – OWTS Prohibitions in Areas Where OWTS Pose a Threat to Water Quality

This project was included in the 2017 Triennial Review as Item 1, "Evaluate Potential Sources of Nitrates in Prioritized Basins." RWQCB staff has been collecting data and information to identify areas where nitrate pollution from Onsite Wastewater Treatment Systems (OWTS), also referred to as septic systems, may be posing a threat to groundwater quality. In areas where the density of existing OWTS may be contributing to nitrate and other pollution, and the OWTS density cannot be mitigated by existing regulations, staff plans to propose a prohibition of discharge from OWTS. This project is slated for completion in 2025. This RWQCB project represents a potential means of limiting nitrate loading to areas in the Indio Subbasin with relatively dense OWTS. These areas also may include Small Water Systems that are affected by high nitrate concentrations in groundwater (see Section 8.4).

Project 10 – Salton Sea Beneficial Use Review

The Coachella Valley is part of the Salton Sea watershed. As described in the RWQCB Staff Report Appendix B, the Salton Sea is an endorheic (terminal) lake without an outlet, which means that certain pollutants have been concentrating in it since its formation in 1905. Such pollutants include salinity and one of its components, chloride, which are both 303(d) listed impairments to the Salton Sea's Warm Freshwater Habitat (WARM) beneficial use. The Salton Sea is not freshwater and because of its endorheic nature may never meet the current water quality objectives for these pollutants associated with the WARM beneficial use. Under this amendment, staff will determine whether WARM is attainable for these pollutants and establish whether the Salton Sea should be considered a saltwater body for the purposes of applicable water quality objectives. Other pollutants and/or beneficial uses may be included as data are gathered and analyzed. Based on the results of this analysis, changes to the Salton Sea's beneficial uses may be proposed. This project is scheduled for completion between December 2024-May 2025.

Project 12 – Groundwater Numeric Water Quality Objectives in Indio Subbasin

This project was included in the 2017 Triennial Review as Item 2, "Establish Water Quality Objectives for Ground Water Throughout the Coachella Valley." RWQCB staff is developing site-specific numeric water quality objectives for total dissolved Solids (TDS) and other constituents in the Indio Subbasin. To help establish appropriate water quality objectives, in 2021 RWQCB initiated a 3-year contract with United States Geological Survey (USGS) to determine existing water quality. Establishment of numeric water

[1] https://www.waterboards.ca.gov/coloradoriver/

quality objectives by RWQCB for TDS and other constituents could have a significant impact on definition of minimum thresholds for the constituents in the Indio Subbasin.

8.1.2 Antidegradation Policy

The Antidegradation Policy (SWRCB Resolution No. 68-16) is a state water policy that requires regulation of discharges to waters of the state to achieve the "highest water quality consistent with maximum benefit to the people of the State." Incorporated into all Basin Plans, the policy applies to high quality waters (surface water as well as groundwater) and requires that the high quality be maintained unless the State finds that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect beneficial uses, and will not result in water quality lower than applicable standards. The Antidegradation Policy also requires the waste discharge requirements for any proposed discharge to covered waters include the best practicable treatment or control (BPTC) of the discharge to assure that no condition of pollution or nuisance will occur, and that the highest water quality will be maintained consistent with maximum benefit to the people of the State.

In November 2012, the California Third District Court of Appeal issued an opinion in the case *"Asociacion de Gente Unida Por El Agua v. Central Valley Regional Water Quality Control Board"* (2012) 210 Cal.App.4th 1255 that interpreted the Antidegradation Policy. The Court held that the Antidegradation Policy applies whenever there is "an existing high quality water" and "an activity which produces or may produce waste …that will discharge into such high quality water." The Court of Appeal determined that a high quality water exists where the baseline water quality (defined to be the best water quality that has existed since 1968) is better than the WQO. If the baseline water quality is equal to or is not meeting the objectives, the water is not "high quality" and all discharges must be managed to meet the current objectives. In that case, the Antidegradation Policy is not triggered. However, if the baseline water quality is better than the WQOs, the baseline water quality must be maintained unless the maximum benefit to the people of the State and related findings required by the Antidegradation Policy are made to permit the discharge.

As described in Section 8.1.4, a Salt and Nutrient Management Plan (SNMP) meeting the requirements of the Recycled Water Policy is required for certain designated basins in California. SNMPs must include an antidegradation analysis demonstrating that the existing projects, reasonably foreseeable future projects, and other sources of loading to the basin included within the plan will, cumulatively, satisfy the requirements of the Antidegradation Policy. In 2015, a Coachella Valley SNMP was prepared and submitted to the Regional Board. The Regional Board provided comments and recommendations on the 2015 SNMP, and as of 2020 a group of local stakeholders are developing a new SNMP, which will include a full antidegradation analysis consistent with the Antidegradation Policy.

8.1.3 Recycled Water Policy

In the Plan Area, recycled water is a significant and reliable local resource used to help offset groundwater pumping. Recycled water has been used for golf course irrigation in portions of the Plan Area since the late 1960s. CVWD and Desert Water Agency (DWA) currently deliver recycled water from three water reclamation plants (WRPs) for municipal and golf course irrigation use in the East and West Valley.

The SWRCB, recognizing the importance of recycled water as a water supply, administers the Recycled Water Policy (adopted in 2009) to encourage the increased use of recycled water and to support water supply diversity and sustainability. The Recycled Water Policy defines the roles of the SWRCB, RWQCBs, and California Department of Water Resources (DWR) among other agencies. DWR responsibilities relevant to Indio Subbasin management include reviewing urban water management plans, cooperating with SWRCB to track recycled water use, implementing the Sustainable Groundwater Management Act (SGMA), and cooperating with SWRCB to allocate and distribute bond funding.

By way of update, on December 11, 2018, the SWRCB adopted an amendment to the Recycled Water Policy that includes the following goals (SWRCB, 2018) and supports water recycling in the Plan Area:

- Increase the use of recycled water State-wide from 714,000 acre-feet per year (AFY) in 2015 to 1.5 million AFY by 2020 and to 2.5 million AFY by 2030.
- Reuse all-dry weather direct discharges of treated wastewater to enclosed bays, estuaries and coastal lagoons, and ocean waters that can be viably put to a beneficial use.
- Maximize the use of recycled water in areas with groundwater overdraft, to the extent that downstream water rights, instream flow requirements, and public trust resources are protected.

Annual reporting is required so that SWRCB can evaluate progress toward these goals and revise them as needed. Specific requirements address monthly volumes of influent and wastewater production, specifying level of treatment. Discharge data must specify where the discharge occurs, for example to surface waters (specifying volume required to maintain minimum instream flow), natural systems (wetlands, wildlife habitats, and duck clubs), injection wells and land disposal (e.g., evaporation or percolation ponds). Water reuse must be reported in terms of monthly volume with annual reporting of the distribution to beneficial uses including the following categories: agricultural irrigation, landscape irrigation, golf course irrigation, commercial applications, industrial applications, geothermal energy production, and other non-potable uses (e.g., dust control, flushing sewers, fire protection). Such reporting also must address direct and indirect potable uses such as groundwater recharge, seawater intrusion barriers, reservoir water augmentation, raw water augmentation, and other potable uses.

8.1.4 Coachella Valley Salt and Nutrient Management Plan

While encouraging the use of recycled water, the Recycled Water Policy states that salts and nutrients from all sources must be managed on a basin-wide or watershed-wide basis to attain water quality objectives and protect beneficial uses. This is typically through development of a SNMP. As described in this section, the CV-SNMP currently is being planned by local agencies in collaboration with the Colorado River RWQCB.

The original 2009 Recycled Water Policy required development of a SNMP by 2014 for each groundwater basin or subbasin in California (later clarified as applicable to priority basins for the GAMA Priority Basin Project). The 2018 Recycled Water Policy amendment includes a requirement that each RWQCB evaluate each basin or subbasin in its region before April 8, 2021. The RWQCB is required to identify basins where salts and/or nutrients are a threat to water quality and therefore need salt and nutrient management planning to achieve water quality objectives in the long term. These RWQCB evaluations are to be updated every 5 years.

The amended Recycled Water Policy continues to encourage collaborative development of a SNMP among SNMP groups, regional boards, the agricultural community, IRWM groups, water and wastewater agencies, stakeholders, and now, GSAs. It notes that some GSPs may sufficiently address salt and nutrient management to be a functionally equivalent SNMP. The current policy presents the required components of a SNMP, including a monitoring network and plan, water recycling use goals and objectives, salt and nutrient source identification, implementation measures, and an antidegradation analysis to ensure adherence to the Antidegradation Policy.

Recycled water is used in the Plan Area for non-potable applications including municipal and golf course irrigation. The Recycled Water Policy specifies the levels of treatment for such use of recycled water, while a subsequent general order (SWRCB Order WQ 2016-0068-DDW) provides for permitting, administration, monitoring and reporting. In the Plan Area, three WRPs produce tertiary-treated recycled water consistent with State policy.

The Recycled Water Policy also regulates indirect potable reuse (IPR) for groundwater recharge, which is not currently practiced in the Indio Subbasin. IPR for groundwater recharge involves planned use of recycled water for replenishment of a groundwater basin that is a source of water supply for a public water system; the groundwater basin provides public health benefits, for example through dilution and travel time. As described in Chapter 11*, Projects and Management Actions*, Indio Water Authority (IWA) is a partner in East Valley Reclamation Authority (EVRA) and is currently evaluating the feasibility of an IPR project to recharge up to 5,000 AFY of recycled water into the Indio Subbasin. While IPR is not currently practiced in Indio Subbasin, it has been used for more than 40 years in other California basins as a reliable, high quality, locally controlled supply and may represent a future option. Accordingly, it is warranted for the GSAs to stay informed of regulatory requirements (including constituents of emerging concern [CECs]) and the experience of other recycling projects.

In 2015, CVWD, DWA, and IWA created an SNMP for the Coachella Valley Groundwater Basin (CVWD, et al., 2015). Subsequently, the *2015 SNMP* was evaluated by the Colorado River RWQCB. The RWQCB provided comments and recommendations on the 2015 SNMP's compliance with the updated Recycled Water Policy (Colorado River Basin RWQCB, 2020). In response, the CV-SNMP was restarted in 2020 by an expanded SNMP agency group that includes all major water and wastewater agencies in Coachella Valley. These include CVWD, CWA and Coachella Sanitary District, DWA, IWA, Myoma Dunes Mutual Water Company, Valley Sanitary District, Mission Springs Water District, and City of Palm Springs, collectively the SNMP Agencies. As of 2021, SNMP Agencies have submitted a Development Workplan that describes a detailed scope of work for updating the CV-SNMP, including a new groundwater monitoring program to support implementation of the SNMP. The *Groundwater Monitoring Workplan* was approved by the RWQCB in February 2021. The SNMP Agencies have begun implementing the *Groundwater Monitoring Workplan* and will report data and program implementation progress for the first year by April 1, 2022.

For the Indio Subbasin, a key issue is the importation of salts with Colorado River water. Importation of Colorado River water for agricultural irrigation (substituting for groundwater pumping) and for groundwater replenishment has been fundamental to reversing chronic groundwater level declines, depletion of storage, subsidence, and seawater intrusion (see *Chapter 9, Sustainable Management Criteria*). However, Colorado River water has higher average TDS concentrations that must be considered and appropriately managed. As summarized in Section 8.1.5, the *2002 CVWMP* and *2010 CVWMP Update* have identified and assessed various alternatives for managing salinity. Chapter 9, *Sustainable Management,* addresses salinity in terms of sustainable management and the role of the CV-SNMP, coordinated with this *Alternative Plan Update*, in analyzing the salt balance, identifying implementation measures to manage salt loading, and developing an implementation plan to address salinity as well as nutrients.

8.1.5 Salinity Management

Identified in the *2002 CVWMP* and *2010 CVWMP Update* as an important issue, salinity management remains a key issue with ramifications for recharge, water recycling, brine management, and agricultural drainage.

8.1.5.1 Impacts of Colorado River Water Recharge

State Water Project (SWP) Exchange supply is provided through the Colorado River Aqueduct (CRA), which delivers water from Lake Havasu (Parker Dam) for recharge at the Whitewater River Groundwater Replenishment Facility (WWR-GRF). Colorado River supply also is provided through the Coachella Canal, a branch of the All-American Canal that brings Colorado River water from Imperial Dam. Water imported via the Coachella Canal is used at the Thomas E. Levy Groundwater Replenishment Facility (TEL-GRF) and Palm Desert Groundwater Replenishment Facility (PD-GRF) groundwater replenishment facilities. TDS concentrations generally are lower for CRA supply (averaging about 590 milligrams per liter (mg/L) from 2010 through 2019), while Coachella Canal supply has averaged about 730 mg/L over the same period. At this time, TDS levels in Colorado River water are meeting or exceeding applicable water quality objectives.

Coachella Canal supplies agriculture irrigation demands in the East Valley.

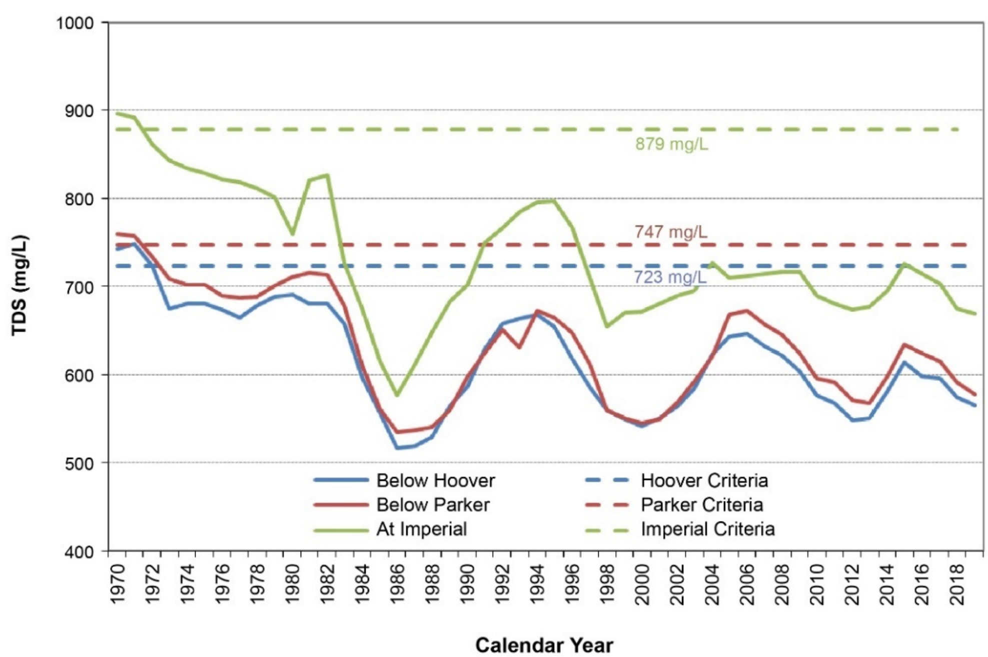
As noted in the *2010 CVWMP Update*, Colorado River water used for direct delivery and recharge in the Indio Subbasin generally has higher TDS concentrations that must be considered and appropriately managed. Use of Colorado River water involves salt loading to the Indio Subbasin and local increases in TDS concentrations (see Chapter 4*, Current and Historical Groundwater Conditions*). CVWD and DWA have investigated alternatives including direct importation and recharge of lower TDS SWP water at the WWR-GRF and MC-GRF. However, direct importation would require extensive pipeline construction for conveyance from western Riverside County and would involve technical and environmental constraints, significant costs, and limited benefits. Another alternative summarized in the *2010 CVWMP Update* involved pre-treatment of Colorado River supplies using reverse osmosis. While a proven technology, drawbacks include permitting, environmental issues, and technical and financial feasibility in light of available power and intermittent deliveries of Colorado River water.

Salinity management includes an ongoing, watershed management approach through the Colorado River Basin Salinity Control Program (Program). This is a cooperative watershed effort among several federal agencies and seven states to meet national, international, and state water quality objectives. Federal, state, and local agencies and private organizations participate to implement on-the-ground activities. To guide activities and track performance, the Program has established numeric criteria for salinity, adopted by the seven Basin states and approved by USEPA. These criteria are illustrated by the horizontal lines on Figure 8-1, which is reproduced from the *2020 Review of Water Quality Standards for Salinity, Colorado*

River System (Colorado River Basin Salinity Control Forum, 2020). The graph also shows flow-weighted average annual salt concentrations at three numeric criteria stations, from upstream to downstream: Below Hoover, Below Parker, and at Imperial. The last two correspond to the diversion points for the CRA and All-American Canal. As shown on Figure 8-1**,** salinity concentrations have decreased since 1970 at all three numeric criteria stations and waters are currently meeting standards.

These decreasing TDS concentrations reflect work accomplished by the Program which has included construction of salinity control measures (for example, preventing inflow to the river from saline springs and plugging of abandoned, flowing oil, and gas wells), advancement of policies for effluent limitation (for example, policies addressing discharges from fish hatcheries), and implementation of non-point source management plans (for example, improved irrigation practices). While the Program has successfully controlled over 1.22 million tons of salt annually, additional measures have been identified to achieve the identified maximum potential salt reduction of 2.35 million tons per year, equivalent to 106 mg/L at Imperial Dam (Colorado River Basin Salinity Control Forum, 2020). The current plan is to pursue a program designed to remove at least 1.7 million tons annually by 2040, which would result in a 47 mg/L reduction in salinity at Imperial Dam. As of early 2021, the Paradox Valley Unit, which had been removing 95,000 tons of salt annually, was shut down after causing a moderate earthquake and has not been restored by USBR. As of 2021, USBR has taken no action and will work with the Colorado River Basin Salinity Control Forum to explore other options (Montrose Press, 2021).

Figure 8-1. Flow Weighted Average Annual Salt Concentrations at Numeric Criteria Stations



Source: 2020 Review Water Quality Standards for Salinity Colorado River System, June 2020 Draft.

FINAL

WOODARD & CURRAN | TODD GROUNDWATER | **Figure 8-1 Flow Weighted Average Annual Salt Concentrations at Numeric Criteria Stations**

8.1.5.2 Brine Discharge/ Management

The *2010 CVWMP Update* identified brine discharge as a major issue that would be associated with desalination of Colorado River water for municipal or agricultural uses, or replenishment. Desalination of significant flows would result in production of large volumes of brine that would need to be disposed in a cost-effective manner and in compliance with Basin Plan requirements. In discussing Salton Sea restoration, the *2010 CVWMP Update* acknowledged that diversion and desalination of drain flows also would reduce inflow to the Salton Sea, with potential environmental impacts. CVWD subsequently piloted desalination of shallow groundwater and not drain flows.

Desalination and brine discharge were also addressed in the *2012 Final Subsequent Program EIR* (*Final SPEIR*) for the *2010 CVWMP Update*, which provided comparison of SWP importation and desalination options. The *Final SPEIR* noted that permitting of discharge of brine to the Salton Sea via wetlands was uncertain. It also generally considered desalination of recharge water as financially infeasible. Similarly, the *2018 IRWM Plan* addressed considerations including high costs for handling and disposing brine, large land areas for evaporation ponds, and regulatory issues associated with brine disposal.

As summarized in existing documents, various alternatives have been explored for desalination. These alternatives involve different sources of water for desalination (e.g., CRA, Coachella Canal, drain flows), volumes of supply, methods of storage and conveyance, options for water treatment, and alternatives for brine management and discharge. Continuing issues exist regarding technical feasibility of complex projects, financial feasibility, permitting, and potential environmental impacts. Referring to Section 8.1.1.2, Triennial Review, RWQCB projects could result in water quality objectives that could disallow brine discharge to the Salton Sea. Planning for Salton Sea restoration is ongoing (see Section 8.3), with likely ramifications for brine discharge.

8.1.6 Agricultural Drainage Discharge Regulations

Water discharges from agricultural operations include irrigation runoff, flows from tile drains, and storm water runoff. These discharges can affect water quality by transporting pollutants (for example, pesticides, nutrients, salts, pathogens, and heavy metals) from cultivated fields into surface waters. The quality of receiving surface water bodies and groundwater can be impaired. Groundwater quality is monitored for numerous constituents (see Chapter 4*, Current and Historical Groundwater Conditions*) and is addressed as an element of sustainable management (see Chapter 9, *Sustainable Management*).

To control the effects of discharges from irrigated agricultural lands, the SWRCB's 2004 Nonpoint Source Implementation and Enforcement Policy (NPS Policy) requires all RWQCBs to regulate agricultural discharges by issuing waste discharge requirements (WDRs) or conditional waivers of WDRs (Orders) to growers. These Orders require water quality monitoring of receiving waters and corrective actions when impairments are found. The Conditional Waiver of WDRs for agricultural discharges in the Coachella Valley was adopted in 2014 (RWQCB, 2014).

Agricultural dischargers include entities who operate and maintain agricultural drains (e.g., CVWD) and property owners, renters/lessees, and operators/growers who discharge water, have potential to discharge water, propose to discharge water, or could directly or indirectly affect water quality. The Conditional Waiver does not provide coverage for discharges from crops for personal use, golf courses, polo fields, discharges originating on tribal/reservation lands, or parcels less than five acres.

To comply, the NPS Policy provides for agricultural dischargers to act individually or collectively in coalition groups. The Coachella Valley Irrigated Lands Coalition (CVILC) was established in 2013 by CVWD and local growers/operators to help irrigated agriculture meet the requirements of the Colorado River Basin RWQCB's Irrigated Lands Regulatory Program (ILRP) in the Coachella Valley. The CVILC is a membership-based coalition that implements programs to help farmers and ranchers reduce their impacts. Programs include best management practices (BMPs), outreach and education (e.g., workshops, information fliers in CVWD billings), and monitoring of water quality as required by the RWQCB.

CVWD samples the drain flows to the Salton Sea.

To comply with the terms of the 2014 Conditional Waiver and ensure attainment of water quality objectives, the CVILC developed a Compliance Program in which members complete an individual Water Quality Management Plan (Farm Plan) and Drain Water Quality Management Plan (Drain Plan) and implement management practices, among other activities. The CVILC also developed a Monitoring and Reporting Program and a Quality Assurance Project Plan. On November 12, 2020, the Colorado River Basin RWQCB adopted Order R7-2020-0026, which supersedes the 2014 Conditional Waiver. The 2020 Order (RWQCB, 2020a) includes new provisions for the Farm Plan, Drinking Water Supply Well Monitoring, and Education Outreach requirements, among others.

8.2 Groundwater Quality

The *2010 CVWMP Update* identified issues including salinity, arsenic, perchlorate, hexavalent chromium(chromium-6), uranium, and nitrate, which also are discussed in Chapter 4, *Current and Historical Groundwater Conditions*. Carcinogens and Endocrine Disrupting Compounds (EDCs) were also identified as issues in the *2010 CVWMP Update*. However, these include a wide variety of chemicals and in many cases, water quality standards have not been established by federal or state regulatory agencies. Specific issues can be tracked by the GSAs as they emerge.

The GSAs continue to track evolving regulations of emerging contaminants; updates on regulations are provided below for salinity, arsenic, perchlorate, (chromium-6), uranium, and nitrate. For each, the current drinking water standard or Maximum Contaminant Level (MCL) is stated. PFAS are a new emerging issue which is also described below.

8.2.1 Salinity

Salinity is typically expressed in terms of TDS. There is no primary, health-based MCL for TDS; secondary water quality standards are based on consumer acceptance of taste and odor. As indicated in the *2015 SNMP,* the California Code of Regulations Title 22 states that there is no fixed consumer acceptance level established for TDS, but there are three Consumer Acceptance Contaminant Level Ranges. Concentrations lower than the Recommended contaminant level (500 mg/L) are desirable for a higher degree of consumer acceptance; constituent concentrations ranging to the Upper contaminant level (1,000 mg/L) are acceptable if it is neither reasonable nor feasible to provide more suitable waters; and constituent concentrations ranging to the Short-Term contaminant level (1,500 mg/L) are acceptable only for existing community water systems on a temporary basis pending construction of treatment facilities or development of acceptable new water sources.

The sources and factors affecting the occurrence of salinity are documented in Chapter 4, *Current and Historical Groundwater Conditions*. Salinity management, the SNMP, and related issues are described in Section 8.1.

8.2.2 Arsenic

Arsenic was identified in the *2010 CVWMP Update* as an emerging issue. As discussed in the *2010 CVWMP Update*, the primary MCL for arsenic before 2001 was 50 micrograms per liter (µg/L). Under the 1996 Amendments to the Safe Drinking Water Act, the U.S. Environmental Protection Agency (USEPA) was required to publish a revised standard for arsenic by January 2001. USEPA published a final MCL for arsenic of 10 µg/L in 2001, which became enforceable in 2006. California adopted the federal MCL effective November 28, 2008.

As discussed in Chapter 4, *Current and Historical Groundwater Conditions*, arsenic occurs naturally in groundwater and most of the Indio Subbasin is characterized by arsenic concentrations below the MCL. However, arsenic is commonly found in groundwater in the southern Subbasin at levels higher than current state and federal drinking water standards. As reported in the *2010* CVWMP Update, Riverside County environmental health officials identified private wells at 19 small community water systems with high levels of arsenic. In response, treatment filters had been installed at about half the systems. All four GSAs provide drinking water supplies that meet all state and federal health standards as documented in their annual water quality consumer confidence reports (available on their respective websites).

CVWD currently operates three water quality treatment facilities in the East Valley to remove naturally occurring arsenic from drinking water before it is delivered to customers. In addition, CVWD is addressing safe drinking water needs through the DAC Infrastructure Task Force. CVWD, in collaboration with the Task Force, completed the East Coachella Valley Water Supply Project (ECVWSP), which identified and mapped small, private water systems; developed a prioritization process that considered criteria such as proximity to existing pipelines, cost, number of people affected and water quality; and conducted preliminary engineering for the top two highest ranked projects. CVWD also has responded to short-term water quality needs. For example, in 2019, CVWD collaborated with Riverside County to provide temporary supplemental water as a safe drinking water supply for Oasis Mobile Home Park in Torres Martinez tribal/reservation lands, which had been found to be out of compliance a few months earlier. CVWD and the Task Force are seeking grant funds to permanently connect the water system to CVWD (CVWD, May 29, 2020). Lastly, CVWD has responded by providing private well owners with a free water quality test for arsenic and with access to information on point-of-use treatment systems.

8.2.3 Perchlorate

Perchlorate was identified in the *2010 CVWMP Update* as an emerging issue because of historical detections in Colorado River supply that originated from two manufacturing facilities and have since been cleaned up to below detection limits (see Chapter 4, *Current and Historical Groundwater Conditions*). Perchlorate is hazardous to human health, difficult to remove from water, and resistant to degradation in groundwater. The MCL has been set at 6 µg/L by the State of California, and all four GSAs provide drinking water supplies that meet or exceed the state and federal standards. In 2015, the State's Office of Environmental Health Hazard Assessment (OEHHA) published an updated public health goal (PHG) of 1 part per billion (ppb; equivalent to µg/L) for perchlorate in drinking water (OEHHA, 2015). A public health goal is not an enforceable regulatory standard; however, it is intended to provide scientific guidance to the SWRCB Division of Drinking Water (DDW) in reviewing the existing state drinking water standard. State law requires that each regulatory drinking water standard must be set as close to the corresponding PHG as is economically and technologically feasible. Accordingly, the SWRCB will use the PHG to inform its review of the current enforceable regulatory standard for the chemical. In addition, SWRCB has recommended revision of the detection limit for purposes of reporting (DLR) for perchlorate (SWRCB, October 2020). Even though perchlorate detections in Subbasin groundwater are less than 2 mg/L and highly localized (see Chapter 4, *Current and Historical Groundwater Conditions*), the GSAs continue to monitor perchlorate and to track the review of the perchlorate PHG.

8.2.4 Chromium-6

Hexavalent chromium (chromium-6) was identified in the *2010 CVWMP Update* as an emerging issue. Chromium occurs as trivalent chromium and as chromium-6; while trivalent chromium is non-toxic, chromium-6 has been linked to health effects. Chromium-6 has a complex regulatory history. In 2011, the OEHHA published a PHG of 0.02 ppb (or µg/L) for chromium-6 in drinking water. Subsequently in 2014, the State adopted the country's first chromium-6 drinking water standard or MCL. That MCL of 10 ppb was then rescinded in 2017 due to a ruling that the state "had failed to consider the economic feasibility of complying with the MCL." Chromium-6 levels are controlled in California drinking water by existing regulations that include an MCL of 50 ppb for total chromium, which is twice as stringent as the national MCL for total chromium of 100 ppb established by the federal Environmental Protection Agency (EPA). However, the PHG has not been changed and the SWRCB is working on establishing a new chromium-6 MCL for drinking water. This process could take several years.

Anticipating a potential MCL revision that could affect their groundwater supply, CWA and IWA sponsored a joint study that identified a recommended treatment technology (City of Coachella, 2016). IWA installed chromium-6 removal systems at three wells. CVWD also investigated methods of treating chromium-6 to meet potentially stringent drinking water standards and conducted a successful pilot project to treat water. In addition, local GSAs are tracking and engaging in the regulatory public process. CVWD has provided input to SWRCB, for example, during the SWRCB workshop on the chromium-6 MCL Estimate of Costs (CVWD, 2020).

8.2.5 Uranium

Uranium has a MCL of 20 picocuries per liter (pCi/L), or about 30 µg/L. It was identified in the *2010 CVWMP Update* as an emerging issue, reflecting insufficient information at the time regarding potential sources to the Indio Subbasin. However, data now available indicate local geologic sources including bedrock formations to the west and east of the northern Subbasin (see Chapter 4, *Current and Historical Groundwater Conditions*). DWA has identified high concentrations of uranium as a potential constraint on groundwater supply (DWA, 2016). DWA has sustained the good quality of its delivered water by intermittently ceasing the operation of wells affected by high uranium concentrations. The GSAs monitor for uranium in both groundwater and Colorado River sources used for recharge; all four GSAs provide drinking water supplies that meet the state and federal standards.

8.2.6 Nitrate

Nitrate has a MCL of 45 mg/L, measured as nitrate. This is equivalent to 10 mg/L measured as nitrogen. It was identified in the *2010 CVWMP Update* as a nitrogen compound that is both a nutrient for plants and a human health issue. The sources and occurrence of nitrate are documented in Chapter 4, *Current and Historical Groundwater Conditions*, while nitrate occurrences in small water systems are summarized in Section 8.4, Small Water Systems, along with CVWD's ECVWSP, which addresses the issue. Drinking water supplied by the GSAs meets drinking water standards, as documented in their annual water quality consumer confidence reports (available on their respective websites). As a nutrient, nitrate will be addressed in the SNMP update now underway (see Chapter 8, *Regulatory and Policy Issues*).

8.2.7 PFAS

Emerging contaminants are chemicals that have not been previously monitored or detected but pose a risk to human health (USEPA 2019). PFAS are a group of emerging contaminants that may pose a danger to reproductive, developmental, immunological, and renal health in humans. Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are the two most common forms of PFAS. Currently, California has a drinking water response level of 10 parts per trillion (ppt) for PFOA and 40 ppt for PFOS, based on a running four-quarter average. The EPA Lifetime Health Advisory recommendation is that combined PFOS and PFOA should not be greater than 70 ppt. PFAS have been used in products including firefighting foams, nonstick cookware, and stain- and water-repellent fabrics for many decades. PFAS contamination of groundwater often occurs near firefighting training facilities, wastewater discharge facilities, or landfills.

The SWRCB has undertaken PFAS monitoring throughout the state, measuring PFAS concentrations in groundwater and identifying point sources of PFAS contamination (SWRCB, 2020). An order by the SWRCB in April 2019 required all water systems near landfills or airports to monitor and report PFAS concentrations for four consecutive quarters. In the Indio Subbasin, selected wells are monitored quarterly for PFAS, including wells near Palm Springs and Cathedral City, and west of Desert Shores. One monitoring well at a landfill site in Cathedral City measured 14 ppt PFOA, but a nearby monitoring well did not detect any PFOA (GAMA GeoTracker). No other concentrations have exceeded the California Response Levels or EPA Lifetime Health Advisory.

Due to the emerging nature of PFAS, federal and state guidelines are subject to change. The US EPA may set PFAS standards for drinking water and wastewater discharge. As additional data about the health effects of PFAS become available, the SWRCB DDW may establish notification levels for additional PFAS chemicals. Water systems in Indio Subbasin will continue to comply with monitoring and reporting requirements.

8.3 Salton Sea Restoration

The Salton Sea, a saline lake at the eastern end of Coachella Valley, is located along the Pacific Flyway migratory bird route and serves as important habitat for over 400 bird species including endangered and threatened species (U.S. Fish and Wildlife Service, 2020). Once known for its sport fishery and recreational uses, the Salton Sea has shrunk in size and deteriorated in water quality, leading to loss of the fishery and in recent years, mass die-offs of birds and fish, raising concerns about these beneficial uses.

The primary source of inflow for the Salton Sea is agricultural drainage from the Imperial and Coachella valleys plus inflow from the New River, Alamo River, and Coachella Valley Stormwater Channel. The Salton Sea does not have a natural outlet, so evaporation is the sole outflow, and any influent salts are concentrated. Moreover, the sea has reduced in volume, leading to more concentration. Consequently, salinity levels have increased over the past several decades. Salinity levels reported in 2020 were greater than 69,000 mg/L, two times greater than the salinity of ocean water (California Natural Resources Agency, 2020). High concentrations of phosphorus and nitrogen compounds in the Salton Sea can also lead to eutrophication. With its current trajectory, the Salton Sea could become hypersaline with elimination of fish that serve as an important food source for migratory birds (Salton Sea Authority, 2016). Decreased inflows over the past several decades have caused the Salton Sea's surface elevation and area to decline, which has exposed more of the playa lakebed. The increasingly exposed playa generates dust that degrades air quality.

Indio Subbasin groundwater is connected to the Salton Sea, with potential for groundwater outflow to the sea and seawater inflow from the sea. The latter represents seawater intrusion, a significant source of potential groundwater quality degradation. The occurrence of outflows/inflows depends on respective groundwater and Salton Sea elevations, which can change through time and vary with location. Salton Sea levels and quality are tracked by USGS, while local groundwater levels and salinity also are monitored regularly (see Chapter 4, *Current and Historical Groundwater Conditions*). The potential for seawater intrusion into Subbasin aquifers has diminished as Subbasin groundwater levels have increased and as the Salton Sea levels have declined and the sea has retreated. As discussed in Chapter 7, *Numerical Model and Plan Scenarios,* on simulated Salton Sea flows, numerical modeling indicates that groundwater outflow to the sea has exceeded inflow from the sea since 2015. Seawater intrusion is also discussed in Chapter 9, *Sustainable Management,* in terms of sustainable management as part of this *Alternative Plan Update*.

Due to its ecological importance and changing condition, legislation has been passed on the State and Federal level to support Salton Sea restoration and in-depth studies have been conducted about the Sea. A recent State initiative is the Salton Sea Task Force, created in 2015, which directs state agencies to create a management plan for ecological restoration (California Natural Resources Agency, 2020). In 2016, a Memorandum of Understanding (MOU) was signed between the U.S. Department of the Interior and the California Natural Resources Agency to affirm that the State will take the lead role in Salton Sea management and facilitate coordination for the *Salton Sea Management Plan* (SSMP). The State's SSMP team (including the California Natural Resources Agency, Department of Fish and Wildlife, and DWR) developed a 10-Year Plan identifying a sequence of dust control and fish and wildlife habitat projects around the Salton Sea.

The Salton Sea Authority (founded in 1993 as a Joint Powers Authority) has been working with the State of California to oversee ecological restoration. CVWD is a stakeholder, along with Riverside and Imperial counties, IID, and Torres Martinez Desert Cahuilla Indians. In 2016, the Authority released a *Funding and Financial Feasibility Action Plan* which sets the foundation for the SSMP. This plan included evaluation of previously proposed restoration alternatives for the Sea, water import alternatives, and alternatives that account for water supply limitations (including the Perimeter Lake concept of establishing a lake around a saline central lake within the current Salton Sea footprint). A North Lake Demonstration Project, involving a 160-acre lake near the community of North Shore, was initiated with DWR grant funding in April 2021 with construction to start in 2022.

As of spring 2021, the SSMP has released an updated draft 10-Year Plan, initiated environmental planning for National Environmental Policy Act (NEPA) compliance, and launched long-term planning with public engagement and an independent review of options for long-term restoration, including water importation. This long-range plan will also include a Watershed Management Plan component. A watershed management plan will have ramifications for Indio Subbasin water management, including plans for increased water recycling, desalination, and water conservation that could decrease flows into the Salton Sea from drains or the groundwater basin.

8.4 Small Water Systems

On February 16, 2016, the SWRCB recognized the human right to water as a core value under Resolution No. 2016-0010, stating that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." Small water systems (SWSs), often serving disadvantaged communities (DACs), may face challenges in providing safe, accessible, and affordable water because they may not have adequate resources to support maintenance, operation, and treatment costs.

SWSs serving DACs are primarily located in rural portions of the East Valley. These SWSs are independent from GSA water systems and depend on local private wells for drinking water supply. In 2017, CVWD estimated that about 10,000 Coachella Valley residents relied on private wells for drinking water (Rumer, Desert Sun, 2017). A recent assessment conducted for this Update used the GAMA data viewer and DDW system information to identify 101 small water systems with 2,772 connections (see also Chapter 2, *Plan Area*). Most of these SWSs are located within the CVWD service area. Systems marked as inactive were excluded. These water systems include both transient (e.g., campgrounds) and non-transient (e.g., schools, office buildings) non-community systems as well as community water systems, many of which in the Plan Area are mobile home parks. Most of the small systems have only one active well. To ensure safe groundwater quality and a reliable supply to these SWSs in its jurisdiction, CVWD initiated a program to connect them to CVWD's system on a priority basis.

8.4.1 Groundwater Supply Issues

Groundwater supply to small water systems in Indio Subbasin may face supply challenges related to system reliability, aging infrastructure, lack of funding and expertise for maintenance and operation, and population growth. Water systems with only one or two wells are more vulnerable to a water outage than a larger system. However, groundwater conditions in the Indio Subbasin show recovery of historical groundwater lows, so it is unlikely that wells will be vulnerable to going dry from lowering water levels. Additionally, most small water system wells with known depths are 400 feet or deeper.

8.4.2 Groundwater Quality Issues

SWSs often do not have the infrastructure to remove contaminants from groundwater. Elevated concentrations of several contaminants have been identified in SWSs. While some SWSs have not reported groundwater quality test results for trace contaminants to DDW in the past 10 years, a total of 76 out of the 101 identified systems reported at least one water quality measurement since 2010.

Many SWSs are vulnerable to naturally-occurring contaminants like arsenic, fluoride, and chromium-6 (see Chapter 4, *Current and Historical Groundwater Conditions,* for information on groundwater quality in Indio Subbasin). For arsenic and chromium-6, chronic exposure to trace concentrations is harmful to human health, and water treatment to remove trace contaminant concentrations is not possible for most small water systems. In brief, 59 wells from 48 SWSs have reported arsenic concentrations since 2010. Of these, 12 systems reported at least one well with a maximum arsenic concentration greater than the 10 µg/L MCL, and at least 50 percent of arsenic measurements from 2010-2020 had concentrations higher than the MCL for wells in 11 water systems. For fluoride, a total of 65 wells from 54 SWSs reported fluoride data since 2010, and wells from 13 SWSs have reported fluoride concentrations greater than the 2 mg/L MCL. At least 50 percent of measurements had fluoride levels exceeding 2 mg/L in wells from 9 water systems. Chromium-6 was measured in 30 wells from 25 water systems. Chromium-6 concentrations were >10 µg/L in 10 wells from 9 water systems, but the maximum result recorded in SWSs was 21 µg/L.

High nitrate and TDS concentrations are more prevalent in raw water from SWSs than in untreated groundwater from larger water systems because the wells are more likely to be shallow. Two SWSs measured TDS concentrations between 500 and 1,000 mg/L. No SWSs recorded TDS concentrations greater than 1,000 mg/L.

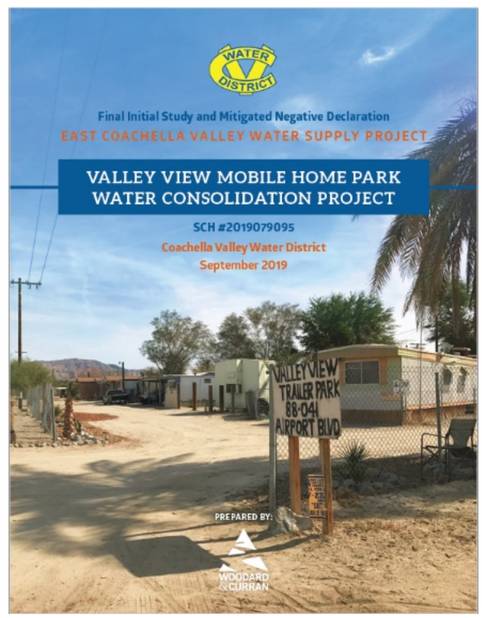
Nitrate (as N[2]) was measured in 85 wells from 72 SWSs. Nitrate concentrations were higher than the 45 mg/L MCL in 5 wells from 5 SWSs. The maximum nitrate concentration measured since 2010 was 97.46 mg/L nitrate as nitrate (reported as 22 mg/L nitrate as N).

8.4.3 Small Water System Consolidations

In response to these water supply issues, the GSAs with multiple small water systems within their respective jurisdictions have completed and continue to work on consolidating communities that currently are not connected to a municipal water system and do not have a reliable water supply source.

CVWD initiated the East Coachella Valley Water Supply Project (ECVWSP) (CVWD, 2018) that assessed the cost and feasibility of connecting 83 small water systems in DACs. The connections were grouped into 43 projects. The timing of connection largely depends on funding availability, with priority given to projects based on cost, permit status, critical need, and the number of systems that can be consolidated through a single project. CVWD's small water system consolidation and infrastructure is overseen by CVWD's DAC Infrastructure Task Force.

Other consolidations include CWA's Shady Lane Water Connection Project to connect the severely disadvantaged mobile home community to the CWA municipal water system. In addition, IWA is consolidating two small mutual water systems in the City of Indio that serve DACs (Boe Bel Heights Mutual Water Association and the Waller Tract Mutual Water Association)



The East Coachella Valley Water Supply Project prioritized small water system consolidations in the East Valley.

[2] The MCL is 10 mg/L for nitrate when measured as nitrogen. All nitrate as nitrogen concentrations were converted to nitrate as nitrate for this groundwater quality assessment.

8.5 Climate Change

Climate change has the potential to affect the availability of imported water supply from the Colorado River and SWP and to affect local water supply and water demand in the Plan Area. Since the *2010 CVWMP Update*, substantial climate modeling has yielded quantitative projections of climate change (including temperature increases and changes in precipitation on a regional scale) that are useful to water managers. The State of California has directed considerable effort toward assessing climate change and incorporating it into planning processes such as the Urban Water Management Plan (UWMP), Integrated Regional Water Management IRWM Plan, and SGMA planning processes.

Since 2010, Indio Subbasin water agencies have included climate change in their respective UWMPs. In addition, the *2018 Coachella Valley IRWM & Stormwater Resource Plan Update* (CVRWMG, 2018) includes extensive discussion of the climate change legislative and policy context, effect of climate change on water supply and demand, and climate change mitigation and adaptation. While the focus of this section is climate change impacts on water supply and demand, it is also recognized that climate change will affect related issues such as stormwater and flood risk, surface water quality, and water-related environments.

As part of this *Alternative Plan Update*, water supply reliability of Colorado River and SWP Exchange water (including climate change effects) is discussed in Chapter 6, *Water Supply,* and a numerical modeling scenario addressing climate change is described in Chapter 7, *Numerical Model and Plan Scenarios*.

The following sections provide brief updates on climate change effects relative to the Colorado River, SWP, and local water supply and demand. Recycled water supply is highly reliable and less affected by climate change.

8.5.1 Colorado River Basin

The *2010 CVWMP Update* summarized DWR and USBR studies available at the time, which provided mostly qualitative discussions of climate change impacts, including: a decrease in annual flow and increased variability (e.g., more frequent and more severe droughts), an increase in evaporative losses and reduced runoff, and earlier snowmelt and a greater proportion of runoff due to rainfall. Given the substantial reservoir storage in the Colorado River Basin relative to annual runoff, a change in the timing of annual runoff was not considered a significant effect. The *2010 CVWMP Update* noted that the Plan Area is protected by California's first priority to Colorado River supply in the lower basin and CVWD's high priority among California users of Colorado River supply. Consequently, no reduction in CVWD's Colorado River supplies was projected at the time.

In 2012, USBR released the *2012 Colorado River Basin Water Supply and Demand Study* (Basin Study; USBR 2012). The *Basin Study* evaluated Colorado River Basin water supply and demand projections (with specific attention to projected climate change through 2060) and evaluated strategies to meet the supply and demand gap. The Basin Study indicated that climate change will reduce system runoff from the Colorado River primarily because of warming and loss of snowpack. Over the next 50 years, Upper Colorado River streamflow is projected to decrease by approximately 9 percent, along with a projected increase in both drought frequency and duration as compared to the observed historical record. Droughts lasting 5 or more years are projected to occur 50 percent of the time over the next 50 years.

In 2019, in response to historical drought and low storage levels in Lakes Powell and Mead, federal legislators passed the Colorado River Drought Contingency Plan Authorization Act, which implements two Drought Contingency Plans, one each for the upper and lower basins (also see Chapter 6, *Water Supply*).

The *Upper Basin DCP* involves management of upper basin reservoirs, water demand management, and weather modification to augment precipitation. The *Lower Basin DCP* sets rules for scaling back water use based on Lake Mead storage conditions. Each of the lower basin states (and California contractors including CVWD) made storage commitments to keep Lake Mead above critically low levels.

Since the *Basin Study*, USBR has not updated their long-term projections for future conditions of the Colorado River system under climate change. This is due in part to the fact that the *Interim Guidelines* and *Lower Basin DCP* only extend through 2026. However, USBR has released interim guidelines for lower basin shortages, which have been conservatively used in this *Alternative Plan Update*'s scenario of anticipated reductions in Colorado River supplies due to climate change.

8.5.2 State Water Project

The *2010 CVWMP Update* summarized DWR analyses based on various global climate models that predicted a warming trend for California, a reduction in exports from the Sacramento-San Joaquin Delta, a decrease in reservoir carryover storage, and a change in the timing of Sierra Nevada runoff due to snowpack changes. All of these were considered to reduce SWP reliability.

The *2018 IRWM & Storm Water Resources Plan Update* (*IRWM Plan*) presents extensive discussion of the effect of climate change on SWP water supplies, noting the water delivered to State water contractors will depend on the amount of rainfall, snowpack, runoff, water storage, pumping capacity from the Delta, and water demand. Temperature increases are expected to modify rainfall and runoff, which may in turn affect SWP operations. As indicated in the *IRWM Plan*, changes in the regional and seasonal distribution of precipitation and effects on Sierran snowpack are most problematic; increased temperatures may reduce the snowpack at a faster rate, thereby releasing snowmelt water earlier and faster than anticipated and thereby reducing capabilities to capture and store runoff. Water demands in and near the water source could increase, diminishing water availability and reliability to SWP contractors downstream. The reliability of SWP water supply is expected to be reduced for the range of future climate projections studied.

Notably for SGMA planning, in July 2018 DWR published its Guidance Document, *Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development* (DWR, 2018). This document provides GSAs with information regarding DWR climate change datasets and related tools as technical assistance to develop projected water budgets. DWR provides four projected climate conditions and desktop tools that can be used by GSAs to process the climate change datasets for their water budget studies or to incorporate into a groundwater/surface water model.

As described in Chapter 7, *Numerical Model and Plan Scenarios*, climate change effects on SWP supply have been evaluated accounting for the recent history of SWP allocations (including drought periods). Climate change (including effects not only on SWP but also Colorado River supplies) is addressed in four projected scenarios for numerical modeling with comparison to a baseline scenario.

8.5.3 Plan Area Supplies and Demands

Projected water demands are described in detail in Chapter 5, *Demand Projections,* while Chapter 6, *Water Supply*, describes available and future water supplies including climate change. DWR's *2018 Guidance Document* (DWR, 2018) provides some summary information on projected climate changes for the Colorado River hydrologic region in California (including Indio Subbasin). Average temperature increases are 2.6 and 5.7 degrees Fahrenheit for 2030 and 2070, respectively, and average precipitation changes are decreases of 1.3 percent and 2.9 percent, respectively, for 2030 and 2070 (DWR, 2018, Figures A-13 and A-14).

Increased temperatures in the Plan Area would increase water demands for crop and landscape irrigation, municipal water use, and evaporative losses from canals and open reservoirs. Increasing temperatures could also change the distribution and form of precipitation from snow at higher elevations to rain, shifting the timing of runoff earlier in the year. Decreased precipitation would result in decreased runoff and availability of local surface water for diversion. In addition, climate change may result in greater seasonal and annual variability of local precipitation, including higher peak stormwater events that strain the capacity of diversion and recharge facilities. As described in Chapter 7, *Numerical Model and Plan Scenarios*, potential climate change effects on local surface water hydrology have been assessed using local, recent hydrologic and drought data the numerical groundwater flow model.

Climate change could also lead to shifts in population, industry, and agriculture, which would in turn affect water demands.

8.6 State Water Conservation

In 2009, the State Legislature enacted Senate Bill X7-7 (SBX7-7), the Water Conservation Act of 2009, which requires water suppliers to increase their water use efficiency. The legislation amended the water code and laid out actions to be conducted by DWR to implement the law, including collaboration with urban and agricultural stakeholders, development of methodologies for measuring and reporting water uses, development of urban water conservation targets, preparation of guidebooks, and development of grant and loan funding criteria as incentives for water conservation. The purpose of the law has been to encourage both urban and agricultural water providers to implement conservation strategies, monitor water usage, and report data to DWR. Implementation of water conservation by urban water suppliers has been reported primarily through UWMPs and by agricultural water suppliers through Agricultural Water Management Plans (AWMPs).

In passing this law—which was identified in the *2010 CVWMP Update* for close tracking—California was the first state to adopt urban water use efficiency targets, namely a 20 percent reduction in urban per capita water use by 2020. All four GSAs submitted UWMPs in 2010 and 2015 in compliance with the Urban Water Management Planning Act. For the 2020 UWMP, six water suppliers (CVWD, Coachella Water Authority, DWA, IWA, Mission Springs Water District, and Myoma Dunes Mutual Water Company) collaborated to prepare a Regional UWMP (Water Systems Consulting, 2021). As documented in the Regional UWMP, all six suppliers achieved and in fact exceeded the per capita water use reduction of 20 percent by 2020.

With regard to AWMPs, CVWD has an agricultural conservation program in the *2010 CVWMP Update*. CVWD has a long history of agricultural water conservation programs. As a signatory to the QSA, CVWD is currently exempt from the portion of SBx7-7 that requires agricultural water suppliers to develop an agricultural water management plan and implement efficient water management practices. Under the QSA, CVWD implemented an Extra-ordinary Conservation Program including scientific irrigation scheduling, salinity management, salinity field mapping, conversion of irrigation systems to micro-irrigation, distribution uniformity evaluations, grower training and meetings and engineering evaluations.

Subsequently in 2018, the California Legislature enacted Assembly Bill 1668 and Senate Bill 606, which together lay out a new long-term water conservation framework that affects both urban and agricultural water providers. Four primary goals for the framework are to:

- Use water more wisely,
- Eliminate water waste,
- Strengthen local drought resilience, and
- Improve agricultural water use efficiency and drought planning.

DWR and SWRCB developed a "Primer" or handbook that summarizes the 2018 Water Conservation Legislation. Entitled *Making Water Conservation a California Way of Life – Primer of 2018 Legislation on Water Conservation and Drought Planning, Senate Bill 606 (Hertzberg) and Assembly Bill 1668 (Friedman)*, the Primer outlines the key authorities, requirements, timeline, roles, and responsibilities of State agencies, water suppliers, and other entities during implementation of actions described in the 2018 legislation. To plan, develop and implement the new framework, DWR and the SWRCB are working in collaboration with stakeholders to develop new standards for:

- Indoor residential water use,
- Outdoor residential water use,
- Commercial, industrial, and institutional (CII) water uses for landscape irrigation with dedicated meters, and
- Water loss.

CVWD and DWA have been actively engaged in the stakeholder workgroups helping to develop the methodologies and procedures for the regulations. Specifically, CVWD has been a participant in two variance studies addressing indoor use and seasonal residential population and DWA has been a pilot agency for Landscape Aerial Measurements.

With the new law, urban water suppliers will be required to stay within annual water budgets for their service areas, based on these standards. In addition, water suppliers will need to report on implementation of new performance measures for CII water use. The legislation also made important changes to existing urban and agricultural water management planning, with enhanced drought preparedness and water shortage contingency planning for urban water suppliers, small water systems and rural communities.

Urban water conservation is being enhanced by local agencies to provide water supplies efficiently and to prepare for water shortages, including drought. While providing these important benefits, it also is recognized that water conservation has broader water management implications including reduction of wastewater flows, decreased availability of recycled water, and potential increases in wastewater salinity.

8.7 Subsidence

Land subsidence is documented in Chapter 4, *Current and Historical Groundwater Conditions*. Subsidence was discussed in the *2010 CVWMP Update* as an emerging issue, having been recognized in the 1990s as occurring with increased pumping in the East Valley since the 1970s. In 1996, the USGS in cooperation with CVWD established a geodetic network of ground surface monuments to monitor elevation changes. Results of the monitoring program published in 2007 (Sneed and Brandt, 2007) documented the occurrence of subsidence—and some uplift—and indicated causes as including tectonic activity and groundwater pumping and associated groundwater level declines.

CVWD and USGS have continued the monitoring and analysis program. As documented in a 2020 USGS Scientific Investigations Report (Sneed, et al., 2020) and summarized in Chapter 4, *Current and Historical Groundwater Conditions*, as much as 2 feet of subsidence occurred in the Indio Subbasin from 1995 to

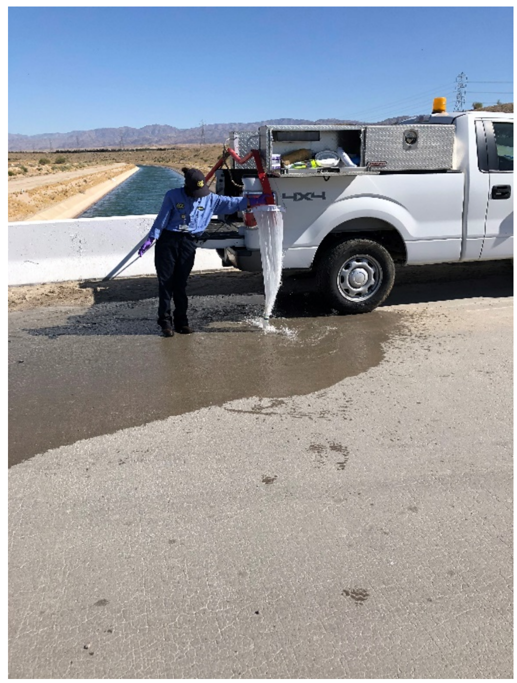
2010. Since 2010, groundwater levels have stabilized or partially recovered in response to the implementation of source substitution, conservation, and groundwater replenishment programs included in the *2010 CVWMP Update*. Elsewhere, up to 1 inch of uplift has been measured since 2011 in the Palm Springs area, corresponding to higher groundwater levels in response to upgradient WWR-GRF recharge. In the Thermal area, the ground surface has also rebounded about 2 inches over the past 10 years, returning to elevations observed in 2001. Land subsidence stopped in many areas and even rebounded.

Sustainable management criteria for subsidence are discussed in Chapter 9, *Sustainable Management*, continued monitoring of groundwater levels and subsidence is discussed in Chapter 10, *Monitoring Program*, and relevant projects and management actions are presented in Chapter 11, *Projects and Management Actions*.

8.8 Other Issues

8.8.1 Invasive Species

The *2010 CVWMP Update* identified an invasive species, Quagga Mussels, which have been found in the Colorado River System and pose a threat of infestation to canal and channel facilities. CVWD has successfully prevented infestation through chlorination and maintenance of turbulence in its conveyance system. Monitoring continues to detect and address any problems.



CVWD monitors for Quagga Mussels in the Coachella Canal and Lake Cahuilla.

8.8.2 Seismic Response

Seismic response was included in the *2010 CVWMP Update*, which summarized the probability of a magnitude 6.7 or greater earthquake in California as greater than 99 percent, as presented in a 2008 USGS study (USGS Fact Sheet 2008-3027). With the occurrence of earthquakes since 2008, USGS has continued refinement of its earthquake forecast model for California. As summarized in its USGS Fact Sheet 2015-3009, the near-certainty of a large event has not changed. However, the likelihood of moderate-sized earthquakes (magnitude 6.5 to 7.5) is lower, whereas that of larger events is higher because of the inclusion of multi-fault ruptures.

The *2010 CVWMP Update* summarized the CVWD Emergency Response Plan and the disaster/emergency preparedness plans of DWA, City of Coachella, and City of Indio. The federal *America's Water Infrastructure Act of 2018* requires that community (drinking) water systems serving more than 3,300 people develop or update risk assessments and Emergency Response Plans (ERPs) with regular 5-year updates and recertifications.

Recognizing the consequences for water systems, DWR is conducting seismic upgrade projects on its own facilities and has strengthened requirements for local water agencies. For example, upcoming 2020 UWMPs are required to identify potential catastrophic water shortages and appropriate response actions. New 2020 requirements include a seismic risk assessment and mitigation plan for water system facilities.

CHAPTER 9: SUSTAINABLE MANAGEMENT

As described in Chapter 1, *Introduction*, in 2016 the Indio Subbasin Groundwater Sustainability Agencies (GSAs) submitted an Alternative Plan to DWR (approved in July 2019) that presented the ongoing management of the Indio Subbasin. The Alternative Plan included discussion of goals and objectives, groundwater conditions, emerging issues, water supply and demand, and projects and management actions, among other topics. The Alternative Plan has continued to guide water management in the Indio Subbasin as demonstrated in the annual reports and in this *Alternative Plan Update*.

The California Department of Water Resources (DWR) approved the Alternative Plan as functionally equivalent to a Groundwater Sustainability Plan (GSP) and provided recommendations to the GSAs in its *Alternative Assessment Staff Report* (DWR, 2019). This chapter discusses sustainability consistent with the groundwater management objectives of the GSAs and—recognizing the benefits of the Sustainable Groundwater Management Act (SGMA) approach in defining terms, establishing procedures, and setting objective metrics for sustainability—is responsive to the specific DWR recommendations that address sustainability and DWR's ongoing evaluation.

9.1 Sustainability Indicators and Criteria

SGMA provides a consistent, state-wide definition of sustainable management as the use and management of groundwater in a manner that can be maintained without causing *undesirable results*, which are defined as significant and unreasonable effects caused by groundwater conditions occurring throughout a basin:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply
- Significant and unreasonable reduction of groundwater storage
- Significant and unreasonable seawater intrusion
- Significant and unreasonable land subsidence that substantially interferes with surface land uses
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

The above indicators provide a framework for addressing the multi-faceted and complex nature of sustainability. SGMA also provides the following criteria for quantitative measures that support demonstration of sustainability:

- **Minimum Threshold** (MT[1]) – numeric value used to define undesirable results for each sustainability indicator
- **Measurable Objective** (MO) – specific, quantifiable goal to track the performance of sustainable management

[1] The abbreviations for Minimum Threshold (MT) and Measurable Objective (MO) are provided because these terms are used often; however, the full unabbreviated term is used when helpful for clarity or when included in a quotation.

- **Interim Milestone** – target value representing measurable groundwater conditions, in increments of 5 years

While providing consistent definitions and criteria, SGMA allows multiple pathways to meet the local needs of each basin. These include not only development of each of these sustainable management criteria, but also use of the groundwater level sustainability indicator as a proxy, identification of additional indicators as decided by local GSAs for a basin, and identification of indicators that are not applicable to the basin. Moreover, it is understood that continued data collection and an improved understanding of basin conditions in the future may lead to changes in the sustainable management criteria through adaptive management.

Sustainability is discussed here with reference to the sustainability goal and objectives that have been defined for water resources management of the Coachella Valley overall and for the Indio Subbasin specifically. Sustainability indicators are presented in the context of management through the Alternative Plan—which is the approved functional equivalent of a GSP—and the Recommended Actions provided by DWR in its *Alternative Assessment Staff Report* (Staff Report) (DWR, 2019) (see Chapter 1, *Introduction*).

9.2 Sustainability Goal and Approach

The *2002 Coachella Valley Water Management Plan* (*2002 CVWMP*) (Coachella Valley Water District [CVWD], 2002) and the *Coachella Valley Water Management Plan 2010 Update* (*2010 CVWMP Update*) (CVWD, 2012) developed an overarching goal for the Valley "to reliably meet current and future water demands in a cost-effective and sustainable manner." This *Alternative Plan Update* continues to be guided by this overall goal, which extends beyond groundwater sustainability to include all available water supplies for Indio Subbasin and water demand management as integral to an overall balance of water supply and demand.

The *2010 CVWMP Update* also identified six objectives, which continue to guide this Alternative Plan. In addition, a seventh objective has been developed to address climate change and drought. The updated objectives are as follows:

- Meet current and future municipal water demands with a 10 percent supply buffer
- Avoid chronic groundwater overdraft
- Manage and protect water quality
- Collaborate with tribes, state and federal agencies on shared objectives
- Manage future costs
- Minimize adverse environmental impacts
- Reduce vulnerability to climate change and drought impacts

These goals and objectives extend beyond groundwater resources and thus, for this *Alternative Plan Update*, a sustainability goal was developed specifically for groundwater sustainability. It is nested under the broader plan goals. The sustainability goal included here supports, rather than supersedes, the plan goals, and provides a qualitative description of the objectives and desired conditions of the Indio Subbasin:

> *To maintain a locally managed, economically viable, sustainable groundwater resource for existing and future beneficial uses in the Indio Subbasin by managing groundwater to avoid the occurrence of undesirable results.*

The sustainability goal has been defined in light of information developed in this *Alternative Plan Update*. This information includes the basin setting (Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget), discussion of sustainability indicators in this chapter, and the description of planned projects and management actions to ensure that the sustainability goal is achieved and maintained (see Chapter 10, *Monitoring Program*; Chapter 11, *Projects and Management Actions*; and Chapter 12, *Plan Evaluation and Implementation*).

This *Alternative Plan Update* incorporates a comprehensive approach to local groundwater management. While acknowledged as functionally equivalent to a GSP, it also utilizes sustainability indicators and criteria as needed. This Alternative Plan is also responsive to the DWR Staff Report Recommended Actions, which are recognized as supporting DWR in its evaluation of Alternative Plan implementation. As indicated in Chapter 1, *Introduction*, the DWR *Alternative Assessment Staff Report* provided Recommended Actions 1 through 7, which are reproduced below and addressed in this chapter (and elsewhere in the Update as appropriate). The DWR Staff Recommended Actions included:

- **Recommended Action 1**. Staff recommend that the Agencies [GSAs] incorporate the information and management activities in the Garnet Hill area from the *Mission Creek/Garnet Hill Water Management Plan* (Garnet Hill WMP, 2013) into the Alternative for the Indio Subbasin.
- **Recommended Action 2.** Staff recommend that the Agencies describe whether the 2005 groundwater levels can be used as a threshold for land subsidence in the East Valley and the Indio Subbasin generally; determine whether those groundwater levels could also be used as a threshold for other sustainability indicators, such as declining groundwater levels and groundwater storage. If it is determined that the 2005 groundwater levels are not appropriate thresholds or a proxy for thresholds, then the Agencies should provide other quantitative thresholds for groundwater levels, groundwater in storage, and subsidence, and for other sustainability indicators, such as declining groundwater levels and groundwater storage. If not appropriate, provide other quantitative thresholds for groundwater levels, groundwater in storage, and subsidence.
- **Recommended Action 3**. Staff recommend that the Agencies provide maps showing the areas affected by the primary water quality constituents of concern, which include, at a minimum, fluoride, arsenic, hexavalent chromium (chromium-6), and dibromochloropropane (DBCP). DWR indicated that the wells known to be affected by these constituents should be shown on a map.
- **Recommended Action 4**. Staff recommend that the Agencies incorporate an approved Salt and Nutrient Management Plan (SNMP) into future iterations of the Alternative.
- **Recommended Action 4a**. Staff recommend that the Agencies continue efforts to study the rate and level of increased salt contents in groundwater due to the importation of Colorado River water.
- **Recommended Action 5**. Staff recommend that the Agencies provide the modeled groundwater elevation that minimizes the risk of saltwater intrusion and discuss how the recent groundwater levels near the Salton Sea referenced in the Alternative compare to the modeled elevation. The Alternative should discuss why the water balance includes inflow from the Salton Sea to the Indio Subbasin and should correlate that inflow with recent groundwater levels and the groundwater model.

- **Recommended Action 6**. Staff recommend that the Agencies clarify whether there is a minimum threshold associated with the amount of flow in the subsurface drains, below which significant and unreasonable undesirable results would occur, and what that quantified minimum threshold is, if applicable, and the implementation horizon for when the goal for the amount of subsurface flow will be achieved, so as to avoid undesirable results.
- **Recommended Action 7**. Staff recommend that the Agencies provide an identification of groundwater-dependent ecosystems in the Subbasin.

Recommended Action 1, to incorporate information and management activities for the Garnet Hill Subarea, is addressed throughout this *Alternative Plan Update*. As summarized in Chapter 2*, Plan Area,* and described in Chapter 3, *Hydrogeologic Conceptual Model,* and Chapter 4, *Current and Historical Groundwater Conditions*, the Garnet Hill Subarea is included in the Indio Subbasin. Management of the Garnet Hill Subarea has been coordinated through the *Mission Creek/Garnet Hill Water Management Plan* (MC/GH WMP, 2013) developed by CVWD, Desert Water Agency (DWA), and Mission Springs Water District (MSWD) in coordination with the *2010 CVWMP Update*. The Subarea is included in this *Alternative Plan Update* and is also included in the *Mission Creek Subbasin Alternative Plan Update*. Management activities for the Garnet Hill Subarea are incorporated into this *Alternative Plan Update*, for example through numerical modeling and project implementation (see Chapter 7, *Numerical Model and Plan Scenarios* and Chapter 12, *Plan Evaluation and Implementation*).

9.3 Quantitative Criteria for Groundwater Levels

Recommended Action 2 in the DWR *Alternative Assessment Staff Report* discusses minimum thresholds for groundwater levels. The Staff Report recommends that the GSAs provide quantitative thresholds and consider groundwater levels as a proxy for other sustainability indicators including storage and subsidence.

Quantitative minimum thresholds for groundwater levels are provided in this section, recognizing that chronic lowering of groundwater levels can indicate significant and unreasonable depletion of supply, causing undesirable results to domestic, agricultural, municipal, and other beneficial uses of groundwater if continued over the planning and implementation horizon. As a clarification, drought-related groundwater level declines are not considered chronic if groundwater recharge and discharge are managed such that groundwater levels recover during non-drought periods.

Declining groundwater levels directly relate to other potential undesirable effects (for example, groundwater storage, land subsidence, interconnected surface water, and seawater intrusion); these are described in subsequent sections. Effects on groundwater users are described here.

Groundwater elevation trends in Indio Subbasin are documented in Chapter 4, *Current and Historical Groundwater Conditions*; hydrographs are presented for 68 wells across the Subbasin. The Indio Subbasin is no longer characterized by overdraft with widespread chronic groundwater level declines. However, the hydrographs (e.g., Figure 4-3 through 4-5) show declines that persisted until the late 2000s, and as shown in Figure 4-9, groundwater in storage in the Indio Subbasin was at its minimum in 2009. The groundwater level declines were halted with the combined effects of groundwater replenishment, source substitution for groundwater (e.g., imported surface water and recycled water), and conservation. Since that time, groundwater levels have risen or at least stabilized throughout the Subbasin.

As noted in the *DWR Staff Report*, the *2010 CVWMP Update* suggested that groundwater levels be maintained above 2005 levels in order to prevent subsidence. However, as discussed in Section 9.5, a 2020 USGS study has provided documentation that subsidence stopped after about 2010. This occurred with stabilizing and rising groundwater levels that followed the historical low groundwater levels and storage in about 2009. As discussed below, historical low groundwater levels were selected as the conceptual basis for meaningful and protective minimum thresholds.

9.3.1 Description of Undesirable Results

Chronic groundwater level declines are widely recognized to cause undesirable effects in production wells. Relatively shallow wells are more susceptible than deep wells. Private domestic wells may be relatively shallow and thus susceptible to declining groundwater levels. In addition, a private well may be more susceptible to undesirable results because of well construction or maintenance problems. A private well may also represent the sole source of drinking water supply for one or more households.

The following is a generalized description of the undesirable results associated with chronic groundwater level decline; in other words, what can happen in a production well with declining groundwater levels. As groundwater levels decline in a well, a sequence of increasingly severe undesirable results occurs. These include an increase in pumping costs and a decrease in pump output (e.g., flow in gallons per minute). With further declines, the pump may break suction, which means that the water level in the well has dropped to the level of the pump intake. Well operators can lower the pump inside the well, but this can cost thousands of dollars. Chronically declining water levels will eventually drop below the top of the well screen. This exposes the screen to air, which can produce two adverse effects. In the first, water entering the well at the top of the screen will cascade down the inside of the well, entraining air; this air entrainment can result in cavitation damage to the pump. The other potential adverse effect is accelerated corrosion of the well screen. Corrosion eventually creates a risk of well screen collapse, which would likely render the well unusable. If water levels decline by more than about half of the total thickness of the aquifer (or total length of well screen), water might not be able to flow into the well at the desired rate regardless of the capacity or depth setting of the pump. This might occur where the thickness of basin fill materials is relatively thin. While describing a progression of potential adverse effects, at some point the well no longer fulfills its water supply purpose and is considered to have "gone dry." For the purposes of this discussion, a well going dry means that the entire screen length (to the bottom of the deepest screen) is unsaturated.

9.3.2 Potential Causes and Effects of Undesirable Results

The Indio Subbasin currently is characterized by stable or increasing groundwater levels, but chronic groundwater declines have occurred, most recently until about 2009. No reports are known of wells adversely affected by groundwater levels at that time although other impacts of groundwater level decline (e.g., subsidence or water quality changes) were recognized and addressed. Similarly, groundwater levels typically are affected by drought. Effects on groundwater levels of the most recent drought were variable across the Subbasin and resulted in some decreased groundwater storage from 2012 to 2016, but the GSAs and DWR have received no reports of well problems with groundwater level declines.

The GSAs have been working to reverse groundwater overdraft through imported water replenishment.

Nonetheless, undesirable results of chronic groundwater level declines could potentially occur. Causes of declines could include severe and prolonged drought, climate change (locally and/or in imported water source areas), or long-term imbalance of demand over supply. Water demands may exceed supply if a reduction of imported water supply occurs. Accordingly, the GSAs have defined sustainability criteria as summarized here.

Some of the potential causes of groundwater level changes, including declines, are within GSA responsibility; most notably, a GSA is responsible for groundwater basin management without causing undesirable results such as chronic groundwater level declines. SGMA also requires that a GSA address significant and unreasonable effects caused by groundwater conditions *throughout the basin.* This indicate s that a GSA is not solely responsible for local or well-specific problems and furthermore that responsibility is shared with a well owner. A reasonable expectation exists that a well owner would construct, maintain, and operate the well to provide its expected yield over the well's life span, given historical groundwater levels (including droughts) and with some anticipation that neighbors also might construct wells (consistent with land use and well permitting policies).

Groundwater level declines across broad areas of the Indio Subbasin could have deleterious impacts on individual wells and well yields, including the ability of private well owners and small communities to reach groundwater for domestic and drinking water supply. Declining groundwater levels also could have negative effects on other beneficial uses with ramifications for the regional economy: for example, agricultural irrigation and cropping, municipal and golf course cost of supplying water, and property values.

9.3.3 Sustainability Criteria for Groundwater Levels

The general approach to defining sustainability criteria is based on recognition of the following: 1) that historical low groundwater levels have occurred relatively recently in the Indio Subbasin and 2) there has been a lack of reported problems. Accordingly, it can be assumed that maintaining groundwater elevations at or above minimum historical values should not cause undesirable results. This has been substantiated by a review of available information on the location and depths of wells serving small water systems, which indicated that historical groundwater low levels were above the shallowest well depths.

This approach is protective of existing production wells and conservative. In fact, it is quite possible that groundwater levels could be locally lower than the historical minimum without resulting in undesirable effects. However, the lack of undesirable results at historical lows is known and relatively certain. A lower level that remains protective is not known unless local wells in the area are fully documented in terms of well construction (e.g., elevation of screen and bottom of well) with assessment of groundwater levels that might cause undesirable results. As described in Section 12.2.7, Monitoring Network Improvements, Plan Implementation includes an expanded well inventory to document the location and construction of existing wells, which will provide a comprehensive basis for such assessment. Ongoing cooperation with well permitting agencies, including the County of Riverside, will ensure that future wells are constructed with sufficient depth.

Determining the level below which undesirable results can occur is the first step in defining the MT. As described below, additional steps involve selection of representative monitoring wells (Key Wells) to track groundwater levels, review of groundwater levels in each Key Well to identify the MT, consideration of how often and how long groundwater levels can be below the MT without causing undesirable results, and decision of how many wells with levels crossing the MT constitute an undesirable result.

9.3.3.1 Selection of Key Wells

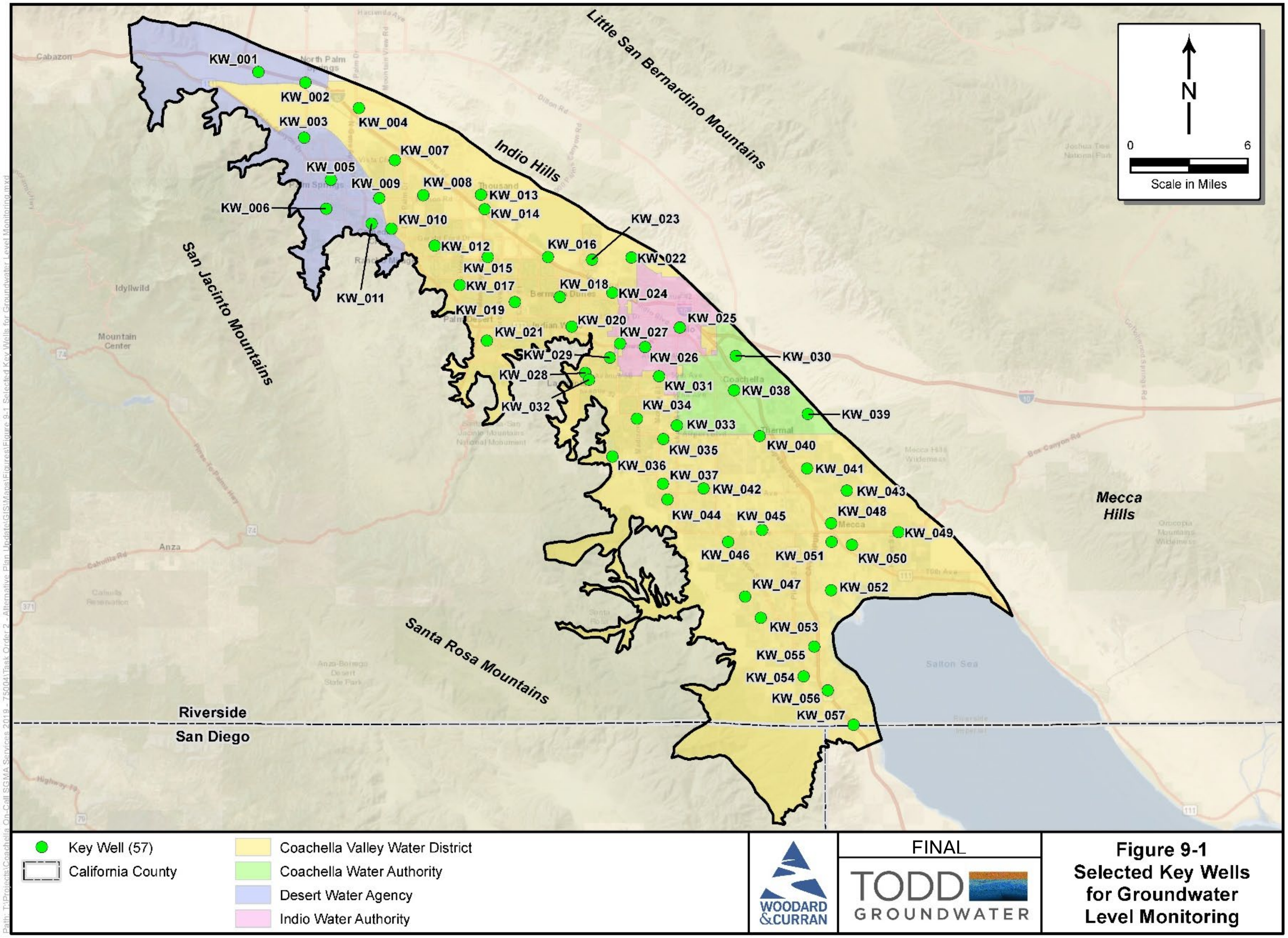
Selected Key Wells are shown in Table 9-1 and Figure 9-1. These wells are representative of local groundwater elevation conditions and are appropriate for inclusion in the Key Well groundwater elevation monitoring network (a subset of the overall monitoring program). These wells will be used for well-by-well definition of sustainability criteria (such as undesirable results and minimum thresholds). Future 5-year updates of this Alternative Plan will include review and any needed refinement of this Key Well network.

Table 9-1. Key Well Network for Groundwater Levels

Key Well Number	SWN	Well Name/Owner	First Year of Record	MT (ft msl)
KW_001	03S04E17K01S	Private	1954	617.0
KW_002	03S04E22A01S	Private	1953	586.4
KW_003	03S04E34R01S	DWA Well 21	1973	242.58
KW_004	03S05E30G01S	Private	1965	379.9
KW_005	04S04E13C01S	DWA Well 23	1975	184.11
KW_006	04S04E24D01S	DWA Well 24	1978	164.27
KW_007	04S05E09B01S	CVWD Well 4562-1	1962	151.4
KW_008	04S05E15R02S	Private	1960	99.0
KW_009	04S05E17Q02S	DWA Well 31	1987	134.49
KW_010	04S05E28F02S	CVWD Well 4519-1	1974	105.4
KW_011	04S05E29F01S	Private	1958	129.3
KW_012	04S05E35G03S	CVWD Well 4503-1	1953	55.1
KW_013	04S06E18R01S	CVWD Well 4623-1	1953	33.7
KW_014	04S06E20M02S	CVWD Well 4628-2	2003	15.4
KW_015	04S06E32N02S	CVWD Well 4611-1	2000	-102.6
KW_016	04S06E35P01S	Private	1985	-45.4
KW_017	05S05E12H02S	CVWD Well 5507-1	1956	4.6
KW_018	05S06E12N01S	CVWD Well 5626-1	1980	-65.1
KW_019	05S06E16A02S	CVWD Well 5620-1	1976	-42.0
KW_020	05S06E24G01S	CVWD Well 5636-1	1965	-86.7
KW_021	05S06E29C01S	CVWD Well 5643-1	1956	-37.0
KW_022	05S07E04A01S	CVWD Well WRP-7 MW-1 Dave Price	1955	-62.6
KW_023	05S07E06B04S	CVWD Well 5720-1	1993	-77.0
KW_024	05S07E08Q01S	Private	1967	-79.4

Key Well Number	SWN	Well Name/Owner	First Year of Record	MT (ft msl)
KW_025	05S07E24M04S	IWA Well 1C	1985	-92.1
KW_026	05S07E27L01S	Private	1965	-142
KW_027	05S07E28E01S	CVWD Well 5701-1	1948	-95.5
KW_028	05S07E31P01S	CVWD Well 5706-1	1978	-107.6
KW_029	05S07E32B01S	CVWD Well 5725-1	2005	-155.2
KW_030	05S08E33D01S	CWA 10	1979	-160.7
KW_031	06S07E02D02S	Private	1985	-157.2
KW_032	06S07E06B01S	CVWD Well 6701-1	1981	-145.4
KW_033	06S07E13M02S	CVWD Well 6781-1	1963	-91.4
KW_034	06S07E16A02S	CVWD Well 6723-1	1987	-172.7
KW_035	06S07E23F01S	Private	1965	-163.2
KW_036	06S07E29B01S	Private	1995	-170.9
KW_037	06S07E35L02S	Private	1988	-176.6
KW_038	06S08E05R02S	CVWD Well 6858-1	1957	-103.4
KW_039	06S08E12Q01S	Private	1991	-132.7
KW_040	06S08E22D02S	CVWD Well 6803-1	1966	-177.1
KW_041	06S08E25Q01S	Private	1979	-188.4
KW_042	06S08E31P01S	Private	1989	-184.8
KW_043	06S09E32Q01S	Private	1966	-176.0
KW_044	07S07E02G02S	Private	1996	-178.2
KW_045	07S08E10P01S	Private	1988	-204.2
KW_046	07S08E17G01S	CVWD Well 7801-1	1972	-197.3
KW_047	07S08E33B01S	Private	1965	-211.4
KW_048	07S09E07J01S	CVWD Well 7993-1	1970	-245.9
KW_049	07S09E14C01S	Private	1992	-180.6
KW_050	07S09E16M03S	Private	1989	-261.5
KW_051	07S09E18H01S	Private	1994	-263.1
KW_052	07S09E30R01S	CVWD Bernadine	1996	-209.1
KW_053	08S08E03L01S	Private	1965	-220.2
KW_054	08S08E24L01S	Private	1939	-257.1
KW_055	08S09E07N03S	CVWD Gracie	2003	-249.6
KW_056	08S09E30A01S	Private	1965	-266.5
KW_057	08S09E33N01S	Private	1952	-262.9

Figure 9-1. Selected Key Wells for Groundwater Level Monitoring



The selection process began with a database of 757 wells that have water level measurements compiled by the GSAs. The selection of Key Wells from this set was based on a quantitative approach that considered wells with long records characteristic of an area and distribution of wells across Indio Subbasin. In brief, all available groundwater elevation data were plotted as hydrographs and well locations were plotted on a basin-scale map. The five criteria include the following:

1. **Available Construction Information** – Wells should have construction information including at least total depth.
2. **Current Monitoring** – Wells need to have been monitored recently to ensure continued access (all selected wells were measured in 2020).
3. **Long Record** – Wells should have a long period of record to reflect changing conditions in the Subbasin. Wells were evaluated with consideration of length of monitoring record and the number of years since 1990 (the beginning year of the *2010 CVWMP Update* model) with consistent monitoring. This period includes overdraft and recovery. Wells were scored based on the number of years with more than two water level monitoring events.
4. **Spatial Distribution** – Wells were prioritized to provide distribution across the Subbasin (evaluated for no more than one well per township range section) and to select at least one well in each GSA jurisdictions. Wells were given a higher ranking if no other monitoring wells were located in the same township range section (TRS) and a lower ranking if there were several wells in the section. Only the highest scoring well in a TRS was selected. If multiple wells had the same score, the well with the longest record was selected. In addition, areas with clusters of wells were identified and only the highest scoring well was selected.
5. **Location near Production Wells** – Wells were rated higher in sections that had more production wells. Conversely, wells were rated lower if few or no pumping wells existed in the TRS. Because the purpose of the MTs is to protect current and future beneficial uses including pumping, the key wells need to reflect pumping locations. However, if a large area of the Subbasin did not have an adequately rated well, the best well in that area is proposed.

Each well was rated (low-0, medium-5, and high-10) for the five criteria as summarized in Table 9-2 below.

Table 9-2. Criteria for Selection of Key Wells for Groundwater Level Monitoring

Criteria	**Low**	**Med**	**High**	
Points	**0**	**5**	**10**	**Field Name**
Construction	N		Y	Well Depth
Current Monitoring	<2017	2018	2019+	Maximum Year
Long Record	<5	5-15	>15	Years with at Least 2 Measurements since 1990
Areal Distribution	>10	5-10	<5	Number of Monitoring Wells in Section
Location near production wells	0	1-4	>5	Number of Production Wells in Section

After all wells with water level monitoring were scored and ranked, the wells were plotted and vetted against additional considerations. These considerations are more qualitative but help refine the selection of higher ranked wells. These considerations include:

- **Small Water Systems** – Wells in and around small community water systems are considered in order to be protective of pumping.
- **GSA represented** – All four of the GSA jurisdiction areas should be represented.
- **All Subareas represented** – insofar as possible at least one well was included per Subarea.
- **Depth of well** – The depth of Key Wells should be representative of the static regional levels. Wells less than 300 feet were not selected unless they were needed for areal distribution or providing a very long and complete record.
- **Location relative to active recharge** – Selection of key wells should not be unduly influenced by Groundwater Replenishment Facilities (GRF). Accordingly, monitoring wells for a GRF or on GRF property were not included. The key wells were selected to monitor regional trends and not local operational effects of these facilities.
- **SNMP** – Wells in the SNMP workplan were considered to provide some overlap of the two programs while recognizing that these are for SNMP objectives.
- **Representative but not redundant** – Hydrographs were visually identified for similar trends in nearby wells to avoid redundancy.

9.3.3.2 Identification of Minimum Threshold

The historical low level represents the conceptual definition of the MT. The MT for each Key Well was based on reviewing its respective hydrograph (from 1990 to 2020) and identifying the historical low groundwater elevation (see hydrographs in Appendix 9-A). These groundwater elevations were designated as MTs. In some cases, the historical low appeared to be a significant outlier and the MT was adjusted. All adjustments were upward, in other words, more protective.

Under current conditions, groundwater levels in all Key Wells are above the MTs and no undesirable results are known to occur. To substantiate this, available information was reviewed on the location and depth of wells serving small water systems, including non-community systems (e.g., schools, businesses) as well as community water systems (e.g., mobile home parks). Section 8.4, Small Water Systems, provides information on small water systems and GSA programs to help provide them with reliable and safe water supplies. While many wells for small water systems do not have known construction or depths, review of available information from 48 wells evaluated in the *East Coachella Valley Water Supply Consolidation Study* (CVWD, 2018) indicates a range of well depths from 225 to 1,060 feet. Comparison of known depths for small water system wells with the MTs indicated that the respective MTs are above known depths for all small water systems with available information and are protective.

For the future, the GSAs will continue to cooperate with agencies responsible for well permitting to ensure that new wells are constructed with sufficient depth to accommodate groundwater level changes relative to the MTs. This will include provision of information on the Key Wells and the MTs and applicable Subbasin areas, which may be accomplished by contouring MTs or by designating applicable areas around each Key Well to define minimum well depths.

9.3.3.3 Minimum Thresholds and Criteria for Undesirable Results

Undesirable results are based on exceedances of MT levels and must be defined not only in terms of how they occur (see Section 9.3.2 Potential Causes of Undesirable Results), but also when and where. By definition, undesirable results are not just drought-related but chronic and are not just local but basin-wide.

Regular groundwater level monitoring (at least three times per year) and annual reporting provides regular updates that allow response by the GSAs and local groundwater users. Management action response times vary. For example, it may take some time for increased replenishment at GRFs to benefit water levels in the Subbasin. Due to some inevitable delays in results from actions, an undesirable result is when water levels fall below MTs for five consecutive same-season events (e.g., five October monitoring events).

Local areas of groundwater level declines can occur due to conditions such as locally increased pumping. However, local declines do not necessarily indicate Subbasin-wide issues such as overdraft. Undesirable groundwater level declines of Subbasin-wide significance could occur due to influences such as severe and prolonged drought, climate change, reduction of imported water supply and increased groundwater pumping. While not likely to occur uniformly across the Indio Subbasin, groundwater level declines could be fairly widespread under these conditions. Significant and undesirable results are defined as occurring when groundwater levels are below the MT for five consecutive same-season monitoring events in 25 percent of Key Wells.

To summarize for the Indio Subbasin:

> The **Minimum Threshold** for undesirable results relative to chronic lowering of groundwater levels is defined at each Key Well by historical groundwater low levels. Undesirable results are indicated when groundwater levels are below the MT for five consecutive same-season monitoring events, in 25 percent or more of the Key Wells in the Indio Subbasin.

9.3.3.4 Measurable Objectives and Interim Milestones

For groundwater levels, the MOs are defined here as an operating range of groundwater levels above the MT, allowing reasonable fluctuations with changing hydrologic and surface water supply conditions and with conjunctive management of surface water and groundwater. The groundwater level MTs represent the bottom of the operating range and are protective of groundwater users and beneficial uses. The top of the operating range is not specified because there is no particular high groundwater level to be a sustainability objective and groundwater levels in many areas are increasing. While unconfined groundwater levels across much of the Subbasin are below historical highs, other areas are characterized by artesian conditions or by use of drainage systems to control high groundwater levels.

> The **Measurable Objective** is to maintain groundwater levels above the groundwater level MTs (as quantified above), and to maintain groundwater levels within the operating range as defined in this section.

Groundwater conditions with respect to chronic groundwater level declines are already sustainable and there is no need to define interim milestones.

9.4 Quantitative Criteria for Groundwater Storage

Groundwater storage is the volume of water in the Subbasin. It provides a reserve for drought or water shortage. The minimum threshold for reduction of groundwater storage is the volume of groundwater that can be withdrawn from a basin or management area without leading to undesirable results. Undesirable results would involve insufficient stored groundwater to sustain beneficial uses through drought or shortage. The storage criteria are closely linked to groundwater levels. Unlike the other sustainability criteria, the reduction of groundwater storage criteria is not defined at individual monitoring sites but is evaluated as a volume on a basin-wide basis. The sustainability indicator for groundwater storage addresses the ability of the groundwater basin to support existing and planned beneficial uses of groundwater even during drought and water supply shortage.

9.4.1 Description, Causes, and Effects of Undesirable Results

As with declines in groundwater level, reduction of groundwater storage could be due to influences such as severe and prolonged drought (locally and/or in imported water source areas), climate change, or a longer-term imbalance of demand over supply. Storage is related to groundwater levels, thus, undesirable results associated with storage would likely be accompanied by one or more undesirable results associated with groundwater levels, including reduced well yields, subsidence, seawater intrusion, and potential depletion of interconnected surface water. Reduction of groundwater storage could affect the ability of groundwater users to support beneficial uses through drought and shortage and have negative effects on the regional economy.

9.4.2 Sustainability Criteria for Groundwater Storage

The potential for reduction of groundwater storage exists for the Indio Subbasin and thus the GSAs have considered minimum thresholds to be defined as the maximum groundwater volume that can be withdrawn without leading to undesirable results. However, use of the groundwater level sustainability criteria (e.g., MTs and MOs) as a proxy for groundwater storage is acceptable provided that GSAs demonstrate a correlation between groundwater levels and storage. Groundwater levels and storage are directly related. This is demonstrated by comparison of groundwater level and storage trends, which reveal similar patterns of historical overdraft, recovery, and response to different water year types including drought (see Chapter 4, *Current and Historical Groundwater Conditions*). The relationship of levels and storage is reflected in the calibrated groundwater flow model (see Chapter 7, *Numerical Model and Plan Scenarios*) that has been used to simulate groundwater levels and storage under projected conditions.

Use of groundwater levels as proxy for storage is responsive to DWR's Recommended Action 2. The rationale for using groundwater levels as a proxy metric for groundwater storage is that the groundwater level MTs and MOs are sufficiently protective to ensure prevention of significant and unreasonable results relating to storage depletion. In brief, groundwater level MTs have been defined to protect beneficial uses and are based on the following:

- A broad geographic distribution of Key Wells that are representative of basin production wells.
- MTs based on historical low groundwater levels that are generally consistent with the historical low storage in about 2009, which occurred without reported well problems.
- Groundwater level MTs involve groundwater levels below the MT for five consecutive same-season monitoring events, in 25 percent or more of the Key Wells in the Indio Subbasin. Thus,

> GSAs are alerted to groundwater level change as it may occur across a broad area, and this perspective will be revealing about storage change as it occurs across the Subbasin.

Accordingly, the MT for storage for the Indio Subbasin is fulfilled by the MT for groundwater levels, modified as follows:

> The **Minimum Threshold** for undesirable results relative to chronic lowering of groundwater levels and depletion of storage is defined at each Key Well by historical groundwater low levels. Undesirable results are indicated when groundwater levels are below the MT for five consecutive same-season monitoring events, in 25 percent or more of the Key Wells in the Indio Subbasin.

For groundwater storage, the MOs is fulfilled by the minimum threshold for groundwater levels, modified as follows:

> The **Measurable Objective** for groundwater storage is to maintain groundwater levels above the groundwater level MTs (as quantified above) and within the operating range as defined in this section.

Groundwater conditions with respect to groundwater levels and storage are sustainable and there is no need to define interim milestones.

9.5 Quantitative Criteria for Land Subsidence

Land subsidence, the differential lowering of the ground surface, can damage structures and hinder surface water drainage. Portions of the Indio Subbasin are susceptible to and have experienced historical subsidence due to groundwater withdrawals (see Chapter 4, *Current and Historical Groundwater Conditions*). In response to subsidence, CVWD and United States Geological Survey (USGS) have collaborated on a series of investigations that documented the location and rate of subsidence and provided a correlation of subsidence to groundwater level declines. The most recent USGS study (Sneed and Brandt, 2020) documented stabilized or rising groundwater levels since 2010 that reflect the combined effect of various projects to increase recharge and reduce groundwater pumping. This study also documented that, although a few areas subsided (albeit at a slower rate), most areas stopped subsiding from 2010 to 2017 and some even uplifted.

9.5.1 Description, Causes, and Effects of Undesirable Results

The land subsidence experienced historically in Indio Subbasin has been caused by declines in groundwater elevations due to pumping exceeding recharge. Potential undesirable results of land subsidence include disruption of surface drainage, water supply conveyance, and flood control facilities; damage to infrastructure such as pipelines, airport runways, railroads, roads, and highways; damage to structures such as housing, septic systems, distribution lines, and piping; and potential subsidence around a production well, disrupting wellhead facilities.

9.5.2 Sustainability Criteria for Land Subsidence

According to the GSP regulations Section 354.28(c)(5), the minimum threshold for land subsidence is defined as the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. However, land subsidence in Indio Subbasin was clearly caused by groundwater level declines, and accordingly, the groundwater level sustainability criteria (MTs and MOs) can be used as a proxy for land subsidence. Use of groundwater levels as proxy for subsidence also is responsive to DWR's Recommended Action 2.

The historical low groundwater levels and storage occurred in about 2009. Since that time groundwater levels have generally increased and subsidence has stopped or slowed, with some variability reflecting different groundwater level trends in specific areas and residual compaction. The *2010 CVWMP Update* indicated that groundwater levels should not be allowed to drop below 2005 levels. However, groundwater levels did generally decline until about 2009 and subsequent USGS study has shown that subsidence rates slowed since about 2010 (Sneed, M. and Brandt, J. T., 2020). Accordingly, the historical low groundwater levels represent a demonstrable turning-point.

While subsidence-induced sagging affected the Coachella Canal (a portion was realigned subsequently in 2014; Sneed, M. and Brandt, J. T., 2020), maintaining groundwater levels above historical lows levels generally is protective against subsidence. Given the mechanics of subsidence, it is unlikely that significant and unreasonable inelastic subsidence would occur with groundwater levels maintained above their MTs.

Accordingly, the MT for land subsidence for the Indio Subbasin is fulfilled by the minimum threshold for groundwater levels, modified as follows:

> The **Minimum Threshold** for defining undesirable results relative to chronic lowering of groundwater levels and subsidence is defined at each Key Well by historical groundwater low levels. Undesirable results are indicated when groundwater levels are below the MT for five consecutive same-season monitoring events, in twenty-five percent or more of the Key Wells in the Indio Subbasin.

For subsidence, the MO is fulfilled by the minimum threshold for groundwater levels, modified as follows:

> The **Measurable Objective** for subsidence is to maintain groundwater levels above the groundwater level MTs (as quantified above), and to maintain groundwater levels within the operating range as defined in this section.

Groundwater conditions with respect to groundwater levels and subsidence are sustainable and there is no need to define interim milestones.

9.6 Interconnected Surface Water and Groundwater-Dependent Ecosystems

As stated in Section 9.1, one of the SGMA undesirable results is depletion of interconnected surface water that has significant and unreasonable adverse impacts on beneficial uses of the surface water. Beneficial uses of surface water are various (recreation, water rights, etc.) but an often-important beneficial use is the existence of Groundwater Dependent Ecosystems (GDEs). GDEs are ecological communities (e.g., riparian vegetation or wetlands) or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.

9.6.1 Background on Indio Subbasin GDEs

As summarized in the *DWR Alternative Assessment Staff Report*, interconnected surface water is described in the Alternative Plan as not being present in the West Valley because groundwater levels are generally much lower than the ground surface. This is substantiated by depth to groundwater mapping (Figure 4-6) that shows depth to groundwater exceeding 100 feet where groundwater level data are available. However, Figures 4-1 and 4-6 also indicate areas where groundwater level data generally are lacking, and these include western canyon areas where Probable GDEs have been identified (see Chapter 4, *Current and Historical Groundwater Conditions*). These Probable GDEs may be associated with surface runoff, snowmelt, or springs and seeps from up-gradient sources.

In the East Valley, depths to regional groundwater generally exceed 20 feet but a shallow semi-perched aquifer zone also is present (see delineated area on Figure 4-6). In areas with shallow, semi-perched groundwater, an agricultural tile drain system was installed in the 1950s through the mid-1970s that allows continued agriculture by providing drainage and salt management.

The DWR Staff Report notes that the groundwater model includes evapotranspiration (ET) by phreatophytic vegetation on undeveloped lands that overlie the semi-perched aquifer area and are not served by the subsurface agricultural drain system in the East Valley. As described in Chapter 7, *Numerical Model and Plan Scenarios,* the current groundwater flow model retained the ET boundary condition, by which ET is calculated by the model based on the extent of the drain system (see Figure 2-5), simulated shallow groundwater elevations, assumed plant rooting depths, and reference ET values. The computed ET rates range from 4,100 to 5,300 AFY and as illustrated in Figure 7-19, are relatively small and uniform over the period 1997-2019. Inclusion of such ET in the model ensures a complete water budget and acknowledges the hydrologic possibility of phreatophyte ET, including potential GDEs but also non-GDE vegetation around agricultural fields and along drainage channels. In brief, the groundwater model indicates the potential for GDEs and accounts for simulated water use (ET) in the water budget.

9.6.2 Identification of GDEs

Vegetation mapping is required to identify the presence of GDEs. In its Staff Report (Recommended Action 7), DWR recommends that the GSAs provide such an identification of groundwater-dependent ecosystems in the Subbasin.

This *Alternative Plan Update* has included a focused study of GDEs in Indio Subbasin. This study, *Indio Subbasin Groundwater Dependent Ecosystems Study,* prepared by a Professional Wetland Scientist, is presented in Appendix 4-B. It included a systematic desktop assessment of the California *Natural Communities Commonly Associated with Groundwater* (NCCAG) database for the Indio Subbasin, a field assessment of 13 selected sites by the wetland scientist and CVWD environmental staff, and identification of probable GDEs, probable non-GDEs, and playa wetland communities. Described in more detail in Chapter 4, *Current and Historical Groundwater Conditions,* and mapped in Figure 4-34, these are defined as follows:

- **Probable GDEs** consist of areas with apparent dense riparian and wetland vegetative communities along mapped drainage systems with potential for deep-rooted phreatophytes, and/or visible, natural surface water flow. These are located along stream channels in upper canyon locations that convey snowmelt, water from cold and hot springs, and mountain front inflow from the surrounding bedrock.
- **Probable Non-GDEs** are areas not correctly mapped in NCCAG including dry upland areas, cultivated and/or flooded agricultural land, obvious human-made ponds, lakes, and other features, channelized drains, and areas with no other indicators of groundwater near the surface, such as dry washes, arroyos, bajadas, and other ephemeral channels where water only flows in response to heavy precipitation events.
- **Playa Wetland Community** included areas of wetland habitat along the Salton Sea exposed seabed (playa) generally downstream of agricultural drains or the Coachella Valley Stormwater Channel (CVSC). The recession of the Salton Sea is exposing thousands of acres of playa each year and water from irrigation ditches and other drainages that previously flowed directly into the Sea now spreads out on the exposed Salton Sea playa where new vegetation and wetlands currently exist.

As described in the next sections, three upper canyon sites have been identified as including Probable GDEs that rely on various up-gradient sources. While recognized as wetland habitat, the Playa Wetland Community habitats are sustained largely by agricultural drain flows and CVSC outflows.

9.6.2.1 Probable GDEs

Probable GDEs are located in the northwestern Indio Subbasin in three canyons along streams (Chino Canyon, Tahquitz, and Palm Canyon creeks). These streams convey mountain front runoff from snowmelt and mountain front recharge, namely subsurface inflow from fractured bedrock along the perimeter of the Indio Subbasin. This mountain front inflow is derived from recharge to mountain areas beyond the Indio Subbasin jurisdiction of the GSAs and sustains the upper canyon flows with runoff, snowmelt, springs (both cold and hot springs), and seeps.

Although flowing into the upper canyon reaches of the Subbasin (see Figure 4-34), the canyon flows are unlikely to be influenced by GSA management and groundwater pumping of the downstream regional groundwater table. This reflects several factors including topographic differences (the canyons are fifty to hundreds of feet higher than the main portion of the Subbasin), and distance upstream and away from active groundwater production areas (see Figure 2-13). While noting that the upper canyon areas with Probable GDEs do not have existing groundwater data, this is because of the lack of local wells and groundwater extraction.

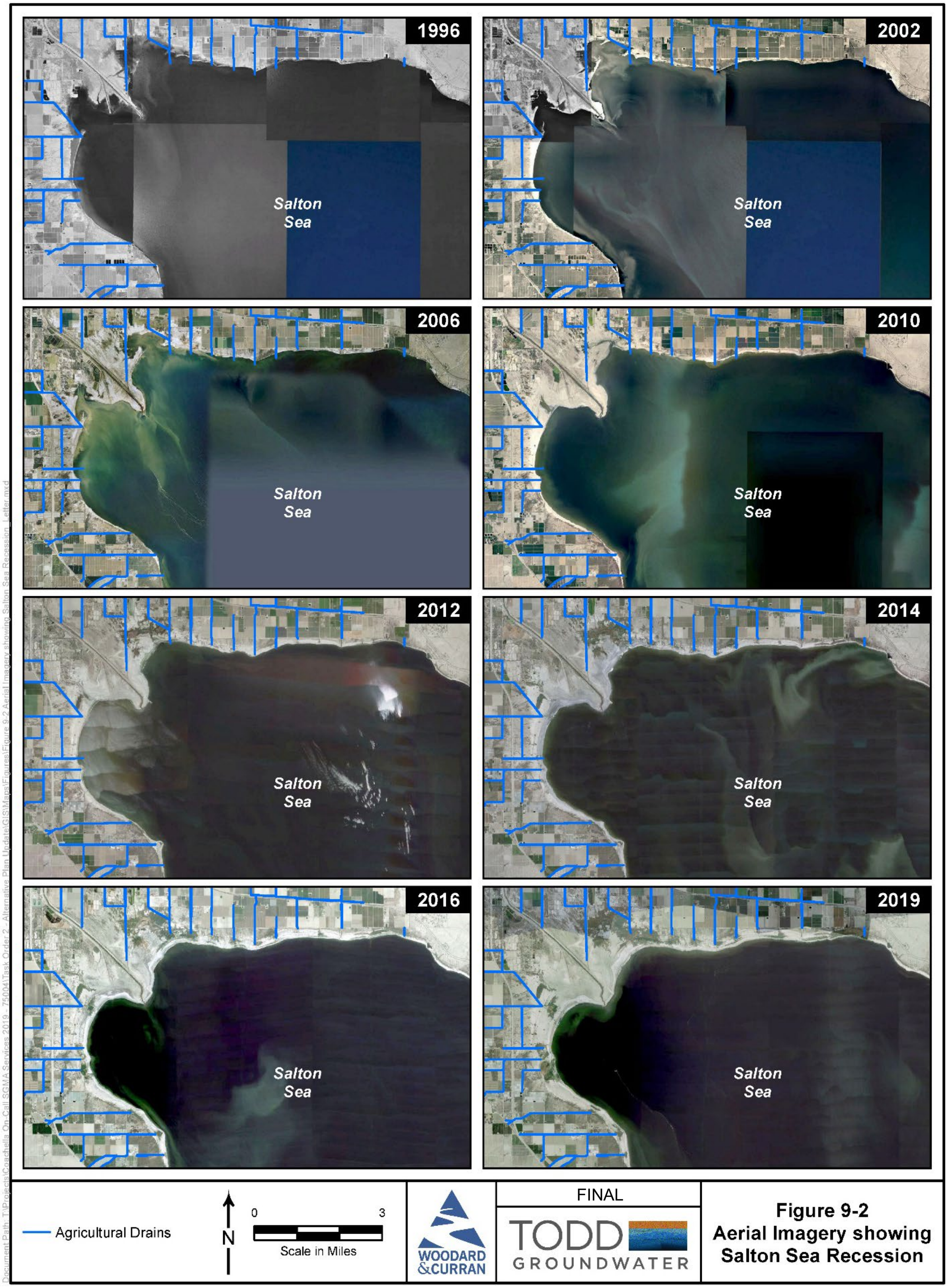
9.6.2.2 Playa Wetland Communities

The Playa Wetland Communities are recognized in the Coachella Valley Multiple Species Habitat Conservation Plan as containing sensitive natural communities and potentially containing desert pupfish habitat. These communities are located at the outlets of agricultural drains and the CVSC and are sustained largely by agricultural drain flows and stormwater channel outflows. As such, these are not associated with depletion of groundwater contributing to interconnected surface water. The agricultural drain system is artificial: designed, built, and maintained for the purpose of conveying agricultural return flows and controlling shallow groundwater levels and quality to allow continued agriculture. The CVSC also is an artificial channel designed and maintained to convey stormwater, drain flows, and other flows to the Salton Sea.

The Salton Sea elevation, however, has declined (for example, by ten feet since 1997 as shown in Figure 7-11) and its shoreline has retreated from the drain outlets and has exposed intervening playa with widths ranging from one quarter mile to more than one mile depending on location. This is illustrated in Figure 9-2 by a series of aerial images for selected years from 1997 to 2019.

As illustrated in Figure 9-2, the Playa Wetland Communities have occurred and expanded as a relatively recent consequence of the shoreline retreat. While the drivers for the location and extent of the wetlands include the drainage outflows coupled with the Salton Sea recession, the relationship between areal extent of the playa wetlands, drain flows, Salton Sea recession, and other factors remain uncertain. The Playa Wetland Communities may continue to change over time affected by continuing Salton Sea recession and by future Salton Sea restoration activities. The interconnection between these factors is uncertain, changing as the Salton Sea recedes, and dependent on other state and federal entities' management of the Salton Sea.

Figure 9-2. Aerial Imagery showing Salton Sea Recession



9.7 Water Quality Constituents of Concern

The *2010 CVWMP Update* identified specific water quality issues including salinity, arsenic, perchlorate, hexavalent chromium (chromium-6), uranium, nitrate, carcinogens, and Endocrine Disrupting Compounds (EDCs). Some of these were regarded as emerging issues, not having violated water quality standards. As noted in the Alternative Plan Bridge document, the *2010 CVWMP Update* did not establish specific water quality thresholds and goals. However, through the Alternative Plan process, the GSAs have continued to identify and track the occurrence of constituents of concern (COCs) with reference to established drinking water standards, have maintained an extensive water quality monitoring program, and have implemented applicable management responses. This is reflected in Chapter 8, *Regulatory and Policy Issues*, and in Chapter 4, *Current and Historical Groundwater Conditions*. Chapter 4, *Current and Historical Groundwater Conditions,* identifies current COCs to include salinity (total dissolved solids or TDS), nitrate, arsenic, chromium-6, uranium, fluoride, perchlorate, and DBCP. These are briefly described in Section 4.4 (along with any drinking water standards) and discussed in terms of occurrence in Indio Subbasin.

In Recommended Action 3, DWR staff recommend that the GSAs provide maps showing the areas affected by the primary water quality constituents of concern, which include, at a minimum, fluoride, arsenic, chromium-6, and DBCP. DWR staff recommend that the maps show the particular wells known to be affected by these constituents.

As documented in Chapter 4, *Current and Historical Groundwater Conditions,* this *Alternative Plan Update* has included substantial collection of water quality data into a database. This was followed by evaluation not only of the mapped extent of the four recommended COCs, but also TDS, nitrate, uranium, and perchlorate (see Figures 4-11 through 4-18). In addition, Chapter 4, *Current and Historical Groundwater Conditions,* provides water quality cross sections for constituents with vertical differentiation (TDS, nitrate, arsenic, and chromium-6) and time concentration plots that represent temporal trends in TDS and nitrate.

9.7.1 Description, Causes, and Effects of Undesirable Results

In addition to salinity, the DWR Staff Report identifies fluoride, arsenic, chromium-6, and DBCP as a minimum list of primary water quality COCs. Given that, the following brief summaries are provided along with summaries of the GSA-identified COCs of uranium and perchlorate. These summaries include the drinking water standard (Maximum Contaminant Level [MCL]), general cause of the COC occurrence, distribution in the Subbasin, and management response. The following COCs are linked to potential health effects and all are being monitored. GSAs are addressing COC problems through efforts (such as the CVWD Disadvantaged Communities Infrastructure Task Force) to identify and consolidate small water systems with water quality and reliability issues. Chapter 4, *Current and Historical Groundwater Conditions,* and Chapter 8, *Regulatory and Policy Issues,* provide additional documentation and discussion.

- **Nitrate** has a primary drinking water MCL of 45 mg/L, measured as nitrate. Nitrate concentrations in Indio Subbasin groundwater are variable, reflecting multiple sources such as historical extent of mesquite forests; use of nitrogen-based fertilizers for agriculture, golf courses, and landscaping; septic tank percolation; and wastewater disposal through percolation. Large water systems selectively drill wells in areas with low nitrate concentrations and have deactivated historically affected wells. The GSAs are assisting small water systems as noted above.

- **Arsenic** has a primary drinking water MCL of 10 micrograms per liter (µg/L). It is naturally occurring with high concentrations locally in the Indio Subbasin and at depth. Arsenic has been addressed in large public water systems by selectively drilling wells in areas or to depths with low arsenic concentrations, by decommissioning affected wells, or by providing water treatment to remove arsenic prior to delivery. Riverside County and the GSAs are assisting small water systems is being addressed by affected by arsenic as noted above.
- Chromium-6 in Indio Subbasin is naturally occurring with relatively higher concentrations in the Thousand Palms and central Thermal Subareas. The total chromium (hexavalent and trivalent) primary MCL is 50 µg/L, but an MCL of 10 µg/L for chromium-6 was set in 2014 and later rescinded. As discussed in Chapter 8, *Regulatory and Policy Issues,* the GSAs have anticipated a chromium-6 MCL that is lower than the total chromium MCL and have investigated possible water treatment options. Replenishment activities may reduce chromium-6 concentrations.
- **Uranium** has a primary MCL of 20 picocuries per liter (pCi/L), or about 30 µg/L. Uranium in Indio Subbasin is naturally occurring with high concentrations in the northwestern portion. However, concentrations greater than the MCL have been detected in only four shallow monitoring wells.
- **Fluoride** has a primary drinking water MCL of 2 mg/L. It is naturally occurring and found in high concentrations along the eastern side of the Indio Subbasin and northern boundary of the Salton Sea. Large water systems selectively drill wells in areas with low fluoride concentrations or provide treatment, and small water systems are assisted by the GSAs as noted above.
- **Perchlorate** has a primary MCL of 6 µg/L and has been detected locally in Indio Subbasin. It may be natural but also is associated with historical manufacturing contamination that affected the Colorado River and has since been mitigated to below detection levels.
- **DBCP** is a pesticide with a primary MCL of 0.2 µg/L. While banned since 1979 it is persistent in groundwater. It has been detected in private irrigation wells in a localized area of central Thermal Subarea. CVWD has managed replenishment to avoid mobilizing DBCP.

Salinity (TDS) is addressed in a subsequent section. Unlike the COCs above, TDS is regulated by Secondary MCLs (or Consumer Acceptance Contaminant Level Ranges) that are set by the SWRCB based on aesthetic concerns such as taste, color, and odor.

9.7.2 Evaluation of Sustainability

The *DWR Staff Report* finds that the Indio Subbasin GSAs have reasonable quantifications and standards related to groundwater quality, with a recommendation to provide maps to facilitate its ongoing evaluation of the Alternative Plan relative to achieving sustainability. These are provided in Chapter 4, *Current and Historical Groundwater Conditions,* along with other water quality information. As summarized in the Bridge Document, the Alternative Plan has included identification of COCs, monitoring of groundwater quality, tracking relative to drinking water standards (as relevant), reporting, and management actions. This *Alternative Plan Update* has improved the data compilation and management relative to water quality COCs and the documentation of groundwater quality conditions.

Groundwater quality monitoring, data compilation, and data review will continue on an established regular basis (see Chapter 10, *Monitoring Program*) and will detect emerging issues or water quality problems. The 5-Year Alternative Plan Updates will be sufficient for comprehensive examination of water quality conditions relative to COCs such as listed above, given that groundwater quality conditions generally do not change rapidly. Groundwater quality conditions can be documented with maps and other graphics as warranted.

Additional efforts to define sustainability indicators or to set specific quantitative thresholds are not needed at this time for COCs such as those listed above. However, if a COC water quality condition develops or is recognized with significant and unreasonable results throughout the Subbasin and associated with Subbasin management activities, the ongoing monitoring allows detection, analysis, and reporting of the issue.

9.8 Water Quality Management

The Alternative Plan has recognized salt addition from imported Colorado River water as a significant impact related to managing groundwater overdraft. Elimination of overdraft was identified in the *2002 CVWMP* and retained in the *2010 CVWMP Update* as a primary goal. This goal recognized the multiple adverse effects of overdraft including chronic groundwater level declines, storage depletion, irreversible subsidence, and seawater intrusion potentially resulting in permanent loss of freshwater storage. Importation of Colorado River water for irrigation and for replenishment was recognized as critical for halting overdraft although it added salts. The Alternative Plan (including the *2002 CVWMP* and *2010 CVWMP Update*) has included ongoing studies to assess the addition of salts and to identify reasonable projects and management action.

As summarized in the *DWR Staff Report*, the GSAs have demonstrated understanding of the water quality impacts associated with using Colorado River to replenish groundwater and have investigated various means to address such impacts, including preparation of a SNMP. As a near-term path toward sustainability with regard to salt management, the *DWR Staff Report* strongly encouraged the GSAs to further quantify the nature and scope of water quality issues associated with water importation, to establish reasonable and achievable standards, and to begin to adopt and implement projects and management actions to achieve sustainability with regard to groundwater quality.

Specifically, in Recommended Actions 4 and 4a, DWR staff recommend that the GSAs incorporate an approved SNMP into future iterations of the Alternative Plan and continue efforts to study the rate and level of increased salt contents in groundwater due to importation of Colorado River water.

9.8.1 Description, Causes, and Effects of Undesirable Results

Salinity was described in the *2002 CVWMP* and *2010 CVWMP Update* in terms of the salt balance (salt inputs, salt outputs, and net addition). Those descriptions have been supplemented in Chapter 4, *Current and Historical Groundwater Conditions,* of this Update. Section 4.4, Groundwater Quality, presents a TDS map representing recent conditions, water quality cross sections, and time concentration plots that show temporal trends in TDS.

As discussed in Chapter 4, *Current and Historical Groundwater Conditions*, groundwater in the Indio Subbasin shows a wide range of salinity, measured in terms of TDS concentrations. TDS is regulated by Secondary MCLs (or Consumer Acceptance Contaminant Level Ranges) that are set by the SWRCB based on aesthetic concerns such as taste, color, and odor. Undesirable results of elevated TDS to drinking water systems can include damage to plumbing and appliances, increased treatment costs, use of bottled water, and increased sampling and monitoring. A recommended level is 500 mg/L, an upper level is 1,000 mg/L, and a short-term level is 1,500 mg/L.

The spatial distribution of TDS (see Figure 4-11) shows a general range of concentrations from less than 250 mg/L in the center of the Subbasin to more than 1,500 mg/L near the Salton Sea. Similarly, the water quality cross sections in Chapter 4, *Current and Historical Groundwater Conditions,* indicate that TDS concentrations generally are less than 500 mg/L with lowest concentrations in deep wells in the central Indio Subbasin. TDS concentrations in shallow zones typically are higher and more variable than in deeper zones.

CVWD monitors water quality in groundwater, surface water, and recycled water.

The spatial and vertical distribution of TDS in groundwater reflects multiple sources including deep infiltration of precipitation, percolation of precipitation runoff, recharge of imported Colorado River water, percolation of treated wastewater, seepage from septic systems, return flows from agricultural and landscape irrigation, and subsurface inflows from adjacent bedrock, other Subbasins (e.g., Desert Hot Springs Subbasin) and deep thermal sources (West Yost, 2021). Historical intrusion from the Salton Sea also has been indicated (see Section 9.10). In addition, the occurrence and distribution of TDS in the Indio Subbasin has been influenced by historical land uses and water/wastewater management practices.

Percolation through the soil and unsaturated zone involves complex processes that affect the volume, concentration, and specific constituents of TDS; these processes include evapotranspiration that concentrates salts in the root zone and geochemical transformations. Once in the groundwater system, the groundwater flow generally is from northwest to southeast (toward the Salton Sea). However, salt migration through the groundwater system (both vertical and horizontal) is driven by dynamics of groundwater recharge and discharge and thus influenced not only by recharge/percolation, but also by groundwater pumping and the presence of agricultural drain systems that intercept and discharge shallow groundwater. Such relationships are particularly important in the East Valley, where higher salinity occurs in perched and shallow zones. Under conditions of overdraft, lowered groundwater levels in the deep Principal aquifer can result in a downward groundwater flow gradient that could allow higher salinity water to migrate downward to affect deeper zones. Reversal of overdraft and restoration of upward gradients flushes the saline perched water into the agricultural drains and out of the system, thereby protecting deep groundwater quality.

Outflows of TDS from the groundwater systems are primarily through groundwater pumping, agricultural drain flows to the CVSC and Salton Sea, and subsurface outflow toward the Salton Sea.

9.8.2 Salt and Nutrient Management Plan

A SNMP was developed by the CVWD, DWA, and IWA and submitted to the Colorado River RWQCB in 2015. The 2015 Coachella Valley SNMP describes hydrogeology, ambient groundwater quality, projected water quality, objectives, management strategies, and a monitoring plan. However, in a letter (RWQCB, February 19, 2020), the RWQCB provided comments and recommendations on the 2015 SNMP's compliance with the updated Recycled Water Policy (Colorado River Basin RWQCB, 2020).

The *Salt and Nutrient Management Plan for the Coachella Valley Groundwater Basin* (CV-SNMP) was restarted in 2020 by the CV-SNMP agencies (water and wastewater agencies including CVWD, CWA and Coachella Sanitary District, DWA, IWA, Myoma Dunes Mutual Water Company, VSD, MSWD, and City of Palm Springs) working in cooperation with RWQCB staff. This has involved preparing a SNMP Development Workplan to define the approach to be used to update the CV-SNMP in a manner that addresses management of salts and nutrients from all sources in order to protect beneficial uses, comply with the Recycled Water Policy (as revised in 2018, see Chapter 8, *Regulatory and Policy Issues*), and to address the specific findings and recommendations previously provided by RWQCB staff. The *SNMP Development Workplan* includes a Groundwater Monitoring Program Workplan (West Yost, 2020) to define the updated SNMP monitoring network, including wells needed to address network gaps, which will be used to monitor the spatial and vertical distribution of salts and nutrients in the Basin.

As of August 2021, workplan development has included preparation of a *Groundwater Monitoring Workplan*, which was approved by the RWQCB on February 21, 2021. The agencies have begun implementing the *Groundwater Monitoring Program Workplan* and will submit annual reports to the RWQCB by March 31 of each year beginning in 2022. A draft *SNMP Development Workplan* was submitted to the RWQCB on May 3, 2021 (West Yost, 2021). The agencies are working on integrating comments received from the RWQCB and will submit the final *SNMP Development Workplan* in September 2021. Implementation of the *SNMP Development Workplan* is scheduled to begin during the first quarter of 2022.

The SNMP update and *Alternative Plan Update* are coordinated efforts. Elements of this Plan Update specifically supporting the SNMP include:

- Collection and organization of water quality data into a database
- Evaluation of the sources, areal extent, vertical distribution, and time trends for TDS and nitrate
- Analysis of the water budget (which supports analysis of TDS and nutrient loading, assimilative capacity, etc.)
- Update and refinement of the numerical model (a potential basis for fate and transport modeling)
- Improvement of the monitoring program relative to TDS, nitrate, and shallow/deep zones
- Identification of projects and actions relevant to water quality management.

The CV-SNMP addresses the Coachella Valley Groundwater Basin (DWR Basin No. 7-021 excluding the San Gorgonio Pass Subbasin) and therefore includes the Indio Subbasin. The *Alternative Plan Update* can incorporate elements of an approved SNMP relevant to the Indio Subbasin and within the context of the basin-wide SNMP. Progress on the implementation of the *SNMP Development Workplan* will be provided in the Indio Subbasin Annual Reports and the next 5-year *Alternative Plan Update*.

9.8.3 Continuing Studies of Salinity in Groundwater

Staff of both DWR and the Colorado River Basin RWQCB have recommended additional study of salinity in groundwater. The DWR Staff Report (Recommendation 4a) calls for continuation of efforts to study the rate and level of increased salt contents in groundwater due to Colorado River importation.

Additional study of salinity in groundwater—including analysis of the rate and level of increased salt contents in groundwater due to Colorado River importation—will be achieved in large part by the CV-SNMP update. Such analysis will be based on data collection to characterize TDS and nitrate loading, including not only quality data but also volumes of multiple sources such as subsurface inflow, replenishment (including the Colorado River sources), wastewater and recycled water, septic systems, and applied water. The analysis also will include characterization of current groundwater quality in all Subbasin areas/Subareas (with delineation of Management Zones), identification of areas of historical changes, and documentation of historical trends in TDS and nitrate loading. Overall, the analysis will satisfy the recommendation for more information on the rate and level of increased salt due to Colorado River importation.

More broadly, these analyses provide the necessary baseline for SNMP forecasting of TDS and nitrate concentrations in groundwater. The forecasting (using enhanced modeling tools to be developed as part of the SNMP update) will involve simulation of a baseline scenario and management scenarios. Subsequent selection of a preferred CV-SNMP scenario can be the basis for establishment of management zones (including consideration of vulnerable areas), description of groundwater beneficial uses for each management zone, recommendation of numeric TDS objectives for each management zone, identification of projects and management actions, and development of implementation measures and schedules to achieve sustainability with regard to groundwater quality.

In addition to the CV-SNMP, this *Alternative Plan Update* has included the systematic efforts of building the data management system, analyzing available water quality data, reviewing the results for data gaps, and planning for new monitoring sites. While not implemented solely to understand salinity, the update and refinement of the numerical groundwater flow model, assessment of the groundwater basin water budget, and quantification of water supplies and demands all contribute to understanding of the groundwater system, which is fundamental to studying salinity.

The assessment of the monitoring network for this Update has been coordinated with the development of the *CV-SNMP Development Workplan*, which includes a *Groundwater Monitoring Program Workplan* (West Yost, 2020). The *CV-SNMP Groundwater Monitoring Program Workplan* describes the physical setting of the groundwater basin as context for the monitoring network, presents an initial sampling network, identifies existing spatial and vertical gaps in the monitoring network, and describes how the gaps will be filled and how the monitoring program will be implemented. Specific wells are identified for groundwater sampling, including 83 wells representing the shallow aquifer system, 98 wells for the deep aquifer system, and 6 wells for the perched aquifer system. The *SNMP Groundwater Monitoring Program Workplan* also identified 23 gaps in the monitoring network and provides justification for filling these gaps. Reasons for inclusion in the SNMP monitoring program include spatial gaps and the need for tracking potential sources such as subsurface inflows, WWTP discharges, septic tank areas, agricultural and landscaping/golf course areas.

As part of ongoing groundwater basin management in 2021, the GSAs have prepared two applications to DWR for Technical Support Services to install new monitoring wells in the Indio Subbasin and Mission Creek Subbasin. The proposed monitoring wells would provide both groundwater levels and quality data, and thereby support improved basin management for the *Indio Subbasin Alternative Plan Update*, *Mission Creek Alternative Plan Update*, and the CV-SNMP.

9.9 Drain Flow Evaluation

As presented in Chapter 2, *Plan Area,* and Chapter 3, *Hydrogeologic Conceptual Model,* an extensive agricultural drainage system (both subsurface tile drainage systems and surface drains) was installed in the East Valley to control high water table conditions, to intercept poor quality shallow groundwater, and to convey the water to the CVSC and Salton Sea. Drain flows are measured at 27 drains and the CVSC, and also have been simulated using the numerical model.

In its Staff Report (Recommended Action 6), DWR recommends clarification of whether there is a minimum threshold associated with the amount of subsurface drain flow below which significant and unreasonable undesirable results would occur, and what that quantified minimum threshold is, if applicable, and the implementation horizon for when the goal for the amount of subsurface flow will be achieved.

As a matter of clarification, the *2010 CVWMP Update* presented simulated drain flows based on modeling of future water supply and management scenarios at the time. This *Alternative Plan Update* revises some of the planning assumptions used in the *2010 CVWMP Update* (see Chapter 7, *Numerical Model and Plan Scenarios,* for updated scenarios) based on current conditions. The 2010 model simulations provided a range of potential 2045 drain flows and predicted that drain flows generally would increase. Higher drain flows are beneficial because they are a response to higher groundwater levels in the East Valley which are protective of the deep aquifer and because they promote export of salt from the Subbasin.

The Grant Street Drain is part of CVWD's agricultural drain system.

As discussed above, drain flows presented in the *2010 CVWMP Update* were an output of the model representing projected cumulative drain flows from open drains and the CVSC. While providing useful simulations, analysis, and guidance for water management planning, the *2010 CVWMP Update* did not present a minimum threshold for drain flows as now understood under SGMA and GSP Regulations. Instead, a more direct metric for evaluating sustainability with regard to protection of the deep aquifer and salt export is being considered by the GSAs.

CVWD will be undertaking a drain flow study (see Chapter 12, *Plan Evaluation and Implementation*) to improve understanding of the relationships among groundwater levels, drain flows, salt export, and protection of the deep aquifer throughout the confined aquifer areas in the East Valley. The Drain Flow Study will study the relationship between groundwater levels in the various aquifers, current and historical crop water application, and flows and salt export through the drain system. Geochemical and isotope studies may be implemented to assess potential water sources (return flows vs rising groundwater) of drain flows. This study will utilize available groundwater and drain flow information; drain flows have been measured monthly at 27 drain sites since 1985 and water quality sampling has occurred at least annually at 25 sites since 1992. The drain flow study will include review of the amount, location, timing, and water quality of flows at all drain locations and the CVSC. In addition, planned monitoring well network improvements will yield additional data on perched, shallow, and deep groundwater levels and quality. All data will be compiled into a GIS database as part of the Data Management System (DMS). In addition, the drain flow study can support calibration of the numerical model (which simulate drain flows as an output) and provide important input to any salt balance studies.

By way of background, downward migration of groundwater is a function not only of geology (i.e., the fine-grained aquitard in the East Valley; see Chapter 3, *Hydrogeologic Conceptual Model*), but largely of vertical hydraulic head differences. Available data indicate that high groundwater levels in the deep zones are generally protective of those deep zones. This is substantiated by the evaluation of TDS and nitrate concentrations with depth in East Valley cross sections (Figures 4-30 through 4-33) that show low concentrations of TDS and nitrate at depth, despite decades of active irrigated agriculture, and higher concentrations in shallow zones. It is also supported by the TDS and nitrate time-concentration plots (e.g., Figure 4-34) that indicate relatively low concentrations in deep wells and less variability, indicating reduced exposure to shallow influences.

Building on the *2010 CVWMP Update*, and applying the concepts of SGMA, the GSAs have defined a specific, potential undesirable result, which is degradation of water quality in the deep Principal Aquifer due to downward migration of water with elevated TDS levels found in shallow groundwater zones. High groundwater levels in the deep zone have a direct relationship with good water quality at depth, and accordingly, the GSAs are considering groundwater levels as an appropriate proxy.

According to SGMA, groundwater levels can serve as a useful proxy for a minimum threshold. However, documentation of a strong correlation is needed between the metric (groundwater levels) and the specific undesirable result being assessed (degradation of the deep Principal Aquifer). This documentation is provided in part by this *Alternative Plan Update*. Additional information will be provided by the new monitoring wells being installed in 2021, specifically with regard to differentiation of shallow and deep groundwater levels and quality. Assuming that groundwater levels can be serve as proxy, a subsequent step will involve identification of representative monitoring sites and establishment of minimum thresholds. with respect to protecting deep water quality.

9.10 Seawater intrusion

SGMA generally has perceived seawater intrusion relative to the Pacific Ocean and not an inland body such as the Salton Sea. The Salton Sea is distinguished by several aspects: salinity in excess of 69 parts per thousand (about twice the amount in the ocean), salinity that gradually is rising, surface water levels that are decreasing, and a shoreline that is retreating.

9.10.1 Background on Monitoring and Management for Seawater Intrusion

Seawater intrusion from the Salton Sea has been emphasized in the Alternative Plan as a potentially substantial and irreversible consequence of overdraft, whereby reduced groundwater pressure in Subbasin aquifers would cause relatively dense saline water to intrude and displace freshwater. The *2002 CVWMP Update* noted the difficulties in reversing seawater intrusion and removing salts with the potential for permanent loss of freshwater storage. Thus, seawater intrusion is a consequence of overdraft with undesirable results including adverse effects on groundwater quality and associated loss of groundwater supply and loss of groundwater storage.

Recognizing these potential undesirable results in the context of overdraft in the East Valley, the *2002 CVWMP* and *2010 CVWMP Update* identified and implemented projects and management actions to halt overdraft. These projects and actions including groundwater replenishment, source substitution, and conservation have been successful in halting and reversing groundwater level declines, increasing groundwater storage, and restoring groundwater outflows to stop seawater intrusion.

CVWD installed nested monitoring wells in 1995 and 2002 near the Salton Sea to provide site-specific data to assess the risk of seawater intrusion (see list in Table 10-2). Monitoring of these wells for levels and quality (as part of the overall monitoring program) allows documentation of areal and vertical extent of seawater intrusion (if any in the vicinity of the wells) and tracking of trends that could provide early warning of seawater intrusion. Groundwater quality constituents including TDS and chloride are tracked in the nested monitoring wells. While TDS concentrations in one of the deepest zones (deeper than 1,430 feet below ground surface) are elevated and fluctuating (see Chapter 4, *Current and Historical Groundwater Conditions*), the nested monitoring wells have shown no evidence that seawater intrusion is occurring.

In addition, local groundwater management (see Chapter 4, *Current and Historical Groundwater Conditions*) has focused on minimizing potential seawater intrusion by increasing groundwater levels and restoring groundwater outflow to the Salton Sea. While protective groundwater elevations were not determined, the groundwater flow model was applied to evaluate seawater intrusion as a potential inflow to the Indio Subbasin groundwater. This approach has provided a broad indicator of the risk of seawater intrusion.

The DWR Staff Report acknowledges the Alternative Plan approach and in Recommended Action 5 indicates the following recommended actions for the Update as rephrased below:

- Discuss why the water balance includes inflow from the Salton Sea to the Indio Subbasin.
- Discuss how recent groundwater levels near the Salton Sea compare to the modeled elevation.
- Correlate Salton Sea inflow with recent groundwater levels and the groundwater model.
- Provide the modeled groundwater elevation that minimizes the risk of saltwater intrusion.

Each of these is addressed in the following sections.

9.10.2 Water Balance and Inflow from Salton Sea

DWR recommended discussion of why the water balance includes inflow from the Salton Sea to the Indio Subbasin. This question is relevant to the water balance (see Chapter 7, *Numerical Model and Plan Scenarios*) and to a description of the undesirable results of seawater intrusion. The undesirable results of Salton Sea intrusion have been long recognized in the Indio Subbasin as degradation of water quality and loss of freshwater storage.

The water balance includes inflow from the Salton Sea because it includes all inflows and outflows to the Subbasin and then uses the groundwater flow model to compute water levels and change in storage. Accounting for all elements of the water balance is fundamental to understanding the local groundwater system. In other words, seawater intrusion is considered an inflow to the water balance but is not considered a groundwater supply.

9.10.3 Groundwater Elevations and Salton Sea Inflow

DWR recommended discussion of how recent groundwater levels near the Salton Sea compare to the modeled elevation. The correlation of measured and modeled groundwater levels near the Salton Sea is illustrated in Figure 7-17 showing model calibration hydrographs. As discussed in Chapter 7, *Numerical Model and Plan Scenarios,* the model is very well calibrated.

With regard to Salton Sea inflow, the groundwater flow model has been used to simulate flow between the Indio Subbasin and the Salton Sea. For this Plan Update, the *2010 CVWMP Update* model input data were updated for 1997-2019, and some were modified including addition of Salton Sea bathymetry and use of Salton Sea elevations for 2009-2019 to account for Salton Sea level declines. As illustrated in Figure 7-20, inflows from Salton Sea have decreased since about 2005 and outflows to the sea have increased. Net groundwater outflow to the Sea first occurred in 2015. This is consistent with generally increasing groundwater levels after about 2010.

Groundwater elevation contour maps are provided in the Indio Subbasin Annual Reports for water years 2016-2017, 2017-2018, 2018-2019, and 2019-2020, roughly the period when groundwater outflows to the Salton Sea have exceeded inflows. For reference, the elevation of the Salton Sea has declined from about -235 to -238 feet msl over this period. Review of these maps (with a focus on the groundwater elevation contours closest to the Salton Sea) show the -200-foot contour crossing the shoreline in 2016-2017 and 2017-2018. In the successive two maps, the -200-foot contour is completely inland (as is the -220-foot contour) indicating that groundwater levels have risen. At the shoreline, current groundwater levels are mapped as about 18 feet above the current Salton Sea level. This differential would increase with Salton Sea level decline and with groundwater level rise.

In Chapter 7, *Numerical Model and Plan Scenarios,* Figure 7-14 shows the simulated groundwater elevations in 2020 for the shallow and deep aquifers. Consistent with the 2019-2020 measured data, the -200 foot and -220 foot contours in the shallow aquifer are inland of the shoreline and higher than the sea while the –200 foot contour for the deep aquifer crosses the shoreline, indicating upward groundwater flow. These modeled groundwater elevations indicate a minimal risk of saltwater intrusion.

Regular review of simulated groundwater elevations in the vicinity of the Salton Sea is warranted in addition to the data review and water budget modeling as part of the Annual Reports and 5-Year Updates. The nested wells provide real data on local groundwater quality from discrete depth zones, any of which could potentially be affected by seawater intrusion. Complementary to the local, zone-specific data is the modeling assessment of outflows and inflows, which provides a broad indicator of net potential for seawater intrusion for the Subbasin.

Similarly, the simulated groundwater elevations can be used as a general indicator of the relative risk of seawater intrusion along the shoreline. Such use of simulated groundwater levels is not a substitute for analysis of measured groundwater levels. However, it can be a reasonable, cost-effective indicator given the low potential for seawater intrusion, as evidenced by the net outflow of groundwater from the Subbasin to the Salton Sea and the lack of data indicating seawater intrusion.

In addition, Salton Sea water levels are currently decreasing, and the shoreline is retreating. Accordingly, the risk of seawater intrusion is declining. Review of any groundwater levels relative to the Salton Sea water levels will need to be monitored and evaluated regularly until the Salton Sea is stabilized.

CHAPTER 10: MONITORING PROGRAM

The Indio Subbasin has been extensively monitored by the Groundwater Sustainability Agency (GSAs) for decades, guided by the primary objective to evaluate the effectiveness of water management programs and projects and to modify actions and plans based on factual data. This *Alternative Plan Update* continues and builds on the existing monitoring programs as presented in previous CVWMP documents and summarized in the Bridge Document (Indio Subbasin GSAs, 2016; see also summary in Chapter 2, *Plan Area*).

This chapter includes description of the monitoring network, methods and protocols for data collection, and development and maintenance of the data management system (DMS). The monitoring program has been assessed with reference to the sustainability goal and objectives, data gaps have been reviewed, and improvements have been identified for implementation.

10.1 Description of Monitoring Network

As summarized in the following sections, the Monitoring Network addresses groundwater levels, climate and hydrology, groundwater production, subsidence, water quality, and seawater intrusion.

Table 10-1 and the following text provide a summary of the monitoring network, which documents groundwater and related surface water and subsidence conditions, in terms of the type of measurement, monitoring site locations and spatial coverage, monitoring frequency, and involved agencies. In most cases, monitored data are compiled and summarized in Annual Reports; these data will also be used to update the *Alternative Plan Update* in 5 years.

Table 10-1 also documents other sources of data that are important input to the water budget analysis and to update of the numerical model. These include managed water supplies and deliveries, such as imported water deliveries, groundwater replenishment volumes, wastewater percolation and water recycling, and municipal water use. As shown, these are mostly metered, and the data are compiled monthly and documented in the Annual Report as part of the water budget analysis.

The GSAs monitor groundwater levels and quality.

Table 10-1. Summary of the Monitoring Network

Monitored Variable	Type of Measurement	Locations	Data Interval	Data Collection Agency	Database Storage Agency	Notes
Groundwater Levels						
Groundwater levels	Depth to water, feet	345 wells in Indio Subbasin	Quarterly to Semiannual	All GSAs	Indio GSAs	Protocols detailed in Section 10.2.2
Climate and Hydrology						
Rainfall	Rain gauge, daily total, inches	12 Riverside County stations	Daily	Riverside County Flood Control and Water Conservation District	Riverside County Flood Control and Water Conservation District	Download from web annually for annual water budget and model update
Reference ET (ET_0)	Daily ETo, inches	4 CIMIS Stations	Daily	CA DWR, CIMIS program	CIMIS	Download from web
Stream flow	Daily average flow, cfs	19 active USGS gages	Daily/15 min interval	USGS	USGS	Download from web
Drain flows	cubic feet per second, cfs or total flow AF	27 sites	Monthly	CVWD	Indio GSAs	
Groundwater Production						
Agricultural	Metered monthly total pumping by well, if above threshold (above 25 AFY in CVWD and above 10 AFY in DWA)	Agricultural irrigation well locations	Monthly	CVWD, DWA	Indio GSAs	Pumping threshold is above 25 AFY in CVWD and above 10 AFY in DWA

Monitored Variable	Type of Measurement	Locations	Data Interval	Data Collection Agency	Database Storage Agency	Notes
Golf Course	Metered monthly total pumping by well if above threshold (above 25 AFY in CVWD and above 10 AFY in DWA)	Golf well locations	Monthly	CVWD, DWA	Indio GSAs	
Municipal	Metered monthly total pumping by well if above threshold (above 25 AFY in CVWD and above 10 AFY in DWA)	Municipal well locations	Monthly	Indio GSA	Indio GSAs	
Community Water Systems	Systems with pumping above threshold are metered (above 25 AFY in CVWD and above 10 AFY in DWA).	Community Water System wells with meters	Monthly	CVWD, DWA	Indio GSAs	
Other (e.g., private individual wells)	Metered groundwater use (above 25 AFY in CVWD and above 10 AFY in DWA)	Well locations	Monthly	CVWD, DWA	Indio GSAs	

Monitored Variable	Type of Measurement	Locations	Data Interval	Data Collection Agency	Database Storage Agency	Notes
Subsidence						
Subsidence	InSAR satellite mapping of ground displacement, and GSP Stations	California groundwater basins including Indio Subbasin	Displacement, 2015-2020, 2019-2020, Annual updated from DWR	DWR (InSAR)	DWR SGMA Data Portal	Download annually, smooth InSAR raster data sets (see Section 6.4.4.6), compare cumulative elevation change since 2015 against Minimum Threshold criterion.
Subsidence	USGS	Coachella Valley	2015-2023	USGS	USGS	Published report to be provided by USGS before June 30, 2025.
Groundwater Quality						
Indio Groundwater Quality Monitoring Program including monitoring for CV-SNMP	Specific conductance, TDS, N, and general minerals	Existing wells in Indio Subbasin (98 deep, 83 shallow, 6 perched) and 23 proposed well locations	Quarterly/ Triannual	All GSAs and CV-SNMP Agencies	Indio GSAs/GAMA	Additional constituents; COCs
Compliance Monitoring - RWQCB	Varies depending on discharge order	WWTP, WRP, other regulated facilities	Various	All GSAs	SWRCB Geotracker database	Download data annually from Geotracker
Municipal systems	Specific conductance, TDS, N, and general minerals; Title 22	Municipal supply wells	Monthly	All GSAs	Indio GSAs	Water quality collected by GSAs and submitted to DDW

Monitored Variable	Type of Measurement	Locations	Data Interval	Data Collection Agency	Database Storage Agency	Notes
Rural ag/domestic wells; community water systems;	Specific conductance, N, and other constituents (depending on monitoring agency)	About 90 wells in Indio	Various	DDW, RWQCB, USGS, DWR, DPR	SWRCB GAMA database	Download data every three years from GAMA
Other Water Budget Elements						
Canal deliveries- All Uses	Metered water deliveries, AF	All points of delivery	Monthly	CVWD	Indio GSAs	
Surface Water Diversion	Volume diverted from tributary watersheds, AF	Whitewater River, Snow Creek, Falls Creek , and Chino Creek	Monthly	DWA	Indio GSAs	
Groundwater Replenishment	Reported as acre-feet per month	Whitewater, Thomas E Levy, Palm Desert GRFs	Monthly	CVWD, DWA	Indio GSAs	
Wastewater percolation ponds losses	WWTP effluent discharge, evaporation, percolation, AF	WWTPs	Monthly	CVWD, DWA	Indio GSAs	
Wastewater discharge to CVSC	AF	CVSC	Monthly	CVWD	Indio GSAs	
Recycled water use	Recycled water delivery, AF	CVWD DWA	Monthly	CVWD, DWA	Indio GSAs	
Municipal Water Use	Metered water use by use type (residential, commercial, industrial, etc.)	All water retailers	Monthly	All GSAs	Indio GSAs	
Crop Census	Land Use by crop type, acreage	CVWD	Trimester	CVWD	Indio GSAs	
Salton Sea Elevation		Salton Sea		USGS	USGS	

10.1.1 Groundwater Levels

As described in Chapter 2, *Plan Area*, the Indio Subbasin GSAs monitor groundwater levels in 345 wells as part of their respective groundwater level monitoring programs (Figure 2-11 shows the wells in the current monitoring network). As shown, 52 of these wells have been monitored by the Indio Subbasin GSAs and Mission Springs Water District (MSWD) as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) program. As part of implementation, the GSAs will upload water levels for the Key Wells (see Chapter 9, *Sustainable Management*) to the Department of Water Resources (DWR) Monitoring Well Module and data will be publicly accessible.

Monitoring well located at PD-GRF.

10.1.1.1 Spatial and Vertical Coverage

Locations of all wells monitored for groundwater levels are shown in Figure 2-11, while Figure 9-1 shows the Key Wells used to monitor groundwater levels with respect to the Minimum Thresholds established by the GSAs (see Chapter 9, *Sustainable Management*). The 57 Key Wells for groundwater levels are also listed in Table 9-1 with the respective Minimum Thresholds. The methodology used to select the Key Wells is described in Chapter 9, *Sustainable Management*.

The scientific rationale for inclusion of key wells in the overall GSAs groundwater level monitoring program has considered the following factors:

- Spatial distribution and density of wells, accounting for variable geographic conditions including topography, hydrology, geologic structures, aquifer characteristics, confined and unconfined conditions, pumping patterns, management activities (including replenishment), and potential impacts to beneficial uses/users
- Length, completeness, and reliability of historical groundwater level record
- Well depth and information on well construction
- Regular access to the well for measurements.

Wells in the Indio Subbasin groundwater level monitoring program have unique well information including a well identification number, an identified vertical reference point for measurements, and well completion report if available.

Well density has been a consideration in identifying new dedicated monitoring well sites and adding wells to the monitoring program. By way of comparison, DWR guidance (DWR, Dec 2016 BMP, Table 1) generally recommends between one to ten monitoring wells per 100 square miles. The Indio Subbasin program exceeds this guidance with an area of about 525 square miles and 2020 monitoring of more than 385 wells. More importantly, the Indio Subbasin monitoring program has been developed to account for the variable spatial factors listed above.

In the future, some wells may become unavailable for various reasons (e.g., loss of access). Consistent with ongoing practice, the GSAs will continue to assess the monitoring well network and find suitable replacements. Monitoring program improvements as part of the *Alternative Plan Update* (coordinated with the *Salt and Nutrient Management Plan* [SNMP]) include identification of additional existing wells for monitoring across the Subbasin and will include installing new dedicated monitoring wells. Most wells with known construction have long screened intervals and many are screened at depths greater than 300 feet below ground surface. Information on vertical groundwater gradients is available from nested wells, from comparison of deep wells with nearby relatively shallow monitoring wells, and from observation of artesian conditions. Available data have allowed identification of perched, shallow, and deep aquifer zones in the East Valley (see Chapter 3, *Hydrogeologic Conceptual Model*). Planning is underway to install additional monitoring wells representing the perched and shallow zones; this is a collaborative effort of the Alternative Plan and CV-SNMP (see Section 10.1.5).

10.1.1.2 Monitoring Frequency

Sustainable Groundwater Management Act (SGMA) and the California Statewide Groundwater Elevation Monitoring Program (CASGEM program) require collection of static groundwater elevation measurements at least two times per year to represent seasonal low and seasonal high groundwater conditions. The GSAs in the Indio Subbasin generally provide groundwater level data at least three times a year (with more frequent monitoring at some locations), which is more frequent than recommended and has allowed tracking of seasonal and long-term trends.

10.1.1.3 Climate, Streamflow, and Drain Flow

As summarized in Chapter 2, *Plan Area,* and Table 10-1, the Indio Subbasin Monitoring Program provides information on climate (rainfall and evapotranspiration), streamflow, and drain flows.

10.1.1.4 Climate

Climate data (including temperature, evapotranspiration, and precipitation) are available from DWR's California Irrigation Management Information System (CIMIS) for four active CIMIS stations (see Figure 2-9 for spatial distribution). Precipitation data are collected by the 12 Riverside County Flood Control and Water Conservation District precipitation monitoring stations, also shown in Figure 2-9. In addition, temperature and precipitation data are available from the National Oceanic and Atmospheric Administration (NOAA) station in Indio. As noted in Table 10-1, daily climate data are downloaded and compiled for the Annual Report. Data are used to support groundwater conditions characterization and evaluation of irrigation water demands (agricultural and golf course).

10.1.1.5 Streamflow

Streamflow is measured by the United States Geological Survey (USGS) at 19 locations within the Indio Subbasin, also shown in Figure 2-9. Surface water diversions by Desert Water Agency (DWA) from Snow, Falls, White Water, and Chino watersheds are measured by DWA. Daily streamflow data are downloaded and compiled annually as part of the Indio Subbasin Annual Reports.

10.1.1.6 Drain Flow

The Coachella Valley Stormwater Channel and associated drains (see Figure 2-5) receive intercepted shallow groundwater from agricultural fields and convey the flow to the Salton Sea. CVWD measures drain flows (volumetric meters or flow in cubic feet per second) on a monthly basis at as many as 27 drain sites (depending on occurrence of flow) plus monitoring of the CVSC. A USGS gage station measures flow in the lower CVSC near the Salton Sea (see Figure 2-9). The CVSC and portions of the drain system receive not only shallow groundwater but also flows of Coachella Canal water in excess of requested deliveries (regulatory water), treated wastewater, and fish farm effluent. The drain flow data are used in tracking groundwater outflow and in calibrating the numerical groundwater flow model.

10.1.2 Groundwater Production

CVWD and DWA have been monitoring (assessing) groundwater production since 1982.

CVWD and DWA have been monitoring (assessing) groundwater production in the Areas of Benefit (AOBs) making up the West Whitewater River Subbasin Management Area since 1982 and the East Whitewater River Subbasin AOB since 2005. As defined in the Water Code, Assessable Production excludes groundwater production from Minimal pumpers who extract 25 acre-feet per year (AFY) or less within CVWD's AOBs and 10 AFY or less within DWA's AOB. While Water Code Section 31635.5 exempts Minimal pumpers and production reporting requirements for CVWD, the GSAs may consider lowering the threshold for reporting groundwater production as provided by SGMA authorities (Water Code Section 10725.8) excepting de minimis extractors (extracting two AFY or less per year for domestic purposes).

Groundwater extractors with production above the thresholds of 25 AFY within CVWD's replenishment program areas and 10 AFY within DWA's replenishment program area are required to install a water use measuring device (i.e., a meter). CVWD encourages well owners to allow CVWD to read their meters directly through metering agreements. However, the groundwater producer can choose to self-report groundwater use totals, if needed. The CVWD groundwater production data set is audited two times a year and summarized as part of the SGMA *Annual Report* and the annual *Engineer's Report*. DWA also audits its groundwater production data as part of the *Annual Report* and their *Engineer's Report*.

Figure 2-13 illustrates the groundwater production across the Subbasin for Water Year (WY) 2018-2019. CVWD and DWA will continue to collect data for all groundwater wells with pumping above the applicable thresholds. As indicated in Chapter 12, *Plan Evaluation and Implementation*, the planned Subbasin Well Inventory project will identify and compile information about all production wells in the Subbasin. Resulting knowledge of existing wells will allow refinement of pumping estimates for wells that are not metered.

10.1.3 Subsidence

Land subsidence, resulting from groundwater level declines and aquifer system compaction, has been a concern in the Coachella Valley since the mid-1990s and has been investigated since 1996 through an on-going cooperative program between CVWD and the USGS (Sneed and Brandt, 2020). The USGS has applied satellite-based Global Positioning System (GPS) surveying techniques to determine the location, extent, and magnitude of the vertical land-surface changes in the Coachella Valley. These surveying techniques include GNSS-Inferred Positioning System and Orbit Analysis Simulation Software (GIPSY-OASIS) and interferometric synthetic aperture radar (InSAR) methods. In addition to areal mapping of vertical changes in land surface elevation, GPS measurements have also been taken at 24 geodetic monuments that have been paired with nearby water level monitoring wells to assess relationships between subsidence and groundwater level change. Results of USGS studies are summarized in Chapter 4, *Current and Historical Groundwater Conditions*.

The USGS has provided data and analyses through a series of published reports that have addressed conditions from 1993 to 2017 (e.g., Sneed and Brandt, 2013; Sneed and Brandt, 2020). The partnership with USGS is continuing. For the Indio Subbasin, the objectives of the study (October 1, 2021, through June 30, 2025) are to (1) detect and quantify land subsidence using GPS methods (2015–22) and InSAR methods (2017–23) and (2) evaluate the relation between changes in land-surface elevation and groundwater levels at selected sites during 2015–23. USGS also will analyze DWR-provided InSAR results to compute changes in land-surface elevation in the Indio Subbasin during 2017–23. Findings will be published in a report in 2025.

In addition, DWR provides InSAR satellite-based data and GPS data to identify and assess land subsidence across many California groundwater basins, including the Indio Subbasin. The data are available through DWR's SGMA Data Portal (see Table 10-1). As available, these data will be downloaded and reviewed annually to detect significant changes in land surface elevation. The utility of annual review will be re-evaluated at the next 5-Year Update, at which time the next USGS Report will be available.

10.1.3.1 Spatial Coverage

The satellite-based mapping provided by USGS (for example, see Figure 4-10) provides Subbasin-wide information on subsidence. In addition, Figure 2-10 shows the current network of GPS stations in the valley used by USGS. InSAR mapping for the entire Indio Subbasin is also available for download from the DWR Sustainable Groundwater Management Act (SGMA) portal.

10.1.3.2 Monitoring Frequency

The Monitoring Program will involve annual download and review of InSAR data from the DWR SGMA portal with analysis for any signs (rate and extent) of significant cumulative subsidence. The USGS report will be available for the next 5-Year Update.

10.1.4 Water Quality

Existing water quality monitoring programs for Indio Subbasin GSAs are summarized in Chapter 2, *Plan Area*, while Chapter 8, *Regulatory and Policy Issues,* includes discussion of various water quality topics and regulatory-driven water quality monitoring programs. As indicated in Chapter 8, *Regulatory and Policy Issues*, surface water and groundwater quality monitoring programs are conducted by various agencies for multiple purposes. These address local surface water, imported water sources, groundwater, recycled water, wastewater discharges, and agricultural drain water with sampling and analysis for different physical parameters, inorganic and organic chemical constituents, and/or microbiological organisms. While being conducted beyond the scope of the *Alternative Plan Update*, these programs represent sources of information to better understand groundwater quality conditions and trends in Indio Subbasin.

10.1.4.1 Water Quality Monitoring and Data Compilation

Multiple sources of water quality information are being compiled into the centralized DMS (See Chapter 12, *Plan Evaluation and Implementation*). As described in Chapter 4, *Current and Historical Groundwater Conditions*, this *Alternative Plan Update* has included compilation into a single database of groundwater quality data from various sources including the USGS National Water Information System and the SWRCB website and from each GSA. The GSAs conduct groundwater quality monitoring, as summarized below:

- **CVWD**—CVWD monitors domestic wells to monitor recharge areas, conducts special studies to address a specific parameter (such as hexavalent chromium) or a specific area, and conducts Coachella Valley Salt and Nutrient Management Plan (CV-SNMP) monitoring
- **CWA**—CWA monitors its domestic wells and conducts CV-SNMP monitoring
- **DWA**—DWA monitors its domestic wells, monitors for State emerging contaminants (e.g., per- and polyfluoroalkyl substances [PFASs]), and conducts CV-SNMP monitoring
- **IWA**—IWA monitors its domestic wells and conducts CV-SNMP monitoring

Figure 2-12 shows the spatial distribution of the wells with available water quality data used in this *Alternative Plan Update*. Chapter 4, *Current and Historical Groundwater Conditions,* provides the documentation and analysis of the groundwater quality data for multiple constituents of concern including salinity (total dissolved solids [TDS]), nitrate, arsenic, hexavalent chromium, uranium, fluoride, perchlorate, and dibromochloropropane (DBCP). This water quality data compilation included collection of water quality data not only for groundwater but also imported water sources, recycled water, and wastewater discharges for the period 1990 through 2019.

An additional source of relevant water quality data is from the agricultural drain system (see Figure 2-5) that intercepts shallow subsurface flow from agricultural fields in the East Valley. Drain flows are monitored for water quality at 27 drain outlets for general minerals and metals annually and for field pH, temperature, EC, and TDS semi-annually.

As discussed in Chapter 2, *Plan Area* and Chapter 8, *Regulatory and Policy Issues*, the SNMP for the Coachella Valley Groundwater Basin (CV-SNMP) was restarted in 2020. The CV-SNMP Groundwater Monitoring Workplan, included in Appendix 2-A, recommended a CV-SNMP monitoring network to include 187 existing wells with the suggested addition of 23 new wells. This *Alternative Plan Update* includes a focused effort to install additional monitoring wells, including application to DWR's Technical Support Services (TSS) program for assistance in installing the monitoring wells.

The CV-SNMP agencies plan to monitor network wells at a minimum of once per 3 years, although many are monitored more frequently as part of other programs. The CV-SNMP Development Workplan, also included in Appendix 2-A, suggests a focused analyte list including TDS, nitrate, major cations, major anions, and total Alkalinity. CVWD and other GSAs also plan to add the identified constituents of concern (COCs) to this monitoring network to help meet the objectives of the Alternative Plan.

10.1.4.2 Spatial and Vertical Coverage

Figure 2-12 shows the spatial distribution of wells used in this *Alternative Plan Update* for groundwater quality characterization and mapping. The existing water quality monitoring programs provide adequate spatial coverage. The planned CV-SNMP monitoring network will provide very good coverage for TDS and nitrate monitoring, with potential extension to other constituents of interest.

Water quality concentrations vary with depth depending on constituent. As shown in Chapter 4, *Current and Historical Groundwater Conditions*, general variations can be documented but depth-specific data generally are limited due to current lack of shallow wells. The construction details for some wells are unknown, and most wells with known construction data are screened at depths greater than 300 feet. Exceptions include the monitoring wells that have been sited and designed to monitor GRFs and WRPs, and the two sets of nested wells near the Salton Sea. Planned monitoring network improvements as part of the CV-SNMP include installation of 6 new monitoring wells in the perched aquifer and 17 new wells in the shallow aquifer.

The scientific rationale for selection of wells used in this *Alternative Plan Update* has included:

- Areal distribution across Indio Subbasin
- Length, completeness, and reliability of historical record
- Regular access to the well for sampling
- Well depth, with specific information on well construction preferred.

The water quality program relies heavily on existing municipal wells and existing monitoring programs. Dedicated monitoring wells could be designed to meet requirements and address gaps not only in the water level monitoring program, but also the water quality monitoring program.

10.1.4.3 Temporal Coverage and Monitoring Frequency

Groundwater quality data in the database complied for the *Alternative Plan Update* extend back to 1971. Wells are sampled with a range of frequencies; community water systems and municipal wells are generally sampled triennially for general constituents, but as often as annually for nitrate and quarterly for total coliform bacteria. Agricultural drains are sampled annually or at a higher frequency. The GSAs audit their groundwater quality monitoring programs to ensure that monitoring frequency is adequate.

10.1.5 Seawater Intrusion

The general monitoring of groundwater levels and quality is relevant to monitoring the potential for saline water intrusion from the Salton Sea. As described in Chapter 4, *Current and Historical Groundwater Conditions*, saline water intrusion is monitored specifically through two sets of dedicated nested monitoring wells, as summarized below in Table 10-2.

Locations of these CVWD monitoring wells are shown on Figure 2-12**.** One set of four wells is located about 2.1 miles north of the Salton Sea and the other set of four wells is about one mile west of the Salton Sea and north of Oasis. These are monitored for changes in groundwater levels and quality, both of which can be used as potential indicators of saline intrusion.

In addition, the groundwater flow model has been used to simulate flow between the Indio Subbasin and the Salton Sea. The relationship of simulated and observed groundwater elevations to the changing level of the Salton Sea is discussed in Chapter 7, *Numerical Model and Plan Scenarios*, and Chapter 9, *Sustainable Management*.

Table 10-2. Summary of Salton Sea Nested Monitoring Wells

SWN	Nickname	Latitude	Longitude	Depth of Well Perforations, feet bgs	
				Top	Bottom
07S09E30R04S	CVWD Ruth	33.52633	-116.08	350	390
07S09E30R03S	CVWD Peggy	33.52633	-116.08	730	770
07S09E30R02S	CVWD Sherrie	33.52633	-116.08	1,220	1,260
07S09E30R01S	CVWD Bernadine	33.52633	-116.08	1,430	1,470
08S09E07N01S	CVWD Dave	33.48447	-116.095	420	480
08S09E07N02S	CVWD Rosie	33.48447	-116.095	720	780
08S09E07N03S	CVWD Gracie	33.48447	-116.095	1,034	1,094
08S09E07N04S	CVWD Richard	33.48447	-116.095	1,315	1,375

10.2 Field Methods for Monitoring Well Data

10.2.1 Protocols for Data Collection and Monitoring

This section focuses on groundwater level monitoring and groundwater quality sampling by Indio Subbasin GSAs. Other data (e.g., climate, streamflow, subsidence) are measured mostly by other agencies (e.g., USGS). Groundwater production is metered, as described in Section 10.1.3.

This section describes general procedures for documenting wells in the monitoring program and for collecting consistent high quality groundwater elevation and groundwater quality data. In general, the methods for establishing location coordinates (and reference point elevations for elevation monitoring) follow the data and reporting standards described in the SGMA Regulations (Section 352.4), CVWD Monitoring Plans, and the guidelines presented by USGS Groundwater Technical Procedures. These procedures are summarized below.

Background data for each monitoring well is required for its inclusion in the monitoring program. These data are generally available for wells in the network described on Table 10-1. As part of Annual Report preparation, location and elevation data are acquired where missing, revised if conditions at a monitored well change, and added when new wells are brought into the program. The methods for acquiring these data follow:

- Location coordinates will be surveyed with a survey grade GPS. The coordinates will be in Latitude/Longitude decimal degrees and reference datum noted.
- Reference point elevations will also be surveyed with a survey grade GPS with elevation accuracy of approximately 0.5 feet. During surveying, the elevations of the reference point and ground surface near the well will be measured to the nearest 0.5 foot. All elevation measurements will reference NAVD88 vertical datum. This will involve some re-surveying of well reference points that are based on an earlier datum.

10.2.2 Field Methods for Groundwater Elevation Monitoring

Reference points and ground surface elevations are documented as described above prior to groundwater elevation monitoring in the field. Field methods for collection of depth-to-water measurements are described below:

1. Measurements in all wells will be collected within a consistent period.
2. Active production wells should be turned off prior to collecting a depth to water measurement.
3. Each agency should follow their standard operating procedure and ensure the well has been off for an adequate period before a static measurement is taken (24 hours, when possible).
4. To verify that the wells are ready for measurement, GSA staff will coordinate with well operators and/or owners as necessary.
5. Coordination with well operators/owners should occur approximately three days prior to the expected measurement date. For municipal wells less lead time may be needed.
6. Depth-to-groundwater measurements are collected by either electric sounding tape (Solinst or Powers type sounders) or by steel tape methods. These depth-to-water measurement methods are described in DWR's *Groundwater Elevation Monitoring Guidelines* (DWR, 2010). Depth to groundwater will be measured and reported in feet to at least 0.1 foot.

10.2.3 Field Methods for Groundwater Quality Monitoring

Groundwater sampling is conducted by trained professionals from the GSAs. Sampling follows standard monitoring well sampling guidelines such as those presented in the National Field Manual for the Collection of Water-Quality Data (USGS, 2012) and/or EPA Groundwater Sampling Operating procedure (SESDROPC-301-R4, 2017).

Generally, the wells have been pumped prior to sample collection, or are purged. Purging is conducted until field instruments indicate that water quality parameters (pH, specific conductance, and temperature) have stabilized, and turbidity measurements are below five Nephelometric Turbidity Unit (NTUs). Wells are typically purged a minimum volume equal to three times the well casing and parameters are monitored until stable conditions are reached. The pumping or purging demonstrates that the sample collected is representative of formation water and not stagnant water in the well casing or well filter pack. For groundwater, field temperature and conductivity are recorded while the well is being purged to ensure that physical parameters have stabilized before collecting a sample. All groundwater samples are collected in laboratory-supplied, pre-labeled containers and include prescribed preservatives.

CVWD collects water quality data at wells and distribution system sites.

All field measurements, if collected, are recorded in a field logbook or worksheets and the sample containers are labeled correctly and recorded on the chain-of-custody form. The applicable chain-of-custody sections are completed and forwarded with the samples to the laboratory. Upon receipt of the samples at the laboratory, laboratory personnel complete the chain-of-custody and a copy of the chain of custody is given back to the sampler.

QA/QC assessment of field sampling includes use of field blanks when required for specific parameters. Field blanks identify sample contamination that is associated with the field environment and sample handling. These samples are prepared in the field by filling the appropriate sample containers with the distilled water used for cleaning and decontamination of all field equipment. One field blank per sampling event is collected.

Water quality samples are analyzed in a certified laboratory.

Samples are analyzed in a certified laboratory that has a documented analytical QA/QC program including procedures to reduce variability and errors, identify and correct measurement problems, and provide a statistical measure of data quality. The laboratory conducts all QA/QC procedures in accordance with its QA/QC program. All QA/QC data are reported in the laboratory analytical report, including: the method, equipment, and analytical detection limits, the recovery rates, an explanation for any recovery rates that are outside of method specific limits, the results of equipment and method blanks, the results of spiked and surrogate samples, the frequency of quality control analysis, and the name of the person(s) performing the analyses. Sample results are reported unadjusted for blank results or spike recovery.

10.3 Data Management System (DMS)

Indio GSAs have been collecting and compiling groundwater data annually including water levels, water quality, and water use for the Annual Report. These data, and other data from the GSAs and other sources, are being compiled in relational databases, which comprise an Access database, GIS geodatabase, and Excel workbooks. These have capabilities for queries to quickly check and summarize data. As part of the *Alternative Plan Update*, the data management system has been redesigned to be practicable, usable, intuitive, and cost effective. The relational database includes easy-to-update tables and reports that assist in data analysis and sustainability goals. These tables include groundwater elevations, water quality, groundwater pumping, direct deliveries of imported water, and well locations. The geodatabase contains spatial files including jurisdictional areas, basin boundaries, monitoring locations, crop censuses, groundwater contours (elevation and quality), geology, and hydrologic features.

The DMS will be updated annually as part of the annual report. In addition, a full review and update will be conducted during the Alternative Plan 5-year update.

10.4 Assessment and Improvement of Monitoring Program

The Bridge Document summarized the status of previously recommended monitoring and reporting improvements and also presented monitoring data gaps. These are summarized below along with brief updates.

- Surface water flow data to estimate potential yield from stormwater capture projects. Stormwater capture, as a category of projects, is currently deferred. This reflects that significant local runoff already is captured cost-effectively at existing facilities (e.g., WWR-GRF, debris basins, West Valley unlined channels) or is integrated into flood control projects.
- Uniform reporting of urban water use by user class to track water conservation efforts. While uniformity among agencies may not be generally feasible, CVWD has improved its reporting by meter class (user type) and continues to make improvements as needed. Other GSAs also continue to maintain and replace meters, as needed.
- Groundwater production data for wells in the East Valley, especially agricultural wells. CVWD has addressed groundwater production reporting for entities producing more than 25 afy.
- Lack of a centralized groundwater database that allows all water agencies to share data. At this time, development of the DMS is underway and is a major focus. As summarized in Section 10.3, data on groundwater levels, water quality, and wells are being compiled and entered into the DMS.
- Non-uniform coverage of water quality data. Coverage of water quality data is being addressed through various efforts, such as the compilation of water quality data, data analysis and documentation of groundwater quality in Chapter 4, *Current and Historical Groundwater Conditions*. As described in Section 10.1.5.1, a major effort is development of the CV-SNMP Monitoring Workplan to include 187 existing wells with planned installation of 23 new monitoring wells. As part of this *Alternative Plan Update*, the GSAs are moving ahead with options to fund the new monitoring wells, including application to DWR's Technical Support Services program.

Other monitoring improvements are part of *Alternative Plan Update* implementation and will be reviewed and updated for each 5-year assessment.

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CHAPTER 11: PROJECTS AND MANAGEMENT ACTIONS

Maintaining sustainability in the Indio Subbasin will require implementation of projects and management actions to offset forecasted increases in water demands. Water management elements included in this *Alternative Plan Update* to help maintain sustainability consist of water conservation measures, acquisition of additional water sources, source substitution and replenishment programs, water quality improvements, and other studies and programs.

11.1 Project Selection and Implementation

The Groundwater Sustainability Agencies (GSAs) have evaluated a range of potential projects and management actions (PMAs) to help maintain sustainability. This section summarizes the process used to select the PMAs for inclusion in this *Alternative Plan Update*, as well as the entities responsible for implementing these activities.

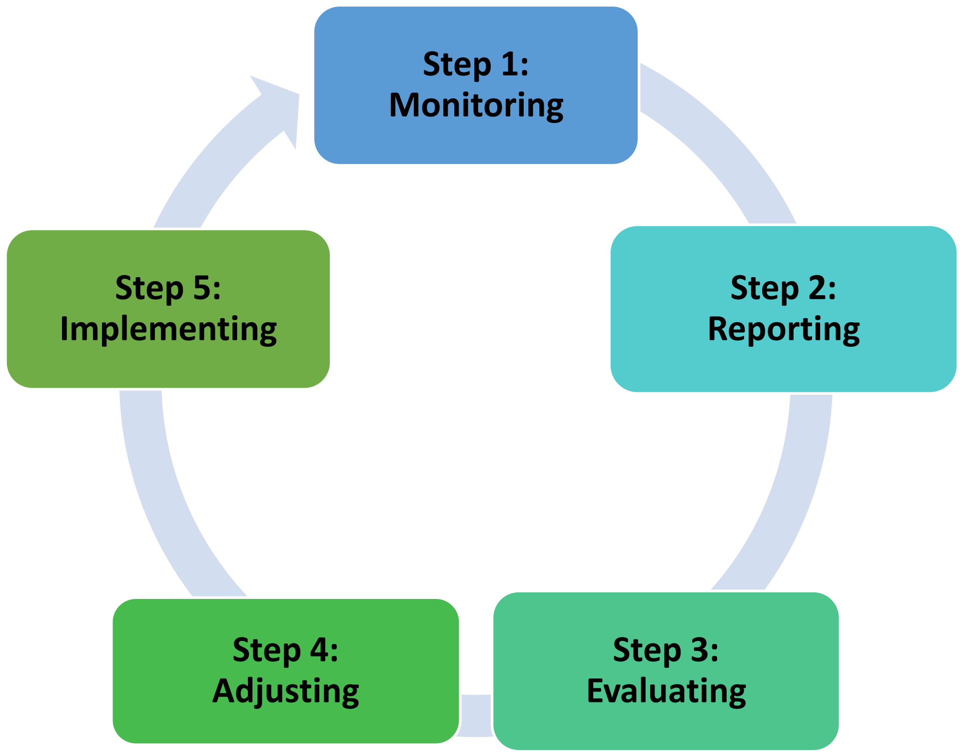
11.1.1 Adaptive Management

The preceding chapters of this *Alternative Plan Update* have documented the success of the Coachella Valley's water management strategies. Expectations for population growth have changed since the *Coachella Valley Water Management Plan 2010 Update (2010 CVWMP Update)* (CVWD, 2012) and resulted in a corresponding reduction in the projected urban development of agricultural and vacant land in the Coachella Valley. At the same time, the reliability of imported water supply from the State Water Project (SWP) has declined due to a combination of drought, climate change, and legal and environmental restrictions in the Sacramento-San Joaquin Delta (Delta). Uncertainty associated with forecasted water demands and anticipated conservation legislation, coupled with climate change and supply constraints, means that the GSAs need flexibility in determining what PMAs to implement in order to maintain a balanced Indio Subbasin and avoid significant and unreasonable undesirable results. This *Alternative Plan Update* incorporates a flexible and adaptive approach to water resources management that will allow the GSAs to adjust the implementation strategy.

The Plan Scenarios evaluated in Chapter 7, *Numerical Model and Plan Scenarios,* simulate a range of potential conditions to ensure that forecasted demands can be met, while sustainably managing groundwater resources. In each of the Plan Scenarios, a different suite of projected water supplies and PMAs is identified. The actual selection of PMAs for implementation by the Subbasin GSAs throughout the planning horizon will depend on how the various demand and supply uncertainties identified in this Plan play out. The selection and implementation of PMAs will be adaptively managed by the GSAs.

The process is cyclical and depends on the outcomes of the Plan implementation activities outlined in Chapter 12, *Plan Evaluation and Implementation*. These Plan implementation activities include ongoing monitoring, annual reporting on the state of the Subbasin, and 5-year updates including application of the numerical model to evaluate potential future scenarios. Adaptive management involves five steps: monitoring, reporting, evaluating, adjusting, and implementing (see Figure 11-1 below). The Plan implementation actions – primarily ongoing monitoring and reporting through the Annual Reports – work to direct the GSAs selection and implementation of PMAs, based on the monitoring outcomes as compared with this Plan's thresholds. This adaptive management approach also allows the GSAs to adapt to changing conditions and delay or defer PMAs if no longer needed.

Figure 11-1. Adaptive Management Cycle for PMA Implementation



Following is a description of each step in the adaptive management cycle:

1. **Step 1: Monitoring**. The GSAs will continue their ongoing monitoring programs as outlined in Chapter 10, *Monitoring Program,* to assess groundwater levels; climate, streamflow, and drain flow; groundwater production; subsidence; water quality; and seawater intrusion.
2. **Step 2: Reporting**. The GSAs will use the monitoring data to track and report conditions for the applicable sustainability indicators discussed in Chapter 9, *Sustainable Management*. If the monitoring data shows negative changes in groundwater condition, the GSAs will move to Step 3.
3. **Step 3: Evaluating**. If any negative trend is observed, the GSAs will conduct an evaluation to determine whether it is a locally driven change in conditions, such as a change in local land use or pumping patterns, or whether it represents a long-term, regional change in conditions. The evaluation will include steps such as analyzing pumping, well logs, land use changes, well permit records, imported water deliveries, or climate/precipitation data to determine if any recent changes occurred that may have affected monitoring results.
4. **Step 4: Adjusting**. To address a long-term regional trend that may cause undesirable results, the GSAs may need to adjust the projects, programs, and activities that are being implemented to manage the Subbasin. Each of the GSAs will select the PMAs within their respective jurisdiction; regional programs may be developed and implemented under the MOU (if amended). Any changes to projects, programs, and activities would then be captured within the 5-Year Plan Update described in Chapter 12, *Plan Evaluation and Implementation*.
5. **Step 5**: **Implementing**. Following selection of proposed or refined PMAs that respond to identified trends, monitoring and management practices will be implemented to reflect the new activities.

6. **Return to Step 1: Monitoring.** Ongoing monitoring data will then be used to assess the results of PMA implementation and if/how conditions change. If monitoring indicates that conditions have been restored to acceptable conditions (i.e., well above the minimum threshold), implementation of the PMAs will be deemed successful. If the exceedance is not addressed, the GSAs will identify and implement additional PMAs to avoid undesirable results.

11.1.2 Project Identification

A variety of PMAs are planned to be implemented over the planning horizon (to 2045) to achieve sustainability in the Subbasin. Projects were identified by the GSAs through a several-month process involving the GSAs, the general public, and interested stakeholders. The GSAs began by reviewing and updating the projects identified in the *2010 CVWMP Update* to determine which had been successfully implemented and could be removed, which could be carried out in the *Alternative Plan Update* planning horizon, and which projects to defer, while also identifying new projects to add that have been developed since the *2010 CVWMP Update*. Project information was compiled into a draft list that was discussed and presented during the SGMA Tribal Workgroup and Public Workshops held on March 3, 2020. The project selection process included review and input from the GSAs and stakeholders, which was used to refine the project list for inclusion in the Plan. This project list was created on the basis of priorities identified by the GSAs and stakeholders.

11.1.3 Project Implementation

The PMAs contained herein will be administered by the GSA project proponents. The GSAs may elect to implement projects individually or jointly with one or more GSAs and/or other project partners, as appropriate. The GSAs will individually consider the demand forecast in Chapter 5, *Demand Projections*; the overall Subbasin water budgets in Chapter 7, *Numerical Model and Plan Scenarios*; and the needs of the different management areas described in Chapter 2, *Plan Area*. The Annual Reports outlined in Chapter 12, *Plan Evaluation and Implementation,* will allow the GSAs to evaluate their cumulative progress toward maintaining, protecting, and improving Subbasin conditions.

11.2 List of Projects and Management Actions

The GSAs reviewed and refined the multiple projects, programs, and activities in the *2010 CVWMP Update* to help the Subbasin maintain sustainability and achieve plan goals. The *Alternative Plan Update* includes a final list of 30 possible PMAs representing a wide variety of activities by the four GSAs. Projects are classified into four categories based on project benefits: water conservation, water supply development, source substitution and replenishment, and water quality protection. Deferred projects, listed in Section 11.7, are those that do not meet the Subbasin's immediate needs or are currently unfeasible and may be revisited in the future. The categorized projects are shown in Figure 11-2. This project list contains a mix of planned and conceptual projects. Planned projects are those that are in the planning or design stages and will be implemented in the near future or as funding becomes available. Conceptual projects are in the planning, design, and funding stages and will be implemented later in the planning horizon.

Figure 11-2. Categorized Projects and Management Actions

Water Conservation

- PMA 1: Urban Water Conservation
- PMA 2: Golf Water Conservation
- PMA 3: Agricultural Water Conservation

Water Supply Development

- PMA 4: Increased Surface Water Diversion
- PMA 5: Delta Conveyance Facility
- PMA 6: Lake Perris Seepage
- PMA 7: Sites Reservoir
- PMA 8: Future Supplemental Water Acquisitions
- PMA 9: EVRA Potable Reuse

Source Substitution & Replenishment

- PMA 10: Mid-Valley Pipeline Direct Customers
- PMA 11: Mid-Canal Storage Project
- PMA 12: East Golf Expansion
- PMA 13: Oasis Distribution System
- PMA 14: WRP-10 Recycled Water Delivery
- PMA 15: Tertiary Expansion
- PMA 16: Canal Water Pump Station Upgrade
- PMA 17: WRP-7 Recycled Water Delivery
- PMA 18: WRP-4 Tertiary Expansion & Delivery
- PMA 19: DWA WRP Recycled Water Delivery
- PMA 20: PD-GRF Phase 2 Expansion
- PMA 21: TEL-GRF Expansion
- PMA 22: WWR-GRF Operation

Water Quality Protection

- PMA 23: Eliminate Wastewater Percolation
- PMA 24: Wellhead Treatment
- PMA 25: Small Water System Consolidations
- PMA 26: Septic to Sewer Conversions
- PMA 27: Implement CV-SNMP Groundwater Monitoring Program Workplan
- PMA 28: Implement CV-SNMP Development Workplan
- PMA 29: Colorado River Salinity Forum
- PMA 30: Source Water Protection

The following sections provide project descriptions for the projects included in the *Alternative Plan Update* grouped by project category.

11.3 Water Conservation

Water conservation is a major component of overall water management in the Indio Subbasin. As a desert community reliant upon imported water supplies, the Coachella Valley has and will continue to use its water resources efficiently. The *2010 CVWMP Update* included water conservation efforts for agriculture, urban, and landscaping water demands, and the GSAs continue to expand and strengthen water conservation programs not only through the *Alternative Plan Update*, but also through other efforts, such as the Coachella Valley Regional Water Management Group (CVRWMG) and the *2020 Coachella Valley Regional Urban Water Management Plan* (*2020 RUWMP*) (CVWD, et al, 2021a).

Water conservation is also a requirement of the California Water Code (CWC) and legislation such as the Water Conservation Act of 2009 (Senate Bill [SB]x7-7) and the 2018 water conservation legislation. This section summarizes water conservation policies and the existing urban, agricultural, and golf course water conservation activities in the Coachella Valley, as well as potential water conservation implementation strategies. Consistent with Plan objectives, the *Alternative Plan Update* achieves a level of water use reduction consistent with applicable State law without causing dramatic lifestyle changes on the part of those conserving.

11.3.1 California Water Conservation Laws and Policies

Urban water use is expected to grow significantly in the future as development occurs. CVWD, DWA, CWA, and IWA are implementing several on-going water conservation programs for both large landscape customers and residential customers. They are also working with local governments and developers to reduce water use in new developments and are partnering with large water users, such as schools, to improve water efficiency and reduce groundwater pumping. California law also establishes multiple policies regarding water conservation. Legislation and policies driving these urban conservation measures are detailed below.

1. **Water Conservation in Landscaping Act**. The Water Conservation in Landscaping Act of 2006 (Assembly Bill 1881, Laird) required cities and counties to adopt water conservation ordinances by January 1, 2010. In accordance with the law, the California Department of Water Resources (DWR) prepared an updated Model Water Efficient Landscape Ordinance (MWELO). For all cities and counties that do not adopt their own conservation ordinances, DWR's updated MWELO would apply within their jurisdiction by January 1, 2010.
2. **California Urban Water Conservation Council Memorandum of Understanding (MOU)/California Water Efficiency Partnership**. In addition to state law requirements, water agencies and public interest groups formed the California Urban Water Conservation Council (CUWCC) in 1991 (CUWCC, 1991). As the State's water conservation landscape began to change in response to the State's historic drought, the CUWCC voted to allow the organization to end and be replaced with the California Water Efficiency Partnership (CalWEP) in 2017. CalWEP set forth eight long-term objectives in its *Strategic Plan* (most recently updated in 2021) to provide leadership and expertise on California water issues, challenges, and opportunities within a collaborative network (CalWEP, 2021).

3. **California 2008 Water Conservation Plan and SBx7-7**. The Water Conservation Act was passed in 2009, and the final 20x2020 Water Conservation Plan was released in February 2010 (SWRCB, 2010). As part of the comprehensive Water Conservation Act of 2009, SBx7-7 mandates California urban water agencies achieve a 10 percent reduction in urban per capita water demand statewide by 2015 and a 20 percent reduction by 2020. Water use reductions are compared on a per capita basis to a 10-year baseline period. As reported in the *2020 RUWMP*, the RUWMP participating agencies met the target water use reduction by 2020 (CVWD, 2021a).
4. **2018 Water Conservation Legislation**. As the effects of climate change become more apparent and in response to the State's historic 2012-2016 drought, the State recognized that more stringent water conservation legislation needed to be implemented. California signed the Water Conservation Legislation into law in 2018, effectively reorganizing and strengthening the conservation and reporting requirements for the drought emergency, mandating water-use reductions, and making "water conservation a way of life" on a permanent basis. Together, Assembly Bill 1668 (Friedman) and SB 606 (Hertzberg) lay out a new long-term water conservation framework, which involves developing new standards for indoor residential water use, outdoor residential water use, commercial, industrial, and institutional (CII) water use for landscape irrigation, and water loss. Urban water suppliers will be required to stay within annual water use objectives, as determined by the State. DWR is currently in the process of conducting numerous studies and investigations, along with development of standards, guidelines, performance measures, data platforms, and recommendations for adoption by the State Water Resources Control Board (SWRCB). New water conservation regulations are anticipated as a result of this 2018 legislation, which will be relevant to the GSAs within the planning horizon.

The following sections describe existing urban, agricultural and golf course water conservation activities as well as potential water conservation implementation strategies consistent with legislation and policies driving the conservation measures.

11.3.1.1 PMA 1: Urban Water Conservation

For the past three decades, water purveyors have placed a significant focus on urban water conservation as a way of life to address the increasing water demands due to population growth and economic development in the Coachella Valley. Local urban water conservation programs began as early as 1988. The Indio Subbasin GSAs have managed a suite of conservation programs and activities designed to increase efficiency, reduce future water demand, and support fulfillment of the requirements of the statewide Water Conservation Act. CVWD, DWA, CWA, and IWA have implemented ongoing programs for both large landscape customers and residential customers for achieving increased water conservation in the Coachella Valley.

The Regional Water Conservation Program (Regional Program) has been a cornerstone of water conservation in the Coachella Valley. Implemented in 2015 by the CVRWMG, this multifaceted Regional Program has achieved a significant level of conservation through a suite of programs and activities designed to increase efficiency, reduce future water demand, and assist the Coachella Valley in meeting regulatory requirements. The Regional Program had an emphasis on coordination and collaboration between the member agencies of the CVRWMG (CVWD, 2020d). Together, under the Regional Program, the agencies developed and branded "CV Water Counts" (https://cvwatercounts.com/) to conduct education and outreach related to water conservation.

The GSAs are committed to implementing State policies and mandates related to water conservation, as described above. To comply with conservation regulations and address supply shortfalls during dry conditions, the GSAs are committed to implementing the conservation programs that are in place (see sections below), including CV Water Counts. Table 11-1 provides a summary of the demand management programs highlighted in the agencies' 2020 RUWMP and identified by the GSAs. The GSAs will also continue to seek grant funding to support ongoing delivery and expansion of their conservation programs.

Table 11-1. Conservation Program Summary

Program	Completed from Program Inception to 2019			
	CVWD[a]	CWA[a,b]	DWA[b]	IWA[b]
Landscape Plan Check	1,126	--	--	16
Residential Smart Controller Rebates	4,801	15	585	15
Large Landscape Smart Controller Rebates	1,769	--	--	--
Residential Turf Conversions (sq ft)	5,974,040	340,338	2,274,416	149,401
Commercial / HOA Turf Conversions (sq ft)	12,819,155	--	--	253,537
Water Waste Investigations	4,941	--	--	243
Toilet Rebates	9,445	42	2,166	628
Commercial Plumbing Retrofit	--	--	--	20
Residential Plumbing Retrofit	--	300	--	157
Efficient Rotating Nozzles	--	--	10,699	--
Clothing Washer Rebates	--	--	181	176

[a] Adapted from *2020 RUWMP* (CVWD et al, 2021a)
[b] Communication with agency staff, 2021.

As part of the *2020 RUWMP,* the GSAs each developed and adopted a Water Shortage Contingency Plan (WSCP) and assessed planned WSCP actions in the context of a 5-year drought risk assessment (CVWD et al., 2021a). Each WSCP included six shortage response levels and associated actions which were consistent among the agencies, as shown in Table 11-2. Each level represents an anticipated reduction in the supplies that would normally be available and the GSAs may activate shortage levels across entire service areas or within certain areas that are impacted by an event. The levels involve voluntary and mandatory conservation measures and restrictions, depending on the causes, severity, and anticipated duration of the water supply shortage. These response actions have been used effectively in the past and could be implemented periodically as part of the GSAs' adaptive management strategy. Each agency's WSCP contains a detailed list of demand reduction actions that could be implemented as needed.

Table 11-2. Water Shortage Contingency Plan Levels

Shortage Level	Percentage Shortage Range	Description	Shortage Response Actions
1	Up to 10%	Normal water supplies	Mandatory prohibitions defined by the State, ongoing rebate programs
2	Up to 10%	Slightly limited water supplies	Outdoor water use restrictions on time of day, increased water waste patrols
3	Up to 10%	Moderately limited water supplies	Outdoor water use restrictions on days per week, restrictions on filling swimming pools
4	Up to 10%	Limited water supplies	Limits on new landscaping, expanded public information campaign
5	Up to 10%	Significantly limited water supplies	Limits on watering of parks or school grounds
6	Up to 10%	Severe shortage or catastrophic incident	No potable water use for outdoor purposes

Source: 2020 RUWMP, WSCP Attachments (CVWD et al., 2021a)

The following sections provide a summary of the range of domestic water conservation projects and programs that CVWD, DWA, CWA, and IWA are currently implementing in the Coachella Valley. As total demand increases and MWELO is applied to new growth, the volume of water conserved will increase, representing the equivalent of a substantial source of supply. Additional savings from urban water conservation will ultimately depend on the public's willingness to participate in the conservation programs and saturation.

Coachella Valley Water District

CVWD currently offers a variety of water-efficiency programs through its annual budget. CVWD also researches new incentives based on changing customer needs and recently implemented two new rebates for washing machines and hot water recirculating pumps. Outreach and education, including K-12 schools, is also a large part of CVWD's efforts to spread the "conservation as a way of life" message to its customers. CVWD has a large section on its website (https:/www.cvwd.org/conservation) devoted to water conservation and education. CVWD continues to offer to its customers a variety of indoor incentives (including Indoor Water Conservation Kit, Residential High Efficiency Toilet Rebates, Residential Efficient Washing Machine Rebates, Residential Hot Water Recirculation Pump Rebates, Commercial Water Efficient Toilet Rebates, Commercial Water Brooms, and Commercial Pre-Rinse Nozzles) and landscape/outdoor incentives (including Residential Landscape Rebates, Residential Smart Irrigation Controller Installations, Residential Rotary Nozzle Rebates, Homeowners' Association (HOA) & Commercial Landscape Rebates, HOA & Commercial Smart Irrigation Controller Rebates, HOA & Commercial Rotary Nozzle Rebates, HOA & Commercial Irrigation Upgrade Rebates, and Landscape Workshops).

CVWD's Landscape and Irrigation System Design Ordinance No. 1302.5 (updated in July 2020) establishes annual maximum water allowances for new and rehabilitated landscape sites that are served domestic water. The allowances are based on landscaped area, plant water use zone, low-moderate landscape plant water use rates, and high irrigation system application efficiency. In implementing Ordinance No. 1302.5, CVWD conducts plan checks and inspections.

CVWD uses water budget based tiered rates. Conservation pricing provides incentives to customers to reduce average or peak use, or both. CVWD uses water commodity rates for its domestic water, non-potable (including Canal and recycled) water, and groundwater replenishment services. Every residential customer is given a personalized water budget based on the number of people living in the home, the size of the home’s landscaped area (budgeting more water to those with larger landscapes), and daily weather (budgeting more water during hotter months). Every landscape meter is given a personalized water budget based on the landscaped area served. Every commercial property is given a personalized water budget based on the demand the entity places on the sanitation system and may include an allotment for landscape area served. Customers pay the tier rate for all water used within that tier. In 2021, CVWD updated water rate studies for its domestic water, Canal water, and replenishment assessment charges.

CVWD’s water loss program evaluates both apparent and real water loss. The programs and practices used to constitute water loss reduction efforts include Production Well Meter Testing; Customer Meter Testing, Leak Detection, and Repair; District Site Use Water Meters; Meter Reading; and Billing Reports.

CVWD’s Large Landscape Irrigation Audit Program assists users in maximizing the efficient operation of their irrigation system by measuring performance, generating irrigation schedules, and recommending improvement actions. Audit sites are chosen based on excessive water consumption, or in response to a request for audit services. The large landscape audit program operates continuously and completes approximately 20 landscape audits per year. The success of this program will be measured by the annual water reduction achieved by large water users participating in the program.

Example of desert landscaping to reduce irrigation demands.

CVWD hosts a Landscaper Certification Program (LCP) for professional landscapers that focuses on water use efficiency. CVWD partnered with College of the Desert (COD) (a local community college with an established Landscape Management Program), Coachella Valley Association of Governments (CVAG), and the cities, county, and neighboring water districts to implement the course and establish certification criteria for incorporation into each city's business license qualification requirements. CVWD developed the curriculum of the LCP using existing staff that hold licenses and certifications in irrigation efficiency, plant water use, horticultural practices, arboriculture, and landscape/golf course irrigation auditing.

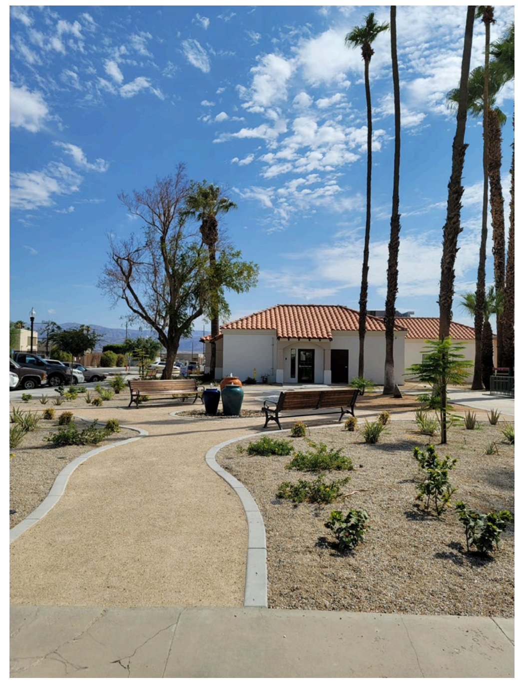
CVWD also hosts a Qualified Water Efficient Landscaper (QWEL) certification class each year. The QWEL certification program was created by the Sonoma County Water Agency in partnership with the North Coast Chapter of the California Landscape Contractors Association and is nationally recognized by the U.S. Environmental Protection Agency (EPA) WaterSense program for Irrigation System Audits. The QWEL professional certification program provides landscape professionals with 20 hours of education on local water supply, sustainable landscaping, soils, water budgeting and water management, irrigation system components and maintenance, irrigation system audits, and scheduling and controller programming

(QWEL, 2018). Upon completion of the course, an exam is given and participants will complete an irrigation system audit. Once all components have been successfully completed, certification is earned.

Coachella Water Authority

CWA is currently offering a variety of rebate programs for indoor and outdoor water use. CWA continues to build its conservation efforts with the development of a website (https://www.conservecoachella.com/) dedicated to water conservation. CWA currently offers to its customers Conservation Programs for CII Accounts, Large Landscape Conservation Programs and Incentives, Residential Ultra Low Flow Toilet (ULFT) Replacement Programs, Residential Plumbing Retrofit, and Water Survey Programs for Single- and Multi-Family Residential Customers (CVWD, 2021a).

The City of Coachella has a prohibition for wasting water in Municipal Code Section 13.03.044, along with a tiered rate structure for water service within its service area. CWA's water rates include a variable commodity charge (monthly charge based on the amount of water used or consumed by the customer in hundreds of cubic feet [HCF]) and a fixed metered account charge (basic monthly rate by meter size). The rates have been designed to recover the full cost of water service in the commodity charge, while discouraging wasteful water use, and will continue to be implemented into the future. Tiered rates are designed to incentivize customers to be proactive in reducing water use.



Example of landscape remodel from CWA's turf rebate program.

Desert Water Agency

DWA continues to increase its investment in outreach related to water conservation. DWA has a large section on its website featuring conservation information and program links (www.dwa.org/save), and hosts regular information sessions, classroom curriculum, and advertising on conservation topics. To date, these investments account for significant water demand reduction within the community. DWA's current conservation programs include a Smart Irrigation Controller Program, Grass Removal Program, Efficient Nozzle Program, Residential Washing Machine Incentives, Commercial Toilet Program, Conservation Coupon Program, and Hospitality Conservation Program. The agency is also developing an Advanced Metering Infrastructure network to give staff and customers access to near real-time water use information.

DWA offers large-landscape customers water use evaluations and will perform them for residential customers upon request. Customers receive a report documenting system deficiencies and outlining water-saving recommendations.

DWA is working to reduce its own water losses through water main replacement, proactive service line replacement, meter testing and updated procedures.

In June 2021, DWA passed Ordinance No. 72 enacting its Water Shortage Contingency Plan. The Ordinance outlines water use restrictions to be implemented during various shortage scenarios.

Indio Water Authority

IWA continues to promote water conservation using different outlets such as social media, speaking engagements, City events, bill inserts/messaging and the City of Indio newsletter. IWA promotes water use efficiency via the agency's website (www.indiowater.org) which features conservation tips, watering guides, and link to rebates and incentives. IWA currently offer rebates and incentives for turf replacement, clothes washer and toilet replacements, smart controller installation, and irrigation upgrades. Additionally, IWA offers an online customer engagement tool where water customers can view water usage, set water use allowance notifications, and be notified of possible leaks on their property. IWA also promptly responds to water waste incidents that are reported via the State water waster portal and to IWA conservation staff.

As part of the *2020 RUWMP*, IWA (along with other participating agencies) updated its Water Shortage Contingency Plan to reflect additional tiers/stages and aligned its water use restrictions as a region to better streamline communication and outreach efforts in promoting conservation. IWA continues to implement Stage 1 of its Water Shortage Contingency Plan, which outlines water use restrictions and promotes water use efficiency as outlined in the Governor's Executive Order B-37-16 which calls for making water conservation a California way of life.

IWA's turf rebate program encourages water use efficiency.

Previously in 2016, the City of Indio passed Ordinance No. 1684 to adopt water use efficient landscape development standards (i.e., MWELO), which applies to new development projects with an aggregate landscape equal to or greater than 500 square feet, and renovated landscape projects with an aggregate landscape area equal or greater than 2,500 square feet. IWA also completes an audited water loss report and reviews for water system distribution leaks as outlined in SB 606 to further curtail inefficient water use.

11.3.1.2 PMA 2: Golf Water Conservation

Golf water conservation has been implemented by CVWD since development of the *2002 CVWMP* and recognition that demand management was essential to balancing the Indio Subbasin. The CVWD Landscape Ordinance (Ordinance No. 1302.5), last updated July 2020, establishes uniform landscaping standards throughout the Coachella Valley. The Ordinance specifies the maximum allowable turf area and associated water demands for new golf courses, and other landscaping must use low water-using plant materials (CVWD, 2019). Ordinance No. 1302.5 is one of the few ordinances in the State to establish turf limitations for new golf courses. In addition, CVWD has identified various methods for existing golf courses to further enhance water savings. CVWD is committed to working with new and existing golf courses to reduce water demands through programs such as irrigation system audits, scheduling irrigation with the best available science, plan checking, inspecting new golf courses for plan check compliance, and monitoring maximum water allowance compliance.

In December 2013, CVWD collaborated with the local chapter of the Golf Course Superintendents Association to create a Golf and Water Task Force. The initial objective of the Task Force was to discuss water supply issues and explore ways in which CVWD could help the 106 golf courses in its service area to reduce water use. The benefit of the collaboration has exceeded the initial goal. In 2014, the golf course representatives on the Task Force were integral in helping develop a turf rebate program that would meet the unique needs of the region's golf courses. They also identified other rebate and incentive opportunities that staff might not have considered without the valuable feedback. CVWD launched the golf course rebate program in 2015, after securing a State grant. The golf course representatives helped promote the program and in 3 years (2015-2017), 31 courses participated in the program with 8 courses participating twice. The conversions equate to 161 acres of turf removed with an estimated water savings of 956 acre-feet per year (AFY). The Task Force also adopted individual water budgets for each golf course in the service area as a tool for understanding the correct amount of water needed. The golf course representatives have been key liaisons for educating all courses about using the budgets and encouraging water conservation among all golf courses. They have also provided feedback about possible rate increases which has had a strong influence on staff and the Board of Directors. Perhaps the most beneficial product of the Task Force is establishment of an open line of communication including invitations to speak about drought and other water issues at regional golf industry events (CVWD, 2021a). CVWD is committed to continued participation in the Task Force. The GSAs will also continue to seek grant funding to support ongoing delivery and expansion of conservation programs targeted to golf courses, including those identified by the Task Force.

One of the primary tools that CVWD has to reduce the impact of golf courses on the Indio Subbasin is the non-potable water program. CVWD currently has 54 golf courses connected to the Mid-Valley Pipeline, the Coachella Canal, or the blended delivery systems from WRP-7 and WRP-10. The conversion of golf courses from private production wells to non-potable water reduces groundwater pumping volumes and maximizes delivery of the region's imported supplies. CVWD is committed to its ongoing non-potable water expansion.

DWA has six courses within its boundaries in the Planning Area. Recycled water is available to and has historically been used at four courses but is currently only accepted at three. The other two courses are far from DWA's recycled water infrastructure and haven't been deemed cost effective to connect.

11.3.1.3 PMA 3: Agricultural Water Conservation

CVWD has implemented agricultural water conservation efforts since preparation of the *2002 CVWMP*. Following the *2010 CVWMP Update*, a variety of agricultural conservation programs have been implemented, including grower education and training, scientific irrigation scheduling, irrigation upgrades/retrofits, and engineering evaluations. Programs with voluntary grower participation, such as the Extraordinary Conservation Measures programs, have been effective in increasing water use efficiency. The Extraordinary Conservation Measures programs were a series of voluntary agricultural conservation measures designed to compensate United States Bureau of Reclamation (USBR) for the accidental overuse of the Colorado River supplies. Through voluntary agricultural conservation, CVWD was able to pay back the overrun (73,200 acre-feet [AF]) by 2009. Between 2015 and 2018, an additional 71 acres of agricultural land were converted from flood/furrow to drip irrigation which resulted in an estimated water savings of 252 AFY (CVWD, 2021b).

CVWD established the Agricultural Water Advisory Group (AWAG) in December 2015 to collaborate with other organizations and educate Valley residents about the agricultural industry's stewardship of water in the Coachella Valley. The AWAG meets biannually to discuss water issues, legislative updates, grant funding opportunities, best management practices (BMPs), and information to assist farmers. This ensures collaboration with entities such as the Natural Resources Conservation Service (NRCS), the United State Department of Agriculture (USDA), and the Agricultural Commissioner's Office (CVWD, 2021b). CVWD is committed to continued participation in the AWAG. The GSAs will also continue to seek grant funding to support ongoing delivery and expansion of agricultural conservation programs, including those identified by AWAG.

An agricultural resource page is available on CVWD's website (www.cvwd.org/434/Agriculture) providing links to various organizations, articles, meeting and training dates, and any available grant information.

11.4 Water Supply Development

CVWD and DWA continue their efforts to obtain additional water supplies to meet projected water demands, increase the reliability of water supply, and to avoid undesirable results associated with chronic groundwater level declines (including storage depletion, subsidence, and seawater intrusion). Sources of additional water include Colorado River water, SWP water, recycled water, exchanges, entitlements and transfers, and other water development projects.

11.4.1 Surface Water

11.4.1.1 PMA 4: Increased Surface Water Diversion

DWA's surface water rights for Chino, Snow, Falls Creek, and Whitewater canyon flows total 13,309 AFY. However, in different water year types, DWA has not always captured all the surface water it has had the right to divert from those sources. DWA plans to divert as much water from those sources as may be available and deliver that diverted surface water to the Whitewater River Groundwater Replenishment Facility (WWR-GRF) for replenishment into the Indio Subbasin and subsequent extraction for use in DWA' domestic water supply system.

11.4.2 SWP Water

CVWD and DWA are working with Metropolitan Water District of Southern California (MWD) and DWR to both improve the reliability of SWP water and acquire additional supplies. Future SWP projects include increased deliveries through the implementation of the Delta Conveyance Facility (DCF), the Lake Perris Dam Seepage Recovery Project, and the Sites Reservoir Project. SWP supplies are expected to increase by approximately 14,300 AF by 2045, along with increased SWP reliability of 26,500 AFY following construction of the DCF.

11.4.2.1 PMA 5: Delta Conveyance Facility

The DCF is a project led by DWR to improve SWP reliability and result in increased future deliveries relative to projected long-term reliability (estimated to be 45 percent, see Chapter 6, *Water Supply*) by modernizing SWP conveyance facilities in the Delta. The DCF will construct and operate a new tunnel to bypass the existing natural channels that are currently used for SWP conveyance, which are vulnerable to earthquakes, sea level rise, and pumping restrictions. The new facilities will convey water from the north Delta to the south Delta and will be operated in coordination with the existing south Delta pumping facilities. The planning process for the proposed DCF is moving forward, and a Draft Environmental Impact Report (EIR) is anticipated for public review in mid-2022.

CVWD and DWA have approved an agreement to advance their share of funding for DCF planning and design costs and are considering approval of an *Agreement in Principle for the Delta Conveyance Facility* (unpublished) in 2021. SWP contractors estimate that SWP Table A deliveries will increase by 500,000 AFY and be restored to approximately 58 percent reliability after the DCF is built, resulting in an average SWP supply delivery increase of 26,500 AFY to CVWD and DWA by 2040. The DCF would increase water supply reliability and help prevent undesirable results in the Indio Subbasin associated with chronic lowering of groundwater levels.

11.4.2.2 PMA 6: Lake Perris Dam Seepage Recovery Project

The Lake Perris Dam Seepage Recovery Project is a project led by DWR to collect and distribute SWP water seeping under Lake Perris Dam and deliver the water to MWD in addition to its current allocated Table A water. The proposed project consists of installing an integrated recovery well system that would include up to six new seepage recovery wells and a conveyance pipeline connecting the wells to the Colorado River Aqueduct. The project is proceeding as planned, and the Draft EIR was released in May 2021 for public comments.

MWD has partnered with CVWD and DWA and is in the process of developing a funding agreement with DWR to fund the environmental analysis, planning, and preliminary design of the project. CVWD and DWA will need an additional agreement (or amendment to the existing *Exchange Agreement*) to exchange a proportion of the recovered seepage water for Colorado River water delivered by MWD to WWR-GRF and Mission Creek Groundwater Replenishment Facility (MC-GRF) (MWD, 2020) through MWD’s Colorado River Aqueduct. As described in Chapter 6, *Water Supply*, the project is anticipated to deliver approximately 2,753 AFY to CVWD and DWA beginning in 2025.

11.4.2.3 PMA 7: Sites Reservoir Project

The Sites Reservoir Project is a reservoir that will capture and store excess water from snowmelt and winter runoff from the Sacramento River for use during dry periods. The Sites Reservoir is in the Sacramento Valley and is considered “off-stream” meaning that it will not dam or impede the Sacramento River or other stream. The Sites Reservoir will operate in conjunction with other California reservoirs to increase water supply reliability and resiliency. The water storage capacity in Northern California is expected to increase by up to 15 percent because of project implementation. Water supply and storage capacity will be made available to water purveyors throughout California who want to purchase water supply from the Sites Reservoir Project. The project is currently in the early planning and permitting stages, and the Sites Project Authority is in the process of negotiating agreements to secure funding and financing for design, construction, and operation of the project (Sites Project Authority, 2020a).

In 2019, CVWD and DWA both entered into an agreement with the Sites Project Authority for the next phase of planning for the Sites Reservoir (Sites Project Authority 2019; 2020b). CVWD and DWA are participating members at 10,000 AFY (5.2 percent) and 6,500 AFY (3.4 percent) levels, respectively. Assuming a 30 percent conveyance loss, CVWD and DWA anticipate a total delivery of 11,550 AFY of Sites Reservoir water beginning in 2035.

11.4.2.4 PMA 8: Future Supplemental Water Acquisitions

As described in Chapter 6, *Water Supply*, CVWD has entered into various agreements with Rosedale Rio-Bravo, Glorious Lands Company, and MWD to deliver supplemental water to the Indio Subbasin. As opportunities arise, CVWD and DWA will continue to make water purchases from programs such as SWP Article 21 (interruptible water) and Turnback Pool water, Governor's Drought Water Bank, the Yuba Accord, and the Rosedale-Rio Bravo transfer.

11.4.3 Potable Reuse

11.4.3.1 PMA 9: East Valley Reclamation Authority Potable Reuse

In 2013, IWA and Valley Sanitary District (VSD) formed a Joint Powers Agreement for the East Valley Reclamation Authority (EVRA), with the main objective to augment local water resources through beneficial water reuse. Indirect potable reuse (IPR) involves use of advanced treated wastewater to replenish groundwater and manage groundwater storage. IPR projects may be used for long-term storage (banking) or shorter-term recharge and extraction. Both strategies help improve local groundwater supply by increasing water levels and potentially improving groundwater quality in a given aquifer (EVRA, 2020). In November 2020, EVRA evaluated the feasibility using treated wastewater from the existing VSD Water Reclamation Facility (WRF) for IPR (EVRA, 2020). The study, which explored both spreading and injection as groundwater recharge options, recommended injection as a viable recharge alternative. The area identified to be utilized for IPR activities, at the southern end of the VSD WRF, is located within a geologically complex area. In addition, the sediments underlying the VSD site are of low permeability, which is not conducive to surface water spreading. Additional work (i.e., geophysical surveys and a deep boring) is needed to verify site-specific, subsurface hydrogeologic conditions. The data collected from this work could be used to assist in the siting and design of potential IPR injection and/or monitoring wells.

In addition to proposed injection wells, an advanced treatment plant would be constructed at the VSD WRF consisting of membrane filtration (microfiltration or ultrafiltration) followed by reverse osmosis (RO) and an ultraviolet disinfection/advanced oxidation process to meet State requirements for subsurface injection. By 2030, EVRA plans advanced treatment and recycling of 5,000 AFY of wastewater from the VSD WRF to potable standards for groundwater replenishment and reuse.

11.5 Source Substitution and Replenishment

Source substitution is the delivery of an alternate source of water to users that currently pump groundwater. The substitution of an alternate water source reduces groundwater extraction and allows the management of groundwater storage. The following discussion of source substitution projects is presented by water source and by location within the Coachella Valley.

Construction of the Mid-Valley Pipeline in 2009 to deliver Canal water to the Mid-Valley area.

11.5.1 Colorado River Water – Non-Potable Water (NPW) Deliveries

Historically, Colorado River water (Canal water) was used almost exclusively for agricultural irrigation, with golf course irrigation beginning in 1986. Direct use of Colorado River water now includes agriculture, duck clubs and fish farms, golf courses, and construction water. This *Alternative Plan Update* assumes continuation of direct delivery to existing Canal water users.

11.5.1.1 PMA 10: Mid-Valley Pipeline (Canal Only Customers)

The Mid-Valley Pipeline (MVP) is a pipeline distribution system to deliver Canal water to the Mid-Valley area to supplement CVWD's recycled water for golf course and open space irrigation. Construction of the first phase of the MVP from the Coachella Canal in Indio to CVWD's WRP-10 (6.6 miles in length) was completed in 2009. At WRP-10, Canal water supplements recycled water for delivery to large irrigators. As of 2020, there were six golf courses connected directly to the MVP prior to its intersection to WRP-10. In addition, 18 golf courses and other municipal users (i.e., schools and homeowners' associations) in the West Valley are connected to the WRP-10 recycled water system and receive a blend of recycled water and Canal water from the MVP. CVWD plans to continue expansion of the MVP non-potable delivery system.

CVWD plans the direct connection to the MVP of an additional 14 golf courses and open spaces that primarily use groundwater for irrigation, thus serving Canal water to meet water demands. An estimated 6,203 AFY of new MVP demand will be delivered within the next 8 to 10 years, with an additional 5,797 AFY demand by 2040. These additional direct connections to the MVP are estimated to eliminate approximately 12,500 AFY of groundwater pumping.

11.5.1.2 PMA 11: Mid-Canal Storage Project

Additional storage near the middle of the existing Coachella Branch of the All-American Canal (Coachella Canal) will be valuable to spread out large flow changes over several hours and reduce peak flows through the Canal. Mid-system storage can attenuate large flow changes that might otherwise exceed existing drawdown criteria or exceed capacity near the Canal's downstream end.

To that end, CVWD will increase water storage through the creation of an inline reservoir along the Coachella Canal. The Mid-Canal Storage Project will increase storage by 728 acre-feet (AF) by removing the existing embankment between the current lined canal with the original earthen canal section to form a single wide trapezoidal reservoir section. The materials removed will be used to construct more gradual canal side slopes (from 1.5:1 to 3:1) and raise the invert two feet higher. This additional storage will allow CVWD to manage common, but unpredictable, events by providing for capture during excess water events for use during deficit water events. During drought periods, this added backup supply will improve efficient use of water and limit waste.

11.5.1.3 PMA 12: East Golf Expansion

The East Golf NPW Program currently serves 30 golf courses with an average annual delivery of 20,283 AFY from 2015 to 2019. The East Golf Expansion project proposes connecting four additional golf customers in the East Valley to the Coachella Canal. These additional connections to the East Golf Expansion system is estimated to eliminate approximately 3,330 AFY of groundwater pumping by 2025.

11.5.1.4 PMA 13: Oasis Distribution System

The Oasis Distribution System would expand the Canal water delivery system to the Oasis Area to utilize additional Colorado River allocations under the Quantification Settlement Agreement (QSA). The project would substitute groundwater production with Canal water for agricultural irrigation and other non-potable landscape irrigation. The Oasis Area is located near the northwest margin of the Salton Sea, south of Avenue 66, West of Harrison Street, and north of Avenue 86. System improvements required to convey water to this area include construction of gravity and pressurized pipelines, surface reservoirs, pump stations, and related modification and connections to the existing irrigation system (CVWD, 2014). Phase 1 of the project includes two reservoirs to provide additional storage and operation improvements and flexibility and is currently under construction. Phase 2 includes land acquisition and construction for four reservoirs, five pump stations, and approximately 18 miles of distribution pipeline and an expansion of the irrigation distribution system to serve an additional 4,520 acres. Phase 2 of the project is planned to begin construction mid-2021 (WEI, 2020). CVWD anticipates construction to be completed in 2022.

The Oasis Distribution System would further expand the Canal water delivery system to the Oasis Area.

Projected expansion would gradually meet existing and potential future pumping demands as follow:

- 12,000 AF in 2023,
- 16,500 AF in 2024,
- 21,000 AF in 2025,
- 23,500 AF in 2026,
- 27,000 AF, in 2027, and
- 32,150 AF in 2028-2045

11.5.2 Direct Deliveries – Recycled Water

Currently, recycled water production exceeds existing demand during the winter months, and the remaining recycled water is disposed of through onsite percolation basins. CVWD has committed to maximizing recycled water use by continuing to expand the NPW system and adding new NPW customers in order to eliminate land disposal and reduce this source of nitrate to the groundwater basin. This *Alternative Plan Update* assumes continued delivery of recycled water from WRP-7, WRP-10, and DWA WRP, along with NPW expansion consistent with growth of municipal demands and associated increases in wastewater flows and recycled water availability. CVWD has plans to begin tertiary treatment and recycled water deliveries from WRP-4 as well, which is described below.

11.5.2.1 PMA 14: WRP-10 Recycled Water Delivery

The WRP-10 distribution system delivers non-potable water to existing customers throughout Indian Wells, Palm Desert, and portions of Rancho Mirage. There are currently 18 customers served by a blend of Canal water and recycled water. CVWD is planning to connect 29 additional customers to serve an additional 27,790 AFY from the WRP-10 NPW system by 2034, which delivers a blend of recycled water and Canal water. This project will increase recycled water deliveries consistent with growth of municipal demands and associated wastewater flow up to the current tertiary treatment capacity of 16,800 AFY. The remaining demands from new connections will be served by Canal water. CVWD has identified a broad array of golf courses in Palm Desert, Rancho Mirage, and Indian Wells for potential future connections.

CVWD is planning to connect 29 additional customers to the WRP-10 recycled water distribution system.

11.5.2.2 PMA 15: WRP-7 Tertiary Expansion

WRP-7 provides service to portions of Cathedral City, Rancho Mirage, Palm Desert, Bermuda Dunes, Thousand Palms, and some unincorporated areas of Riverside County. It currently has a secondary treatment permit capacity of 5.0 million gallons per day (mgd) and a tertiary treatment capacity of 2.5 mgd (2,800 AFY). The recycled water produced at WRP-7 meets Title 22 requirements and is used for irrigation and is either stored in a covered storage reservoir or pumped offsite to an open reservoir near the Del Webb Sun City Golf Course.

CVWD plans to expand its WRP-7 recycled water production tertiary treatment capacity by 3 mgd to a total capacity of 5.5 mgd (6,150 AFY) to meet anticipated regulatory changes and utilize increases in future wastewater flows. Recent WRP-10 RWQCB permits suggest more stringent RWQCB regulation of wastewater percolation operations (CVWD, 2020b). CVWD's *2020 Sanitation Master Plan Update* projects the average day flow rate for WRP-7 to be 5.2 mgd in 2045 (CVWD, 2020c). This project provides the ability to recycle 100 percent of the 2045 projected WRP-7 flow, while eliminating the need to discharge treated effluent to percolation ponds, thus avoiding implementation of additional treatment to meet future anticipated water quality regulations. Design for the WRP-7 expansion project is underway, and construction is anticipated in 2025.

11.5.2.3 PMA 16: Canal Water Pump Station Upgrade

The Canal Water Pump Station Upgrade would upgrade the Mile Post (MP) 113.2 Canal water pump station capacity in order to convey Colorado River supply for blending with WRP-7 recycled water. This project will be designed/constructed in two phases (5.5 mgd and 6.2 mgd). The MP 113.2 Pump Station is located at Madison and Avenue 40 on the southwest corner next to the Coachella Canal in Indio. Phase 1 will involve replacement of two 2,800 gpm pumps. Phase 2 will involve the addition of a third 2,800 gpm pump. Additional NPW storage is also being designed as part of Phase 1 to provide flexibility for delivery. Planning and design are expected to be completed by 2022, with project construction to be completed by 2026.

11.5.2.4 PMA 17: WRP-7 Recycled Water Delivery

Golf courses in the mid-Valley area use recycled water for irrigation.

WRP-7, located west of Interstate 10, currently serves three golf courses with a blend of recycled water and Canal water from the Coachella Canal. WRP-7 has a current tertiary capacity of 2,800 AFY and delivered an average of 1,790 AFY from 2015-2019. This project will establish four recycled water connections to add a total estimated flow of 533 AFY by 2028. CVWD may also increase recycled water deliveries in the WRP-7 tributary area as the surrounding areas within WRP-7's proximity become developed, resulting in increased wastewater flows. Opportunities for expansion include growth to the west of WRP-7 within proximity to the existing WRP-7 customers, as well as increased deliveries to existing customers.

11.5.2.5 PMA 18: WRP-4 Tertiary Expansion & Delivery

WRP-4 provides service to the Cities of La Quinta, Mecca, Palm Desert, and Thousand Palms. Under current operations, the secondary system treats about 2.0 mgd average daily flow and does not have tertiary treatment capacity. The treatment system produces secondary effluent which is discharged to the Coachella Valley Storm Channel (CVSC) under a National Pollutant Discharge Elimination System (NPDES) permit, which has a maximum month average daily effluent flow of 9.9 mgd.

CVWD's tertiary treatment expansion at WRP-4 will be implemented in four phases. To avoid potential future restrictions on the minimum amount of treated wastewater that may be required to be discharged to the CVSC, the first phase is recommended to be constructed as soon as possible. Phase 1, which will provide 10 mgd of total tertiary treatment capacity, includes a secondary effluent equalization basin, lagoon effluent pretreatment (if required), coagulation/rapid mix, Filter Building, and filters; expands the chlorine contact basins and chemical feed systems; adds a new recycled water storage basin (up to 177 million gallons [MG]); and adds a new recycled water pump station (10 mgd capacity) and pipeline that connects into a new non-potable system off-site. The project will also require new Waste Discharge Requirements (WDRs) with Colorado River RWQCB and a permit amendment for the NPDES permit #CA0104973.

Phase 2 will provide overall space and structural elements for another 10 mgd of treatment capacity, increase capacity to 13.3 mgd by commissioning the fourth filter, and add equipment to the existing facilities, including coagulation/rapid mix, filters, chlorine contact basins, and recycled water pumps. Phase 3 will increase capacity to 16.7 mgd and add equipment to the existing facilities, including media and equipment to commission the fifth filter. Phase 4 will increase capacity to 20 mgd and add equipment to the existing facilities, including filter media and equipment to commission the sixth filter. The recycled water storage may also require expansion based on seasonal demand patterns, and the non-potable system will be expanded (CVWD, 2020c).

Design is underway for the Phase 1 WRP-4 tertiary expansion, with construction anticipated in 2025. CVWD is currently working on the Wastewater Change Petition process with SWRCB and the NPDES/WDRs permitting process with the Colorado River RWQCB, along with project-level environmental compliance. The outcomes of the Change Petition will determine the final construction timeline and recycled water delivery volumes for the WRP-4 expansion. Since recycled water volumes are yet undetermined and distribution system options are still being analyzed, WRP-4 deliveries have not been included in the water budget modeling. However, CVWD plans to proceed with this project pending resolution of the Change Petition.

11.5.2.6 PMA 19: DWA WRP Recycled Water Delivery

The DWA WRP project will increase deliveries of recycled water in DWA's service area as new customers are identified and consistent with wastewater flow growth up to the 11,200 AFY of existing tertiary capacity.

11.5.3 Groundwater Replenishment

Three replenishment facilities are currently operated in the Indio Subbasin (see Figure 2-5): WWR-GRF, Palm Desert GRF (PD-GRF), and Thomas E. Levy GRF (TEL-GRF). Groundwater replenishment is an important component of Indio Subbasin management. With surface spreading, water is placed in shallow ponds where it is allowed to percolate into the underlying aquifers. Surface spreading requires large areas of open land for construction of ponds and the absence of significant confining clay layers that would prevent the water from reaching the aquifers. Since 1973, CVWD and DWA have replenished the western portion of the Subbasin at the WWR-GRF with nearly 4 million AF of SWP Exchange water and at the PD-GRF with a total of 14,836 AF since starting operations in 2019. CVWD has replenished the eastern portion of the Subbasin at TEL-GRF with about 400,000 AF since full-scale operations commenced in 2009.

11.5.3.1 PMA 20: PD-GRF Expansion

The PD-GRF Expansion will expand direct replenishment capacity at PD-GRF.

The PD-GRF Expansion will expand direct replenishment capacity at the PD-GRF incrementally from 2020 through 2025. Phase I, which involved repurposing and improving existing percolation ponds located north of WRP-10, was completed and began operations in early 2019. Phase II proposes to construct three detention basins within the Whitewater River Stormwater Channel (WRSC) to the south of the facility, as well as extend the existing MVP within the northern bank of the stormwater channel. The EIR for Phase II was approved by CVWD's Board of Directors in 2018, and the design of Phase II was complete as of August 2019. To support construction within potentially jurisdictional waters, CVWD is currently working on permitting with the California Department of Fish and Wildlife, U.S. Army Corps of Engineers, and Colorado River RWQCB. Construction of Phase II is scheduled to be complete in 2023 (CVWD, 2020a). This *Alternative Plan Update* assumes the PD-GRF will increase recharge capacity by 15,000 AFY to a total capacity of 25,000 AFY starting in 2023. Increased replenishment at the PD-GRF will directly improve groundwater levels in the mid-Valley portion of the Subbasin.

11.5.3.2 PMA 21: TEL-GRF Expansion

Construction of the full-scale TEL-GRF was completed in mid-2009. This facility is located on the east side of the Subbasin in La Quinta and has an estimated average recharge design capacity of 40,000 AFY. Currently, the capacity is limited by hydraulic and water delivery constraints within the Canal water distribution system to a long-term average of about 36,000 AFY. CVWD conducted a study in 2017 to evaluate the feasibility of increasing groundwater replenishment with Colorado River water at the TEL-GRF. The study recommended additional monitoring to better characterize hydrogeological conditions, and six monitoring wells were installed in 2019 in the vicinity of the GRF (CVWD, 2020a). Based on the results of the additional monitoring, TEL-GRF recharge capacity may be increased. The TEL-GRF Expansion will expand recharge capacity at the TEL-GRF incrementally from 2020 through 2025. This *Alternative Plan Update* assumes recharge capacity will increase to 40,000 AFY in 2025.

11.5.3.3 PMA 22: WWR-GRF Operation

The WWR-GRF has a recharge capacity of more than 300,000 AFY. The available capacity is valuable for conjunctive use operations by CVWD and DWA, as well as MWD through the Advance Delivery Agreement. Since 2015, CVWD has been working with the U.S. Bureau of Land Management (BLM) on right-of-way acquisition for the portion of the WWR-GRF that is sited on public lands managed by the BLM.

CVWD and DWA intend to replenish as much SWP Table A water or other imported water at WWR-GRF as is available annually. The highest replenishment volume received to the facility was in 2017 at 385,994 AF. The SWP Exchange supply is projected to supply on average about 80,250 AFY for the WWR-GRF (see discussion in Chapter 6, *Water Supply,* for SWP reliability assumptions). This *Alternative Plan Update* assumes the reliability of Table A deliveries of 45 percent and diversions to MC-GRF of 8 to 10 percent, with additional reductions in reliability starting in year 2045 under climate change conditions. CVWD also currently replenishes a portion of its Colorado River supply at WWR-GRF (ranging from 35,000 to 50,000 AFY), based on its *2019 Exchange Agreement* with MWD, until that water is needed in the East Valley. If additional SWP exchange water can be acquired and/or SWP reliability improved through the DCF, average annual replenishment could increase to 119,500 AFY. Further, advance deliveries from MWD may increase individual year deliveries beyond anticipated annual averages.

11.6 Water Quality Protection

Groundwater quality is an important issue in the Subbasin. The Indio Subbasin has variable concentrations of water quality constituents as documented in Chapter 4, *Current and Historical Groundwater Conditions*. Some constituents (e.g., arsenic, hexavalent chromium) are naturally occurring. Sources of loading for TDS and Nitrate include subsurface inflow, watershed runoff, artificial recharge, wastewater percolation, septic seepage, and return flows (CV-SNMP Agencies, 2021). The GSAs conduct ongoing water quality monitoring to understand water quality conditions. Below are the PMAs related to water quality that will help protect the groundwater basin for beneficial uses and users and avoid undesirable results.

11.6.1 Water Quality Programs and Policies

As described in Chapter 8, *Regulatory and Policy Issues*, drinking, surface, and groundwater quality is regulated by the SWRCB and its RWQCBs. The following water quality policies and programs are applicable to the Indio Subbasin:

- **Drinking Water Regulations**. The SWRCB Division of Drinking Water (DDW) regulates public water systems, oversees water recycling projects, permits water treatment devices, and supports and promotes water system security. Drinking water regulations are contained in Title 17 and Title 22 of the California Code of Regulations. Each of the GSAs in the Indio Subbasin maintains drinking water quality in compliance with DDW regulations. Note that private domestic wells are not regulated by DDW; private domestic wells and State Small Water Systems (between 5 and 14 connections) are regulated by Riverside County Department of Environmental Health (DEH).

- **Surface and Groundwater Regulations**. The Colorado River RWQCB regulates surface and groundwater within the Colorado River Basin, which includes the Indio Subbasin. The RWQCB guides water quality protection with its *Water Quality Control Plan for the Colorado River Basin Region* (Colorado River RWQCB, amended 2019), in addition to adopting and enforcing waste discharge and surface water discharge permits. Each of the GSAs in the Indio Subbasin complies with RWQCB regulations in implementation of its projects and programs.

- **Colorado River Salinity Forum**. The Colorado River Basin Salinity Control Act was passed by Congress in 1974 to address the growing salinity problem which would require cost-effective salinity control measures on the river. The Salinity Forum is a seven-state approach to lowering salinity levels by conducting triennial reviews of water quality along the river and reporting on progress achieved. Over the last 30 years, the salinity concentrations in the Colorado River have an overall, long-term downward trend, as a result of the programs. Weighted average annual salinity are at or below the numeric criteria (see Figure 8-1), while the Colorado River Basin States continue to develop their compact-apportioned water supply through projects and programs to meet water supply needs. The Program has successfully controlled over 1.22 million tons of salt annually and has identified additional measures to achieve the identified maximum potential salt reduction of 2.35 million tons per year by 2040.

- **Coachella Valley Salt and Nutrient Management Plan (CV-SNMP).** To address rising salinities in groundwater, the SWRCB adopted a *Recycled Water Policy* in February 2009 which requires the development of Salt and Nutrient Management Plans (SNMPs) for groundwater basins throughout California. The plans require basin wide management of salts and nutrients from all sources in a manner that protects groundwater quality and beneficial uses. In 2015, CVWD, DWA, and IWA produced the *Coachella Valley Salt & Nutrient Management Plan* (*CV-SNMP)* (CVWD, et al., 2015). Subsequently, the Colorado River RWQCB evaluated the plan and concluded that the *2015 SNMP* did not fully satisfy *Recycled Water Policy* requirements and provided a series of recommendations (Colorado River Basin RWQCB, 2020). In April 2021, an expanded SNMP agency group which includes all water and wastewater agencies in the Coachella Valley prepared a Development Workplan that describes a detailed scope of work to develop an updated CV-*SNMP*, including a new monitoring program. The Colorado River RWQCB approved the CV-SNMP Groundwater Monitoring Workplan in early 2021(see also Chapter 8, *Regulatory and Policy Issues*).
- **Disadvantaged Communities Infrastructure Task Force.** CVWD established the Disadvantaged Communities Infrastructure (DACI) Task Force to collaborate with other entities and community members to achieve safe and affordable drinking water, wastewater, and flood control services in historically disadvantaged Coachella Valley areas. The DACI Task Force meets bi-monthly to discuss the various consolidation and infrastructure projects that are underway. CVWD, in collaboration with the DACI Task Force, completed domestic water and sanitation consolidation master plans in 2018 to prioritize the systems that are to be consolidated. Coordination among the groups' local entities, regulators, and community members helps to garner support for ongoing grant funding, permitting, and approval processes.

11.6.1.1 PMA 23: Eliminate Wastewater Percolation

Currently, CVWD's WRP-7, WRP-10, and Palm Springs' WWTP/DWA's WRP all discharge to percolation ponds within the Indio Subbasin. Over the last decade, non-potable water deliveries (described under Section 11.5 above) in the Indio Subbasin have expanded dramatically and reduced wastewater percolation. The GSAs will continue to reduce percolation of wastewater into the Indio Subbasin by continuing to implement source substitution efforts. The GSAs will continue to work with the Colorado River RWQCB to acquire permits for recycling of municipal wastewater, which will both protect groundwater quality and deliver a reliable new water supply to local customers.

11.6.1.2 PMA 24: Wellhead Treatment

The Wellhead Treatment project will assess the need to expand groundwater treatment facilities to treat additional wells in the future for arsenic, nitrate, or other constituents of concern. The GSAs are collaborating with the County of Riverside and small water systems to expand the potable water system to additional communities that are experiencing poor water quality in private wells (see also Chapter 8, *Regulatory and Policy Issues,* on treatment for arsenic).

Elevated concentrations of nitrate exist in some western areas of the Indio Subbasin (see Chapter 4, *Current and Historical Groundwater Conditions*), reflecting natural and human-induced sources. Generally, wells with high nitrate concentrations are relatively shallow, and deeper groundwater tends to be higher quality. Naturally elevated arsenic concentrations in groundwater also have been found in the East Valley, northwest of the Salton Sea (see Chapter 4, *Current and Historical Groundwater Conditions*) with indications of higher concentrations at depth.

Wellhead treatment technology can be designed to remove selected constituents (such as nitrate and arsenic) in drinking water wells that exceed the maximum contaminant levels (MCLs). The GSAs will continue to monitor the development of new MCLs (e.g., hexavalent chromium) and report on groundwater quality and as needed. In addition, the GSAs will seek grant funding to consolidate small water systems with recurring violations (see below) and will evaluate the feasibility of installing wellhead treatment on GSA wells to ensure delivered drinking water meets state and federal MCLs established to protect public health.

11.6.1.3 PMA 25: Small Water System Consolidations

Small water systems, often serving disadvantaged communities (DACs), may face challenges in providing safe, accessible, and affordable water because they may not have adequate resources to support maintenance, operation, and treatment costs. Primarily within the East Valley, the GSAs are working to extend public water and sewer service to mobile home park communities with deficient infrastructure and poor water quality. In 2018, CVWD completed the East Coachella Valley Water Supply Project (ECVWSP), a master planning effort to identify and prioritize small water systems within East Valley that could benefit from consolidation with its public water system. The master planning effort involved representatives from SWRCB, DEH, and multiple non-profits through the DACI Task Force. Over 80 small water systems currently relying on private groundwater wells and septic systems were identified. The ECVWSP grouped the systems into approximately 40 water consolidation projects based on proximity to each other and to CVWD's existing facilities. CVWD began the preliminary engineering and environmental documentation for the two highest priority water consolidation projects in 2019 – Saint Anthony and Valley View. The Saint Anthony Project has an estimated capital cost of approximately $34 million and is currently under design. A portion of the project is anticipated to begin construction in 2021, with the remaining portions beginning construction in 2023. The Valley View Project is estimated to cost approximately $11 million. Preliminary design of the project is complete, and implementation is expected to begin in the next 5 years. The ECVWSP identified other water consolidation projects; CVWD will continue to implement these as funding becomes available in the future.

CWA is also working to consolidate multiple mobile home parks within its service area to address water quality deficiencies identified by DEH. Grant funding is being sought for construction of the necessary infrastructure for the small water system consolidations.

11.6.1.4 PMA 26: Septic to Sewer Conversions

Septic systems are a significant, documented source of nitrate to the groundwater basin. The Colorado River RWQCB has adopted septic tank prohibitions in areas of where high septic tank density has caused water quality degradation. Conversion from septic systems to sewer can offset a large proportion of this existing nitrate source to the basin. CVWD is pursuing a number of septic to sewer conversions to improve groundwater quality and sanitation within small communities in the East Valley. In 2018, CVWD completed a master planning effort to identify and prioritize parcels with septic systems within East Valley that could benefit from consolidation with its public sanitation system. The master planning effort involved representatives from SWRCB, DEH, and multiple non-profits through the DACI Task Force. Nearly 90 individual septic systems were identified, ranked, and prioritized for consolidation. The effort screened the priority systems to 55 and then grouped those into 18 sanitation consolidation projects based on proximity and potential to develop a backbone system in the East Valley. Several of the top five ranked consolidation projects in the master planning process – El Mesquite, Sunbird, Airport Blvd, Monroe Street, and Avenue 66 – are currently in the preliminary design, environmental compliance, and funding phases. Construction for those projects is anticipated to begin within the next 5 years. CVWD will continue to implement consolidations as funding becomes available in the future.

11.6.2 Coachella Valley Salt and Nutrient Management Plan (CV-SNMP)

In 2015, the CV-SNMP was developed for the Coachella Valley Groundwater Basin in accordance with the *Recycled Water Policy*. The SNMP was prepared to manage salts and nutrients on a Subbasin-wide basis, while encouraging recycled water use. However, the RWQCB found the 2015 CV-SNMP insufficient and made recommendations for improvements in 2020. In 2020 and 2021, the CV-SNMP partners – which include CVWD, Coachella Sanitary District, City of Palm Springs, CWA, DWA, IWA, Mission Springs Water District, Myoma Dunes Mutual Water Company, and Valley Sanitary District – prepared a CV-SNMP Groundwater Monitoring Program Workplan and a CV-SNMP Development Workplan to guide revisions to the plan.

11.6.2.1 PMA 27: Implement CV-SNMP Groundwater Monitoring Program Workplan

The GSAs, along with the other CV-SNMP partners, will implement the *CV-SNMP Groundwater Monitoring Program Workplan* (Monitoring Workplan; see Appendix 2-A) submitted to the RWQCB in December 2020 outlining an expanded groundwater monitoring program that would sufficiently determine whether concentrations of TDS and N in groundwater are consistent with water quality objectives. The RWQCB approved the Monitoring Workplan in February 2021. The Monitoring Workplan covers all Subbasins within the Coachella Valley Groundwater Basin except for the San Gorgonio Pass Subbasin; includes sampling from the deep, shallow, and perched zones of the aquifer; focuses on critical areas near large WRPs, GRFs, and other potential sources of loading; and emphasizes areas near production wells. The Monitoring Workplan establishes the monitoring network, sampling frequency, and reporting, and identifies gaps to be filled in the monitoring network. Monitoring data will be reported to the GAMA system annually starting in 2022. The monitoring program established in Chapter 10, *Monitoring Program,* was coordinated with the *CV-* Monitoring Workplan.

11.6.2.2 PMA 28: Implement CV-SNMP Development Workplan

The GSAs, along with the other CV-SNMP partners, will implement the *CV-SNMP Development Workplan* (Development Workplan; see Appendix 2-A) submitted to the RWQCB in April 2021 outlining a scope of work for updating the CV-SNMP in accordance with the *Recycled Water Policy*. The CV-SNMP agencies have submitted a draft Development Workplan that will be presented to the RWQCB for discussion at their September 2021 meeting. The goal of the Development Workplan is to outline the steps necessary to resolve the challenges identified by the RWQCB in their review comments. Implementation of the Workplan will involve conducting public outreach and creating a technical advisory committee, characterizing current groundwater quality and loading, developing N/TDS forecasting methodologies, completing forecasting for multiple scenarios, selecting a preferred scenario, establishing management zones, and recommending TDS objectives. The implementation schedule for the Development Workplan concludes with a final CV-SNMP submitted to the RWQCB in 2026.

The CV-SNMP update may require implementation of mitigation for N/TDS loading, which will be evaluated during implementation of the Development Workplan. Mitigation may include the types of activities identified in the *2010 CVWMP Update* and *2015 CV-SNMP*:

- **Enhanced Septic Systems**. For areas where sewer conversion is not feasible due to economic or physical constraints, the use of enhanced septic technologies can provide additional nitrate removal. The EPA Environmental Technology Verification Program's Water Quality Protection Center provides several septic technology alternatives for enhanced nutrient reduction.
- **Regulation of Self-Regenerating Water Softeners**. A preventable source of salts to the Subbasin is the use of self-regenerating water softeners (SRWS). SRWS use an ion-exchange media to replace calcium and magnesium that contribute to hardness in water, with sodium and/or potassium. The salt added using SWRS enters the sewer/septic system and returns to the groundwater basin through percolation ponds after waste treatment or through irrigation of recycled water. In some regions of the State, prohibitions on the installation/sale of SRWS have been implemented to manage salt addition to the wastewater stream.
- **Fertilizer Application Optimization**. Fertilizers containing nitrogen are a known source of nitrate to the groundwater basin. The use of recycled water that contains higher concentrations of nutrients can reduce the reliance on fertilizers as the nutrient source to a particular crop, resulting in reduced importation of nutrients to the Subbasin. Agencies can communicate the nutrient loads of their recycled water supplies to their users and the users incorporate these nutrient loads when determining the need for fertilizer applications.

11.6.2.3 PMA 29: Colorado River Basin Salinity Control Forum

The Salinity Forum, which is a cooperative effort involving federal, state, and local agencies, includes projects that remove salt tonnage. This will be accomplished principally by reducing the salt contributions to the Colorado River from existing sources and minimizing future increases in salt load caused by human activities. CVWD will continue to support and participate in Salinity Forum efforts, including construction of salinity control measures (for example, prevention of inflow to the river from saline springs), advancement of policies for effluent limitation (for example, policies addressing discharges from fish hatcheries), and implementation of non-point source management plans (for example, improved irrigation practices).

11.6.2.4 PMA 30: Source Water Protection

Well management programs are required to ensure that existing and future wells do not impact the usability of the groundwater resource. Specific programs applicable to the Coachella Valley are well construction/destruction/abandonment policies, artesian well management, and well capping:

- **Well Construction, Destruction, and Abandonment**. Improperly constructed wells can result in poor yield and contaminated groundwater by establishing a pathway for pollutants to enter a well, allowing migration between aquifers of water with varying quality, or enabling the unauthorized disposal of waste into the well. Inactive or improperly abandoned wells present a physical danger and can allow groundwater pollution. Existing well construction, destruction and abandonment policies will be strengthened and implemented in cooperation with Riverside County DEH.

- **Leaking Artesian Well Rebate Program**. Historically, artesian groundwater conditions existed in much of the East Valley. Artesian flows occurred in decreasing amounts until the early 1990s (CVWD, 2010). As water management actions in the Indio Subbasin restore water levels, artesian conditions may reoccur. However, most wells are not properly equipped to deal with artesian pressure. CVWD will continue to implement the Leaking Artesian Well Rebate Program to educate and work with well owners to properly control artesian wells to avoid unnecessary waste of water and the potential for property damage.

11.7 Deferred Projects

The projects contained in this section have been determined by the GSAs as currently unfeasible or unnecessary at this time given Indio Subbasin conditions; however, they are retained here for future reference in case Indio Subbasin conditions change and additional management strategies are needed or if projects become feasible in the future. The *2010 CVWMP Update* includes more detailed description of these projects. The deferred projects include the following:

- **Intentionally Created Surplus Program**. The potential may exist to develop additional supply under the Intentionally Created Surplus (ICS) program. The ICS program was created by the *Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead* in December 2007 (USBR, 2007). CVWD is currently not participating in the ICS program.

- **Yuma Desalter Saved Water**. The Yuma Desalter was constructed by USBR in 1992 to treat saline agricultural return flows from the Wellton-Mohawk Irrigation and Drainage District. The plant has been maintained since construction, but only operated three times since then. Given that the Yuma Desalter has not been operated in the past 10 years, this project has been deferred.

- **Development of Fargo Canyon Subarea Supplies**. Growth in Indio Subbasin areas northeast of the San Andreas fault will create additional demands for both potable and non-potable water. CVWD and the cities of Coachella and Indio would need to investigate groundwater resources in the Fargo Canyon Subarea of the Desert Hot Springs Subbasin to determine the available supply and suitability for meeting demands in the area.

- **Stormwater Capture**. Stormwater capture has been identified as a potential method to augment local water supplies. Short duration, high intensity storms inducing large flows make it cost prohibitive for long term capture. The cities and unincorporated communities within the Plan Area – through the *Municipal Separate Storm Sewer System (MS4)* permit – require local runoff induced by increased impervious area related to new developments to include stormwater capture and recharge infrastructure. The potential yield of these smaller systems is not known at this time. Consequently, stormwater capture is categorized as deferred, but may be considered in conjunction with other projects that construct stormwater and flood control facilities.

- **Storage Opportunities with Imperial Irrigation District (IID)**. As part of the QSA, CVWD and IID have signed an agreement that allows IID to store surplus Colorado River water in the Coachella Valley. This program would benefit Coachella Valley by providing higher levels of groundwater storage while IID water is stored in the Valley. However, IID does not actively use the Indio Subbasin for conjunctive use.

- **Urban Water Treatment**. The use of Canal water for potable uses would require treatment to meet drinking water regulations. In 2008, CVWD completed a pilot treatability study for Canal water (Malcolm-Pirnie, 2008) which investigated three alternative treatment approaches for meeting the Surface Water Treatment Rule and providing RO to reduce the salinity of Colorado River water delivered for urban use. This project has been categorized as deferred because direct treatment and use of Canal water is not planned by CVWD.
- **Colorado River Desalination**. This project proposes to construct three or more separate RO treatment facilities, one at each recharge location, to remove the salt and other minerals from Colorado River water and to recharge the treated water into the Subbasin. However, this project has been categorized as a deferred project because the size, complexity, and intermittent operation of required treatment facilities would be cost prohibitive, exceed available renewable energy supplies, and would require a feasible plan for brine disposal.
- **Construction of SWP Extension**. This project includes direct delivery of SWP through the construction of a SWP extension of the California Aqueduct. A direct connection to the terminus of the East Branch of the California Aqueduct in Cherry Valley would require at least 23-miles of conveyance pipeline. This project has been categorized as a deferred project because construction of such a pipeline (or aqueduct) is an expensive alternative to the existing exchange agreement with MWD and could adversely impact this agreement resulting in significant reductions in SWP supplies. Additionally, project permitting and approvals present uncertainty and there would be a significant environmental impact. In addition, direct importation of SWP water would most likely result in the loss of approximately 100,000 AFY of Colorado River water that results from the exchange of SWP water for QSA water from MWD.
- **Drain Water Desalination**. Drain water desalination was recommended for irrigation purposes and considered a maximum of 100,000 AFY to be delivered to the Canal water distribution system. CVWD has concluded drain water desalination is not needed at this time to meet projected demands and is therefore categorized as a deferred project.
- **Ocean Water Desalination**. Coastal communities in Southern California are developing and implementing ocean water desalination. Though opportunities to work with coastal communities to develop ocean water desalination may arise in the future, ocean water desalination has been categorized as a deferred project as it is more expensive than other sources of water, is energy intensive, and requires multiple agreements to implement.

11.8 PMA Implementation

The sections above provide a menu of potential PMAs that could be selected and implemented by the GSAs, depending on the outcomes of the monitoring programs and adaptive management process. Table 11-3 includes the implementation actions necessary to move these projects and programs forward to ensure Indio Subbasin sustainability.

Table 11-3. *Alternative Plan Update* Implementation Actions

Activity Name	Project Proponent(s)	Activity Name	Activity Description
Water Conservation			
PMA 1: Urban Water Conservation	CVWD, DWA, IWA, CWA	Outreach/Education and CV Water Counts	Continue to implement public information programs, including CV Water Counts. Educate the public on conservation programs being planned and/or implemented, as well as educational tips that customers can use to lower their water usage. Includes publications, demonstration gardens, workshops, community events, website, social media, and a school education program.
	CVWD, DWA, IWA, CWA	Water Shortage Contingency Plan (WSCP)	Implement WSCP as needed in response to drought conditions. Implement supply augmentation, demand reduction, and operational changes as needed to meet declared shortage level.
	CVWD, DWA, IWA, CWA	Grant Funding	Pursue grant funding to fund urban water conservation programs at a higher level, as needed.
	CVWD, DWA, IWA, CWA	Conservation Study	Conduct a Conservation Study, including a detailed analysis of market saturation. Quantify potential savings from implementing current programs, relative cost on an AF basis, and potential for future savings.
	CVWD, DWA, IWA, CWA	Update and Implement Water Rates	Update Replenishment Assessment Charge and all water and sewer rates as necessary per cost of service studies. Consider tiered rates. Implement updated rates.
	CVWD, DWA, IWA, CWA	Leak Detection/Water Loss	Continue to implement water loss reduction programs and practices.
	CVWD, DWA, IWA, CWA	Implement Landscape Ordinance	Continue to implement MWELO, including plan checks.
	CVWD, DWA	Water Audits	Continue to implement Large Landscape Irrigation Audit Program to assist users in maximizing the efficient operation of their irrigation system by measuring performance, generating irrigation schedules and recommending improvement actions.
	CVWD	Professional Landscaper Training	Continue to host a LCP for professional landscapers that focuses on water use efficiency.
	CVWD, DWA	Water Waste Program/Patrols	Actively patrol the service area for water waste violations. Unresolved issues result in increasing fines to customers.

Activity Name	Project Proponent(s)	Activity Name	Activity Description
	CVWD, DWA, IWA, CWA	Indoor Rebates	Implement indoor rebate programs, designed to assist homeowners and commercial customers who want to reduce their water usage by upgrading or replacing devices, or installing new technology to improve efficiency.
	CVWD, DWA, IWA, CWA	Landscape/Outdoor Rebates	Implement landscape/outdoors rebates, designed to assist homeowners, HOA, and commercial customers who want to reduce their outdoor water usage by converting their lawn to desert-friendly landscaping, installing smart irrigation controllers, or improving the efficiency of their systems. Reducing outdoor usage is the best way to meet a monthly water budget.
PMA 2: Golf Water Conservation	CVWD	Golf & Water Task Force Meetings	Continue to meet bi-monthly, or as needed, with Golf & Water Task Force to discuss conservation programs that support golf courses.
	CVWD	Model Golf Course Water Budgets	Continue to create model water budgets for area golf courses and provide that information to the courses. While the courses are not billed according to those budgets (see water budget based tiered rates below), they can use the budget as a tool to determine their efficiency rates.
	CVWD	Golf Course Education Programs	Develop golf course incentive programs that provide education for golf course managers on water use efficiency.
	CVWD, DWA	Grant Funding	Secure grant funding as available to create incentive programs for water use efficiency such as lake liner programs, irrigation efficiency programs, or turf removal rebates.
	CVWD	Conservation Study	Complete a Conservation Study to better quantify potential savings from implementing current or proposed golf conservation programs, relative cost on an AF basis, and potential for future savings as needed.
PMA 3: Agricultural Water Conservation	CVWD	AWAG Meetings	Continue to meet bi-annually with AWAG to discuss any updates that impact the agricultural community and receive input from local farmers.
	CVWD	Agricultural Efficiency	Work with other agencies and organizations through AWAG to identify projects and programs that could assist farmers, including small farmers, on improving water use efficiency.

Activity Name	Project Proponent(s)	Activity Name	Activity Description
	CVWD	Agricultural Resource Page	Maintain agriculture page on CVWD website with links to resources such as agricultural articles, grants and rebates, meetings and groups, education, and trainings.
	CVWD	Grant Funding	Secure grant funding to create incentive programs for water use efficiency such as flood-to-drip rebates, soil sensor programs, or irrigation fixture upgrades.
	CVWD	Conservation Study	Complete a Conservation Study to better quantify potential savings from implementing current or AWAG identified programs, relative cost on an AF basis, and potential for future savings as needed.
Water Supply Development			
PMA 4: Increased Surface Water Diversion	DWA	Surface Water Diversions	Increase surface water diversions for replenishment at WWR-GRF for use in its domestic water supply system.
PMA 5: Delta Conveyance Facility	CVWD, DWA	DCF Deliveries	Continue participation in DCF, anticipated to increase Table A deliveries from 45% to ~58% starting in 2041; 60% Table A and 40% Article 21
PMA 6: Lake Perris Seepage	CVWD, DWA	Lake Perris Seepage	Continue participation in Lake Perris Seepage, which installs a series of five pumps placed down-gradient from the face of the Lake Perris Dam that will pump seepage from the lake into a collection pipeline that discharges directly into MWD's Colorado River Aqueduct. Anticipated 2025-2045 per 2019 Terms Sheet, 2,753 AFY
PMA 7: Sites Reservoir	CVWD, DWA	Sites Reservoir	Continue participation in Sites Reservoir, which captures and stores stormwater flows from the Sacramento River for release in dry years. Deliveries at 11,550 AFY (participation amount with assumed 30% conveyance loss) beginning in 2035.
PMA 8: Future Supplemental Water Acquisitions	CVWD, DWA	Supplemental Water	Enter into new agreements for Supplemental water, as available from SWP or Colorado River.
PMA 9: EVRA Potable Reuse	IWA	Implement Groundwater Model and PDR	Implement groundwater model and begin regulatory and stakeholder engagement. FY 2021-2023. Preliminary Design FY 2023-2024.

Activity Name	Project Proponent(s)	Activity Name	Activity Description
Source Substitution and Replenishment			
PMA 10: Mid-Valley Pipeline (Canal Only Customers)	CVWD	FY 32-40 Mid-Valley Pipeline Golf Course Connections/Design & Construction	Seek Clean Water State Revolving Fund (CWSRF) and Water Infrastructure Improvements for the Nation Act (WIIN) grant funding support to design and construct mid-valley pipeline canal connections to Indian Wells Country Club, El Dorado Country Club, La Rocca, Marrakesh Country Club, Shadow Mountain, Vintage Country Club, Morningside Country Club, Chaparral Country Club, Date Palm Country Club, Rancho Las Palmas, Monterrey Country Club, Thunderbird Country Club, and Porcupine Ridge. The projects will expand canal delivery for landscape irrigation to area golf courses.
PMA 11: Mid-Canal Storage Project	CVWD	Design and Environmental	Develop plans, specifications, and engineering (PS&E), along with environmental permitting support, for the project.
	CVWD	Mid-Canal Storage Construction	Construct a wide trapezoidal reservoir section within the Coachella Canal to store peak flows, improve water efficiency, and limit water waste.
PMA 12: East Golf Expansion	CVWD	East Golf Expansion	Deliver Canal water to 5 additional golf courses in East Valley.
PMA 13: Oasis Distribution System	CVWD	Oasis Distribution System	Expand the Canal water delivery system to the Oasis area. Substitute groundwater production with Canal water for agricultural irrigation and other non-potable landscape irrigation.
PMA 14: WRP-10 Recycled Water Delivery	CVWD	FY 18 Non-Potable Water Golf Course Connections/Construction	Seek CWSRF and WIIN grant funding support to construct non-potable water connections to Oasis Country Club, Woodhaven Country Club, Palm Desert Resort Country Club, Bermuda Dunes Country Club, Marriott Desert Springs, Marriott Shadow Ridge, Emerald Desert, and T1 Pump Station. The project will expand non-potable water landscape irrigation to area golf courses.
	CVWD	FY 21 Non-Potable Water Golf Course Connections/Design & Construction	Seek CWSRF and WIIN grant funding support to design and construct non-potable water connections to Suncrest Country Club, Rancho Mirage Country Club, Annenberg, Tamarisk Country Club, Tri-Palm Country Club, Jack Ivey Ranch, Palm Royale Country Club, Southwest Community Church, and Indian Wells Tennis Garden. The project will expand non-potable water landscape irrigation to area golf courses.

Activity Name	Project Proponent(s)	Activity Name	Activity Description
	CVWD	FY 22 Non-Potable Water Golf Course Connections/Design & Construction	Seek CWSRF and WIIN grant funding support to design and construct upsizing improvements to the existing NPW pipelines, converting Indian Ridge Country Club to lake delivery, and non-potable water connections to Desert Island and Springs Country Club. The project will expand non-potable water landscape irrigation to area golf courses.
	CVWD	FY 25 Non-Potable Water Golf Course Connections/Design & Construction	Seek CWSRF and WIIN grant funding support to design and construct non-potable water connections to Mission Hills Country Club, Westin Hills, Outdoor Resort, and Forest Lawn. The project will expand non-potable water landscape irrigation to area golf courses.
	CVWD	Future Non-Potable Water Golf Course Connections/Design & Construction	These projects are planned for FY26 and beyond depending on new golf courses and residential tracts.
PMA 15: WRP-7 Tertiary Expansion	CVWD	FY 21 – WRP-7 Tertiary Treatment Expansion and MP113.2 Pump Station Upgrade/Construction.	Seek CWSRF and WIIN grant funding support to construct an expansion of the tertiary system by 2.5 mgd for a total capacity of 5.0 mgd, add a 5-million-gallon tertiary water storage bladder, repurpose a land disposal pond to accept secondary effluent for pretreatment, and upgrade the capacity of the MP 113.2 canal water pump station. The project will expand non-potable water landscape irrigation to area golf courses.
PMA 16: Canal Water Pump Station Upgrade	CVWD	Canal Water Pump Station Upgrade	Construct pump station to convey Canal water. Complete design of MP 113.2 Canal Water Pump Station upgrade in 2022. Complete construction in 2026.
	CVWD	FY21 – WRP-7 Tertiary Treatment Expansion and MP113.2 Pump Station Upgrade/Construction	Seek CWSRF and WIIN grant funding support to construct a capacity upgrade to the existing pump Station at MP 113.2 canal water pump station. The additional pump station capacity will expand non-potable water landscape irrigation to area golf courses.

Activity Name	Project Proponent(s)	Activity Name	Activity Description
PMA 17: WRP-7 Recycled Water Delivery	CVWD	FY 22 Non-Potable Water Golf Course Connections/Design & Construction	Seek CWSRF and WIIN grant funding support to design and construct non-potable water connections to Talavera Residential Community, Young's Family Farms, and Shadow Hills High School, and Shadow Hills North Golf Course. The project will expand non-potable water landscape irrigation to area golf courses.
PMA 18: WRP-4 Tertiary Expansion & Delivery	CVWD	FY 22 WRP-4 – Phase 1A Tertiary Expansion and New Customer Connections/Construction	This project includes seeking CWSRF and WIIN grant funding support to construct an expansion of the tertiary system by 2.5 mgd and connect three new irrigation farm customers including Grimmway Farms, West Coast Turf, and Ocean Mist. The project will expand non-potable water to area irrigation customers.
	CVWD	FY 26 WRP-4 – Phase 1B Tertiary Expansion and New Customer Connections/Design & Construction	This project includes seeking CWSRF and WIIN grant funding support to construct an expansion of the tertiary system by 7.5 mgd for a total capacity of 10 mgd and connect new irrigation farm customers. The project will expand non-potable water to area irrigation customers.
PMA 19: DWA WRP Recycled Water Delivery	DWA	DWA WRP Recycled Water	Increase deliveries of recycled water in DWA's service area consistent with existing customer demands, wastewater flow growth and new cost-effective connections.
PMA 20: PD-GRF Expansion	CVWD	FY 22 - Palm Desert Groundwater Facility - Phase II	Construct three groundwater replenishment basins to receive Colorado River water within the Whitewater River Stormwater Channel. A groundwater replenishment facility will serve to help mitigate historical groundwater level declines within the West Whitewater River Sub-basin Area. Approximately an additional 15,000 AFY of Colorado River water will be delivered via the adjacent Mid-Valley Pipeline, for a total replenishment in the near vicinity of 25,000 AFY.
PMA 21: TEL-GRF Expansion	CVWD	TEL-GRF Expansion	Expand recharge capacity at the TEL-GRF from 37,000 to 40,000 AF.
PMA 22: WWR-GRF Operation	CVWD, DWA	Maximize WWR-GRF Replenishment	Continued operation of WWR-GRF at maximum available replenishment water. If additional SWP exchange water can be acquired, increase replenishment.

Activity Name	Project Proponent(s)	Activity Name	Activity Description
Water Quality Protection			
PMA 23: Eliminate Wastewater Percolation	CVWD, CWA, DWA	Eliminate Wastewater Percolation	Eliminate wastewater percolation. Recycle water that would have been percolated to be protective of water quality.
PMA 24: Wellhead Treatment	CVWD, DWA, IWA, CWA	Wellhead Treatment	Assess the need to expand groundwater treatment facilities to treat additional wells in the future for arsenic, nitrate, or other constituents.
	IWA	Hexavalent Chromium Wellhead Treatment	Pending Cr6 MCL, upgrade resin at existing IX treatment plants (FY 2021-22). Begin design and construction of new wellhead treatment facilities (FY 2022-26)
PMA 25: Small Water System Consolidations	CVWD, DWA, IWA, CWA	Small Water System Consolidations	Extend urban water service to small water systems (e.g., mobile home/RV park communities) with deficient infrastructure and poor water quality. Implement consolidations as grant funding becomes available.
	CVWD	Saint Anthony Water Consolidation Project	Seek grant funding to design and construct a new domestic water pipeline along Avenue 66 and adjacent roadways to serve the Saint Anthony area with clean, safe drinking water.
	CVWD	Valley View Water Consolidation Project	Seek grant funding to design and construct a new domestic water pipeline along Airport Blvd and adjacent roadways to serve the Valley View area with clean, safe drinking water.
PMA 26: Septic to Sewer Conversions	CVWD, DWA, IWA, CWA	Septic to Sewer Conservations	Seek USDA, CWSRF, and WIIN grant funding support to design and construct septic-to-centralized sewer systems and expand service to DACs. Implement conversions as grant funding becomes available.
	CVWD	Monroe Trunk Sewer	Seek grant funding to design and construct a new sewer pipeline along Monroe Street from Avenue 62 to Avenue 64 to expand CVWD's service area to the tribal residential neighborhood within the intersection of Avenue 64 and Monroe.
	CVWD	Avenue 66 Trunk Sewer	Seek grant funding to design and construct a new sewer pipeline along Avenue 66 and Harrison to expand CVWD's service area to the Torres-Martinez Coachel center, Sunbird Mobile Home Park, and residential neighborhood within Middleton Road.

Activity Name	Project Proponent(s)	Activity Name	Activity Description
	CVWD	Airport Blvd Sewer Consolidation Project	Seek grant funding to design and construct a new sewer collection system (gravity sewer pipelines and lift stations), along Desert Cactus Dr, Ave 57th, Fillmore St and Airport Blvd.
PMA 27: Implement CV-SNMP Groundwater Monitoring Program Workplan	CVWD, DWA, IWA, CWA	Implement CV-SNMP Workplans	Implement the CV-SNMP Groundwater Monitoring Program Workplan approved by the RWQCB to expand and improve the region's groundwater monitoring system for water quality.
PMA 28: Implement CV-SNMP Development Workplan	CVWD, DWA, IWA, CWA	Implement CV-SNMP Workplans	Develop a compliant CV-SNMP per the SNMP Development Workplan submitted to the RWQCB.
PMA 29: Colorado River Basin Salinity Control Forum	CVWD, DWA	Colorado River Salinity Forum	Support implementation of Colorado River Salinity Forum projects through participation and comments on Forum activities.
PMA 30: Source Water Protection	CVWD, DWA	Abandoned well management program	Continue cooperating with Riverside County DEH to identify and cap/destroy unused wells.
	CVWD	Leaking artesian well rebate program	Continue implementing CVWD's leaking artesian well rebate program.
	CVWD	Well management rebate programs	Continue to secure grant funding when available to supplement leaking artesian well rebate program and fund proper abandonment/destruction of unused wells.

CHAPTER 12: PLAN EVALUATION AND IMPLEMENTATION

This *Alternative Plan Update* describes the planning process for the Groundwater Sustainability Agencies (GSAs) in achieving a reliable and sustainable water supply. This chapter provides an evaluation of how implementation of this Plan will achieve the dual goals of meeting projected demands and maintaining groundwater sustainability. This chapter also outlines the *Alternative Plan Update* implementation activities necessary to support those goals.

12.1 Plan Evaluation

This *Alternative Plan Update* includes analysis of the range of uncertainties facing the GSAs in planning for a balance of future water demands and supplies. Chapter 5, *Demand Projections,* and Chapter 6, *Water Supply,* both address potential future conditions that are outside of the GSAs' control, including increased municipal or agricultural demands, climate change, and regulatory changes. The planning process considered those uncertainties in the development of the five Plan scenarios in Chapter 7, *Numerical Model and Plan Scenarios*, which analyzed a range of potential future conditions given those uncertainties. Chapter 11, *Projects and Management Actions,* then lays out an adaptive management process by which the GSAs can identify and select projects and management actions (PMAs) for implementation based on Indio Subbasin conditions. The PMAs are packaged in the Plan scenarios, and as described in Chapter 7, *Numerical Model and Plan Scenarios*, the scenarios associated with the 5-Year Plan and Future Projects indicate that the GSAs can maintain the Subbasin water balance despite climate change. Indio Subbasin conditions will be evaluated using the monitoring data as outlined in Chapter 10, *Monitoring Program,* and as compared to the sustainability objectives and thresholds established in Chapter 9, *Sustainable Management*. Each of these components of the planning process is essential to a water management plan that meets projected demands and maintains groundwater sustainability.

12.1.1 GSA Priorities

Consistent with the development and approach of this *Alternative Plan Update* (see Chapter 1, *Introduction*) and guided by the sustainability goal and objectives (see Chapter 9, *Sustainable Management*), the GSAs have collaboratively defined priorities for the PMAs. While overdraft has been reversed in terms of chronic groundwater level declines, storage depletion, subsidence, and seawater intrusion, the GSAs still face uncertainties in terms of forecasted demands and water supply availability.

Accordingly, this Plan Evaluation has focused on securing water reliability and resilience, namely the ability to provide consistent water supply and to respond to changing future conditions. Water supply reliability in the Indio Subbasin is the GSAs' ability to consistently provide adequate water supply to meet projected demands while sustainably managing the Subbasin.

Chapter 6, *Water Supply,* describes *c*urrently available and projected future water supplies, but does not quantify future groundwater supplies, which will be the result of conjunctive use of groundwater storage and supplies with other water supplies. The role of groundwater is quantified using the numerical model as described in Chapter 7, *Numerical Model and Plan Scenarios.* In brief, the projected local surface water and imported supplies alone are not fully adequate to meet the anticipated demands in Chapter 5, *Demand Projections*, but the scenarios simulated with the model demonstrate that with available groundwater supplies the Indio Subbasin can reliably and sustainably meet future demands under a range of conditions. Historical data included in Chapter 4, *Current and Historical Groundwater Conditions,* demonstrate that the management activities under the *Coachella Valley Water Management Plan 2010 Update* (*2010 CVWMP Update*) (Coachella Valley Water District [CVWD], 2012) have eliminated groundwater overdraft, stopped subsidence, and reversed seawater intrusion. To maintain water reliability and resilience through the planning horizon, the GSAs established the following priorities (in no particular order) for use in selection of PMAs:

- Fully use available Colorado River water supplies
- Support improvement of the long-term reliability of SWP supplies, including participation in the Delta Conveyance Facility (DCF)
- Continue developing recycled water as a reliable local water supply
- Implement source substitution and replenishment for resilience in response to changing conditions and for maintenance of long-term groundwater supply reliability
- Increase water-use efficiency across all sectors
- Participate in development of the Coachella Valley Salt and Nutrient Management Plan (CV-SNMP) to address salt and nutrient management in the Indio Subbasin.

The project list is provided in Chapter 11, *Projects and Management Actions,* along with implementation actions associated with each PMA. Using an adaptive management process, the GSAs can adjust project implementation if monitoring shows that water demands and supplies are higher or lower than projected or if tracking of groundwater levels indicates that undesirable results (including storage depletion and subsidence) could occur in the foreseeable future. Projects listed as "deferred" in Chapter 11, *Projects and Management Actions,* are not currently needed to achieve Indio Subbasin sustainability within the planning horizon but are retained as possible PMAs for future implementation as needed.

12.1.2 Water Supply Evaluation

This *Alternative Plan Update* continues the provision from the *2010 CVWMP Update* of a supply buffer on both municipal and agricultural demands. A 10 percent supply buffer was applied to projected municipal demands, plus an additional 1,500 acres of agricultural demands (see Table 12-1). This supply buffer (28,415 acre-feet per year [AFY)] ensures that the GSAs are planning for adequate supplies to meet anticipated growth over the coming 25 years. Table 12-1 also includes the demand forecast with expanded agricultural demands that was considered in Chapter 7, *Numerical Model and Plan Scenarios*.

Table 12-1. Demand Forecast with Supply Buffer (AFY)

	5-Yr Average (2015-2019)	2020	2025	2030	2035	2040	2045
Demand Forecast							
Municipal	157,800	180,318	192,098	204,163	216,074	225,997	235,148
Agricultural	292,100	290,312	287,092	284,693	283,045	281,644	280,243
Golf	105,300	105,300	106,075	106,850	107,625	107,625	107,625
Other	19,500	18,893	21,593	21,593	21,593	21,593	21,593
Total	**574,700**	**594,823**	**606,858**	**617,299**	**628,337**	**636,859**	**644,610**
Demands with Supply Buffer							
Demands with Supply Buffer		**617,754**	**630,968**	**642,616**	**654,845**	**664,359**	**673,025**
Expanded Agricultural Demands with Supply Buffer		**617,754**	**637,985**	**656,650**	**675,897**	**692,428**	**708,111**

The potential local and imported supplies described below are based on the information presented in Chapter 6, *Water Supply*.

12.1.2.1 Local Supplies

Table 12-2 provides a summary of the local water supplies in the Indio Subbasin that are simulated for the year 2045 under each of the four Plan scenarios with climate change. These include surface water diversions, local watershed runoff that naturally infiltrates, recycled water, and net groundwater inflows from uses and other sources that replenish the Subbasin, less outflows. Chapter 6, *Water Supply,* quantifies the surface water, watershed runoff, and recycled water that is available to the GSAs under historical and climate change conditions (refer to Table 6-16). Return flows are groundwater inflows and were calculated during development of the Plan scenarios summarized in Chapter 7, *Numerical Model and Plan Scenarios* (refer to Table 7-12). Note that net groundwater inflows are listed at the bottom, separate from local supplies. While net inflows contribute to the available groundwater supply, they are calculated as part of the model simulations.

12.1.2.2 Imported Supplies

The imported water supplies in the Indio Subbasin consist of Colorado River water, SWP exchange supplies, and other imported water sources (e.g., Rosedale Rio-Bravo transfer). Chapter 6, *Water Supply,* quantifies the total imported water supply available from all three sources under historical and climate change conditions (refer to Table 6-16). Chapter 7, *Numerical Model and Plan Scenarios* (Section 7.5), explains where those supplies were directed under the Plan scenarios, either for direct delivery or replenishment. Table 12-2 provides a summary of the imported supplies projected for the year 2045 under each of the with-project Plan scenarios.

Table 12-2. Comparison of Planned Supplies Under Plan Scenarios, 2045 (AFY)

	5-Year Plan with Climate Change	Future Projects with Climate Change	Expanded Agriculture with Climate Change
Local Supplies			
Surface Water Diversions	6,000	6,000	6,000
Natural Infiltration[a]	29,200	29,200	29,200
Recycled Water - Current	13,398	13,398	13,398
Recycled Water - Future[b]	6,815	11,815	11,815
Imported Supplies			
Colorado River (less Conveyance Losses)[c]	411,550	411,550	411,550
SWP Water (less Allocation To MC-GRF)[c]	78,248	78,248	78,248
Other: Rosedale Rio-Bravo[d]	0	0	0
Delta Conveyance Facility	0	23,562	23,562
Lake Perris Seepage	0	2,484	2,484
Sites Reservoir	0	10,426	10,426
Total Local + Imported Supplies	**545,211**	**586,683**	**586,683**
Net Groundwater Inflow[e]	121,660	114,320	117,636
Total Supplies with Net Returns from Use	**666,871**	**701,003**	**704,319**

[a] Natural infiltration of watershed runoff excludes surface water diversions and outflow to Salton Sea.

[b] Recycled Water – Future includes planned potable reuse projects by East Valley Reclamation Authority.

[c] Colorado River and SWP supply volumes do not account for evaporative loss that occurs during replenishment activities. Those losses were accounted for in the modeling.

[d] Rosedale Rio-Bravo supply is available through year 2035 and is zero in 2045. Included here to align with Chapter 6, *Water Supply* tables.

[e] Net groundwater inflow includes agricultural, golf course, and municipal return flows, plus subsurface inflow and wastewater percolation, less subsurface outflow, drain flow, and ET. Note that net groundwater inflow values are 25-year averages, not year 2045. Refer to Table 7-12.

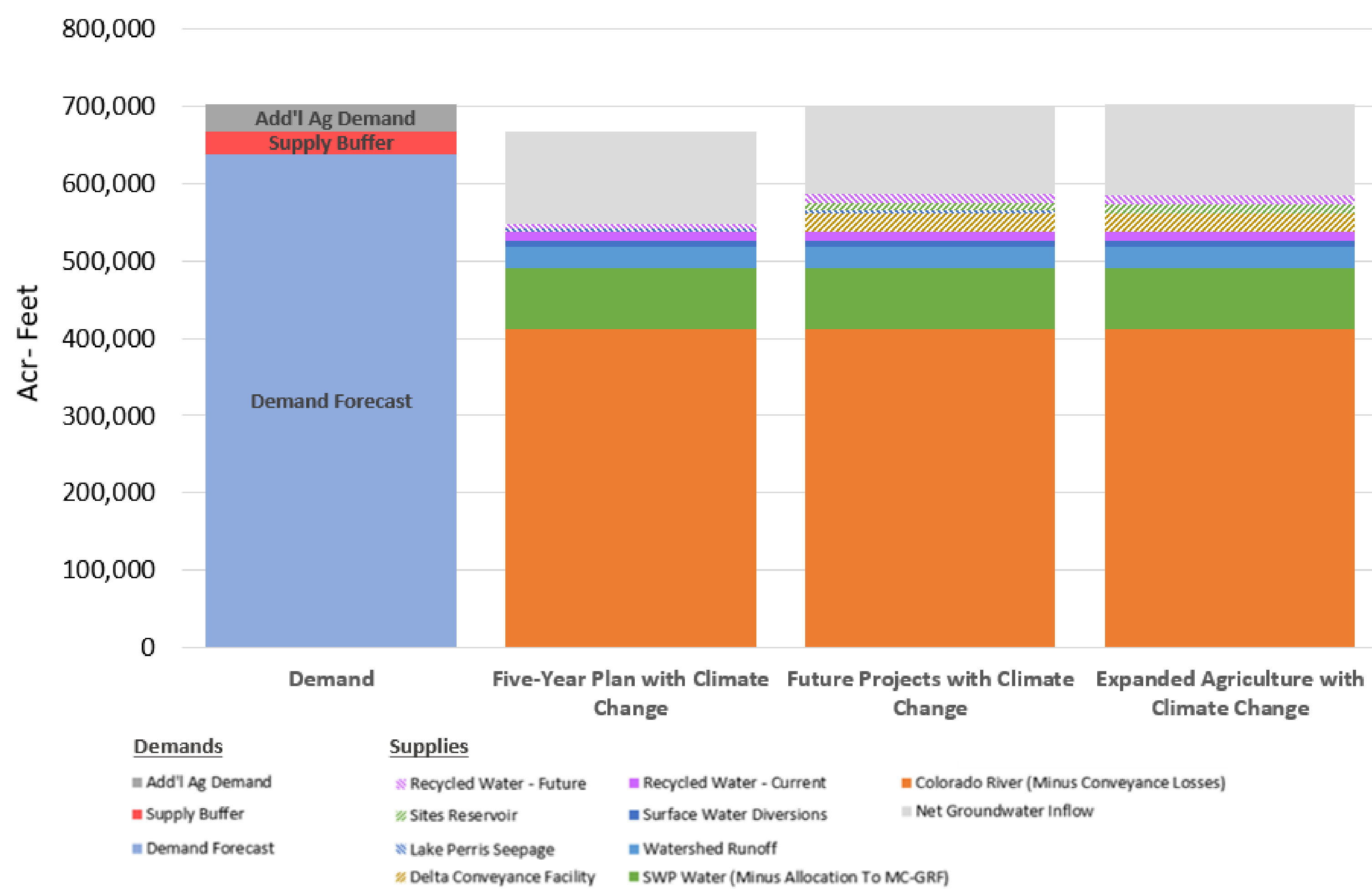
As shown in Table 12-2, the GSAs forecast existing available supplies in the 5-Year Plan with Climate Change scenario and then forecast the implementation of future supplies in the Future Projects with Climate Change and Expanded Agriculture with Climate Change scenarios. Although the volume of existing imported water sources remains constant across the Plan scenarios, that supply is directed to different uses in the scenarios. In the Future Projects and Expanded Agriculture scenarios, additional imported water sources are included in the forecast. As the GSAs implement non-potable connections to deliver Canal water directly throughout the Subbasin, Colorado River replenishment volumes are adjusted and groundwater levels, storage, pumping, and other outflows change. This results in the different groundwater outcomes for the scenarios, as described in Chapter 7, *Numerical Model and Plan Scenarios.*

As shown in this *Alternative Plan Update*, the local surface water and imported water sources in the GSAs' current water supply portfolio are adequate to meet projected demands if the supply buffer is not considered. A comparison of the projected water demands (refer to Table 12-1) with the available water supplies identified in Chapter 6, *Water Supply,* is presented in Table 12-2 and Figure 12-1. The figure shows available water supplies, as modeled in Chapter 7, *Numerical Model and Plan Scenarios,* in year 2045 because that is peak projected demand within the planning horizon. The baseline demand forecast in Table 12-1 is 644,610 AFY by 2045 and all three Plan scenarios in Table 12-2 have adequate supply to meet that demand, which some supply buffer. Additionally, as demonstrated in in Chapter 7, *Numerical Model and Plan Scenarios,* all three with-project Plan scenarios will gain in groundwater storage over the planning horizon. Should some type of extended shortage, drought, or emergency occur, the GSAs have other water management tools, such as more aggressive implementation of water conservation programs and Water Shortage Contingency Plans, to address supply gaps. To ensure water supply reliability and resilience through the planning horizon, the GSAs are committed to the suite of additional supply and source substitution projects identified in Chapter 11, *Projects and Management Actions*.

The GSAs manage their portfolio of local and imported water supplies conjunctively with groundwater supplies, providing replenishment and utilizing the storage capacity of the Indio Subbasin. The modeling described in Chapter 7, *Numerical Model and Plan Scenarios,* demonstrates that with consideration of groundwater inflows and outflows, the GSAs can manage the amount of forecasted groundwater production from the Indio Subbasin while maintaining sustainability and avoiding undesirable results associated with chronic groundwater level declines (as well as storage depletion, subsidence, and seawater intrusion). Figure 12-2 shows that the simulated groundwater balance generally includes more inflows than outflows in the with-project Plan scenarios. With the groundwater budget factored in, along with active conservation programming, the GSAs will be able to meet forecasted demands with the supply buffer and contribute to increases in Indio Subbasin storage.

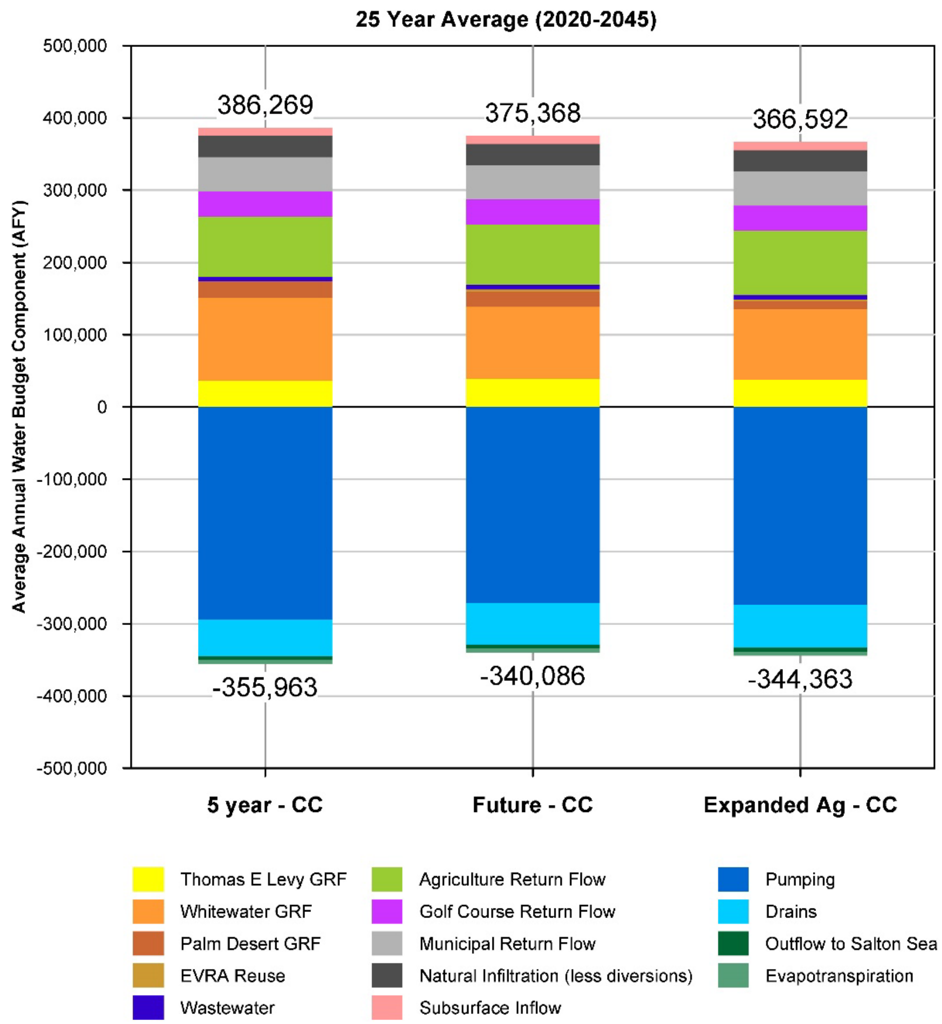
In the three with-project Plan scenarios that simulated varying project implementation and/or agricultural demands, results show a net increase in storage at the end of the 25-year planning horizon and continuing stability through the end of the modeling timeframe. Through implementation of this *Alternative Plan Update,* the Indio GSAs will be able to meet projected pumping demands and maintain Indio Subbasin sustainability with regard to water levels and storage under the range of potential futures established through the Plan scenarios. The three scenarios demonstrate that continued imported water replenishment and expansion of non-potable connections is essential to maintaining a balanced basin. The simulated hydrographs and storage are projected to be higher than historical lows and to increase over the planning horizon. To address uncertainties in water supply or demand, this Plan identifies a range of PMAs that can be implemented by the GSAs. Under this Plan, conservation continues to be implemented, available Canal water is fully utilized, SWP supplies are acquired, when possible, recycled and non-potable water is expanded throughout the Mid-Valley, and domestic water and sewer consolidations protect the groundwater supplies of disadvantaged communities. This flexible approach allows for future implementation of more aggressive conservation or deferred projects to offset supply gaps that might arise.

Figure 12-1. Comparison of Planned Supplies and Demands Under Plan Scenarios, 2045



	WOODARD &CURRAN	FINAL TODD GROUNDWATER	**Figure 12-1 Comparison of Planned Supplies and Demands Under Plan Scenarios, 2045**

Figure 12-2. Model Inflows and Outflows by Scenario



Note:
CC = Climate Change

WOODARD & CURRAN

FINAL

TODD GROUNDWATER

Figure 12-2
Model Inflows and Outflows By Scenario

This *Alternative Plan Update* demonstrates that the GSAs can meet the established Plan goal "*to reliably meet current and future water demands in a cost-effective and sustainable manner".* In addition to meeting forecasted demands with the supply buffer, the GSAs will continue to recover from and avoid chronic groundwater overdraft, manage and protect water quality, and reduce vulnerability to climate change and drought, all within an adaptive management framework that allows for ongoing collaboration with stakeholders and tribes, cost control, and minimization of environmental impacts.

12.2 Plan Implementation

The Indio GSAs are working collaboratively to implement the Alternative Plan and ensure the sustainability of the Indio Subbasin. This includes implementing projects and management actions described in *Section 11, Projects and Management Actions*, as well as ongoing Plan implementation and administrative activities. As shown in Figure 12-3, Alternative Plan implementation includes the program management, tribal coordination, public outreach, ongoing data collection and monitoring, and funding activities necessary to implement this Plan.

Figure 12-3. Alternative Plan Implementation

- GSA Program Management
- Monitoring Programs
- Tribal Coordination
- Stakeholder Outreach
- Annual Reports
- 5-year Plan Update
- Monitoring Network Improvements
- Refine Subbasin Characterization
- Pursue Funding Opportunities
- Implement Projects & Management Actions (PMAs)

This section describes the above items, including contents of required Annual Reports and Plan Updates that will be provided to DWR. This section also identifies the specific actions to move the proposed projects and management actions forward.

12.2.1 GSA Program Management

Each of the four GSAs is administered independently with oversight of individual agency projects and programs, as well as coordination among the GSAs. GSA program management primarily consists of general program administration, coordination between the GSAs and California Department of Water Resources (DWR), and oversight of ongoing GSA monitoring and reporting. Representatives from the four GSAs meet periodically at the staff level for information sharing and to coordinate activities. Staff-level meetings are not noticed or open to the public. Governance occurs independently via each of the four

GSA governing boards and councils, whose meetings are publicly noticed. Tribal and stakeholder engagement is described under Sections 12.6 and 12.7 below., respectively.

GSA administration includes coordination of Plan implementation activities, regular email communications to update GSA members on ongoing Indio Subbasin activities, administration of projects implemented by the GSA, and general oversight and coordination. This includes coordination of technical activities associated with Plan implementation, including monitoring network improvements. Other administrative actions involve tracking and evaluating Plan implementation and sustainability conditions, as well as assessing the benefit to the Indio Subbasin. GSA program management also includes grant applications and administration for potential funding sources. Administrative activities include oversight of consultants or contractors that may be retained by the GSAs in support of Plan implementation, including Plan updates, annual reporting, and monitoring.

GSA staff meetings are anticipated to be held annually, at a minimum, to discuss Annual Report data collection and findings, implementation of projects and management actions, and other topics necessary to implement this *Alternative Plan Update*. All oversight and administration activities are assumed to occur as needed and on an ongoing basis.

12.2.2 Monitoring Programs

Chapter 10, *Monitoring Program,* identifies monitoring programs and provides procedures for tracking sustainability progress. Monitoring programs are a critical element of Plan implementation. The monitoring programs described in Chapter 10, *Monitoring Program,* will allow the GSAs to track conditions within the Indio Subbasin and adjust implementation of the management strategies described in Chapter 11, *Projects and Management Actions*. This *Alternative Plan Update* has identified monitoring networks and protocols for groundwater levels, climate and hydrologic conditions, groundwater production, subsidence, water quality, and seawater intrusion. Monitoring network data will be collected for the following purposes:

- Characterize Indio Subbasin conditions
- Identify groundwater level, storage, and quality trends
- Determine if additional management activities are necessary
- Determine whether undesirable results are occurring

The following monitoring programs will be implemented to support ongoing groundwater management and to support Sustainable Groundwater Management Act (SGMA) compliance in the Indio Subbasin:

- **Groundwater Levels**. Groundwater levels are monitored at least three times per year in approximately 345 wells by the Indio Subbasin GSAs as part of their respective groundwater level monitoring programs. As part of Plan implementation, water levels will be uploaded to the DWR Monitoring Well Module and data will be publicly accessible.

- **Climate, Streamflow, and Drain Flow.** Climate data (including temperature, evapotranspiration, and precipitation) are available from DWR's California Irrigation Management Information System (CIMIS) for four active CIMIS stations. Precipitation data have been and will be collected for the 12 Riverside County Flood Control and Water Conservation District precipitation monitoring stations. Temperature and precipitation data are also available from the National Oceanic and Atmospheric Administration (NOAA) station in Indio. Streamflow is measured by the United States

Geological Survey (USGS) at 19 locations within the Indio Subbasin. CVWD measures drain flows at 27 drain sites on a monthly basis.

- **Groundwater Production.** The GSAs, specifically CVWD and Desert Water Agency (DWA), have been monitoring (assessing) groundwater production in the West Areas of Benefit (AOBs) since 1982 and the East AOB since 2005. CVWD and DWA groundwater production data set is audited two times a year and summarized as part of the SGMA Annual Report and the annual Engineer's Report. The GSAs also submit validated Water Loss Audits annually. These audits inventory all sources of production and are publicly available.

- **Subsidence**. Land subsidence has been investigated since 1996 through an on-going cooperative program between CVWD and the USGS. The USGS has applied satellite-based Global Positioning System (GPS) surveying techniques to determine the location, extent, and magnitude of the vertical land-surface changes in the Coachella Valley. GPS measurements have also been taken at 24 geodetic monuments that have been paired with nearby water level monitoring wells to assess relationships between subsidence and groundwater level changes. In addition, DWR provides interferometric synthetic aperture radar (InSAR) satellite-based data and GPS data to identify and assess land subsidence across many California groundwater basins, including the Indio Subbasin. In its cooperative study with the GSAs, USGS also will analyze DWR-provided InSAR results with findings published in 2025.

- **Water Quality**. The GSAs monitor and report the quality of their water sources to the California State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW). These data are publicly available on the SWRCB's Groundwater Ambient Monitoring and Assessment Program (GAMA) website. CVWD also collects water quality data for other programs such as monitoring of the GRFs. Groundwater quality data are also available from various other sources, including the USGS National Water Information System. The new CV-SNMP monitoring program will be a robust new source of compiled water quality data.

- **Seawater Intrusion**. Saline water intrusion is monitored specifically through two sets of dedicated nested monitoring wells operated by CVWD. One set of four wells is located about 2.1 miles north of the Salton Sea and the other set is about one mile west of the Salton Sea and north of Oasis.

Monitoring data for the representative well network, as described in Chapter 10, *Monitoring Program,* will be managed and reported to DWR and stakeholders in the Annual Reports described in Section 12.8. The monitoring networks build on the foundation of existing monitoring programs and develop further monitoring to continue the characterization of the Indio Subbasin. The monitoring program will be coordinated with DWR's SGMA Portal, Monitoring Well Module, and partner agencies such as USGS.

12.2.2.1 Data Management System

The GSAs have been collecting and compiling groundwater data annually including water levels, water quality, and water use. For this *Alternative Plan Update* and subsequent Annual Reports, these data, and other data from the GSAs and other sources, are being compiled in relational databases, which comprise an Access database, GIS geodatabase, and Excel workbooks. As part of the *Alternative Plan Update*, the DMS has been redesigned to be practicable, usable, intuitive, and cost effective. These tables include groundwater elevations, water quality, groundwater pumping, direct deliveries of imported water, and well locations. The geodatabase contains spatial files including jurisdictional areas, basin boundaries, monitoring locations, crop censuses, groundwater contours (elevation and quality), geology, and hydrologic features. The regional DMS will be updated annually as part of the Annual Report. In addition, a full review and update will occur during the 5-year Plan Update.

Additionally, DWR has built a DMS through its SGMA Portal (see: https://sgma.water.ca.gov/portal/) for submittal and viewing of Annual Report data by GSAs throughout the State. The GSAs, stakeholders, and interested parties will rely on that database to make data from Key Wells widely available.

12.2.3 Tribal Coordination

Throughout the *Alternative Plan Update* process, the GSAs have engaged with the Indio Subbasin tribal governments, namely the Agua Caliente Band of Cahuilla Indians, the Augustine Band of Cahuilla Indians, the Cabazon Band of Mission Indians, the Torres Martinez Desert Cahuilla Indians, and the Twenty-Nine Palms Band of Mission Indians, each of which have provided representatives to the SGMA Tribal Workgroup meetings. The SGMA Tribal Workgroup, established in 2017, has been active for several years through submittal and DWR approval of the Alternative Plan and the *Alternative Plan Update* process. During the *Alternative Plan Update*, the SGMA Tribal Workgroup continued to discuss major water-related concerns facing the tribes and ensuring regional water management efforts, such as the long-term implementation of the *Alternative Plan Update*, are responsive to those needs. During these meetings, the GSAs presented work in progress and requested data from the tribes to support the planning process (e.g., land use plans, water demands).

The GSAs will continue to engage with the tribes through quarterly SGMA Tribal Workgroup meetings. At the Workgroup meetings, the GSAs will present monitoring data, Annual Report findings, and status of project implementation to support Indio Subbasin sustainability.

12.2.4 Stakeholder Outreach

The GSAs have conducted stakeholder outreach to identify and obtain input from groups that may be otherwise limited from participating in the *Alternative Plan Update* process and implementation. The GSAs have used a variety of outreach methods to coordinate among local stakeholders and communicate SGMA-related information to interested parties during Plan development. The GSAs plan to continue collaboration and public outreach during Plan implementation. This will include providing opportunities for stakeholder participation at public workshops, providing access to Plan information through email announcements and online (see project website: www.IndioSubbasinSGMA.org), releasing Annual Reports that evaluate the Plan's progress toward implementation, and continued coordination with entities representing diverse communities in the Indio Subbasin.

12.2.4.1 Stakeholder Workshops

During the *Alternative Plan Update*, the GSAs hosted seven public workshops to share information, present work in progress, and request feedback from stakeholders.

The GSAs will continue to host stakeholder workshops to ensure open participation in Plan implementation by members of the public and interested parties and to receive stakeholder input. Stakeholder workshops are anticipated to be held annually to present the findings of the Annual Reports, including reporting on monitoring data and compliance with sustainability criteria established in this *Alternative Plan Update*. The Indio Subbasin website will be updated as needed to feature meeting agendas and materials, so that stakeholders have access to past and current materials related to Plan implementation.

Additionally, the GSAs will continue to report out to their Boards of Directors annually, at a minimum, for review and discussion of the Annual Reports. Board meetings are publicly noticed and open to all stakeholders to participate.

12.2.4.2 Outreach and Website Maintenance

The GSAs have used an email list to communicate with stakeholders and interested parties (see overview in *Section 1, Introduction*). Announcements related to Plan implementation – such as availability of new data, release of Annual Reports, and scheduling of public workshops – will continue to be distributed via email. Prior to stakeholder workshops or meetings, email announcements will be circulated with access to meeting materials via the website. Emails will also be distributed as specific deliverables are finalized, when opportunities are available for stakeholder input, or when items of interest to the stakeholder group arise, such as relevant funding opportunities.

The Indio Subbasin website will be updated as needed to feature meeting agendas and materials, Annual Reports, and other program information as applicable.

12.2.5 Annual Reports

Annual Reports have been submitted by April 1 of each year since 2018, following the Alternative Plan adoption. As summarized below, Annual Reports provide general information, documentation of Subbasin conditions, and description of plan implementation progress.

12.2.5.1 General Information

The Annual Reports include an Executive Summary that highlights key contents and findings. The Introduction presents the organization of the Annual Report, a summary of the *Alternative Plan* process, and a map and overview of the Subbasin.

12.2.5.2 Subbasin Conditions

The Subbasin setting section provides updated context on climate, the Coachella Valley Groundwater Basin, and the Indio Subbasin. Additional sections summarize current hydrologic and groundwater conditions and monitoring program results with evaluation of how conditions have changed in the Indio Subbasin over the previous year and comparison of groundwater data for the year to historical groundwater data. Reporting will include comparison of groundwater conditions to any minimum thresholds established by the GSAs, with discussion of adaptive management, as needed. Sections of the Annual Report document groundwater elevation data, groundwater extractions, surface water conditions (including local surface water, imported water deliveries, and recycled water), total water use, and change in groundwater storage. Annual reports present selected hydrographs of groundwater elevation data, groundwater level contour maps, groundwater level change maps, and graphs documenting pumping and other elements of the water budget, and cumulative change in groundwater storage.

12.2.5.3 Plan Implementation Progress

Plan implementation progress is described in the Annual Reports, including projects and management actions, acquisition of additional water supplies, source substitution, groundwater recharge, and water quality improvements. Status of the monitoring program is also summarized.

12.2.6 5-year Plan Update

The GSAs have committed to update of the *Alternative Plan* every 5 years to assess progress toward meeting sustainability, incorporate changes in conditions including water demand and supply availability, evaluate PMAs, and evaluate projected groundwater conditions using the numerical model.

12.2.6.1 Alternative Plan Update

The GSAs will evaluate the *Alternative Plan Update* every 5 years. At that time, the GSAs will report on whether any *Alternative Plan Update* sustainability criteria (e.g., minimum thresholds or measurable objectives established by the GSAs) should be revised, based on any significant changes and outcomes of the monitoring programs. The 5-year Update will include the following:

- **Sustainable Management**—Description of the current Subbasin conditions with reference to Alternative Plan objectives and any sustainability indicators established by the GSAs. New information and significant changes will be identified and discussed.
- **Plan Implementation Progress**—Description of implementation activities, update of the implementation schedule, and adjustments to projects and management actions.
- **Update of Alternative Plan Elements**—Update of Alternative Plan elements (such as Plan Area, Hydrogeologic Conceptual Model, Groundwater Conditions, Sustainable Management) to reflect increased understanding available from ongoing monitoring, new information, and significant changes.
- **Monitoring Network Update**—Reporting on the status of the Plan's monitoring programs and discussion of progress made in filling data gaps.
- **Regulatory or Policy Issues**—Summary of new regulatory or policy issues relevant to water resources management of the Indio Subbasin.
- **Plan Amendments**—Identification of any amendments made to the Alternative Plan and discussion of potential future amendments if identified.
- **Coordination**—Summary of coordination among GSAs within or outside of the Indio Subbasin and collaboration with land use agencies.

12.2.6.2 Indio Subbasin Groundwater Model Update

The Indio Subbasin groundwater model will be updated annually to evaluate annual change in groundwater storage and comprehensively reviewed and updated every 5 years based on additional information provided by GSAs. This will include extending the historical model time series to the update year and updating all inputs. Areas of higher uncertainty, such as agricultural demands and imported water reliability will be refined using additional information made available through the monitoring program and implemented projects. Additional drain flow information will be used to achieve better calibration. Once the model has been updated and re-calibrated, the future scenarios will be designed and simulated. Associated water budget and model outputs will be evaluated considering project implementation.

12.2.7 Monitoring Network Improvements

The groundwater monitoring networks have abundant historical data that meet or exceed data density requirements outlined in DWR's *Monitoring Networks and Identification of Data Gaps, Best Management Practices for Sustainable Management of Groundwater* (DWR, 2016) in the deeper zones. The GSAs are pursuing additional dedicated shallow monitoring wells to help monitor shallow and perched areas of the Subbasin for both water levels and water quality.

12.2.7.1 Groundwater Monitoring Improvements

To better understand the basin in general and vertical gradients specifically, the GSAs are implementing groundwater monitoring improvements. The GSAs will regularly assess the monitoring network and install additional and/or replacement monitoring wells. This effort is being coordinated with the Coachella Valley SNMP monitoring networks to achieve the overall goal of groundwater quality protection.

12.2.7.2 Subbasin Well Inventory

Unlike many other groundwater basins in California, the Indio Subbasin has an extensive well inventory that has been compiled by CVWD and DWA in order to implement the Replenishment Assessment Charge (RAC) Programs for assessable groundwater production. CVWD levies and collects the RAC from groundwater producers that benefit from the Groundwater Replenishment Programs (GRPs) and extract more than 25 acre-feet per year (AFY) within the CVWD's West Whitewater River Subbasin Area of Benefit (AOB) and East Whitewater River Subbasin AOB in the Indio Subbasin. DWA levies and collects the RAC from groundwater producers that benefit from the GRPs and extract more than 10 AFY within DWA's West Whitewater River Subbasin AOB. However, there is incomplete data on minimal pumpers who do not meet these criteria. It is unclear how many wells producing less than the RAC criteria exist, and approximations of unreported production are best estimates.

The GSAs are planning a well inventory for the Indio Subbasin that will identify and compile information about all production wells located in the Indio Subbasin. CVWD is planning to initiate this effort, with the other GSAs participating at their discretion. The well inventory will involve development of a well registry to aid in this process. The well inventory will support any extension or refinement of the monitoring network, allow improvement of groundwater extraction estimates, and improve the understanding of how private wells may affect Indio Subbasin conditions and how Indio Subbasin management may affect private wells. The well inventory will provide documentation of well locations and well construction relative to the Key Wells and Minimum Thresholds identified for managing groundwater levels (see Section 9.3.3, Sustainability Criteria for Groundwater Levels). This will help substantiate the current effectiveness of the groundwater level MTs in protecting wells or identify as-yet unknown shallow wells. The comprehensive well inventory will also provide a basis for cooperating with well permitting agencies (e.g., County of Riverside) to ensure that new wells are constructed with appropriate construction and depth to provide reliable water supply despite reasonably anticipated and managed changes in groundwater levels. Compilation of the well inventory may include the following:

- Review and organize the DMS to incorporate well inventory component
- Gather water well drillers reports with well construction information
- Coordinate with well owners to identify wells and obtain relevant information on location, construction, use, status, and monitoring, if any

- Conduct as-needed field visits to verify well location, use, and status
- Input well inventory information into the DMS.

The GSAs will collaborate with DWR, local agencies, water users, landowners, and leaseholders to identify and locate wells and compile information on construction, status, and use.

12.2.7.3 Expand Groundwater Production Reporting

SGMA (Section 10725.8) authorizes GSAs to require that the use of every groundwater extraction facility (production well) be measured with a water-measuring device (meter) with the exception of de minimis extractors (domestic users extracting 2 AFY or less). As explained in Section 12.10.2, both CVWD and DWA already require metering and extraction reporting by groundwater produces using more than 25 and 10 AFY, respectively, based on their respective water management authorities. CVWD and DWA separately author an *Engineer's Report on Water Supply and Replenishment Assessment* annually to assess the groundwater supply conditions and the need for continued replenishment within their AOBs, to provide a description of the current GRF operations, and to recommend adjustments to the RAC that is levied on groundwater production (see CVWDs website: https://cvwd.org/Archive.aspx?AMID=43 and DWA's website: https://dwa.org/about-us/documents/library/).

The GSAs may consider expansion of groundwater extraction reporting to include groundwater pumpers that produce less than the current assessment threshold but more than the de minimis threshold established by SGMA. CVWD will initiate a Cost of Service Study within its service area to consider SGMA fees that may apply to this reporting; the other GSAs may require reporting and develop fees within their service areas at their discretion.

12.2.8 Refine Subbasin Characterization

Means to improve understanding of the Indio Subbasin have been identified in this *Alternative Plan Update,* which the GSAs will explore over the coming 5 years. Refining the Indio Subbasin characterization in these areas will improve the GSAs ability to manage the Indio Subbasin.

12.2.8.1 Drain Flow Study

There are 27 agricultural drains where CVWD collects flow measurements and water quality data. The agricultural drain system was designed to intercept shallow, higher salinity groundwater (from return flows and rising groundwater) and convey it to the Salton Sea. As discussed in Chapter 7, *Numerical Model and Plan Scenarios*, the subsurface drain flows are an outflow from the Indio Subbasin included in the groundwater balance. As such, they are an important component of the water budget output from the groundwater model. The drains are also a source of salt outflow important to the Subbasin's salt balance. The Drain Flow Study will study the relationship between groundwater levels in the various aquifers, current and historical crop water application, and flows and salt export through the drain system Geochemical and isotope studies could be implemented to assess potential water sources (return flows vs rising groundwater) of drain flows. The study will contribute to an improved understanding of the relationship between groundwater levels in the various aquifers, protection of water quality in the deep aquifer, drain flow volumes and salt export, which may result in refinements of this groundwater model element.

12.2.8.2 Subsidence Study

CVWD has on ongoing partnership with USGS. CVWD will collaborate with USGS and the other GSAs on the current study (July 1, 2021, through June 30, 2025), whose objectives are to (1) detect and quantify land subsidence using GPS methods (2015–22) and InSAR methods (2017–23), (2) evaluate the relation between changes in land-surface elevation and groundwater levels at selected sites during 2015–23, and (3) provide technical assistance to CVWD and their contractors in the potential development of subsidence simulation capabilities for the existing numerical groundwater flow model. USGS also will analyze DWR-provided InSAR results to compute changes in land-surface elevation in the Indio Subbasin during 2017–23. Findings will be published in a report in 2025.

12.2.8.3 Subsurface Flow Study

The GSAs will conduct analyses of the San Gorgonio and Mission Creek Subbasin boundaries to better estimate subsurface inflows from adjacent Subbasins. The study will consider subsurface flow at faults and to the Garnet Hill Subarea and will be used to update and improve the numerical model. This effort will include coordination with the GSAs of adjacent groundwater Subbasins and their numerical models.

12.2.9 Pursue Funding Opportunities

The development of this *Alternative Plan Update* was funded, in part, through a Proposition 68 Sustainable Groundwater Management Grant. Costs of overall Plan implementation are expected to be shared by the GSAs through the 2018 MOU, a second Supplement to the 2016 MOU, that establishes cost-share agreements, individual agency contributions, and/or new cost-sharing agreements yet to be developed (see Appendix 1-C). However, there will be a need to seek funding opportunities to support Plan projects and management actions and ongoing implementation.

12.2.9.1 Pursue Grant Programs

Outside grants will be sought to reduce the cost of implementation to participating agencies and the communities of the Indio Subbasin. Financing options under consideration include loans and grants for projects and management actions, as well as monitoring network improvements and other planning/feasibility analysis needed to support Plan implementation. Funding through grants or loans has varying levels of certainty and may be available for some implementation activities (including capital projects). Table 12-3 lists examples of potential funding options.

Table 12-3. Potential Funding Sources for 2022 Alternative Plan Implementation

Funding Source	Description
Sustainable Groundwater Management (SGM) Grant Program administered by DWR	With the passage of Propositions 1 and 68, DWR established the SGM Grant Program to fund planning and implementation activities for groundwater basins subject to SGMA. Propositions 1 and 68 allocated $240 million for competitive grants, in two rounds of grant solicitations, to fund implementation projects that address drought and groundwater challenges, prevent or clean up contaminated groundwater, support supply reliability, and support water banking, exchange, or reclamation. The Round 2 solicitation, for medium and high priority basins, is anticipated in Spring 2022.
Technical Support Services (TSS) for Groundwater Sustainability Plans administered by DWR	DWR's TSS program supports GSAs as they develop and implement their GSPs. TSS's goal is to provide education, data, and tools to GSAs at both regional and statewide scales to build the capacity needed to achieve sustainability. TSS provides field activities (monitoring well installation, geologic logging, etc.), modeling, and mapping.
Clean Water State Revolving Fund (CWSRF) Loan Program administered by SWRCB	Historically, the SWRCB has had $200 to $300 million available annually for low-interest loans (typically ½ of the General Obligation Bond Rate) for water recycling, wastewater treatment, and sewer collection projects. During recent years, available funding has become limited due to high demand. Success in securing a low-interest loan depends on the demand of the CWSRF Program and available funding. Applications are accepted on a continuous basis. SWRCB prepares a fundable list for each fiscal year. In order to receive funding, a project must be on the fundable list.
Water Recycling Funding Program (WRFP) – Planning and Construction Grants from SWRCB	WRFP grants were most recently funded by Proposition 1, as well as the general CWSRF Program. Planning grants (for facilities planning) are available and can fund 50% of eligible costs, up to $75,000. Construction grants have been periodically exhausted but are typically restored with water bond funding. Low-interest loans through the CWSRF program are available and while limited, recycled water projects receive priority over wastewater projects (which are also eligible under CWSRF, the umbrella program for the WRFP).
Drinking Water State Revolving Fund Loan Program administered by the SWRCB Division of Drinking Water	Approximately $100 to $200 million is available on an annual basis for drinking water projects. Low-interest loans are available for project proponents should they decide to seek financing. Funding has become more limited; however, applicants are encouraged to apply. Applications are accepted on a continuous basis. SWRCB prepares a fundable list for each fiscal year. In order to receive funding, a project must be on the fundable list.
Infrastructure State Revolving Fund Loan Program administered by the California Infrastructure and Economic Development Bank (I-Bank)	Low-interest loans are available from I-Bank for infrastructure projects (such as water distribution). Maximum loan amount is $25 million per applicant. Applications are accepted on a continuous basis.

Funding Source	Description
Title XVI Water Recycling and Reclamation / Water Infrastructure Improvements for the Nation (WIIN) Program – Construction Grants administered by the United States Bureau of Reclamation (USBR)	Grants up to 25% of project costs or $20 million, whichever is less, are available from USBR for water recycling projects. A Title XVI Feasibility Study must be submitted to and approved by USBR to be eligible. USBR solicits grants annually.
WaterSMART Title XVI Water Recycling and Reclamation Program – Feasibility Study Grants administered by USBR	Grants up to $150,000 have been available in the past for preparation of Title XVI Feasibility Studies. It is possible future rounds may be administered.
Revenue Bonds	Revenue bonds can be issued to pay for capital costs of projects allowing for repayment of debt service over 20- to 30-year timeframe. Depends on the bond market and the existing debt of project proponents.
Integrated Regional Water Management (IRWM) implementation grants administered by DWR	The Coachella Valley IRWM Region can pursue grant funding through the IRWM Implementation Grant Program. The Coachella Valley IRWM Region falls within the Colorado River Funding Area (Funding Area). The Colorado River Funding Area was allocated $22.5 million in funding through Proposition 1. Of that, roughly $7.9 million was awarded to the Funding Area during the Round 1 solicitation. The remaining funding is anticipated to be distributed during the Round 2 solicitation, which is expected in late 2021.
Proposition 68 grant programs administered by various state agencies	Grant programs funded through Proposition 68, which was passed by California voters in 2018, and administered by various state agencies are expected to be applicable to fund SGMA implementation activities. These grant programs are expected to be competitive, where $74 million has been set aside for Groundwater Sustainability statewide.

12.2.9.2 Consider Groundwater Management Fee

Implementation of this *Alternative Plan Update* is anticipated to be based on contributions from the GSAs and available grant programs. However, additional funding may be required to sustainably manage the Indio Subbasin. SGMA (Section 10725.8) authorizes GSAs to collect a groundwater management fee in order to effectively manage the groundwater balance. CVWD will initiate a Cost of Service Study to evaluate implementing a SGMA fee that may apply to groundwater production. The other GSAs may consider a similar fee, and if so, would require groundwater production reporting. This would provide an additional source of revenue for Plan implementation and improve assessment of groundwater extraction from the Indio Subbasin.

Ultimately, it will be up to the individual GSAs to determine how they meet their financial goals for Plan implementation. If grants or loans are secured for project implementation, potential pumping fees and assessments may be adjusted to align with the operating costs of ongoing implementation activities.

12.2.10 Implement PMAs

Chapter 11, *Projects and Management Actions,* includes projects and programs that have been identified to protect and improve groundwater levels and quality. Some of the PMAs are ongoing programs, some are in the planning and design phases, and others are still conceptual. Based on the outcomes of the monitoring programs described in Section 12.5 and analyzed in the Annual Reports described in Section 12.8, the GSAs will adaptively manage the Indio Subbasin. PMAs will be moved forward as needed to maintain the Indio Subbasin in sustainable conditions, able to meet Plan Area water demands, and groundwater levels and quality that avoid undesirable results. Table 11-5 in Chapter 11, *Projects and Management Actions,* includes the implementation actions necessary to move these projects and programs forward to ensure Indio Subbasin sustainability. With implementation of these PMAs as outlined in this *Alternative Plan Update*, the GSAs are anticipated to meet their water management goals and comply effectively with SGMA.

12.3 Implementation Timeline

Table 12-4 presents the implementation timeline for this Plan through the next 5 years when the next *Alternative Plan Update* is due to DWR. Included in the schedule are activities necessary for ongoing Plan monitoring and updates, as well as tentative schedules for anticipated projects and management actions. Additional details about the activities included in the implementation timeline have been described throughout this Plan.

GSA operations and Plan implementation will incur costs, which will require funding by the GSAs. The activities associated with Subbasin-wide management and Plan implementation will be borne by the four GSAs. Some activities (such as the Annual Reports and 5-Year Plan Updates) will be funded under the cost-sharing arrangement established by the Memorandum of Understanding (MOU) signed in 2016, along with multiple supplements (see Appendix 1-C). Other management activities will be funded by individual GSAs or through other cost-sharing agreements or amendment to the MOU. Projects will be administered by the GSA project proponents. GSAs may elect to implement projects individually or jointly with one or more GSAs.

Table 12-4. *Alternative Plan Update* Implementation Timeline

Activity	Timeline
GSA Program Management	
Oversight and Coordination	Ongoing
GSA Meetings	Annually, or as needed
Monitoring Programs	
Groundwater Level Monitoring	Ongoing
Climate, Streamflow, and Drain Flow Monitoring	Ongoing
Groundwater Production Monitoring	Ongoing
Subsidence Monitoring	Ongoing
Water Quality Monitoring	Ongoing
Seawater Intrusion Monitoring	Ongoing
Applied Recharge Monitoring	Ongoing
Data Management System (DMS)	Ongoing
Tribal Coordination	
SGMA Tribal Workgroup	Quarterly
Stakeholder Outreach	
Stakeholder Workshops	Annually, or as needed
Outreach and Website Maintenance	Ongoing
Annual Reports	
Submit Annual Reports	Annually
5-Year Plan Update	
Alternative Plan Update	Submit by January 1, 2027
Groundwater Model Updates	2024 –2026
Monitoring Network Improvements	
Groundwater Monitoring Improvements	Ongoing
Develop Subbasin Well Inventory	Ongoing
Expand Groundwater Production Reporting	Ongoing
Refine Subbasin Characterization	
Drain Flow Study	2022 - 2025
Subsidence Study	2022 – 2025
Subsurface Inflow Study	2022 – 2025
Pursue Funding Opportunities	
Pursue Grant Programs	As funding is available
Evaluate Groundwater Management Fee	Ongoing
Implement Projects and Management Actions (PMAs)	
PMA 1: Urban Water Conservation	Ongoing
PMA 2: Golf Water Conservation	Ongoing
PMA 3: Agricultural Water Conservation	Ongoing
PMA 4: Increased Surface Water Diversion	Ongoing
PMA 5: Delta Conveyance Facility	Planning underway

Activity	Timeline
PMA 6: Lake Perris Seepage	Planning underway
PMA 7: Sites Reservoir	Planning underway
PMA 8: Future Supplemental Water Acquisitions	As available
PMA 9: EVRA Potable Reuse	Planning underway
PMA 10: Mid-Valley Pipeline (Canal Only Customers)	Planning underway
PMA 11: Mid-Canal Storage Project	Planning underway
PMA 12: East Golf Expansion	Planning underway
PMA 13: Oasis Distribution System	Construction underway
PMA 14: WRP-10 Recycled Water Delivery	Planning, design, and construction underway
PMA 15: WRP-7 Tertiary Expansion	Planning and design underway
PMA 16: Canal Water Pump Station Upgrade	Design underway
PMA 17: WRP-7 Recycled Water Delivery	Planning and design underway
PMA 18: WRP-4 Tertiary Expansion & Delivery	Design underway
PMA 19: DWA WRP Recycled Water Delivery	As available
PMA 20: PD-GRF Expansion	Planning underway
PMA 21: TEL-GRF Expansion	Planning underway
PMA 22: WWR-GRF Operation	Ongoing
PMA 23: Eliminate Wastewater Percolation	Ongoing
PMA 24: Wellhead Treatment	Ongoing
PMA 25: Small Water System Consolidations	Ongoing
PMA 26: Septic to Sewer Conversions	Ongoing
PMA 27: Implement CV-SNMP Groundwater Monitoring Program Workplan	Ongoing
PMA 28: Implement CV-SNMP Development Workplan	Ongoing
PMA 29: Colorado River Salinity Forum	Ongoing
PMA 30: Source Water Protection	Ongoing

12.4 Summary

The overarching goal of the *Alternative Plan Update* is to reliably meet current and future water demands in a cost-effective and sustainable manner. Implementation of the original *2002 Coachella Valley Final Water Management Plan* (*CVWMP)* (CVWD, 2002) and *2010 CVWMP Update* (CVWD, 2012) has achieved that overarching goal with the recognition that water management and development of projects and management actions is an ongoing adaptive process.

With the passage of SGMA in 2014, the GSAs are addressing the sustainability indicators established in the legislation. This *Alternative Plan Update* incorporates a goal specifically for groundwater sustainability, which is to maintain a locally managed, economically viable, sustainable groundwater resource for existing and future beneficial uses in the Indio Subbasin by managing groundwater to avoid the occurrence of undesirable results. This *Alternative Plan Update* establishes the groundwater conditions and hydrogeological conceptual model for the Indio Subbasin, forecasts water demands through the planning horizon, describes water supplies available to the GSAs, defines sustainable management for this region, presents water management projects and programs to ensure Subbasin sustainability, and models the simulated conditions that will result from implementation of those project portfolios. This planning process has demonstrated that with the proposed projects identified in this Plan, and despite anticipated climate changes, the Indio Subbasin GSAs are able to meet forecasted demands under a variety of conditions and maintain the Indio Subbasin in balance, even increasing groundwater storage over time. Subsidence and saltwater intrusion have been stopped and are not anticipated to occur during Plan implementation.

As documented in this *Alternative Plan Update*, the water supply of the Indio Subbasin is managed sustainably by the Indio Subbasin GSAs, with ongoing and adaptive management into the foreseeable future. This *Alternative Plan Update* has been developed in collaboration with the recently initiated CV-SNMP and the two plans will continue to be coordinated. The GSAs have succeeded in reversing historical groundwater trends and are currently – and plan to continue – managing the Indio Subbasin sustainably. This Plan demonstrates that the GSAs have the necessary tools to support effective water management in the region.

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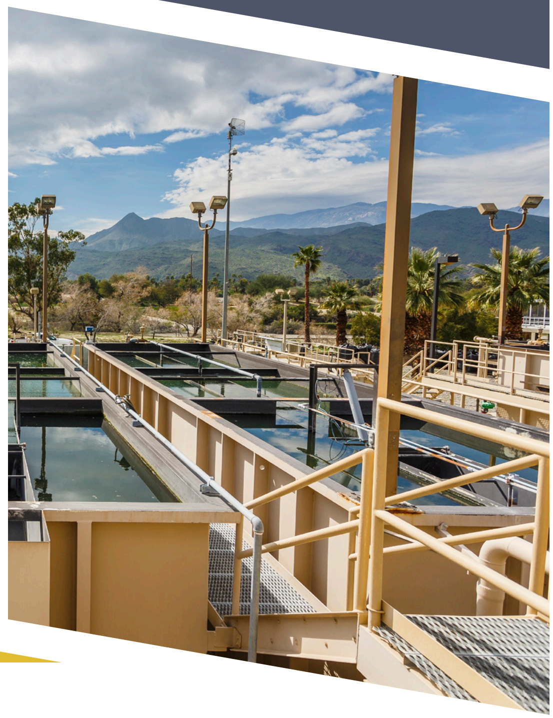

Prepared by

TODD GROUNDWATER

2490 Mariner Square Loop, Suite 215
Alameda, CA 94501
toddgroundwater.com

WOODARD & CURRAN

9655 Chesapeake Drive, Suite 320
San Diego, CA 92123
woodardcurran.com