2020
URBAN WATER MANAGEMENT PLAN

JUNE 2021

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

2020
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JUNE 2021

WATER TOMORROW
Planning for the Future

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF TABLES

Table **Page**

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Abbreviation	Terms
Units of Measurement	
AF	Acre-Feet
AFY	Acre-feet per Year
TAF	Thousand Acre-Feet
MAF	Million Acre-Feet
cfs	Cubic feet per second
GPCD	Gallons per Capita per Day
MGD	Million gallons per Day
mg/L	Milligrams per liter
MW	Megawatts
µg/L	Micrograms per liter
ng/L	Nanograms per liter
pCi/L	Picocuries per liter
kWh	Kilo-Watt Hour
Acronyms	
AGWA	Association of Ground Water Agencies
AMPAC	American Pacific Corporation
AVEK	Antelope Valley East Kern Water Agency
AWE	Alliance for Water Efficiency
AWWA	American Water Works Association
BDCP	Bay Delta Conservation Plan
BMPs	Best Management Practices
CAP	Climate Action Plan
CAWCD	Central Arizona Water Conservation District
CBM	Condition-based maintenance
CCL3	Contaminant Candidate List 3
CCP	Conservation Credits Program
CCWD	Contra Costa Water District
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CECs	Constituents of Emerging Concern
CEQA	California Environmental Quality Act
CII	Commercial, Industrial, and Institutional
CMMS	Computerized Maintenance Management System
CO_2	Carbon Dioxide
CPE	Comprehensive Program Evaluation
CRA	Colorado River Aqueduct
CRSS	Colorado River Simulation System
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
CVWD	Coachella Valley Water District
CWC	California Water Code
CWSRF	Clean Water State Revolving Fund
CY	Calendar Year
DAC	Disadvantaged Community

LIST OF ABBREVIATIONS

Abbreviation	Terms
D/DBP	Disinfectants/Disinfection Byproduct
DBP	Disinfection Byproduct
DCP	Drought Contingency Plan
DDW	The SWRCB's Division of Drinking Water
DFW	Department of Fish and Wildlife
DLR	Detection Level for purposes of Reporting
DMM	Demand Management Measure
DOE	U.S. Department of Energy
DPC	Delta Protection Commission
DPR	Direct Potable Reuse
DRA	Drought Risk Assessment
DSOD	Division of Safety of Dams
DTSC	California Department of Toxic Substances Control
DVL	Diamond Valley Lake
DWA	Desert Water Agency
DWCV	Desert Water Agency/Coachella Valley Water District
DWR	California Department of Water Resources
ECLO	Existing Conveyance and Low Outflow
EDD	California Employment Development Department
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ELPH	Equivalent Level of Public Health Protection
ESA	Endangered Species Act
ESP	Energy Sustainability Plan
ET_o	Evapotranspiration
FSA	Future Supply Actions
FWUA	Friant Water Users Authority
FY	Fiscal Year
GHG	Greenhouse Gas Emissions
GRP	Groundwater Recovery Program
GWRS	Groundwater Replenishment System
HECW	High Efficiency Clothes Washer
HET	High Efficiency Toilet
HTC	Hyatt/Thermalito Complex
ICP	Innovative Conservation Program
ICS	Intentionally Created Surplus
IEUA	Inland Empire Utilities Agency
IID	Imperial Irrigation District
IPR	Indirect Potable Reuse
IRP	Integrated Water Resources Plan
IRPSIM	Integrated Water Resources Plan Simulation Model
JWPCP	Joint Water Pollution Control Plant
LAA	Los Angeles Aqueduct
LADWP	Los Angeles Department of Water and Power
LRP	Local Resources Program
M&I	Municipal & Industrial

LIST OF ABBREVIATIONS

Abbreviation	Terms
MCL	Maximum Contaminant Level
MFR	Multi-family Residential
MLPA	Marine Life Protected Area
MOU	Memorandum of Understanding
MWD	The Metropolitan Water District of Southern California
MWD-EDM	Metropolitan's Econometric Demand Model
MWDOC	Municipal Water District of Orange County
MWELO	Model Water Efficient Landscape Ordinance
MWQI	Municipal Water Quality Investigations
NASA	National Aeronautics and Space Administration
NDEP	Nevada Division of Environmental Protection
NDMA	N-nitrosodimethylamine
NEPA	National Environmental Policy Act
NERT	Nevada Environmental Response Trust
NMFS	National Marine Fisheries Services
OCWD	Orange County Water District
OEHHA	Office of Environmental Health Hazard Assessment
OMP&R	Operation, Maintenance, Power and Replacement
PFAS	Per- and polyfluoroalkyl substances
PFBS	Perfluorobutane sulfonic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PG&E	Pacific Gas & Electric
PHG	Public Health Goal
polyDADMAC	polydiallyldimethylammonium chloride
PPCP	Pharmaceutical/Personal Care Product
PPRs	Present Perfected Rights
PVID	Palo Verde Irrigation District
QMCP	Quagga Mussel Control Program
QSA	Quantification Settlement Agreement
RDM	Robust Decision Making
RPAs	Reasonable and Prudent Alternatives
RRWP	Regional Recycled Water Program
RTP-12	2012-2035 Regional Transportation Plan/Sustainable Communities Strategy
RTS	Readiness-to-Serve Charge
RWA	Raw Water Augmentation
SAF	San Andreas Fault
SANDAG	San Diego Association of Governments
SAR	System Access Rate
SARI Line	Santa Ana Regional Interceptor Line
SB X7-7	Senate Bill X7-7, Water Conservation Act of 2009
SCAG	Southern California Association of Governments
SCWC	Southern California Water Coalition
SDCWA	San Diego County Water Authority
SDP	Seawater Desalination Program

LIST OF ABBREVIATIONS

Abbreviation	Terms
Series 13	SANDAG Series 13: 2050 Regional Growth Forecast
SFR	Single-Family Residential Model
SNMP	Salt and Nutrient Management Plan
SNWA	Southern Nevada Water Authority
SPR	System Power Rate
SRCSD	Sacramento Regional County Sanitation District
SRWSTF	Seismic Resilience Water Supply Task Force
SWC	State Water Contractors
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TVMWD	Three Valleys Municipal Water District
UCMR2	Unregulated Contaminant Monitoring Regulation 2
USBR	U.S. Department of the Interior, Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound
WIFIA	Water Infrastructure Finance and Innovation Act
WRD	Water Replenishment District of Southern California
WSAP	Water Supply Allocation Plan
WSCP	Water Shortage Contingency Plan
WSDM Plan	Water Surplus and Drought Management Plan
WSR	Water Stewardship Rate
WUCA	Water Utility Climate Alliance
WUE	Water Use Efficiency
YCWA	Yuba County Water Agency

Phrases

2015 IRP Update	2015 Integrated Water Resources Plan, Water Tomorrow
Act	Urban Water Management Planning Act
Annual Assessments	Annual Water Supply and Demand Assessment
Arvin-Edison	Arvin-Edison Water Storage District
Bank	Governor’s Water Bank
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta
California Plan	California’s Colorado River Water Use Plan
Conservancy	Sacramento-San Joaquin Delta Conservancy
Council	Delta Stewardship Council
Delta	Sacramento/San Joaquin River Delta
Forum	Colorado River Basin Salinity Control Forum
Kern Delta	Kern Delta Water District
Metropolitan	The Metropolitan Water District of Southern California
MWD Act	Metropolitan Water District Act
Plan	Urban Water Management Plan
Policy	State Recycled Water Policy

LIST OF ABBREVIATIONS

Abbreviation	Terms
Regional Board	Regional Water Quality Control Board
Sanitation Districts	Los Angeles County Sanitation Districts
Science Board	Delta Independent Science Board
Semitropic	Semitropic Water Storage District

Summary of Compliance

SB X7-7	
Water Code § 10608.36 – Assessment of Measures, Programs, and Policies	Assess present and proposed future measures, programs, and policies to help achieve water use reduction targets • Metropolitan's actions to help achieve the urban per capita water use reduction pursuant to the goals set forth in SB X7-7 are discussed in Sections 3.4, 3.5, and 3.7.
Agency Coordination	
Water Code § 10610.2(a)(4)	Water suppliers should collaborate closely with local land-use authorities to ensure water demand forecasts are consistent with current land-use planning. • See Sections 2 and 5 and Appendix 1.
Water Code § 10620(d)(2) – Develop Water Shortage Contingency Plan	Each urban water supplier shall develop its own water shortage contingency plan. • See Section 2.5 and Appendix 4.
Water Code § 10620(d)(3) – Coordination with Appropriate Agencies	Describe the coordination of the plan preparation. • See Section 5.
Water Code § 10620(f) – Describe Resource Maximization/Import Minimization Plan	Discuss how water management tools and options are used to maximize resources and minimize the need to import water. • Metropolitan's planning strategy within the IRP and adaptive implementation approach are discussed in Section 2 and provide an overview of the water management tools and options. See pages 2-2 through 2-6. • Further details are provided in Sections 1.4 (conservation and local resources, pages 1-25 through 1-27), 3.4 (demand management and conservation, pages 3-37 through 3-55), and 3.5 (recycling, groundwater recovery, and desalination, pages 3-56 through 3-78.)
Water Code § 10621(b) – City and County Notification and Participation	Notify any city or county within service area of Urban Water Management Plan (UWMP) review & revision at least 60 days before public hearing. May consult with and obtain comments from notified cities and counties. • Notification and participation are discussed in Section 5, pages 5-1 through 5-10, and Appendix 12, DWR Submittal Table 10-1.
Water Code § 10621(f) – Plan Submittal to Department of Water Resources (DWR)	Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021 • Submission of the 2020 UWMP by the July 1, 2021 deadline is detailed in Section 5.
Contents of UWMP	
Water Code § 10630.5 – Simple Lay Description	Include a simple lay description of how much water the agency has on a reliable basis, how much it needs for the foreseeable future, the agency's strategy for meeting its water needs, the challenges the agency faces, and any other information necessary to provide a general understanding of the plan. • The Simple Lay Description is contained in the Executive Summary.

Summary of Compliance

Water Code § 10631(a) – Service Area Information	Describe service area of supplier • Service area is discussed in Section 1.2, pages 1-6 through 1-10 and shown in Figure 1-1. Include current and projected population • Population is discussed in Section 1.3 and shown in Table 1-1, Figure 1-2, and Figure 1-3. • Population analysis is discussed in Appendix 1, page A.1-5. Projections are on page A.1-10, Table A.1-2. • Current and projected population are shown in Appendix 12, DWR Submittal Table 3-1. Population projections must be based on data from state, regional or local service agency projections • See footnote Table A.1-2, page A.1-10. Describe climate characteristics that affect water management • See Section 1.3, pages I-14 through I-16, Figure 1-5, and Table 1-4, and Section 2.6, pages 2-43 through 2-48. Describe other social, economic, and demographic factors affecting water management • See Section 1.3, pages 1-12 through 1-14 and Appendix 1. Describe current and projected land uses within the existing or anticipated service area affecting the supplier's water management planning. Suppliers shall coordinate with local or regional land use authorities to determine the most appropriate land use information. • See methodologies and assumptions for developing projections of demand and water use in Section 2.2.
Water Code § 10631(b)(1-3) – Water Sources	Identify and quantify existing and planned water supply sources in 5-year increments to 20 years or as far as data is available • Current supplies and quantities are described in Section 1.4, pages 1-21 through 1-30. • Historic and current water supplies are described in Appendix 2. • Planned water supplies and quantities are discussed in Section 2, and details are provided in Appendix 3, and particularly in Table A.3-7, pages A.3-58 through A.3-70. • See Appendix 12, DWR Submittal Tables 6-8 and 6-9. Detailed discussion of anticipated supply availability under normal water year, single dry year, and droughts lasting at least 5 years, as well as more frequent and severe drought periods (as described in the drought risk assessment). For each water supply source, consider any information pertinent to the Section 10635 reliability analysis, including climate change. • See Section 2, Tables 2-4 through 2-7, pages 2-18 through 2-25. • See Section 2.2 (estimating demand on Metropolitan) page 2-9, • See Section 2.3 (water reliability assessment), pages 2-15 through 2-20, Section 2.4 (drought risk assessment), pages 2-21 through 2-25, Section 2.6 (other supply reliability risks), pages 2-43 through 2-48, and the discussions presented under the Colorado River and State Water Project (SWP), Sections 3.1 and 3.2. • See Section 3 and Appendices 3 and 5 • See Appendix 12, DWR Submittal Tables 7-1, 7-2, 7-3, 7-4, and 7-5.

Summary of Compliance

	Describe the management of each supply source in correlation with the other supplies. • See Section 3 and Appendix 3. Describe the measures being taken to acquire and develop planned water supply sources. • See Section 3 and Appendix 3.
Water Code § 10631(b)(4) – If Groundwater Identified as Existing or Planned Source	Metropolitan does not supply groundwater. However, Metropolitan partners with various entities for groundwater storage and exchange programs. • See Sections 3.3, 3.5, and 3.6; Appendix 2 (pages A.2-4 through A.2-5, A.2-8 through A.2-9, A.2-15); and Appendix 3 (pages A.3-25 through A.3-28, A.3-31 through A.3-32, A.3-53 through A.3-55) for discussions of issues related to groundwater basins. • See Section 4 for salinity issues related to groundwater basins.
Water Code § 10631(c) – Transfer or Exchange Opportunities	Describe short-term and long-term exchange or transfer opportunities • Section 1.4 (augmenting water supplies), pages 1-27 through 1-28. • Section 3.1 (pages 3-3 through 3-12) describes plans for banking, exchange and transfer opportunities along the Colorado River and Aqueduct. • Section 3.2 (pages 3-13 through 3-30) describes plans for banking, exchange and transfer opportunities within the State Water Project. • Section 3.3 (pages 3-31 through 3-36) describes plans for banking, exchange and transfer opportunities within the Central Valley/State Water Project. • Section 3.6 (pages 3-79 through 3-82) describes plans for banking, exchange and transfer opportunities within the local region. • Further details are provided in Appendix 3, particularly Table A.3-7 on pages A.3-58 through A.3-70.
Water Code §§ 10631(d)(1) and (2) – Past, Current, and Projected Water Use	Urban retail water suppliers are to quantify past, current, and projected water use by sector in five-year increments • Not applicable to Metropolitan (which is a wholesaler) because this reporting requirement applies only to urban retail water suppliers. However, Metropolitan voluntarily provides this information in the following Sections: • See Section 1.3, page 1-13 and Figure 1-4 for historical retail water demands. • Past, current, and future water uses are shown in Appendix 1, Table A.1-13 on page A.1-14. Water uses by sector and county are shown in Tables A.1-6 through A.1-11 on pages A.1-13 through A.1-15. Water demands by sector are shown in Appendix 12 DWR Submittal Tables 4-1, 4-2, and 4-3. Identify and quantify sales to other agencies • See Section 1.3, page 1-13 and Figure 1-4 for historical retail water demands. • Historic sales are presented in Table A.2-2 on page A.2-3. • Metropolitan does not project sales by individual agency. However, total projected sales/demands to other agencies are shown in Section 2.2, pages 2-7 through 2-14.

Summary of Compliance

Water Code §§ 10631(d)(1)(J), (d)(3)(A)-(C) – Distribution System Water Loss	Urban retail water suppliers are to quantify distribution system water loss for each of the 5 years before the plan update • Not applicable to Metropolitan (which is a wholesaler) because this reporting requirement applies only to urban retail water suppliers. However, Metropolitan voluntarily provides this information in the following Sections: • Section 2.6, page 2-43, Appendix 7, Tables A.7-1 to A.7-5, and Appendix 12, DWR Submittal Table 4-4 (Optional for Wholesaler).
Water Code § 10631(d)(4)(A) and (B) – Water Savings Estimate	Water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans Provide citations to the codes, standards, ordinances, or transportation and land use plans used to make projections Indicate extent that water use projections consider savings from codes, standards, ordinances, or transportation and land use plans. • See discussion on estimating demands and code-based conservation in Section 2, page 2-9 and Appendix 6.
Water Code § 10631(e)(2) – Description of Supplier's Water Demand Management Measures, Distribution System Asset Management, Assistance Programs	Provide narrative description of items in §10631(e)(1)(B)(ii), (iv), (vi), and (vii), distribution system asset management, and wholesale supplier assistance programs • See discussion on metering, Section 3.4, page 3-47. • See discussion on public education and outreach, Section 3.4, pages 3-38 through 3-43. • See discussion on water conservation programs, Section 3.4, pages 3-44 through 3-46. • See discussion on demand management and conservation, Section 3.4, pages 3-37 through 3-52. • See discussion on distribution system asset management, Section 3.4, pages 3-53 through 3-55. • See discussion on assistance programs to retail water agencies (rebate programs, public education and outreach, and other efforts to reduce water demand), Section 3.4, pages 3-37 through 3-52.
Water Code § 10631(f) – Planned Water Supply Projects and Programs	Detailed description of expected future supply projects & programs to meet projected water use Timeline for each proposed project or program Quantification of each project's normal water year yield (AFY) Quantification of each project's single dry-year water year yield (AFY) Quantification of each project's 5-year drought yield (AFY) • Section 3.1 (pages 3-3 through 3-12) describes plans for banking, exchange and transfer opportunities along the Colorado River and Aqueduct. • Section 3.2 (pages 3-13 through 3-30) describes plans for banking, exchange and transfer opportunities within the State Water Project. • Section 3.3 (pages 3-31 through 3-36) describes plans for banking, exchange and transfer opportunities within the Central Valley/State Water Project. • Section 3.6 (pages 3-79 through 3-82) describes plans for banking, exchange and transfer opportunities within the local region. • Further details are provided in Appendix 3, particularly Table A.3-7 on pages A.3-58 through A.3-70. • See Appendix 12, DWR Submittal Table 6-7.

Summary of Compliance

Water Code § 10631(g) – Opportunities for Development of Desalinated Water	Describe opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply • See discussion on groundwater recovery and seawater desalination in Section 1.4, pages 1-24 through 1-26, and Section 3.5, pages 3-56 through 3-73. • See Appendix 5, Table A.5-2 on pages A.5-9 through A.5-11 for a list of existing, under construction, CEQA, and conceptual groundwater recovery projects and their ultimate yield/capacity. • See Appendix 5, Table A.5-3 on page A.5-12 for a list of existing, CEQA, and conceptual seawater desalination projects.
Water Code § 10631(h) – If Supplier Relies on a Wholesale Supplier for Water	Urban water suppliers that rely on wholesale agency for water source must provide wholesale agency with water use projections in 5-year increments to 20 years or as far as data is available. Wholesaler to provide urban water suppliers with existing and planned water supply availability projections, by source, and planned water supply quantities over same 5-year increments and during various water-year types. • See discussions on Metropolitan and member agency coordination for the IRP Process in Sections 2 and 5. • See Appendix 3, Table A.3-7, and Appendix 12, DWR Submittal Table 2-4.
Water Code § 10631.1 – Projected Water Use for Low-Income Housing	Water use projections for single-family and multi-family residential housing for lower income households. • This is incorporated with the retail demand forecast, as reflected in Section 2 and Appendix 1.
Water Code § 10631.2 – Calculation or Estimation of Energy Intensity of Urban Water Systems	Must include any of the following that the supplier can readily obtain: estimated amount of energy for extraction or diversion (from sources), conveyance, treatment, distribution, treated water supplies compared to nontreated water supplies, and storage of water, and any other appropriate energy-related information. • Estimate of the amount of energy used and energy intensity is presented in Appendix 10. • See Section 3.8 for discussion of Metropolitan's Energy Management Initiative.
Water Shortage Contingency Plan	
Water Code § 10632 – Water Shortage Contingency Plan **Water Code § 10632(a)(1) – Analysis of Water Supply Reliability**	Every supplier shall prepare and adopt a water shortage contingency plan as part of its Plan. Water shortage contingency plan must include the analysis of water supply reliability conducted pursuant to Section 10635. • See Section 2.5 and Appendix 4 For Water Supply Reliability assessments • See Sections 2.2, 2.3, and 2.4

Summary of Compliance

Water Code § 10632(a)(2) – Procedures Used to Conduct Annual Water Supply and Demand Assessment	Written decision-making process used each year to determine water supply reliability. Key data inputs and assessment methodology to evaluate water supply reliability for current year and one dry year, including: (i) current year unconstrained demand, (ii) current year available supply, (iii) existing infrastructure capabilities and plausible constraints, (iv) locally applicable evaluation criteria used for each annual water supply and demand assessment, and (v) description and quantification of each water supply source. • See Section 2.5 and Appendix 4
Water Code § 10632(a)(3)(A) – Six Standard Water Shortage Levels	Six standard water shortage levels corresponding to ranges of up to 10, 20, 30, 40, and 50% shortages and greater than 50% shortage. Shortage levels shall be defined based on the suppliers' water supply conditions, including percentage reductions in water supply, changes in groundwater levels, changes in surface elevation or level of subsidence, or other changes in hydrological or other conditions indicative of available water supply. Shortage levels also apply to catastrophic interruption of water supplies, including regional power outage, earthquake, Delta levee failure, and aqueduct failure. • See discussion of Water Shortage Contingency Plan in Section 2.5 and Appendix 4, including description of Metropolitan's Water Surplus and Drought Management Plan and Water Supply Allocation Plan. • See discussion of Metropolitan's Emergency Storage Objective developed under its catastrophic supply interruption plan in Section 2.5 and Appendix 8. • See Appendix 12, DWR Submittal Tables 8-1, 8-2, and 8-3
Water Code § 10632(a)(4) – Shortage Response Actions	Shortage response actions that align with the shortage levels and include: (i) supply augmentation actions, (ii) demand reduction actions, (iii) operational changes, (iv) mandatory prohibitions against specific water use practices, and (v) estimated extent to which the gap between supplies and demand will be reduced by each action. • See discussion of Water Shortage Contingency Plan in Section 2.5 and Appendix 4, including description of Metropolitan's Water Surplus and Drought Management Plan and Water Supply Allocation Plan. • See discussion of Metropolitan's Emergency Storage Objective developed under its catastrophic supply interruption plan in Section 2.5 and Appendix 8. • See Appendix 12, DWR Submittal Tables 8-1, 8-2, and 8-3.
Water Code § 10632(a)(5) – Communication Protocols and Procedures	Communication protocols and procedures to inform customers, the public, interested parties, and governments regarding: (i) any current or predicted shortages, (ii) any shortage response actions triggered or expected to be triggered, and (iii) any other relevant communications. • See Section 2.5 and Appendix 4.
Water Code § 10632(a)(6) – Customer Compliance, Enforcement, Appeal, and Exemption Procedures	For an urban retail water supplier, customer compliance, enforcement, appeal, and exemption procedures for triggered shortage response actions. • Not applicable to Metropolitan as a wholesaler.

Summary of Compliance

Water Code § 10632(a)(7) – Legal Authorities	Describe legal authorities that empower supplier to implement shortage response actions. Statement that supplier will declare a water shortage emergency in compliance with Chapter 3 (Water Code §§ 350-359 re Water Shortage Emergencies). Statement that supplier will coordinate with any city or county within which it supplies water supply services for the possible proclamation of a local emergency. • See Section 2.5 and Appendix 4.
Water Code § 10632(a)(8) – Financial Consequences	Describe financial consequences of and responses for drought conditions. Describe potential revenue reductions and expense increases associated with shortage response actions, and mitigation actions to address such reductions and increases. Describe cost of compliance with Chapter 3.3 (Water Code §§ 365-367 re Excessive Water Use During Drought). • See Sections 2.5 and 2.7, page 2-27, and Appendix 4.
Water Code § 10632(a)(9) – Monitoring and Reporting Requirements and Procedures for Customer Compliance and State Reporting	For an urban retail water supplier, monitoring and reporting requirements and procedures for monitoring customer compliance and to meet state reporting requirements. • Not applicable to Metropolitan as a wholesaler.
Water Code § 10632(a)(10) – Reevaluation and Improvement Procedures	Reevaluation and improvement procedures for systematically monitoring and evaluating the functionality of the water shortage contingency plan. • See Section 2.5 and Appendix 4.
Water Code § 10632(b) – Water Features	Analyze and define water features artificially supplied with water separately from swimming pools and spas when developing water shortage contingency plan • Not applicable to Metropolitan because prohibitions against specific water use practices are enforced on end users and are not within Metropolitan's authority as a wholesaler.
Water Code § 10632(c) – Plan Availability	Water shortage contingency plan shall be available to customers and any city or county within which the supplier provides water supplies no later than 30 days after adoption of the plan. • Posting of water shortage contingency plan on Metropolitan's website and provision of water shortage contingency plan to cities and counties are described in Section 5.
Water Code § 10632.5 – Seismic Risk Assessment and Mitigation Plan	Include a seismic risk assessment and mitigation plan. • See Section 2.5 and Appendix 9.

Summary of Compliance

Recycled Water Plan	
Water Code § 10633 – Recycled Water as Potential Water Source; Agency Coordination	Provide information, to the extent available, on recycled water and its potential as a water source in the supplier's service area. Coordinate plan preparation with local water, wastewater, groundwater, and planning agencies within supplier's service area. • See Section 1.4, pages 1-24 through 1-30, Section 3.5, pages 3-56 through 3-78, Tables 3-12 and 3-13 on pages 3-76 through 3-77, Appendix 2, pages A.2-8 through A.2-9, and Appendix 5, Table A.5-1. • Coordination of the plan preparation is discussed in Section 5.
Water Code § 10633(a) – Wastewater System Description	Describe the wastewater collection and treatment systems in the supplier's service area Quantify the volume of wastewater collected and treated • Not applicable to Metropolitan because it does not collect or treat the wastewater generated within its service area. Instead, Metropolitan provides a general narrative description of the wastewater collection and treatment systems operated by others in its service area. • See Section 3.5, pages 3-57 through 3-78, Table 3-8 on page 3-57, Tables 3-12 and 3-13 on pages 3-76 through 3-77, Appendix 2, pages A.2-8 through A.2-9, and Appendix 5, Table A.5-1.
Water Code § 10633(a) through (d) – Wastewater Disposal and Recycled Water Uses	Describes methods of wastewater disposal in the supplier's service area • Not applicable to Metropolitan because it does not dispose of wastewater within its service area. Instead, Metropolitan provides a general narrative description of wastewater disposal by others in its service area. • See Section 3.5, pages 3-57 through 3-78. Describe quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project. • Not applicable to Metropolitan because it does not treat or discharge recycled water. Instead, Metropolitan provides a general narrative description of the treatment and discharge of recycled water by others in its service area. • See Section 3.5, pages 3-57 through 3-78. Describe the current type, place and quantity of use of recycled water in supplier's service area Describe and quantify potential uses of recycled water Determination of technical and economic feasibility of serving the potential uses • Not applicable to Metropolitan because it does not use recycled water in its service area. Instead, Metropolitan provides a general narrative description of the use of recycled water by others in its service area, including potential uses and the technical and economic feasibility of serving the potential uses of recycled water • See Section 3.5, pages 3-56 through 3-78, Section 4, pages 4-6 through 4-7, Appendix 2, pages A.2-8 through A.2-9, and Table A.5-1.

Summary of Compliance

Water Code § 10633(e) – Projected Uses of Recycled Water	Projected use of recycled water in service area at the end of 5, 10, 15, and 20 years • See Section 2, Tables 2-1 through Table 2-3, pages 2-12 through 2-14 and Section 3.5. Compare UWMP 2015 projections with UWMP 2020 actual use of recycled water • The 2015 UWMP, Tables 2-1, 2-2, and 2-3 included the following projections for recycled water use in 2020 (without the Santa Ana River baseflow): 436 TAF for a single dry year; 427 TAF for a multiple dry year; and 436 TAF for an average year. In 2020, actual recycled water use is estimated at 441 TAF, as discussed in Table 3-14 on page 3-77 and Appendix 2, page A.2-8 of this 2020 UWMP. • See Appendix 12, DWR Submittal Table 6-5.
Water Code §§ 10633(f), (g) – Actions to Encourage Use of Recycled Water **Plan to Optimize Use of Recycled Water**	Describe actions, including financial incentives, that might be taken to encourage recycled water uses Describe projected results of these actions in terms of acre-feet of recycled water used per year Provide a plan to optimize the use of recycled water in the supplier's service area • Metropolitan provides a general narrative description of the actions it takes to encourage recycled water uses in its service area • See Section 1.4, pages 1-24 through 1-25, 1-27, Table 1-5, Section 3.5, pages 3-56 through 3-78, Tables 3-12 and 3-13 on pages 3-76 and 3-77, and Appendix 5, Table A.5-1.
Water Quality Impacts on Reliability	
Water Code § 10634 – Water Quality Impacts on Availability and Reliability of Supply	Discuss water quality of existing sources in 5-year increments to 20 years and how water quality affects water management strategies and supply reliability • See Section 3.2, SWP Water Quality, pages 3-25 through 3-27, 3-29. • See Section 4, Water Quality, pages 4-1 through 4-21.
Water Service Reliability	
Water Code § 10635(a) – Supply and Demand Comparison: Normal Water Year	Compare the projected normal water supply to projected normal water use over the next 20 years, in 5-year increments. • For projected water use, see Section 2, Table 2-3, page 2-14. • For projected water supply, see Table 2-6, page 2-19 and Table A.3-7 in Appendix 3, pages A.3-58 through A.3-70, and Appendix 12, DWR Submittal Table 7-2.
Water Code § 10635(a) – Supply and Demand Comparison: Single-Dry Year Scenario	Compare the projected single-dry year water supply to projected single-dry year water use over the next 20 years, in 5-year increments. • For projected water use, see Section 2, Table 2-1, page 2-12. • For projected water supply, see Table 2-4, page 2-17 and Table A.3-7 in Appendix 3, pages A.3-59 through A.3-70, and Appendix 12, DWR Submittal Table 7-3.

Summary of Compliance

Water Code § 10635(a) – Supply and Demand Comparison: 5-Year Drought Scenario	Project a 5-year drought period occurring between 2021-2025 and compare projected supply and demand during those years Project a 5-year drought period occurring between 2026-2030 and compare projected supply and demand during those years Project a 5-year drought period occurring between 2031-2035 and compare projected supply and demand during those years Project a 5-year drought period occurring between 2036-2040 and compare projected supply and demand during those years • Metropolitan has projected 5-year periods for the next 20 years. • For projected water use, see Section 2, Table 2-2, page 2-13. • For projected water supply, see Table 2-5, page 2-18 and Table A.3-7 in Appendix 3, pages A.3-58 through A.3-70. • See Appendix 12, DWR Submittal Table 7-4.
Water Code § 10635(b) – Drought Risk Assessment	Include a drought risk assessment for water service to customers as part of information considered in developing the demand management measures and water supply projects and programs to be included in the Plan. • See Section 2.4.
Water Code § 10635(b)(1) – Data, Methodology, and Basis	Describe the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a 5-year drought, starting from the year following when the assessment is conducted. • See Sections 2.1 and 2.4, and Appendices 1 and 3, specifically Table A.3-8.
Water Code § 10635(b)(2) – Reliability of Each Supply Source	Determine the reliability of each supply source under a variety of water shortage conditions. • See Section 2.3, specifically Tables 2-4, 2-5, and 2-6, and Appendix 3, specifically Tables A.3-7 and A.3-8.
Water Code § 10635(b)(3) – Comparison of Total Water Supply Sources to Total Projected Water Use	Compare the total water supply sources available with the total projected water use for the drought period. • See Section 2.3, specifically Tables 2-4, 2-5, and 2-6.
Water Code § 10635(b)(4) – Historical Drought Hydrology, Projected Supply and Demand Changes Due to Climate Change, Regulatory Changes, and Other Criteria	Consider historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria. • See Sections 1.4, 2.6, 4, and Appendices 1, 2, 3, and 6.
Water Code § 10635(c) – Plan Submittal to Cities and Counties	Supplier to provide portion of Plan on water service reliability to cities and counties within its service area no later than 60 days after Plan submittal. • Provision of Plan to cities and counties is described in Section 5.
Water Code § 10640 – Water Shortage Contingency Plan	Supplier to prepare a water shortage contingency plan pursuant to Section 10632, periodically review the water shortage contingency plan, and adopt any amendments or changes. • See Section 2.5 and Appendix 4.

Summary of Compliance

Water Code § 10641 – Consultations with public agency, state agency or experts	Supplier may consult with and obtain comments from any public agency, state agency, or any person with special expertise as to water demand management methods and techniques • Stakeholder, state agency, public agency, and expert participation, consultation, outreach, comments, and notification are described in Section 5.
Water Code § 10642 – Public Hearing; Notice; Adoption	Encourage involvement of diverse social, cultural & economic community groups prior to and during Plan and water shortage contingency plan preparation • See Section 5, pages 5-1 through 5-12. Prior to adoption, Plan and water shortage contingency plan available for public inspection and hold public hearing • See Section 5, pages 5-5 and 5-12. Provide proof of public hearing and notice • See Section 5, page 5-11. Provide meeting notice to any city or county in service area • See Section 5, pages 5-8 and 5-11, and Appendix 12, DWR Submittal Table 10-1. Provide notice pursuant to Chapter 17.5 of the Government Code • See Section 5, page 5-12. After hearing, Plan and water shortage contingency plan shall be adopted as prepared or as modified after hearing. • See Section 5, pages 5-13 and 5-15.
Water Code §§ 10615, 10643 – Plan Implementation	Include in Plan strategy and time schedule for implementation Implement Plan in accordance with the schedule set forth in the Plan • Metropolitan has conducted a review of its planning progress through the 2020 IRP Update, discussed in Section 2. In addition, in each section, Metropolitan has included an "Achievement to Date" that discusses progress towards its planning goals, current issues, and potential problems with continued implementation of the Plan. • Section 3 summarizes the implementation plan and continued progress in developing a diversified resource mix consistent with the IRP to meet the region's water supply needs DMM Programs • Metropolitan's conservation plan and approach are discussed in Section 3.4. Individual conservation programs are discussed on pages 3-44 through 3-48.
Water Code § 10644(a)(1) –Plan Submittal	Submit to DWR, the California State Library, and any city or county within service area copy of Plan no later than 30 days after adoption. • Plan submission is described in Section 5.
Water Code § 10644(a)(2) – Plan shall include any Standardized Forms, Tables, or Displays specified by DWR	Submit Plan electronically Include in Plan DWR's standardized forms, tables, or displays • Plan submission is described in Section 5. • DWR's standardized tables for wholesale urban water agencies are completed and presented in Appendix 12.
Water Code § 10644(b) – Water Shortage Contingency Plan Revision	Submit copy of revised water shortage contingency plan to DWR no later than 30 days after adoption. • Plan submission is described in Section 5 and Appendix 4.

Summary of Compliance

Water Code § 10645 – Plan and Water Shortage Contingency Plan Available for Public Review	No later than 30 days after plan submittal, the supplier and DWR to make the Plan and water shortage contingency plan available for public review during normal business hours. • Posting of Plan and water shortage contingency plan on Metropolitan's website for public review is described in Section 5.

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Executive Summary and Simple Lay Description of 2020 UWMP Findings

Metropolitan's 2020 Urban Water Management Plan (UWMP) has been prepared in compliance with the California Water Code (CWC)[1]. This Executive Summary satisfies the requirement of CWC Section 10630.5 to include a simple lay description of information necessary to provide a general understanding of the plan, including a description of Metropolitan's reliable water, as well as its needs, strategies, and potential challenges for the foreseeable future.

This plan provides an assessment of Metropolitan's water service reliability, describes and evaluates sources of water supply, efficient uses of water, demand management measures, implementation strategy and schedule, and other relevant information and programs. In addition to the water reliability assessments, the plan includes an evaluation of frequent and severe periods of droughts, as described in the Drought Risk Assessment, and the preparation and adoption of the Water Shortage Contingency Plan (WSCP).

Metropolitan's 2020 UWMP was developed as part of the 2020 Integrated Water Resources Plan (IRP) planning process and provides a representation of Metropolitan's planning elements reported under the conditions required by the Act. The IRP represents Metropolitan's comprehensive planning process and will serve as Metropolitan's blueprint for long-term water reliability, including key supply development and water use efficiency goals. Together, these plans serve as the reliability roadmap for the region. The planning process involved extensive coordination with Southern California's water agencies, municipal service providers, and public planning agencies. Metropolitan's Board of Directors provided oversight throughout the ongoing process for the development of the 2020 IRP that informed the preparation of the 2020 UWMP. Metropolitan's outreach efforts sought to engage the general public, businesses, environmental organizations, diverse communities, cities, counties, and other stakeholders with an interest in the future of Southern California's water supplies. The information included in the 2020 UWMP represents the most current and available planning projections of supply capability and demand forecasts developed through a collaborative process with the member agencies.

As with Metropolitan's previous plans, the 2020 UWMP does not explicitly discuss specific activities undertaken by its member agencies unless they relate to one of Metropolitan's water demand or supply management programs. Presumably, each member agency will discuss these activities in its UWMP.

Factors Considered for Metropolitan's Water Reliability Assessments for the UWMP

The Act requires reporting agencies to describe their water service reliability under the conditions associated with a normal water year, single dry-year, and droughts lasting at least five consecutive water years, with projected information in five-year increments for 20 years. The factors used to evaluate Metropolitan's supply and demand balance for the 2020 UWMP are

[1] This UWMP complies with the Urban Water Management Planning Act (Act), which was added by Statute 1983, Chapter 1009, became effective on January 1, 1984, and currently includes CWC Sections 10610 through 10657; and with CWC Section 10608.36 which was added by SB X7-7 in 2009.

presented below. Some of the considerations and resulting projections may change as Metropolitan's planning progresses. These changes may be reflected in future updates of the UWMP. Metropolitan and its member agencies have engaged in a comprehensive regional planning process called the IRP since the 1990s. In its 2020 IRP process, Metropolitan and its member agencies are using a scenario planning approach to identify and account for the broad range of uncertainty that the region faces in its water supplies and demands. Instead of focusing on a target for future water supply needs based on a single projected outcome of supplies and demands, this approach encouraged broader thinking and discussion of possible future conditions for local and imported water supply and retail demand, and the policy implications for Metropolitan and its service area. Adaptive management during implementation will allow flexibility in how the region prepares for the supply and demand conditions as they evolve through the future. The scenario planning in the 2020 IRP started with identifying the major drivers of change that impact water supply and demand for the region, understanding how they interact, and then assessing the potential scale of impact in the future. Data sources and quantification methods were identified that could be used for quantitative and qualitative analysis of the drivers and their impact on water supplies and demands. The detailed analyses of future local and imported water supplies; economic growth, demographics and water demands; and changing hydrology were incorporated into the UWMP. The IRP planning effort and policy discussions continued into 2021.

Hydrologic Conditions and Reporting Period

The 2020 UWMP presents Metropolitan's water reliability assessments from 2025 through 2045. As specified in the Act, there are three water-year types that must be included in the water service reliability assessment for the UWMP. To simulate hydrologic conditions for the required reliability assessments, Metropolitan assumed the following:

- <u>Normal Year</u>. The average of historic years 1922 to 2017 most closely represents the water supply conditions that Metropolitan considers available during a normal water year.
- <u>Single Dry Year</u>. The conditions for the year 1977 represent the lowest total water supply available to Metropolitan.
- <u>Five-Consecutive-Year Drought</u>. The five consecutive years of 1988 to 1992 represent the driest five-consecutive year historical sequence for Metropolitan's water supply. This five-year sequence is used to complete both Metropolitan's water service reliability and drought risk assessments.

Metropolitan developed and evaluated estimates of future demands and supplies from local sources and from Metropolitan sources based on a record of 96 years (1922-2017) of historic hydrology. Supply and demand analyses for the single dry year and droughts lasting at least five consecutive water years were based on conditions affecting the watershed and supplies from the SWP, as this supply availability fluctuates the most among Metropolitan's sources of supply. Using the same 96-year period of the SWP supply availability, 1977 is determined to be the single driest year and 1988-92 is the driest 5-year historical sequence that represents the lowest water supply available for SWP supplies to Metropolitan. In addition, staff analysis of the 8-river index, an indicator of river flow and runoff in the SWP watershed, indicated that 1977 is the single driest year and 1988-92 is the lowest 5 consecutive dry years from 1922 through 2017. The 8-river index is used by DWR and other water agencies as an estimate of the unimpaired runoff (or natural water production) of the Sacramento and San Joaquin River basins, which are sources of water for the SWP.

Demand Projections

Within Metropolitan's service area, retail water demands can be met with local supplies or imported supplies. In the UWMP, Metropolitan's supply reliability assessments focus on the future demands for Metropolitan's imported and other supplies. The expected firm demand on Metropolitan is the difference between total demands, adjusted for conservation, and projected total local supplies. Thus, in order to project the regional need for water, Metropolitan starts with a projection of total demand including retail Municipal and Industrial (M&I), retail agricultural, seawater barrier, and replenishment demands, determines the adjustments from total conservation, and subtracts the total local supplies that are available to meet a portion of those demands.

Total Demands

Demographic growth is a major driver of the current and future retail M&I water demand. Metropolitan updates its retail M&I projection periodically based on the release of official regional demographic and economic projections, and in the 2020 IRP, alternative demographic projections are being evaluated. The projections of retail M&I water demands used in the 2020 UWMP are based on demographic data and projections taken from the following reports:

- Southern California Association of Governments (SCAG) Connect SoCal: The 2020-2045 Regional Transportation Plan/Sustainable Community Strategy (May 2020)
- San Diego Association of Governments (SANDAG) San Diego Forward: The 2019 Federal Regional Transportation Plan (October 2019)

The SCAG and SANDAG regional growth forecasts are the core assumptions for the retail M&I demand forecasts for the UWMP assessments. These forecasts drive the estimating equations of the retail demand forecasting in Metropolitan's Econometric Demand Model (MWD-EDM). Both SCAG and SANDAG prepare demographic forecasts based on land use data for their respective regions through extensive processes that emphasize input from local planners and are done in coordination with local or regional land use authorities, incorporating essential information to reflect anticipated future populations and land uses. SCAG's and SANDAG's projections undergo extensive local review, incorporate zoning information from city and county general plans, and are supported by Environmental Impact Reports.

Retail agricultural demands consist of retail level water use for irrigating crops. Metropolitan's member agencies estimate agricultural water use based on many factors, including farm acreage, crop types, historical water use, and land use conversion. Each member agency estimates its agricultural demands differently, depending on availability of information. Metropolitan relies on member agencies' estimates of agricultural demands for the 2020 UWMP.

Metropolitan also includes in its assessment of total demands the local groundwater requirements for seawater barrier and groundwater basin replenishment. Seawater barrier demands represent the amount of water needed to hold back seawater intrusion into the coastal groundwater basins. Replenishment demands represent the amount of water that member agencies plan to use to replenish the groundwater basins and augment natural replenishment from precipitation. Metropolitan relies on member agencies' and groundwater management agencies' projections for these demands, as well as projections of local supplies that are also used to meet these demands.

Total Conservation

Projected regional water demand is adjusted to account for water conserved by best management practices from active, code-based, and price-effect conservation. Active conservation levels are derived by calculating water savings from all active program device-based savings installed to date. Code-based conservation levels are derived by calculating water savings from devices covered by existing water conservation ordinances and plumbing codes, including the state Model Water Efficient Landscape Ordinance, with replacement and new construction rates driven by demographic growth consistent with SCAG and SANDAG land use and transportation plans used to derive retail demand. Price-effect conservation is derived by calculating water savings by retail customers attributable to the effect of changes in the real (inflation adjusted) price of water.

Total Local Supplies

Projections of local supplies are based on information gathered from Metropolitan's annual local production surveys and communications between Metropolitan and member agency staff. The projections include groundwater and surface water production, recycled water and recovery of contaminated or degraded groundwater (funded under the Metropolitan's Local Resources Program, as well as local agency funded programs), and seawater desalination. The local supply projections presented in demand tables for the 2020 UWMP are consistent with the local supply projections reported in member agencies' UWMPs, with one variation being the Colorado River water SDCWA exchanges with Metropolitan for deliveries of blended Metropolitan water.

The total local supplies presented in the 2020 UWMP also include projections of Los Angeles Aqueduct deliveries from the Los Angeles Department of Water and Power (LADWP).

Water Use Reduction Achievement in 2020

On November 10, 2009, the state Legislature passed Senate Bill 7 as part of the Seventh Extraordinary Session, referred to as SB X7-7 or the Water Conservation Act of 2009. This law is the water conservation component to the historic Delta legislative package, and seeks to achieve a 20 percent statewide reduction in urban per capita water use in California by December 31, 2020. According to CWC Section 10608.36, wholesale agencies are required to include in their UWMPs an assessment of present and proposed future measures, programs, and policies that would help achieve the water use reductions required under SB X7-7. Urban wholesale water suppliers are not required to comply with the target-setting and reporting requirements of SB X7-7.

As a wholesale water agency, Metropolitan is not required to establish or report on an urban water use reduction target. However, Metropolitan's regional conservation programs and local resource programs are designed to assist member agencies and retail water suppliers in the service area to comply with SB X7-7. Therefore, Metropolitan monitors the progress of its service area. Also, in compliance with SB X7-7, Metropolitan assesses its actions, programs, and policies to help achieve the water use reductions required by SB X7-7.

Based on an analysis of population, demand, and the methodologies for setting targets described in the legislation, Metropolitan's baseline per capita water use is 182 GPCD, and the 2020 reduction target is 146 GPCD. From 2011 to 2014, there was a slight increase in per capita water use explained in part by continued economic recovery and drier weather as compared to previous years. With mandatory restrictions from the state and implementation of Metropolitan's Water Supply Allocation Plan, Metropolitan's 2015 UWMP reported an interim water use reduction achievement of 131 gallons per capita per day (GPCD), which is a 28 percent reduction from the baseline. Over the last five years, Metropolitan continued to provide support for retail agency water use reduction efforts through technical assistance, legislation, code and standards updates, and financial incentives where needed to increase water use efficiency. Based on best available data as of January 2021, Metropolitan estimates a 2019 per capita water use of 121 GCPD, well exceeding Metropolitan's 2020 water use target of 146 GPCD with a 34 percent reduction from the baseline.

Supply Capabilities

The 2020 UWMP reports on Metropolitan's water reliability and identifies projected supplies to meet the long-term demand within its service area. For the 2020 UWMP reliability assessments, Metropolitan's supply capabilities are evaluated using the following assumptions for its imported supplies:

Colorado River Supplies

Colorado River supplies include Metropolitan's basic Colorado River apportionment, along with supplies that result from existing and committed programs, including those from the IID-MWD Conservation Program, the implementation of the Quantification Settlement Agreement (QSA) and related agreements, and the exchange agreement with SDCWA. The QSA established the baseline water use for each of the agreement parties and facilitates the transfer of water from agricultural agencies to urban uses. Since the QSA, additional programs have been implemented to increase Metropolitan's supplies. These include the PVID Land Management, Crop Rotation, and Water Supply Program, as well as the Lower Colorado River Water Supply Project. The 2007 Interim Guidelines provided for the coordinated operation of Lake Powell and Lake Mead, as well as the Intentionally Created Surplus (ICS) program that allows Metropolitan to store water in Lake Mead. These stored supplies can be used to supply additional water to ensure that, when needed, Metropolitan can deliver up to Metropolitan's Colorado River Aqueduct (CRA) capacity of 1.25 MAF.

In light of declining reservoir levels, the Lower Basin Drought Contingency Plan (DCP) was signed in 2019. This agreement incentivizes storage in Lake Mead and requires certain volumes of water be stored in Lake Mead under certain Lake Mead elevation levels through 2026. Metropolitan is to store certain volumes of water in Lake Mead as DCP ICS once Lake Mead is below elevation 1,045 feet. This agreement also increases Metropolitan's flexibility to take delivery of water stored as ICS at Lake Mead elevations below 1,075 feet. The goal of this agreement is to keep Lake Mead above critical elevations, and overall, it increases Metropolitan's flexibility to store water in Lake Mead in greater volumes and to take delivery of stored water to fill the CRA as needed.

Projections for Colorado River supplies for the 2020 UWMP are based on the United States Bureau of Reclamation's (USBR) Colorado River Simulation System (CRSS) modeling developed in January 2021, which is the latest available at the time of production of this plan. USBR modeling is used to estimate Metropolitan's basic apportionment and the availability of QSA and other related programs.

State Water Project Supplies

State Water Project (SWP) supplies are estimated using the 2019 SWP Delivery Capability Report distributed by the California Department of Water Resources (DWR) in August 2020. The 2019 Delivery Capability Report presents the current DWR estimate of the amount of water deliveries for current (2020) conditions and conditions 20 years in the future under DWR's set of stated assumptions. These estimates incorporate restrictions on SWP and Central Valley Project (CVP) operations in accordance with water quality objectives established by the State Water Resources Control Board, the biological opinions of the U.S. Fish and Wildlife Service and National Marine Fisheries Service issued on October 21, 2019, and the Incidental Take Permit issued by the California Department of Fish and Wildlife on March 31, 2020. In addition, these estimates incorporate amendments to the Coordinated Operations Agreement between the Central

Valley Project and the State Water Project made in 2018. Under the 2019 Delivery Capability Report, the delivery estimates for the SWP for 2019 conditions as percentage of Table A amounts are 7 percent, equivalent to 134 TAF for Metropolitan, under a single dry-year (1977) condition and 58 percent, equivalent to 1.1 MAF for Metropolitan, under the long-term average condition.

In dry, below-normal conditions, Metropolitan has increased the supplies received from the California Aqueduct by developing flexible Central Valley/SWP storage and transfer programs. Over the years, under the pumping restrictions of the SWP, Metropolitan has collaborated with the other contractors to develop numerous voluntary Central Valley/SWP storage and transfer programs. The goal of these storage/transfer programs is to develop additional dry-year supplies that can be conveyed through the California Aqueduct during dry hydrologic conditions and regulatory restrictions.

Storage

A key component of Metropolitan's water supply capability is the amount of water in Metropolitan's storage facilities. Storage is a major component of Metropolitan's dry-year and emergency resource management strategy. Metropolitan's likelihood of having adequate supply capability to meet projected demands, without implementing the Water Supply Allocation Plan (WSAP), depends on its storage resources. Metropolitan's WSCP also underscores the importance of storage as it is identified as one of potential shortage response actions at various water shortage levels.

In developing the supply capabilities for the 2020 UWMP, Metropolitan assumed the current (2020) storage levels at the start of simulation and used the median storage levels going into each of the five-year increments based on the balances of supplies and demands. Under the median storage condition, there is an estimated 50 percent probability that storage levels would be higher than the assumption used, and a 50 percent probability that storage levels would be lower than the assumption used. All storage capability figures shown in the 2020 UWMP reflect actual storage program conveyance constraints. It is important to note that under some conditions, Metropolitan may choose to implement the WSAP in order to preserve storage reserves for a future year, instead of using the full supply capability. This can result in impacts at the retail level even under conditions where there may be adequate supply capabilities to meet demands.

Findings of the 2020 Urban Water Management Plan

The 2020 UWMP provides an assessment and summary of Metropolitan's water service reliability outlook through 2045 under the assumptions and cited sources of information described above. As a reporting document, the UWMP will be updated every five years to reflect changes in water demand and supply projections.

The 2020 UWMP satisfies all the content and process requirements mandated by the Act, including the required collaboration for its planning initiatives and report preparation. It should be noted that Metropolitan's primary planning venue is its IRP and that the scenario planning approach within its 2020 IRP is intended to extend Metropolitan's planning beyond single scenario outcomes like that shown within this UWMP. The key findings of Metropolitan's 2020 UWMP are as follows:

Water Service Reliability and Projected Water Supplies

- Metropolitan has completed its water service reliability assessment, under the stated UWMP assumptions and conditions required by the Act, and determined that it has supply capabilities sufficient to meet expected demands from 2025 through 2045 under a single dry-year condition and a period of drought lasting five consecutive water years, as presented in Figure ES-1, as well as in a normal water year hydrologic condition.

- Metropolitan has evaluated its water shortage risk, under the stated UWMP assumptions and conditions required by the Act, and determined that it has supply capabilities sufficient for a drought period that lasts five consecutive water years based on the driest five-year historic sequence for Metropolitan's water supply. This Drought Risk Assessment was completed starting from the year following when the assessment is conducted (2021 through 2025) and is presented in Figure ES-2.
- Metropolitan has plans for supply implementation and continued development of a diversified resource portfolio including programs in the Colorado River, SWP, Central Valley storage and transfers programs, local resource projects, and in-region storage that enables the region to meet its water supply needs.
- Metropolitan has developed comprehensive plans for stages of actions it would undertake to address frequent and severe periods of droughts; six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage; and a catastrophic interruption in water supplies through its Water Shortage Contingency Plan, Water Surplus and Drought Management Plan (WSDM Plan)[2], and Water Supply Allocation Plan (WSAP)[3].
- Metropolitan continues to invest in measures that will help improve the region's water use efficiency over time.
- Metropolitan continues to plan for emergency and catastrophic scenarios, recently revising an Emergency Storage Objective to manage against potential interruption in water supplies resulting from catastrophic occurrences within the Southern California region, including seismic events along the San Andreas fault, and Seismic Risk Assessment and Mitigation Plan to assess the vulnerability of Metropolitan's water system and mitigate those vulnerabilities. In addition, Metropolitan is working with the State on the Delta Risk Management Strategy to reduce the impacts of a seismic event in the Delta that would cause levee failure and disruption of SWP deliveries.
- Metropolitan has and will continue to regard water quality with paramount importance to water supply reliability. Metropolitan owns and operates five water treatment plants, three of which are among the 10 largest in the world. Metropolitan is a national leader in providing safe drinking water that meets increasingly stringent standards, testing for over 400 constituents and performing nearly 200,000 water quality tests annually on samples gathered throughout its distribution system. Metropolitan's Water Quality Laboratory analyzes these samples to ensure that Metropolitan's delivered water meets or surpasses all state and federal drinking water standards. Because treatment to remove specific contaminants can be more costly than measures to protect water at the source, Metropolitan also actively supports improved watershed protection programs for its source waters in the Colorado River and State Water Project.

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[2] The WSDM plan is a coordinated plan used to direct Metropolitan's resource operations to help attain the region's reliability goal recognizing the interdependence of surplus and shortage actions. The WSCP is consistent with the WSDM Plan. See Attachment A in Appendix 4.

[3] The WSAP is intended as an equitable approach for encouraging water use efficiency and minimizing regional impacts in times of shortage consistent with the principles and considerations approved by the Board through the WSDM Plan. See Attachment B in Appendix 4.

Challenges Ahead and Strategies for Managing Reliability Risks

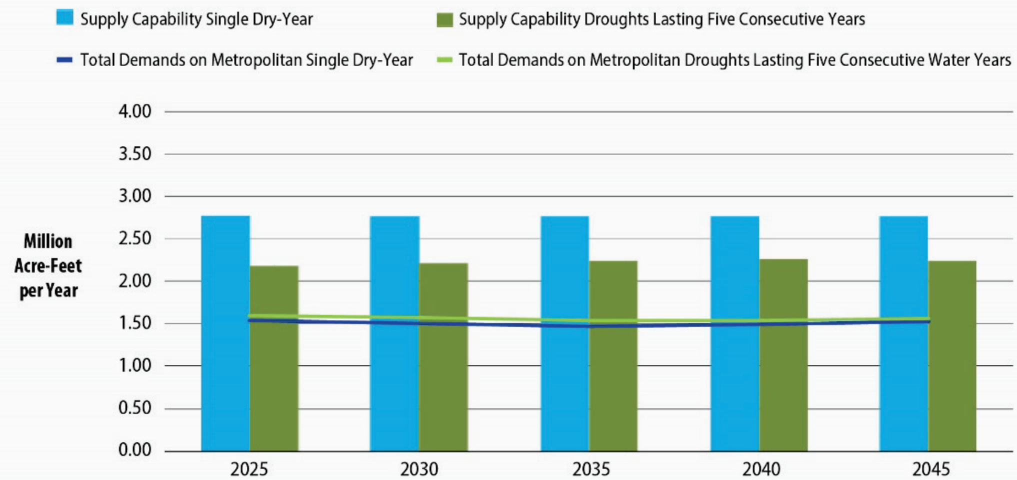
- Metropolitan faces a number of challenges in providing adequate, reliable, and high-quality supplemental water supplies for southern California: The Colorado River Basin has historically experienced large swings in annual hydrologic conditions; however, these swings have largely been buffered through a large volume of storage.
- Dramatic swings in annual hydrologic conditions have impacted water supplies available from the State Water Project (SWP) over the last decade. Metropolitan's efforts in building dry-year storage reserves, water banking and transfers have helped manage the wide swings in SWP allocations.
- With approximately 30 percent of Southern California's water supply transported across the Bay-Delta, its declining ecosystem has led to reduction in water supply deliveries. Operational constraints will likely continue until a long-term solution to the problems in the Bay-Delta is identified and implemented.
- Approximately half of the region's water supplies come from resources controlled or operated by local water agencies. These resources include water extracted from local groundwater basins, catchment of local surface water, non-Metropolitan imported water supplied through the Los Angeles Aqueduct, and Colorado River water exchanged for Metropolitan supplies.
- Water quality challenges, such as algae toxins, per- and polyfluoroalkyl substances (PFAS), and the identification of constituents of emerging concern, have a significant impact on the region's water supply conditions and underscore the importance of flexible and adaptive regional planning strategies.

Metropolitan continues to address these water supply challenges through a variety of actions that will maintain water reliability within its service area. Metropolitan's proactive measures include:

- **Continuing water conservation** by expanding outreach, adding devices, and increasing incentives to residents,
- **Increasing local resources** by providing incentives for on-site recycled water hook-up and the Local Resources Program (LRP),
- **Augmenting water supplies** through water transfers and exchanges,
- **Improving return capability of storage programs** to effectively take delivery of water when needed,
- **Maintaining dry year and emergency storage for the region** to remain reliable during periods of low supply and emergencies,
- **Modifying Metropolitan's distribution system** to enhance operational flexibility and efficient delivery of Colorado River, State Water Project, and in-region supplies within Metropolitan's service area,
- **Implementing shortage response actions** under the Water Shortage Contingency Plan and elements of the Water Surplus and Drought Management Plan and Water Supply Allocation Plan to distribute the limited imported supplies and preserve storage reserves, and
- **Responding to water quality concerns** by protecting the quality of the source water, developing water management programs that maintain and enhance water quality, and changing water treatment protocols or blending.

Sections 1.4 and 2.6 offer detailed discussions and additional insight on Metropolitan's current challenges, current available resources, short-term supply outlook, other supply reliability risks, and recent and near-term actions to meet these challenges.

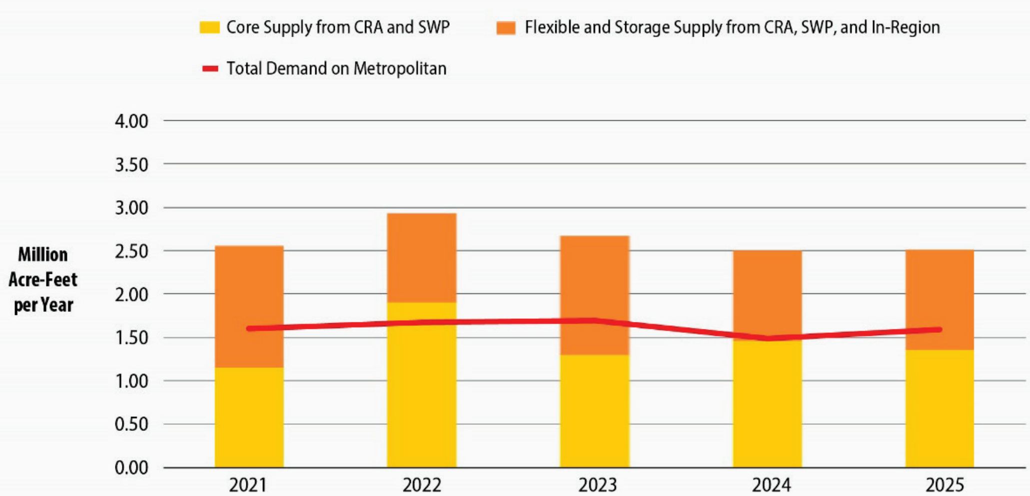
Figure ES -1 Supply Capabilities under Single Dry-Year and Droughts Lasting Five Consecutive Years



Notes:

1. Supply capabilities are derived using the simulated median storage level going into each of five-year increments based on the balances of supplies and demands. Under the median storage condition, there is an estimated 50 percent probability that storage levels would be higher than the assumption used, and a 50 percent probability that storage levels would be lower than the assumption used.
2. Under some conditions, Metropolitan may choose to implement the WSAP in order to preserve storage reserves for a future year, instead of using the full supply capability. This can result in impacts at the retail level even under conditions where there may be adequate supply capabilities to meet firm demands.
3. All storage capability figures shown in the 2020 UWMP reflect actual storage program conveyance constraints.
4. Total demands on Metropolitan illustrated in the figure includes delivery obligations associated with Exchange with SDCWA.

Figure ES -2 Drought Risk Assessment for 2021-2025



Notes:

1. Drought risk assessment for 2021-2025 is based on historic 1988 to 1992 conditions (driest five consecutive year historic sequence for Metropolitan's water supply) .
2. Shortfall from core supplies may be met through supply augmentation actions by exercising Metropolitan's flexible supplies and storage from CRA, SWP, and In-Region.
3. As of January 2021, Metropolitan has 3.2 MAF of dry-years supplies that may be utilized to meet sfortfall from core supplies.
4. Metropolitan may also implement demand reduction and operational flexibility as part of its shortage response actions, if needed.
5. Total Demand on Metropolitan illustrated in the figure includes delivery obligations associated with Exchange with SDCWA.

Introduction 1

1.1 Introduction to this Document and the Agency

Organization of this Document

Metropolitan's 2020 Urban Water Management Plan (UWMP) was prepared in compliance with California Water Code (CWC) Sections 10610 through 10657 of the Urban Water Management Planning Act (Act), which were added by Statute 1983, Chapter 1009 and became effective on January 1, 1984, and Section 10608.36 of SB X7-7, which was enacted in 2009. In addition to complying with the Act, this report details Metropolitan's current situation and how it will meet the challenges of the future.

This document contains five sections. The first section is the Introduction that defines Metropolitan in terms of governance, structure, and current water supply status. This section also briefly outlines how Metropolitan will meet current and future challenges. The second section describes Metropolitan's planning activities and explains how the agency will manage the region's water resources to ensure a reliable water supply for the region. The third section describes the actions Metropolitan has taken to implement the plans outlined in Section 2 and lists future programs and activities. The fourth section addresses the issue of water quality and steps taken to deliver high-quality water to Metropolitan's service area. The fifth section details the public outreach component integrated with Metropolitan's planning processes. In addition, this document includes Appendices that contain supporting documents on the required and voluntary reporting elements. The sections are further described in detail below:

Section 1 - Introduction

In addition to demonstrating how this report complies with the Act, the 2020 UWMP details Metropolitan's current situation and outlines its plan for meeting the challenges of the future. The Introduction section includes:

- Discussion of the Act and Metropolitan's reporting responsibilities under the Act;
- Introduction to Metropolitan and description of its formation, purpose, service area, current and projected land uses, member agencies, and governance;
- Historical, economic, and demographic information on Metropolitan's service area;
- Discussion of Metropolitan's current condition, challenges, and resource planning strategies; and
- Evaluation of Metropolitan's supply capabilities during a drought lasting five consecutive water years.

Section 2 - Planning for the Future

The Planning for the Future section discusses how Metropolitan plans to meet Southern California's water needs in the future. The section highlights the importance of Integrated Water Resources Planning (IRP) by summarizing Metropolitan's planning processes over the years and emphasizes the need for Metropolitan to implement adaptive and multiple scenario planning strategies that will prepare the region to deal with uncertainties. This section also includes:

- Evaluation of regional water demand under a normal water year, single dry-year, and droughts lasting at least five years, for years 2025 through 2045;
- Evaluation of supply capabilities under a normal water year, single dry-year, and droughts lasting at least five consecutive water years, for years 2025 through 2045;
- Evaluation of frequent and severe periods of droughts, as described in the Drought Risk Assessment for years 2021 through 2025;
- Preparation and adoption of Water Shortage Contingency Plan (WSCP), including a discussion of Metropolitan's Emergency Storage Objective and Seismic Risk Assessment and Mitigation Plan;
- Discussion of other supply reliability risks including climate change; and
- Discussion of the different elements of Metropolitan's rate structure and revenue management.

Section 3 – Implementing the Plan

The Implementing the Plan section summarizes Metropolitan's progress in developing a diversified resource mix that enables the region to meet its water supply needs. The investments that Metropolitan has made and its continuing efforts in many different areas coalesce toward its goal of long-term supply reliability for the region. This section includes:

- Discussion of resources and program development for the Colorado River, SWP, Central Valley/SWP storage and transfers programs, conservation, local resources program (groundwater recovery, recycling, desalination), and groundwater; and
- Discussion of Metropolitan's measures, programs, and policies to help achieve the SB X7-7 goal of 20 percent water use reduction by 2020 and the region's progress in meeting this target.

Section 4 - Water Quality

The Water Quality section identifies key regional water quality issues and discusses the protection of the quality of source water and development of water management programs that maintain and enhance water quality. This section also includes:

- Discussion of water quality issues of concern, constituents of emerging concern, and water quality programs that Metropolitan has undertaken to protect its water supplies.

Section 5 – Coordination and Public Outreach

The Coordination and Public Outreach section presents the processes undertaken in the development of the 2020 IRP, 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP with the public and other stakeholders. It provides a list of all meetings and workshops conducted to promote and achieve consensus and collaborative planning. Included in this section are the public notification letters and announcements distributed by Metropolitan as required by the Act and copies of the Metropolitan resolutions adopting and approving the 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP for submittal to DWR.

Appendices

The appendices provide detailed background on the information presented in the 2020 UWMP.

Appendix 1 - Demand Forecast

Appendix 2 - Existing Regional Water Supplies

Appendix 3 - Justifications for Supply Projections

Appendix 4 - Water Shortage Contingency Plan

Appendix 5 - Local Projects

Appendix 6 - Conservation Estimates and Water Savings from Codes, Standards, and Ordinances

Appendix 7 - Distribution System Water Losses

Appendix 8 - Emergency Storage Objective

Appendix 9 - Seismic Risk Assessment and Mitigation Plan

Appendix 10 - Metropolitan's Energy Intensity Calculations, Including Conveyance and Distribution Generation

Appendix 11 - Quantifying Regional Self-Reliance and Reduced Reliance on Water Supplies from the Delta Watershed

Appendix 12 - DWR 2020 UWMP Submittal Tables

Urban Water Management Planning Act

This report has been prepared in compliance with Water Code Sections 10610 through 10657 of the Urban Water Management Planning Act (Act). This Act requires that "*every urban water supplier shall prepare and adopt an urban water management plan*" (Water Code § 10620(a)). An "urban water supplier" is defined as a supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually (Water Code § 10617). These plans must be filed with the California Department of Water Resources (DWR) every five years. Recent amendments to the Act changed the Water Code to require each urban supplier to update and submit its 2020 UWMP by July 1, 2021 and changed the update and submittal dates for subsequent UWMPs to July 1 in years ending in 6 and 1.

Changes in the Act since 2015

There have been numerous changes made and new requirements added to the Act since the 2015 UWMP. Set forth below is a general overview of the key current and new requirements for urban wholesale suppliers. Detailed descriptions of these existing and new requirements are provided in the various sections of this 2020 UWMP.

- Detailed evaluation of the supplies necessary to meet demands over at least a 20-year period, in five-year increments, under a normal water year, single dry-year, and droughts lasting at least five consecutive water years;
- Instead of a water shortage contingency analysis, suppliers must adopt a water shortage contingency plan which includes 10 prescribed elements, such as the procedures used to conduct an annual water supply and demand assessment; six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage; and shortage response actions that align with the defined shortage levels;
- Drought risk assessment which includes: (i) the data, methodology, and basis for one or more supply shortage conditions necessary to conduct a drought risk assessment for a 5-year

drought; (ii) a determination of the reliability of each supply source under a variety of water shortage conditions; (iii) a comparison of total available water supply sources to total projected water use for the drought period; and (iv) a consideration of historical drought hydrology, projected supplies and demands under climate change conditions, and anticipated regulatory changes;

- Water use projections, where available, must display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans;
- Simple lay description of information necessary to provide a general understanding of the UWMP;
- Description of supplier's service area must include current and projected land uses affecting supplier's water management planning;
- Seismic risk assessment and mitigation plan;
- Compliance with the Act is required in order for a supplier to be eligible for a water grant or loan;
- Energy information that a supplier can readily obtain; and
- Evaluation of reasonable and practical efficient water uses, recycling, and conservation activities.

Senate Bill 7 of the Seventh Extraordinary Session of 2009, Water Conservation in the Delta Legislative Package

In addition to changes to the Act, the state Legislature passed Senate Bill 7 as part of the Seventh Extraordinary Session, referred to as SB X7-7, on November 10, 2009, which became effective February 3, 2010. This law was the water conservation component to the historic Delta legislative package and seeks to achieve a 20 percent statewide reduction in urban per capita water use in California by December 31, 2020. This implements the Governor's similar 2008 water use reduction goals. The law requires each urban retail water supplier to develop urban water use targets to help meet the 20 percent goal by 2020, and an interim urban water reduction target by 2015.

The bill states that the legislative intent is to require all water suppliers to increase the efficiency of use of water resources and to establish a framework to meet the state targets for urban water conservation called for by the Governor. The bill establishes methods for urban retail water suppliers to determine targets to help achieve increased water use efficiency by the year 2020. The law is intended to promote urban water conservation standards consistent with the California Urban Water Conservation Council's adopted best management practices.

Urban wholesale water suppliers are not required to perform all of the target-setting and reporting requirements of SB X7-7. However, wholesale agencies must include in their UWMPs an assessment of present and proposed future measures, programs, and policies that would help achieve the water use reductions required under this law (Water Code § 10608.36).

Sections 3.4, 3.5, and 3.7 of this plan address actions Metropolitan took to help urban retail water suppliers to achieve the urban per capita water use reduction pursuant to the goals set forth in SB X7-7.

Metropolitan's Compliance with the Urban Water Management Planning Act

As with Metropolitan's previous plans, this Plan does not explicitly discuss specific activities undertaken by member agencies unless they relate to one of Metropolitan's water demand or supply management programs. Presumably, each member agency will discuss these activities in its Urban Water Management Plan, but elements of this Plan do not necessarily have to be adopted by the urban water suppliers or the public agencies directly providing retail water.

DWR Guidance

In April 2021, DWR issued the final 2020 UWMP Guidebook for urban water suppliers (DWR Guidebook). The 2020 DWR Guidebook was updated from the 2015 version to reflect new legislation. As part of the Guidebook, DWR updated the Standardized Submittal Tables for the reporting and submittal of UWMP data to DWR. As mentioned above, water suppliers are required to use these Standardized Submittal Tables for electronic submittal of their UWMPs to DWR to satisfy the legislative requirement (Water Code § 10644(a)(2)). For the 2020 UWMP, Metropolitan electronically submitted the Standardized Submittal Tables to DWR through its Water Use Efficiency portal. In addition, Metropolitan included the Standardized Submittal Tables in this plan as Appendix 12.

The 2020 DWR Guidebook includes a voluntary checklist to show reporting of required elements to assist DWR with its review of the submitted UWMP. Included in the beginning of this 2020 UWMP is a compliance checklist, organized by Water Code section, which summarizes Metropolitan's response to the requirements of the Water Code and indicates where each required element can be found in the Plan.

1.2 The Metropolitan Water District of Southern California

Formation and Purpose

The Metropolitan Water District of Southern California (Metropolitan) is a public agency organized in 1928 by a vote of the electorates of 13 Southern California cities. The agency was enabled by the adoption of the original Metropolitan Water District Act (MWD Act) by the California Legislature "for the purpose of developing, storing and distributing water for domestic purposes." The MWD Act also allows Metropolitan to sell "surplus water not needed or required for domestic or municipal uses within the district for beneficial purposes." In 1992, the Metropolitan Board of Directors adopted the following mission statement:

> *"To provide its service area with adequate and reliable supplies of high quality water to meet present and future needs in an environmentally and economically responsible way."*

The first function of Metropolitan was building the Colorado River Aqueduct (CRA) to convey water from the Colorado River. Deliveries through the aqueduct to member agencies began in 1941 and supplemented the local water supplies of the Southern California member cities. In 1960, to meet growing water demands in its service area, Metropolitan contracted for participation in the State Water Project (SWP), which is owned and operated by DWR and would deliver additional water supplies via the California Aqueduct. SWP deliveries began in 1972. Metropolitan currently receives imported water from both of these sources: (1) Colorado River water via the CRA, and (2) the SWP via the California Aqueduct.

Service Area

Metropolitan's service area covers the Southern California coastal plain. It extends about 200 miles along the Pacific Ocean from the city of Oxnard on the north to the international boundary with Mexico on the south, and it reaches as far as 70 miles inland from the coast (Figure 1-1). The total area served is approximately 5,200 square miles, and it includes portions of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties. Table 1-1 shows that although only 14 percent of the land area of the six Southern California counties is within Metropolitan's service area, approximately 86 percent of the populations of those counties reside within Metropolitan's boundaries.

Member Agencies

Metropolitan is currently composed of 26 voluntary member agencies, including 14 cities, 11 municipal water districts, and one county water authority. Metropolitan is a water wholesaler with no retail customers. It provides treated and untreated water directly to its member agencies.

Metropolitan's 26 member agencies deliver to their customers a combination of local groundwater, local surface water, recycled water, and imported water purchased from or exchanged with Metropolitan. For some member agencies, Metropolitan supplies most of the water used within that agency's service area, while others obtain varying amounts of water from Metropolitan to supplement local supplies. Between 2011 and 2020, Metropolitan has provided between 40 and 50 percent of the municipal, industrial, and agricultural water used in its service area. The remaining water supply comes from local wells, local surface water, recycling, and the city of Los Angeles' aqueducts from the Owens Valley/Mono Basin east of the Sierra Nevada. Member agencies also implement conservation and other programs that can be considered part of their supplies.

Some member agencies provide retail water service, while others provide water to the local area as wholesalers. Table 1-2 shows Metropolitan's member agencies and the type of service that they provide. As shown in the table, 15 member agencies provide retail service to customers, 9 provide only wholesale service, and 2 provide a combination of both. Throughout Metropolitan's service area, approximately 250 retail water suppliers directly serve the population.

Metropolitan's member agencies serve residents in 152 cities and 89 unincorporated communities. Table 1-3 shows the member agencies of Metropolitan, as well as the cities and communities served by those member agencies. Figure 1-1 also shows the geographical area served by the member agencies.

Currently, member agencies receive water from Metropolitan at various delivery points, and pay for service through a rate structure made up of multiple components. The majority of these components consist of uniform volumetric rates, and the majority of the revenue is collected through these volumetric rates. Metropolitan's pricing and rate structure are described in detail in Section 2.7.

To aid in planning future water needs, member agencies advise Metropolitan in July of each year of how much water they anticipate they will need during the next five years. In addition, Metropolitan works with its member agencies to forecast future water demands.

Table 1-1
July 1, 2020 Area and Population in the
Six Counties of Metropolitan's Service Area

County	Total County	In Metropolitan Service Area	Percent in Metropolitan
Land Area (Square Miles)			
Los Angeles County	4,061	1,408	35%
Orange County	789	699	89%
Riverside County	7,208	1,057	15%
San Bernardino County	20,052	242	1%
San Diego County	4,200	1,420	34%
Ventura County	1,845	365	20%
Metropolitan's Service Area	**38,155**	**5,191**	**14%**
Population (Persons)			
Los Angeles County	10,172,000	9,275,000	91%
Orange County	3,191,000	3,184,000	100%
Riverside County	2,449,000	1,813,000	74%
San Bernardino County	2,184,000	872,000	40%
San Diego County	3,352,000	3,261,000	97%
Ventura County	841,000	630,000	75%
Metropolitan's Service Area	**22,189,000**	**19,035,000**	**86%**

Source: State of California, Department of Finance, E-2. California County Population Estimates and Components of Change by Year, July 1, 2010-2020. Sacramento, California, December 2020.

Table 1-2
Metropolitan's Member Agencies and Type of Water Service Provided

Member Agency	Retail or Wholesale
Los Angeles County	
Beverly Hills, City of	Retail
Burbank, City of	Retail
Central Basin Municipal Water District	Wholesale
Compton, City of	Retail
Foothill Municipal Water District	Wholesale
Glendale, City of	Retail
Las Virgenes Municipal Water District	Retail
Long Beach, City of	Retail
Los Angeles, City of	Retail
Pasadena, City of	Retail
San Fernando, City of	Retail
San Marino, City of	Retail
Santa Monica, City of	Retail
Three Valleys Municipal Water District	Wholesale
Torrance, City of	Retail
Upper San Gabriel Valley Municipal Water District	Wholesale
West Basin Municipal Water District	Wholesale
Orange County	
Anaheim, City of	Retail
Fullerton, City of	Retail
Municipal Water District of Orange County	Wholesale
Santa Ana, City of	Retail
Riverside County	
Eastern Municipal Water District	Retail & Wholesale
Western Municipal Water District	Retail & Wholesale
San Bernardino County	
Inland Empire Utilities Agency	Wholesale
San Diego County	
San Diego County Water Authority	Wholesale
Ventura County	
Calleguas Municipal Water District	Wholesale

Table 1-3
Member Agencies

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA					
Municipal Water Districts (11)		**Member Cities (14)**			**County Water Authorities (1)**
Calleguas	Las Virgenes	Anaheim	Glendale	San Marino	San Diego
Central Basin	Orange County	Beverly Hills	Long Beach	Santa Ana	
Foothill	Three Valleys	Burbank	Los Angeles	Santa Monica	
Inland Empire	Upper San Gabriel Valley	Compton	Pasadena	Torrance	
Eastern	West Basin	Fullerton	San Fernando		
	Western				

Calleguas MWD
- *Camarillo*
- *Camarillo Heights*
- *Fairview*
- *Lake Sherwood Valley*
- *Las Posas*
- *Moorpark*
- *NAWS Point Mugu*
- *NCBC Port Hueneme*
- *Oak Park*
- *Oxnard*
- *Port Hueneme*
- *Santa Rosa Valley*
- *Simi Valley*
- *Somis*
- *Thousand Oaks*

Central Basin MWD
- *Artesia*
- *Bell*
- *Bellflower*
- *Bell Gardens*
- *Cerritos*
- *Commerce*
- *Cudahy*
- *Downey*
- *East Los Angeles*
- *Florence*
- *Hawaiian Gardens*
- *Huntington Park*
- *La Habra Heights*
- *Lakewood*
- *La Mirada*
- *Lynwood*
- *Maywood*
- *Montebello*
- *Norwalk*
- *Paramount*
- *Pico Rivera*
- *Santa Fe Springs*
- *Signal Hill*
- *South Gate*
- *South Whittier*
- *Vernon*
- *Whittier*

Foothill MWD
- *Altadena*
- *La Cañada Flintridge*
- *La Crescenta*
- *Montrose*

Inland Empire
- *Chino*
- *Chino Hills*
- *Fontana*
- *Montclair*
- *Ontario*
- *Rancho Cucamonga*
- *Upland*

Eastern MWD
- *Good Hope*
- *Hemet*
- *Homeland*
- *Juniper Flats*
- *Lakeview*
- *Mead Valley*
- *Menifee*
- *Moreno Valley*
- *Murrieta*
- *Murrieta Hot Springs*
- *Nuevo*
- *North Canyon Lake*
- *Perris*
- *Quail Valley*
- *Romoland*
- *San Jacinto*
- *Sun City*
- *Temecula*
- *Valle Vista*
- *Winchester*

Las Virgenes MWD
- *Agoura*
- *Agoura Hills*
- *Calabasas*
- *Chatsworth*
- *Hidden Hills*
- *Lake Manor*
- *Malibu Lake*
- *Monte Nido*
- *Westlake Village*
- *West Hills*

MWD of Orange County
- *Aliso Viejo*
- *Brea*
- *Buena Park*
- *Capistrano Beach*
- *Corona Del Mar*
- *Costa Mesa*
- *Coto De Caza*
- *Cypress*
- *Dana Point*
- *Fountain Valley*
- *Garden Grove*
- *Huntington Beach*
- *Irvine*
- *Laguna Beach*
- *Laguna Hills*
- *Laguna Niguel*
- *Laguna Woods*
- *La Habra*
- *Lake Forest*
- *La Palma*
- *Leisure World*
- *Los Alamitos*
- *Mission Viejo*
- *Monarch Beach*
- *Newport Beach*
- *Orange*
- *Placentia*
- *Rancho Santa Margarita*
- *San Clemente*
- *South Laguna*

MWD of Orange County (cont.)
- *San Juan Capistrano*
- *Seal Beach*
- *Stanton*
- *Tustin*
- *Tustin Foothills*
- *Villa Park*
- *Westminster*
- *Yorba Linda*

Three Valleys MWD
- *Azusa*
- *Charter Oak*
- *Claremont*
- *Covina*
- *Covina Knolls*
- *Diamond Bar*
- *Glendora*
- *Industry*
- *La Verne*
- *Pomona*
- *Rowland Heights*
- *San Dimas*
- *So. San Jose Hills*
- *Walnut*
- *West Covina*

Upper San Gabriel Valley MWD
- *Arcadia*
- *Avocado Heights*
- *Baldwin Park*
- *Bradbury*
- *Citrus*
- *Covina*
- *Duarte*
- *El Monte*
- *Glendora*
- *Hacienda Heights*
- *Industry*
- *Irwindale*
- *La Puente*
- *Mayflower Village*
- *Monrovia*
- *Rosemead*
- *San Gabriel*
- *South El Monte*
- *South Pasadena*
- *South San Gabriel*
- *Temple City*
- *Valinda*
- *West Covina*
- *West Puente Valley*

West Basin MWD
- *Alondra Park*
- *Carson*
- *Culver City*
- *El Segundo*
- *Gardena*
- *Hawthorne*
- *Hermosa Beach*
- *Inglewood*
- *Ladera Heights*
- *Lawndale*
- *Lennox*

West Basin MWD (cont.)
- *Lomita*
- *Malibu*
- *Manhattan Beach*
- *Marina Del Rey*
- *Palos Verdes Estates*
- *Rancho Palos Verdes*
- *Redondo Beach*
- *Rolling Hills*
- *Rolling Hills Estates*
- *Ross-Sexton*
- *Topanga Canyon*
- *West Athens*
- *West Hollywood*

***Western MWD of* Riverside County**
- *Bedford Heights*
- *Canyon Lakes*
- *Corona*
- *Eagle Valley*
- *El Sobrante*
- *Jurupa*
- *Lake Elsinore*
- *Lake Mathews*
- *March AFB*
- *Murrieta*
- *Norco*
- *Riverside*
- *Rubidoux*
- *Temecula*
- *Temescal Canyon*
- *Woodcrest*

San Diego CWA
- *Alpine*
- *Bonita*
- *Bonsall*
- *Camp Pendleton*
- *Carlsbad*
- *Casa De Oro*
- *Chula Vista*
- *Del Mar*
- *El Cajon*
- *Encinitas*
- *Escondido*
- *Fallbrook*
- *Lakeside*
- *La Mesa*
- *Lemon Grove*
- *Mount Helix*
- *National City*
- *Oceanside*
- *Pauma Valley*
- *Poway*
- *Rainbow*
- *Ramona*
- *Rancho Santa Fe*
- *San Diego*
- *San Marcos*
- *Santee*
- *Solana Beach*
- *Spring Valley*
- *Valley Center*
- *Vista*

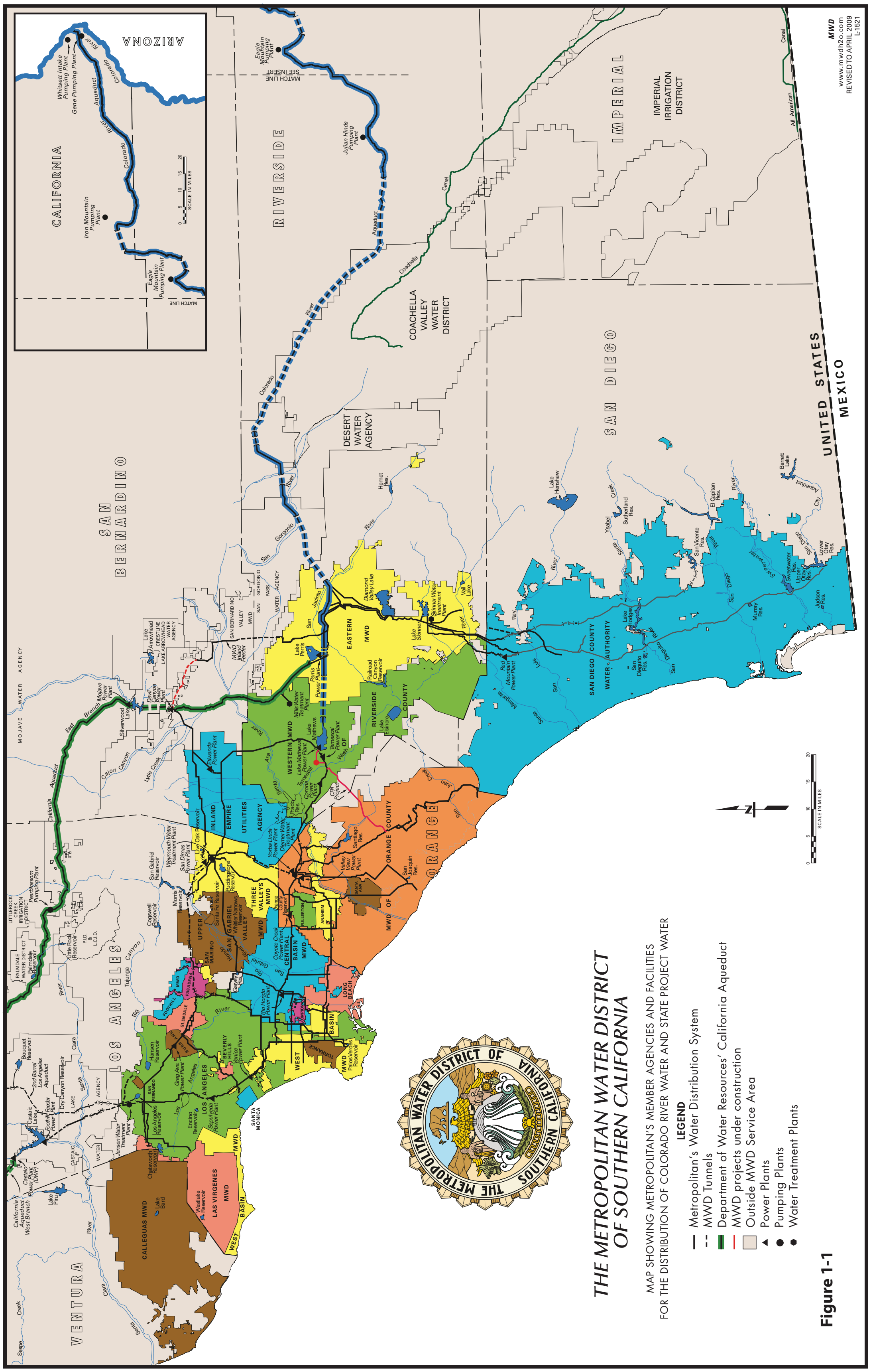

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA
MAP SHOWING METROPOLITAN'S MEMBER AGENCIES AND FACILITIES
FOR THE DISTRIBUTION OF COLORADO RIVER WATER AND STATE PROJECT WATER
LEGEND
Metropolitan's Water Distribution System
MWD Tunnels
Department of Water Resources' California Aqueduct
MWD projects under construction
Outside MWD Service Area
Power Plants
Pumping Plants
Water Treatment Plants
THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
MWD
www.mwdh2o.com
REVISED TO APRIL 2009
L-1521
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
ORANGE
SAN DIEGO
IMPERIAL
CALIFORNIA
ARIZONA
UNITED STATES
MEXICO
COACHELLA VALLEY WATER DISTRICT
DESERT WATER AGENCY
IMPERIAL IRRIGATION DISTRICT
SAN DIEGO COUNTY WATER AUTHORITY
CALLEGUAS MWD
LAS VIRGENES MWD
WEST BASIN MWD
CENTRAL BASIN MWD
THREE VALLEYS MWD
UPPER SAN GABRIEL VALLEY MWD
INLAND EMPIRE UTILITIES AGENCY
WESTERN MWD OF RIVERSIDE COUNTY
EASTERN MWD
MWD OF ORANGE COUNTY
SANTA MONICA
BEVERLY HILLS
LONG BEACH
SCALE IN MILES

Figure 1-1

Board of Directors and Management Team

Metropolitan's Board of Directors currently consists of 38 directors. The Board consists of at least one representative from each member agency, with each agency's assessed valuation determining its additional representation and voting rights. Directors can be appointed by the chief executive officer of the member agency or be elected by a majority vote of the governing body of the agency. Metropolitan does not compensate directors for their service. The Board includes business, professional, and civic leaders. Board meetings are generally held on the second Tuesday of each month and are open to the public.

Throughout its history, the Board has delegated certain tasks to Metropolitan staff, which are codified in Metropolitan's Administrative Code. In addition, Metropolitan has developed policy principles to help achieve its mission to provide adequate and reliable supplies of high-quality water in an environmentally and economically responsible way. These policies can be found in a variety of documents including: specific policy statements, the Administrative Code, Board-adopted policy principles, and letters submitted to the Board. Policy statements are also embedded in formal Board meeting discussions and recorded in meeting minutes. The policies established by the Board are subject to all applicable laws and regulations. The management of Metropolitan is under the direction of its General Manager, who serves at the discretion of the Board, as do Metropolitan's General Auditor, General Counsel, and Ethics Officer.

1.3 Metropolitan Service Area Historical Information

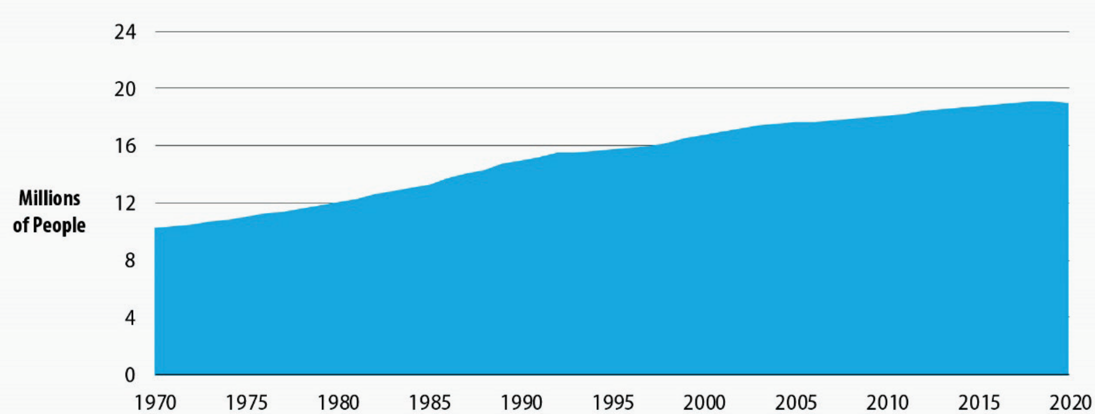
Population

In 1990, the population of Metropolitan's service area was approximately 15.0 million people. By 2020, it had reached an estimated 19.0 million, representing almost half of the state's population. In the past, annual growth has varied from about 200,000 annually in the 1970s and early-to-mid-1980s to more than 300,000 annually in the late 1980s. Population growth slowed due to economic recession during the early 1990s to just over 50,000 in 1995, before again rising to more than 250,000 per year in the period 1999 through 2002. Growth has generally averaged 90,000 persons per year during the last 10 years from 2011-2020. Figure 1-2 shows the service area population growth from 1970 to 2020. From 2019 to 2020, the region experienced net decline in population due to the COVID-19 pandemic.

The most populated cities within Metropolitan's service area are Los Angeles (largest city in the state), San Diego (second largest in the state), Long Beach, Anaheim, Santa Ana, and Riverside. The Department of Finance State Population Report from May 2020 reports biggest numeric increases occurring in the cities of Los Angeles and San Diego, consistent with their larger population base. Figure 1-3 shows the 5-year growth rates for the six counties within Metropolitan's service area. As can be seen from this figure, there has been an overall decrease in population growth rate in the last 5 years. Appendix 1 presents a detailed discussion of the demographic trends in Southern California and their impacts on regional demand forecasts.

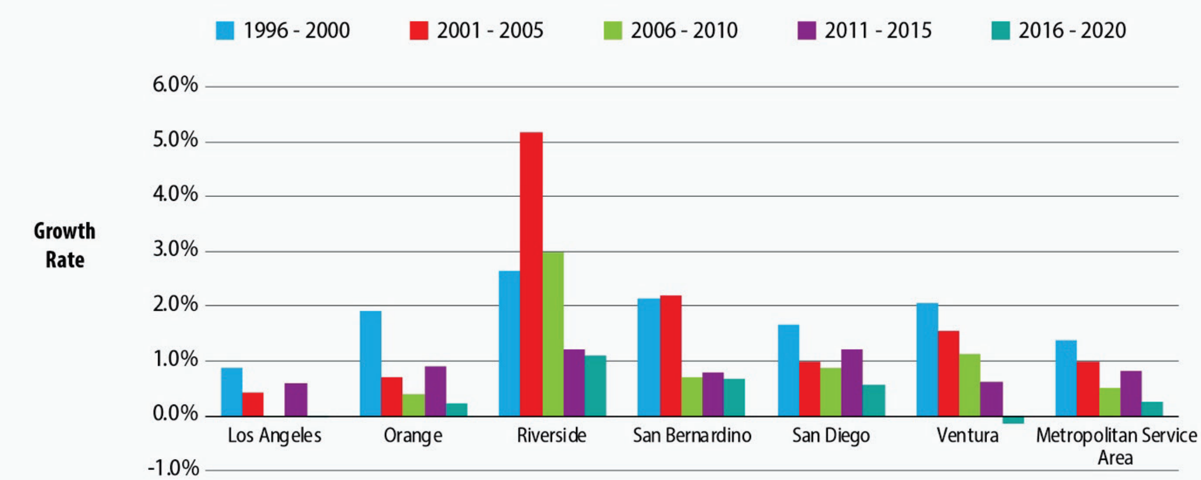
In preparing its demographic and growth forecast, Metropolitan relied on Southern California Association of Government's (SCAG's) 2020 Demographics and Growth Forecast Proposed Final Technical Report to the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). The report includes information on social factors affecting water management such as race, ethnicity, and cultures. As noted in SCAG's report, Southern California is one of the most diverse regions in the nation in race and ethnicity. Race and ethnicity are important for demographers to consider while forecasting since fertility and household formation have strong cultural underpinnings that vary based on these categories.

Figure 1-2 Service Area Population Growth 1970-2020



SOURCE: U.S. Census, California Department of Finance and Metropolitan

Figure 1-3 Average Annual Population Growth Rates in Metropolitan's Service Area



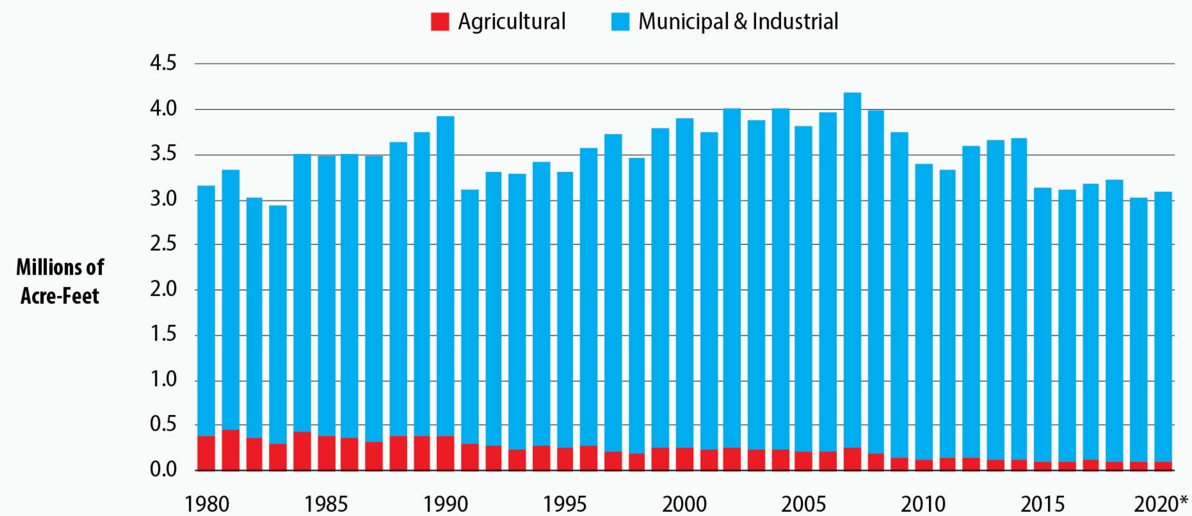
SOURCE: U.S. Census, California Department of Finance and Metropolitan

Historical Retail Water Demands

Figure 1-4 presents historical retail water demands on a calendar year basis in Metropolitan's service area. Since 1980, retail water demands varied from 2.9 million acre-feet (MAF) in 1983 to nearly 4.2 MAF in 2007. Following record demand in 1990 of over 3.9 MAF, due to the economic recession, drought impacts, conservation, and mandatory water use restrictions, demands declined to 3.1 MAF in 1991. Demand remained below the historic peak level as a result of continuing effects from the recession and the drought, coupled with a number of wet years and ongoing conservation efforts. In 2000, retail demands once again reached 3.9 MAF, reaching the early peak level for the first time in a decade. Since 2000, retail demands reached a new peak level in 2007 with nearly 4.2 MAF. Calendar year 2007 was the driest year since 1989, with precipitation measured at 5.66 inches in Downtown Los Angeles. Since the peak retail demand in 2007, a decrease in demand was observed during the economic recession of 2008-2012. Starting in 2012, the severe drought in California led to a massive conservation campaign and water use restriction by the State, Metropolitan, and local water agencies resulting in a decrease in demand in 2015. Demands remain low even after the mandatory restriction was lifted in the spring of 2017.

In 2020, about 96 percent of retail demands were used for municipal and industrial purposes (M&I), and 4 percent for agricultural purposes. The relative share of agricultural water use has declined due to urbanization and market factors, including the price of water. Agricultural water use accounted for 19 percent of total regional water demand in 1970, 12 percent in 1980, 10 percent in 1990, and 4 percent in 2010.

Figure 1-4 Retail Demand in Metropolitan's Service Area



*Data not available. 2020 estimated based on historical data.

Climate and Rainfall

As Figure 1-5 shows, Metropolitan's service area encompasses three major climate zones. Table 1-4 reports the average temperature and rainfall information for representative locations within those three zones for the 30-year period from 1990 to 2019. The evapotranspiration data (expressed as Et_o) are reported for the 30-year period of 1985 to 2014.

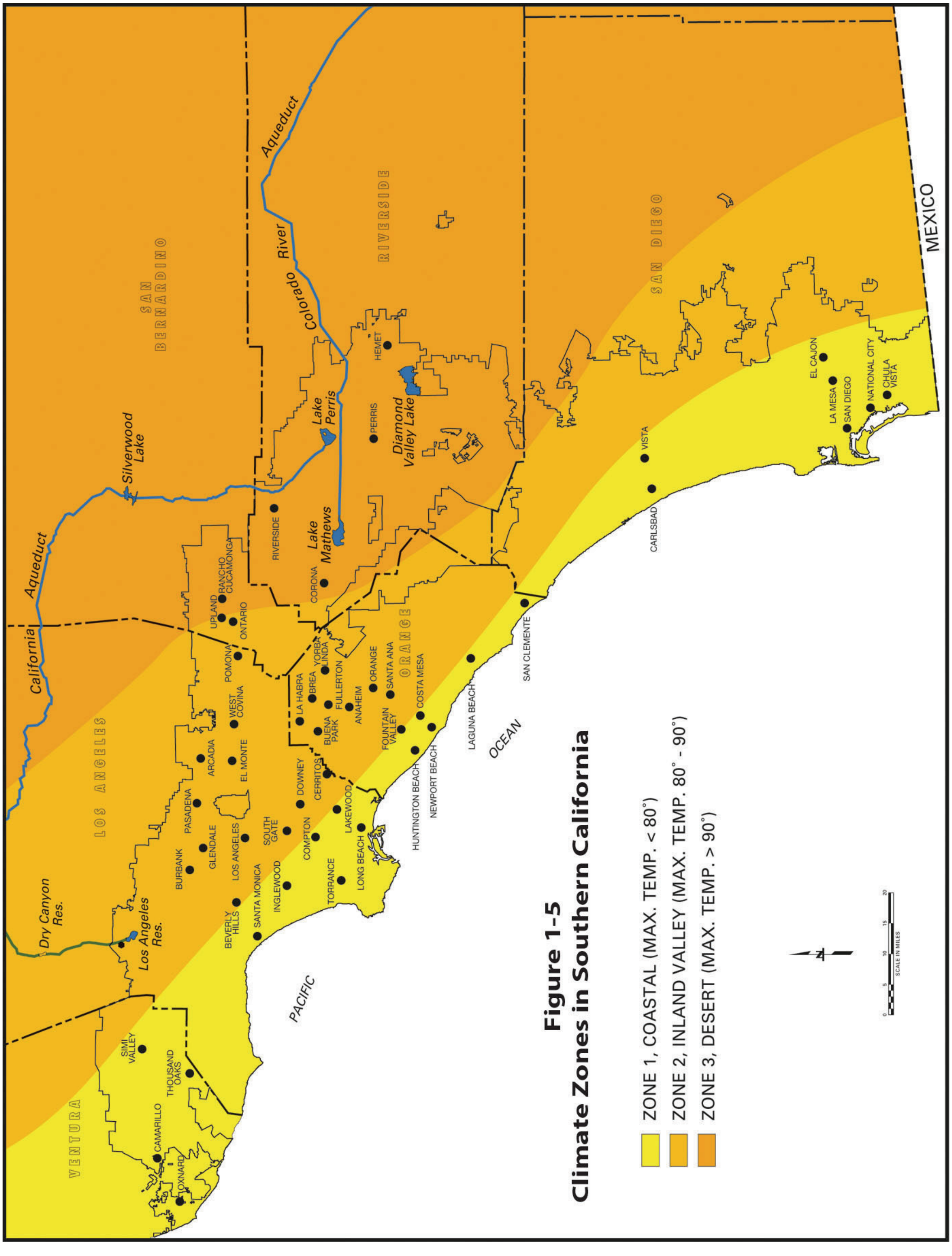


Figure 1-5
Climate Zones in Southern California

Table 1-4 Weather Variables in Three Zones in Metropolitan's Service Area

30-year Average (1990-2019)

Average Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Los Angeles County[1]	68.77	68.54	70.62	73.06	74.34	78.16	82.95	84.61	83.69	79.41	73.77	67.90	75.48
Riverside County[2]	65.89	65.55	66.45	68.22	68.98	71.18	74.87	76.85	76.64	74.04	70.15	65.42	70.35
San Diego County[3]	69.76	70.02	73.61	77.79	80.93	88.06	94.21	95.84	92.65	84.52	76.35	68.83	81.05

30-year Average (1990-2019)

Average Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Los Angeles County[1]	3.32	3.74	2.09	0.61	0.35	0.09	0.02	0.00	0.13	0.58	0.78	2.42	15.20
San Diego[2]	2.05	2.22	1.40	0.55	0.29	0.07	0.08	0.01	0.12	0.49	0.80	1.67	9.85
Riverside[3]	2.01	2.48	1.31	0.52	0.23	0.09	0.13	0.13	0.15	0.47	0.66	1.35	11.16

30-year Average (1985-2014)

Et_o[4]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Los Angeles County	2.2	2.7	3.7	4.7	5.5	5.8	6.2	5.9	5.0	3.9	2.6	1.9	50.1
San Diego	2.5	2.9	4.2	5.3	5.9	6.6	7.2	6.9	5.4	4.1	2.9	2.6	56.4
Riverside	2.1	2.4	3.4	4.6	5.1	5.3	5.7	5.6	4.3	3.6	2.4	2.0	46.5

1. Temperature and precipitation data are from the National Oceanic and Atmospheric Administration, USC Station KCQT. Last updated February 18, 2020.
2. Temperature and precipitation data are from the National Oceanic and Atmospheric Administration, Riverside Station KNOC. February 18, 2020.
3. Temperature and precipitation data are from the National Oceanic and Atmospheric Administration, San Diego Airport Station KSAN. Last updated February 18, 2020.
4. Eto values are from Model Water Efficient Landscape Ordinance, September 10, 2009, Appendix A: Reference Evapotranspiration (Eto) Table.
   Eto values were derived from: 1) California irrigation Management Information System (CIMIS); 2) Reference Evapotranspiration Zone Map, UC Department of Land, Air and Water Resources and California Department of Water Resources 1999; 3) Reference Evapotranspiration for California, UC Department of Resources, 1987, Bulletin 1922; and 4) Determining Daily Reference Evapotranspiration, UC Cooperative Extension, Division of Agriculture and Natural Resources, 1987, Publication Leaflet 21426.

1.4 Current Conditions

Current Challenges

Metropolitan faces a number of challenges in providing adequate, reliable, and high-quality supplemental water supplies for southern California. One of those challenges is widely variable hydrologic conditions that can have a significant impact on Metropolitan's imported water supply sources. This section offers a brief discussion of Metropolitan's current challenges, current available resources, short-term supply outlook, and recent and near-term actions to meet these challenges.

Dramatic swings in annual hydrologic conditions have characterized the past decade on the State Water Project (SWP). 2014 saw the lowest allocation of contract supplies from the SWP up to that point, and 2015 saw the lowest ever Northern Sierra snowpack. Just two years later in 2017, the SWP watershed experienced the highest ever Sacramento River runoff, and the highest SWP allocation since 2006. Wet conditions returned in 2019, helping Metropolitan to build dry-year storage reserves to record high levels. Dry conditions have returned in 2020. The year began with a dry January and the driest February on record. In addition to below average precipitation, the snowpack peaked in April at only 66 percent of the April 1 average measurement. This dry hydrology produced only 52 percent of average runoff for the water year. As a result, Metropolitan only received 20 percent of its contract water supplies in 2020. For calendar year 2021, the SWP allocation decreased from an initial allocation of 10 percent to five percent based on on-going dry conditions. The five percent SWP allocation for Metropolitan in 2014 and 2021 represents the lowest in the history of the SWP.

The Colorado River Basin has also historically experienced large swings in annual hydrologic conditions; however, these swings have largely been buffered through a large volume of storage. In 2020, the Upper Colorado River Basin snowpack peaked in April at 107 percent of average. However, April through July runoff was observed at just 52 percent of average due to hot and dry conditions in the late spring and early summer. This is an example of a potential change in relationship between precipitation and expected runoff. The Colorado River Basin experienced 5 consecutive years of significantly below average runoff starting in 2000, followed by a period of alternating years of above average, near average, and significantly below average runoff through 2020. This 21-year period has been mitigated by actions taken by Metropolitan in cooperation with the Bureau of Reclamation and the other Basin States to maintain system storage, avoiding a shortage declaration. At the close of 2020, however, system storage is at or near its lowest since 2000, so there is less water available to buffer future dry conditions.

Sacramento-San Joaquin River Delta Issues

The Sacramento-San Joaquin River Delta (Bay-Delta) is the hub of California's water supply and is critically important to the entire state. About 30 percent of Southern California's water supply moves across the Bay-Delta. The Bay-Delta's declining ecosystem, caused by a number of factors that include agricultural runoff, predation of native fish species, urban and agricultural discharge, changing ecosystem food supplies, and overall system operation, has led to reduction in water supply deliveries. Operational constraints will likely continue until a long-term solution to the problems in the Bay-Delta is identified and implemented.

<u>Delta Conveyance</u>

In his State of the State address delivered February 12, 2019, Governor Newsom announced that he did not "support WaterFix as currently configured," but does "support a single tunnel." On April 29, 2019, Governor Newsom issued Executive Order N-10-19, directing several agencies to (among other things), "inventory and assess… [c]urrent planning to modernize conveyance through the Bay Delta with a new single tunnel project." The Governor's announcement and Executive Order led to DWR's withdrawal of all approvals and environmental compliance documentation associated with California WaterFix. The CEQA process identified in this notice for the proposed Delta Conveyance Project will, as appropriate, utilize relevant information from the past environmental planning process for California WaterFix, but the proposed project will undergo a new stand-alone environmental analysis leading to issuance of a new EIR.

On January 15, 2020, DWR issued a Notice of Preparation of an Environmental Impact Report for the DCP. The proposed project would construct and operate new conveyance facilities in the Delta that would add to the existing SWP infrastructure. New intake facilities as points of diversion would be located in the north Delta along the Sacramento River between Freeport and the confluence with Sutter Slough. The new conveyance facilities would include a single main tunnel to convey water from the new intakes to the existing Banks Pumping Plant and potentially the federal Jones Pumping Plant 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. The new north Delta facilities would be sized to convey up to 6,000 cfs of water from the Sacramento River to the SWP facilities in the south Delta. DWR would operate the dual conveyance system in compliance with all state and federal regulatory requirements and would not reduce DWR's current ability to meet standards in the Delta to protect biological resources and water quality for beneficial uses.

2019 Biological Opinions

In August 2016, USBR and DWR reinitiated consultation with NMFS and USFWS on the Coordinated Long-term Operations of the CVP and SWP due to new information and science on declining listed fish species populations. On October 21, 2019, USFWS and NMFS released their Biological Opinions, and on February 18, 2020, USBR signed a Record of Decision, pursuant to the National Environmental Policy Act, completing its environmental review and adopting the 2019 Long-Term Operations Plan.

The 2019 Long-Term Operations Plan incorporates and updates many of the requirements contained in the previous 2008 and 2009 Biological Opinions. It also includes over $1 billion over a ten-year period in conservation, monitoring and new science, some of which is in the form of commitments carried forward from the previous 2008/2009 Biological Opinions. Those costs are shared by the SWP and CVP. The 2019 Long-Term Operations Plan and 2019 Biological Opinions are expected to increase SWP deliveries by an annual average of 200,000 acre-feet as compared to the previous Biological Opinions.

California ESA Incidental Take Permit

DWR described and analyzed its proposed SWP long-term operations plan for purposes of obtaining a new California ESA permit in its November 2019 Draft EIR. The 2019 Draft EIR proposed essentially the same operations plan as the federal 2019 Biological Opinions, with the addition of operations for the California ESA-listed Longfin smelt. The proposed project included an estimated $540 million in conservation, monitoring and science, much of which overlapped with DWR's share of the estimated $1 billion under the federal 2019 Biological Opinions. In December 2019, DWR submitted its application for an incidental take permit under the California ESA to the California Department of Fish and Wildlife (CDFW), with a modified State operations plan that added new outflow and environmental commitments. On March 27, 2020, DWR released its final EIR and Notice of Determination, describing and adopting a State operations plan with additional operational restrictions and additional conservation commitments. On March 31, 2020, CDFW issued a California ESA incidental take permit for the SWP that included further operational restrictions and outflow. The final approved project and incidental take permit reduce long-term average SWP deliveries by more than 200 TAF, which more than erased any potential improvement in SWP water supplies that were anticipated to result from the 2019 Biological Opinions. In addition, the approved project and incidental take permit add another estimated $218 million over a ten-year period in environmental commitments for the SWP beyond the SWP's share of the $1 billion required to comply with the 2019 Biological Opinions.

Bay-Delta Water Quality Control Plan Update/Voluntary Agreements

The Bay-Delta Plan is reviewed periodically, and new standards and allocations of responsibility can be imposed on the SWP as a result. The last review was completed in 2006, and the current review has been ongoing since approximately 2010 in a phased approach.

Phase 1 focuses on the southern Delta salinity objectives for the protection of agriculture, San Joaquin River flow objectives for the protection of fish and wildlife, and a program of implementation for achieving those objectives. Phase 2 considers the comprehensive review of the other elements of the Bay-Delta Plan, including but not limited to Sacramento River and Delta outflow objectives.

The SWRCB has also encouraged all stakeholders to work together to reach one or more voluntary agreements for consideration by the SWRCB that could implement the proposed amendments to the Bay-Delta Plan through a variety of tools, while seeking to protect water supply reliability. Metropolitan is participating in the Phase 2 proceedings and voluntary agreement negotiations. In March of 2019, DWR and CDFW put forward a project description and planning agreement that would allow the SWRCB to analyze the environmental impacts and benefits of the voluntary agreement alternative to the percentage of unimpaired flow framework.

In December 2018, the SWRCB adopted the Phase 1 Bay-Delta Plan amendments and Final Substitute Environmental Document. Among other things, the Phase 1 updates established new Lower San Joaquin River (LSJR) flow objectives and revised southern Delta salinity objectives. In July of 2018, the SWRCB released a framework that describes the draft proposal for Phase 2, which will update the flow requirements for the Delta and its contributing watersheds, including the Sacramento River and its tributaries. The framework provides additional details about the flow requirements staff is likely to propose, how these new requirements could be implemented, and preliminary information on their potential environmental benefits and water supply effects. The framework also states that the SWRCB is interested in receiving potential Bay-Delta Plan amendment language developed through the voluntary agreement process that would authorize, with the affirmative concurrence from CDFW, a coordinated control of flows and other, non-flow factors that would achieve benefits comparable to the unimpaired flow requirements.

Other issues, such as the continued decline of some fish populations in the Bay-Delta and surrounding regions and certain operational actions in the Bay-Delta, may significantly reduce Metropolitan's water supply from the Bay-Delta. Future new or revised Biological Opinions or incidental take authorizations under the Federal ESA and California ESA might further adversely affect SWP and CVP operations. Additionally, new litigation, listings of additional species under the ESAs, or new regulatory requirements imposed by the SWRCB could further adversely affect SWP operations in the future by requiring additional export reductions, releases of additional water from storage, or other operational changes impacting water supply operations. Metropolitan cannot predict the ultimate outcome of any of the litigation or regulatory processes described above, but believes they could have an adverse impact on the operation of the SWP pumps, Metropolitan's SWP supplies, and Metropolitan's water reserves.

Operational constraints likely will continue until a long-term solution to the problems in the Bay-Delta is identified and implemented. The Delta Vision process, established by Governor Schwarzenegger, was aimed at identifying long-term solutions to the conflicts in the Bay-Delta, including natural resource, infrastructure, land use, and governance issues. In addition, State resource agencies and various water user entities are currently engaged in the development of the Delta Conveyance Project, which is aimed at making physical and operational improvements to the SWP system in the Delta necessary to restore and protect access south-of-Delta SWP water supplies and restore and protect water quality by addressing anticipated sea-level rise, seismic risks, and by providing operational flexibility to improve aquatic conditions in the Delta and better manage risks of further regulatory constraints on SWP operations.

Water Supply Conditions

The water conditions that the region faced leading up to 2020 were characterized by alternating scarcity and abundance. Whereas the five years leading up to the prior UWMP were characterized by severe drought and depletion of Metropolitan's dry year storage reserves, conditions leading up to 2020 have included two very wet years and the rebuilding of Metropolitan's storage reserves to record high levels.

The five-year period began with 2016 reflecting average hydrologic conditions and a 60 percent SWP allocation. This level of supplies allowed for a modest recovery in storage reserves after the drought of 2014-2015. The wettest year on record followed in 2017, and with an 85 percent SWP allocation, Metropolitan was able to add over a million acre-feet to storage reserves by the end of 2017. As such, Metropolitan was well prepared to manage a future dry year, which arrived in 2018 with a 35 percent allocation. Wet conditions returned in 2019; with a 75 percent allocation, storage reserves increased by nearly 600 TAF, ending the year at a record high 3.1 MAF. With high volumes of water in storage, and healthy supplies on the Colorado River, Metropolitan was well prepared to meet the challenge of a dry 2020 and 20 percent SWP allocation.

Investments in storage and flexible operations have prepared Metropolitan to capitalize on available supplies in wet years and manage through drought years. During the wet years of 2017 and 2019, Metropolitan achieved the following milestones:

- In 2017, record deliveries of 395 TAF to exchange partners Desert Water Agency and Coachella Valley Water District from the Colorado River Aqueduct to accomplish the largest single year increase in the Advance Delivery Account;
- In 2017 and 2019, record creation of Intentionally Created Surplus storage in Lake Mead of 351 TAF and 410 TAF, respectively; and
- In 2019, a record low diversion of Colorado River water of approximately 540 TAF, a level not seen since the 1950s.

While recent wet conditions along with flexible adaptive management have brought great successes in building storage reserves, water supply challenges remain. These include:

- Analysis of historical records suggest a potential change in the relationship between precipitation and runoff in the Colorado River Basin and has contributed to a drying trend over the last 21 years. With Lake Mead and Lake Powell at 40 and 42 percent of capacity, respectively, there is practically no buffer to avoid a shortage from any future period of reduced precipitation and runoff.
- Groundwater basins and local reservoirs dropped to very low operating levels due to record-dry hydrology in Southern California in 2016. Due to wetter hydrology in 2017 and 2019, the groundwater basins started to recover. However, levels in groundwater basins throughout

the service area remained below healthy storage levels. In addition, groundwater production in the service area has remained at low levels even after the drought;

- Supply availability in the Los Angeles Aqueduct system continues to be affected by both drought and environmental mitigation efforts related to Owens Lake and the Lower Owens River.

In addition, water quality challenges such as algae toxins, PFAS, and the identification of constituents of emerging concern, have a significant impact on the region's water supply conditions and underscore the importance of flexible and adaptive regional planning strategies.

Current Available Resources

Metropolitan's primary purpose is to provide a supplemental supply of water for domestic and municipal uses at wholesale rates to its member public agencies. Metropolitan's principal sources of water are the SWP and the Colorado River. Metropolitan's robust planning strategy continues to balance available local and imported water resources and member agencies' demands within Metropolitan's service area.

A. Imported Supplies

Metropolitan receives water from the Colorado River through the Colorado River Aqueduct (CRA) and from the SWP through the California Aqueduct. Figure 1-6 shows the historic annual deliveries from the SWP and the Colorado River.

<u>Colorado River</u>

The Colorado River was Metropolitan's original source of water after Metropolitan's establishment in 1928. Metropolitan has a legal entitlement to receive water from the Colorado River under a permanent service contract with the Secretary of the Interior. The CRA, which has a capacity of 1.25 MAF a year, is owned and operated by Metropolitan. It transports water from Lake Havasu, at the border of the state of California with Arizona, approximately 242 miles to its terminus at Lake Mathews in Riverside County.

Over the years, Metropolitan increased reliable supply through the CRA through programs that it helped fund and implement including: farm and irrigation district conservation programs, improved reservoir system operations, land management programs, and water transfers and exchanges through arrangements with agricultural water districts in southern California, entities in Arizona and Nevada that use Colorado River water, and the U.S. Department of the Interior, Bureau of Reclamation (USBR). A detailed discussion of availability of Colorado River water for delivery to Metropolitan is included in Section 3.1.

Metropolitan also receives approximately 277,700 AF per year of additional Colorado River supplies pursuant to an exchange agreement with its member agency, San Diego County Water Authority (SDCWA) (the Exchange Agreement). Pursuant to several agreements, SDCWA receives transfers of Colorado River water from Imperial Irrigation District (IID) and water resulting from the Coachella Canal Lining Project and All-American Canal Lining Project. Pursuant to the Exchange Agreement with Metropolitan, SDCWA makes that water available to Metropolitan at Lake Havasu, which Metropolitan then adds to its supplies. In exchange, Metropolitan delivers a like-amount of its own blended water to SDCWA at the Metropolitan-SDCWA connections.[1]

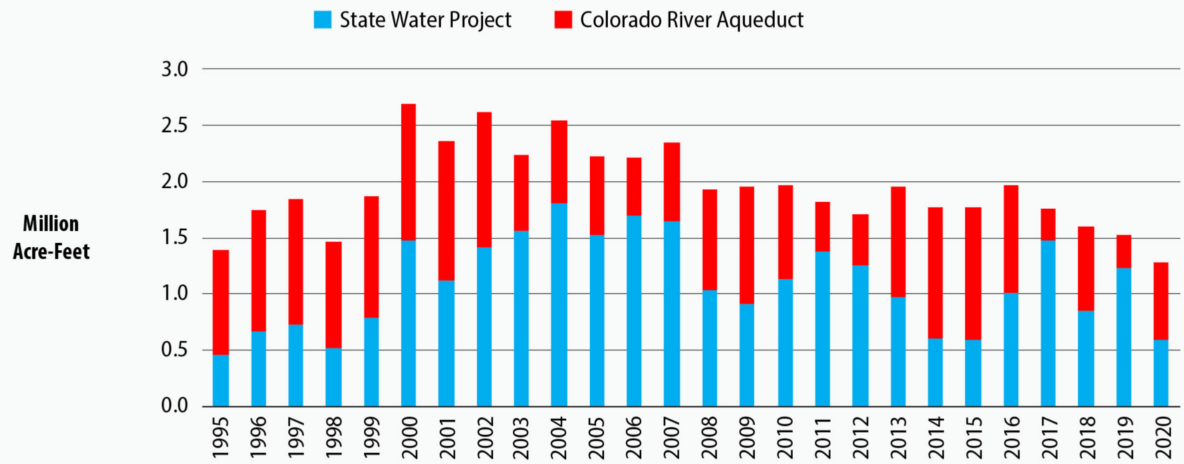
State Water Project

Metropolitan imports water from the SWP, owned by the state of California and operated by DWR. This project transports Feather River water stored in and released from Oroville Dam and conveyed through the Bay-Delta, as well as unregulated flows diverted directly from the Bay-Delta south via the California Aqueduct to four delivery points – one from the Aqueduct's West Branch at the northwestern and three from the East Branch at the northeastern portion of Metropolitan's service area.

In 1960, Metropolitan signed a water supply contract with DWR for participation in the SWP (State Water Contracts). Metropolitan is one of 29 agencies that have long-term contracts with DWR (State Water Contractors) that are participants in the SWP through State Water Contracts, and is the largest agency in terms of the number of people it serves (19.2 million), the share of SWP water that it is allocated pursuant to the State Water Contract (approximately 46 percent), and the percentage of total annual payments made to DWR by agencies with State Water Contracts (approximately 53 percent in 2020). A more detailed discussion of the SWP supplies is provided in Section 3.2.

[1] Prior UWMPs reported these exchanges as SDCWA's local supplies and not as Colorado River water made available to Metropolitan at Lake Havasu with Metropolitan's other Colorado River supplies. This was because Metropolitan reported information in the UWMP as reported by each member agency and SDCWA reported the exchanges as local supplies. Metropolitan has determined that it is most appropriate to report the exchanges here consistently with the transaction, pursuant to Water Code Section 10615. Section 10615 requires that Metropolitan describe and evaluate all sources of supply made available to the district. SDCWA has independently acquired the IID transfer water pursuant to its transfer agreement with IID, and Metropolitan assigned to SDCWA its rights to the canal lining water for 110 years. Under the Colorado River Water Delivery Agreement, the Secretary of the Interior has agreed to deliver this conserved Colorado River water to the Colorado River Aqueduct Intake at Lake Havasu for diversion by Metropolitan. Metropolitan and SDCWA executed the 2003 Exchange Agreement providing for Metropolitan to take possession of the water at Lake Havasu. Metropolitan owns and manages this water at its complete discretion for the benefit of its member agencies. In exchange for the volume made available to Metropolitan at Lake Havasu (at uneven intervals), Metropolitan delivers annually an equal volume to SDCWA (in even monthly deliveries) from whatever source or sources available to Metropolitan. Accordingly, other Metropolitan reports, including the Integrated Water Resources Plan (IRP) and the Annual Report, have accurately not categorized that water as "local supplies." To reflect the transfer of the Colorado River water to Metropolitan at Lake Havasu for its ownership and management, the exchange water is categorized here as water imported from the Colorado River pursuant to the Exchange Agreement and not as a local supply. This is consistent with Section 10615's requirement, and is also consistent with Metropolitan's prior report of the SDCWA exchange water at Section 3.1 of the UWMP and its exclusion from the local supplies at Figure 1-7 of prior UWMP reports.

Figure 1-6 Imported Water Supplies in Metropolitan's Service Area



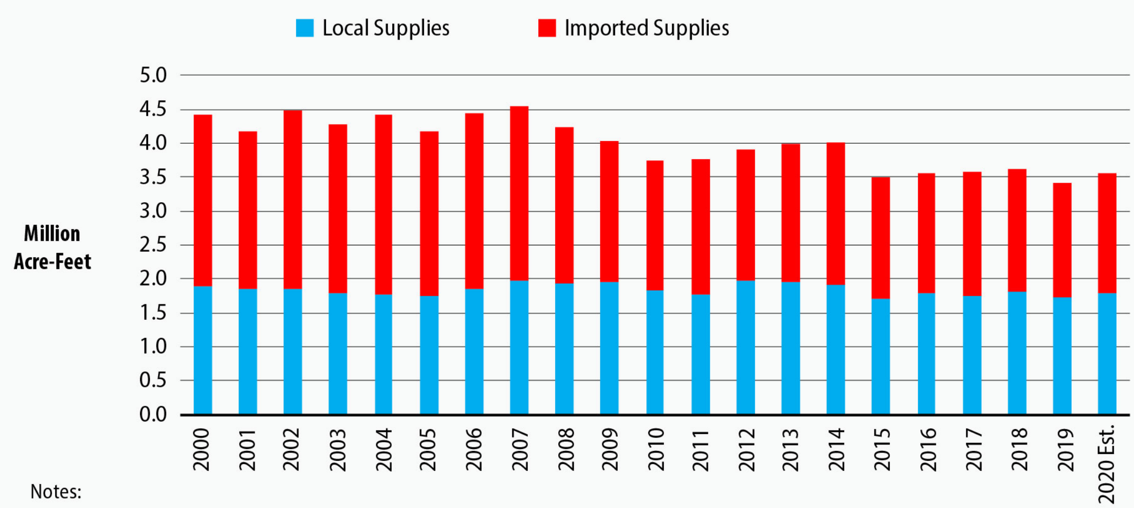
Notes:

1. State Water Project Supplies include Table A, Art. 21, Art. 14(b), Art. 12(d), Art. 12(e), Art. 55, draws from storage & carryover, DWCV & other exchanges, transfers, Drought Water Bank and Dry Year Pool Purchases, Pools A&B, Flood Water, wheeling, Port Hueneme lease, and SBVMWD Purchases.
2. Colorado River Aqueduct supplies are gross Havasu diversions less return flows, deliveries to USBR, Mexico, and storage.

B. Local Supplies

Approximately 50 percent of the region's water supplies come from resources separately controlled or operated by local water agencies. These resources include water extracted from local groundwater basins, catchment of local surface water, and non-Metropolitan imported water supplied through the Los Angeles Aqueduct. Figure 1-7 shows the historic annual use of local and imported water supplies within Metropolitan's service area.

Figure 1-7 Annual Regional Water Supplies in Metropolitan's Service Area



Notes:

1. Local supplies include: Groundwater, Groundwater Recovery, Recycled Water, and Surface water
2. Imported supplies include: Full-service, IAWP, Replenishment and LAA
3. Data not available for 2020. Estimate for 2020 is based on historical data.

Groundwater

The groundwater basins that underlie the region provide an annual average supply of approximately 1.2 MAF (2011-2020 average). Natural recharge of the groundwater basins is supplemented by active recharge of captured stormwater, recycled water, and imported water to support this level of annual production.

Estimates indicate that available storage space in the region's groundwater basins in mid-2020 is approximately 4.7 MAF. Successive dry years have resulted in groundwater depletions that will need to be replaced with natural recharge during wet years and active spreading of captured stormwater, recycled water, and imported water. Groundwater basin managers and water suppliers have taken steps to store water in advance of dry years to soften the potential impact on groundwater aquifers and to maintain reliable local water supplies during dry years.

Recycling, Groundwater Recovery, and Seawater Desalination

Recycling and groundwater recovery are local resources that add balance to Southern California's diverse water portfolio. In addition to replenishment of groundwater basins as described above, water recycling provides extensive treated wastewater for applicable municipal and industrial uses. Common uses of recycled water include landscape irrigation, agricultural irrigation, and commercial and industrial applications. Groundwater recovery employs additional treatment techniques to effectively use degraded groundwater supplies that were previously not considered viable due to high salinity or other contamination.

While water recycling and groundwater recovery projects in the Southern California region are primarily developed by local water agencies, many newer projects have been developed with financial incentives provided through Metropolitan's Local Resources Program (LRP). The LRP is a performance-based program that provides incentives to expand water recycling and support recovery of degraded groundwater, among other types of projects. In 2020, the regional water production from water recycling and groundwater recovery totaled approximately 552 TAF, of which 120 TAF was developed with Metropolitan funding assistance. A detailed discussion of recycling and groundwater recovery is presented in Section 3.5.

Seawater desalination represents a significant opportunity to diversify the region's water resource mix with a new, locally controlled, reliable potable supply. Metropolitan supports seawater desalination to its member agencies by providing technical assistance, regional facilitation of research and information exchanges, and financial incentives through the LRP.

In December 2015, pursuant to its Water Purchase Agreement with the San Diego County Water Authority (SDCWA), Poseidon Resources began operation of the 56 TAF Claude "Bud" Lewis Seawater Desalination Plant in the City of Carlsbad. During fiscal years 2017 through 2019, the facility produced an annual average of 42.1 TAF, meeting nearly 9 percent of SDCWA's service area demands. The Carlsbad facility does not receive funding through Metropolitan's LRP. Seawater desalination is discussed in more detail in Section 3.5

Surface Water

In addition to the groundwater basins, local agencies maintain surface reservoir capacity to capture local runoff. The average yield captured from local watersheds is estimated at approximately 90 TAF per year (2011-2020 average). The majority of this supply comes from reservoirs within the service area of the SDCWA.

Los Angeles Aqueduct

Although the Los Angeles Aqueduct (LAA) imports water from outside the region, Metropolitan classifies water provided by the LAA as a local resource because it is developed and imported by a local agency (the Los Angeles Department of Water and Power). This resource provided approximately 200 TAF per year on average over the last ten years from 2011 to 2020 but was reduced to approximately 33 TAF during a historic dry period of 2015.

Table 1-5 shows the projected local supplies estimated for a normal water year and under five consecutive years of drought for 2025, 2035, and 2045.

Table 1-5
Local Supplies for Normal and Dry Years
(Acre-Feet)

	2025		2035		2045	
	Normal Year[1]	Dry Year[2]	Normal Year	Dry Year	Normal Year	Dry Year
Local Groundwater						
From Natural Recharge[3]	939,000	985,000	964,000	988,000	991,000	1,011,000
Replenishment	316,000	255,000	332,000	327,000	335,000	334,000
Local Projects						
Groundwater Recovery	143,000	139,000	158,000	158,000	159,000	159,000
Recycling	550,000	491,000	687,000	658,000	706,000	703,000
Seawater Desalination	51,000	56,000	51,000	56,000	51,000	56,000
Local Runoff Stored	80,000	77,000	82,000	77,000	82,000	77,000
Los Angeles Aqueduct	257,000	118,000	258,000	118,000	258,000	118,000
Exchange with SDCWA	278,000	278,000	278,000	278,000	278,000	278,000
Total	**2,613,000**	**2,400,000**	**2,809,000**	**2,660,000**	**2,860,000**	**2,736,000**

[1] Normal Water Year is based on 1922 through 2017.

[2] Dry Year is based on five consecutive years of drought (1988-92).

[3] Estimate of natural recharge is based on basin balance considering projected local groundwater production and replenishment deliveries to the groundwater basins.

Metropolitan's Actions to Address Supply Challenges

Metropolitan progressively addressed the challenges of water shortages caused by the dramatic swings in annual hydrologic conditions that have characterized the past decade on the SWP. Metropolitan took actions that include: (1) Increasing water conservation by expanding outreach, adding devices, and increasing incentives to residents, (2) Increasing local resources by providing incentives for on-site recycled water hook-up and increasing incentives for the LRP, (3) Augmenting water supplies through water transfers and exchanges, (4) Improving return capability of storage programs, (5) Modifying Metropolitan's distribution system to enhance the use of Colorado River water, and (6) Implementing the Water Supply Allocation Plan to distribute the limited imported supplies and preserve storage reserves.

Continuing Water Conservation

By 2040, conservation and water recycling will account for one-third of Southern California's water supply portfolio in Metropolitan's service area. Metropolitan supports financial incentives, education, outreach programs and appliance/plumbing standards at both the regional and local level to ensure water conservation meets this goal.

On April 1, 2015, Governor Brown issued an Executive Order (Order) calling for a 25 percent reduction in consumer water use in response to the historically dry conditions throughout the State of California. The next month, Metropolitan increased funding for its conservation program to a record amount of $450 million over the next two fiscal years due to strong response to the incentive program and to assist retail agencies in the service area to meet their mandatory water reduction targets. Since the drought ended, Metropolitan has been working hard these past five years to ensure that water demand in its service area continues to remain low. Gallons per capita measurement is the major conservation indicator of residential water demand, and for the last five years, Metropolitan's service area has remained below the theoretical standard set to meet a 20 percent reduction goal by 2020. While Metropolitan is not subject to meeting the requirements of California's 20X2020 Water Conservation Plan, its conservation efforts are designed to help its member agencies and their retailers to meet their requirements.

Metropolitan's conservation program has seen numerous changes from the previous years of record high conservation activity during the last drought, as focus shifted from relying heavily on providing incentives to developing additional training and research programs to supplement conservation activity. This new focus was designed to reach a broader audience in order to maintain water demand levels achieved during the recent drought. The educational courses teach students the numerous benefits of water efficient landscaping and how to convert their traditional landscaped yards to something more appealing and sustainable, while greatly reducing their outdoor water usage. Ongoing educational efforts include turf removal, California Friendly native plants and landscaper training classes. Additionally, Metropolitan is searching for other water saving opportunities by researching the potential of water saving processes in cooling tower water use, the effects on household water pressure reduction on residential water use, and a household water demand pilot study to determine residential end use from water using fixtures.

Recent conservation highlights include the launching of a revised Turf Replacement Program, establishing additional water efficiency incentives with energy utilities, and a new program for increasing conservation in disadvantaged communities. The disadvantaged community program is comprised of three parts: (1) a regional pilot program; (2) increased flexibility for member agencies to use Metropolitan funds for member agency-administered programs; and, (3) grant funding support. The $3 million regional pilot program provides $250 for installation of premium high-efficiency toilets within multi-family housing constructed prior to 1994. Analyzing program data may better explain how regional approaches could increase conservation within disadvantaged communities. Under the second component, 100 percent of the Metropolitan funds given to member agencies for their locally administered conservation programs could be targeted toward supporting disadvantaged communities or income-qualified consumers. Metropolitan also works with member and local agencies to help identify opportunities and procure grant funding for such conservation programs

Increasing Local Resources

Since 1982, Metropolitan has assisted local agencies in the development of water recycling and groundwater recovery under the Local Resources Program (LRP). The LRP has evolved over time in an effort to help support the development of local supply projects including the methodology for providing the incentives to the Member Agencies. In October 2014, Metropolitan's Board approved additional LRP refinements to support further development of local resources, which included increasing the maximum incentive amount, offering three incentive payment structures, including on-site recycled water retrofit costs, including other water resources (such as seawater desalination and stormwater), and providing reimbursable services for Metropolitan's technical assistance.

On-site Retrofit Program

In February 2014, Metropolitan's Board approved the On-site Retrofit Pilot Program to offer incentives to modify existing water users' potable water or industrial water systems to utilize recycled water.

Stormwater Pilot Programs

In September 2019, Metropolitan's Board approved the Stormwater for Direct-use Pilot Program to offer incentives for development and monitoring of new and existing direct-use stormwater projects. The primary purpose of the Pilot Program is to collect data from several region-wide stormwater projects. The data collected will provide a better understanding of actual stormwater runoff capture volumes, costs, and project performance. The Pilot Program will help evaluate the potential water supply benefits delivered by stormwater capture projects and provide a basis for potential future funding approaches.

In November 2019, Metropolitan's Board approved the Stormwater for Recharge Pilot Study. The purpose of this study is to evaluate the relationship between stormwater capture and yield to define the water supply benefits of stormwater. Yield for purposes of this study is defined as either increased groundwater production or decrease in imported water needs relative to baseline. The study also requires a minimum of 3 years of monitoring, both of the amount of stormwater captured and the impact to the groundwater basins via groundwater modeling and monitoring wells or sensors. This study will help evaluate the potential water supply benefits delivered by stormwater capture projects and provide a basis for potential future funding approaches.

Augmenting Water Supplies

Augmenting water supplies through water transfers and exchanges is an element of Metropolitan's IRP to mitigate water shortages during dry periods.

The Colorado River System has experienced a drying trend since 2000, leading to substantially decreased water levels in both Lakes Mead and Powell. In March 2014, Metropolitan's Board approved entering into an agreement with the Central Arizona Water Conservation District, Denver Water, Southern Nevada Water Authority (SNWA), and the United States to establish a two-year pilot program to compensate entitled users of the Colorado River water for voluntary reductions in water use, including fallowing of agricultural lands. The water savings from this program became system water and supported lake elevations.

Metropolitan also entered into several agreements to improve Metropolitan's operational flexibility on both a short-term and mid-term basis:

- In January 2015, Metropolitan's Board authorized an exchange of up to 50 TAF with Westside Mutual Water Company and Kern County Water Agency. This one-for-one exchange provides water at a time in the year when SWP supplies are expected to be low and provides flexibility on timing of returning water.
- In September 2015, Metropolitan's Board authorized an amendment to the operational storage agreement with SNWA and the Colorado River Commission of Nevada allowing

Metropolitan access to additional Colorado River water during 2015. Metropolitan paid SNWA $44.375 million for 150 TAF of water apportioned to but not used by SNWA during 2015. When SNWA requests return of water stored under this amendment, SNWA would reimburse Metropolitan for the costs paid for the initial delivery of water.

- In November 2015, Metropolitan's Board authorized entering into agreements with Antelope Valley-East Kern Water Agency (AVEK) to develop exchange and storage programs for SWP supplies. This would be an uneven exchange: for every two acre-feet provided to Metropolitan, AVEK would receive back one acre-foot in the future. Metropolitan may also store at least 30 TAF of its SWP supplies in wet years in the Antelope Valley groundwater basin.
- In September 2020, Metropolitan's Board authorized new price terms for the purchase of transfer supplies under the Yuba Accord. The price terms will be fixed for the next five years. Metropolitan has received around 200 TAF of new supplies before losses under the program.
- In March 2021, Metropolitan's Board authorized entering into an agreement with San Bernardino Valley Municipal Water District to obtain surplus SWP supplies. The program provides improved water supply reliability to Metropolitan and Metropolitan's member agencies within the Santa Ana River Watershed. The program is estimated to provide a long term average of around 13 TAFY to the region.

Improving Return Capabilities of Storage Programs

Metropolitan has a number of storage programs with water agencies along the California Aqueduct that would allow it to store SWP supplies during surplus conditions and to have stored water returned when needed. In 2015, Metropolitan provided up-front capital costs to its water management program partners to build infrastructure to improve the return capabilities of several storage programs.

- In September 2014, Metropolitan's Board authorized providing capital funds to Semitropic Water Storage District to enhance the pumpback capacity of the Semitropic Groundwater Storage Program by 13,200 AFY. The capital costs would be reimbursed to Metropolitan should Semitropic market the added capacity to another party after Metropolitan has at least one year of recovery capability.
- In March 2015, Metropolitan's Board authorized entering into agreement with Arvin Edison Water Storage District to restore 2,500 AFY of return capability by replacing groundwater wells of the Arvin Edison/Metropolitan Water Management Program. The capital costs will be reimbursed as credits to future Program costs.
- Also, in March 2015, Metropolitan's Board authorized entering into agreement with Kern-Delta Water District to improve the return reliability of the Kern-Delta Water District Water Management Program. The improvement includes a pipeline that would reduce losses when Kern River supplies are delivered for exchange. Metropolitan's upfront costs will be more than offset through an elimination of put regulation fees on the next 20,000 AF delivered into the Program.
- In April 2019, Metropolitan's Board authorized entering into an agreement with AVEK for the High Desert Water Bank. Under the Water Bank, Metropolitan could store up to 280,000 acre-feet (AF) of its State Water Project (SWP) Table A or other supplies in the Antelope Valley groundwater basin. Metropolitan will have first priority to 70,000 AF per year of both put and take capacity. Metropolitan will pay AVEK for the capital costs for construction of monitoring and production wells, turnouts from the California Aqueduct, underground and aboveground pipelines, recharge basins, water storage, and booster pump facilities. In

addition, Metropolitan would subsequently pay actual operation and maintenance, energy, and recovery usage fees to recover the water in storage.

Modifying Metropolitan's Distribution System

As a result of ongoing extraordinary dry conditions throughout the state of California, the SWP allocation for calendar year 2014 was five percent, which represents about 96,000 acre-feet of SWP Table A water allocation for Metropolitan. Although Metropolitan had been utilizing storage reserves to help bridge the gap between the low SWP supplies and its demand for SWP water, a number of extraordinary operational actions were taken in 2014 to use available Colorado River water and DVL storage supplies to deliver water service to areas where Metropolitan ordinarily uses SWP supplies to provide its service.

Metropolitan modified its normal operations in several areas of the system to use Colorado River water to provide service to areas as far west as the cities of Thousand Oaks and Calabasas, as well as other locations within Metropolitan's system, some of which had not received Metropolitan water from the Colorado River for extended periods since the completion of the SWP in the early 1970s. System modifications have also been implemented to increase system flexibility to use Colorado River water and DVL water for service to new areas of the system.

- In April 2014, Metropolitan's Board authorized a project that would allow Metropolitan to serve water from multiple sources, such as DVL, to the Mills Treatment Plant in Riverside. The initial phase, construction of an interconnect between the Inland Feeder and the Lakeview Pipeline, near San Jacinto, California, was completed in October 2014, which allowed for an initial flow of water. The second phase of the project, lining of the Bernasconi Tunnel No. 2 was completed in March of 2015 and allowed for increased flows from DVL. The final phase of the project, installation of 3 large valves to improve flow control was completed in 2018.
- In May 2014, Metropolitan's Board authorized the design of improvements to the Greg Avenue Pump Station to enhance water supply reliability in the West Valley area and construct flow control modifications to the outlet of the Jensen Water Treatment Plant. These projects currently allow the West Valley area and Ventura County, which is served normally with SWP water only, to receive blended supplies from the SWP and the Colorado River. Construction of the Greg Avenue Pump station improvements to enhance the long term reliability of the pumps was authorized in February 2019 and is scheduled to be completed in April 2021.

Additionally, several Metropolitan member agencies made modifications within their own local systems to maximize the use of more readily available Colorado River water and DVL supplies and to further reduce the use of scarce SWP supplies.

In the face of another five percent SWP Table A allocation in 2021, Metropolitan is applying the lessons learned in 2014 and able to reap the benefits of the distribution system modifications that help minimize the use of limited SWP supplies

Implementing the Shortage Response Actions, when needed

Recent legislative changes to the California Water Code (CWC) introduced a new Section 10632, which requires that every urban water supplier prepare and adopt a Water Shortage Continency Plan (WSCP). The WSCP is a guide for a supplier's intended actions during water shortage conditions. It is meant to improve preparedness for droughts and other impacts on water supplies by describing the process used to address varying degrees of water shortages. While intended to be a stand-alone plan that may be revised outside of the UWMP process, the CWC requires suppliers to initially include the WSCP as part of their 2020 UWMP.

Metropolitan developed a WSCP to be consistent with its existing Water Surplus and Drought Management (WSDM) Plan and Water Supply Allocation Plan (WSAP). Metropolitan's WSDM Plan, approved in 1999, provides policy guidance for managing regional water supplies during surplus and shortage conditions. It provides an overall vision for operational supply management and characterizes a flexible sequence of actions to minimize the probability of severe shortages and reduce the likelihood of extreme shortages. Thus, the WSDM Plan principles guide the specific actions to be taken under WSCP shortage stages. Metropolitan's WSAP, developed in 2008, is integral to the WSCP's shortage response strategy. In the event that Metropolitan determines that shortage response actions through supply augmentation and demand reduction measures are insufficient to meet a projected shortage, the WSAP may be implemented to fairly distribute a limited amount of water supply using a detailed methodology that reflects the range of local conditions and needs of the region's retail water consumers.

Metropolitan's Board authorized the implementation of the WSAP for the period of July 2009 through April 2011 in response to the drought and low storage reserves. During the dry period of 2012 through 2016, Metropolitan managed its operations through significant use of regional storage reserves. It was anticipated that at end of year 2014, total dry year storage reserves would approach levels similar to those when the WSAP was first implemented in 2009. On December 9, 2014, Metropolitan's Board approved adjustments to the formula for calculating member agency supply allocations for future implementation of the WSAP. On April 14, 2015, Metropolitan's Board approved implementation of the WSAP at a Level 3 Regional Shortage Level, effective July 1, 2015 through June 30, 2016. The WSAP allows member agencies the flexibility to choose among various local supply and conservation strategies to help ensure that demands on Metropolitan stay in balance with limited supplies.

Over the last three years, favorable supply conditions notably in 2017 and 2019, allowed Metropolitan to rebuild its storage reserves. Metropolitan's regional dry year storage is estimated to be at approximately 3.2 MAF by the end of 2020. In addition, Metropolitan also has 750 TAF of stored supplies reserved to meet service area demands during emergency conditions. Metropolitan's comprehensive shortage response planning, combined with improved storage reserves, puts the region in a better position to withstand future dry conditions. Metropolitan's WSCP, WSDM Plan, and WSAP are described in detail in Section 2 and Appendix 4.

Planning for the Future

2

The purpose of this section is to show the approach and extent to which Metropolitan plans to meet Southern California's water supply needs in the future. In its role as supplemental supplier to its 26 member agencies in the Southern California water community, Metropolitan faces ongoing challenges in meeting its member agencies' needs for water supply reliability and quality in the region. Increased environmental regulations and competition for water from outside the region have resulted in changes in delivery patterns and timing of imported water supply availability. At the same time, the Colorado River has experienced a drying trend over the past 21 years, resulting in reservoir levels that are reduced from historical levels.

As described in the previous chapter, the water used in Southern California comes from a number of sources. From 2010 through 2019, Metropolitan has provided 40 percent to 50 percent of the water needs in its service area from the Colorado River via the CRA, and from the Sacramento-San Joaquin River Watershed via the SWP. As Metropolitan continues to face various water supply challenges, development of adaptable resource management strategies to meet a range of possible future demands is ongoing.

Metropolitan's continued progress in developing a diverse resource mix enables the region to meet its water supply needs. The investments that Metropolitan has made and its ongoing efforts in many different areas coalesce toward its goal of long-term regional water supply reliability. Metropolitan's actions have been focused on the following:

- Continuing water conservation
- Developing water supply management programs outside of the region
- Developing storage programs related to the SWP and the Colorado River
- Developing storage and groundwater management programs within the Southern California region
- Increasing water recycling, groundwater recovery, stormwater, and seawater desalination
- Pursuing long-term solutions for the ecosystem, regulatory and water supply issues in the California Bay-Delta

Metropolitan has undertaken a number of planning initiatives over the years. This section summarizes past and current efforts, which include the 1996 Integrated Water Resources Plan (IRP) and its three updates in 2004, 2010, and 2015; the 2020 IRP; the Water Shortage Contingency Plan; the Water Surplus and Drought Management Plan; the Water Supply Allocation Plan; Metropolitan's Emergency Storage Objective; and Seismic Resiliency Studies. Collectively, they provide policy framework guidelines and resource targets for Metropolitan to achieve its goals towards regional water supply reliability.

While Metropolitan coordinates regional supply planning through its inclusive IRP process, Metropolitan's member agencies also conduct their own planning analyses – including their own urban water management plans – and may develop projects independently of Metropolitan.

Appendix 5 shows a list of potential local projects provided to Metropolitan by its member agencies.

2.1 Integrated Water Resource Planning

In 1993, Metropolitan commenced an Integrated Water Resources Planning process as the beginning of a new era of regional reliability planning for its Southern California service area. As this planning process began, Metropolitan held a series of three regional assemblies from 1993 through 1995 addressing strategic planning issues. Attendance at these regional assemblies included Metropolitan's Board, Metropolitan's senior management, member agency managers, local retail water providers, groundwater basin managers, and invited public representatives. The purpose of these regional assemblies was to gain consensus on resource policy issues, provide direction for future work, and to endorse regional objectives, principles, and strategies.

A key outcome of the regional assemblies was the establishment and adoption of water supply principles which provided critical policy guidance for the development and adoption of future Metropolitan IRPs. In summary, these principles state:

- No water supplier in Southern California is an isolated, independent entity unto itself, and all, to varying degrees, are dependent upon a regional system of water importation, storage, and distribution.
- Metropolitan plays a leading role in Southern California's regional water management, having the responsibility for importing water from outside the region and convening dialogues on regional water issues, encouraging local water development and conservation, advocating the region's interests to the state and federal governments, and leading the region's water community.
- Water suppliers at all levels have a responsibility to promote a strong water ethic both within the water community and among the public, developing plans through open processes, committing to achieving adopted regional goals and strategies, and committing to a policy of equity and fairness in development and implementation of water management programs.

These regional assemblies laid the foundation for Metropolitan's integrated regional planning path from 1996 to the present. This path has guided Metropolitan's water resources strategy from the initial adoption of the Metropolitan's IRP in 1996 to successive IRP updates in 2004, 2010, and 2015.

The 1996 IRP

Metropolitan's inaugural IRP established a long-term, comprehensive water resources strategy to provide the region with a reliable and affordable water supply. One of the fundamental outcomes of the 1996 IRP was the identification and subsequent implementation of a diverse portfolio of resource investments in both imported and in--region supplies, and in water conservation measures. The 1996 IRP further emphasized the construction and creation of a network of water storage facilities, both below and above ground. It also set a regional water supply reliability goal of providing full capability to meet all retail-level water demands under all foreseeable hydrologic events.

The 1996 IRP process identified cost-effective solutions that offered long-term reliability to the region. Having identified the need for a portfolio of diversified supplies to meet its demands, the 1996 IRP analyzed numerous resource portfolios seeking to find a "Preferred Resource Mix" that would provide the region with reliable and affordable water supplies through 2020. The analysis determined the preferred mix of resources based on cost-effectiveness, diversification, and reliability. Establishing the "Preferred Resource Mix" was an integral part of the 1996 IRP, and subsequent updates have continued to focus on how best to diversify Metropolitan's water portfolio and establish the broad resource targets for the region that helped to meet IRP objectives.

The 2004 IRP Update

The 2004 IRP Update was the first major review and update in the IRP process. The 2004 IRP Update reviewed the goals and achievements of the 1996 IRP, identified the changed conditions for water resource development, and updated resource development targets through 2025. These targets included increased conservation savings and planned increases in local supplies. The 2004 IRP Update also explicitly recognized the need to handle uncertainties inherent in any planning process. Some of these uncertainties include:

- Fluctuations in population and economic growth
- Changes in water quality regulations
- Discovery of new chemical contaminants
- Regulation of endangered species affecting sources of supplies
- Changes in climate and hydrology

As a result, a key component of the 2004 IRP Update was the addition of a 10 percent "planning buffer." The planning buffer identified additional supplies, both imported and locally developed, that could be implemented to address uncertainty in future supplies and demands.

The 2010 IRP Update

In keeping with the reliability goal established under the original 1996 IRP of meeting full-service demands at the retail level under all foreseeable hydrologic conditions, the 2010 IRP Update sought to stabilize Metropolitan's traditional imported water supplies and establish additional water resources to withstand California's inevitable dry cycles and growth in water demand. The 2010 IRP Update marked the first time that Metropolitan and its member agencies explicitly acknowledged the increasing impact that emerging challenges and uncertainties such as environmental regulations, threats to water quality, climate change, and economic unknowns would have on planning for a reliable, high quality, and affordable water supply. By 2010, the Colorado River had experienced below-average precipitation conditions for most of the previous decade, and the SWP was facing historic regulatory cutbacks that significantly reduced its supplies that pass through the Sacramento-San Joaquin Delta in Northern California. Recognizing that the conditions for developing and maintaining water supply reliability had changed, Metropolitan set out not only to update the IRP, but also to examine how best to adapt to the new water supply paradigm.

Adaptive Management Strategy

The 2010 IRP Update specifically planned for uncertainty with a range of adaptive management strategies that both meets demands under observed hydrologic conditions and responds to future uncertainty. The plan provided solutions by developing diverse and flexible resources that perform adequately under a wide range of future conditions. Specifically, the adaptive management strategy was a three-component plan that included the following:

- Core Resources Strategy – Designed to maintain reliable water supplies under known conditions. The Core Resources Strategy represented baseline efforts to manage water supply and demand conditions. This strategy was based on "what we know today," including detailed planning assumptions about future demographic scenarios, water supply yields, and a range of observed historical weather patterns. Under this strategy, Metropolitan and its member agencies would advance water use efficiency through conservation and recycled water, along with further local supply development such as groundwater recovery and seawater desalination. Metropolitan would also stabilize traditional imported supplies from the Colorado River and Northern California.

- Uncertainty Buffer – A suite of actions which help to mitigate short-term changes. The 2010 IRP Update set goals for a range of potential buffer supplies to protect the region from possible shortages in a cost-effective manner, starting with a further expansion of water use efficiency on a region-wide basis. The buffer would enable the region to adapt to future circumstances and foreseeable challenges that were not assumed under the Core Resources Strategy, such as short-term loss of local supplies or regulatory restrictions.
- Foundational Actions – Strategies for additional water resources to augment the core or buffer supplies. Foundational Actions were designed to prepare the region by determining viable alternative supply options for long-range planning. These preparatory actions, including feasibility studies, technological research and regulatory review, were designed to lay the foundation for potential alternative resource development.

The 2015 IRP Update

Following the 2010 IRP, drought in California and across the southwestern United States has put the IRP adaptive management strategy to the ultimate stress test. Dry conditions in California persisted into 2015, resulting in a fourth consecutive year of drought. The year 2015 began with the driest January on record, resulting in the earliest and lowest snowpack peak in recorded history at only 17 percent of the traditional snowpack peak on April 1st. In the ten years since 2006, there were only two wet years, with the other eight years having been below normal, dry, or critically dry. Within Southern California, continuing dry conditions impacted the region's local supplies, including its groundwater basins.

Throughout 2015, Metropolitan engaged in a comprehensive process with its Board of Directors and member agencies to review how conditions had changed since the 2010 IRP Update and to establish targets for achieving regional reliability, taking into account known opportunities and risks. Areas reviewed in the 2015 IRP Update include demographics, hydrologic scenarios, water supplies from existing and new projects, water supply reliability analyses, and potential resource and conservation targets. Metropolitan's Board of Directors adopted the 2015 IRP Update on January 12, 2016.[1]

The 2015 IRP Update approach explicitly recognizes that there are remaining policy discussions that will be essential to guiding the development and maintenance of local supplies and conservation. Since the adoption of the 2015 IRP Update and its targets for water supply reliability, Metropolitan has begun a process to address questions such as how to meet the targets for regional reliability, what are local and what are regional responsibilities, how to finance regional projects, etc. This discussion will involve extensive interaction with Metropolitan's Board of Directors and member agencies, with input from the public.

[1] http://www.mwdh2o.com/PDF_About_Your_Water/2015_IRP_Update_Report.pdf

Findings and Conclusions

The findings and conclusions of the 2015 IRP Update are:

- Action is needed – Without the investments in conservation, local supplies, and the California WaterFix targeted in the 2015 IRP Update, Metropolitan's service area would experience unacceptable level of shortage allocation frequency in the future.
- Maintain Colorado River supplies – The plan to stabilize deliveries at 900,000 AF in a typical year will require more than 900,000 AF of planned actions.
- Stabilize SWP supplies – A collaborative approach with state and federal agencies to pursue better science for resolving questions about SWP operations and advancing coequal goals of Delta restoration and statewide water supply reliability in the near term. Also work collaboratively with state and federal agencies in the California WaterFix and EcoRestore efforts.
- Develop and protect local supplies and water conservation – The 2015 IRP Update embraces and advances the regional self-sufficiency ethics by increasing the targets for additional local supplies and conservation. These targets are discussed in detail in Section 3 of this UWMP.
- Maximize the effectiveness of storage and transfers – Rebuilding Metropolitan's supply of water reserves is imperative when the drought is over. A comprehensive water transfer approach that takes advantage of water when it is available will help to stabilize and build storage reserves, increasing Metropolitan's ability to meet water demands in dry years.
- Continue with the adaptive management approach – The IRP is updated periodically to incorporate changed conditions, and an implementation report is prepared annually to monitor the progress in resources development. The 2015 IRP Update also includes Future Supply Actions (renaming the Foundational Actions component of the 2010 IRP Update to better reflect the attention on developing future supplies) that would advance a new generation of local supplies through public outreach; development of legislation and regulation; technical studies and support; and land and resource acquisitions.

The 2020 IRP

The 2020 IRP provides a broader look and concept than the previous IRP updates. The 2020 IRP strengthens the adaptive management approaches employed in prior updates through the incorporation of an explicit scenario planning step. Coming on the completion of a full "planning cycle" with reaching the end of the planning horizon of the 1996 IRP, the 2020 IRP has the benefit of a fuller understanding of the lessons learned from the previous 25 years. The key lesson is that the future is not predictable and is a function of many diverse drivers that are out of the control of the water community. The purpose of scenario planning is to broaden the understanding of plausible, but uncertain, future conditions affecting both supplies and demands. On the demand side, uncertainties surrounding future economic conditions, the extent to which local supplies are developed, and water use behavior will guide member agency dependence on Metropolitan in meeting their retail demands. On the supply side, factors like climate change impacts and regulatory uncertainty are expected to affect future supply availability in unpredictable ways.

With these uncertainties in mind, scenario planning will allow for the evaluation of investments and actions needed to achieve desired reliability under a diverse range of future conditions. It will also reinforce the adaptive capabilities of the IRP by identifying and enabling the development of future “sign-posts” indicating emerging conditions that may require the redirection of future investments and actions.

While prior IRP updates have addressed uncertainty, adaptation, and preparedness, the addition of a scenario planning element to the process further explores the plausible futures that Metropolitan may confront. Since retaining the ability to adapt through investments in preparedness can be expensive, the scenario planning element should support informed decisions regarding affordable levels of preparedness, as well as identify unacceptable consequences of inaction.

The process of developing scenarios is built on a comprehensive identification of those drivers of change that affect supply stability and demands on Metropolitan. Building on input received from the Board, member agencies, and the public, four scenarios were developed within a framework that examined the drivers of change over a range of future demands on Metropolitan and imported supply stability. This exercise provides four sets of logical, quantified assumptions resulting in unique supply demands gaps against which various investment options can be tested.

The UWMP, along with the original IRP and its subsequent updates, used a single set of assumptions for the uncertainties that drive supply and demands. In the 2020 IRP, Metropolitan explicitly acknowledges that the future is unpredictable and that a scenario planning approach can expand our thinking by examining multiple plausible futures. This approach will better prepare Metropolitan’s service area for the uncertainties that lie ahead. Metropolitan believes this is an improvement over the single outcome approach taken in past IRPs and the UWMP requirements. It is important to emphasize that the scenario planning element of the 2020 IRP complements the IRP planning approach that has evolved since 1996. It is also important to note that the UWMP assumptions fall within the plausible futures contemplated in the IRP. This means that, while the reliability assessments in the UWMP comply with the Act, Metropolitan and its member agencies are contemplating and comparing future conditions that are beyond the requirements of the Act and thus will be prepared for a wider range of conditions than shown in the UWMP assessments. The following sections describe the methodology and IRP assumptions being applied for the purposes of the UWMP.

2.2 Estimating Demands on Metropolitan

The Urban Water Management Planning Act requires suppliers to conduct three key basic planning analyses to evaluate supply reliability. The first is a water service reliability assessment that compares the total water supply sources available to the water supplier with the long-term projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The second is a drought risk assessment (DRA) that evaluates a drought period that lasts five consecutive water years starting from the year following when the assessment is conducted. And third, a Water Shortage Contingency Plan (WSCP) that includes a detailed proposal for how the supplier intends to act during actual water shortage conditions. As one of the recent additions to the Act's requirements, suppliers need to present the WSCP as part of their UWMP. However, the WSCP is its own independent plan that shall be adopted and provided to customers, cities, and counties within the supplier's service area, and may be amended independent of a supplier's UWMP. These required assessments and planning are included in Sections 2.3, 2.4, and 2.5.

The 2020 UWMP presents Metropolitan's water reliability assessments from 2025 through 2045. As specified in the Act, there are three year types that must be included in the water service reliability assessment for the UWMP. To simulate hydrologic conditions for the required reliability assessments, Metropolitan assumed the following:

- Normal Year. The average of historic years 1922 to 2017 most closely represents the water supply conditions that Metropolitan considers available during normal water year.
- Single Dry Year. The conditions for the year 1977 represent the lowest water supply available to Metropolitan.
- Five-Consecutive-Year Drought. The five consecutive years of 1988 to 1992 represent the driest five-consecutive year historical sequence for Metropolitan's water supply. This five-year sequence is used to complete both Metropolitan's water service reliability and drought risk assessments.

Metropolitan developed estimates of future demands and supplies from local sources and from Metropolitan sources based on 96 years (1922-2017) of historic hydrologic conditions. The 96-year period starting in 1922 was chosen because the CalSim 2 model used in the 2019 SWP Delivery Capability Report began in 1922. Supply and demand analyses for the single-dry year and 5-year drought cases were based on conditions affecting the SWP as this supply availability fluctuates the most among Metropolitan's sources of supply. Using the same 96-year period of the SWP supply availability, 1977 is the single driest year, and 1988 through 1992 are the 5 consecutive driest years for SWP supplies to Metropolitan. In addition, staff analysis of the 8-river index indicated that 1977 is the single driest year and 1988 through 1992 are the lowest 5 consecutive dry years from 1922 through 2017. The 8-river index is used widely by DWR and other water agencies as an estimate of the unimpaired runoff (or natural water production) of the Sacramento and San Joaquin River basins, which are sources of water for the SWP.

Demand Projection for the UWMP

Metropolitan developed its demand projections for the UWMP by first estimating total retail demands for its service area and then factoring out water savings attributed to conservation.[2] Projections of local supplies were then derived using data from current and expected local supply programs. The resulting difference between total demands net of savings from conservation and local supplies is the expected regional demands on Metropolitan supplies.

2 Information generated as part of this analysis is contained in Appendix 1.

These various estimates are shown in Tables 2-1 through 2-3. Major categories used in these tables are defined below.

Total Demands

Total demands are the sum of retail demand for M&I and agricultural, seawater barrier demand, and replenishment demand. Total demands represent the total amount of water needed by the member agencies. Total demands include:

- Retail Municipal and Industrial (M&I) Demand – Retail M&I demands represent the full spectrum of urban water use within the region. These include residential, commercial, industrial, institutional, and un-metered water uses. Demographic and economic factors are the major drivers behind M&I water demands. The demographic and economic data used in developing these projections for the UWMP were taken from the Southern California Association of Governments' (SCAG) 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy from the Connect SoCal Complete Report (as adopted on May 7, 2020) and from the San Diego County Association of Governments' (SANDAG) San Diego Forward: The 2019 Federal Regional Transportation Plan (October 2019, Version 17). The SCAG and SANDAG regional growth forecasts are the core assumptions that drive the estimating equations in Metropolitan's Econometric Demand Model (MWD-EDM).

  SCAG's and SANDAG's projections undergo extensive local review, incorporate zoning information from city and county general plans, and are backed by Environmental Impact Reports. Both SCAG and SANDAG prepare demographic forecasts based on land use data for their respective regions through extensive processes that emphasize input from local planners and are done in coordination with local or regional land use authorities, incorporating essential information to reflect anticipated future populations and land uses. These growth forecasts are used to guide development of regional plans and strategies mandated by federal and state governments. Metropolitan's use of SCAG and SANDAG projections is consistent with CWC Section 10631's requirement for suppliers to include current and projected land uses within the existing or anticipated service area affecting the supplier's water management planning.

  Impacts of potential annexation are not included in the demand projections for the 2020 UWMP. However, Metropolitan's Review of Annexation Procedures concluded that the impacts of annexation within the service area beyond 2020 would not exceed two percent of overall demands.

- Retail Agricultural Demand – Retail agricultural demands consist of water use for irrigating crops. Member agencies estimate agricultural water use based on many factors, including farm acreage, crop types, historical water use, and land use conversion. Each member agency estimates its agricultural demand differently, depending on the availability of information. Metropolitan relies on member agencies' estimates of agricultural demands for the 2020 UWMP.

- Seawater Barrier Demand – Seawater barrier demands represent the amount of water needed to hold back seawater intrusion into the coastal groundwater basins. Groundwater management agencies determine the barrier requirements based on groundwater levels, injection wells, and regulatory permits.

- Storage Replenishment Demand – Storage replenishment demands represent the amount of water member agencies plan to use to replenish their groundwater basins or surface reservoirs in order to maintain sustainable basin/reservoir heath and production. For the 2020 UWMP, replenishment deliveries are not included as part of consumptive demands.

Climate impacts to M&I and Agricultural demands are captured using climate adjustment factors. These factors were estimated using observed range of weather variables, precipitation and temperature, on historical consumptive demands. Metropolitan updated these factors to include the most recent weather and climate outcomes and recent changes in water use and irrigation demands. By incorporating these factors, Metropolitan's demand projections are calibrated to the more recent water use behaviors and better reflect current climate change impacts.

Conservation Adjustment

Water savings from conservation reduces total retail demand. Conservation savings consists of the following:

- <u>Code-Based Conservation</u> – Water savings resulting from plumbing codes and other institutionalized water efficiency measures. Sometimes referred to as "passive conservation," this form of conservation would occur as a matter of course without any additional financial incentives from water agencies. In addition, water savings from Model Water Efficiency Ordinance (MWELO) is assumed for 50 percent of new home construction since the ordinance does not have a uniform effective enforcement mechanism for compliance. MWELO is also assumed not to affect water use projections for existing homes and businesses. Water savings from codes, standards, and ordinances are discussed in Appendix 6.
- <u>Active Conservation</u> – Water saved as a direct result of programs and practices directly funded by a water utility. Active conservation is unlikely to occur without agency action.
- <u>Price Effect Conservation</u> – Reductions in customer use attributable to changes in the real (inflation adjusted) cost of water. Because water has a positive price elasticity of demand, increases in water price will decrease the quantity of water demanded by the end use consumer.
- <u>Pre-1990 Savings</u> – Conservation savings are commonly estimated from a base-year water-use profile. Beginning with the 1996 IRP, Metropolitan identified 1980 as the base year for estimating conservation because it marked the effective date of a new plumbing code in California requiring toilets in new construction to be rated at 3.5 gallons per flush or less. Between 1980 and 1990, Metropolitan's service area saved an estimated 250 TAF per year as the result of this 1980 plumbing code and unrelated water rate increases. Within Metropolitan's planning framework, these savings are referred to as "pre-1990 savings."

Metropolitan's conservation savings projection includes savings from Metropolitan's Conservation Credits Program, code-based conservation, price effect conservation, and pre-1990 device retrofits. The projection does not include savings from the implementation of future active conservation programs.

Local Supplies

Local supplies represent water produced or imported independently by the member agencies and other local water agencies within Metropolitan's service area. Local supplies are a key component in determining how much Metropolitan supply is needed. Projections of local supplies relied on information gathered from several sources including past urban water management plans, Metropolitan's annual local supply survey, and communications between Metropolitan and member agency staff. Local supplies include:

- <u>Groundwater and Surface Water</u> – Groundwater production consists of extractions from local groundwater basins. Groundwater production is supported by the active recharge of stormwater, recycled water, and imported water. Passive recharge (or native yield) also supports groundwater production. Surface water comes from stream diversions and rainwater captured in reservoirs.

- The Los Angeles Aqueduct – A major source of imported water is conveyed from the Owens Valley via the Los Angeles Aqueduct (LAA) by the Los Angeles Department of Water and Power (LADWP). Although LADWP imports water from outside of Metropolitan's service area, Metropolitan classifies water provided by the LAA as a local resource because it is developed and controlled independently by a local agency.
- Seawater Desalination – Highly treated seawater suitable for municipal and industrial potable use.
- Groundwater Recovery and Recycled Water – Developed and operated by local water agencies, groundwater recovery projects treat degraded groundwater to meet potable use standards. Recycled water projects recycle wastewater for municipal, industrial, and agricultural consumptive uses as well as for groundwater replenishment and local seawater intrusion barriers.

The local supply projections presented in the demand tables are consistent with the local supply projections that the Metropolitan member agencies are including in their respective UWMPs.[3] [4] Information regarding the member agencies' local supply projections was compiled through the extensive coordination process between Metropolitan and its member agencies. Additionally, Metropolitan maintains an inventory of member agency local supply projects that have been identified within Metropolitan's service area. Appendix 5 contains the inventory of local supply projects by type of supply and includes a classification that shows the current stage of development for each supply in the inventory. The stages of development included in Appendix 5 are: Existing, Under Construction, CEQA, and Conceptual projects. The project inventory in Appendix 5 was updated and completed as part of the 2020 IRP Update survey completed by Metropolitan's member agencies in June 2019 and October 2020.

Determining Demands on Metropolitan

Metropolitan serves imported water to its 26 member agencies. For most member agencies, they have other sources of water produced locally from groundwater basins, surface reservoirs, the LAA, recycled water projects, groundwater recovery projects, and seawater desalination projects. When local supplies are not enough to meet retail demands, member agencies purchase supplemental water from Metropolitan.

In determining demands for imported water, Metropolitan developed its Sales Model to calculate the difference between total forecasted retail demands and local supply projections

[3] One variation from the member agency local supply reporting is the Colorado River water SDCWA secured from Coachella Canal Lining Project and All-American Canal Lining Project that it exchanges with Metropolitan pursuant to the parties' Exchange Agreement, since that water is provided to Metropolitan at Lake Havasu where Metropolitan receives other Colorado River water, used by Metropolitan like other Colorado River supplies, and Metropolitan delivers a like-amount of Metropolitan blended water to SDCWA in exchange. (See Section 1 at p. 22.)

[4] Another variation from the member agency local supply reporting is the hydrology used for projecting future Los Angeles Aqueduct supply. LADWP in its UWMP uses a 30-year median hydrology from FY 1985/86 to 2014/15 while Metropolitan uses the 1922 to 2017 hydrology provided by LADWP, consistent with Metropolitan's modeling framework. The discrepancies between LADWP's 30-year median hydrology and Metropolitan's 96 hydrology resulted in Metropolitan's projection being approximately 70,000 acre-feet higher in average conditions. In a single dry-year, LADWP uses the FY 1989/1990 hydrology while Metropolitan uses 1977 hydrology, resulting in Metropolitan's projection being approximately 50,000 acre-feet higher. Both Metropolitan and LADWP use the 1988-1992 hydrology for five consecutive dry-year conditions.

on a per member agency basis. The balance is the demand on Metropolitan's imported water supply. The Sales Model calculates the difference between forecasted demands and projected local supplies after factoring in climate impacts to both demand and local supply. The Sales Model employs a modeling method using historical hydrologic conditions from 1922 to 2017 to simulate the expected demands on Metropolitan supplies based on hydrologic conditions. Each hydrologic condition results in one possible outcome for the forecast year in the planning horizon. For example, each forecast year, such as 2025, has 96 possible outcomes, one for each historical hydrology year during the period 1922 to 2017. This method of modeling produces a distribution of outcomes ranging from the driest to the wettest years within this historical period.

The Sales Model forecasts three types of demands on Metropolitan:

1. Consumptive Use – Metropolitan's supplies that are used to meet retail M&I demand.
2. Seawater Barrier – Imported water needed to hold back seawater intrusion into the coastal groundwater basins.
3. Replenishment – Water for groundwater or reservoir replenishment, when available, to meet replenishment demands.

Due to differences in data and modeling methodology, the results of Metropolitan's forecast are not directly comparable to member agencies' forecasts. Differences from the member agencies forecasts are not cumulative and can offset each other on the regional level. The overall impact is within the range of Metropolitan's supply capability under all year types.

For additional information on Metropolitan's demand forecast, see Appendix 1.

Table 2-1
Metropolitan Regional Water Demands
Single Dry-Year
(Acre-Feet)

		2025	2030	2035	2040	2045
A.	**Total Demands[1]**	**4,929,000**	**5,037,000**	**5,160,000**	**5,265,000**	**5,378,000**
	Retail Municipal and Industrial	4,397,000	4,507,000	4,626,000	4,737,000	4,848,000
	Retail Agricultural	144,000	134,000	130,000	122,000	123,000
	Seawater Barrier	61,000	61,000	61,000	61,000	61,000
	Storage Replenishment	327,000	334,000	343,000	345,000	346,000
B.	**Total Conservation**	**1,162,000**	**1,211,000**	**1,263,000**	**1,325,000**	**1,389,000**
	Existing Active (through 2020)[2]	93,000	55,000	35,000	25,000	17,000
	Code-based	560,000	623,000	665,000	701,000	731,000
	Price-Effect[3]	259,000	283,000	313,000	349,000	391,000
	Pre-1990 Conservation	250,000	250,000	250,000	250,000	250,000
C.	**Total Local and Other Imported Supplies**	**2,501,000**	**2,604,000**	**2,702,000**	**2,722,000**	**2,743,000**
	Groundwater	1,278,000	1,300,000	1,324,000	1,333,000	1,344,000
	Surface Water	78,000	80,000	80,000	80,000	80,000
	Los Angeles Aqueduct[4]	119,000	119,000	119,000	119,000	119,000
	Seawater Desalination	56,000	56,000	56,000	56,000	56,000
	Groundwater Recovery	143,000	157,000	158,000	158,000	159,000
	Recycling[5]	550,000	613,000	687,000	698,000	706,000
	Other Imported Supplies[6]	278,000	278,000	278,000	278,000	278,000
D.	**Total Metropolitan Demands**	**1,266,000**	**1,222,000**	**1,195,000**	**1,218,000**	**1,247,000**
	Consumptive Use	1,125,000	1,081,000	1,055,000	1,078,000	1,107,000
	Seawater Barrier	4,000	4,000	4,000	4,000	4,000
	Replenishment	136,000	136,000	136,000	136,000	136,000

Notes:
All units are acre-feet unless specified, rounded to the nearest thousand.
Totals may not sum due to rounding.
[1] Growth projections are based on SCAG 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy and SANDAG San Diego Forward: The 2019 Federal Regional Transportation Plan.
[2] Does not include future active conservation savings. 1990 is base year.
[3] Includes un-metered water use savings.
[4] Los Angeles Aqueduct Projection uses 1977 hydrology.
[5] Excludes Santa Ana River base flow, which is used for recharge of Orange County groundwater basin and reflected in the Groundwater production numbers.
[6] Exchange with SDCWA.

Table 2-2
Metropolitan Regional Water Demands
Drought Lasting Five Consecutive Water Years
(Acre-Feet)

		2025	2030	2035	2040	2045
A.	**Total Demands[1]**	**4,877,000**	**5,064,000**	**5,182,000**	**5,299,000**	**5,410,000**
	Retail Municipal and Industrial	4,414,000	4,540,000	4,658,000	4,777,000	4,889,000
	Retail Agricultural	147,000	143,000	135,000	129,000	126,000
	Seawater Barrier	61,000	61,000	61,000	61,000	61,000
	Storage Replenishment	255,000	319,000	327,000	332,000	334,000
B.	**Total Conservation**	**1,162,000**	**1,211,000**	**1,263,000**	**1,325,000**	**1,389,000**
	Existing Active (through 2020)[2]	93,000	55,000	35,000	25,000	17,000
	Code-based	560,000	623,000	665,000	701,000	731,000
	Price-Effect[3]	259,000	283,000	313,000	349,000	391,000
	Pre-1990 Conservation	250,000	250,000	250,000	250,000	250,000
C.	**Total Local and Other Imported Supplies**	**2,400,000**	**2,561,000**	**2,660,000**	**2,713,000**	**2,736,000**
	Groundwater	1,240,000	1,293,000	1,316,000	1,333,000	1,345,000
	Surface Water	77,000	76,000	77,000	77,000	77,000
	Los Angeles Aqueduct[4]	118,000	118,000	118,000	118,000	118,000
	Seawater Desalination	56,000	56,000	56,000	56,000	56,000
	Groundwater Recovery	139,000	152,000	158,000	158,000	159,000
	Recycling[5]	491,000	588,000	658,000	694,000	703,000
	Other Imported Supplies[6]	278,000	278,000	278,000	278,000	278,000
D.	**Total Metropolitan Demands**	**1,314,000**	**1,292,000**	**1,259,000**	**1,261,000**	**1,286,000**
	Consumptive Use	1,221,000	1,164,000	1,130,000	1,132,000	1,158,000
	Seawater Barrier	8,000	4,000	4,000	4,000	4,000
	Replenishment	85,000	124,000	124,000	124,000	124,000

Notes:
All units are acre-feet unless specified, rounded to the nearest thousand.
Totals may not sum due to rounding.
[1] Growth projections are based on SCAG 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy and SANDAG San Diego Forward: The 2019 Federal Regional Transportation Plan.
[2] Does not include future active conservation savings. 1990 is base year.
[3] Includes un-metered water use savings.
[4] Los Angeles Aqueduct Projection uses 1988-1992 hydrology.
[5] Excludes Santa Ana River base flow, which is used for recharge of Orange County groundwater basin and reflected in the Groundwater production numbers.
[6] Exchange with SDCWA.

Table 2-3
Metropolitan Regional Water Demands
Normal Water Year
(Acre-Feet)

		2025	2030	2035	2040	2045
A.	**Total Demands[1]**	**4,925,000**	**5,032,000**	**5,156,000**	**5,261,000**	**5,374,000**
	Retail Municipal and Industrial	4,403,000	4,514,000	4,632,000	4,743,000	4,854,000
	Retail Agricultural	144,000	134,000	130,000	123,000	123,000
	Seawater Barrier	61,000	61,000	61,000	61,000	61,000
	Storage Replenishment	316,000	323,000	332,000	334,000	335,000
B.	**Total Conservation**	**1,162,000**	**1,211,000**	**1,263,000**	**1,325,000**	**1,389,000**
	Existing Active (through 2020)[2]	93,000	55,000	35,000	25,000	17,000
	Code-based	560,000	623,000	665,000	701,000	731,000
	Price-Effect[3]	259,000	283,000	313,000	349,000	391,000
	Pre-1990 Conservation	250,000	250,000	250,000	250,000	250,000
C.	**Total Local and Other Imported Supplies**	**2,613,000**	**2,712,000**	**2,809,000**	**2,836,000**	**2,860,000**
	Groundwater	1,255,000	1,273,000	1,296,000	1,311,000	1,326,000
	Surface Water	80,000	82,000	82,000	82,000	82,000
	Los Angeles Aqueduct[4]	257,000	257,000	258,000	258,000	258,000
	Seawater Desalination	51,000	51,000	51,000	51,000	51,000
	Groundwater Recovery	143,000	157,000	158,000	158,000	159,000
	Recycling[5]	550,000	613,000	687,000	698,000	706,000
	Other Imported Supplies[6]	278,000	278,000	278,000	278,000	278,000
D.	**Total Metropolitan Demands**	**1,149,000**	**1,110,000**	**1,084,000**	**1,100,000**	**1,125,000**
	Consumptive Use	1,020,000	981,000	954,000	971,000	996,000
	Seawater Barrier	4,000	4,000	4,000	4,000	4,000
	Replenishment	125,000	125,000	125,000	125,000	125,000

Notes:
All units are acre-feet unless specified, rounded to the nearest thousand.
Totals may not sum due to rounding.
[1] Growth projections are based on SCAG 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy and SANDAG San Diego Forward: The 2019 Federal Regional Transportation Plan.
[2] Does not include future active conservation savings. 1990 is base year.
[3] Includes un-metered water use savings.
[4] Los Angeles Aqueduct Projection uses 1922-2017 hydrology.
[5] Excludes Santa Ana River base flow, which is used for recharge of Orange County groundwater basin and reflected in the Groundwater production numbers.
[6] Exchange with SDCWA.

2.3 Water Reliability Assessment

After estimating demands for normal water year, single dry year, and droughts lasting at least five years, the water reliability assessment for the UWMP requires urban water suppliers to identify projected supplies to meet these demands. Table 2-4 summarizes the sources of supply for the single dry year (1977 hydrology), while Table 2-5 shows the region's ability to respond in future years under a repeat of the 1988-92 drought period lasting five consecutive water years. Table 2-5 provides results for the average of the five consecutive dry-year period rather than a year-by-year detail. Over the years, Metropolitan has developed numerous programs to increase its water supply capabilities, dry year supplies, and regional storage. These programs may be exercised in conjunction with effective demand management measures during drought years. Under this reliability planning, if a five consecutive year drought sequence was to repeat, Metropolitan could exercise similar supply augmentation and demand management options for each of the five drought years at the appropriate level to meet demands. This methodology best captures Metropolitan's complex demand and supply planning with appropriate flexibility. Table 2-6 reports assessment under a normal water year represented by the average of the 96 historic hydrologies from 1922 to 2017. Appendix 2 provides a detailed description of the existing regional water supplies and Appendix 3 contains detailed justifications for the sources of supply used for this analysis.

Metropolitan's supply capabilities are evaluated using the following assumptions:

Colorado River Supplies

Colorado River supplies include Metropolitan's basic Colorado River apportionment, as well as supplies that result from existing and committed programs, including those from the IID-MWD Conservation Program, the implementation of the Quantification Settlement Agreement (QSA), related agreements, and the exchange agreement with SDCWA. The QSA established the baseline water use for each of the agreement parties and facilitates the transfer of water from agricultural agencies to urban uses. Since the QSA, additional programs have been implemented to increase Metropolitan's supplies. These include the PVID Land Management, Crop Rotation, and Water Supply Program, as well as the Lower Colorado River Water Supply Project. The 2007 Interim Guidelines provided for the coordinated operation of Lake Powell and Lake Mead, as well as the Intentionally Created Surplus (ICS) program that allows Metropolitan to store water in Lake Mead. These stored supplies can be used to supply additional water to ensure that, when needed, Metropolitan can deliver up to the CRA capacity of 1.25 MAF. A detailed discussion of the QSA is included in Section 3.1 and Appendix 3.1.

In light of declining reservoir levels, the Lower Basin Drought Contingency Plan (DCP) was signed in 2019. This agreement incentivizes storage in Lake Mead and requires certain volumes of water be stored in Lake Mead under certain Lake Mead elevation levels through 2026. Metropolitan is to store certain volumes of water in Lake Mead as DCP ICS once Lake Mead is below elevation 1,045 feet. This agreement also increases Metropolitan's flexibility to take delivery of water stored as ICS at Lake Mead elevations below 1,075 feet. The goal of this agreement is to keep Lake Mead above critical elevations, and overall, it increases Metropolitan's flexibility to store water in Lake Mead in greater volumes and to take delivery of stored water to fill the CRA as needed.

Projections for the Colorado River supplies for the 2020 UWMP are based on the United States Bureau of Reclamation's (USBR) Colorado River Simulation System (CRSS) modeling developed in January 2021, which is the latest available at the time of production of this plan. USBR modeling is used to estimate Metropolitan's basic apportionment and the availability of QSA and other related programs. While the official January 2021 CRSS run uses a full historical hydrology set, USBR also examines a stress test hydrology set as a proxy to show climate change impacts. The stress test hydrology includes the latest 30 years which has lower inflows as compared to the full hydrology. The reliability assessments are inclusive of the sequence of hydrology found within the stress test hydrology set and is by proxy an estimate of lower inflows resulting from climate change. USBR is currently developing a climate change hydrology set that utilizes a suite of global climate models but it was unavailable at this time. For this reliability assessment, Metropolitan used the current methodologies USBR employs in its official CRSS run.

State Water Project Supplies

SWP supplies are estimated using the 2019 SWP Delivery Capability Report distributed by DWR in August 2020 and the Early Long-Term (ELT) Alternative described in the 2015 SWP Delivery Capability Report. The 2019 SWP Delivery Capability Report presents current DWR estimates of the amount of water deliveries for current (2020) conditions and conditions 20 years in the future, assuming currently existing SWP facilities. Since this UWMP uses DWR's 2019 SWP Delivery Capability Report to estimate future SWP supplies, any changes in supply reliability that would result from new facilities proposed under the Delta Conveyance Project and Sites Reservoir are not included in the following tables. These estimates incorporate restrictions on SWP and Central Valley Project (CVP) operations in accordance with water quality objectives established by the State Water Resources Control Board, the biological opinions of the U.S. Fish and Wildlife Service and National Marine Fisheries Service issued on October 21, 2019, and the Incidental Take Permit issued by the California Department of Fish and Wildlife on March 31, 2020. In addition, these estimates incorporate amendments to the Coordinated Operations Agreement between the Central Valley Project and the State Water Project made in 2018. Under the 2019 SWP Delivery Capability Report - existing condition scenario, the delivery estimates for the SWP for 2020 conditions as a percentage of Table A amounts are 58 percent, equivalent to 1,109 TAF for Metropolitan, under a single dry-year (1977) condition and 7 percent, equivalent to 134 TAF for Metropolitan, under a long-term average condition. Detailed description of SWP supply programs are included in Section 3.2 and Appendix 3.2. To include consideration of climate change impacts, the ELT alternative as described in the 2015 Delivery Capability Report was also utilized in the analysis. DWR included climate change impacts to deliveries at a 2025 emission level and 15 cm of sea level rise in this alternative. DWR also considers the current impacts to State Water Project deliveries from existing subsidence in the Delivery Capability Report. In the 2019 Delivery Capability Report, they found that subsidence has reduced the flow capacity in the aqueduct at locations in San Luis and San Joaquin Field Divisions but has not yet resulted in a reduction in deliveries. DWR may address any potential future impacts of subsidence based on the efficacy of Sustainable Groundwater Management Act and Groundwater Management Plans in future analyses.

In dry, below-normal conditions, Metropolitan has increased the supplies received from the California Aqueduct by developing flexible Central Valley/SWP storage and transfer programs. Over the years, under the pumping restrictions of the SWP, Metropolitan has collaborated with the other contractors to develop numerous voluntary Central Valley/SWP storage and transfer programs. The goal of these storage/transfer programs is to develop additional dry-year supplies that can be conveyed through the California Aqueduct during dry hydrologic conditions and regulatory restrictions. Descriptions of these storage and transfer programs are included in Section 3.3 and Appendix 3.2.

Storage

A key component of Metropolitan's water supply capability is the amount of water in Metropolitan's storage facilities. Over the past two decades, Metropolitan has developed a large regional storage portfolio that includes both dry-year and emergency storage capacity. Storage is a key component of water management. Storage enables the capture of surplus amounts of water in normal and wet climate and hydrologic conditions when it is plentiful for supply and environmental uses. Stored water can then be used in dry years and in conditions where augmented water supplies are needed to meet demands. Metropolitan's resource analysis model considers all the capacities and constraints of its storage facilities and programs and simulates the fill and withdrawal of these facilities through the 96 hydrologic conditions from 1922 to 2017. In-region storage and supply programs are discussed in detail in Section 3.6 and Appendix 3.3.

Interpreting Metropolitan's Reliability Assessment and Supply Capabilities in the UWMP

Metropolitan's long-term water service reliability assessment performed for the UWMP shows that, under required and stated assumptions and the conditions required by the Act, there would be supply and storage capabilities, and projected surplus supplies, sufficient to meet projected demands from 2025 through 2045. This assessment applies under a normal water year, a single dry year, and five consecutive drought year conditions as specified by the Act. However, this assessment should be considered as addressing the specific conditions and assumptions stated in the UWMP and is not inclusive of a fuller range of assumptions and conditions that are considered in the 2020 IRP, which is Metropolitan's primary long-term water supply reliability planning process. To address the uncertainties and planning parameters in the IRP, additional supply and demand management measures may be identified and developed and implemented that are outside of the needs and capabilities indicated by the UWMP reliability assessments. A write up on the impact of alternative forecasts and projections of local supplies on Demand on Metropolitan is included in the 2020 Reference Materials page posted on Metropolitan's website (www.mwdh2o.com). This write up provides supplemental information on alternative forecasts and projections for estimating local supply development and production in the service area that may be appropriate for different planning applications and its impact on estimates of Demand on Metropolitan.

Table 2-4
Single Dry-Year
Supply Capability[1] and Projected Demands
Repeat of 1977 Hydrology
(Acre-feet per year)

Forecast Year	2025	2030	2035	2040	2045
Current Programs					
In-Region Supplies and Programs	875,000	877,000	876,000	876,000	874,000
California Aqueduct[2]	647,000	634,000	634,000	634,000	633,000
Colorado River Aqueduct					
Total Supply Available[3]	1,424,000	1,403,500	1,352,500	1,352,500	1,380,750
Aqueduct Capacity Limit[4]	*1,250,000*	*1,250,000*	*1,250,000*	*1,250,000*	*1,250,000*
Colorado River Aqueduct Capability	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Capability of Current Programs	**2,772,000**	**2,761,000**	**2,760,000**	**2,760,000**	**2,757,000**
Demands					
Total Demands on Metropolitan	1,266,000	1,222,000	1,195,000	1,218,000	1,247,000
Exchange with SDCWA	278,000	278,000	278,000	278,000	278,000
Total Metropolitan Deliveries[5]	**1,544,000**	**1,500,000**	**1,473,000**	**1,496,000**	**1,525,000**
Surplus	**1,228,000**	**1,261,000**	**1,287,000**	**1,264,000**	**1,232,000**
Programs Under Development					
In-Region Supplies and Programs	0	0	0	0	0
California Aqueduct	0	0	0	0	0
Colorado River Aqueduct					
Total Supply Available[3]	0	0	0	0	0
Aqueduct Capacity Limit[4]	*0*	*0*	*0*	*0*	*0*
Colorado River Aqueduct Capability	0	0	0	0	0
Capability of Proposed Programs	**0**	**0**	**0**	**0**	**0**
Potential Surplus	**1,228,000**	**1,261,000**	**1,287,000**	**1,264,000**	**1,232,000**

[1] Represents Supply Capability for resource programs under listed year type.
[2] California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.
[3] Colorado River Aqueduct includes programs and Exchange with SDCWA conveyed by the aqueduct.
[4] Maximum CRA deliveries limited to 1.25 MAF including Exchange with SDCWA.
[5] Total demands are adjusted to include Exchange with SDCWA.

Table 2-5
Drought Lasting Five Consecutive Water Years
Supply Capability[1] and Projected Demands
Repeat of 1988-1992 Hydrology
(Acre-feet per year)

Forecast Year	2025	2030	2035	2040	2045
Current Programs					
In-Region Supplies and Programs	194,000	197,000	197,000	197,000	197,000
California Aqueduct[2]	734,800	772,000	794,000	816,000	792,000
Colorado River Aqueduct					
Total Supply Available[3]	1,410,000	1,403,500	1,403,500	1,365,000	1,380,750
Aqueduct Capacity Limit[4]	*1,250,000*	*1,250,000*	*1,250,000*	*1,250,000*	*1,250,000*
Colorado River Aqueduct Capability	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Capability of Current Programs	**2,178,800**	**2,219,000**	**2,241,000**	**2,263,000**	**2,239,000**
Demands					
Total Demands on Metropolitan	1,314,000	1,292,000	1,259,000	1,261,000	1,286,000
Exchange with SDCWA	278,000	278,000	278,000	278,000	278,000
Total Metropolitan Deliveries[5]	**1,592,000**	**1,570,000**	**1,537,000**	**1,539,000**	**1,564,000**
Surplus	**586,800**	**649,000**	**704,000**	**724,000**	**675,000**
Programs Under Development					
In-Region Supplies and Programs	0	0	0	0	0
California Aqueduct	0	0	0	0	0
Colorado River Aqueduct					
Total Supply Available[3]	0	0	0	0	0
Aqueduct Capacity Limit[4]	*0*	*0*	*0*	*0*	*0*
Colorado River Aqueduct Capability	*0*	*0*	*0*	*0*	*0*
Capability of Proposed Programs	**0**	**0**	**0**	**0**	**0**
Potential Surplus	**586,800**	**649,000**	**704,000**	**724,000**	**675,000**

[1] Represents Supply Capability for resource programs under listed year type.
[2] California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.
[3] Colorado River Aqueduct includes programs and Exchange with SDCWA conveyed by the aqueduct.
[4] Maximum CRA deliveries limited to 1.25 MAF including Exchange with SDCWA.
[5] Total demands are adjusted to include Exchange with SDCWA.

Table 2-6
Normal Water Year
Supply Capability[1] and Projected Demands
Average of 1922-2017 Hydrologies
(Acre-feet per year)

Forecast Year	2025	2030	2035	2040	2045
Current Programs					
In-Region Supplies and Programs	875,000	877,000	876,000	876,000	874,000
California Aqueduct[2]	1,774,000	1,766,000	1,764,000	1,762,000	1,761,000
Colorado River Aqueduct					
Total Supply Available[3]	1,453,000	1,390,500	1,390,500	1,339,500	1,367,750
Aqueduct Capacity Limit[4]	*1,250,000*	*1,250,000*	*1,250,000*	*1,250,000*	*1,250,000*
Colorado River Aqueduct Capability	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Capability of Current Programs	**3,899,000**	**3,893,000**	**3,890,000**	**3,888,000**	**3,885,000**
Demands					
Total Demands on Metropolitan	1,149,000	1,110,000	1,084,000	1,100,000	1,125,000
Exchange with SDCWA	278,000	278,000	278,000	278,000	278,000
Total Metropolitan Deliveries[5]	**1,427,000**	**1,388,000**	**1,362,000**	**1,378,000**	**1,403,000**
Surplus	**2,472,000**	**2,505,000**	**2,528,000**	**2,510,000**	**2,482,000**
Programs Under Development					
In-Region Supplies and Programs	0	0	0	0	0
California Aqueduct	13,000	13,000	13,000	13,000	13,000
Colorado River Aqueduct					
Total Supply Available[3]	0	0	0	0	0
Aqueduct Capacity Limit[4]	*0*	*0*	*0*	*0*	*0*
Colorado River Aqueduct Capability	0	0	0	0	0
Capability of Proposed Programs	**13,000**	**13,000**	**13,000**	**13,000**	**13,000**
Potential Surplus	**2,485,000**	**2,518,000**	**2,541,000**	**2,523,000**	**2,495,000**

[1] Represents Supply Capability for resource programs under listed year type.

[2] California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.

[3] Colorado River Aqueduct includes programs and Exchange with SDCWA conveyed by the aqueduct.

[4] Maximum CRA deliveries limited to 1.25 MAF including Exchange with SDCWA.

[5] Total demands are adjusted to include Exchange with SDCWA.

2.4 Drought Risk Assessment

CWC Section 10635(b) requires every urban water supplier to include, as part of its urban water management plan, a drought risk assessment (DRA) for its water service as part of information considered in developing its demand management measures and water supply projects and programs. The DRA analysis allows suppliers to consider how to manage their water supplies during stressed hydrologic conditions in relation to variations in demand. The DRA helps a supplier to evaluate the functionality of its WSCP shortage response actions and understand the type and degree of response that is appropriate for managing water supplies. This evaluation can help the supplier to identify risks and take proactive steps before the next actual drought lasting at least five consecutive years.

CWC Section 10612 requires the DRA to be based on the driest five-year historic sequence for the agency's water supply. Furthermore, CWC Section 10635 also requires that the analysis consider plausible changes on projected supplies and demands due to climate change, anticipated regulatory changes, and other locally applicable criteria, and that the DRA start from the year following when the assessment is conducted. For the 2020 UWMP, DRA is developed for years 2021 through 2025. Accordingly, the 2020 UWMP Guidebook suggests that the historic five driest consecutive years on record may be considered a starting point in the analysis which is informed by other factors. Suppliers may then use these estimated supply conditions to prepare the DRA analysis, assuming they occur over the next five years.

For Metropolitan, the five-consecutive years of 1988 to 1992 represent the driest five-consecutive year historic sequence for Metropolitan's water supply. Thus, Metropolitan used this five-year historic sequence to complete its DRA. Metropolitan developed estimates of future demands and supplies from local sources and from Metropolitan sources based on 96 years (1922-2017) of historic hydrology. Supply and demand analyses for droughts lasting at least five consecutive water years were based on conditions affecting the SWP, as this supply availability fluctuates the most among Metropolitan's sources of supply. Using the same 96-year period of the SWP supply availability, 1988 to 1992 is the driest 5-year historical sequence that represents the lowest water supply available for SWP supplies to Metropolitan. In addition, staff analysis of the 8-river index indicates that the period 1988 to 1992 represents the lowest five consecutive dry years from 1922 through 2017. The 8-river index is used by DWR and other water agencies as an estimate of the unimpaired runoff (or natural water production) of the Sacramento and San Joaquin River basins, which are sources of water for the SWP.

Water Use Characterization

Metropolitan developed its demand forecast by first estimating total retail demands for its service area and then factoring out water savings attributed to conservation.[5] Projections of local supplies then were derived using data from current and expected local supply programs. The resulting difference between total demands net of savings from conservation and local supplies is the expected regional demands on Metropolitan supplies. As explained in detail in Section 2.2, Metropolitan used its Sales Model to calculate the difference between total forecasted retail demands and local supply projections. The balance is the demand on Metropolitan that will be met by supplies from Colorado River, SWP, and in-region storage.

Based on the 96 years of historic hydrologic condition (1922 to 2017), the five consecutive years of 1988 to 1992 represent the driest five-consecutive year historical sequence for Metropolitan's water supply and the five consecutive driest years for SWP supplies. Thus, Metropolitan used a repeat of the historic condition of 1988 to 1992 to assess the near-term drought risk for years 2021

[5] Information generated as part of this analysis is contained in Appendix 1.

to 2025. Under this assessment, the historic condition for 1988 is used to forecast the water use for the first year 2021, the historic condition for 1989 is used to forecast the water use for the second year 2022, and so on up to year 2025. Metropolitan's projected water use is presented annually for the next five years in Table 2-7, including the year-by-year change in projected use. In addition, estimated actual water use for 2020 and the historic water use for 2016 through 2019 are presented in Table 2-7.

Climate impacts to M&I and Agricultural demands are captured using climate adjustment factors. These factors were estimated using observed range of weather variables, precipitation and temperature, on historical consumptive demands. Metropolitan updated these factors to include the most recent weather and climate outcomes and recent changes in water use and irrigation demands. By incorporating these factors, Metropolitan's demand projections are calibrated to the more recent water use behaviors and better reflect current climate change impacts.

Supply Characterization

Metropolitan's assumptions for its supply capabilities are discussed and presented in 5-year increments under its water reliability assessment in Section 2.3. For Metropolitan's DRA, these supply capabilities are further refined and presented annually for the years 2021 to 2025 by assuming a repeat of historic conditions from 1988 to1992. This historic five-year sequence represents the lowest water supply available for SWP supplies to Metropolitan.

For its DRA, Metropolitan assessed the reliability of each individual water supply source over the five consecutive year drought through a modeling method using the same historical hydrologic conditions from 1922 to 2017. Also, as part of this DRA, the expected quantity of each water supply source for each year of the five-year drought was evaluated and included within the tabulated capability of each supply category. Metropolitan's supply sources under the CR, SWP, and in-region supply categories are individually listed and discussed in detail in Section 3. Future supply capabilities for each of these supply sources are also individually tabulated in Appendix 3, with consideration for plausible changes on projected supplies under climate change conditions, anticipated regulatory changes, and other factors. as explained in Section 2.6.

Metropolitan used DWR's analyses of SWP delivery capability which includes climate change impacts to deliveries at a 2025 emission level and 15 cm of sea level rise. This resulted in adjusted delivery capability. The DWR analyses also incorporates restrictions on SWP and Central Valley Project (CVP) operations in accordance with water quality objectives established by the State Water Resources Control Board, the biological opinions of the U.S. Fish and Wildlife Service and National Marine Fisheries Service issued on October 21, 2019, and the Incidental Take Permit issued by the California Department of Fish and Wildlife on March 31, 2020. In addition, these estimates incorporate amendments to the Coordinated Operations Agreement between the Central Valley Project and the State Water Project made in 2018. In the 2019 Delivery Capability Report, they found that subsidence has reduced the flow capacity in the aqueduct at locations in San Luis and San Joaquin Field Divisions but has not yet resulted in a reduction in deliveries.

For the Colorado River, Metropolitan used the official January 2021 CRSS run which utilized a full hydrology set. USBR also examines a stress test hydrology set as a proxy to show climate change impacts. The stress test hydrology includes the latest 30 years and has lower inflows as compared to the full hydrology. The driest five-year period 1988-1992 falls within this stress test hydrology. USBR acknowledges that climate change impacts are demonstrated in the stress test hydrology. The five-year dry period used by Metropolitan in the DRA is within this stress test hydrology period, incorporating the decreased inflows associated with climate impacts.

The supply capabilities presented in Table 2-7 are based on Metropolitan's core supplies of programs within the Colorado River and SWP. Metropolitan's core water supplies are listed in Appendix 4 WSCP Table A.4-3. In addition, Metropolitan has numerous flexible supplies and storage programs within the Colorado River, SWP, and in-region that may be exercised as supply augmentation actions, if needed, consistent with the shortage response actions identified in Metropolitan's WSCP. The supply capabilities of Metropolitan's core, flexible, and storage programs for 2021 to 2025 are presented in detail in Appendix 3 Table A.3-8.

Total Water Supply and Use Comparison

Metropolitan's DRA is presented in Table 2-7 and provides a comparison of Metropolitan's total water supply and use for the next five years. This table is based on and is an abridged version of DWR's optional Planning Tool. Table 2-7 also includes DWR Submittal Table 7-5, Five-Year Drought Risk Assessment Table to Address Water Code Section 10635(b). Metropolitan's DRA uses annual total comparisons of its water supply and use. Developing the DRA using annual totals versus monthly values is most practicable for large wholesale suppliers, like Metropolitan, with core supply sources that are annually assessed and depend on unpredictable hydrology, such as the SWP, Colorado River, and availability of water transfers, among others.

Metropolitan's near-term assessment reveals that there could be a potential shortfall of core supplies in four of the next five years. This shortfall is largely triggered by the assumed low supply conditions from the SWP under a repeat of the historical condition of 1988 to 1992, which is modeled at 12% for 2021, 15% for 2023, 23% for 2024, and 18% for 2025. Actual supply conditions for the next five years may prove different from these historic supply conditions. This DRA illustrates Metropolitan's potential shortage response actions, if such a shortfall were to happen.

As detailed in Section 2.5 and Appendix 4, Metropolitan has a robust Water Shortage Contingency Plan and comprehensive shortage response planning that include demand reduction measures and supply augmentation actions. For years 2021, 2023, 2024, and 2025, the estimated shortfalls from the Colorado River and SWP core supplies are 432 TAF (Level 3), 388 TAF (Level 3), 23 TAF (Level 1) and 223 TAF (Level 2), respectively, with the corresponding WSCP shortage levels indicated in parentheses. Appendix 4 Table A.4-5 presents Metropolitan's response actions for the different shortage levels, which include take from Storage, execute Flexible Supplies, implement Voluntary Demand Reduction, and implement Water Supply Allocation Plan. Appendix 4 Table A.4-6 further identifies Metropolitan's supply augmentation actions that may be exercised to mitigate any potential shortage, including withdrawal from available flexible supplies and storage programs.

As detailed in Section 3 and Appendix 3, Metropolitan has built its dry-year and emergency storage through partnerships with various entities and investments in infrastructure. As of January 1, 2021, Metropolitan has 3.2 MAF in storage that may be used for dry-year needs, with estimated supply capacity to withdraw and deliver over 1 MAF to 1.4 MAF per year for the next five years. Because dry-year storage is at a record high, Metropolitan may only need to implement supply augmentation actions to meet the potential core supply shortfall. Supply augmentation actions may include exercising Metropolitan's flexible supplies and storage from the Colorado River, SWP, and in-region. In addition to supply augmentation, Metropolitan may also implement demand reduction and operational flexibility as part of its shortage response actions, to preserve storage or under scenarios where dry-year storage levels are not high. The factual shortage response actions, combination of actions selected, and volume of take from supply programs exercised all depend on the shortage that needs to be met, storage balance of the supply programs, program constraints, and other supply management considerations. With a potential core supply surplus estimated for year 2022, no water service reliability concern is anticipated, and no shortage response actions are expected to be exercised.

This DRA shows, under the assumptions described in this UWMP, that Metropolitan's total core, flexible, and storage supplies exceed the projected demand on Metropolitan for 2021 to 2025. This demonstrates Metropolitan's water service reliability for each year of the next five years under a repeat of the driest five-year historic sequence of Metropolitan's water supply. A graphical representation of the DRA is presented in Figure ES-2, as part of the Executive Summary. Metropolitan will periodically revisit its representation of both individual supply sources and of the gross water use estimated for each year and will revise its DRA if needed. A portion of Table 2-7 is also presented in Appendix 12 as new DWR Submittal Table 7-5.

Table 2-7
Metropolitan's Drought Risk Assessment
Water Use, Supply, and Risk Assessment for 2021 – 2025
(also included as Appendix 12 DWR Submittal Table 7-5)

Based on DWR DRA Optional Planning Tool (Annual totals in AF)

Water Use Worksheet	
Historicf and Actual	
2016	1,663,599
2017	1,449,015
2018	1,560,487
2019	1,327,928
Customer Water Use Subtotal	1,394,261
Losses[1]	48,520
2020 Total Gross Water Use	**1,442,781**
Five Consecutive Water Years	
Change from 2020	153,219
2021 Gross Water Use	**1,596,000**
Change from 2021	73,000
2022 Gross Water Use	**1,669,000**
Change from 2022	19,000
2023 Gross Water Use	**1,688,000**
Change from 2023	(197,000)
2024 Gross Water Use	**1,491,000**
Change from 2024	101,000
2025 Gross Water Use	**1,592,000**

[1] Losses include treated system losses and surface reservoir evaporation.

Supply Worksheet[1]	
2021 (1st year)	**1,164,000**
2022 (2nd year)	**1,903,000**
2023 (3rd year)	**1,300,000**
2024 (4th year)	**1,468,000**
2025 (5th year)	**1,369,000**
Supply 1 - Colorado River Aqueduct supplies[2]	
2021 (1st year)	919,000
2022 (2nd year)	866,000
2023 (3rd year)	996,000
2024 (4th year)	979,000
2025 (5th year)	987,000
Supply 2 - State Water Project supplies	
2021 (1st year)	245,000
2022 (2nd year)	1,037,000
2023 (3rd year)	304,000
2024 (4th year)	489,000
2025 (5th year)	382,000
Supply 3 - In-Region supplies	
2021 (1st year)	0
2022 (2nd year)	0
2023 (3rd year)	0
2024 (4th year)	0
2025 (5th year)	0

DRAFT Submittal Table 7-5: Five-Year Drought Risk Assessment Tables to address Water Code Section 10635(b)

2021	Total
Gross Water Use	**1,596,000**
Total Supplies	**1,164,000**
Surplus/Shortfall w/o WSCP Action	**(432,000)**
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	432,000
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	**0%**

2022	Total
Gross Water Use [Use Worksheet]	**1,669,000**
Total Supplies [Supply Worksheet]	**1,903,000**
Surplus/Shortfall w/o WSCP Action	**234,000**
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	0
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	234,000
Resulting % Use Reduction from WSCP action	**0%**

2023	Total
Gross Water Use [Use Worksheet]	**1,688,000**
Total Supplies [Supply Worksheet]	**1,300,000**
Surplus/Shortfall w/o WSCP Action	**(388,000)**
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	388,000
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	**0%**

2024	Total
Gross Water Use [Use Worksheet]	**1,491,000**
Total Supplies [Supply Worksheet]	**1,468,000**
Surplus/Shortfall w/o WSCP Action	**(23,000)**
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	23,000
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	**0%**

2025	Total
Gross Water Use [Use Worksheet]	**1,592,000**
Total Supplies [Supply Worksheet]	**1,369,000**
Surplus/Shortfall w/o WSCP Action	**(223,000)**
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	223,000
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	**0%**

1. Includes Metropolitan's core supplies as defined in WSCP in Appendix 4. Detailed Supply Worksheets are included in Appendix 3 Table A.3-8. Metropolitan may exercise supply augmentation actions from flexible and storage programs as response to any potential core supply shortfall using the 3.2 MAF of dry-year supplies currently in storage. In addition, Metropolitan may also implement demand reduction actions, if needed.
2. Maximum CRA deliveries limited to 1.25 MAF, including Exchange with SDCWA and US.

2.5 Water Shortage Contingency Plan

In addition to the water supply reliability analysis addressing normal, dry, and multiple dry water years, CWC Section 10632 requires urban suppliers to prepare and adopt a water shortage contingency plan which includes the shortage response actions that they would take in response to six standard water shortage levels. The Water Shortage Contingency Plan (WSCP) is Metropolitan's plan in the case of an actual water shortage condition. As illustrated in the preceding section's service reliability assessment, Metropolitan has the supply capabilities to meet projected demands during various hydrologic conditions. With such service reliability, Metropolitan's WSCP is part of its resiliency strategy to improve preparedness for droughts and other impacts on water supplies. In fulfillment of the Act's requirements, described below are the WSCP reporting elements which show how Metropolitan will manage and mitigate a water shortage. A copy of Metropolitan's WSCP is provided in Appendix 4.

Water Supply Reliability Analysis

CWC Section 10632(a)(1) directs the WSCP to include an "analysis of water supply reliability conducted pursuant to Section 10635." As shown in the water reliability assessment in Section 2.3, Metropolitan anticipates being able to meet water demands with adequate supplies across the single driest year and droughts lasting five consecutive water years scenarios through the year 2045. Metropolitan's DRA in Section 2.4. anticipates no water service reliability concerns or shortfall mitigation measures will be needed over the next five years, under a repeat of the historic driest five-year sequence of Metropolitan's water supply.

Annual Water Supply and Demand Assessment Procedures

Pursuant to CWC Section 10632(a)(2), Metropolitan must include in its WSCP the procedures used for conducting an annual Water Supply and Demand Assessment (Annual Assessment). The Annual Assessment is a determination of Metropolitan's annual outlook for water supply reliability, and how a perceived shortage may relate to WSCP shortage stage response actions in the current calendar year. This determination will be based on information available to Metropolitan at the time of the analysis. Starting in 2022, the Annual Assessment will be due by July 1 of every year. CWC Section 10632.1 states: "An urban water supplier that relies on imported water from the State Water Project or the Bureau of Reclamation shall submit its annual water supply and demand assessment within 14 days of receiving its final allocations, or by July 1 of each year, whichever is later." The Annual Assessment and related reporting are to be conducted based on the procedures described in the WSCP.

The Annual Assessment determination will be based on considerations of available core water supplies, unconstrained water demand, planned water use, and infrastructure conditions. The difference between projected core water supplies and anticipated unconstrained demand will be used to determine what, if any, shortage stage is expected under the WSCP framework. CWC Section10632(a)(2)(B)(ii) requires the Annual Assessment to determine "current year available supply, considering hydrological and regulatory conditions in the current year and one dry year." The Annual Assessment will include two separate estimations of Metropolitan's annual water supply and unconstrained demand using: 1) current year conditions and 2) assumed dry year conditions. Accordingly, the Annual Assessment's shortage analysis will present separate sets of findings for the current year and dry year scenarios. The CWC does not specify the characteristics of a dry year, allowing discretion to the Supplier. Metropolitan will use this discretion to refine and update its assumptions for a dry year scenario in each Annual Assessment as information becomes available.

By the month of June, Metropolitan staff will present a completed Annual Assessment for approval by Metropolitan's Board of Directors or by the Board's authorized designee with expressly delegated authority for approval of Annual Assessment determinations. This presentation to the decision-making body will include a request that the approval of the Annual Assessment determination also appropriately triggers any recommended specific shortage response actions resulting from the assessment. Upon approval, Metropolitan staff will then formally submit the Annual Assessment to the California Department of Water Resources by July 1.

Six Standard Water Shortage Levels

As required by CWC 10632(a)(3)(A), the WSCP is framed around six standard shortage levels that correspond to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortages. Each of the six shortage levels represents an increasing gap between Metropolitan's estimated core supplies and unconstrained demand as determined in the Annual Assessment. Shortage levels also apply to catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other emergency events.

Shortage Response Actions

CWC 10632(a)(4) directs the WSCP to contain shortage response actions that align with the defined shortage levels, and include:

- Supply Augmentation Actions
- Demand Reduction Actions
- Operational Changes
- Additional, mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions (Not applicable to Metropolitan as a wholesaler with no retail customers)
- An estimate of the extent to which the gap between supplies and demand will be reduced by implementation of each action.

Metropolitan has invested extensively in a diverse portfolio of supply sources and system resiliency to prepare for a wide range of possible challenging conditions. Metropolitan follows the principles of its Water Surplus and Demand Management (WSDM) Plan, which was adopted in 1999 and provides policy guidance for managing regional water supplies to achieve reliability.

Shortage responses will be customized to meet the circumstances for the particular shortage. Because circumstances can change at any time, Metropolitan's shortage responses actions will be adjusted accordingly throughout the year. To determine specific actions that would be taken at each standard shortage level, Metropolitan will evaluate conditions specific to cost, timing, distribution needs and capabilities, and other variables that include SWP allocation, Colorado River conditions, preexisting demand reduction measures, supply program take capacities, and storage balances.

Supply augmentation actions are comprised of Metropolitan's portfolio of water storage reserves and flexible supply sources that are available on an as-needed basis, such as water from its storage facilities and from transfer and exchange programs. Demand reduction actions are temporary measures that can constrain demand in the current year, such as public information campaigns and mandatory allocations. Operational flexibility actions are an acknowledgement that Metropolitan will adjust its operations as needed during shortages. These adjustments may include temporarily deferring or accelerating scheduled maintenance and planned shutdowns or adjusting the distribution system to compensate for limitations in Colorado River or State Water Project water.

Shortages are characterized not merely by shortfalls in annual core water supplies, but also by the water balances in Metropolitan's storage programs. Thus, a 10 percent or even a 50 percent shortfall in core supplies could be met entirely with stored water if storage levels are sufficient to meet demand. If storage levels are already depleted, the same shortfall in core supplies could potentially require a more complex mix of supply augmentation and demand reduction actions. During most years, Metropolitan anticipates that it can meet all or most shortages with supply augmentation actions. Depending on intensity, voluntary demand reduction measures are estimated to reduce retail water usage by up to 20 percent. In the most severe situations, allocating shortages to member agencies through the Water Supply Allocation Plan (WSAP) would address any remaining shortages not already mitigated by supply augmentation and lesser demand reduction actions.

Communication Protocols

Metropolitan's WSCP Communication Plan details Metropolitan's action-oriented strategy for education, outreach, and coordination during each WSCP standard shortage stage and in response to a catastrophic loss of supply. The WSCP Communications Plan provides messaging strategies that would be implemented at each level, leading up to more focused crisis communication strategies. It emphasizes the need for plans to be adaptable and that Metropolitan management and/or Board of Directors could also call for specific messaging strategies that address unique shortage scenarios.

Compliance and Enforcement

This WSCP reporting element is required for urban retail suppliers only.

Legal Authorities

Metropolitan is a wholesale water provider organized as a cooperative of 26 voluntary members. Metropolitan was formed pursuant to the Metropolitan Water District Act, Statutes 1969, chapter 209, codified at California Water Code, Appendix Section 109 (the "MWD Act"). Pursuant to the MWD Act, Metropolitan has the express and implied statutory authority to "[p]rovide, sell, and deliver water at wholesale for municipal and domestic uses and purposes," among other powers. (MWD Act, §§ 120, 130.) To accomplish the provision of water, Metropolitan is also expressly authorized to promote and implement conservation programs, including during times of water shortage. (MWD Act, § 130.5.)

Metropolitan also has authority under the California Water Code to implement supply shortage programs. (Cal. Water Code, §§ 350-359, 375-378.) For example, Section 375(a) of the Water Code provides:

Notwithstanding any other provision of the law, any public entity which supplies water at retail or wholesale for the benefit of persons within the service area or area of jurisdiction of the public entity may, by ordinance or resolution adopted by a majority of the members of the governing body after holding a public hearing upon notice and making appropriate findings of necessity for the adoption of a water conservation program, adopt and enforce a water conservation program to reduce the quantity of water used by those persons for the purpose of conserving the water supplies of the public entity.

Cal. Water Code, § 375(a). Water Code Section 375(b) also provides the authority for pricing to encourage water conservation.

Metropolitan's Board of Directors has approved many policies and rules, codified in Metropolitan's own Administrative Code, which further provide Metropolitan the authority to ensure the availability of its water during times of shortages. For example, Administrative Code Section 3107 requires that any territory annexed to Metropolitan comply with Metropolitan's water use efficiency guidelines.

The Board has also ratified various policies and rules to implement a Water Supply Allocation Plan (WSAP) to address shortage conditions. Metropolitan's WSAP provides a standardized methodology for allocating supplies during times of shortage. The WSAP is authorized pursuant to the following Board actions:

- By Minute Item 43514, dated April 13, 1999, the Board adopted the Water Surplus and Drought Management Plan.
- By Minute Item 44005, dated June 17, 2000, the General Manager has the authority to reduce Interim Agriculture Water Program deliveries up to 30 percent prior to imposing any mandatory allocation under the Water Surplus and Drought Management Plan.
- By Minute Item 47393, dated February 12, 2008, the Board adopted the Water Supply Allocation Plan.
- By Minute Item 48376, dated August 17, 2010, the Board approved adjustments to the Water Supply Allocation Plan.
- By Minute Item 48803, dated September 12, 2011, the Board approved adjustments to the Water Supply Allocation Plan.
- By Minute Item 74526, dated February 11, 2014, the Board adopted the Water Supply Alert Resolution.
- By Minute Item 49979, dated December 9, 2014, the Board approved adjustments to the Water Supply Allocation Plan.

In addition to the statutes and other legal authorities set forth above, Metropolitan is empowered to implement and enforce its shortage response actions pursuant to various resolutions. For example, on April 11, 2016, Metropolitan's Board voted to adopt Metropolitan's 2015 UWMP and authorized its submittal to the State of California as stated in Resolution 9209. Metropolitan's 2015 UWMP contains Metropolitan's December 2014 Water Supply Allocation Plan in Appendix 4. Metropolitan's 2015 UWMP also describes in Section 2.4 Metropolitan's WSAP and Water Surplus and Drought Management (WSDM) Plan, which guide Metropolitan's planning and operations during both shortage and surplus conditions. Similarly, on May 11, 2021, Metropolitan's Board voted to adopt Metropolitan's UWMP and WSCP as stated in Resolutions 9279 and 9281, respectively. These two Resolutions authorize Metropolitan to implement and enforce its shortage response actions contained in the WSCP, which is attached as Appendix 4 to the UWMP.

Additionally, numerous agreements allow Metropolitan to take its shortage response actions. Supply augmentation actions are authorized by the agreements shown in Appendix 3 of the 2020 UWMP: Justifications for Supply Projections.

If necessary, Metropolitan shall declare a water shortage emergency in accordance with CWC Chapter 3 (commencing with Section 350) of Division 1. In addition, Metropolitan shall coordinate with any city or county within which it provides water supply services for the possible proclamation of a local emergency, as defined in Government Code Section 8558.

Financial Consequences of WSCP

A water shortage may be created by either a reduction in water supply, or an increase in water demand, or a combination of both. Metropolitan's shortage response actions include supply augmentation, demand management, and operational flexibility, all of which could impact Metropolitan financially. From these financial effects, there is a potential for expenditures exceeding revenues more than budgeted, thereby requiring unanticipated draws from reserves.

Variation in the amount of revenues is already part of Metropolitan's financial planning. Revenues vary according to regional weather and the availability of statewide water supplies. In dry years, local demands increase, and Metropolitan may receive higher than anticipated revenues due to increased sales volumes. In contrast, in wet years, demands decrease, and revenues drop due to lower sales volumes. In addition, statewide supply shortages such as those in 2009 and 2015 also affect Metropolitan's revenues. Such revenue surpluses and shortages could cause instability in water rates. To mitigate this risk, Metropolitan maintains financial reserves, with a minimum and target balance, to stabilize water rates during times of reduced water sales. The reserves hold revenues collected during times of high water sales and are used to offset the need for revenues during times of low sales. Metropolitan's practice of using reserves to buffer unexpected increases or decreases in budgeted revenue also applies to unexpected expenditure increases or decreases resulting from shortage responses.

Metropolitan uses its financial reserves to mitigate the impacts of water shortages. This policy applies to each of the six shortage levels described in the WSCP. Financial reserves create a buffer to reduce the financial impact of the water shortage. Other mitigation actions such as reducing O&M expenses, deferring Capital Improvement Projects, and rates/charges increases are part of Metropolitan's biennial budget and rate design cycle and are not used routinely to mitigate financial impacts of water shortage response actions.

Metropolitan's reserve policy provides for a minimum reserve requirement and target amount of unrestricted reserves at June 30 of each year. Funds in excess of the target amount are to be utilized for capital expenditures in lieu of the issuance of additional debt, or for the redemption, defeasance or purchase of outstanding bonds or commercial paper as determined by the Board. However, if the fixed charge coverage ratio (the amount necessary to cover all fixed costs) is at or above 1.2, amounts over the minimum may be expended for any lawful purpose of Metropolitan, as determined by the Board. Therefore, unrestricted reserves are available to address Metropolitan's shortage response actions, as well as the consequences of those actions, so long as its fixed charge coverage ratio is at or above 1.2.

Monitoring and Reporting

This WSCP reporting element is required for urban retail suppliers only.

WSCP Reevaluation and Improvement

The WSCP will be periodically re-evaluated to ensure that its shortage response actions are effective and up to date based on lessons learned from implementing the WSCP. The WSCP will be revised and updated during the UWMP update cycle to incorporate updated and new information. For example, new supply augmentation actions will be added, and actions that are no longer applicable for reasons such as program expiration will be removed. However, if significant revisions are warranted, the WSCP will be updated outside of the UWMP update cycle. In the course of preparing the Annual Assessment each year, Metropolitan staff will routinely consider the functionality of the overall WSCP and will prepare recommendations for Metropolitan's Board of Directors if changes are found to be needed.

Relationship with other Metropolitan Shortage Planning

The WSCP is designed to be consistent with the Water Shortage and Demand Management (WSDM) Plan, Water Supply Allocation Plan (WSAP), and other emergency planning efforts as described below. WSDM Plan principles guide the specific actions to be taken under WSCP shortage stages. Data collection, continual analysis, and monthly reporting processes of WSDM Plan implementation will form the basis for Metropolitan's Annual Water Supply Demand Assessment that will be provided annually to the state beginning in July 2022. The WSAP is integral to the WSCP's shortage response strategy in the event that Metropolitan determines that supply augmentation (including storage) and lesser demand reduction measures would not be sufficient to meet a projected shortage.

Water Surplus and Drought Management Plan

Metropolitan's Board adopted the WSDM Plan in April 1999, which provides policy guidance for managing regional water supplies to achieve the reliability goals of the IRP and identifies the expected sequence of resource management actions that Metropolitan will execute during surpluses and shortages to minimize the probability of severe shortages and reduce the possibility of extreme shortages and shortage allocations. Unlike Metropolitan's previous shortage management plans, the WSDM Plan recognizes the link between surpluses and shortages, and it integrates planned operational actions with respect to both conditions.

WSDM Plan Development

Metropolitan and its member agencies jointly developed the WSDM Plan during 1998 and 1999. This planning effort included more than a dozen half-day and full-day workshops and more than three dozen meetings between Metropolitan and member agency staff. The result of the planning effort is a consensus plan that addresses a broad range of regional water management actions and strategies.

WSDM Plan Principles and Goals

The guiding principle of the WSDM Plan is to manage Metropolitan's water resources and management programs to maximize management of wet year supplies and minimize adverse impacts of water shortages to retail customers. From this guiding principle came the following supporting principles:

- Encourage efficient water use and economical local resource programs
- Coordinate operations with member agencies to make available as much surplus water as possible for use in dry years
- Pursue innovative transfer and banking programs to secure more imported water for use in dry years
- Increase public awareness about water supply issues

The WSDM Plan also declared that if mandatory import water allocations become necessary, they would be calculated on the basis of need, as opposed to any type of historical purchases. The WSDM Plan contains the following considerations that would go into an allocation of imported water:

- Impact on retail consumers and regional economy
- Investments in local resources, including recycling and conservation
- Population growth

- Changes and/or losses in local supplies
- Participation in Metropolitan's non-firm (interruptible) programs
- Investment in Metropolitan's facilities

<u>WSDM Plan Implementation</u>

Each year, Metropolitan evaluates the level of supplies available and existing levels of water in storage to determine the appropriate management stage. Each stage is associated with specific resource management actions designed to: (1) avoid an Extreme Shortage to the maximum extent possible; and (2) minimize adverse impacts to retail customers if an Extreme Shortage occurs. The current sequencing outlined in the WSDM Plan reflects anticipated responses based on detailed modeling of Metropolitan's existing and expected resource mix.

<u>Surplus Stages</u>

Metropolitan's supply situation is considered to be in surplus as long as net annual deliveries can be made to water storage programs. The WSDM Plan further defines four surplus management stages that guide the storage of surplus supplies in Metropolitan's storage portfolio. Deliveries for storage in DVL and in SWP terminal reservoirs continue through each surplus stage provided there is available storage capacity. Withdrawals from DVL for regulatory purposes or to meet seasonal demands may occur in any stage. Deliveries to other storage facilities may be interrupted, depending on the amount of the surplus.

<u>Shortage Stages</u>

The WSDM Plan distinguishes between Shortages, Severe Shortages, and Extreme Shortages. Within the WSDM Plan, these terms have specific meanings relating to Metropolitan's ability to deliver water to its member agency customers.

Shortage: Metropolitan can meet full-service demands and partially meet or fully meet interruptible demands, using stored water or water transfers as necessary.

Severe Shortage: Metropolitan can meet full-service demands only by using stored water, transfers, and possibly calling for extraordinary conservation.

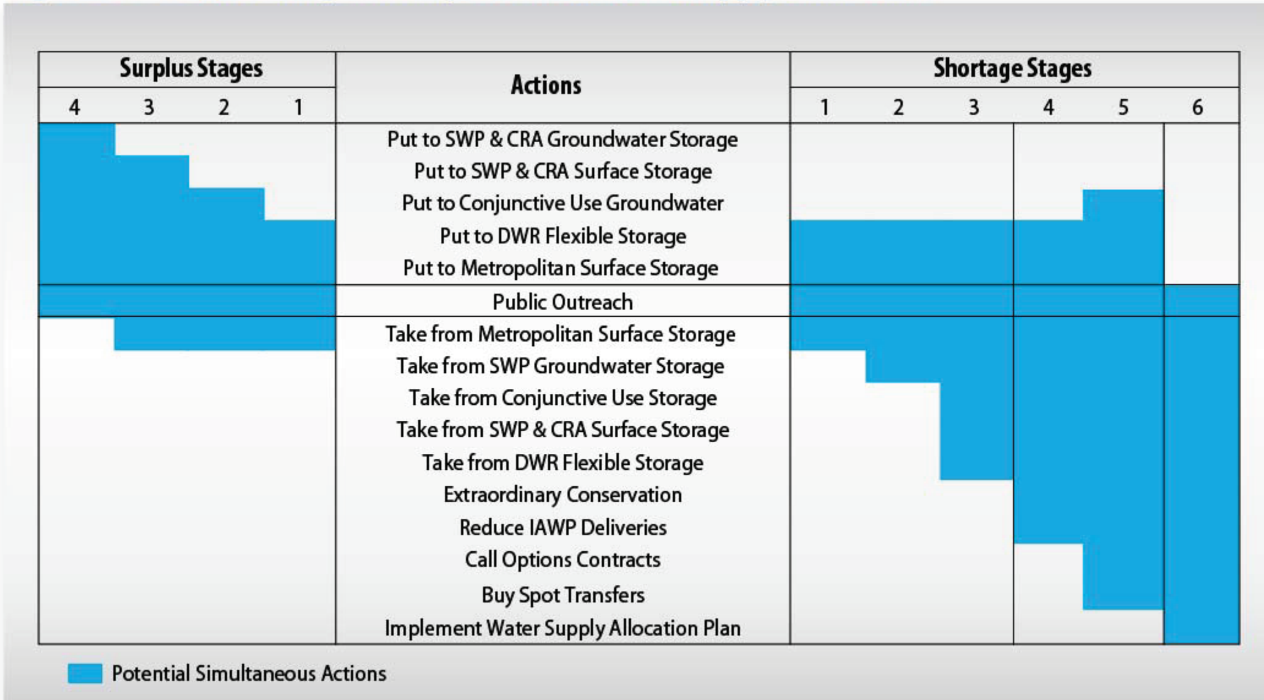
Extreme Shortage: Metropolitan allocates available supply to full-service customers.

The WSDM Plan also defines six shortage management stages to guide resource management activities. These stages are not defined merely by shortfalls in imported water supply, but also by the water balances in Metropolitan's storage programs. Thus, a 10 percent shortfall in imported supplies could be a stage one shortage if storage levels are high. If storage levels are already depleted, the same shortfall in imported supplies could potentially be defined as a more severe shortage.

When Metropolitan must make net withdrawals from storage to meet demands, it is considered to be in a shortage condition. Under most of these stages, Metropolitan is still able to meet all end-use demands for water. For shortage stages 1 through 3, Metropolitan will meet demands by withdrawing water from storage. At shortage stages 4 and 5, Metropolitan may undertake additional shortage management steps, including issuing public calls for extraordinary conservation and exercising water transfer options, or purchasing water on the open market.

Figure 2-1 shows the actions under surplus and shortage stages and when an allocation plan would be necessary to enforce mandatory cutbacks. The overriding goal of the WSDM Plan is to avoid reaching Shortage Stage 6, an Extreme Shortage.

Figure 2-1 Resource Stages, Anticipated Actions, And Supply Declarations



Water Supply Allocation Plan

The WSAP provides a formula for allocating available water supplies to the member agencies in case of extreme water shortages within Metropolitan's service area. The WSAP was approved by Metropolitan's Board in February 2008 and has since been implemented three times, most recently in April 2015. The WSAP was developed in consideration of the principles and guidelines described in the WSDM Plan, with the objective of creating an equitable needs-based allocation. The WSAP formula seeks to balance the impacts of a shortage at the retail level for shortages of Metropolitan supplies of up to 50 percent. The formula takes into account growth, local investments, changes in supply conditions, and the demand hardening aspects of non-potable recycled water use and the implementation of conservation savings programs.

Water Supply Allocation Plan Development

Between July 2007 and February 2008, Metropolitan staff worked jointly with Metropolitan's member agencies to develop the WSAP. Throughout the development process, Metropolitan's Board was provided with regular progress reports on the status of the WSAP. The WSAP was adopted at the February 12, 2008 Board meeting. Since the WSAP's adoption in 2008, Metropolitan has worked extensively with the member agencies to periodically review the WSAP formula. Following Board-directed formal review of the WSAP at 12 months after initial implementation and at 3 years after initial adoption, the Board approved adjustments to the WSAP formula on August 17, 2010, and September 13, 2011. In light of drought conditions, Metropolitan staff convened a member agency working group between July and November 2014 to revisit the WSAP before possible implementation in 2015. On December 9, 2014, the Board approved additional adjustments to the formula.

The WSAP Formula

The WSAP formula is calculated in three steps: base period calculations, allocation year calculations, and supply allocation calculations. The first two steps involve standard computations, while the third step contains specific methodology developed for the WSAP.

Step 1: Base Period Calculations

The first step in calculating a water supply allocation is to estimate water supply and demand using a historical base period with established water supply and delivery data. The base period for each of the different categories of demand and supply is calculated using data from fiscal years (July through June) ending 2013 and 2014.

Step 2: Allocation Year Calculations

The next step in calculating the water supply allocation is estimating water needs in the allocation year. This is done by adjusting the base period estimates of retail demand for population growth and changes in local supplies.

Step 3: Supply Allocation Calculations

The final step is calculating the water supply allocation for each member agency based on the allocation year water needs identified in Step 2. There are a number of adjustments that go into a member agency's water supply allocation. Each element and its application in the allocation formula are discussed in detail in Metropolitan's WSAP.

Annual Reporting Schedule on Supply/Demand Conditions

Managing Metropolitan's water supply resources to minimize the risk of shortages requires timely and accurate information on changing supply and demand conditions throughout the year. To facilitate effective resource management decisions, the WSDM Plan includes a monthly schedule for providing supply/demand information to Metropolitan's senior management and Board, and for making resource allocation decisions. Table 2-8 shows this schedule.

Table 2-8
Schedule of Reporting and Water Supply Allocation Decision-Making

Month	Information Report/Management Decision
January	Initial supply/demand forecasts for year
February - March	Update supply/demand forecasts for year
April - May	Finalize supply/demand forecasts Management decisions re: Contractual Groundwater and Option Transfer Programs Board decision re: Need for Extraordinary Conservation
October - December	Report on Supply and Carryover Storage

Catastrophic and Emergency Planning

As part of the WSCP, the CWC requires urban suppliers to plan for catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other potential emergency events. In addition, CWC Section 10632.5 further requires urban water suppliers to develop a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities. For Metropolitan, these required planning elements are captured in the analyses that went into developing its Emergency Storage Objective, Seismic Resiliency Reports, and Emergency Response Plans. Elements of these Metropolitan analyses are summarized below.

Emergency Storage Objective

Metropolitan established its original criteria for determining emergency storage requirements in the October 1991 Final Environmental Impact Report for the Eastside Reservoir, which is now named Diamond Valley Lake. These criteria were again discussed in the 1996 IRP. Metropolitan's Board approved both of these documents. Emergency storage requirements are based on the potential of a major earthquake that would damage all supply aqueducts isolating Southern California from its imported water sources.

In 2019, Metropolitan and its member agencies completed a collaborative process to update the regional planning estimate of Metropolitan's Emergency Storage Objective. This emergency storage represents the amount of water that Metropolitan would store for the region in preparation for a catastrophic earthquake that would damage the aqueducts that transport imported water supplies to Southern California, including: the Colorado River Aqueduct, both the East and West branches of the California Aqueduct, and the Los Angeles Aqueduct.

The emergency storage allows Metropolitan to deliver reserve supplies to the member agencies to supplement local production. This helps avoid severe water shortages during periods when the imported water aqueducts may be out of service. The Emergency Storage Objective considers a six- and twelve-month outage period for the imported supply aqueducts incorporating latest seismic information and operational flexibility of Metropolitan's system, a retail water demand cutback ranging from 25 to 35 percent considering the level of conservation that the region achieved during the recent drought, and an aggregated loss of 10 to 20 percent of local supplies accounting for factors that could affect local production during emergency conditions.

Under this update, Metropolitan's Emergency Storage Objective was set to 750 TAF, as this level of storage would prevent severe water shortages to the region given new information on expected recovery durations. The emergency storage volume represents a planning estimate for the amount of water that Metropolitan would store for the region in preparation for a catastrophic earthquake or other disaster. It is not intended to set a basis or a policy for allocating or apportioning storage for any individual member agency. The detailed description of Metropolitan's Emergency Storage Objective is included in Appendix 8.

Emergency Freshwater Pathway (Sacramento-San Joaquin Delta)

It has been estimated by the California Department of Water Resources (DWR) that in the event of a major earthquake in or near the Delta, water supplies could be interrupted for up to three years, posing a significant and unacceptable risk to the California business economy. A post-event strategy would provide necessary water supply protections to avert this catastrophe. Such a plan has been coordinated through DWR, Corps of Engineers (Corps), Bureau of Reclamation (Reclamation), California Office of Emergency Services (Cal OES), Metropolitan, and the State Water Contractors.

<u>DWR Delta Flood Emergency Management Plan</u>

The Delta Flood Emergency Management Plan (DWR, 2018) provides strategies for response to Delta levee failures, up to and including earthquake-induced multiple island failures during dry conditions when the volume of flooded islands and saltwater intrusion are large, resulting in curtailment of export operations. Under these severe conditions, the plan includes a strategy to establish an emergency freshwater pathway from the central Delta along Middle River and Victoria Canal to the export pumps in the south Delta. The plan includes the prepositioning of emergency construction materials at existing and new stockpile and warehouse sites in the Delta, and development of tactical modeling tools (DWR Emergency Response Tool) to predict levee repair logistics, timelines of levee repair and suitable water quality to restore exports. The Delta Flood Emergency Management Plan has been extensively coordinated with state, federal and local emergency response agencies. DWR, in conjunction with local agencies, the Corps and Cal OES, conduct tabletop and field exercises to test and revise the plan under real time conditions.

DWR and the Corps provide vital Delta region response to flood and earthquake emergencies, complementary to Cal OES operations. These agencies perform under a unified command structure and response and recovery framework. The Northern California Catastrophic Flood Response Plan (Cal OES, 2018) incorporates the DWR Delta Flood Emergency Management Plan. The Delta Emergency Operations Integration Plan (DWR and USACE, 2019) integrates personnel and resources during emergency operations.

<u>Pathway Implementation Timeline</u>

The Delta Flood Emergency Management Plan has found that using pre-positioned stockpiles of rock, sheet pile and other materials, multiple earthquake-generated levee breaches and levee slumping along the freshwater pathway can be repaired in less than six months. A supplemental report (Levee Repair, Channel Barrier and Transfer Facility Concept Analyses to Support Emergency Preparedness Planning, M&N, August 2007) evaluated among other options, the placement of sheet pile to close levee breaches, as a redundant method if availability of rock is limited by possible competing uses. The stockpiling of sheet pile is vital should more extreme emergencies warrant parallel and multiple repair techniques for deep levee breaches. Stockpiles of sheet pile and rock to repair deep breaches and an array of levee slumping restoration materials are stored at DWR and Corps stockpile sites and warehouses in the Delta.

<u>Emergency Stockpile Sites and Materials</u>

DWR has acquired lands at Rio Vista and Stockton as major emergency stockpile sites, which are located and designed for rapid response to levee emergencies. The sites provide large loading facilities, open storage areas and new and existing warehousing for emergency flood fight materials, which augment existing warehousing facilities throughout the Delta. The Corps maintains large warehousing facilities in the Delta to store materials for levee freeboard restoration, which can be augmented upon request of other stockpiles in the United States. Pre-positioned rock and sheet pile are used for closure of deep levee breaches. Warehoused materials for rapid restoration of slumped levees include muscle (k-rail) walls, super sacks, caged rock containers, sandbags, stakes and plastic tarp. Stockpiles will be augmented as materials are used.

<u>Emergency Response Drills</u>

Earthquake-initiated multiple island failures will mobilize DWR and Corps resources to perform Delta region flood fight activities within an overall Cal OES framework. In these events, DWR and the Corps integrate personnel and resources to execute flood fight plans through the Delta Emergency Operations Integration Plan (DWR and USACE, 2019). DWR, the Corps and local agencies perform emergency exercises focusing on communication readiness and the testing of mobile apps for information collection and dissemination. The exercises train personnel and test the readiness of emergency preparedness and response capabilities under unified command, and provide information to help to revise and improve plans.

Levee Improvements and Prioritization

The DWR Delta Levees Subventions and Special Projects Programs have prioritized, funded and implemented levee improvements along the emergency freshwater pathway and other water supply corridors in the central and south Delta. These efforts are complementary to the Delta Flood Emergency Management Plan, which along with pre-positioned emergency flood fight materials, ensures reasonable seismic performance of levees and timely pathway restoration after a severe earthquake. These programs have been successful in implementing a coordinated strategy of emergency preparedness to the benefit of SWP and CVP export systems.

Significant improvements to the central and south Delta levees systems along Old and Middle Rivers began in 2010 and are continuing to the present time. This complements substantially improved levees at Mandeville and McDonald Islands and portions of Victoria and Union Islands. Levee improvements along the Middle River emergency freshwater pathway and Old River consist of crest raising, crest widening, landside slope fill and toe berms, which improve seismic stability, reduce levee slumping and create a more robust flood-fighting platform. Urban agencies, including Metropolitan, Contra Costa Water District, East Bay Municipal Utility District, and others have participated in levee improvement projects along or near the Old and Middle River corridors.

SWP Seismic Improvement

DWR's recent SWP seismic resiliency efforts have focused heavily on SWP Dam Safety. The most prominent is the joint USBR/DWR corrective action study of Sisk Dam which will result in a massive seismic stability alteration project - to begin next year. Similarly, Perris Dam had a major foundation modification and stability berm added to the downstream face which has resulted in the removal of the DSOD imposed storage restriction. Several analyses have been conducted on SWP dam outlet towers/access bridges which has resulted in seismic upgrades (some completed/some on-going). Updated dam seismic safety evaluations are being performed on the Oroville Dam embankment and the radial gate control structure on the flood control spillway.

In addition to the dam safety elements, DWR has procured and stockpiled spare pipe sections for the SBA to increase recovery times following seismic induced damage (as part of the 2015 South Bay Aqueduct Reliability Improvement Project). Seismic retrofits have also been completed on 23 SWP bridges located in four Field Divisions with additional retrofits in various development stages. DWR has also updated the earthquake notification procedures and has replaced and expanded instrumentation for the SWP's seismic network.

Electrical Outages

Metropolitan has also developed contingency plans that enable it to deal with both planned and unplanned electrical outages. These plans include the following key points:

- In event of power outages, water supply can be maintained by gravity feed from regional reservoirs such as DVL, Lake Mathews, Castaic Lake, and Silverwood Lake.
- Maintaining water treatment operations is a key concern. As a result, all Metropolitan treatment plants have at least two emergency generators capable of operating the treatment plant in the event of supply failure on the main electrical grid. These generators will automatically operate when power from the grid is interrupted, and annual testing is conducted to ensure they are operational and reliable. In addition, within the water treatment plants there are also dual electrical systems for all critical facilities (e.g., chemical feed systems) to provide redundancy and resiliency.

- Valves at Lake Skinner can be operated by the backup generation at the Lake Skinner treatment plant.
- Metropolitan owns mobile generators that can be transported quickly to key locations, such as reservoir Intake/outtake structures, if necessary.
- The CRA electric transmission system can supply power to the five CRA pumping plants from three independent power sources: Mead 230kV substation located near Hoover Dam; Parker Dam 230kV substation near Gene; and from interconnections with Southern California Edison. These multiple locations where Metropolitan's 230 kV transmission system interconnects to the regional transmission grid provide a redundant path to bring 230 kV power to Hinds, Eagle Mountain, Iron Mountain and Gene Pumping Plants. In addition to redundant paths of power to each CRA pumping plant, the CRA electric transmission system has dual lines from the 230 kV Mead substation and multiple disconnect switches and circuit breakers. This improves the flexibility of the CRA electric transmission system to isolate portions of the system for maintenance or repairs and re-route power from the three independent power sources to the pumping plants while repairs are executed.

Seismic Risk Assessment and Mitigation Plan

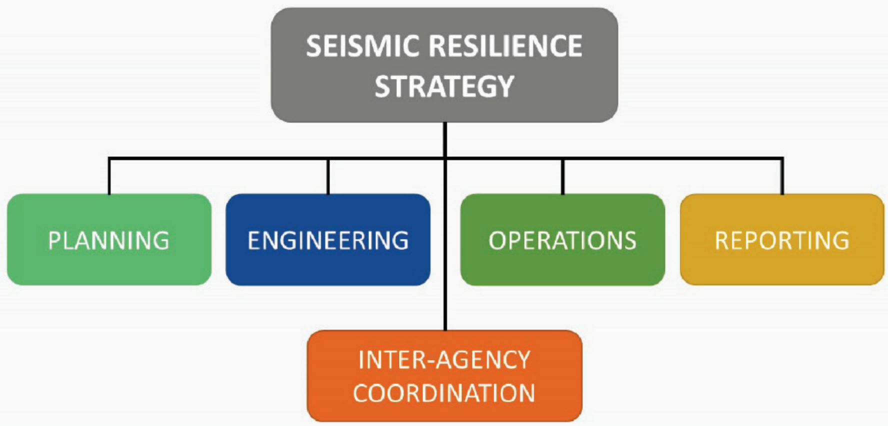
Beginning January 2020, CWC Section 10632.5 mandates UWMPs to include a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities. For Metropolitan, the required assessment and plan are accomplished as part of developing its resilience strategy and are presented in detail in its seismic resiliency reports. This section provides a summary of the various components of Metropolitan's resilience strategy. These components are described in detail in Metropolitan's Seismic Resilience Report First Biennial Report (February 2018) and Seismic Resilience Report 2020 Update (February 2020) presented as part of Appendix 9.

Over its nearly 90-year history, Metropolitan has been proactive in mitigating seismic risks posed to its expansive infrastructure, as well as improving its ability to maintain (or quickly restore) water deliveries following a major earthquake. This ability to mitigate seismic risks and maintain (or quickly restore) water deliveries following a seismic event is referred to as "seismic resilience." Metropolitan's holistic strategy for seismic resilience follows a "defense in depth" multi-layered approach for managing risk. Metropolitan's Seismic Resilience Strategy has three primary objectives:

1. Provide a diversified water supply portfolio, system flexibility, and emergency storage
2. Prevent damage to water delivery infrastructure in probable seismic events and limit damage in extreme events
3. Minimize water delivery interruptions through a dedicated emergency response and recovery organization

Metropolitan's Seismic Resilience Strategy is implemented through four components that encompass the various internal functions that promote Metropolitan's seismic resilience objectives. These components are supplemented by Metropolitan's commitment to inter-agency coordination when preparing and responding to a seismic event and other emergencies. The strategy is shown below in Figure 2-2.

Figure 2-2 Seismic Resilience Strategy



A brief description of the components of Metropolitan's Seismic Resilience Strategy and examples of their implementation are provided below.

Planning

The goals of the planning component are to develop and maintain a diversified water resource portfolio; provide a flexible system that allows for operational changes to handle variations in water supply, planned or unplanned system outages; and to maintain adequate emergency storage supplies. Metropolitan has developed a diverse water resource portfolio through the enactment of various exchange and water banking programs. These water supply programs are described in detail in Section 3 and Appendix 3. In addition to existing supply programs, development of the Regional Recycled Water Program would provide Metropolitan with an additional water resource and would be strategically located on the coastal side of the San Andreas Fault. Metropolitan also strives for regional seismic resilience by incentivizing local agencies to develop increased conservation, recycling, storage, and other water management programs.

As Metropolitan expanded its system over the years, it has continually improved the flexibility of the system to handle changes in water supply or pipeline or facility outages. One example of Metropolitan's system flexibility is the Common Pool service area, which can be supplied by the Jensen, Weymouth, or Diemer water treatment plants. Additionally, Metropolitan has constructed its system such that most of the service area can be supplied by either Colorado River or State Water Project supplies.

Metropolitan's imported water supplies from the CRA and SWP East and West Branches cross the San Andreas Fault (SAF) Zone prior to reaching Metropolitan's service area. A major earthquake on the SAF has the potential of damaging all three aqueducts and disrupting imported supplies for up to six months. Metropolitan constructed Diamond Valley Lake (DVL) on the coastal side of the fault to mitigate the potential impacts of a major SAF earthquake to its service area. Completion of DVL nearly doubled Metropolitan's available surface water storage in the region and, along with other local reservoirs, is used to maintain 6 to 12 months of emergency water storage supply. Water from DVL can supply 4 of Metropolitan's 5 regional water treatment plants.

Engineering

The goal of the engineering component is to assess and mitigate seismic risk to individual facilities and the system. This is accomplished through Metropolitan's Seismic Resilience of Structures Program, the Seismic Resilience of Pipelines Program, the Dam Safety Program, and through special seismic assessments.

Seismic Resilience of Structures

Metropolitan's program to increase the seismic resilience of structures is an ongoing program with the goal of protecting life safety and critical infrastructure to minimize water delivery interruptions following a seismic event. The initial program focused on evaluating the seismic risk of above ground structures (e.g. water treatment plants) constructed prior to 1990 and upgrading structures to mitigate the risk when found to be seismically deficient. The program has recently expanded to include post-1990 structures due to the progress made on the initial list of structures. Examples of seismically upgraded facilities include the Colorado River Aqueduct pump plant buildings, the Weymouth East and West Wash Water Tanks, and the Diemer and Jensen Administration Buildings.

Seismic Resilience of Pipelines

Metropolitan's conveyance and distribution system has been built in conformance with standards and practice at the time of design. In keeping with the goals of the Seismic Resilience Strategy, Metropolitan is developing seismic design criteria for new pipelines based on current state of practice, geotechnical and seismicity criteria, operating conditions, and asset management strategies. The planned design approach for new pipelines will be to establish performance criteria, identify seismicity and ground conditions along the alignment, and design the pipeline to resist damage from ground shaking and deformation. Specialized pipe joints and sections can be designed to accommodate ground deformation from fault displacement or liquefaction. For existing pipelines, seismic resilience will be incorporated as a component of pipeline rehabilitation projects. Metropolitan will evaluate each upgrade individually to balance risk, performance, and cost. Metropolitan's Casa Loma Siphon Barrel No. 1 Seismic Upgrade Project is an example of Metropolitan incorporating seismic design in the rehabilitation of existing pipelines. The existing siphon, which crosses a segment of the San Jacinto Fault Zone and is subject to long-term subsidence, will be replaced with earthquake-resistant ductile iron pipe. The pipe joints are designed to accommodate ground displacement without failure to allow for continued service following an earthquake.

Dam Safety Program

Metropolitan has an ongoing Dam Safety Initiatives Program that has initiated several plans to improve Metropolitan's dam seismic safety and earthquake readiness. These initiatives are being coordinated with the California Division of Safety of Dams (DSOD) and Office of Emergency Services and include the following:

- Ongoing preparation of Emergency Action Plans, including inundation maps
- Performing training exercises at the dam site to test processes during a seismic event
- Providing training and guidance on overall dam safety
- Reviewing operation and maintenance methods for reservoir drawdown and operations after a seismic event
- Updating guidelines and procedures on protection against seismic risk
- Establishing a strong communications system on seismic information

- Performing structural strengthening of dams, including rehabilitation and improvement of spillways and inlet/outlet towers such as Lake Skinner Outlet Tower
- Improving dam safety instrumentation, monitoring, and reporting capabilities

Special Seismic Assessments

Metropolitan conducts special seismic assessments to increase understanding of the vulnerability of Metropolitan's assets and operations to various seismic hazards. The studies focus on hazards specific to individual facilities or the system as a whole and identify options to mitigate the risks posed by the hazards. In addition, the studies support emergency response training and planning for future earthquake events by estimating the magnitude of damage that may occur from various seismic events. The following is a list of some of the reports that Metropolitan has completed.

- Liquefaction Susceptibility Mapping for the Metropolitan Water District of Southern California's Feeder System (Report No. 1625), Carollo Engineers, Inc., 2019.
- Colorado River Aqueduct – San Gorgonio Pass Seismic Event Vulnerability Study (Report No. 1484), GeoPentech, July 2014.
- Potential Effects of Southern California Seismic Events on Metropolitan Water Deliveries (Report No. 1335), Metropolitan Facility Planning staff, January 2009.

Operations

The goal of the operations component is to maintain effective emergency planning and response capabilities. This is accomplished through maintaining an effective Emergency Response Organization, conducting routine emergency response training exercises and maintaining emergency construction capabilities.

Metropolitan's Emergency Response Organization (ERO) is comprised of over 200 predesignated employees who work in the Emergency Operations Center (EOC), the Incident Command Posts, or in the field during emergencies. ERO staff has completed specialized training that meets state and federal requirements. Metropolitan's emergency response structure follows the National Incident Management System (NIMS) and the State of California's Standardized Emergency Management System (SEMS).

In addition to specialized NIMS training, Metropolitan staff routinely participate in emergency response training exercises that are often based on a postulated seismic event. In 2019, Metropolitan started a new five-year emergency exercise plan that will allow all member agencies to participate in at least one of Metropolitan's annual emergency exercises. The first of these exercises was a tabletop exercise for the Orange County member agencies on August 29, 2019, which focused on a hypothetical incident at the Diemer Water Treatment Plant.

Metropolitan has conducted over 100 exercises since February 2018. This included two large functional emergency exercises for the EOC and multiple tabletop exercises, workshops, and seminars for the 12 Incident Command Posts located at the water treatment plants, conveyance and distribution facilities, and other strategic locations in Metropolitan's service area.

Metropolitan maintains the necessary staffing, materials, and equipment to respond to two simultaneous pipeline breaks. The Machine Shop and Coating Shop at La Verne are available to fabricate pipe sizes up to 12 feet in diameter, and Metropolitan's construction forces have the necessary equipment and expertise to make the repairs in-house. In addition, Metropolitan has upgraded its satellite phones to ensure communication ability following a seismic event and is in the process of installing high frequency radios at all Incident Command Posts and the Emergency Operations Center.

Reporting

Metropolitan has committed to providing annual updates to its Board of Directors on its seismic resilience strategy and its progress toward identified short-term and long-term goals. Metropolitan has also committed to providing a formal report on a five-year interval summarizing accomplishments related to seismic resilience and changes in directives to the Seismic Resilience Strategy.

Inter-Agency Coordination

Improving the region's seismic resilience requires that member agencies understand the seismic risks to the imported water supplies so that they may appropriately plan on the local level. Opportunities for inter-agency coordination are provided through the Local Resources Program, where Metropolitan incentivizes the development of local groundwater, recycling, and other supply resources to offset imported demands. As stated previously, Metropolitan provides member agencies the opportunity to participate in emergency response exercises. As part of a recent study, Metropolitan developed maps that define the relative liquefaction susceptibility of the region inclusive of the conveyance and distribution system and has made these maps available to member agencies. Recently, Metropolitan updated the emergency storage goals through several workshops in coordination with member agencies.

Metropolitan is also a member of the Seismic Resilience Water Supply Task Force, along with the California Department of Water Resources (DWR) and the Los Angeles Department of Water and Power (LADWP). As the owners of the three conveyance facilities that provide imported water to the region, Metropolitan, DWR, and LADWP recognize the importance of coordinating responses following a major seismic event that disrupts the imported water supplies. Each agency has provided an overview of the seismic risk to their respective systems and are in the process of developing a Water Mutual Assistance Agreement to formalize the coordination efforts following a major earthquake that disrupts service to the imported water supplies.

Emergency Response Plans

Metropolitan also has two Emergency Response Plans: one dated March 2019 that has been in place long-term and is updated periodically; and a second dated September 2020, prepared pursuant to the requirements of the recently-enacted America's Water Infrastructure Act of 2018. The two plans work in conjunction. Together, Metropolitan's Emergency Response Plans present Metropolitan's organization and strategy for response to emergencies caused by natural hazards, malevolent acts, or other unavoidable circumstances. Metropolitan operates in accordance with the California Standardized Emergency Management System, the Incident Command System, and the National Incident Management System. The Emergency Response Plans provide guidelines for evaluating an emergency situation, responding to an emergency, and activating Incident Command Posts and the Emergency Operations Center. They also describe the Emergency Response Organization. Although the plans provide a framework for emergency response, they do not attempt to identify and discuss every potential situation or problem that may occur during an emergency. The plans will be exercised and updated regularly.

2.6 Other Supply Reliability Risks

Metropolitan provides water to a broad and heterogeneous service area with water supplies from a variety of sources and geographic regions. Each of these demand areas and supplies has its own unique set of benefits and challenges. Among the challenges Metropolitan's region faces are the following:

Supplies

- The Colorado River Basin experienced a severe 5-year drought from 2000-2004 with both precipitation and runoff significantly below average. Since that time, precipitation has been, on average, near normal while runoff has been less than average in two out of every three years. Overall, a potential change in the precipitation to runoff relationship may be resulting in conditions in which less runoff is generated from a given level of precipitation, pushing the system toward a drying trend that is often characterized as a long-term drought.
- Endangered species protection and conveyance needs in the Sacramento-San Joaquin River Delta System have resulted in operational constraints that are particularly important because pumping restrictions impact many water resources programs – SWP supplies and additional voluntary transfers, Central Valley storage and transfers, in-region groundwater storage, and in-region surface water storage.
- Changing climate patterns are predicted to shift precipitation patterns and possibly affect water supply.
- Difficulty and implications of environmental review, documentation, and permitting for multi-year transfer agreements, recycled water projects, and seawater desalination plants.
- Public perception of recycled water use.
- Opposition to local seawater desalination projects from environmental groups and community organizations. New regulations and permitting uncertainty are also barriers to seawater desalination supplies.

Operations and Water Quality

- The cost and use of energy and greenhouse gas emissions.
- Water quality regulations and issues, such as algae toxins, PFAS, and the identification of constituents of emerging concern, have a significant impact on the region's water supply conditions and underscore the importance of flexible and adaptive regional planning strategies.
- Salt and concentrate balance from a variety of sources.

Demand

- Fluctuations in population and economic growth.
- Uncertain location of growth.
- Uncertain housing stock and density.
- Changes in outdoor water use patterns.
- Potential COVID-19 impacts

The challenges posed by continued population growth, environmental constraints on the reliability of imported supplies, and new uncertainties imposed by climate change demand that Metropolitan assert the same level of leadership and commitment to taking on large-scale regional solutions to providing water supply reliability. New solutions are potentially available in the form of dramatically improved water-use efficiency, indirect and direct potable use of recycled water, and large-scale application of ocean desalinization.

Distribution System Water Losses

California Water Code Section 10631(d)(3) requires that urban retail suppliers quantify distribution system water loss for each of the five years preceding the plan update based on water system balance methodology developed by the American Water Works Association (AWWA). For the 2020 UWMP, Metropolitan is voluntarily reporting its treated distribution water loss. Metropolitan followed the AWWA Water Audit methodology to track all sources of water and uses of water within its system. The AWWA Water Audit methodology quantifies real and apparent water system losses in an agency's distribution system.

For its voluntary distribution system water losses assessment, Metropolitan included its water balance audit for the treated water portion of its system for calendar years 2015 through 2019. The results of Metropolitan's audit showed that the average total amount of treated distribution system water losses over the last five years from 2015 to 2019 is approximately 7.8 TAF. A detailed discussion of Metropolitan's treated distribution system water losses is included in Appendix 7 and summarized in Tables A.7-1 through A.7-5. In addition to the treated distribution system losses described in the AWWA tables, Metropolitan estimates that 41.6 TAF was lost from reservoir evaporation occurring in Lake Mathews, Lake Skinner, and DVL during calendar year 2019.

Climate Change

Climate change adds its own uncertainties to the challenges of planning. Metropolitan's water supply planning has been fortunate in having almost one hundred years of hydrological data regarding weather and water supply. This history of rainfall data has provided a sound foundation for forecasting both the frequency and the severity of future drought conditions, as well as the frequency and abundance of above-normal rainfall. But weather patterns can be expected to shift dramatically and unpredictably in a climate driven by increased concentrations of carbon dioxide in the atmosphere. These changes in weather significantly affect water supply planning, irrespective of the debate associated with the sources and cause of increasing concentrations of greenhouse gases. As a major steward of the region's water supply resources, Metropolitan is committed to performing its due diligence with respect to climate change.

Potential Impacts

While uncertainties remain regarding the exact timing, magnitude, and regional impacts of these temperature and precipitation changes, researchers have identified several areas of concern for California water planners. These include:

- Reduction in Sierra Nevada snowpack;
- Increased intensity and frequency of extreme weather events;
- Prolonged drought periods;
- Water quality issues associated with increase in wildfires;
- Changes in runoff pattern and amount; and
- Rising sea levels resulting in
  - Impacts to coastal groundwater basins due to seawater intrusion;
  - Increased risk of damage from storms, high-tide events, and the erosion of levees; and
  - Potential pumping cutbacks on the SWP and Central Valley Project (CVP)

Other important issues of concern due to global climate change include:

- Effects on local supplies such as groundwater;
- Changes in urban and agricultural demand levels and patterns;
- Increased evapotranspiration from higher temperatures;
- Impacts to human health from water-borne pathogens and water quality degradation;
- Declines in ecosystem health and function;
- Alterations to power generation and pumping regimes; and
- Increases in ocean algal blooms affected seawater desalination supplies.

Metropolitan's Activities Related to Climate Change Concerns

Resource Planning

Under the 2020 IRP, Metropolitan recognizes additional risks and uncertainties from a variety of sources:

- Water quality
- Climate change
- Regulatory and operational changes
- Project construction and implementation issues
- Infrastructure reliability and maintenance
- Demographic and growth uncertainty

Any of these risks and uncertainties, should they occur individually or collectively, may result in a negative impact to water supply reliability. While it is impossible to know how much risk and uncertainty to guard against, the region's reliability will be more secure with a long-term plan that recognizes risk and provides resource development to offset that risk.

Metropolitan has established an intensive, comprehensive technical process to identify key vulnerabilities to regional reliability. This Robust Decision Making (RDM) approach was used with both the 2015 and 2010 IRP Updates. The 2015 RDM approach utilized the Delta Method to examine climate change impacts to Metropolitans water supplies across its three basins. The Delta Method is a technique that downscales data from a suite of global climate models and creates climate perturbation factors, in this case temperature and precipitation changes, and applies them to Metropolitan's baseline Integrated Water Resources Plan Simulation Model (IRPSIM) assumptions. This methodology can show how vulnerable the region's reliability is to longer-term risks such as climate change and can also establish "signposts" that can be monitored to see when critical changes may be happening. For example, if observed climate data shows we are trending toward more severe change and the results of the RDM analysis show an unacceptable level of reliability in this future, Metropolitan can use this as a signpost to take action. Signposts include monitoring the direction of ever-changing impacts from improved Global Climate Models, and housing and population growth patterns.

The RDM analysis was not only valuable in identifying vulnerabilities to Metropolitan's 2015 IRP approach to long-term reliability, it was also pivotal in understanding how climate change would best be incorporated into the 2020 IRP and IRPSIM modeling. On the Colorado River Aqueduct, the RDM analysis helped determine that the most appropriate way to look at climate change impacts would be to alter the inflow hydrologies within the CRSS model, which would then serve as inputs to Metropolitan's IRPSIM model. On the SWP side, climate change impacts were included by altering SWP water deliveries provided in the 2019 Delivery Capability report and derived by CalSim 2. Metropolitan assembled a panel of climate change experts to translate how specific climate change impacts, such as changes to runoff timing, would be quantified and to what degree in the IRP scenario approach.

Knowledge Sharing and Research Support

Metropolitan is an active and founding member of the Water Utility Climate Alliance (WUCA). WUCA consists of twelve nationwide water providers collaborating on climate change adaptation. As a part of this effort, WUCA pursues a variety of activities on multiple fronts.

Member agencies of WUCA annually share individual agency actions on climate change adaptation and greenhouse gas mitigation strategies and collaborate on projects aimed at advancing adaptation in the water sector. WUCA also monitors development of climate change-related research, technology, programs, and federal legislation.

In addition to supporting federal and regional efforts, WUCA has released numerous white papers and reports. In 2019, WUCA co-produced with the Water Research Foundation the report "Mapping Climate Exposure and Climate Information Needs to Water Utility Business Functions." The purpose of this paper was to develop a comprehensive, enterprise-level framework for understanding the exposure and sensitivities of water utility business functions to a changing climate and for accelerating the mainstreaming of climate considerations into utility management.

In 2016, WUCA published "Co-producing Actionable Science for Water Utilities." The paper explores the efforts of four water utilities to co-produce actionable science by forging partnerships with scientific institutions to explore integrating climate considerations into their specific management context. The experiences of these four utilities and their scientific partners, as part of the Piloting Utility Modeling Applications project of the Water Utility Climate Alliance, provide a wealth of empirical evidence to illustrate some of the core concepts formulated to explain how to produce usable information and how to link research to decision making.

In recent years, WUCA has created a training that rotates around the country and aims to build a community of smart consumers of climate information proactively pursuing climate adaptation in the water sector. The training sessions include learning different methods for incorporating climate change information into water resource planning, guiding principles for resilience planning, communication strategies, tactics for decision making under conditions of uncertainty, and more.

WUCA continues to pursue opportunities and partnerships with water providers, climate scientists, federal agencies, research centers, academia and key stakeholders. Metropolitan also continues to pursue knowledge sharing and research support activities outside of WUCA. Metropolitan regularly provides input and direction on California legislation related to climate change issues. Metropolitan is active in collaborating with other state and federal agencies, as well as non-governmental organizations, on climate change related planning issues. The following list provides a sampling of entities that Metropolitan has recently worked with on a collaborative basis:

- RAND Corporation
- USBR
- U.S. Army Corps of Engineers
- AWWA Research Foundation

- National Center for Atmospheric Research
- California Energy Commission
- California Department of Water Resources

Quantification of Current Research

Metropolitan continues to incorporate current climate change science into its planning efforts. A major component of the current IRP effort is to explicitly reflect uncertainty in Metropolitan's future water management environment. This involves evaluating a wider range of water management strategies and seeking robust and adaptive plans that respond to uncertain conditions as they evolve over time, and that ultimately will perform adequately under a wide range of future conditions. The potential impacts and risks associated with climate change, as well as other major uncertainties and vulnerabilities, have been incorporated into the current IRP process. Overall, Metropolitan's planning activities strive to support the Board adopted policy principles on climate change by:

- Supporting reasonable, economically viable, and technologically feasible management strategies for reducing impacts on water supply,
- Supporting flexible "no regret" solutions that provide water supply and quality benefits while increasing the ability to manage future climate change impacts, and
- Evaluating staff recommendations regarding climate change and water resources under the California Environmental Quality Act (CEQA) to avoid adverse effects on the environment.

Implementation of Programs and Policies

Metropolitan has made great efforts to implement greenhouse gas mitigation programs and policies for its facilities and operations. Similar to Metropolitan's approach to managing water resources, effectively reducing greenhouse gas emissions requires a portfolio approach that looks at all sources and implements strategies to reduce emissions over time. To date, these programs and policies have focused on:

- Developing Metropolitan's Climate Action Plan, which sets the target and guides future actions to reduce emission levels, pursuant to CEQA guidelines, and complements Metropolitan's IRP;
- Developing Metropolitan's Energy Sustainability Plan, which identifies ways to contain energy costs, move toward energy independence, and reduce price volatility through cost-effective alternative energy projects;
- Exploring water supply/energy relationships and opportunities to increase efficiencies;
- Participating in The Climate Registry, a nonprofit greenhouse gas emissions registry for North America that provides organizations with the tools and resources to help them calculate, verify, report, and manage their greenhouse gas emissions in a publicly transparent and credible way;
- Acquiring "green" fleet vehicles, and supporting an employee Rideshare program;
- Designing retail battery energy storage systems at the Weymouth, Skinner, and Jensen treatment plants, as well as the OC-88 (Orange County) pump station;
- Developing solar power at the Skinner water treatment plant, the Weymouth water treatment plant, the Jensen water treatment plant, and the Diamond Valley Lake Visitor Center; and

- Identifying and pursuing development of "green" renewable water and energy programs that support the efficient and sustainable use of water.

Metropolitan also continues to be a leader in efforts to increase regional water use efficiency. Metropolitan has worked to increase the availability of incentives for local conservation and recycling projects, as well as supporting conservation Best Management Practices for industry and commercial businesses. Many of Metropolitan's water use efficiency incentives also reduce customer electricity and natural gas use. In recognition of this fact, Metropolitan has MOUs with regional energy utilities to jointly implement water use efficiency programs that save energy and reduce greenhouse gas emissions.

2.7 Pricing and Rate Structures

Revenue Sources and Management

A high proportion of Metropolitan's revenues come from volumetric water rates. Water sales revenues are approximately 80 percent of Metropolitan's total revenues. As a result, Metropolitan's revenues vary according to regional weather, the availability of statewide water supplies, the availability of local supplies to its member agencies, the economy, and other factors. For example, in dry years, local demands tend to increase, and Metropolitan may receive higher than anticipated revenues due to increased sales volumes. In contrast, in wet years, demands tend to decrease, and revenues drop due to lower sales volumes. In addition, statewide supply shortages such as those in 2009 and 2015 also affect Metropolitan's revenues. Such revenue surpluses and shortages could cause instability in water rates. To mitigate this risk, Metropolitan maintains financial reserves, with a minimum and target balance, to help stabilize water rates during times of reduced water sales. The reserves hold revenues collected during times of high water sales and are used to offset the need for revenues during times of low sales.

Another way in which Metropolitan helps to mitigate rate volatility is by generating a portion of revenues from fixed sources. Metropolitan currently has two fixed charges: the Readiness-to-Serve Charge (RTS) and the Capacity Charge. Metropolitan also collects tax revenue from taxable property within its boundaries. The revenues from fixed charges generate approximately 18 percent of all Metropolitan revenues. RTS revenues have been decreasing gradually, from $155.5 million in fiscal year 2015-16, to $135 million in fiscal year 2021-22.

Finally, Metropolitan generates revenue from interest income, hydroelectric power sales, and miscellaneous income such as rents and leases. For the last five fiscal years, these averaged approximately three percent of all Metropolitan revenues. These internally generated revenues are referred to as revenue offsets and reduce the amount of revenue that needs to be collected from rates and charges.

Elements of Rate Structure

This section provides an overview of Metropolitan's rate structure. The different elements of the rate structure are discussed below and summarized in Table 2-9.

System Access Rate (SAR)

The SAR recovers the costs of Conveyance, Distribution, and Storage that is used on an average annual basis through a uniform, volumetric rate. All member agencies pay the SAR for access to conveyance and distribution capacity in the Metropolitan system.

Water Stewardship Rate (WSR)

The WSR provides a dedicated source of funding for Metropolitan's demand management function through a uniform, volumetric rate recovered through the end of calendar year 2020. Metropolitan's demand management operations functions include past and future conservation and local resources projects. Because of the uniform benefits conferred on all system users by investments in conservation and local resources, all users of Metropolitan's conveyance and distribution system paid the WSR except for exchange deliveries to SDCWA in calendar years 2018 through 2020.

Metropolitan's Board suspended the billing and collection of the WSR for calendar years 2018, 2019, and 2020 on exchange deliveries to SDCWA pending Metropolitan's completion of a cost allocation study of its demand management costs. Having completed the demand management cost allocation process, in December 2019 Metropolitan's Board directed staff: (1) to incorporate the use of the 2019/20 fiscal-year-end balance of the Water Stewardship Fund to fund all demand management costs in the proposed FY 2020/21 and 2021/22 biennial budget; and (2) to not incorporate the WSR, or any other rates or charges to recover demand management costs, with the proposed rates and charges for CYs 2021 and 2022. As a result, the WSR is not collected from any member agency as of January 1, 2021. This decision provided the Board additional time to consider a rate design alternative for recovery of future demand management costs.

Therefore, as a result of this Board decision, the WSR is not incorporated in the rate structure during calendar years 2021 and 2022.

System Power Rate (SPR)

The SPR recovers the costs of energy required to pump water to Southern California through the SWP and CRA. The cost of power is recovered through a uniform, volumetric rate.

Treatment Surcharge

The Treatment Surcharge recovers all of the costs of providing treatment capacity and operations through a uniform, volumetric rate per acre-foot of treated water transactions.

Capacity Charge

The Capacity Charge recovers the costs incurred to provide peak capacity within the Distribution System. The Capacity Charge also provides a price signal to encourage agencies to reduce peak demands on the Distribution System and to shift demands that occur during the May 1 through September 30 period into the October 1 through April 30 period, resulting in more efficient utilization of Metropolitan's existing infrastructure and deferring capacity expansion costs.

Readiness-To-Serve Charge (RTS)

The RTS recovers the cost of the portion of system that is available to provide emergency service and available capacity during outages and hydrologic variability.

The RTS is a fixed charge that is allocated among the member agencies based on a ten-fiscal-year rolling average of firm demands. Water transfers and exchanges are included for purposes of calculating the ten-year rolling average. The Standby Charge is collected at the request of some member agencies that have elected to use the charge as a direct offset to the member agency's RTS obligation.

Tier 1 Supply Rate

The Tier 1 Supply Rate is a volumetric rate charged on Metropolitan's water sales that are within a member agency's Tier 1 maximum. The Tier 1 Supply Rate supports a regional integrated approach through the uniform, postage stamp rate. The Tier 1 Supply Rate is calculated as the amount of the total revenue requirement functionalized as supply divided by the estimated amount of Tier 1 water sales.

Tier 2 Supply Rate

The Tier 2 Supply Rate is a volumetric rate that reflects Metropolitan's cost of purchasing water transfers north of the Delta. The Tier 2 Supply Rate is charged on Metropolitan water sales that exceed a member agency's Tier 1 maximum. The Tier 2 Supply Rate encourages the member agencies and their customers to maintain existing local supplies and develop cost-effective local supply resources and conservation.

Table 2-9
Rate Structure Components

Rate Design Elements	Service Provided/ Costs Recovered	Type of Charge
System Access Rate	Conveyance/Distribution/Storage (Average Capacity)	Volumetric ($/AF)
System Power Rate	Power	Volumetric ($/AF)
Treatment Surcharge	Treatment	Volumetric ($/AF)
Capacity Charge	Peak Distribution System Capacity	Fixed ($/cfs)
Readiness-To-Serve Charge	Available capacity for Conveyance/Distribution and Emergency Storage	Fixed ($Million)
Tier 1 Supply Rate	Supply	Volumetric ($/AF)
Tier 2 Supply Rate	Reflects cost of water transfers from North of the Delta	Volumetric ($/AF)

The following tables provide further information regarding Metropolitan's rates. Table 2-10 summarizes the rates and charges effective January 1, 2020, January 1, 2021, and January 1, 2022. Average costs of Metropolitan's service by member agency will vary depending upon an agency's RTS allocation, Capacity Charge, and relative proportions of treated and untreated Tier 1, and Tier 2 water purchases. Table 2-11 provides the details of the Capacity Charge, calculated for calendar year 2021.

Table 2-12 provides the details of the RTS calculation for calendar year 2021 by member agency. Table 2-13 provides the current Purchase Order commitment quantities that member agencies will purchase from Metropolitan over the 10-year period starting January 2015 through December 2024. Tier 1 annual average limits for each member agency are also shown in this table.

Table 2-10
Metropolitan Water Rates and Charges

Effective	Jan 1, 2020	Jan 1, 2021	Jan 1, 2022
Tier 1 Supply Rate ($/AF)	$208	$243	$243
Tier 2 Supply Rate ($/AF)	$295	$285	$285
System Access Rate ($/AF)	$346	$373	$389
Water Stewardship Rate ($/AF)	$65	-	-
System Power Rate ($/AF)	$136	$161	$167
Full Service Untreated Volumetric Cost ($/AF)			
Tier 1	$755	$777	$799
Tier 2	$842	$819	$841
Treatment Surcharge ($/AF)	$323	$327	$344
Full Service Treated Volumetric Cost ($/AF)			
Tier 1	$1,078	$1,104	$1,143
Tier 2	$1,165	$1,146	$1,185
Readiness-to-Serve Charge ($M)	$136	$130	$140
Capacity Charge ($/cfs)	$8,800	$10,700	$12,200

Table 2-11
Capacity Charge Detail Calendar Year 2021

	Peak Day Demand (cfs) (May 1 through September 30) Calendar Year				
Agency	2017	2018	2019	3-Year Peak	Calendar Year 2021 Capacity Charge ($10,7000/cfs)
Anaheim	33.0	37.2	37.1	37.2	$398,040
Beverly Hills	25.7	27.8	23.5	27.8	$297,460
Burbank	14.0	17.1	17.3	17.3	$185,110
Calleguas	186.5	184.7	168.9	186.5	$1,995,550
Central Basin	36.7	39.2	48.6	48.6	$520,020
Compton	0.1	6.9	2.9	6.9	$73,830
Eastern	216.6	225.1	223.3	225.1	$2,408,570
Foothill	18.6	19.9	16.0	19.9	$212,930
Fullerton	13.0	13.3	13.1	13.3	$142,310
Glendale	41.4	33.5	32.2	41.4	$442,980
Inland Empire	140.5	147.8	118.7	147.8	$1,581,460
Las Virgenes	44.6	45.9	39.4	45.9	$491,130
Long Beach	55.2	80.4	51.8	80.4	$860,280
Los Angeles	250.4	284.6	283.2	284.6	$3,045,220
MWDOC	418.6	442.3	263.2	442.3	$4,732,610
Pasadena	39.9	43.0	40.0	43.0	$460,100
San Diego	749.7	855.5	672.0	855.5	$9,153,850
San Fernando	0.0	0.0	0.0	0.0	$0.0
San Marino	7.5	4.5	2.3	7.5	$80, 250
Santa Ana	19.9	19.3	19.4	19.9	$212,930
Santa Monica	16.6	16.7	20.7	20.7	$221,930
Three Valleys	126.4	142.9	128.1	142.9	$1,529,030
Torrance	34.0	32.6	27.8	34.0	$363,800
Upper San Gabriel	12.1	23.3	29.1	29.1	$311,370
West Basin	201.7	202.4	211.8	211.8	$2,266,260
Western	175,2	194.7	170.5	194.7	$2,083,290
Total	**2,877.9**	**3,140.6**	**2,660.9**	**3,184.1**	**$34,069,870**

Totals may not foot due to rounding

Table 2-12
Readiness-to-Serve Charge (by Member Agency)
Calendar Year 2021

Member Agency	Rolling Ten-Year Average Firm Deliveries (Acre-Feet) FY2009-10 to FY2018-19	RTS Share	12 months @ $130 million per year (1/21-12/21)
Anaheim	17,327	1.17%	1,526,562
Beverly Hills	10,447	0.71%	920,439
Burbank	12,324	0.84%	1,085,747
Calleguas MWD	97,188	6.59%	8,562,554
Central Basin MWD	42,103	2.85%	3,709,422
Compton	779	0.05%	68,659
Eastern MWD	94,363	6.40%	8,313,628
Foothill MWD	8,395	0.57%	739,661
Fullerton	8,126	0.55%	715,882
Glendale	16,548	1.12%	1,457,930
Inland Empire Utilities Agency	56,561	3.83%	4,983,172
Las Virgenes MWD	20,449	1.39%	1,801,585
Long Beach	30,374	2.06%	2,676,061
Los Angeles	269,780	18.28%	23,768,407
Municipal Water District of Orange County	207,818	14.04%	18,309,363
Pasadena	18,840	1.28%	1,659,827
San Diego County Water Authority	258,318	17.51%	22,758,613
San Fernando	36	0.00%	3,136
San Marino	838	0.06%	73,804
Santa Ana	10,780	0.73%	949,787
Santa Monica	5,511	0.37%	485,554
Three Valleys MWD	62,229	4.22%	5,482,576
Torrance	15,990	1.08%	1,408,786
Upper San Gabriel Valley MWD	26,406	1.79%	2,326,450
West Basin MWD	115,328	7.82%	10,160,744
Western MWD	68,688	4.66%	6,051,651
Metropolitan Total	**1,475,544**	**100.00%**	**$130,000,000**

Totals may not foot due to rounding

Table 2-13
Purchase Order Commitments and Tier 1 Limits
(by Member Agency)
January 2015 through December 2024

Member Agency	Annual Average Tier 1 Maximum	Purchase Order Commitments (acre-feet)
Anaheim	24,439	148,270
Beverly Hills	13,380	89,200
Burbank	16,776	108,910
Calleguas MWD	118,228	788,180
Central Basin MWD[1]	71,770	-
Compton[1]	3,372	-
Eastern MWD	117,585	783,900
Foothill MWD	11,773	73,310
Fullerton	11,299	75,320
Glendale	26,222	174,810
Inland Empire Utilities Agency	93,283	398,350
Las Virgenes MWD	24,358	162,390
Long Beach	51,804	263,140
Los Angeles	373,623	2,033,130
Municipal Water District of Orange County	321,635	2,144,230
Pasadena	22,965	153,100
San Diego County Water Authority[1]	393,542	-
San Fernando[1]	629	-
San Marino	1,442	9,610
Santa Ana	19,617	80,860
Santa Monica[1]	7,406	-
Three Valleys MWD	80,688	537,920
Torrance	19,204	128,030
Upper San Gabriel Valley MWD	67,228	110,080
West Basin MWD	135,418	902,780
Western MWD	105,783	705,220
Total	**2,133,470**	**9,870,740**

[1] No Purchase Order; Tier 1 maximum is annual, not cumulative.
Totals may not foot due to rounding.

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Implementing the Plan

3

This section summarizes Metropolitan's implementation plans and continued progress in developing a diversified resource mix that enables the region to meet its water demands under a wide range of possible future conditions. The investments that Metropolitan has made and its ongoing efforts in many different areas coalesce toward its goal of long-term regional water supply reliability. Many of the resource programs discussed are already successfully implemented. Others will take more time to execute. Considerations are also in place for emerging integrated supplies, which could augment sources of regional water supply from non-traditional sources. In addition, water demand reductions brought about by legislative mandates could affect the landscape of future supply planning and implementation. The following sections discuss each of these programs, presenting both successes to date and the programs that are still underway.

Metropolitan's IRP implementation approach is consistent with the California Water Resilience Portfolio that was released in July 2020. The California Water Resilience Portfolio is discussed briefly below.

California Water Resilience Portfolio

On April 29, 2019, Governor Newsom issued Executive Order N-10-19 that directed the California Natural Resources Agency, the California Environmental Protection Agency, and the California Department of Food and Agriculture to prepare a water resilience portfolio that meets the needs of California's communities, economy and environment through the 21st century.

The agencies were directed to first inventory and assess:

a. Existing demand for water on a statewide and regional basis and available water supply to address this demand.

b. Existing water quality of aquifers, rivers, lakes and beaches.

c. Projected water needs in the coming decades for communities, economy and environment.

d. Anticipated impacts of climate change to our water systems including growing drought and flood risks, and other challenges to water supply reliability.

e. Work underway to complete voluntary agreements for the Sacramento and San Joaquin river system regarding flows and habitat.

f. Current planning to modernize conveyance through the Bay Delta with a new single tunnel project.

g. Expansion of the state's drinking water program to ensure all communities have access to clean, safe and affordable drinking water.

h. Existing water policies, programs and investments within state government.

The California Water Resilience Portfolio outlines goals and actions to help address the state's water challenges through a broad and diversified approach. The goals and actions are meant to be achieved region by region based on the unique challenges and opportunities in each area and are organized into four categories:

1. Maintain and diversify water supplies – the state will continue to help regions reduce reliance on any one source of water supply and diversify water supplies to enable flexibility in the face of changing conditions.
2. Protect and enhance natural ecosystems – the state will provide leadership in restoring the environmental health of our river systems through effective standard setting, continued investments and more adaptive and holistic environmental management.
3. Build connections – the state aims to improve infrastructure to store, move and share water more effectively, and to integrate water management through shared use of science, data and technology.
4. Be prepared – the state will provide guidance to support preparation, protective actions and adaptive management of regions in the face of new threats and stresses due to climate change.

3.1 Colorado River

Metropolitan's goal for the Colorado River is to maintain current supplies and programs, while also maintaining flexibility through dry-year programs and storage. This goal involves protecting existing supply and storage programs in the face of risks that could impact Colorado River supplies in the future.

Background

Metropolitan was established to obtain an allotment of Colorado River water, and its first mission was to construct and operate the Colorado River Aqueduct (CRA). Under its contracts with the federal government, Metropolitan has a basic fourth priority entitlement of 550 TAF per year of Colorado River water. Metropolitan also holds a fifth priority for an additional 662 TAF per year that exceeds California's 4.4 MAF per year basic apportionment, and another 180 TAF per year when surplus flows are available. Metropolitan can obtain water under the fifth priority from:

- Water unused by the California holders of priorities 1 through 3
- Water saved by the Palo Verde land management, crop rotation, and water supply program, or
- When the U.S. Secretary of the Interior makes available either or both:
    - Surplus water, and
    - Water apportioned to, but unused by, Arizona and/or Nevada.

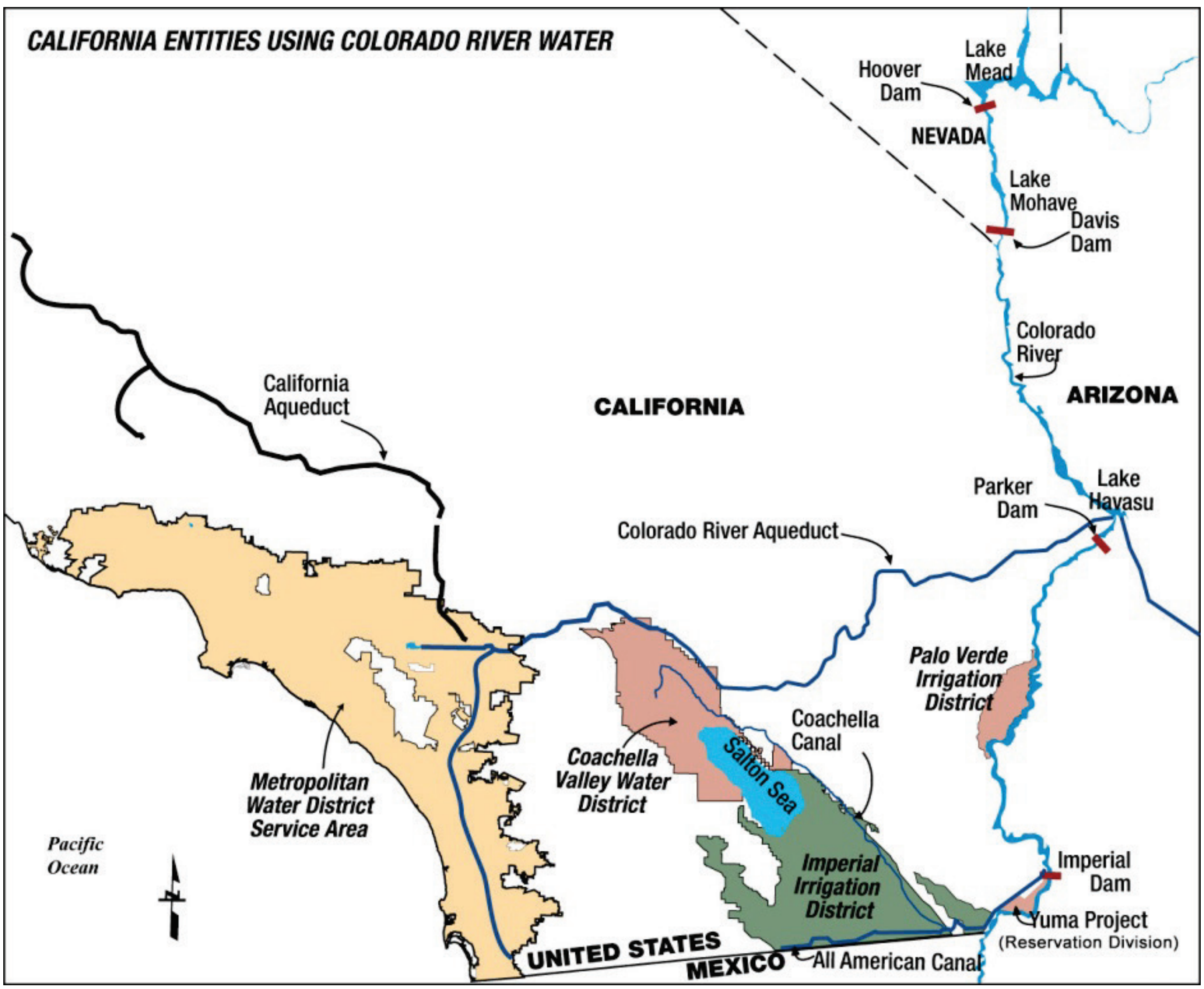
To satisfy a condition imposed by Congress in the Boulder Canyon Project Act, California's legislature enacted the Limitation Act in 1929, agreeing to limit consumptive use of Colorado River water to 4.4 MAF per year, plus not more than one-half of any excess or surplus waters unapportioned by the Colorado River Compact. The 1931 Seven Party Agreement provides the basis for the priorities among California contractors' use of Colorado River water available to California. Palo Verde Irrigation District (PVID), the Yuma Project (Reservation Division), Imperial Irrigation District (IID), and Coachella Valley Water District (CVWD), collectively the "agricultural entities," and Metropolitan are the entities that currently hold the priorities. These priorities are included in the contracts that the Department of the Interior executed with the California agencies in the 1930s for delivery of water from Lake Mead. The first four priorities total 4.4 MAF per year. As noted above, Metropolitan has the fourth priority of 550 TAF to California's basic apportionment and the fifth priority to 662 TAF per year. Under priorities 1 through 3, an amount not to exceed 3.85 MAF was apportioned to the agricultural entities for beneficial consumptive use. The Seven Party Agreement did not specify individual quantities for each of the first three priorities; rather, the amount of water available under the third priority was limited to the amount unused by the holders of priorities 1 and 2 on designated areas of land. This lack of quantification among the agricultural priorities posed an obstacle to the acquisition of water from the agricultural entities for use in Metropolitan's service area.

The Consolidated Decree issued in 2006 by the U.S. Supreme Court in *Arizona v. California*, consolidated into one decree the initial 1964 decree, the 1979 supplemental decree, the 1984 second supplemental decree, the 2000 third supplemental decree, and the 2006 approval settlements reached on the water rights claim of the Fort Yuma Indian Reservation. The Consolidated Decree confirmed the normal year allocation of 4.4 MAF per year to California. This limit effectively reduced Metropolitan's dependable supply of Colorado River water to its fourth priority amount of 550 TAF per year. The Consolidated Decree quantified present perfected rights (PPRs) to the use of Colorado River water by certain Indian reservations, federal wildlife refuges, and other users. Within California some, but not all, of these PPRs are encompassed by the Seven Party Agreement. Consumptive use under these non-encompassed PPRs, known as "Miscellaneous and Indian PPRs," could reach as much as 61 TAF annually. Since 1985, these PPR holders have used less than 20 TAF annually. Because over 5.362 MAF of Colorado River water were already allocated by California's Seven Party Agreement, it was not clear which rights would be affected by the use of these non-encompassed PPRs.

For a period following the Court's 1964 decree, Metropolitan's fifth priority rights were satisfied with water unused under California's first three agricultural priorities and water allocated to, but unused by, Arizona and Nevada. With the commencement of Colorado River water deliveries to the Central Arizona Project in 1985, the availability of Colorado River water to meet Metropolitan's needs was determined on a year-by-year basis. Through 2002, Metropolitan's diversion requests were fully satisfied with unused supplies and surplus waters.

Figure 3-1 shows the major aqueducts within southern California including those from the Colorado River, and entities within the state having rights to use water from the Colorado River.

Figure 3-1



Changed Conditions

California's Colorado River Water Use Plan and the Quantification Settlement Agreement

Metropolitan and the State of California acknowledged that Metropolitan would obtain less water from the Colorado River in the future than Metropolitan had in the past, but the lack of clearly quantified water rights hindered efforts to promote water management projects. The Secretary of the Interior asserted that California's users of Colorado River water had to limit their use to a total of 4.4 MAF per year, plus any available surplus water. Under the auspices of the state's Colorado River Board, these users developed a draft plan to resolve the problem, which was known as "California's Colorado River Water Use Plan" or the "California Plan." It characterized how California would develop a combination of programs to allow the state to limit its annual use of Colorado River water to 4.4 MAF per year plus any available surplus water. The 2003 Quantification Settlement Agreement (QSA) among IID, CVWD, and Metropolitan is a critical component of the California Plan. It establishes the baseline water use for each of the agencies, facilitates the transfer of water from agricultural agencies to urban uses, and specifies that IID, CVWD, and Metropolitan would forbear use of water to permit the Secretary of the Interior to satisfy the uses of the PPRs not covered by the Seven Party Agreement.

On November 5, 2003, IID filed a validation action in Imperial County Superior Court, seeking a judicial determination that thirteen agreements associated with the QSA are valid, legal, and binding. Other lawsuits also were filed challenging the execution, approval, and subsequent implementation of the QSA on various grounds. All of the QSA cases were coordinated in Sacramento County Superior Court. After more than a decade of litigation, the final challenges to the QSA were dismissed, and the agreements were upheld.

San Diego County Water Authority (SDCWA) is participating in three QSA-related projects that are providing additional water supplies that the agency exchanges with Metropolitan for receipt of Metropolitan deliveries.[1] First, the water conserved by these projects is made available to Metropolitan. In exchange, Metropolitan is delivering an amount of Metropolitan water equal to the amount of Colorado River water conserved by IID for SDCWA. Second, federal law allocates a portion of the water available as a result of the Coachella Canal Lining Project and the All-American Canal Lining Project for the benefit of parties, including five Indian Bands, and two non-Indian municipal water purveyors (San Luis Rey Settlement Parties) involved in litigation over water rights to the San Luis Rey River in San Diego County. Metropolitan has agreed to exchange that water and provide an equal amount of water to the United States for use by the San Luis Rey Settlement Parties, and SDCWA has agreed to convey the water when capacity is available for use within the Settlement Parties' service areas. The remainder of the water available as a result of the canal lining projects, up to the cap specified in the Metropolitan-SDCWA exchange agreement, is exchanged with SDCWA.

In 2005, Metropolitan entered into a settlement agreement in Arizona v. California with the Quechan Indian Tribe and other parties. The Tribe uses Colorado River water on the Fort Yuma Indian Reservation. Under the settlement agreement, the Tribe, in addition to the amounts of water decreed for the benefit of the Reservation in the 1964 decree in Arizona v. California, is entitled to (a) 20 TAF of diversions from the Colorado River, or (b) the amount necessary to supply the consumptive use required for irrigation of a specified number of acres, and for the satisfaction of related uses, whichever is less. Of the additional diversions, 13 TAF became available to the Tribe in 2006. An additional 7 TAF becomes available to the Tribe in 2035. Metropolitan agreed

[1] These projects, the SDCWA/IID transfer and the Coachella and All-American canal lining projects, will be discussed in SDCWA's Urban Water Management Plan.

to provide annual incentive payments to the Tribe if the Tribe forbore diversion of the additional water, thereby allowing Metropolitan to divert it.

Current Dry Condition

The Colorado River Basin experienced a severe 5-year drought from 2000 to 2004 with both precipitation and runoff significantly below average. Since that time precipitation has been, on average, near normal, while runoff has been less than average in two out of every three years. Overall, a potential change in the precipitation to runoff relationship may be resulting in conditions in which less runoff is generated from a given level of precipitation, pushing the system toward a drying trend that is often characterized as a long-term drought. For example, in 2020, the Upper Colorado River Basin snowpack peaked in April at 107 percent of median. However, April through July runoff was observed at just 52 percent of average due to hot and dry conditions in the late spring and early summer. The overall 21-year drying trend has resulted in Lake Mead and Lake Powell storage at 40 and 42 percent of capacity, respectively, leaving less of a buffer for a future period of reduced precipitation.

Quagga Mussels

Quagga mussels were discovered in January of 2007 in Lake Mead and rapidly spread downstream to the Lower Colorado River. The presence and spawning of quagga mussels in the Lower Colorado River and in reservoirs located in southern California pose an immediate threat to water and power systems serving more than 25 million people in the southwestern United States. Quagga mussels (*Dreissena bugensis*) are a related species to the better-known zebra mussels (*Dreissena polymorpha*) and are indigenous to Ukraine. They were introduced to the Great Lakes in the 1980s from fresh-water ballast of a transoceanic ship traveling from Eastern Europe. Although the introduction of these two species into drinking water supplies does not typically result in violation of drinking water standards, invasive mussel infestations can adversely impact aquatic environments and infrastructure. If unmanaged, invasive mussel infestations have been known to severely impact the aquatic ecology of lakes and rivers; clog intakes and raw water conveyance systems; reduce the recreational and aesthetic value of lakes and beaches; alter or destroy fish habitats; and render lakes more susceptible to deleterious algae blooms.

Implementation Approach

Metropolitan's planning strategy recognized explicitly that program development would play an important part in reaching the target level of deliveries from the Colorado River. The implementation approach explored a number of water conservation programs with water agencies that receive water from the Colorado River or are located in proximity to the CRA. Negotiating the QSA was a necessary first step for all of these programs. On October 10, 2003, after lengthy negotiations, representatives from Metropolitan, IID, and CVWD executed the QSA and other related agreements. Parties involved also included SDCWA, the California Department of Water Resources (DWR), the California DFW, the U.S. Department of the Interior, and the San Luis Rey Settlement Parties. One of those related agreements was the Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement, which specifies to which agencies water will be delivered under priorities 3a and 6a of the Seven Party Agreement during its term.

Metropolitan has identified several programs that could be used to achieve the regional long-term development targets for the Colorado River, as shown in Table 3-1. Metropolitan has entered into or is exploring agreements with agencies as described in this section. In addition,

Appendix 3 provides a detailed discussion of these programs and describes whether the programs are being implemented, are deferred, or are under investigation.

Colorado River Water Management Programs

Imperial Irrigation District/Metropolitan Water District Conservation Program

Under agreements executed in 1988 and 1989, Metropolitan has funded water efficiency improvements within IID's service area in return for the right to divert the water conserved by those investments. Under this program, IID implemented a number of structural and non-structural measures, including the lining of existing earthen canals with concrete, constructing local reservoirs and spill-interceptor canals, installing non-leak gates, and automating the distribution system. Other implemented programs include the delivery of water to farmers on a 12-hour rather than a 24-hour basis and improvements in on-farm water management through irrigation management improvements. Through this program, IID has conserved an additional 105 TAF per year on average upon completion of program implementation. Execution of the QSA and amendments to the 1988 and 1989 agreements resulted in changes in the availability of water under the program, extending the term to 2078 if the term of the QSA extends through 2077, which guaranteed Metropolitan at least 85 TAF per year with the remainder of the conserved water available to CVWD when needed. In a 2019 agreement, Metropolitan and CVWD agreed to increase the amount of water guaranteed to Metropolitan to 90 TAF per year from 2020 to 2026, with the remainder of the conserved water available for Metropolitan's delivery to CVWD at Whitewater.

Palo Verde Land Management, Crop Rotation, and Water Supply Program

In May 2004, Metropolitan's Board authorized a 35-year land management, crop rotation, and water supply program with PVID. Under the program, participating farmers in PVID are paid to reduce their water use by not irrigating a portion of their land. A maximum of 29 percent of the lands within the Palo Verde Valley can be fallowed in any given year. Under the terms of the QSA, water savings within the PVID service area are made available to Metropolitan. This program provides up to 133 TAF of water to be available to Metropolitan in certain years. Over the life of the program, an average of 84.5 TAF per year has been saved and made available to Metropolitan. Additionally, in March 2009, Metropolitan and PVID entered into a one-year supplemental fallowing program within PVID that provided for the fallowing of additional acreage, with savings of 24.1 TAF in 2009 and 32.3 TAF in 2010.

Bard Seasonal Fallowing Program

In December 2019, Metropolitan's Board authorized a seven-year seasonal fallowing program with the Bard Water District. Under the program, participating farmers in Bard are paid to reduce their water use by not irrigating their land between the late spring and summer months. A maximum of 3,000 acres will be fallowed in the Bard Unit. Estimated water savings are between 1.5 and 2.0 AF per irrigable acre. Bard is part of the Yuma Project Reservation Division. Bard therefore holds a higher priority than Metropolitan, and any reductions in their water consumption increases supplies available to Metropolitan. Metropolitan has the option to make a fallowing call every year. The fallowing call notifies Bard and the farmers if Metropolitan needs fallowing the following year. This program provides up to 6 TAF of water to be available to Metropolitan in certain years.

Management of Metropolitan-Owned Land in Palo Verde

In 2001, Metropolitan acquired 8,946 acres of irrigable farmland within the Palo Verde Irrigation District (PVID). These lands were leased to growers and were eventually enrolled in the PVID Land

Management, Crop Rotation and Water Supply Program when it began in 2005. In 2015, Metropolitan acquired an additional 12,049 irrigable acres from Verbena LLC, bringing Metropolitan's ownership in the Palo Verde Valley to approximately 20,995 acres of irrigated farmland. The lands have historically been leased to growers who produced high water-using crops such as alfalfa.

In 2017 and 2018, Metropolitan entered into new leases on the lands with the goal of reducing consumptive water use while maintaining the lands as productive farmland. Strategies for reducing water use include incentivizing lessees to grow lower water-using crops, experimenting with different crop rotation cycles, and studying alternative irrigation practices. To assist in these studies, Metropolitan has deployed technologies for measuring crop water use via remote sensing imagery and ground-based sensors.

If long-term water savings from these farm leases is realized, Metropolitan may explore ways to have them formally accounted for in Metropolitan's Colorado River supplies in the future.

<u>Southern Nevada Water Authority and Metropolitan Storage and Interstate Release Agreement</u>

SNWA has undertaken extraordinary water conservation measures to maintain its consumptive use within Nevada's basic apportionment of 300 TAF. The success of the conservation program has resulted in unused basic apportionment for Nevada. As SNWA expressed interest in storing a portion of the water with Metropolitan, the agencies, along with the United States and the Colorado River Commission of Nevada, entered into a storage and interstate release agreement in October 2004. Under the agreement, additional Colorado River water supplies are made available to Metropolitan when there is space available in the CRA to receive the water. SNWA stored approximately 422 TAF with Metropolitan through 2019, 330 TAF of which is available for return to SNWA. In addition to providing capacity for SNWA to store unused water, the program has been beneficial to Metropolitan, providing additional water during dry years, especially during the recent California drought (2011 to 2016). SNWA is not expected to call upon Metropolitan to return water until after 2026.

<u>Lower Colorado Water Supply Project</u>

The Lower Colorado Water Supply Project was authorized by Congress in the 1980s to provide up to 10 TAF of water per year to the City of Needles and other entities adjacent to the river in California that do not have rights or have insufficient rights to use Colorado River water. In March 2007, Metropolitan, the City of Needles, and the United States Bureau of Reclamation (USBR) executed a Lower Colorado Water Supply Project contract. Under the contract, Metropolitan receives, on an annual basis, project water left unused by the project contractors along the River. The water supply for the project comes from groundwater wells located along the All-American Canal. A portion of the payments made by Metropolitan to the City of Needles is placed in a trust fund for potentially acquiring a new water supply for the project should the groundwater pumped from the project's wells become too saline for use. Metropolitan received 9.5 TAF from this project in 2019 and will receive an estimated 8.8 TAF in 2020 based on the amount of water pumped and used by other project water users.

<u>Exchange with SDCWA</u>

SDCWA has acquired conserved Colorado River water reaching an annual volume of 277.7 TAF by 2023. SDCWA makes this water available at Lake Havasu for Metropolitan diversion, where Metropolitan takes possession of the water and provides a matching volume from Metropolitan's blended supplies to SDCWA by exchange in equal monthly amounts. The conserved water is acquired by SDCWA through its transfer agreement with the Imperial Irrigation District (IID) and from the lining of the All-American and Coachella canals.

Under the transfer agreement with IID, 192.5 TAF was transferred and exchanged with Metropolitan in 2020. In 2021, the transfer reaches 205 TAF, reduces to 202.5 TAF in 2022, then stabilizes at 200 TAF per year in 2023. The water is being conserved through on-farm efficiency conservation arrangements made by IID with its customers and other system efficiency measures.

The Coachella Canal Lining Project consists of a 35-mile concrete-lined canal, including siphons, which replaced an earthen canal. The project was completed in December 2006 and conserves 30,850 AF annually. The All-American Canal Lining Project consists of a concrete-lined canal constructed parallel to 23 miles of earthen canal. The project was completed in 2009 and conserves 67,700 AF annually.

Pursuant to the QSA and related agreements, the 98,550 AF of water resulting from these projects annually is allocated as follows: 16,000 AF to the San Luis Rey Settlement Parties in San Diego County, 77,700 AF to SDCWA, and 4,850 AF for Coachella Canal Lining Project mitigation. Any portion of the latter volume not used for mitigation is allocated to SDCWA; however, whether SDCWA can actually receive such water is subject to other laws, agreements, and factors.

The combined volume IID transferred water and canal lining water that Metropolitan will exchange with SDCWA is limited to 282.7 TAF in 2021, 280.2 TAF in 2022, and 277.7 TAF each year thereafter.

Exchange with the United States

Of the 16,000 AF allocated to the San Luis Rey Settlement Parties from the water conserved from the All-American Canal Lining Project and Coachella Canal Lining Project, the United States furnishes this water at Metropolitan's Colorado River Intake on Lake Havasu. Metropolitan takes possession of the water and by exchange delivers an equal volume of Metropolitan's blended supplies to SDCWA. By separate agreement, SDCWA conveys the water to the San Luis Rey Settlement Parties.

Lake Mead Storage Program

In May 2006, Metropolitan and the USBR executed an agreement for a demonstration program that allowed Metropolitan to leave conserved water in Lake Mead, for exclusive use by Metropolitan in later years, that Metropolitan would otherwise have used in 2006 and 2007. The program required that such water left in Lake Mead must be through reduced use resulting from implementation of extraordinary conservation measures and not simply be water that was not needed by Metropolitan in the year it was stored. This extraordinary conservation was accomplished through savings realized under the Palo Verde Land Management, Crop Rotation, and Water Supply Program. Through the two-year demonstration program, Metropolitan created 44.8 TAF of "Intentionally Created Surplus" (ICS) water.

In December 2007, Metropolitan entered into agreements to set forth the rules under which ICS water is developed, stored in, and delivered from Lake Mead. According to these rules, the amount of water stored in Lake Mead, created through extraordinary conservation, that is available for delivery in a subsequent year was reduced by a one-time deduction of five percent, resulting in additional system water in storage in the lake, and an annual evaporation loss of three percent, beginning in the year following the year the water is stored. The 2019 Lower Basin Drought Contingency Plan (Lower Basin DCP; see below) changed these rules such that, for ICS creators party to the DCP (including Metropolitan), a one-time10 percent deduction is assessed on ICS in the year it is created, without additional future evaporation losses. Metropolitan created ICS water in 2009, 2010, 2011, 2012, 2016, 2017, 2018, and 2019 and withdrew ICS water in 2008, 2013, 2014, and 2015. As of January 1, 2020, Metropolitan had a total of 866 TAF of Extraordinary Conservation ICS water in Lake Mead.

Under these agreements, Metropolitan also agreed to store excess conservation by IID, up to 25 TAF per year with a cumulative cap of 50 TAF, with return upon the request of IID, subject to the conditions of the agreement. This was later amended in 2015 to temporarily increase the amount of excess conservation that Metropolitan would store, to account for the success of IID's conservation programs and the extreme drought conditions within the State of California. Metropolitan stored water for IID in 2014, 2015, 2016, and 2017. As of January 1, 2020, Metropolitan has stored approximately 168 TAF of IID's excess conservation either through application of the California ICS Agreement and its amendment, or through application of 3.B.8 of the 2007 Interim Guidelines (aka Lake Mead Storage Program)

The December 2007 federal guidelines concerning the operation of the Colorado River system reservoirs provided the ability for agencies to create "System Efficiency ICS" through the development and funding of system efficiency projects that save water that would otherwise be lost from the Colorado River. To that end, in 2008 the Central Arizona Water Conservation District (CAWCD), SNWA, and Metropolitan contributed funds for the construction of the Drop 2 (Brock) Reservoir by the USBR. The purpose of the Drop 2 (Brock) Reservoir is to increase the capacity to regulate deliveries of Colorado River water at Imperial Dam, reducing the amount of lost storage in Lake Mead due to excess flow downstream of Imperial Dam by approximately 70 TAF annually. In return for its $25 million net contribution toward construction, operation, and maintenance, 100 TAF of water that was stored in Lake Mead was assigned to Metropolitan as System Efficiency ICS. Through 2019, Metropolitan has diverted 35 TAF of this amount, with 65 TAF remaining in storage.

In 2009, Metropolitan entered into an agreement with the United States, SNWA, the Colorado River Commission of Nevada, and CAWCD to have USBR conduct a one-year pilot operation of the Yuma Desalting Plant at one-third capacity. The pilot project operated between May 2010 and March 2011 and provided data for future decision-making regarding long-term operation of the Plant and developing a near-term water supply. Metropolitan's contribution toward plant operating costs secured 24.4 TAF of System Efficiency ICS which is still stored in Lake Mead as of January 1, 2020.

<u>Quagga Mussel Control Program</u>

The presence and spawning of quagga mussels in the lower Colorado River from Lake Mead through Lake Havasu pose a threat to Metropolitan's Colorado River Aqueduct (CRA) system and other Colorado River water users due to the potential to continuously seed water conveyance systems with mussel larvae.

Metropolitan developed the Quagga Mussel Control Program (QMCP) in 2007 to address the long-term introduction of mussel larvae into the CRA from the lower Colorado River. The QMCP consists of surveillance activities and control measures. Inspections for adult mussel infestation of submerged infrastructure are conducted during annual CRA shutdowns (usually three to four weeks). Microscopic larvae are routinely monitored throughout the year in infested lakes and at non-infested locations.

Control activities consist of continuous chlorination of the CRA system (target residual = 0.1 – 0.5 mg/L) at the outlets of Copper Basin (5 miles downstream of the intake from the Colorado River), Lake Skinner, and Lake Mathews at the western terminus of the CRA. The outlet towers at Lakes Skinner and Mathews are also chlorinated for two weeks every quarter when operations allow (0.6 mg/L target residual). Attached mussels are removed during routine cleaning of the trash racks at the Whitsett Intake Pumping Plant at the start of the CRA. The annual CRA shutdowns desiccate exposed quagga mussels, thus providing an additional control measure.

Recent shutdown inspections have demonstrated that the combined use of chlorine and regularly scheduled shutdowns effectively control mussel infestation along the length of the CRA since only few and small mussels are usually found during these inspections.

<u>Lower Basin Drought Contingency Plan</u>

In April 2019, the President signed legislation directing the Secretary of the Interior to sign and implement four DCP agreements related to the Upper and Lower Basin DCPs without delay. The agreements were executed, and the Upper and Lower Basin DCPs became effective on May 20, 2019 and will continue to be effective through 2026. The Lower Basin Drought Contingency Plan Agreement requires California, Arizona, and Nevada to store defined volumes of water ("DCP Contributions") in Lake Mead at specified lake levels. California would begin making contributions if Lake Mead's elevation is projected to be at or below 1,045 feet above sea level on January 1. Depending on the lake's elevation, California's contributions would range from 200 to 350 TAF a year. Pursuant to intrastate implementation agreements that terminate in 2026, Metropolitan is responsible for 93 percent of any California DCP Contribution that may be required under the Lower Basin DCP. CVWD is responsible for 7 percent of California's required DCP Contributions. In January 2020, the Lake Mead elevation was 1,090 feet; thus, no California DCP Contributions are necessary at this time. As noted above, under the Lower Basin DCP, the one-time deduction on new ICS was increased to 10 percent while the annual evaporation loss was removed.

Implementation of the Lower Basin DCP enhances Metropolitan's ability to store water in Lake Mead and to ensure that water in storage can be delivered at a later date. The Lower Basin DCP increases the total volume of water that California may store in Lake Mead by 200 TAF, which Metropolitan will have the right to use. Water stored as ICS will be available for delivery as long as Lake Mead's elevation remains above 1,025 feet. Previously, that water would likely have become inaccessible below a Lake Mead elevation of 1,075 feet. Rules are set for delivery of DCP ICS through 2026 and between 2027 and 2057.

Achievements to Date

Metropolitan has developed a number of supply and conservation programs to increase the amount of supply available from the Colorado River. The Colorado River faces long-term challenges of water demands exceeding available supply with additional uncertainties due to climate change. Metropolitan's supply and conservation programs, as well as planned additional water management programs for 2035, are shown in Table 3-1.

Table 3-1
Colorado River Program Capabilities
Year 2035
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Basic Apportionment – Priority 4	550,000	550,000	550,000
DCP Contribution Reduction[1]	0	0	0
IID/MWD Conservation Program	85,000	85,000	85,000
Priority 5 Apportionment (Surplus)	0	0	0
PVID Land Management, Crop Rotation, and Water Supply Program	130,000	130,000	117,000
Bard Seasonal Fallowing Program	6,000	6,000	6,000
Lower Colorado Water Supply Project	9,000	9,000	9,000
Lake Mead ICS Storage Program	337,500	337,500	337,500
Binational ICS	51,000	0	51,000
Forbearance for Present Perfected Rights	(2,000)	(2,000)	(2,000)
CVWD SWP/QSA Transfer Obligation	(35,000)	(35,000)	(35,000)
DWCV SWP Table A Obligation	(51,000)	(12,000)	(113,000)
DWCV Advance Delivery Account	51,000	12,000	113,000
IID Payback	0	0	0
SNWA Agreement Payback	(22,000)	(22,000)	(22,000)
Subtotal of Current Programs	***1,109,500***	***1,058,500***	***1,096,500***
Programs Under Development			
Additional Transfer Programs	0	0	0
Subtotal of Proposed Programs	***0***	***0***	***0***
Additional Colorado River Exchange Supplies			
Exchange with SDCWA	278,000	278,000	278,000
Exchange with United States	16,000	16,000	16,000
Subtotal of Additional Colorado River Supplies	***294,000***	***294,000***	***294,000***
Maximum CR Supply Capability[2]	**1,403,500**	**1,352,500**	**1,390,500**
Less CRA Capacity Constraint (amount above 1.25 MAF)	*(153,500)*	*(102,500)*	*(140,500)*
Maximum Expected CRA Deliveries[3]	**1,250,000**	**1,250,000**	**1,250,000**

[1] DCP contribution beyond capacity of ICS accounts.
[2] Total amount of supplies available without taking into consideration CRA capacity constraint.
[3] The CRA delivery capacity is 1.25 MAF annually.

3.2 State Water Project

Much of the SWP water supply passes through the San Francisco-San Joaquin Bay-Delta (Bay-Delta). The SWP consists of a series of pump stations, reservoirs, aqueducts, tunnels, and power plants operated by DWR. Figure 3-2 shows SWP facilities. This statewide water infrastructure provides water to 29 urban and agricultural agencies throughout California. More than two-thirds of California's residents receive some of their drinking water from the Bay-Delta.

The original State Water Contract called for an ultimate delivery capacity of 4.2 MAF, with 1,911 TAF allocated to Metropolitan pursuant to its participation in the SWP. For decades, the Bay-Delta has experienced water quality and supply reliability challenges and conflicts due to variable hydrology and environmental standards that limit pumping operations. SWP deliveries in the most recent critically dry years lagged these projections and were 5 percent of contractual amounts in 2014 and 20 percent of contractual amounts in 2015. Dry conditions in 2020 also supported a supply allocation of only 20 percent. Consequently, Metropolitan's key concern is the continual deterioration of water supply reliability.

Another important concern for Metropolitan is sustained improvement in SWP water quality. Metropolitan must be able to meet the increasingly stringent drinking water regulations that are expected for disinfection by-products and pathogens in order to protect public health. Meeting these regulations will require improving the Bay-Delta water supply by cost effectively combining alternative source waters, source improvement, and treatment facilities. Additionally, Metropolitan requires water quality improvements of Bay-Delta water supplies to meet its 500 mg/L salinity blending objective in a cost-effective manner, while minimizing resource losses and helping to ensure the viability of regional recycling and groundwater management programs.

Background

Endangered Species Act Permits - The listing of several fish species as threatened or endangered under the federal or California Endangered Species Acts (respectively, the "Federal ESA" and the "California ESA" and, collectively, the "ESAs") has adversely impacted operations and limited the flexibility of the SWP. Currently, five species (the winter-run and spring-run Chinook salmon, Delta smelt, North American green sturgeon, and Central Valley steelhead) are listed under the ESAs. In addition, on June 25, 2009, the California Fish and Game Commission declared the longfin smelt a threatened species under the California ESA. Because of the listing of the various species, the federal Central Valley Project (CVP) and SWP are prohibited from "taking" the fish in their operations and must consult with federal fisheries agencies to determine whether their operations will jeopardize the existence of the species. If so, CVP and SWP must establish "reasonable and prudent alternatives" (RPAs) to normal project operations to minimize their impacts on the smelt and salmon.

In 2004 and 2005, the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) issued biological opinions and incidental take statements that governed operations of the SWP and the CVP with respect to the Delta smelt, the winter-run and spring-run Chinook salmon, and the Central Valley steelhead. In July 2006, the USBR reinitiated consultation with the USFWS and NMFS with respect to the 2004 and 2005 biological opinions (with the addition of the North American green sturgeon, which was listed in April 2006) following the filing of legal challenges to those biological opinions and incidental take statements.

Figure 3-2
Current and Projected Facilities of the State Water Project

In 2008, USFWS issued a Biological Opinion with RPAs including criteria for operation of the CVP and SWP in a manner not likely to jeopardize the continued existence of the Delta smelt or adversely modify designated critical habitat. NMFS made a similar finding with respect to project operation effects on the listed salmon and steelhead in its revised Biological Opinion in 2009. Coordinated CVP/SWP operations were required to incorporate RPAs suggested by the agencies in the 2008 and 2009 Biological Opinions to ensure they are exempt from the otherwise applicable prohibition on “take” of Federal ESA-listed species.

To comply with the California ESA, DWR obtained consistency determinations for species listed under both ESAs and a separate Fish & Game Code Section 2081 Incidental Take Permit that authorized the incidental take of the state-listed Longfin smelt from SWP operations.

2019 Biological Opinions - In August 2016, USBR and DWR reinitiated consultation with NMFS and USFWS on the Coordinated Long-term Operations of the CVP and SWP due to new information and science on declining listed fish species populations. USBR submitted the initial biological assessment to USFWS and NMFS. The biological assessment contains a description of USBR’s and DWR’s proposed long-term coordinated operations plan (the “2019 Long-Term Operations Plan”). On October 21, 2019, USFWS and NMFS released their Biological Opinions. On February 18, 2020, USBR signed a Record of Decision, pursuant to the National Environmental Policy Act, completing its environmental review and adopting the 2019 Long-Term Operations Plan.

The 2019 Long-Term Operations Plan incorporates and updates many of the requirements contained in the previous 2008 and 2009 Biological Opinions. It also includes over $1 billion over a ten-year period in conservation, monitoring and new science, some of which is in the form of commitments carried forward from the previous 2008/2009 Biological Opinions. Those costs are shared by the SWP and CVP. The prior 2008 and 2009 Biological Opinions resulted in an estimated reduction in SWP deliveries of 0.3 million acre-feet during critically dry years to 1.3 million acre-feet in above normal water years as compared to the previous baseline. The 2019 Long-Term Operations Plan and 2019 Biological Opinions are expected to increase SWP deliveries by an annual average of 200,000 acre-feet as compared to the previous Biological Opinions. However, as explained further below, DWR committed to forego the anticipated improvement in the California ESA permitting process.

On December 2, 2019, a group of non-governmental organizations, including commercial fishing groups and the Natural Resources Defense Council (the “NGOs”), sued the Department of Interior, Department of Commerce, USFWS, NMFS, and USBR alleging the 2019 Biological Opinions are arbitrary and capricious, later amending the lawsuit to include claims alleged against USBR under the federal ESA and the National Environmental Policy Act. On February 20, 2020, the California Natural Resources Agency (Natural Resources), the California Environmental Protection Agency, and the Attorney General (collectively, the “State Plaintiffs”) sued the federal agencies, making allegations similar to the NGOs, but also alleging that USBR must obtain a California ESA permit for CVP operations that cause incidental take of the state-listed Longfin smelt. The State Water Contractors intervened in both cases to defend the 2019 Biological Opinions. In May 2020, the court granted, in part, a preliminary injunction that affected CVP operations only for a short time in May. The federal defendants are nearing completion of the administrative records that will form the evidentiary basis for briefing the merits of the cases, and the court has issued a briefing schedule for any objections to the administrative records. Once the administrative records are finalized, the parties anticipate filing cross-motions for summary judgment. The outcome of those cross-motions may obviate the need for a trial.

California ESA Incidental Take Permit - DWR described and analyzed its proposed SWP long-term operations plan for purposes of obtaining a new California ESA permit in its November 2019 Draft EIR under CEQA. Its 2019 Draft EIR proposed essentially the same operations plan as for the federal 2019 Biological Opinions, with the addition of operations for the California ESA-listed Longfin smelt. The proposed project included an estimated $540 million in conservation, monitoring and science, much of which overlapped with DWR's share of the estimated $1 billion under the federal 2019 Biological Opinions. In December 2019, DWR submitted its application for an incidental take permit under the California ESA to the California Department of Fish and Wildlife (CDFW), with a modified State operations plan that added new outflow and environmental commitments. On March 27, 2020, DWR released its final EIR and Notice of Determination, describing and adopting a State operations plan with additional operational restrictions and additional conservation commitments. On March 31, 2020, CDFW issued a California ESA incidental take permit for the SWP that included further operational restrictions and outflow. The final approved project and incidental take permit reduce long-term average SWP deliveries by more than 200 TAF, which more than erased any potential improvement in SWP water supplies that were anticipated to result from the 2019 Biological Opinions. In addition, the approved project and incidental take permit add another estimated $218 million over a ten-year period in environmental commitments for the SWP beyond the SWP's share of the $1 billion required to comply with the 2019 Biological Opinions.

On April 28, 2020, Metropolitan and Mojave Water Agency (Mojave) jointly sued CDFW, DWR and Natural Resources, alleging that the new California ESA permit and Final EIR violate CEQA and the California ESA. Metropolitan and Mojave also allege that DWR breached their respective State Water Contracts and the implied covenant of good faith and fair dealing by, among other things, accepting an incidental take permit containing mitigation or other measures in excess of that required by law. The State Water Contractors and the Kern County Water Agency also filed CEQA and CESA actions, and a CEQA challenge was filed by several federal contractors. In addition, San Bernardino Valley Municipal Water District sued CDFW and DWR, alleging CEQA and CESA violations, breach of its State Water Contract and the implied covenant, as well as unconstitutional takings and anticipatory repudiation of contract claims. Four other lawsuits also have been filed by certain commercial fishing groups and a tribe, several environmental groups, and two in-Delta water agencies challenging the Final EIR as inadequate under CEQA and, in some of the cases, alleging violations of the California ESA, Delta Reform Act, public trust doctrine and, in one of the cases, certain water right statutes. Since the initial filings, Coachella Valley Water District, San Gorgonio Pass Water Agency and the Municipal Water District of Orange County have joined Metropolitan's case; and nine individual State Water Contractors joined the SWC and Kern County Water Agency in their case, adding breach of contract and implied covenant claims. All eight cases have been ordered coordinated, and a stay has been imposed on any discovery until modified or lifted by the coordination trial judge. At this time, Metropolitan is unable to assess the likelihood of success of any litigation relating to the California ESA permit, including any future litigation or any future claims that may be filed, or any potential effect on Metropolitan's SWP water supplies.

Bay-Delta Water Quality Control Plan Update/Voluntary Agreements – The State Water Resources Control Board (SWRCB) is the agency responsible for setting water quality standards and administering water rights throughout California. The SWRCB exercises its regulatory authority over the Bay-Delta and its tributaries by means of public proceedings leading to regulations and decisions that can affect the availability of water to Metropolitan and other users of SWP water. These include the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan), which establishes the water quality objectives and proposed flow regime of the estuary, and water rights decisions, which assign responsibility for implementing the objectives of the Bay-Delta Plan to users throughout the system by adjusting their respective water rights permits.

Since 2000, SWRCB's Water Rights Decision 1641 (D-1641) has governed the SWP's ability to export water from the Bay-Delta for delivery to Metropolitan and other agencies receiving water from the SWP. D-1641 allocated responsibility for meeting flow requirements and salinity and other water quality objectives established earlier by the Bay-Delta Plan.

The Bay-Delta Plan gets reviewed periodically, and new standards and allocations of responsibility can be imposed on the SWP as a result. The last review was completed in 2006, and the current review has been ongoing since approximately 2010 in a phased approach.

Phase 1 focuses on the southern Delta salinity objectives for the protection of agriculture, San Joaquin River flow objectives for the protection of fish and wildlife, and a program of implementation for achieving those objectives. Phase 2 considers the comprehensive review of the other elements of the Bay-Delta Plan, including but not limited to Sacramento River and Delta outflow objectives.

The SWRCB has also encouraged all stakeholders to work together to reach one or more voluntary agreements for consideration by the SWRCB that could implement the proposed amendments to the Bay-Delta Plan through a variety of tools, while seeking to protect water supply reliability. Metropolitan is participating in the Phase 2 proceedings and voluntary agreement negotiations. In March of 2019, DWR and CDFW put forward a project description and planning agreement that would allow the SWRCB to analyze the environmental impacts and benefits of the voluntary agreement alternative to the percentage of unimpaired flow framework.

In December 2018, the SWRCB adopted the Phase 1 Bay-Delta Plan amendments and Final Substitute Environmental Document. Among other things, the Phase 1 updates established new Lower San Joaquin River (LSJR) flow objectives and revised southern Delta salinity objectives. The LSJR flow objectives for February through June require 40 percent of unimpaired flow, based on a minimum 7-day running average, from each of the Stanislaus, Tuolumne, and Merced Rivers, with the ability to adjust between 30 and 50 percent through adaptive management, and with certain minimum base flows. The SWRCB estimates that the new LSJR flow objectives will reduce water available for human consumptive use by between 7 and 23 percent, on average, and 38 percent in critically dry years.

On February 25, 2019, the Office of Administrative Law approved the Phase 1 amendments, which are now in effect. The SWRCB plans to fully implement the new LSJR flow objectives through adjudicatory (water rights) and regulatory (water quality) processes by 2022. The SWRCB has stated that it encourages voluntary agreements that will assist in implementing the LSJR flow objectives through a combination of flow and non-flow habitat restoration measures, and will consider such agreements as part of its proceedings to implement the Phase 1 Bay-Delta Plan update, consistent with its obligations under applicable law.

In July of 2018, the SWRCB released a framework that describes the draft proposal for Phase 2, which will update the flow requirements for the Delta and its contributing watersheds, including the Sacramento River and its tributaries. The framework provides additional details about the flow requirements staff is likely to propose, how these new requirements could be implemented, and preliminary information on their potential environmental benefits and water supply effects. Among other things, SWRCB staff anticipate proposing an inflow level of 45-65 percent of unimpaired flow, with a starting point of 55 percent. The proposed program of implementation would allow voluntary agreements with nonflow measures to be lower in the range – so long as the measures provide the same level of resource protection as 55 percent, and that the agreement is still within the range of 45-65 percent. The framework states that the SWRCB is interested in receiving potential Bay-Delta Plan amendment language developed through the voluntary agreement process that would authorize, with the affirmative concurrence from CDFW, a coordinated control of flows and other, non-flow factors that would achieve benefits comparable to the unimpaired flow requirements.

Other issues, such as the recent decline of some fish populations in the Bay-Delta and surrounding regions and certain operational actions in the Bay-Delta, may significantly reduce Metropolitan's water supply from the Bay-Delta. Future new or revised Biological Opinions or incidental take authorizations under the Federal ESA and California ESA might further adversely affect SWP and CVP operations. Additionally, new litigation, listings of additional species under the ESAs, or new regulatory requirements imposed by the SWRCB could further adversely affect SWP operations in the future by requiring additional export reductions, releases of additional water from storage, or other operational changes impacting water supply operations. Metropolitan cannot predict the ultimate outcome of any of the litigation or regulatory processes described above, but believes they could have an adverse impact on the operation of the SWP pumps, Metropolitan's SWP supplies, and Metropolitan's water reserves.

Operational constraints likely will continue until a long-term solution to the problems in the Bay-Delta is identified and implemented. The Delta Vision process, established by Governor Schwarzenegger, was aimed at identifying long-term solutions to the conflicts in the Bay-Delta, including natural resource, infrastructure, land use, and governance issues. In addition, State resource agencies and various water user entities are currently engaged in the development of the Delta Conveyance Project, which is aimed at making physical and operational improvements to the SWP system in the Delta necessary to access south-of-Delta SWP water supplies and restore and protect water quality by addressing anticipated sea-level rise, seismic risks, and by providing operational flexibility to improve aquatic conditions in the Delta and better manage risks of further regulatory constraints on SWP operations.

Changed Conditions

In August 2020, DWR released the 2019 State Water Project Delivery Capability Report. The 2019 Delivery Capability Report presents the current DWR estimate of the amount of water deliveries for current (2019) conditions and conditions 20 years in the future for each SWP contractor under a range of hydrologic conditions. These estimates incorporate regulatory requirements in accordance with the SWRCB Water Quality Control Plan, the USFWS and NMFS Biological Opinions and the CDFW Incidental Take Permit. In addition, these estimates incorporate 2018 amendments to the Coordinated Operations Agreement between the SWP and CVP. Future capability estimates also reflect the potential impacts of climate change and sea level rise. Under the 2019 Delivery Capability report, the delivery estimates for the SWP for 2019 conditions as a percentage of Table A amounts are 7 percent, equivalent to 134 TAF for Metropolitan, under a single dry year (1977) condition and 58 percent, equivalent to 1.1 MAF for Metropolitan, under long-term average conditions.

Implementation Approach

Metropolitan's implementation approach for the SWP depends on the full use of the current State Water Contract provisions, including its basic contractual amounts and Article 21 interruptible supplies. In addition, it requires successful negotiation and implementation of a number of agreements. Each of these stakeholder processes or agreements involves substantial Metropolitan and member agency staff involvement to represent regional interests. Metropolitan is committed to working collaboratively with DWR, SWP contractors, and other stakeholders to ensure the success of these extended negotiations and programs.

SWP Reliability

This discussion provides details of the major actions Metropolitan is undertaking to improve SWP reliability.

Delta Conveyance Project – Planning for a Delta conveyance project to address declining populations of sensitive fish species and the increasingly restrictive permit conditions began decades ago. In the mid-1990s, a consortium of federal, state, and local agencies including Metropolitan entered the Bay-Delta Accord, which included hundreds of millions of dollars for ecosystem restoration in the Delta and its salmon-bearing tributaries. In 2000, a similar consortium completed the CALFED analysis of a program of ecosystem restoration and improvements to Delta conveyance and issued a Record of Decision that included dual conveyance as an alternative. In April 2006, the CALFED Program issued a 10-year Action Plan to refocus the program based on new scientific and policy information. The scientific information indicated that the current physical configuration of the Delta did not lead to a sustainable condition due to increasing risk of seismic events and sea level rise; and that population levels for Delta pelagic (open water) organisms were at record low levels and were appearing to continue to decline.

The 10-year Action Plan also indicated that several water users were considering the development of a habitat conservation plan for the Delta. This effort was the initiation of the Bay Delta Conservation Plan (BDCP), which began with the support and participation of water suppliers, including Metropolitan. One of the conservation measures included new points of diversion on the Sacramento River in the north Delta connected by a canal or two tunnels to Clifton Court Forebay (part of the SWP) in the south Delta.

In September 2006, Governor Schwarzenegger signed Executive Order S-17-06, which launched the Delta Vision process by establishing a Blue-Ribbon Task Force, a cabinet-level Delta Vision Committee, Delta Science Advisors, and a Stakeholder Coordination Group. The executive order charged the Blue-Ribbon Task Force with developing both a long-term vision for a sustainable Delta and a plan to implement that vision. The Delta Vision Committee recommended, among other things, creation of a state plan for the Delta and Suisun Marsh aimed at landscape-scale ecosystem restoration and a new Delta conveyance infrastructure to create a dual system of conveyance. On February 28, 2008, Governor Schwarzenegger, in a letter to state Senators Perata, Machado, and Steinberg, stated his intention to direct DWR to proceed with preparation of environmental review and permitting activities for the BDCP.

In 2009, in light of the Delta Vision reports and recommendations, the Legislature enacted the Sacramento-San Joaquin Delta Reform Act of 2009, which established the coequal goals for the Delta of ecosystem restoration and restoration of reliable SWP and CVP supplies, created the Delta Stewardship Council, and charged the new agency with development of a Delta Plan to further the coequal goals in a manner that protects and enhances the Delta as an evolving place. The Delta Reform Act and the first Delta Plan, adopted in 2013, called for incorporation of the BDCP into the Delta Plan if it met state and federal requirements for a habitat conservation plan and natural communities' conservation plan.

The BDCP planning process continued under Governor Brown, but in light of comments on the BDCP, DWR began analyzing three new sub-alternatives to the BDCP that involved new conveyance independent of any landscape-scale habitat restoration called the California WaterFix. At the same time, Governor Brown initiated California EcoRestore, which was aimed at restoration of 30,000 acres of fish habitat in the Delta. In July 2017, DWR approved California WaterFix. Metropolitan's Board authorized participation in California WaterFix in October 2017, and again in April and July of 2018.

In his State of the State address delivered February 12, 2019, Governor Newsom announced that he did not "support WaterFix as currently configured," but does "support a single tunnel." On April 29, 2019, Governor Newsom issued Executive Order N-10-19, directing several agencies to (among other things) "inventory and assess… [c]urrent planning to modernize conveyance through the Bay Delta with a new single tunnel project." The Governor's announcement and Executive Order led to DWR's withdrawal of all approvals and environmental compliance documentation associated with California WaterFix. The CEQA process identified in this notice for the proposed Delta Conveyance Project will, as appropriate, utilize relevant information from the past environmental planning process for California WaterFix, but the proposed project will undergo a new stand-alone environmental analysis leading to issuance of a new EIR.

On January 15, 2020, DWR issued a Notice of Preparation of an Environmental Impact Report for the DCP, stating:

> *DWR's underlying, or fundamental, purpose in proposing the project is to develop new diversion and conveyance facilities in the Delta necessary to restore and protect the reliability of State Water Project (SWP) water deliveries and, potentially, Central Valley Project (CVP) water deliveries south of the Delta, consistent with the State's Water Resilience Portfolio.*
>
> *The above stated purpose, in turn, gives rise to several project objectives. In proposing to make physical improvements to the SWP Delta conveyance system, the project objectives are:*
>
> - *To address anticipated rising sea levels and other reasonably foreseeable consequences of climate change and extreme weather events.*
> - *To minimize the potential for public health and safety impacts from reduced quantity and quality of SWP water deliveries, and potentially CVP water deliveries, south of the Delta resulting from a major earthquake that causes breaching of Delta levees and the inundation of brackish water into the areas in which the existing SWP and CVP pumping plants operate in the southern Delta.*
> - *To protect the ability of the SWP, and potentially the CVP, to deliver water when hydrologic conditions result in the availability of sufficient amounts, consistent with the requirements of state and federal law, including the California and federal Endangered Species Acts and Delta Reform Act, as well as the terms and conditions of water delivery contracts and other existing applicable agreements.*
> - *To provide operational flexibility to improve aquatic conditions in the Delta and better manage risks of further regulatory constraints on project operations*

The proposed project would construct and operate new conveyance facilities in the Delta that would add to the existing SWP infrastructure. New intake facilities as points of diversion would be located in the north Delta along the Sacramento River between Freeport and the confluence with Sutter Slough. The new conveyance facilities would include a single main tunnel to convey water from the new intakes to the existing Banks Pumping Plant and potentially the federal Jones Pumping Plant 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. The new north Delta facilities would be sized to convey up to 6,000 cfs of water from the Sacramento River to the SWP facilities in the south Delta. DWR would operate the dual conveyance system in compliance with all state and federal regulatory requirements and would not reduce DWR's current ability to meet standards in the Delta to protect biological resources and water quality for beneficial uses.

Contract Amendments – Metropolitan and other State Water Contractors have undertaken negotiations with DWR to extend their State Water Contracts. In June 2014, DWR and the State Water Contractors reached an Agreement in Principle (the "Agreement in Principle") on an amendment to the State Water Contracts to extend the contracts and to make certain changes related to financial management of the SWP in the future. DWR and 25 of the State Water Contractors, including Metropolitan, have signed the Agreement in Principle. Under the Agreement in Principle, the term of the State Water Contract for each Contractor that signs an amendment would be extended until December 31, 2085. The Agreement in Principle served as the "proposed project" for purposes of environmental review under CEQA. DWR issued a Notice of Availability of the Draft Environmental Impact Report ("EIR") for the proposed project on August 17, 2016. DWR released the Final EIR on November 16, 2018 and certified the final EIR and issued a Notice of Determination on December 11, 2018. Concurrently, Metropolitan considered the certified final EIR and approved the water supply contract extension amendment at its December 11, 2018 Board meeting. That same day, DWR filed a lawsuit seeking to validate the contract extension. In January of 2019, two groups of plaintiffs filed lawsuits challenging DWR's Final EIR and approval of the Contract Extension under CEQA, the Delta Reform Act, and public trust doctrine. Those cases have been related to the validation action and are pending before the same judge. To date, 21 of the 29 State Water Contractors have executed the amendment, achieving the DWR established threshold needed for it to be fully executed. DWR is awaiting a decision from the trial court on the validation litigation described above before moving forward with execution of the amendments with individual State Water Contractors.

In a process separate from the State Water Contract extension amendment described above, Metropolitan and other State Water Contractors undertook public negotiations with DWR to amend their State Water Contracts to clarify how costs would be allocated for the California WaterFix, as well as to clarify the criteria applicable to certain water management tools including single and multi-year water transfers and exchanges between State Water Contractors. DWR and the State Water Contractors reached an Agreement in Principle in 2018 (the "2018 AIP"), and DWR issued a Draft EIR. On April 29, 2019, Governor Newsom issued the executive order directing State agencies to develop a comprehensive statewide strategy to build a climate-resilient water system that included consideration of a single-tunnel Delta conveyance facility instead of the approved California WaterFix project. DWR removed the WaterFix cost provisions from the 2018 AIP and, on February 28, 2020, recirculated the Draft EIR for only the 2018 AIP's water management provisions. DWR certified a Final EIR for the water management tools AIP in August 2020 and finalized contract language in October 2020. Since then, all but three of the SWP contractors have approved and signed the amendments, including Metropolitan, which approved the amendments on February 9, 2021. As a result, the amendments became effective on February 28, 2021. The water management provisions allow for greater flexibility for transfers and exchanges among those public agencies with State Water Contracts. Specifically, it would confirm existing practices for exchanges, allow more flexibility for non-permanent water transfers, and allow for the transfer and exchange of certain portions of Article 56 carry over water.

In light of the shift from California WaterFix to the Delta Conveyance Project, Metropolitan and other State Water Contractors embarked on a third public process to further negotiate proposed amendments related to cost allocation for a potential new Delta Conveyance Project. In March of 2020, DWR and the State Water Contractors reached an Agreement in Principle ("Delta Conveyance AIP") for the allocation of costs and benefits for a Delta Conveyance project based on an allocation of proportionate shares. The Delta Conveyance AIP provides a mechanism that would allow for the costs related to any Delta Conveyance project to be allocated for and collected by DWR. The Delta Conveyance AIP also provides for the allocation of benefits for any Delta Conveyance project. Additionally, the Delta Conveyance AIP includes a white paper that describes how DWR would account for and administer any Delta Conveyance project benefits and costs if a project were implemented today. Contract language is under development, and any contract approval would follow DWR completing the Delta Conveyance Project environmental review.

COA Addendum – DWR operates the SWP in coordination with the federal CVP, which is operated by USBR. Since 1986, the coordinated operations have been undertaken pursuant to a Coordinated Operations Agreement for the Central Valley Project and State Water Project (the "COA"). The COA defines how the State and federal water projects share water quality and environmental flow obligations imposed by regulatory agencies. The agreement calls for periodic review to determine whether updates are needed in light of changed conditions. After completing a joint review process, DWR and USBR agreed to amend the COA to reflect water quality regulations, Biological Opinions, and hydrology updated since the 1986 agreement was signed. On December 13, 2018, DWR and USBR executed an Addendum to the COA (the "COA Addendum"). Through the COA Addendum, DWR will adjust current SWP operations to modify pumping operations, as well as project storage withdrawals to meet in-basin uses, pursuant to revised calculations based on water year types. The COA Addendum will shift responsibilities for meeting obligations between the CVP and the SWP, resulting in a shift of approximately 120 TAF in long-term average annual exports from the SWP to the CVP. In executing the COA Addendum, DWR found the agreement to be exempt from environmental review under the California Environmental Quality Act ("CEQA") as an ongoing project and that the adjustments in operations are within the original scope of the project. On January 16, 2019, commercial fishing groups and a tribe ("petitioners") filed a lawsuit against DWR alleging that entering into the COA Addendum violated CEQA, the Delta Reform Act, and the public trust doctrine. The parties are in the process of completing the administrative record, which will form the evidentiary basis at trial, which has not been set at this time.

Ecosystem Restoration – The main objective under the EcoRestore Program is the restoration of at least 30,000 acres of Delta habitat, with the near-term goal of making significant strides toward that objective by 2020. These restoration programs include projects and actions that comply with pre-existing regulatory requirements designed to improve the overall health of the Delta. Other priority restoration projects would also be identified by the Sacramento-San Joaquin Delta Conservancy and other agencies and local governments. Funding is provided through multiple sources, including various local and federal partners, state bonds, and other state-mandated funds. SWP/CVP contractors have provided funds as part of existing regulatory obligations imposed on the SWP and CVP.

Delta Science Initiatives – Metropolitan's Bay-Delta science program supports water supply reliability and ecosystem restoration by protecting the Bay-Delta environment, driving better management decisions, and fostering effective regulations. Metropolitan is conducting a science program to ensure that regulations effectively protect aquatic species while ensuring a reliable water supply. The key elements of the science program include: (1) staff with scientific expertise to design, manage and participate in scientific investigations addressing Metropolitan's priorities; (2) funding science studies through direct funding, collaborations, staff in-kind contributions, and by pursuing external grant funding sources to leverage Metropolitan's science investments; (3) collaborations with external organizations to conduct science studies, including the State Water Contractors, Collaborative Science and Adaptive Management Program (CSAMP), Interagency Ecological Program agencies, Delta Stewardship Council Delta Science Program, and university scientists; and (4) participation in the Bay-Delta science community through communication of science study findings, participation in science conferences and publishing results of scientific studies in peer reviewed journals.

Metropolitan's Bay-Delta science efforts focus on three priority areas of water operations to protect Delta fish, Delta stressors and habitat needs of listed fish species.

- Water Operations to Protect Delta Fish. A priority focus for the science program is to develop a better understanding of the effect of water project operations on the health, abundance, and distribution of listed fish species, including Delta smelt, longfin smelt and Chinook salmon. The science program includes investigation of the mechanisms behind flow-abundance relationships observed in analysis of fish survey data for Delta smelt and longfin smelt, factors that affect adult Delta smelt, salmon and steelhead entrainment risk at the CVP and SWP export facilities, potential bias in fish survey data, and development of effective methods to study Delta smelt without collecting or harming the fish.
- Delta Stressors. Multiple stressors in the Bay-Delta ecosystem affect the health, abundance, and distribution of listed fish species; however, we have limited understanding of the impacts of various stressors and their specific role in the decline of listed species. The science program includes investigation into key stressors to develop information that can support development of effective management actions. These studies include investigation into predation impacts on salmon, toxic contaminant effects on Delta smelt and juvenile salmon, and the effects of nutrients on the food web.
- Habitat Needs for Delta Fish. Compared to the historical Delta, the modern Delta is highly altered and has a small fraction of tidal marsh habitat remaining and greatly reduced levels of primary production. Food and habitat limitation have been identified as important stressors for listed species. The science program includes investigation of salmon habitat needs, pilot studies to enhance the food web, longfin smelt habitat studies, pilot projects to benefit Delta smelt, monitoring the effectiveness of habitat improvement actions, and evaluation of land use and habitat opportunities on Metropolitan's Delta Island properties.

<u>SWP Terminal Storage</u>

Metropolitan has contractual rights to 65 TAF of flexible storage at Lake Perris (East Branch terminal reservoir) and 154 TAF of flexible storage at Castaic Lake (West Branch terminal reservoir). This storage provides Metropolitan with additional options for managing SWP deliveries to maximize yield from the project. Over multiple dry years, it can provide Metropolitan with 44 TAF of additional supply. In a single dry year like 1977, it can provide up to 219 TAF of additional supply to Southern California.

<u>Yuba Dry Year Water Purchase Program</u>

In December 2007, Metropolitan entered into an agreement with DWR providing for Metropolitan's participation in the Yuba Dry Year Water Purchase Program between Yuba Water Agency and DWR. This program provides for transfers of water from the Yuba Water Agency during dry years through 2025.

<u>Desert Water Agency/Coachella Valley WD SWP Table A Transfer</u>

Under the transfer agreement, Metropolitan transferred 100 TAF of its SWP Table A contractual amount to Desert Water Agency/CVWD (DWCV). Under the terms of the agreement, DWCV pays all SWP charges for this water, including capital costs associated with capacity in the California Aqueduct to transport this water to Perris Reservoir, as well as the associated variable costs. The amount of water actually delivered in any given year depends on that year's SWP allocation. Water is delivered through the existing exchange agreements between Metropolitan and DWCV, under which Metropolitan delivers Colorado River supplies to DWVC equal to the SWP supplies delivered to Metropolitan. While Metropolitan transferred 100 TAF of its Table A amount, it retained other rights, including interruptible water service; its full carryover amounts in

San Luis Reservoir; its full use of flexible storage in Castaic and Perris Reservoirs; and any rate management credits associated with the 100 TAF.

Desert Water Agency/Coachella Valley WD Exchange and Advance Delivery Program

Under this program, Metropolitan delivers Colorado River water to the Desert Water Agency and CVWD in advance of the exchange for their SWP Contract Table A allocations. In addition to their Table A supplies, Desert Water Agency and CVWD may take delivery of other SWP supplies available to SWP Contractors. By delivering enough water in advance to cover Metropolitan's future exchange obligations, Metropolitan is able to receive Desert Water Agency and CVWD's available SWP supplies without having to deliver an equivalent amount of Colorado River water. This program allows Metropolitan to maximize delivery of SWP water in wet years by enabling delivery of Colorado River supplies to storage in the Advance Delivery Program instead of to the service area. These Table A deliveries are incorporated into the estimate of SWP Deliveries under Current Programs shown in Table 3-2.

Desert Water Agency/Coachella Valley WD Other SWP Deliveries

Since 2008, Metropolitan has provided Desert Water Agency and CVWD written consent to take delivery of non-SWP supplies separately acquired by each agency from the SWP facilities. These deliveries include water acquired from the Yuba Dry Year Water Purchase Program, the Multi-Year Water Pool, the 2009 Drought Water Bank, and long-term water supplies purchased by CVWD from Rosedale Rio-Bravo Water Storage District. Metropolitan has also consented to:

- 10 TAF of exchange deliveries to CVWD for non-SWP water acquired from the San Joaquin Valley from 2008 through 2010,
- 36 TAF of exchange deliveries to Desert Water Agency for non-SWP water acquired from the San Joaquin Valley from 2008 through 2015, and
- 16.5 TAF of exchange deliveries to CVWD from groundwater storage of Kern River flood flows or SWP water delivered from Kern County Water Agency provided by Rosedale Rio Bravo Water Storage District from 2012 through 2035.

Effective in 2020, Metropolitan, Desert Water Agency and CVWD executed an amendment to the Advance Delivery Program and exchange of water. Among its provisions is the termination of Metropolitan's right to an annual option to call-back the 100,000 acre-feet Table A transfer. It also provides that Metropolitan will deliver Article 21 and non-SWP water supplies for Desert and CVWD to the extent that Metropolitan has available capacity. This agreement also includes an additional exchange of 15 TAF per year from 2020 to 2026. However, as the source of the exchange is water CVWD can call from the ID/MWD Conservation Program, which is Colorado River water, this exchange is discussed in more detail in the IID/MWD Conservation Program section.

Table 3-2 summarizes Metropolitan's SWP supply range for 2035. Appendix 3 provides a detailed discussion of the current SWP programs and programs that are under development.

Table 3-2
California Aqueduct
Program Capabilities
Year 2035
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
MWD Table A [1]	499,000	122,000	1,108,000
DWCV Table A	51,000	12,000	113,000
San Luis Carryover [2]	57,000	283,000	283,000
Article 21 Supplies	0	0	20,000
Yuba River Accord Purchase	0	0	0
Subtotal of Current Programs	***607,000***	***417,000***	***1,524,000***
Programs Under Development			
Subtotal of Proposed Programs	***0***	***0***	***0***
Maximum Supply Capability	**607,000**	**417,000**	**1,524,000**

[1] Includes Port Hueneme lease.
[2] Includes DWCV carryover.

SWP Water Quality

Metropolitan requires a safe drinking water supply from the Bay-Delta to meet current and future regulatory requirements for public health protection. Finding cost-effective ways to reduce total organic carbon (TOC), bromide concentrations, pathogenic microbes, and other unknown contaminants from the Bay-Delta water supply is one of Metropolitan's top priorities. Metropolitan also requires a SWP supply that is consistently low in salinity - Total Dissolved Solids (TDS) - so it can blend SWP water with higher-salinity Colorado River water to achieve salinity goals for its member agencies. In addition, Metropolitan needs consistently low-salinity SWP water to increase in-basin water recycling and groundwater management programs. These programs require that blended water supplied to the member agencies meets the TDS goal adopted by Metropolitan's Board, which specifies a salinity objective of 500 mg/L for blended imported water.

Metropolitan is actively involved in DWR's Municipal Water Quality Investigations (MWQI) Program. The highly variable quality of SWP water influences the operation of Metropolitan's system and its water treatment process. Increasingly restrictive State and Federal drinking water standards, concerns over emerging contaminants such as personal care products and pharmaceuticals, algal taste and odors, and Delta ecosystem fisheries issues are critical variables. DWR's MWQI Program strives to monitor, protect, and improve drinking water quality of Delta water deliveries to the urban State Water Contractors and other users of Delta water. The program focuses on issues related to drinking water quality through regular water quality monitoring, special field and laboratory studies, the use of forecasting tools such as computer models and data management systems, and reporting. While the program has developed extensive monitoring in the Delta including real-time monitoring, increased monitoring along the California Aqueduct is the next major step.

Levee modifications at Franks Tract and other source control actions may significantly reduce ocean salinity concentrations in Delta water, which would benefit Delta water users and export interests alike. Franks Tract is an island located in the central Delta that was actively farmed until levee breaches in 1936 and 1938. Since 1938, the tract has remained a flooded island, and its levees remain in disrepair. Tidal flows in the Delta entrap saline ocean water in the flooded tract, resulting in degraded water quality for both in-Delta and export users. Computer modeling analyses by Metropolitan, DWR, and the US Geological Survey indicate that reducing this salinity intrusion by partially closing existing levee breach openings and/or building radial gate flow control structures will significantly reduce TDS and bromide [2] concentrations in water from the Delta during the summer and fall months and in drought years.

In 2016, the California Department of Fish and Wildlife (CDFW), as part of the 2016 Delta Smelt Resiliency Strategy, began a process of working with the local community, local agencies, and interested stakeholders in developing a habitat enhancement plan for Franks Tract called the Franks Tract Restoration Feasibility Study. The objective was to assess the feasibility of restoring components of the historic tidal marsh form and function to create habitat suitable for Delta Smelt, reduce the extent of aquatic weeds, decrease predation on Delta Smelt and other native fishes by lowering habitat suitability for non-native species, modify hydrology to something more similar to historical conditions, improve food webs, and improve water quality in the interior Delta, which would benefit both in-Delta diverters and SWP and CVP supplies. In its current state of shallow open water, Franks Tract facilitates salinity intrusion into the mid-Delta as a result of tidal pumping through False River. Restoration designs focus on minimizing tidal pumping from False River. In 2018, CDFW determined that it is feasible to achieve the project objectives. In response to community concerns, in July 2019, CDFW, in cooperation with the Department of Parks and Recreation, launched a second round of planning that lasted from August 2019 through September 2020. Stakeholders, advisors, and the public chose the Central Landmass as the preferred design concept as documented in the Franks Tract Futures 2020 Reimagined report published in September 2020.

The state has adopted an "equivalent level of public health protection" (ELPH) program that targets water quality actions outside the Delta. The Bay-Delta Program is coordinating a feasibility study on water quality improvement in the California Aqueduct.

Metropolitan and the Friant Water Users Authority (FWUA) have entered into a partnership to investigate the potential of enhancing the quantity and affordability of the eastern San Joaquin Valley's water supply while improving Southern California's water quality. The FWUA and Metropolitan studied projects that benefited both regions. Using Proposition 13 funds, an existing canal belonging to the Arvin-Edison Water Storage District was enlarged, enabling greater volumes of water to be exchanged between their groundwater and the California Aqueduct.

SWP System Outage and Capacity Constraints

The California Aqueduct is experiencing reduction in flow capacity in certain areas due to ongoing land subsidence. Subsidence has been observed in the San Joaquin Valley since the 1920s, and subsidence was included in the planning and design of the California Aqueduct. The DWR published a detailed study in 2017 describing the impacts of subsidence in the reduction of concrete liner freeboard and the ability to store water in certain pools, reducing operational flexibility and increasing power costs. Through 2016, no contracted deliveries had been curtailed due to subsidence, but DWR has a subsidence program aimed to proposed improvements to the California Aqueduct and restore capacity, as well as work with the Groundwater

[2] The importance of managing bromides is discussed in the Water Quality chapter.

Sustainability Agencies that cover the extension of the California Aqueduct to minimize future subsidence.

In 2015, Metropolitan, DWR, and the Los Angeles Department of Water and Power formed the Seismic Resilience Water Supply Task Force (SRWSTF). The goal of the SRWSTF is to collaborate on studies and mitigation measures aimed at improving the reliability of imported water supplies to Southern California. The SRWSTF aims to identify options to accelerate initial repairs acting as one agency and establish consensus on regional priorities for aqueduct repairs.

Because of the risk of a prolonged shutdown of the SWP caused by seismic or hydrologic events either within the Delta or along the California Aqueduct, Metropolitan has acted to ensure that Southern California has adequate emergency storage. Diamond Valley Lake (DVL) and SWP terminal reservoir storage, combined with member-agency emergency storage, are jointly capable of providing the region with a six-month supply of water if combined with a temporary 25 percent reduction in demand. Metropolitan engineering studies indicate this would provide sufficient time to repair the SWP and resume delivery.

Following the February 2017 Oroville spillways incident, DWR initiated a Comprehensive Needs Assessment (CNA). The CNA is led by DWR and technically reviewed by an Independent Review Board (IRB) composed of dam safety experts. The CNA is not investigating the causes of the February 2017 incident, but rather aims to identify actions to be taken by DWR to improve the resilience of the Oroville Dam complex. The report was released in November 2020 with a determination that Oroville is safe to operate, and no urgent repairs are needed. Several risk-reduction projects are currently being implemented and more projects are anticipated into the near future.

DWR is also investing to reduce seismic and hydrologic risk of aging SWP infrastructure critical in Southern California. A major retrofit to Perris Dam (Riverside County) was completed in April 2018, and other two major projects to improve seismic stability are currently under development with planned construction to start in a few years. Pyramid Dam and Castaic Dam (Los Angeles County) are also being studied with the planned assessment work estimated to be completed by 2022 and complete modernization work to take about 10 years to complete.

Achievements to Date

SWP Reliability

Metropolitan's Long-Term Action Plan

Besides the short- and mid-term actions described earlier in Section 1.4, Metropolitan's adopted Delta action plan in June 2007 includes a long-term Delta Plan. The long-term action plan recognizes the need for a global, comprehensive approach to the fundamental issues and conflicts in the Delta to result in a truly sustainable Delta. A piecemeal approach cannot satisfy the many stakeholders that have an interest in the Delta and will fail; there must be a holistic approach that deals with all issues simultaneously. In dealing with the basic issues of the Delta, solutions must address the physical changes required, as well as the financing and governance. There are three basic elements that must be addressed: Delta ecosystem restoration, water supply conveyance, and flood control protection and storage development. In addition, the state needs to establish governance structures and financing approaches to implement and manage the three identified elements.

Governor's Delta Vision Process

Through this enduring Delta crisis, the Legislature and the Governor initiated in 2006 a process to develop a new long-term vision for the Delta. SB 1574 (Kuehl/2006) required a cabinet committee to present recommendations for a Delta strategic vision. The governor created a Delta Vision Blue-Ribbon Task Force to advise the Cabinet Committee. The Task Force produced an October 2008 Strategic Plan, which the Cabinet Committee largely adopted and submitted, with its recommendations, to the Legislature on January 3, 2009. Metropolitan, as a stakeholder in the process, provided input to the Task Force.

The 2009 Delta Legislation

After delivery of the Delta Vision recommendations, the Legislature held informational hearings from Delta experts, Task Force members, and the Schwarzenegger Administration, as well as the public at large, and engaged in vigorous water policy discussions. Following the informational hearings, several legislators began developing detailed legislation which culminated in pre-print proposals being issued in early August of 2009 for public review and discussion over the summer recess. The Assembly Water, Parks and Wildlife Committee and the Senate Natural Resources and Water Committee then held joint informational hearings on the pre-print proposals and received extensive public comment. Thereafter, legislative leadership appointed a conference committee, which convened and held additional public hearings, with further legislator discussions on key issues. That work continued into the 7th Extraordinary Session, which was called by the governor specifically to address the pending Delta and water issues, and culminated in the signing of a historic package of bills. One of the keystones of that package was SB X7-1, which reformed Delta policy and governance. Specifically, SB X7-1:

- Established a new legal framework for Delta management, emphasizing the coequal goals of "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem" as foundation for state decisions as to Delta management.
- Reconstituted and redefined the role of the Delta Protection Commission (DPC) to narrow membership to focus on local representation and to expand the DPC's role in economic sustainability.
- Created a new Sacramento-San Joaquin Delta Conservancy (Conservancy) to support efforts that advance environmental protection and the economic well-being of Delta residents.
- Created the Delta Stewardship Council (Council) as an independent state agency to guide actions in the Delta which furthers the coequal goals of Delta restoration and water supply reliability.
- Repealed the CALFED Bay-Delta Authority Act and transfers existing staff, contracts, etc. to the Council.
- Created the Delta Independent Science Board (Science Board) and Delta Science Program.
- Required the State Water Resources Control Board (SWRCB) to develop by August 12, 2010, new flow criteria for the Delta ecosystem necessary to protect public trust resources.
- Required the Department of Fish and Game (DFG), now the Department of Fish and Wildlife (DFW), by December 31, 2010, to develop and recommend to the SWRCB flow criteria and quantifiable biological objectives for aquatic and terrestrial species.
- Created a Delta Watermaster as the enforcement officer for the SWRCB Division of Water Rights in the Delta.
- Required the Council to develop, adopt, and commence implementation of the "Delta Plan" by January 1, 2012, with a report to the Legislature by March 31, 2012.

- Required the DPC to develop a proposal to protect, enhance, and sustain the unique cultural, historical, recreational, agricultural, and economic values of the Delta as an evolving place.
- Required the Delta Plan to further the coequal goals of Delta ecosystem restoration and a reliable water supply.
- Required the Delta Plan to promote statewide water conservation, water use efficiency, and sustainable use of water, as well as improvements to water conveyance/storage and operation of both to achieve the coequal goals.
- Required the Delta Plan to attempt to reduce risks to people, property, and state interests in the Delta by promoting effective emergency preparedness, appropriate land uses, and strategic levee investments.
- Announced a statewide policy to reduce reliance on the Delta in meeting California's future water supply needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency. Each region that depends on water from the Delta watershed shall improve its regional self-reliance for water through investment in water use efficiency, water recycling, advanced water technologies, local and regional water supply projects, and improved regional coordination of local and regional water supply efforts.
- Required the Council to include the Bay Delta Conservation Plan (BDCP) in the Delta Plan and made the BDCP eligible for state funding if:
    - The BDCP complies with Natural Community Conservation Planning Act (NCCPA) and is approved as a Habitat Conservation Plan under the Federal ESA.
    - The BDCP complies with the California Environmental Quality Act and includes a full range of alternatives, including a reasonable range of flow criteria, rates of diversion, and other operational criteria.
    - DWR consults with the Council and Science Board during development of the BDCP.
    - DFW approves the BDCP as a Natural Community Conservation Plan and determines that it meets the requirements for incorporation into the Delta Plan.

SWP Water Quality

The most significant achievement for SWP water quality has been continued definition and advancement of the Delta Improvement Package. Most notably, the Franks Tract studies identified cost-effective ways to achieve significant improvements in the quality of Delta export water.

SWP System Reliability

The completion and filling of DVL marked the most important achievement with respect to protecting Southern California against an SWP system outage. Water deliveries to the reservoir commenced in November 1999, and the lake was filled by early 2003. The lake can hold up to 810 TAF which provides Southern California with emergency water supply, as well as carryover and regulatory storage. As of December 2020, the DVL storage is at 704 TAF.

<u>Inland Feeder</u>

The Inland Feeder is a 44-mile-long conveyance system that connects the SWP to DVL and the CRA. The Inland Feeder provides greater flexibility in managing Metropolitan's major water supplies and allows greater amounts of SWP water to be accepted during wet seasons for storage in DVL. In addition, the Inland Feeder increases the conveyance capacity from the East Branch of the SWP by up to 1,000 cubic feet per second, allowing the East Branch to operate up to its full capacity. The project also improves the quality of the Southland's drinking water by allowing more uniform blending of lower salinity water from the SWP with Colorado River supplies, which have a higher mineral content. Construction of the Inland Feeder was completed in September 2009.

Inland Feeder-Lakeview Pipeline Intertie

The Inland Feeder-Lakeview Pipeline Intertie connects the two conveyance pipelines at the PC-1 control structure on the Inland Feeder. The project allows for delivery of water from Diamond Valley Lake to the Mills Water Treatment Plant. Completed in 2016, the project was a direct response to the extreme drought period in 2014, which saw a 5 percent allocation of Metropolitan's SWP supplies. The intertie enables the Mills Plant to withstand an extended interruption of supplies from the California Aqueduct East Branch. The intertie also provides delivery flexibility to handle any required repairs by DWR to the Santa Ana Valley Pipeline north segment.

3.3 Central Valley/State Water Project Storage and Transfer Programs

Metropolitan endeavors to increase the reliability of supplies received from the California Aqueduct by developing flexible SWP storage and transfer programs. Over the years, Metropolitan has developed numerous voluntary SWP storage and transfer programs to secure additional dry-year water supplies.

Background

Metropolitan has a long history of managing the wide fluctuations of SWP supplies from year to year by forming partnerships with Central Valley agricultural districts along the California Aqueduct, as well as with other Southern California SWP Contractors. These partnerships allow Metropolitan to store its SWP supplies during wetter years for return in future drier years. Some programs also allow Metropolitan to purchase water in drier years for delivery via the California Aqueduct to Metropolitan's service area.

Because yields from individual programs can vary widely depending on hydrologic conditions and CVP/SWP operations, the dry-year yields for the various programs reported in this section are expected values only. In any given year, actual yields could depart from the expected values. Despite that uncertainty, Metropolitan's models of these programs indicate that in the aggregate, they can meet the resource target under a wide range of hydrologic conditions and CVP/SWP operations.

In addition, the SWP storage and transfer programs have served to demonstrate the value of partnering, and, increasingly, Central Valley agricultural interests see partnering with Metropolitan as a sensible business practice beneficial to their local district and regional economy.

Implementation Approach

Metropolitan is currently operating several SWP storage programs that serve to increase the reliability of supplies delivered through the California Aqueduct. Metropolitan pursues SWP water transfers on an as-needed basis. Table 3-3 lists the expected yields from these storage and transfer programs. Figure 3-3 shows the location of Metropolitan's statewide groundwater banking programs.

Storage and Transfer Programs

Semitropic Storage Program

Metropolitan has a groundwater storage program with Semitropic Water Storage District located in the southern part of the San Joaquin Valley. The maximum storage capacity of the program is 350 TAF. The specific amount of water Metropolitan can store in and subsequently expect to receive from the program depends upon hydrologic conditions, any regulatory requirements restricting Metropolitan's ability to export water for storage, and the demands placed on the Semitropic Program by other program participants. In 2014, Metropolitan amended the program to increase the return yield by an additional 13.2 TAF per year. The minimum annual yield available to Metropolitan from the program is currently 34.7 TAF, and the maximum annual yield is 236.2 TAF, depending on the available unused capacity and the SWP allocation. During wet years, Metropolitan has the discretion to use the program to store portions of its SWP water that are in excess of the amounts needed to meet Metropolitan's service area demand. In Semitropic, the water is delivered to district farmers who use the water in lieu of pumping groundwater. During dry years, the district returns Metropolitan's previously stored water to Metropolitan by direct groundwater pump-in return and the exchange of SWP supplies.

Arvin-Edison Storage Program

Metropolitan amended the groundwater storage program with Arvin-Edison Water Storage District in 2008 to include the South Canal Improvement Project. The project increases the reliability of Arvin-Edison returning higher water quality to the California Aqueduct. In addition, Metropolitan and Arvin-Edison often enter into annual operational agreements to optimize program operations in any given year. The program storage capacity is 350 TAF. The specific amount of water Metropolitan can expect to store in and subsequently receive from the program depends upon hydrologic conditions and any regulatory requirements restricting Metropolitan's ability to export water for storage. The storage program is estimated to deliver 75 TAF. During wet years, Metropolitan has the discretion to use the program to store portions of its SWP supplies which are in excess of the amounts needed to meet Metropolitan's service area demand. The water can be either directly recharged into the groundwater basin or delivered to district farmers who use the water in lieu of pumping groundwater. During dry years, the district returns Metropolitan's previously stored water to Metropolitan by direct groundwater pump-in return or by exchange of surface water supplies. In 2015, Metropolitan funded the installation of three new wells at a cost of $3 million that will restore the return reliability by 2.5 TAF per year. The funding will ultimately be recovered through credits against future program costs. As a result of recent detection of 1,2,3-trichloropropane in Arvin-Edison wells, Metropolitan has temporarily suspended operation of the program until the water quality concerns can be further evaluated and managed.

Table 3-3 summarizes Metropolitan's Central Valley/SWP transfer programs supply range for 2035. The supply capabilities shown reflect actual storage program conveyance constraints. In addition, SWP supplies are estimated using DWR's 2019 SWP Delivery Capability Report released in August 2019. Appendix 3 provides a detailed discussion of the current Central Valley and SWP storage and transfers programs and programs that are under development.

Table 3-3
Central Valley/State Water Project Storage and Transfer Programs
Supply Projection
Year 2035
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
San Gabriel Valley MWD Exchange and Purchase	2,000	2,000	2,000
Central Valley Storage and Transfers			
Semitropic Program	50,000	45,000	68,000
Arvin Edison Program[1]	0	0	0
Mojave Storage Program	0	0	0
Antelope Valley/East Kern Acquisition and Storage	43,000	70,000	70,000
Kern Delta Program	42,000	50,000	50,000
Transfers and Exchanges	50,000	50,000	50,000
Subtotal of Current Programs	***187,000***	***217,000***	***240,000***
Programs Under Development			
San Bernardino Valley Water District Program	0	0	13,000
Subtotal of Proposed Programs	***0***	***0***	***13,000***
Maximum Supply Capability	**187,000**	**217,000**	**253,000**

[1] Take and put amounts limited due to water quality considerations.

San Bernardino Valley MWD Transfer Program

The San Bernardino Valley MWD Transfer Program allows for the purchase of a portion of San Bernardino Valley MWD's SWP supply under surplus conditions. Each calendar year, a determination will be made on how much surplus supplies are available, and Metropolitan will then decide how much will be purchased. The agreement term is until December 31, 2035 and can be extended with a State Water Contract extension.

San Gabriel Valley MWD Exchange Program

The San Gabriel Valley MWD program allows for the exchange of up to 5 TAF each year. For each acre-foot Metropolitan delivers to the City of Sierra Madre, a San Gabriel Valley MWD member agency, San Gabriel Valley MWD provides two acre-feet to Metropolitan in the Main San Gabriel Basin, up to 5 TAF. The program provides increased reliability to Metropolitan by allowing additional water to be delivered to Metropolitan's member agencies Three Valleys MWD and Upper San Gabriel Valley MWD.

Antelope Valley-East Kern Water Agency Exchange and Storage Program

The Antelope Valley-East Kern Water Agency (AVEK) exchange and storage program provides Metropolitan with additional supplies and increased reliability. Under the exchange program, for every two acre-feet Metropolitan receives, Metropolitan returns one acre-foot to AVEK to improve its reliability. The exchange program is expected to deliver 30 TAF over ten years, with 10 TAF available in dry years. Under the program, Metropolitan will also be able to store up to 30 TAF in the AVEK's groundwater basin, with a dry year return capability of 10 TAF.

High Desert Water Bank Program

In December 2019, Metropolitan entered into an agreement with AVEK for the High Desert Water Bank Program to improve water supply reliability during dry years or emergencies and provide greater operational flexibility to balance supplies and demands. Under the Program, Metropolitan will have the ability to store up to 280 TAF of its SWP Table A or other supplies in the Antelope Valley groundwater basin. Metropolitan will provide up to $131 million for the construction of monitoring and production wells, turnouts from the California Aqueduct, underground and aboveground pipelines, recharge basins, water storage, and booster pump facilities. Metropolitan will have first priority to 70 TAF per year of both put and take capacity. The project is anticipated to be in operation by 2024.

Kern-Delta Water District Storage Program

This groundwater storage program has 250 TAF of storage capacity. The program is capable of providing up to 50 TAF of dry-year supply. In 2015, Metropolitan agreed to fund the cross-river pipeline that, when completed, will help improve Metropolitan's return reliability by reducing losses during exchanges. Metropolitan has not incurred any cost to date, as the pipeline has not been constructed. Environmental and regulatory issues have delayed implementation of the pipeline. Water for storage can be either directly recharged into the groundwater basin or delivered to district farmers who use the water in lieu of pumping groundwater. During dry years, the district returns Metropolitan's previously stored water to Metropolitan by direct groundwater pump-in return or by exchange of surface water supplies.

Mojave Storage Program

Metropolitan entered into a groundwater banking and exchange transfer agreement with Mojave Water Agency on October 29, 2003. This agreement was amended in 2011 to extend the term of the program through 2035 and to allow for the cumulative storage of up to 390 TAF. The agreement allows for Metropolitan to store water in an exchange account for later return. Through 2021, Metropolitan can annually withdraw the Mojave Water Agency's SWP contractual amounts in excess of 10%. After 2021, the withdraw rate lowers, reserving 20% of Mojave Water Agency's SWP contractual amounts. Under a 100% allocation, the State Water Contract provides Mojave Water Agency 82.8 TAF of water.

Presently, the Mojave Water Agency is not accepting additional water from Metropolitan. As of January 2021, Metropolitan has approximately 19 TAF remaining in storage. Without additional deliveries to the exchange account, the program may not be able to provide return supplies beyond 2025.

Central Valley Transfer Programs

Metropolitan secures Central Valley water transfer supplies via spot markets and option contracts to meet its service area demands when necessary. Hydrologic and market conditions, and regulatory measures governing Delta pumping plant operations, will determine the amount of water transfer activity occurring in any year. Transfer market activity, described below, provides examples of how Metropolitan has secured water transfer supplies as a resource to fill anticipated supply shortfalls needed to meet Metropolitan's service area demands.

In 2003, Metropolitan secured options to purchase approximately 145 TAF of water from willing sellers in the Sacramento Valley during the irrigation season. These options protected against potential shortages of up to 650 TAF within Metropolitan's service area that might have arisen from a decrease in Colorado River supply or as a result of drier-than-expected hydrologic conditions. Using these options, Metropolitan purchased approximately 125 TAF of water for delivery to the California Aqueduct.

In 2005, Metropolitan, in partnership with seven other State Water Contractors, secured options to purchase approximately 130 TAF of water from willing sellers in the Sacramento Valley, of which Metropolitan's share was 113 TAF. Metropolitan also had the right to assume the options of the other State Water Contractors if they chose not to purchase the transfer water. Due to improved hydrologic conditions, Metropolitan and the other State Water Contractors did not exercise these options.

In 2008, Metropolitan, in partnership with seven other State Water Contractors, secured approximately 40 TAF of water from willing sellers in the Sacramento Valley, of which Metropolitan's share was approximately 27 TAF.

In 2009, Metropolitan, in partnership with 8 other buyers and 21 sellers, participated in a statewide Drought Water Bank, which secured approximately 74 TAF, of which Metropolitan's share was approximately 37 TAF.

In 2010, Metropolitan, in partnership with three other State Water Contractors, secured approximately 100 TAF of water from willing sellers in the Sacramento Valley, of which Metropolitan's share was approximately 88 TAF. Metropolitan also purchased approximately 18 TAF of water from Central Valley Project Contractors located in the San Joaquin Valley. In addition, Metropolitan entered into an unbalanced exchange agreement that resulted in Metropolitan receiving approximately 37 TAF.

In 2015, Metropolitan, in partnership with eight other State Water Contractors, secured approximately 20 TAF of water from willing sellers in the Sacramento Valley, of which Metropolitan's share was approximately 13 TAF.

In addition, Metropolitan has secured water transfer supplies under the Yuba Accord, which is a long-term transfer agreement. To date, Metropolitan has purchased approximately 200 TAF.

Finally, Metropolitan has secured water transfer supplies under the Multi-Year Water Pool Demonstration Program. In 2013, 2015, and 2016 Metropolitan secured 30 TAF, 1.3 TAF, and 7 TAF respectively.

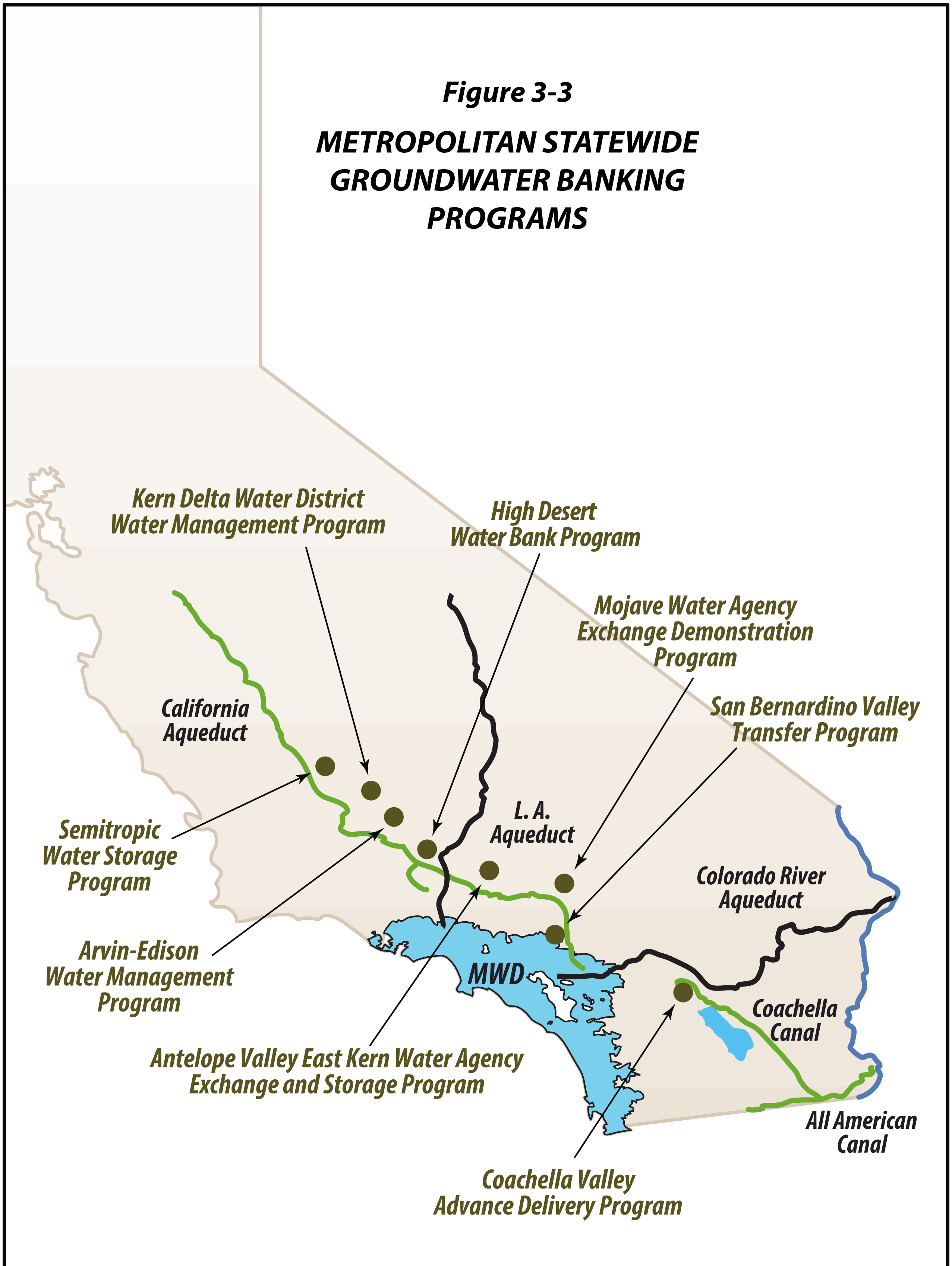
Metropolitan's recent water transfer activities demonstrate Metropolitan's ability to develop and negotiate water transfer agreements either working directly with the agricultural districts who are selling the water or through a statewide Drought Water Bank. Because of the complexity of cross-Delta transfers and the need to optimize the use of both CVP and SWP facilities, DWR and USBR are critical players in the water transfer process, especially when shortage conditions increase the general level of demand for transfers and amplify ecosystem and water quality issues associated with through-Delta conveyance of water. Therefore, Metropolitan views state and federal cooperation to facilitate voluntary, market-based exchanges and sales of water as a critical component of its overall water transfer strategy.

Achievements to Date

Metropolitan has made rapid progress to date developing SWP storage and transfer programs. Most notably, Metropolitan has utilized approximately 122 TAF to supplement its SWP supplies during the recent 2016-2020 period. Of this total, approximately 90 TAF are from SWP storage program extractions in Semitropic, Arvin, Kern Delta, and Mojave; 13 TAF are from the San Gabriel Valley MWD program; and 19 TAF of SWP transfer supplies were purchased from the Yuba water purchase programs.

Figure 3-3

METROPOLITAN STATEWIDE GROUNDWATER BANKING PROGRAMS



3.4 Demand Management and Conservation

Demand management through conservation is a core element of Metropolitan's long-term water management strategy. Metropolitan continues to build on a 30-year investment in conservation of more than $823 million, reflecting a long-term commitment to water conservation. Among other measures, this investment has resulted in the replacement of more than 3.8 million toilets with more water efficient models, rebates of more than 620,000 high-efficiency clothes washers (HECWs), and removal of approximately 195 million square-feet of grass from both commercial and residential properties. Collectively, Metropolitan's conservation programs and other conservation in the region will reduce Southern California's reliance on delivery of imported water by almost 1.2 MAF per year by 2030.

Metropolitan's continued approach to conservation has put its service area on target to achieve California's 20x2020 Water Conservation Plan per capita goal of less than 145 gallons per capita per day (GPCD). Continuous conservation messaging, along with active conservation programs, have contributed to Metropolitan maintaining its water demand to sustainable levels, while also meeting its regional target.

Background

Metropolitan's conservation policies and programs are designed to maintain a sustainable water demand level and meet the conservation savings target adopted in the IRP. These policies and programs directly relate to the demand management measures for wholesale water agencies in the Urban Water Management Planning Act.

Water conservation savings result from active, code-based, and price-effect conservation efforts. Active conservation consists of water-agency funded programs such as rebates and incentives for water efficient fixtures and equipment and turf removal. Code-based and price-based conservation consists of demand reductions attributable to conservation-oriented plumbing codes and usage reductions resulting from increases in the price of water. Metropolitan does not currently assign a savings value for public awareness campaigns and conservation education because any initial effect on demand reduction and the longevity of the effect are difficult to measure. It is generally accepted that these outreach programs prompt consumers to install water saving fixtures and change water-use behavior, thereby creating a residual benefit of increasing the effectiveness of complementary conservation programs.

Distinguishing between active, code-based, and price-effect conservation can be analytically complex when, for example, active programs for fixtures are concurrent with conservation-related plumbing codes. Metropolitan uses specially designed estimating models to quantify and project conservation savings. This plan combines active, code-based, and price-effect conservation savings using methods that avoid double counting.

Conservation savings are commonly estimated from a base-year water-use profile. Metropolitan uses 1980 as the base year because it marked the effective date of a new plumbing code in California requiring toilets in new construction to be rated at 3.5 gallons per flush or less. Between 1980 and 1990, the region saved an estimated 250 TAF per year as the result of this 1980 plumbing code and unrelated water rate increases. These savings are referred to as "pre-1990 savings." Metropolitan's resource planning target combines pre-1990 savings and estimates of more recently achieved savings.

Including regional pre-1990 conservation savings, Metropolitan anticipates savings of 1.19 MAF by 2030. A large share of the savings has already been achieved through existing Metropolitan and member agency programs, pre-1990 savings, price-effects, and continued savings that accrue from plumbing codes. The remainder is expected to be achieved through additional agency-sponsored active conservation programs, code changes, and price-effects.

Implementation Approach

Metropolitan's approach to achieving the conservation target depends on implementing a suite of demand management measures, including public education and outreach, a variety of conservation programs, metering, research and development, and asset management. These programs include cost-effective active conservation programs and new, innovative programs that address regional water uses. Metropolitan also provides support to member agencies for local programs that assist with implementing local conservation programs while reducing per capita water use. Metropolitan continues to seek state and federal grant funding for conservation in coordination with its member agencies.

As the California Urban Water Conservation Council (CUWCC) disbanded, Metropolitan worked with other California water agencies to form the California Water Efficiency Partnership (CALWEP). CALWEP's mission is to maximize urban water efficiency and conservation throughout California by supporting and integrating innovative technologies and practices; encouraging effective public policies; advancing research, training, and public education; and building collaborative approaches and partnerships. Metropolitan is an active participant on the CALWEP Board, the Program Committee, and Research Committee.

Metropolitan also participates in national water efficiency efforts. Metropolitan is a USEPA WaterSense partner, helping to promote water efficient products and practices in Southern California. Metropolitan is also a member of the Alliance for Water Efficiency, participating on its Board and in the committees on research, WaterSense and water efficient products, and education and outreach.

The following sections describe Metropolitan's demand management measures and conservation programs, including education and outreach.

Public Education and Outreach

Since 1983, Metropolitan's Education Unit has provided award-winning water education programs, supplemental materials, teacher in-services and classroom presentations for K-12 teachers and students in Southern California. Since that time, materials and outreach programs have expanded to the pre-K and college education levels. In 2015, Metropolitan implemented an education strategic plan which sought to:

1. Expand working programs
2. Develop an "Educational Pipeline" to jobs in the water industry
3. Leverage collaborations
4. Invest in educational technology

These initiatives, as well as Metropolitan's curricula and materials, have impacted a generation of students, expanded their understanding of California's water supply and distribution systems, water sources, water use and conservation, the science of water, public policies, and the importance and responsibility of stewardship. All Metropolitan programs correlate to California Content Standards including Common Core and Next Generation Science Standards (NGSS). These programs are continually evaluated for effectiveness and improved upon. Metropolitan's most recent online education programs are summarized in Table 3-4.

Public Education Programs

Metropolitan has continued to update and expand its comprehensive K-12 water education curriculum that meets all California education standards for each grade level in the areas of science, math, language arts and social studies classroom materials. Metropolitan worked with its member agencies to annually hold more than 700 outreach events which directly interact with more than 170,000 students, teachers, parents, and participants through its water education programs, curricular materials, and engagements. More than 12,000 public visitors and students annually tour the Diamond Valley Lake Visitor Center to learn more about Metropolitan's water systems and programs. These efforts led to Metropolitan's Education Unit being awarded the 2015 Governor's Environmental and Economic Leadership Award (GEELA), California's highest environmental honor.

In 2015, Metropolitan redesigned its museum-quality exhibit at the Vista del Lago visitor's center at Pyramid Lake, part of the State Water Project.

Throughout 2016, Metropolitan worked to develop virtual reality tours of the Colorado River Aqueduct and augmented reality watershed exhibits to encourage students to think critically about water issues in Southern California. This work led to a collaboration with the Department of Water Resources to create a virtual reality tour of the State Water Project which received first-place recognition from the National Association of Government Communicators.

In 2017, Solar Cup, the nation's largest high school solar boat race, celebrated its 15-year anniversary. This program engages 40 teams and more than 750 high school students annually in STEAM (science, technology, engineering, art and math) topics associated with water stewardship and renewable energy.

In 2018, Metropolitan's "Water is Life" Student Art Exhibit and Calendar celebrated its 30-year anniversary. This program annually compiles more than 12,000 pieces of art generated by K-12 students throughout Metropolitan's service area.

In 2019, Metropolitan's World Water College Grant Program increased solicited proposals from $10,000 to $20,000 grants to conduct research and development on improving water quality, environmental science of watersheds, and the implementation of water-use efficiency technologies. Since 2004, Metropolitan's World Water College Grant Program has disbursed approximately $800,000 in grants to 26 colleges, benefitting more than 800 students.

Outreach

Since late 2013, the primary focus of Metropolitan's conservation and education outreach programs has been on the drought response and the need for additional conservation in order to maintain the region's water supply reserves. That message has evolved to emphasize conservation and stewardship as a sustainable way of life, rather than only a response to dry conditions.

Each year, Metropolitan implements a variety of conservation and education outreach programs. The "Let's All Take a Turn" campaign launched July 1, 2015 and continued in 2016, but added additional messaging around a new trademarked logo of H2Love, and the tagline, "Love Water. Save Water." This message emphasized the value of water conservation not only during the drought, but every day. Working with Metropolitan's 26 member agencies, the research-based advertising campaign includes several months of media coverage through radio live reads, 53 community newspapers, digital and online advertising, other customized materials and special outreach events throughout Southern California. The entire campaign was produced in five languages: English, Spanish, Mandarin, Korean, and Vietnamese, and Print advertising included Tagalog language materials.

The campaign's design was informed by extensive research through focus groups, telephone interviews, and web surveys conducted in two languages throughout Metropolitan's service area. The media strategy was developed to effectively target the diverse communities, age groups, socioeconomic factors, and languages spoken in the region. The "Let's All Take A Turn" campaign supplements Metropolitan's strong program of outreach activities, social and traditional media, and business outreach efforts to spread the word to residents, businesses, community leaders and elected officials about the importance of water conservation.

A new component of the conservation campaign was an official sponsorship with Major League Soccer's LA Galaxy. This partnership provided digital signage at the StubHub Center in Carson, water-awareness exhibit booths at four home games, public service announcements and social media videos featuring LA Galaxy goalie Brian Rowe, cross-promotion of water-saving messages on Metropolitan and LA Galaxy social media platforms, Facebook Live events with actor Johnny Rey Diaz, and outreach activities with the LA Galaxy community foundation organization.

As part of the campaign, Metropolitan also conducted several television interviews and placed a series of advertorial news stories in the online editions of the Los Angeles Times and Nativo for added value news stories. Metropolitan placed advertorials on digital media focusing on the seriousness of the drought, what people can do to save water, and offering landscape and gardening advice including a Facebook Live broadcast by Sunset Magazine which was viewed by more than 7,000 people. In addition, Metropolitan used social and digital media to reach large audiences in cost effective and optimized strategies, including setting up playlists on Pandora and its Spanish-language equivalent, Uforia. The playlists promote shorter showers by listening to five-minute-long songs about water or rain. These elements promoted the ongoing need for conservation in Southern California, describing long-term benefits of investments in water storage and local water resources, and the availability of rebates and incentives for turf removal and water-saving devices and appliances.

The H2Love advertising campaign continued to support sustainable, lifelong water conservation. The campaign included digital ads, billboards, bus wraps and transit shelters, as well as a continued partnership with the Major League Soccer's LA Galaxy, its own Pandora song list, and a takeover of the Santa Monica Pier Ferris wheel.

Metropolitan's online conservation portal, bewaterwise.com®, was redesigned with a more user- and mobile-friendly navigation and translated into Chinese and Spanish. A Garden of the Month video series was launched on bewaterwise.com® and multiple social media platforms featuring California Friendly® inspiration gardens.

Metropolitan's multilingual H2Love campaign concluded in spring 2018 with a successful 12-week media strategy featuring outdoor billboards, radio ads, community newspapers and a sponsorship with Major League Soccer's LA Galaxy. With nearly two billion media impressions delivered and a toolkit of informational resources and files, the campaign successfully reached its target audiences as demonstrated in a post-campaign public survey. Outreach efforts increased traffic to the district's bewaterwise.com® conservation website by more than 300 percent, and social media growth in views increased more than one-hundred-fold.

While social media and search engine optimization maintained message consistency and visibility, Metropolitan initiated a request for proposal process for a new three-year water conservation outreach media campaign. Metropolitan's Board of Directors awarded a $14.7 million contract to the Los Angeles-based firm Quigley-Simpson & Heppelwhite, which produced Metropolitan's award-winning Take a Turn and H2Love campaigns. The new "Save

Water 365" campaign launched in July 2018. The campaign encouraged Southern Californians to save water every day. It also reminded residents to take advantage of rebate programs – including incentives for indoor and outdoor water-saving devices, as well as rebates for landscape transformation that requires more efficient irrigation systems, design and plants. The campaign also reached very diverse audiences in English, Spanish, Mandarin, Korean, Vietnamese, and Tagalog through traditional and grassroots marketing efforts. Creative messaging included signs on food trucks, local convenience and hardware stores, and a sponsorship with the LA Dodgers.

The "Save Water 365" campaign delivered more than 1 billion media impressions. Working with Metropolitan's 26 member agencies, the research-based advertising campaign included:

- Digital and online advertising
- Total of 1,475 billboards and television commercials
- Radio messages on more than 50 stations
- Animated digital ads with general rebate and landscape transformation program messaging
- Print ads in community newspapers
- English and Spanish language Pandora radio stations and other customized materials and special outreach events throughout Southern California

The campaign also included a grass-roots outreach effort in multiple languages through advertising at convenience and hardware stores and on food trucks, as well as a presence on a popular Chinese game show. The media strategy was designed to effectively target diverse communities, age groups, socioeconomic factors and languages spoken in the region.

In August 2018, Metropolitan began an official sponsorship with Major League Baseball's Los Angeles Dodgers. This sponsorship included a title night event before more than 40,000 fans featuring former Metropolitan Board Chairman Randy Record throwing the opening pitch. The evening highlighted a Dodger groundskeeper and the many ways in which the Dodger organization conserves water. Public service announcements were displayed on LED boards throughout the stadium, as well as cross promotions on conservation on Metropolitan's and the Dodgers' social media platforms.

Growth in social media activity was dramatic. In 2018, Metropolitan's Facebook page received more than 55 million impressions, with more than 27,000 followers. On Twitter, Metropolitan received strong engagement for its water efficiency posts, including short videos and animated gifs to reach a broader audience during its conservation campaign and for Delta Conveyance initiatives. Metropolitan used Facebook Live and Snapchat geo-filters to reach a broader audience throughout 2017-18.

The success of Metropolitan's outreach activities was recognized with several prestigious awards including the best in show for the National Association of Government Communicators in 2018. This organization is a national association of communication officials from local, state and federal public agencies. Metropolitan was a finalist in 13 of 40 award categories.

In April 2019, the general conservation message of the "Save Water 365" campaign became more targeted and focused on promoting the incentive under Metropolitan's revamped turf replacement program. The incentive provides Southern Californians $2 for every square-foot of grass replaced with more water efficient sustainable landscaping. The campaign continued to reach diverse audiences on multi-media platforms: digital billboards featured in shopping malls, grocery stores and movie theaters encouraged residents to "ditch their grass and claim their rebate." Radio spots promoting the "ditch your grass" message in English and Spanish were featured on nearly 40 radio stations, and creative digital display ads generated nearly 120 million impressions on digital media and nearly 300,000 ad clicks.

Local community outreach also played an important role in this campaign through strengthened partnerships between Metropolitan and its member agencies. Turf Replacement Program advertisements in English, Spanish, and Chinese ran in 25 publications from May to June 2019, and together, these advertisements reached 1.7 million readers across the district's area.

Metropolitan also partnered with Los Angeles- and San Diego-based news shows to develop water conservation programming in English and Spanish. On-air talent spoke about the benefits of replacing your lawn with California Friendly® and native landscaping and promoted Metropolitan's turf rebate.

In fall 2019, Metropolitan launched a multilingual digital campaign that continued to promote the turf rebate incentive. Digital display banners on home improvement and lifestyle websites encouraged viewers to save money by converting their lawns to sustainable landscapes. Together with search advertising, these display ads generated 151 million impressions and thousands of turf rebate applications. The Hispanic market saw a significant increase in online engagement and drove the most landing page visits with 200k link clicks. Part of the fall campaign's communications strategy was to collaborate with Los Angeles- and San Diego-based news shows to develop water conservation programming in English and Spanish. On-air talent spoke about the benefits of replacing your lawn with California Friendly® and native landscaping and promoted Metropolitan's turf rebate.

To supplement digital outreach, Metropolitan partnered with Los Angeles Dodgers, Angels, Rams, Chargers, Lakers, Clippers and Kings sports organizations to promote advertisements with water use efficiency messaging. The ads appeared in game-day programs and annual yearbooks, reaching millions of fans across Southern California. These creative assets also received more than half a million impressions on Metropolitan's social media channels.

Additionally, Metropolitan initiated in-house design and advertising campaigns to reach new online demographics. Staff designed an award-winning social media campaign called Patch Match in the format of a dating app that 'matches' consumers with the perfect California Friendly® plants and promotes water conservation. The social media campaign was significantly more efficient than other digital and online advertising, reaching more than 200,000 people with nearly 400,000 impressions, resulting in nearly 3,000 page views to bewaterwise.com. The National Association of Government Communicators honored Patch Match with a first-place award in the social media category.

In late 2019, staff brought their creative concepts to fruition with the "Wasting Water Is…" campaign. This three-part digital commercial series was produced entirely in-house and featured scenarios where water wasters learn how scary, tragic and offensive wasting water really is. Production costs for all three commercials totaled less than $50,000 compared to typical advertising agency costs of $300,000 to $500,000 per video. Movie posters and animated GIFs promoted on Metropolitan social media channels resulted in more than 5.5 million impressions with more than 79,000 link clicks. Staff also advertised the videos on YouTube and connected TV devices such as Apple TV, Chromecast and Roku, targeting entertainment, lifestyle and sports themed content that outperformed targeted goals at an average 44 percent view through rate.

Throughout these years, Metropolitan officials conducted hundreds of interviews with news reporters from major TV and print media outlets, ethnic media and community publications to discuss a wide range of water-related issues. Topics included the effect of climate change and drought on Colorado River resources, water supply reliability and conservation, and raising awareness about Metropolitan's new turf replacement program. As part of this public outreach, Metropolitan's General Manager Jeffrey Kightlinger blogged on Metropolitan's webpage mwdh2o.com and wrote guest blogs and op-eds encouraging conservation in 2019. Metropolitan continues to provide outreach to Southern California's businesses and industry.

Metropolitan is an active member in many chambers of commerce and other business organizations and provides regular updates to members on water policy issues and programs. Water use efficiency programs that help reduce demand for potable water are a key focus of these partnerships. In addition, Metropolitan hosts hundreds of community and business leaders on inspection trips of the State Water Project and Colorado River Aqueduct to help them better understand the challenges of providing reliable water to Southern California and how the Colorado River is managed to provide water for urban areas and agriculture.

Community Partnering Program

Over the past five fiscal years, Metropolitan has engaged in approximately 270 sponsorship programs and projects through its Community Partnering Program. Investments totaling $540,000 were provided to non-profit organizations, member agencies, other public resource agencies and educational institutions for programs including California native plant gardens and outdoor classrooms, Earth day events, water quality laboratory test kits, and multi-lingual educational publications addressing conservation, water-use efficiency, recycling, watersheds and more regional issues.

California Friendly Landscape Education and Training Program

Metropolitan provides education and training on ways to conserve water in homes and landscapes. Offerings include in-person and online classes, surveys, and audits.

<u>Landscape Classes</u>

Metropolitan offers in-person and online courses in irrigation efficiency and water-wise garden design through its California Friendly Landscape and Native Plant Training Program. Metropolitan also offers Turf Removal Classes. In FY 2019-20 Metropolitan conducted 45 classes for 1,200 students throughout Metropolitan's service area. After COVID-19 forced the temporary cancellation of in-person classes, Metropolitan created online Zoom courses with its vendors to continue offering Southern California residents valuable water saving landscape education.

<u>Landscape Irrigation Surveys</u>

Metropolitan provides irrigation surveys for large landscape customers. These surveys are performed by a certified Landscape Irrigation Auditor and provide the customer with specific recommendations on how to improve irrigation efficiency at the site. The survey report generated by the auditor also provides information on incentives to help the customer fund the needed improvements. In fiscal year 2019-20, 21 surveys were conducted.

<u>Irrigation Evaluations and Residential Surveys</u>

Metropolitan provides funding to its member agencies that choose to implement irrigation evaluations and indoor surveys for residents. Irrigation evaluations provide customers with a recommended irrigation schedule and suggested improvements for irrigation systems. Indoor residential surveys provide customers with information on identifying leaks and making changes to water-using devices in the home.

Water Conservation Programs

Metropolitan's water conservation programs focus on two main areas: (1) residential water use, and (2) commercial, industrial, and institutional water use. Metropolitan directly manages regional programs and provides financial support for local programs that are implemented by the member agencies. Metropolitan's Water Use Efficiency team provides program development, implementation, administration, monitoring, evaluation, and research.

Metropolitan's Conservation Credits Program (CCP) provides the basis for financial incentives and funding for the conservation programs and other demand management related activities. Established in 1988, this funding mechanism supports Metropolitan's commitment to conservation as a long-term water management strategy.

The basis of Metropolitan's financial support to member agency conservation efforts is estimated at $195 per acre-foot of water saved up to the device cost. In general, CCP-funded water conservation project proposals must:

- Have demonstrable water savings;
- Reduce water demands on Metropolitan's system; and
- Be technically sound and require Metropolitan's participation to make the project financially and economically feasible.

Metropolitan introduced two new funding options for member agency conservation efforts. Member agencies may use a portion of their funding for projects that provide value to the region, but the water savings may be difficult to measure. In addition, member agencies can use funding to target disadvantaged communities.

Table 3-5 summarizes CCP savings and investments. Additional funding for conservation programs has been made available through federal and state government agencies. Metropolitan has worked to obtain a share of this funding to enhance the region's water conservation investments. Table 3-6 describes past sources and uses of these funds.

Table 3-7 summarizes the types and numbers of efficient devices that have been installed through Metropolitan's conservation programs since they began in fiscal year 1990-91.

Regional Conservation Programs

As mentioned above, Metropolitan's conservation programs focus on two main sectors: (1) residential water use, and (2) commercial, industrial and institutional water use.

Residential Programs

Metropolitan's residential conservation activities consist of two major programs:

- SoCal Water$mart – Metropolitan provides a region-wide residential rebate program named SoCal Water$mart. Since its inception in 2008, rebate activity has increased dramatically as many residential customers became increasingly aware of the financial incentives available to them to help offset the purchase of water-efficient devices. To date, this program helped to replace over 277,000 toilets, 319,000 washing machines, 50,000 smart irrigation controllers, 459,000 rotating nozzles, and hundreds of thousands of other devices and appliances.
- Metropolitan-Funded Residential Programs Administered by Member Agencies – Metropolitan's member and retail agencies also implement local residential water conservation programs within their respective service areas and receive Metropolitan incentives for qualified retrofits and other water-saving actions. Typical projects include

premium high-efficiency toilet (HET) distributions, locally administered clothes washer direct-installation programs, turf removal programs, and residential water audits.

Residential Rebate Items

Metropolitan provides incentives on a variety of water efficient devices for the residential sector. The following is a brief description of current and past devices that contribute to projected conservation savings:

- Turf Removal (Residential) – About 50 percent of residential household water demand is used for outside irrigation where opportunities to conserve water are substantial. Southern California residents have turned the turf removal program into Metropolitan's most popular conservation measure. To encourage market transformation, Metropolitan has paid over $198 million in the regional turf removal program for residential properties since program inception.
- High-Efficiency Clothes Washers – HECWs continue to be a major component of indoor water conservation. The water efficiency of clothes washers is represented by the "integrated water factor," which is a measure of the amount of water used to wash a standard load of laundry. Washers with a lower integrated water factor will save more water per wash cycle. Metropolitan has continued to move the water conservation rebate standards by requiring lower integrated water factors for eligible washers. The program eligibility requirement is currently set at an integrated water factor 3.2, which saves over 10,700 gallons per year per washer over a conventional top loading washer. Metropolitan has also partnered with Southern California Gas on a direct-installation program for high-efficiency clothes washers in low-income households.
- High-Efficiency Toilets – Metropolitan has provided incentives for water efficient toilets since 1988. Metropolitan changed its rebate program to provide funding for toilets that flush at 1.1 gallons or less. Metropolitan uses the Maximum Performance of Premium Toilet Models testing list to distinguish qualifying models.
- High Efficiency Sprinkler Nozzles – Pop-up, high efficiency spray heads provide significant outdoor water savings over conventional nozzles. Field tests and studies have demonstrated these nozzles apply water more evenly than traditional nozzles with fixed fan spray patterns, creating the potential for water savings. Low precipitation rates associated with these nozzles can also reduce run-off, thereby offering a significant value-added benefit when irrigating sloping landscapes.
- Irrigation Controllers – Smart irrigation controllers and soil moisture sensors adjust irrigation schedules based on water needs, temperature, sunlight, soil moisture, soil conditions, plant types, slope or some combination of indicators. Metropolitan uses the USEPA WaterSense list for eligible controllers.

Commercial, Industrial and Institutional Programs

Metropolitan's commercial industrial and institutional (CII) conservation consists of three major rebate and incentive programs:

- SoCal Water$mart Program – The majority of the commercial conservation activity comes from Metropolitan's regional SoCal Water$mart program, which also issues rebates to multi-family properties.
- Water Savings Incentive Program – The Water Savings Incentive Program provides financial incentives for customized landscape irrigation and industrial process improvements. This program allows large-scale water users to create their own conservation projects and receive

incentives for up to 10 years of water savings for measured water-use efficiency improvements.

- Metropolitan-Funded Commercial Programs Administered by Member Agencies – Member and retail agencies also implement local commercial water conservation programs using Metropolitan incentives. Projects target specific commercial sectors, with some programs also receiving assistance from state or federal grant programs. Metropolitan incentives are also used as the basis for meeting cost-share requirements for the grants.

<u>*Commercial Rebate Items*</u>

Metropolitan's CII programs provide rebates for water-saving plumbing fixtures, landscaping equipment, food-service equipment, cleaning equipment, HVAC (heating, ventilation, air conditioning) equipment, and medical equipment.

- Turf Removal (Commercial) – Similar to the residential sector, water demand for landscape irrigation on commercial, industrial, and institutional properties is significant. Opportunities to conserve water are substantial, particularly in areas with ornamental turf. With an increased incentive rate ($2 per square foot of turf removed), approximately 92 million square feet of grass has been removed from commercial, industrial, and institutional properties since program inception through the regional rebate program, and member agency turf programs. To encourage market transformation, Metropolitan has paid over $138 million for the regional turf removal program for commercial properties since inception.
- Commercial Devices – Following is a list of current and past devices that contribute to projected conservation savings:
  - Connectionless Food Steamers
  - Cooling Tower Conductivity Meters
  - Dry Vacuum Pumps
  - High-Efficiency Clothes Washers
  - High-Efficiency Toilets
  - High-Efficiency Urinals
  - Ice Machines
  - In-Stem Flow Regulators
  - Large Rotors - High Efficiency Nozzles
  - Laminar Flow Restrictors
  - High Efficiency Nozzles
  - pH Cooling Tower Controllers
  - Plumbing Flow Control Valves
  - Premium High Efficiency Toilets
  - Pre-rinse Spray Heads
  - Soil Moisture Sensors
  - Steam Sterilizers
  - Ultra-Low-Flush Toilets
  - Ultra-Low-Flush Urinals
  - Water Brooms
  - Weather-Based Irrigation Controllers
  - X-ray Processors
  - Zero/Ultra Low Water Urinals

Disadvantaged Communities Program Initiative

Metropolitan initiated an effort to increase water efficiency within disadvantaged communities (DACs) in Metropolitan's service area through the Disadvantaged Communities Program. This program has been executed in three parts. First, a Regional Pilot Program for Multi Family/Apartments Pre-1994 offering an enhanced incentive for Premium High-Efficiency Toilets, targeting pre-1994 structures for retrofits combined with rigorous data collection and analysis. Part two is an effort to help Metropolitan's member agencies implement local DAC projects by providing intensive member agency local support and technical assistance with program design and administration. And finally, Metropolitan looks for grant support to fund regional and local DAC projects.

Metering

Metropolitan's water distribution system is metered. Metropolitan has over 400 service connections that meter water deliveries to our member agencies. Meters at these service connections are checked every six months or sooner to verify that they are measuring correctly. More extensive maintenance is done on a yearly basis to ensure the meter systems continue to operate reliably.

Research and Development Programs

Metropolitan is committed to conservation research as a way to advance technology, improve program results, and help transform markets. Self-funded studies include determining water savings from municipal leak detection programs, effectiveness of single-family home pressure relief valves on lowering water demand, quantifying residential water use and water fixture inventory, and analyzing savings attributed from landscape irrigation system improvements.

Metropolitan's Innovative Conservation Program (ICP) is a competitive grant program that evaluates water savings and reliability of new water saving devices, technologies, and strategies. With funding provided by USBR, Southern Nevada Water Authority, Central Arizona Project, Southern California Gas, Western Resource Advocates, and Metropolitan, approximately $570,000 of funding was available for research for the 2018 ICP. After evaluating over 60 project proposals, twelve were selected. The projects focused on landscape, commercial, industrial, and residential water use applications. The next round of grants will be implemented in fiscal year 2021.

Metropolitan has partnered with the Alliance for Water Efficiency (AWE) for water conservation research. The current research project involves exploring the water efficiency potential of cooling towers through process improvements and operational management. Past projects have included: lessons learned through a drought management study of Australia, a water neutral development ordinance, a study on commercial kitchen efficiency, a study on outdoor impacts of the drought, and reasons and rationale for landscape choices.

Measurement and Evaluation

Measurement and evaluation are important components of Metropolitan's conservation programs. These serve four primary functions:

- Providing a means to measure and evaluate the effectiveness of current and potential conservation programs
- Developing reliable estimates of various conservation programs and assessing the relative benefits and costs of these interventions
- Providing technical assistance and support to member agencies in the areas of research methods, statistics, and program evaluation
- Documenting the results and the effectiveness of Metropolitan-assisted conservation efforts

Metropolitan's staff has served as technical advisors for a number of state and national studies involving the quantification and valuation of water savings.

Recognition for Conservation Achievements

Conservation is an integral part of water supply planning at Metropolitan. Metropolitan works to improve the understanding of the costs and benefits of conservation so investment decisions are both efficient and effective at meeting program goals. As a cooperative member of California's water conservation community, Metropolitan has made significant contributions to the development and coordination of conservation activities throughout the state. These contributions have been recognized in the form of "Gold Star" certification from the Association of California Water Agencies and awards from the USBR and California Municipal Utilities Association.

Table 3-4
Online School Education Programs

Online Education Offerings	Grades	Notes
Water Journeys	Grades 4 – College	In partnership with Los Angeles County Sanitation Districts, Water Journeys begins with a presentation on water awareness, aqueducts, conservation and recycling followed by a walking tour of the Regional Recycled Water Purification Center.
DVL Online Fieldtrip	Grades 4-8	Diamond Valley Lake, the largest reservoir in Southern California, located in Riverside County near Hemet. Students experience a variety of standards-based, water-related, hands-on science activities.
Girl Scout Programs	K - 12 Daisies, Brownies & Juniors, Cadettes, Seniors and Ambassadors	Metropolitan is offering a FREE online patch program about Southern California's water sources and conveyance systems.
Scout Programs	K - 12	Metropolitan is offering a FREE online patch program about Southern California's water sources and conveyance systems aligned with Environmental Science Merit Badge Requirements
On-line class presentations	PreK - College	Metropolitan staff will create a customized water-education presentation or "H2O Show" for students from pre-K to college.
Online Story Time	PreK – 3rd	Bring story times to life with our engaging educators and colorful stories about water.
All About Water Curriculum	K - 2nd	New video experiments and interdisciplinary activities about water conservation, water quality and distribution, the water cycle, and fresh and saltwater.
VR Trip SWP	Grades 4 – College	Immerse your students in the State Water Project system and discover the 444-mile journey that water makes to Southern California. Students will virtually visit the Bay Delta, Banks Pumping Plant, the California Aqueduct, Chrisman Pumping Plant, and Lake Perris.
VR Trip CRA	Grades 4 – College	Follow the journey of water to Southern California via Metropolitan's Colorado River Aqueduct. The tour is available as a virtual reality app for Apple and Android mobile devices.

Table 3-5
Metropolitan's Conservation Credits Program

Fiscal Year	Annual Water Savings (AF)	Lifetime Water Savings (AF)	Investment
2019 – 2020	212,000	55,719	$25.7 million
2018 – 2019	208,000	55,263	$16.4 million
2017 – 2018	213,000	82,435	$12.6 million
2016 - 2017	206,000	137,065	$41.4 million
2015 - 2016	203,000	731,093	$229 million

Table 3-6
Grant Program Funding

Funding Source	Program/Project	Funding Amount ($1,000s)	Description	Status
CALFED				
	Residential HECW	$925	Increase rebate amount	Completed
	Protector del Agua	$100	Course development	Completed
Prop 13 Grants				
	HECW	$2,500	Increase rebate amount	Completed
	ET Controllers	$1,800	Initiate rebates	Completed
CPUC (w/CUWCC)				
2003	Pre-Rinse Spray Valves: Phase 1	$1,600[1]	12,000 direct installations[1]	Completed
2004	Pre-Rinse Spray Valves: Phase 2	$2,200[1]	17,000 direct installations[1]	Completed
USBR				
2003	CA-Friendly Landscapes	$182	New home landscapes	Completed
2003	Data Loggers	$50	Software error analysis	Deferred
2004	CA-Friendly Landscapes	$60	New home landscapes	Completed
2004	Synthetic Turf pilot	$220	Provide incentives	Completed
2004	World Forum	$50	College/university grants	Completed
2004	CII Region wide	$250	Additional dollars to rebate amounts and for administration	Completed
2005	Protector del Agua	$50	Develop web classes	Completed
2005	Landscape Market Analysis	$50	Analyze landscape conservation opportunities	Completed
2005	City Makeover	$50	Public landscapes	Completed
2006	Innovative Conservation Program	$300	Support research projects	Completed
2008	Innovative Conservation Program	$300	Support research projects	Completed
2012	Sprinkler Nozzle Incentive Program	$1,501	Provide incentives	Completed
2013	High Efficiency Clothes Washer Program Innovative Conservation Program	$500 $100	Provide incentives Support research projects	Completed Completed
2014 2015 2017	California Friendly Turf Replacement – Phase 2 Incentive Program Innovative Conservation Program Innovative Conservation Program	$300 $100 $100	Provide incentives Support research projects Support research projects	Completed Completed Completed
Water for the West				
	Protector del Agua	$25	Develop web classes	Completed
Prop 50				
	Residential HECW	$1,660	Increase rebate amount	Completed
	CA-Friendly Landscapes	$423	Common area landscapes	Completed
	High Efficiency Toilets	$1,000	Increase rebate amount	Completed
	Protector del Agua	$78	Develop on-line classes	Completed
2008	Residential HECW	$2,000	Increase rebate amount	Completed

[1] This is the funding amount and number of installations that represent Metropolitan's share of the project.

Table 3-7
Conservation Achievements in Metropolitan's Service Area

	Quantity	Units
Commercial Rebated Devices (FY 1990-91 to FY 2019-20)		
Audits/Surveys	14,419	ea
Connectionless Food Steamers	219	ea
Cooling Tower Conductivity Controllers	1,232	ea
Dry Vacuum Pump	40	ea
Toilets	241,015	ea
Urinals	40,849	ea
Ice Machines	145	ea
In-stem Flow Regulators	35,265	ea
High-Efficiency Washers	36,545	ea
pH Conductivity Controllers	398	ea
Plumbing Flow Control Valves	56,148	ea
Pre-Rinse Spray Heads	17,192	ea
Laminar Flow Restrictors	27,627	ea
High-Efficiency Nozzles	1,730,313	ea
Soil Moisture Sensors	790	ea
Steam Sterilizers	28	ea
Water Brooms	6,931	ea
Weather-Based Irrigation Controllers	13,106	acres
Weather-Based Irrigation Controllers	573,226	stations
X-Ray Processors	185	ea
Large Rotors - High-Efficiency Nozzles	86,870	ea
Synthetic Turf	7,455,647	sq. ft.
Turf Removal	85,350,839	sq. ft.
Residential Rebated Devices (FY 1990-91 to FY 2019-20)		
Aerators	158,817	ea
Audits/Surveys	152,544	ea
Cisterns High-Efficiency Clothes Washers	2,010 585,607	 ea
Toilets	3,596,694	ea
High-Efficiency Rotating Nozzles	1,274,686	ea
Rain Barrels	176,552	ea
Soil Moisture Sensors	15	ea
Showerheads	1,735,436	ea
Turf Removal	101,786,618	sq. ft.
Weather-Based Irrigation Controllers	69,493	ea
Weather-Based Irrigation Controllers	28,527	stations

Asset Management Program

In compliance with California Water Code § 10631(e)(2), below is a description of Metropolitan's distribution system asset management program.

Metropolitan's approach to asset management is contained within its Infrastructure Reliability Strategy. The goal of Metropolitan's Infrastructure Reliability Strategy is to ensure long-term reliable performance of the system in an efficient and cost-effective manner. Infrastructure reliability is addressed through three programs: the Maintenance Management Program, the Infrastructure Protection Plan, and the Dam Safety Program. The activities performed under these programs allow for Metropolitan to extend the life span of its facilities and equipment and improve the overall reliability of the entire conveyance, treatment, and distribution system. Metropolitan is also completing a Strategic Asset Management Plan that will further expand the use of asset data for improved planning, maximizing the value of infrastructure assets and enhancing the longer-term visibility for its Capital Investment Plan.

Maintenance Management Program

Metropolitan manages the maintenance on approximately 135,000 pieces of equipment located at its five treatment plants, sixteen hydro-electric power plants, five desert pumping plants, 242 miles of canals, and over 5,000 structures on 830 miles of pipeline.

Computerized Maintenance Management System**:** A Computerized Maintenance Management System (CMMS) is used to track, plan, and schedule the required activities. The system currently has over 28,000 preventative maintenance cycles scheduled with approximately 96 percent of these performed at fixed intervals (Time Based). The remaining four percent are performed based on the condition or use of the equipment (Condition Based).

<u>Routine Maintenance, Inspection, and Monitoring</u>

Monitoring, inspection, and maintenance of equipment and facilities are a proactive effort to assess the overall condition of the assets. This effort encompasses identifying needed repairs and performing routine maintenance.

<u>Time-Based Maintenance</u>

Metropolitan currently uses time-based maintenance as the primary means of maintaining equipment reliability. Time-based maintenance for equipment is set at specific time intervals using manufacturer recommendations. These recommendations are used to develop Job Plans in the CMMS which detail the individual steps required for a particular maintenance operation.

<u>Condition-Based Maintenance</u>

Condition-based maintenance (CBM) relies on an understanding of how a piece of equipment degrades or fails to meet its intended function. It requires a greater depth of understanding of the manufacturer's recommended maintenance, industry standards, or practices. This knowledge is used in conjunction with field experience to develop a technique to gauge the equipment's condition. Through trending or analysis, a determination can then be made as to when the equipment may reach a point where corrective maintenance will be required including rehabilitation or replacement. A regular inspection cycle is set in the CMMS software to evaluate current equipment condition. High and low condition alarms are also set that trigger a corrective maintenance activity when equipment is starting to degrade or its use has reached a servicing checkpoint.

Predictive maintenance is a subcategory of CBM that uses diagnostic equipment or testing to determine the equipment condition. Predictive maintenance is also used to detect impending problems before the equipment malfunctions. In some cases, Metropolitan has automated the inspections such as through online vibration monitoring systems that trend the performance of critical and large equipment. A fundamental characteristic of this type of maintenance is that it provides the capability to anticipate potential problems while the equipment is still operating. This provides several key benefits when compared to time-based maintenance or allowing equipment to reach a point where corrective maintenance is required. These benefits include: improved availability or uptime, enhanced reliability, and reduced cost.

Corrective Maintenance

Corrective maintenance is performed on equipment that either has already failed or has had a problem detected during routine (time or condition based) maintenance. Corrective maintenance needs to be scheduled, requires replacing equipment components, or involves a shutdown of the impacted system. Corrective maintenance is also tracked, planned, and scheduled in the CMMS.

Major Scheduled Outages/Shutdowns

In addition to the general maintenance described above, Metropolitan may take major systems out of service, such as water treatment plants, large pipelines, conveyance systems, or other large facilities, typically for periods of seven to twenty-one days. This is done to perform major maintenance or repairs on several components or systems, upgrade or add new processes, or perform other important work.

Reports and Metrics

Metropolitan produces internal reports that track maintenance management activities including overall backlog and past due work orders (including any missed regulatory preventive maintenance). In addition, other CMMS reports are available that provide managers, planners/schedulers, and maintenance staff with the data needed to evaluate and track work.

Metropolitan utilizes best management practices and performance metrics from the Society of Maintenance & Reliability Professionals to ensure a reliable and cost-effective maintenance management program.

Infrastructure Protection Plan

Activities under the Infrastructure Protection Plan ensure long-term infrastructure reliability by conducting special condition assessments and vulnerability assessments of Metropolitan's facilities.

Special Condition Assessments

Special Condition Assessments are extensive inspections, investigations, and evaluations of Metropolitan facilities and equipment that go beyond routine maintenance and monitoring activities. The assessments are conducted to identify needed rehabilitation and replacement projects which can lead to long-term reliability programs. These assessments include: inspections of facilities during shutdowns when the facility may otherwise be non-accessible, investigations of systemic issues, and evaluations of Metropolitan's ability to maintain deliveries in the event of an unplanned facility outage or loss of water supply.

Special Condition Assessments may be initiated through requests from Water Systems Operations, in response to a specific event or concern within Metropolitan's system, or due to an issue identified within the water industry that could potentially affect Metropolitan. Through these activities, long-term infrastructure reliability programs are developed and executed to ensure that the reliability of Metropolitan's distribution system is unimpeded, and the overall life-expectancy of its assets is maintained to the most cost-effective standard possible.

Vulnerability Assessments

Vulnerability Assessments involve simulating hazards such as vehicle impact, flooding, fire, equipment failure, third-party impacts, and earthquakes in order to identify their potential impacts to Metropolitan's ability to deliver water. Like the condition assessments, Vulnerability Assessments utilize operator experience and event reviews to identify potential vulnerabilities and impacts. The assessments evaluate both the reliability of individual facilities, as well as the reliability of Metropolitan's system as a whole, if it is exposed to a potential hazard. It is through these assessments that mitigation options are identified to improve reliability.

Potential mitigation includes facility and equipment upgrades, and procedural changes for designing, operating, or maintaining facilities. In addition, mitigation options may include recommendations for Metropolitan's emergency response planning to improve the capability to respond to an unplanned outage and restore service as quickly as possible. The types of hazards assessed include: seismic activity, hydraulic surge, vehicle impact, equipment malfunction, erosion or flooding, fire, corrosion, wind-blown projectiles, third party construction, and vandalism.

As a part of the Vulnerability Assessments, a specific set of reliability design criteria for water treatment plants have been developed to ensure optimal reliability, starting in the design phase. These reliability design criteria establish design practices that ensure that reliability is designed into new facilities, and that the staff uses this criterion when reviewing each capital project.

Dam Safety Program

Metropolitan owns, operates, and maintains 20 facilities under the jurisdiction of the California Division of Safety of Dams (DSOD). In total, there are 24 individual dams/reservoir facilities, with some reservoirs having multiple dams. The Dam Safety Program is a robust and proactive comprehensive management program that includes daily or weekly observations and regularly scheduled detailed inspections in addition to mandatory annual inspections with DSOD personnel.

Metropolitan also ensures dam integrity by incorporating surveillance and monitoring instrumentation that measures specific parameters, including, but not limited to, seepage and structural movement. Staff also conducts cyclical facility assessment to identify potential vulnerabilities to dam embankments, dam structures, foundations, outlet structures and spillways. In addition, staff prepares Emergency Action Plans and regularly updates the associated inundation maps as required by the DSOD.

3.5 Recycling, Groundwater Recovery, and Desalination

Metropolitan continues to support local resources development through its Local Resources Program (LRP). The LRP provides financial incentives for local agencies to develop supplies including water recycling, groundwater recovery, and seawater desalination. In addition, for the first time, Metropolitan is planning for its own recycled water supply. The Regional Recycled Water Program would provide advanced treated water that could be used for both potable and non-potable reuse.

Metropolitan's involvement in local resources development started in 1982 as the Local Projects Program to provide financial incentives to its member agencies to develop recycled water projects. In 1991, Metropolitan established the Groundwater Recovery Program to provide financial assistance for the development of groundwater recovery projects. In 1995, these two programs combined into the LRP. Water recycling projects involve further treatment of treated wastewater that is currently discharged to the ocean, streams, or lands and use it instead for non-potable uses such as landscape and agricultural irrigation, commercial and industrial purposes, and for indirect potable uses such as groundwater replenishment, seawater intrusion barriers, and reservoir water augmentation. Currently, more than half of the water recycling in California occurs in Metropolitan's service area.

Groundwater recovery projects involve treatment of high salinity or contaminated groundwater for potable uses. Groundwater recovery projects use a variety of treatment technologies to remove undesirable constituents such as nitrates, volatile organic compounds (VOCs), perchlorate, color, and salt. Desalination of brackish groundwater and other local supplies enhances the continued supply reliability of the region by maximizing local groundwater resources.

Metropolitan's service area is also leading the development of seawater desalination in California. The 56 TAF Carlsbad Desalination Project in San Diego County started operations in 2015 and represents the largest seawater desalination project in the country. Several other local water agencies are considering seawater desalination projects. One of the largest of these is the Huntington Beach Seawater Desalination Project, currently being developed by Poseidon Resources LLC (a private company). These projects have the potential to help meet Metropolitan's current goals for new local supplies.

Metropolitan's Regional Recycled Water Program, a partnership with the Los Angeles County Sanitation Districts (Sanitation Districts), would purify treated wastewater from the Sanitation Districts' Joint Water Pollution Control Plant. The program could produce up to 168,000 acre-feet of purified water for groundwater replenishment, industrial use, and potentially raw water augmentation. The agencies have been working together for over 10 years on the program. They are currently operating a demonstration facility and seeking approval from their Boards of Directors to begin the environmental planning phase. At full-scale, the program could be one of the largest water reuse efforts of its kind in the world.

Background

Recycling

This section provides a description of the wastewater sources that potentially could be recycled. This section also discusses the existing and potential uses of recycled water, as well as the technical and economic issues associated with those uses. In general, Metropolitan supports:

- Increasing water recycling in California and the Colorado River Basin

- Advocating funding assistance by parties that benefit both directly and indirectly from the use of recycled water
- Expanding recycled water uses
- Reviewing recycled water regulations to ensure streamlined administration, and public health and environmental protection
- Planning efforts and voluntary cooperative partnerships at the local and statewide levels
- Conducting research and studies to address public acceptance, new technologies, and health effects assessments
- Increasing cooperation between agencies to serve recycled water in other agency service areas

Wastewater Disposal in the Service Area

As part of regional planning that encourages use of recycled water, a database has been developed that includes the name of each wastewater treatment facility, operating agency, location and elevation of the facility, extent of wastewater treatment, capacity and anticipated production, method of effluent disposal, and influent and effluent water qualities. Table 3-8 shows the existing and projected total effluent capacities of the wastewater treatment plants from a database of 89 plants identified within Metropolitan's service area.

Wastewater treatment capacity provides an indication of the amount of wastewater being generated and disposed in Metropolitan's service area. Most wastewater plants in the service area provide secondary treatment, a level of treatment that complies with the Clean Water Act. Inland wastewater plants generally provide treatment to tertiary levels so the effluent may be disposed of in a stream or other water body or for beneficial reuse. A growing percentage of tertiary treated effluent undergoes reverse osmosis or electrodialysis reversal processes, producing high-quality recycled water for groundwater replenishment, industrial uses, or, in some instances, municipal uses.

Within Metropolitan's service area, many local agencies collect and treat municipal wastewater. Some of the largest agencies include:

- Los Angeles County Sanitation Districts
- Orange County Sanitation District
- City of Los Angeles Bureau of Sanitation
- San Diego Metropolitan Wastewater Department
- Eastern Municipal Water District
- Western Municipal Water District
- Inland Empire Utilities Agency

Table 3-8
Existing and Projected Total Effluent Capacity
Wastewater Treatment Plants within Metropolitan's Service Area[1]

Treatment Level	Existing Capacity (MGD)	2040 Capacity (MGD)
Primary	1,770	3,139
Secondary	1,169	2,708
Tertiary	434	1,464
Advanced	104	229

[1] This data was compiled as part of the Southern California Comprehensive Water Reclamation and Reuse Study in 2002. As of the date of this UWMP, this reuse study has not been updated to reflect new information.

Many small special-purpose wastewater agencies, dual-purpose (water and wastewater) special districts, and municipal wastewater agencies also provide wastewater treatment and disposal services within Metropolitan's service area.

Wastewater is collected in a sewer collection system. From there, it flows to a wastewater treatment plant. Once treated, wastewater is disposed of through one of three mechanisms:

Ocean Outfalls

Treated wastewater is either disposed of directly through an ocean outfall or conveyed to the ocean outfall via a land outfall.

Reuse

Currently, about 441 TAF per year of recycled water is used for landscape irrigation, industrial processes, and groundwater replenishment applications in the region. A few inland treatment plants (in Riverside and San Bernardino counties) irrigate feed and fodder crops with recycled water. While this use is considered beneficial, it is not necessarily the highest and best use for recycled water. Higher value uses of recycled water include landscape or agricultural irrigation, commercial and industrial applications, groundwater replenishment, seawater intrusion barrier, and other uses such as street sweeping and dust control.

Stream Discharge

The majority of inland plants discharge treated effluent into local streams and rivers. That water is then used downstream for beneficial uses, eventually flowing to the ocean. Some of the affected rivers (or ephemeral streams) include:

- Los Angeles River
- Santa Ana River
- Calleguas Creek
- Rio Hondo & San Gabriel Rivers
- Santa Margarita River

Uses of Recycled Water

Water recycling is a reliable water supply, and it helps local agencies comply with environmental regulations. Uses of recycled water can generally be categorized as non-potable, indirect potable for groundwater replenishment or reservoir water augmentation, and direct potable.

Non-Potable Reuse

- *Industrial* – Industrial users represent a large potential market for recycled water, particularly in heavily industrialized areas, such as the cities of Vernon, Commerce, Industry, and the Wilmington area of Los Angeles. Additionally, refineries in West Basin MWD's service area and the city of Torrance use recycled water. Typical industrial uses include cooling tower makeup water, boiler feed water, paper manufacturing, carpet dying, and process water. Industrial users are high-demand, continuous-flow customers, which allows greater operational flexibility by allowing plants to base load operations rather than contend with seasonal and diurnal flow variations. Because of these operational benefits, industrial users reduce the need for storage and other peak demand facilities and management.
- *Irrigation* – Recycled water is used to irrigate golf courses, parks, schoolyards, cemeteries, greenbelts, roadway medians, and agricultural purposes throughout Southern California. Using recycled water for irrigation reduces the need for imported water during the critical summer months and in drought situations when water supplies are scarce. Unlike industrial uses, irrigation demands have large seasonal variations in reuse.

Indirect Potable Reuse

Indirect Potable Reuse (IPR) refers to the use of recycled water for groundwater replenishment, and reservoir water augmentation purposes. These types of uses require additional treatment levels beyond irrigation uses and use of an environmental buffer.

- Groundwater Replenishment – Metropolitan's service area overlies numerous groundwater basins, most of which rely on artificial recharge to sustain groundwater production, and some of which are threatened by seawater intrusion. Water agencies along the Los Angeles and Orange Counties coastline inject water into the underlying groundwater basins to create a barrier against this seawater intrusion and protect groundwater quality. The use of recycled water for seawater intrusion barrier projects is increasing and is replacing imported water used for this purpose. Increasing the proportion of recycled water can free imported water for direct consumption. For example, Metropolitan's Regional Recycled Water Program would provide purified recycled water instead of imported water to replenish multiple groundwater basins in the region, making imported water available for other purposes. Table 3-9 presents a summary of this recycled water use.
- Reservoir Water Augmentation – Reservoir Water Augmentation (previously identified as surface water augmentation) includes use of advanced treated recycled water to augment a surface water reservoir. The reservoir serves as an environmental buffer (similar to groundwater aquifer in the case of groundwater replenishment) prior to when recycled water is treated for potable uses. Blended water from the reservoir is then treated at a conventional water treatment plant for potable purposes. There is currently no reservoir water augmentation with recycled water in Metropolitan's service area. The State Water Resources Control Board (SWRCB) adopted the surface water augmentation regulations, required under SB 918, in 2018. The City of San Diego is currently operating a demonstration project to evaluate the feasibility and expected permitting requirements of a full-scale reservoir water augmentation project.

Table 3-9
2020[1] Recycled Water Use for
Groundwater Replenishment and Seawater Barrier Injection
(TAF per year)

Groundwater Basin	Recycled Water Use
Central Basin	56
Chino Basin	13
Orange County Basin	97
West Coast Basin	12
Other Basins	1
Total	**179**

[1] Data for 2020 not available at the time of publication, used average of 2017-2019.

Direct Potable Reuse

Direct Potable Reuse (DPR) refers to the use of advanced treated municipal recycled water as a direct supply before or after a conventional water treatment plant. DPR does not require an environmental buffer. There are two distinct forms of DPR: raw water augmentation, and treated drinking water augmentation. Currently, there are no permitted DPR projects in California. The report to the Legislature on DPR feasibility is complete (December 2016). In addition, SWRCB issued a framework for regulating DPR (1st edition April 2018, 2nd edition August 2019).

<u>Raw Water Augmentation</u>

Raw Water Augmentation (RWA) refers to the use of advanced treated wastewater as a direct supply before a conventional water treatment plant. Metropolitan is considering RWA as part of the Regional Recycled Water Program. This DPR option would involve delivery of advanced treated water upstream of the Weymouth and/or Diemer water treatment plants.

<u>Treated Water Augmentation</u>

Treated Water Augmentation means the planned placement of recycled water into the water distribution system of a public water system.

<u>Technical and Economic Issues of Recycled Water</u>

Recycled water use is growing rapidly in Metropolitan's service area. Further expansion depends on progress in research, regulatory change, public acceptance, water quality issues, cost, operational issues, and conflicting institutional objectives. Each of these challenges, as well as opportunities for recycled water use, lessons learned, and recommendations to enhance the development of recycled water, is discussed below.

<u>Challenges</u>

<u>Lengthy and Variable Permitting Process</u>

The SWRCB established the Recycled Water Policy (Policy). This Policy requires the SWRCB and the nine Regional Water Quality Control Boards (Regional Boards) to encourage the use of recycled water, consistent with state and federal water quality laws. The Policy provides additional direction to the Regional Boards on appropriate criteria to be used in regulating recycled water projects. The Division of Drinking Water (DDW) and the nine Regional Boards are responsible for setting the rules and permitting for recycled water projects. The timeline and roadmap for getting a permit are challenging and inconsistently implemented in different regions of the state. Limited history and technical information (e.g., on DPR) to inform regulations and limited staffing at DDW and other agencies have challenged the ability to propose, revise, and adopt new regulations in a timely manner. Agencies planning and designing DPR and IPR projects face delays because of regulatory uncertainty. In addition, many project proponents seeking grant or loan funding have identified lengthy CEQA review as a challenge.

IPR projects face regulatory constraints such as treatment, blend water, retention time, and Basin Plan Objectives, which are the designated uses assigned by the SWRCB and which may limit how much recycled water can feasibly be recharged into the groundwater basins. For example, the Basin Plan Objective for TDS of a particular basin may be lower than the quality of the tertiary water effluent available, resulting in the need for more blended water or advanced levels of treatment. These treatment requirements impact the economic feasibility of a project.

Public Perception/Conflicting Messaging

Public acceptance of recycled water is critical in implementing water reuse projects, especially potable reuse projects. In the past, public opposition halted a number of recycled water projects, citing concerns about the source of the water and resulting water quality.

The public does not have a clear understanding of the difference between non-potable reuse, IPR, and DPR. The public is most familiar with non-potable reuse as they see recycled water in use at parks, golf courses, schools, and other large landscapes. Signage for non-potable reuse projects at parks, schools, and golf courses that read, “Using recycled water; do not drink” can adversely affect the public’s acceptance of DPR and IPR even though IPR has been used in some areas for over 50 years.

With effective outreach, public understanding and acceptance of potable reuse have improved. Projects such as Orange County’s Groundwater Replenishment System conduct tours and presentations to thousands of people, raising awareness of the project, addressing water quality concerns that may be associated with recycling wastewater, and gaining support. Metropolitan’s Regional Recycled Water Program also involves extensive outreach to the communities impacted by the program.

Education and public outreach are still needed. Any water reuse effort must include public engagement to build awareness of the project and acceptance of recycled water as a new supply.

Cost

Cost, including up-front capital and ongoing operation and maintenance, remains a concern to recycled water development for some agencies. The cost for expanding recycled water distribution systems remains a significant consideration to full implementation of non-potable reuse projects, as these projects require pipelines connecting the treatment plants and the individual users. Some non-potable reuse and IPR projects and all DPR projects require advanced treatment facilities, which are comparatively expensive. Advanced treatment may also require additional concentrate disposal facilities (e.g., a brine line) and extensive infrastructure for injection wells/spreading facilities, or for delivery of the product water to a spreading ground, surface reservoir, or water treatment plant for potable uses. Ultimately, end users play a very important role for recycled water advancement. Site conversion costs (borne by the customer) and additional conveyance infrastructure for new customers can also be significant considerations in reaching full non-potable reuse project capacity. Some agencies may be challenged with cash flow issues or inability to secure the funding needed to implement projects.

In addition, with the increasing prospect of statewide regulations, some agencies pursuing IPR may be hesitant to extend their existing distribution system for non-potable reuse projects for fear of stranded facilities. Similarly, some agencies pursuing DPR may delay their planned indirect potable reuse projects to prevent stranded distribution facilities.[3]

Source Control and Effluent Water Quality Needs

Source water quality and flow control is essential to help safeguard the water recycling treatment process and the end use of the water by placing controls on the type, timing, and amount of wastewater that comes into the plant. A good source control program limits wastewater treatment plant disruptions and ensures treatment processes are capable of handling spikes in volume, industrial influent, and high salinity influent. When it comes to the treatment process, recycled water policy requires that the effluent meets certain water quality standards. Salt and nutrient management plans protect groundwater beneficial uses and prevent excess degradation, which may limit expanded IPR applications if the agency does not have funds for advanced treatment to remove salts to meet the Basin Plan Objectives. In some cases, existing source control plans may need to be updated to deal with constituents of emerging concern and with more stringent needs of the users.

Source water quality for non-potable reuse can be affected by drought patterns in Southern California. Drought years with low State Water Project allocations will increase potable water salinity and, as a result, increases the salinity of source water for water reclamation plants. High salinity in wastewater decreases the viability of recycled water for irrigation uses and may also cause NPDES discharge violations for local agencies.

Water use efficiency helps conserve water, but also incidentally reduces wastewater volume resulting in an increase in the concentration of wastewater. As a result, additional treatment is needed, which increases operation and maintenance costs of the system. Source water quality is especially important for implementing IPR and DPR projects to protect potable water systems.

Operational Issues

While each agency is different, it is important to recognize the possible operational issues that may occur with the use of recycled water, including:

- Reduction in wastewater flows due to ongoing conservation and drought
- Lack of seasonal storage to address diurnal and seasonal demands; construction of storage facilities may be needed for flow equalization
- Concentrate disposal needs
- Environmental flow or stream discharge requirements may limit the ability to deliver recycled water during high demand periods
- Regulatory issues such as blend requirements and water quality objectives may impact the effectiveness of IPR
- Need for multiple barriers to ensure recycled water quality and for monitoring techniques that provide feedback in real-time to respond to plant disruptions, especially with DPR projects
- Need for additional operator training and certification

[3] Indirect potable reuse projects usually require injection wells or a distribution system to a surface reservoir or recharge basin, and may also require improvements to a surface reservoir, recharge basin, or treatment facility.

Opportunities

Progress Towards New Regulatory Process

The State of California has made progress in developing permit standards that provide opportunities to expand recycled water use.

In December 2018, the State Recycled Water Policy was amended to further encourage use of recycled water from municipal wastewater, promote standardized state-wide implementation, and provide directions for Regional Boards, proponents, and the public when issuing permits. The amended policy included standardized annual reporting requirements and updated recycled water categories for better tracking. The Policy also included baseline monitoring requirements for emerging contaminants.

Non-potable reuse: The SWRCB adopted a general permit (Order WQ 2016-0068) for most non-potable beneficial reuse of treated municipal wastewater in June 2016. The permit provides an opportunity for non-potable reuse projects to come online sooner with standardized conditions and conditionally delegated authority for an Administrator to manage a local water recycling program. Revisions to the Recycled Water Policy in 2018 further standardized statewide implementation requiring most regional non-potable reuse permits be moved to the statewide general permit.

On-site treated non-potable water systems legislation (SB 996, Chaptered September 2018), requires the SWRCB to adopt risk-based water quality regulations by December 1, 2022. The legislation also requires local jurisdictions to adopt ordinances and requires treatment systems to comply with adopted water quality standards.

IPR and DPR: The SWRCB adopted uniform water recycling criteria for IPR for groundwater recharge in June 2014 and reservoir (surface water) water augmentation in March 2018. The SWRCB is facing a December 31, 2023 deadline from AB 574 to develop regulations for DPR through raw water augmentation. AB 574 also requires the establishment and administration of a science advisory panel to provide DPR guidance and assurance of protection of public health. Per the State's August 2019 DPR framework, the State will be developing a regulatory package for both treated and raw water augmentations concurrently.

Metropolitan continues to work with the WateReuse Association and other agencies on legislative and regulatory issues to streamline permitting processes and to provide needed funding and support for increased use of recycled water.

New Funding Opportunities

Proposition 1 provided $625 million for water recycling projects. Grants and loans for planning and construction are administered through the SWRCB's Water Recycling Funding Program. An additional $100 million was available through DWR for desalination.

Proposition 13, approved by voters is 2000, is also used to fund grants and loans for planning and construction of recycled water projects. Repayment of low-interest loans from previous projects allows limited funding from this program to continue.

Proposition 68, approved by the voters in 2018, provided $72 million in grants and loans for recycled water planning and construction activities. The remaining funding has been committed by the SWRCB for disadvantaged community projects. The SWRCB has committed to spend the remaining available Prop 1 and Prop 68 funding on approved projects on the FY 2020-21 Intended Use Plan.

The Clean Water State Revolving Fund (CWSRF) provides low-interest loans to public agencies for planning, design, and construction of water recycling projects. There is currently a substantial backlog of CWSRF projects on the FY20-21 Intended Use Plan (~$7 billion) that could limit the number of new projects approved over the next several years.

The Water Infrastructure Finance and Innovation Act (WIFIA) program was authorized by the Water Resources Development Act of 2014. The program is similar to the State Revolving Fund programs like the CWSRF program but is intended to provide federally subsidized low-interest loans for up to 49 percent of large regional projects.

Title XVI Water Reclamation and Reuse Program was established in 1992 and provides grant funding up to 25 percent of project costs or $20 million for selected projects in the western U.S. Title XVI requires projects be either congressionally authorized or competitively selected after USBR approval of a feasibility study.

In 2014, Metropolitan increased the financial incentives under its LRP for agencies to develop recycled water. Metropolitan also established the On-site Retrofit Pilot Program to provide rebates to customers that convert their irrigation and industrial system from potable water to recycled water. In addition, Metropolitan established the Reimbursable Services Program to provide technical and construction assistance to its member agencies for local project development. Under this program, Metropolitan advances funds and is reimbursed by the agency.

Improving Public Perception

Recent droughts have heightened water awareness in the region and have provided momentum for water conservation and reuse. The public is more willing to accept alternative supplies such as recycled water. Extensive public outreach and education have also helped improve the public's perception of recycled water. Public sharing of information, open door stakeholder meetings, and focus groups have been very effective at distributing information and addressing public concerns. Case studies and demonstration projects are used to educate and improve public acceptance of recycled water.

Agencies are working together to share best practices for public outreach, create consistent messaging, simplify water reuse terminology, and ensure effective communications with the public. One such group is the WateReuse California Communications Collaborative Group, which provides a forum to discuss and collaborate on water reuse communications. The group offers resources for communications professionals, including a terminology document to provide consistent and simple water reuse terminology, for use with the public.

New Technologies, Research, and Information Sharing

New technologies, research, and information sharing greatly enhance the development of recycled water. Programs such as Metropolitan's Future Supply Actions (FSA) Funding Program focus on technical studies and pilot projects that reduce barriers to future local production. Projects under this program include optimizing new treatment techniques for recycled water, exploring new monitoring methodologies, and testing innovative brine concentration technology. In addition to the technical portions of this program, the FSA Funding Program supports collaboration between agencies and regional sharing of information.

Metropolitan is also conducting cutting-edge research at the Regional Recycled Water Advanced Purification Center. The demonstration facility is testing the effectiveness of membrane bioreactors followed by reverse osmosis and ultraviolet disinfection/advanced oxidation in the advanced water treatment process. During testing, Metropolitan and the Sanitation Districts are analyzing water quality for removal of various contaminants, especially microorganisms. The agencies are also working closely with state regulators and an independent scientific advisory panel to oversee the work. Once regulators approve the process, it may be used throughout California. Additional research on membrane bioreactors and potential purification processes to address raw water augmentation are also planned at the demonstration facility. The studies will help further potable reuse in California and across the globe.

Research is especially critical in advancing new water supply options, such as DPR. WateReuse, in partnership with other agencies (including Metropolitan), is leading the California Direct Potable Reuse Initiative [4] to advance DPR as a water supply option in California and to address regulatory, utility, and community concerns. WateReuse's report *Direct Potable Reuse: A Path Forward* [5] provides an overview of DPR and identifies research needs.

Regional studies can also examine the needs of multi-jurisdictional areas and foster communication among agencies to promote the use of recycled water. For example, sharing regional information such as GIS data can identify areas of recycled water surpluses and needs.

<u>*Partnerships*</u>

Drinking water, wastewater, and groundwater management agencies share some common objectives, including access to source water, cost minimization, and protection of the environment. Many agencies are successfully cooperating and developing recycled water projects. These partnerships can allow sanitation districts to reduce the cost of disposing treated wastewater in the ocean, reduce impacts to the marine environment, and provide a source of reclaimed water to water agencies for recycling. At the same time, groundwater basin management agencies could be the recipients of final recycled water, helping maintain or increase groundwater levels.

<u>*Lessons Learned*</u>

There have been many success stories on recycled water development. Focusing on public outreach and education has improved public perception. Partnerships and joint efforts among water and wastewater agencies proved to be an effective way to remove barriers and make progress. Numerous studies and research funded by federal, state, and local agencies are benefitting local and regional efforts.

<u>*Public Outreach is Important*</u>

Public outreach and education have helped improve the public's perception of recycled water. Both experience and research have shown that when the public is informed and takes part in the decision-making process, they will likely accept and support recycled water as a new supply in their community.

Water shortages raise awareness for alternate ways to conserve. As a result, the public is more willing to accept alternative supplies such as recycled water, support the more expensive projects, and tolerate rate increases. Potable reuse projects throughout Southern California are advancing due to this increased public awareness and support. Non-potable reuse is also increasing. Some residential property owners are interested in using recycled water for watering plants to help with the drought. For example, residents have access to recycled water from "residential recycled water fill stations" in the Irvine Ranch Water District. Programs like these improve public acceptance of recycled water, increase recycled water use, and conserve potable supplies.

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[4] https://www.watereuse.org/foundation/research/direct potable reuse-Initiative
[5] https://www.watereuse.org/product/direct-potable-reuse-path-forward

Standard practice for water reuse projects now includes robust outreach. Many projects dedicate considerable resources towards public engagement. For example, Metropolitan's Regional Recycled Water Program features a learning center at its demonstration facility to provide a platform for public outreach. The facility and learning center are used to conduct tours, introducing the public to the program and potential new source of water.

Additional Funding is Needed

LRP incentives and onsite retrofit program funding have increased use of recycled water in the region by almost 200 percent. However, incentives alone may not be enough to spur project development - capital funding is also necessary because the LRP pays for project performance; in other words, it provides funding after a project begins operation. Metropolitan increased its LRP incentive rate in 2014, and also offers three options for an agency to receive funding. Agencies select the option that allows the project to receive incentives when they are needed, recognizing the higher costs borne by the agency and lower cost recovery at the start of operation. Although available construction funding for recycled water projects has increased under Proposition 1, projects generally still require a 50 percent local match. One source of funding is typically not enough to fund a recycled water project.

Partnerships Can Be Successful

History shows us that partnerships among agencies help advance use of recycled water and provide tangible benefits to each participating agency. A good example of partnerships working well is the agreement between Orange County Water District (OCWD) and the Orange County Sanitation District. This partnership began in the 1970s, when OCWD built the Water Factory 21 to produce recycled water to mitigate seawater intrusion in the Orange County Groundwater Basin. Twenty years later, the two agencies decided to jointly build the Groundwater Replenishment System (GWRS) recycled water project. The GWRS is the largest planned IPR facility in the world with a current capacity of 100 TAF per year and future expansion to 130 TAF per year.

Other examples of cooperation between agencies to further recycled water use include partnerships between the city of Los Angeles and West Basin Municipal Water District (West Basin Water Recycling Program), the City of Los Angeles and the City of Burbank (North Hollywood Water Recycling Project), City of Long Beach and the Water Replenishment District (Alamitos Barrier Water Recycling Project), and the Los Angeles County Sanitation Districts and Central Basin Municipal Water District (Century and Rio Hondo Water Recycling Project).

In addition, Metropolitan and the Sanitation Districts have been in partnership since 2009 to develop a regional recycled water project for groundwater replenishment and raw water augmentation. The Regional Recycled Water Program (RRWP) would produce up to 150 MGD of purified water from the Joint Water Pollution Control Plant in Carson. As a first step toward full implementation, Metropolitan and the Sanitation Districts cooperated to complete the Advanced Purification Center in 2019. The Advanced Purification Center is a 0.5 million gallon per day demonstration facility that will generate information needed for the potential future construction of a full-scale recycled water facility. It uses a unique application of membrane bioreactors designed to significantly increase efficiency in water recycling. Scientists and engineers will test the process, utilizing full-scale treatment modules, to ensure the resulting purified water meets the highest water quality standards. Once approved by regulators, this innovative process could be used throughout California and even applied around the globe. Metropolitan and the Sanitation Districts are continuing to move forward with the program, to enhance their partnership and begin the next phase of the program. Metropolitan's Board approved proceeding with the environmental planning phase of the project in November 2020.

Metropolitan is also in partnership with many other organizations to collaborate on this program. Potential recipients of the water, such as groundwater basin managers and member agencies, are partners. The Southern Nevada Water Authority, Central Arizona Project and Arizona Department of Water Resources are also partners, collaborating on how the project could support Colorado River water use. Metropolitan is also partnering with LADWP to work together to develop recycled water. LADWP's Operation Next Program to reuse wastewater from Hyperion is also a key project in development and could provide a potable supply for the region.

Water Industry Organizations and Regional Collaboration Help Advance Recycled Water

Recent advancements to recycled water development are due, in large part, to cooperation and collaboration among water and sanitation districts, as well as other water industry organizations. Historically, the WateReuse Association was one of the main advocates for recycled water development in the state. Their activities initially focused on permitting issues, public outreach/education, conferences for information sharing, and research related to recycled water. As recycled water became a core resource for water and wastewater agencies, they started to ramp up their activities to help advance recycled water and utilized partnerships with academia along with other trade organizations such as the Association of California Water Agencies, California Urban Water Agencies, WateReuse Association, and California Association of Sanitation Agencies. Professional organizations such as American Water Works Association are another vehicle to promote recycled water through research, technical seminars, and operator training and certification. These organizations have proven to be effective in promoting regional collaboration on research and leveraging resources. Recently, the Southern California Water Coalition (SCWC) has launched the Recycled Water Task Force with the goal of addressing barriers, gaining acceptance, and educating stakeholders on recycled water.

Recommendations

Explore Opportunities to Improve Permitting Process

- Streamline and simplify water recycling regulations with uniform administration consistent with operations, public health, and the environment
- Support legislation and regulation that expand the types of recycled water uses consistent with the protection of public health and help achieve the state's recycled water goal
- Convene a forum to discuss projects, permitting, and treatment technologies

Improve Public Education and Awareness of Water Recycling

- Continue to pursue unified, consistent messaging
- Consider updating signage for non-potable reuse, expanding residential fill stations, and other public outreach strategies to further advance public acceptance of recycled water
- Use demonstration facilities and learning centers like the Regional Recycled Water Advanced Purification Center to educate the public and key stakeholders about recycled water

Explore Various Investment Strategies, Such as Incentives, Ownership, and Partnerships

- Promote collaboration among stakeholders and agencies to facilitate implementation of recycled water projects in California

- Promote development of new financing to increase water recycling, advance research in science and technology, assess health effects, develop additional regional planning, and study innovative technologies
- Explore the development of recycled water partnerships or ownership
- Pursue the RRWP as a showcase of recycled water development
- Consider additional end user programs to replace potable water systems with recycled water
- Collaborate on pursuing grant funding

Consider Joint Technical Studies and Projects

- Explore integration approaches
- Investigate programs for the development of new technologies, such as comprehensive real-time monitoring devices and techniques that improve water quality and ensure public health, and maintain public confidence
- Study opportunities to protect or improve the quality of wastewater source supplies, as well as optimizing wastewater treatment for use in potable reuse applications
- Explore development of a regional study to help identify opportunities for seasonal storage
- Advance research that supports timely development of DPR regulations in California

Groundwater Recovery

All Southern California groundwater basins experience varying degrees of water quality challenges as a result of urban and agricultural uses. The accumulation of high-salinity water and degradation from volatile organics are two common constraints to the economic use of groundwater for urban applications. In some cases, the threat of increased salt buildup can also complicate conjunctive use of groundwater basins and imported supplies.

Use of degraded groundwater normally requires high levels of treatment. Membrane processes used to recover the majority of severely degraded water have a high capital cost and incur a high operational cost for power. Once treated, however, recovered groundwater may be integrated into potable water systems. Metropolitan initiated its Groundwater Recovery Program (GRP) in 1991 to encourage local agencies to treat and use degraded groundwater for municipal purposes. The GRP was open to all technologies that recovered and used degraded groundwater. The GRP was retired in 1998 and folded into Metropolitan's LRP.

Seawater Desalination

The constant availability of ocean water regardless of weather or climate is one of the key benefits of seawater desalination. Countries with arid or Mediterranean climates and/or growing populations with developing economies have embraced seawater desalination as a drought and climate resistant option for meeting water needs. In the past 20 years, water agencies in Australia, Spain, Singapore, Hong Kong, India, China, Israel, and other countries throughout the middle east have implemented large-scale seawater desalination plants in response to droughts and to meet growing demands. Within Southern California, San Diego County Water Authority, the City of Santa Barbara, and communities on Catalina Island have supplemented their water supplies with seawater desalination.

Seawater desalination projects provide unique benefits as part of a diversified water resource portfolio. In California, they also present unique development challenges compared to other alternative resources. Table 3-10 provides a summary of the primary benefits and challenges:

Table 3-10
Summary of Benefits and Challenges of Seawater Desalination Projects

Benefits	Challenges
• Highly reliable potable supply resistant to weather variations and climate change • Low salinity, high-quality resource improves supply blends and supports reuse • Locally controlled • Does not affect and is not affected by upstream or downstream water rights – truly a new supply • Located near coastal population centers • Supports Southern California's desalination industry cluster and innovation centers	• Expensive compared to many alternative existing supplies and some new alternative supplies • Potential marine life impacts • Local community and environmental opposition • Permitting uncertainty and development risk • Energy intensive and thus increased exposure to energy rate uncertainty • Demand risk in wet years

Metropolitan and its member agencies have been considering seawater desalination as a potential new supply source since the 1960s. Up until the 1990s, seawater desalination was considered expensive compared to other resource alternatives, especially imported water. Advances in membrane technology, energy recovery, and process design in the 1990s lowered desalination costs compared to other new supply alternatives.

By the early 2000s, several member agencies began pursuing local projects to diversify their resource portfolios. In 2001, Metropolitan created an incentive program, the Seawater Desalination Program (SDP), to support these projects. Soon after, the Board approved Metropolitan's role as a regional facilitator for seawater desalination with the purpose of assisting the member agencies with state and regional development issues. Metropolitan signed SDP agreements with Long Beach, MWDOC and West Basin in 2006. In 2014, Metropolitan merged seawater desalination projects into the LRP to promote development of additional local supplies in the region. Metropolitan's SDP agreements with the three member agencies expired in June 2020.

In order to protect California's coastal and marine resources, seawater desalination projects in the State must meet stringent environmental regulations. Relevant regulations include the California Ocean Plan and Marine Life Protected Area restrictions. Additionally, projects located near coastal generating stations are affected by the California's Once Through Cooling regulations. Each of these is discussed below:

<u>Ocean Plan Regulations</u>

In May 2015, the SWRCB updated California's Ocean Plan with regulations for new seawater desalination projects. The regulations include requirements for ocean water intakes, outfalls, brine discharges, mitigation, monitoring and permitting. Regional Water Quality Control Boards are responsible for implementing the regulations and have broad powers over project design elements.

Marine Life Protected Areas

In 2011, the California DFW adopted a system of 50 Marine Life Protected Areas (MLPAs) covering approximately 15 percent of Southern California's coastline[6]. MLPAs are defined zones along the coast where certain commercial and recreational activities are restricted. Most construction and operational activities associated with seawater desalination are prohibited in MLPAs with the exception of certain types of subsurface intakes. MLPAs are located along the Channel Islands, the mainland coast, and locations surrounding the Channel Islands. The MLPA network includes areas near planned seawater desalination projects. In October 2020, Governor Newsom announced a 30 percent by 2030 initiative. The initiative calls for preserving 30 percent of the California's lands and coastal waters by 2030. Implementation of the initiative may increase MLPAs within Southern California's coastal waters and could affect potential sites for seawater desalination projects. Additional MLPAs may also provide marine life mitigation opportunities for potential projects.

Once-Through Cooling Regulations

Prior to the revised Ocean Plan regulations, the SWRCB in 2010 adopted regulations requiring coastal power plants to phase out the use of once-through-cooling (the use of seawater to cool generators in a single-pass system) by 2030. As once-through-cooling is phased out, many of the environmental and operational benefits of co-locating seawater desalination projects with coastal power plants have been diminished. However, coastal power plants remain attractive sites for development due to the presence of coastal-dependent industrial zoned land, power infrastructure, and the potential to repurpose existing infrastructure.

Changed Conditions

The status of locally planned projects changes from year to year. Metropolitan periodically surveys its member agencies for planned projects to coordinate local supply projections and plans. Recent changes in long-term strategies, regulations, and funding priorities could provide new opportunities to develop these resources.

Recycled Water

Several recent state policies and adopted codes help recycled water development as described below.

SWRCB adopted the State Recycled Water Policy (Policy) in February 2009 after several years of negotiation and amended it in 2013 to include the monitoring and analytical requirements for constituents of emerging concern (CEC). The Policy supports the SWRCB Strategic Plan to promote sustainable local water supplies and establishes a mandate to increase the use of recycled water in California by 1 MAF per year over 2002 levels (approximately 525 TAF) by 2020 and by an additional 3 MAF per year by 2030. The Policy is organized into recycled water goals, roles of agencies, salt and nutrient management plans, landscape irrigation, groundwater replenishment, anti-degradation, emerging constituents, and recycled water incentives.

SWRCB's General Permit for Recycled Water Use was adopted June 4, 2014, in response to the Governor's drought declaration and to facilitate the use of recycled water to offset potable water demands. Coverage is available to most treated municipal wastewater for non-potable uses, but specifically excludes groundwater replenishment. Monitoring for CECs is not required for non-potable uses. Application of recycled water for irrigation sites is limited to agronomic rates.

[6] http://www.wildlife.ca.gov/Conservation/Marine/MPAs/Network/Southern-California

On November 18, 2009, the Building Standards Commission unanimously voted to approve the California Dual Plumbing Code that establishes statewide standards for installing both potable and recycled water plumbing systems in new commercial, retail, and office buildings, theaters, auditoriums, condominiums, schools, hotels, apartments, barracks, dormitories, jails, prisons, and reformatories. The code was adopted January 15, 2010, with an effective date of January 1, 2011.

Assembly Bill 2071 (Levine 2014) directed the SWRCB, in consultation with other agencies, to determine if the voluntary use of disinfected treated recycled water for watering animals would pose a significant risk to the public and animal health. Use of recycled water would be prohibited for dairy animals that are producing items for human consumption. An expert panel provided recommendations in 2018 including source control, ultraviolet light disinfection, and animal health surveys. The SWRCB will require these conditions in proposed projects and update the Title 22 Water Recycling Criteria. Permit conditions for a use of recycled water not addressed by the uniform statewide water recycling criteria shall be considered on a case-by-case basis.

The SWRCB shall update the uniform statewide criteria for non-potable recycled water uses by January 1, 2023.

Assembly Bill 2282 (Gatto 2014) directed the California Building Standards Commission to adopt mandatory building standards for the installation of recycled water systems for newly constructed commercial and residential buildings in areas where there is access to a water recycling facility. These standards became effective in July 2018 but were invalidated in 2019 for not complying with the Administrative Procedure Act. The California Building Standards Commission is expected to hold new workshops to address requirements.

Assembly Bill 574 (Quirk 2017) specifies that "direct potable reuse" includes "raw water augmentation" and "treated drinking water augmentation." The bill also changed the term "surface water augmentation" to "reservoir water augmentation" and redefined that term to mean the planned placement of recycled water into a raw surface water reservoir used as a source of domestic drinking water supply for a public water system or into a constructed system conveying water to such a reservoir. This bill mandates the following: 1) requires the SWRCB, on or before December 31, 2023, to adopt uniform water recycling criteria for DPR through raw water augmentation, 2) requires the SWRCB to establish and administer an expert review panel, and would require the SWRCB, before adopting the uniform water recycling criteria, to submit the proposed criteria to the expert review panel; 3) prohibits the SWRCB from adopting the uniform water recycling criteria until the expert review panel adopts a finding that the proposed criteria would adequately protect public health; 4) allows the SWRCB to extend the date by which the uniform water recycling criteria are to be adopted if certain criteria are met; and 5) authorizes the SWRCB, after it has adopted the initial uniform water recycling criteria, to reconvene or reestablish the expert review panel.

Groundwater Recovery Brine Disposal

The management of existing regional brine lines and the development of new brine line systems will be a critical factor in the continued growth in brackish groundwater desalination. Brine lines will also be applicable for disposing brine from advanced treatment of wastewater for recycled water use. All processes that recover degraded groundwater also produce concentrated waste flows for which disposal can be problematic. Most importantly, membrane processes such as reverse osmosis—the predominant desalting technology used in Southern California—produce significant volumes of brine that can account for about 15 percent of the treated water. In Southern California, brines generated from brackish water desalination are typically disposed through dedicated brine lines to ocean outfalls or sanitary sewers.

The region currently has two operating brine lines: the Santa Ana Regional Interceptor (SARI line) and the Calleguas Regional Salinity Management Pipeline. The SARI line collects brine from desalters in San Bernardino, Riverside, and Orange Counties and discharges to a treatment plant operated by the Orange County Sanitation Districts (OCSD), with final discharge through the OCSD ocean outfall. A key benefit of the SARI line is that it has allowed inland water agencies to recover impaired groundwater resources which would otherwise be unusable.

A lower portion of the Calleguas Regional Salinity Management Pipeline is in operation while the upper reach is still under construction. The Calleguas Regional Salinity Management Pipeline delivers brine from recycled water plants and groundwater desalination facilities in Ventura County to the ocean.

A third regional line is in the planning phase in San Diego County. The Southern California Salinity Coalition, a coalition of water and wastewater agencies, has advocated for state and federal financial assistance to build these regional brine lines.

Seawater Desalination

Changed conditions for seawater desalination include sustained operations of the Carlsbad Seawater Desalination plant, state and federal funding opportunities, and increased permitting uncertainty.

<u>Carlsbad Desalination Project Operations</u>

In 2015, the San Diego County Water Authority (SDCWA) started taking delivery of supplies from the Carlsbad Desalination Project (Carlsbad Project). The Carlsbad Project is the largest seawater desalination in the United States with a capacity of 50 MGD, or 56 TAF per year. The SDCWA developed the Carlsbad Project under a Public-Private Partnership with Poseidon Resources Inc. Production from the project is guided by a Water Purchase Agreement which specifies minimum and maximum purchases and also determines the price SDCWA pays for the supplies from the project. The following Table shows production from the Carlsbad Project since 2015.

Table 3-11
Claude Bud Lewis Carlsbad Seawater Desalination Program Production[1]

Fiscal Year Ending	Production (AF)
2016	27,349
2017	40,421
2018	40,907
2019	46,036
2020 (est.)	43,868

[1] Source: SDCWA

<u>State and Federal Funding Opportunities</u>

Several State and Federal funding opportunities exist to promote the development of seawater desalination projects. Within California, the Department of Water Resources (DWR) provides funding through the Water Desalination Grant Program. DWR taps limited funds for the Grant

Program from Proposition 1 and in the past from Proposition 50. As of January 2020, the Grant Program has funded over $100 million in grants for 70 projects. The program funds new construction, demonstration projects, and research studies. It also covers brackish water desalination projects. In 2018, DWR converted the program to a continuous application process.

Federal funding for desalination projects includes programs administered by the United States Bureau of Reclamation (USBR) and the Department of Energy (DOE).

USBR promotes desalination through its Desalination and Water Purification Research Program (DWPRP). Under DWPRP, USBR funds research, pilot tests and demonstration projects to improve technologies for desalination and brine management. Program goals include reducing desalination costs, energy use and environmental impacts. USBR operates the Brackish Groundwater National Desalination Research Facility and other desalination technology testing laboratories as part of the program. Several member agencies have received DWPRP grants for local desalination projects.

The DOE established a new Water-Energy desalination hub called the National Alliance for Water Innovation (NAWI). NAWI's focus is to accelerate the development of early-stage desalination technologies in order to lower desalination's costs and energy use. Led by Lawrence Berkeley National Laboratory, NAWI is a consortium of national laboratories, university researchers, private companies and water industry stakeholders. DOE is funding NAWI with $100 million over a five-year period starting in 2020. While the focus of NAWI is early-stage pre-commercial technologies, water agencies will have opportunities to participate in research projects and pilot tests. Water agencies will also help guide NAWI's research agenda. Metropolitan joined NAWI in 2020.

Implementation Approach

Local Resources Program

The Local Resources Program (LRP) is the primary tool for Metropolitan to incentivize local resources development. The success of the LRP is due to its adaptability to changed conditions. Periodically, Metropolitan and its member agencies review and update the LRP in response to water supply conditions.

In October 2018, Metropolitan's Board authorized an interim program target of 170 TAF since the program target established in 2007 of 174 TAF was nearly subscribed. The executed agreements, in combination with submitted and proposed LRP applications, exceeded the remaining program capacity under the 2007 LRP target. By establishing an interim target, Metropolitan continues to encourage and support development of local supplies. The interim target may be revised upon completion of the 2020 IRP.

On-Site Retrofit Program

Metropolitan continues to explore ways to help increase recycled water use. In order for a site to receive recycled water, the potable water systems must be retrofitted for recycled water use. In July 2014, to catalyze an increase in recycled water use, Metropolitan established the On-site Retrofit Program to provide financial incentives directly to public or private property owners to convert potable water irrigation or industrial water systems to recycled water service. The goal of this program is to alleviate some of the costs borne by property owners to retrofit their sites. The program offers a rebate of up $195/AF for five years of estimated water savings, capped at actual retrofit costs. Eligible items include retrofit costs related to project design, permitting, construction, connection fees, and required recycled water signage. The program currently has an annual budget of $2 million and is accepting applications on a first-come, first-served basis until funding is exhausted.

Stormwater Pilot Programs

Metropolitan's 2015 IRP Update called for the development of a diverse resource portfolio through local supply projects – including recycled water, groundwater recovery, seawater desalination, and stormwater capture. Metropolitan has played an active role in the development of those local supplies through different approaches and programs developed over the years. Since 1982, Metropolitan has provided incentives to its member agencies to develop local projects through the LRP. Local stormwater capture projects currently are not funded through the LRP in part due to the need to have a better understanding of the connection between captured stormwater and yield.

In 2018, the SCWC published a white paper that detailed benefits and challenges associated with stormwater development. Although stormwater projects deliver multiple benefits, such as supply yield, flood mitigation, habitat creation, and water quality improvements, some of the main challenges with developing stormwater projects are related to costs, metering, data collection, and water supply yield. The relationship between stormwater capture and yield has not been extensively analyzed. In addition, most projects do not demonstrate a direct link to increased groundwater production or yield. This limits the ability to fully characterize stormwater capture project costs or to quantify the water supply benefit.

To better understand the actual costs and potential benefits associated with stormwater capture, yield, and reuse, Metropolitan developed two Stormwater Pilot Programs. The Direct Use Pilot Program aims to develop costs and benefits associated with capture and direct reuse of stormwater. Under this pilot, projects are required to capture stormwater onsite or through storm drain diversion. In addition, projects must meter both captured and reused stormwater. The Recharge Pilot Program was initiated to further examine the relationship between stormwater capture and yield. The Recharge Pilot requires participants to measure both stormwater capture and how much of the captured water reaches the primary pumping and subsequently allows for increased groundwater production or yield. Proposed methods for measuring how stored water recharges the primary pumping aquifers must use at least one physical method and one modeling method. This pilot will help collect data to better understand how stormwater recharge affects usable groundwater. Both pilots provide funding for new construction and installation of monitoring equipment. Additionally, both pilots provide funding for collecting three years of monitoring data. The Direct Use Pilot launched in January of 2020 with a $5.0 million budget, while the Recharge Pilot launched shortly after in March 2020, with a budget of $7.5 million.

The data collected from the pilot programs will provide a better understanding of stormwater projects and their performance. Providing funding to offset construction and monitoring costs alleviates a key constraint in project development and the ability to quantify stormwater volumes. Furthermore, the data collected from the pilot programs will help evaluate the water supply benefits delivered by stormwater projects and provide a basis for potential future funding approaches.

Regional Recycled Water Program

The Regional Recycled Water Program, a partnership with the Los Angeles County Sanitation Districts, will purify wastewater that currently flows to the ocean to produce high quality water that could be used again. On November 10, 2015, Metropolitan's Board authorized Metropolitan to enter into an agreement with the Sanitation Districts to implement a demonstration-scale recycled water treatment plant and to establish the framework of terms and conditions for development of a regional recycled water supply program. Under this agreement, Metropolitan has the opportunity to work collaboratively with the Sanitation Districts to develop a potential regional recycled water supply program that would purify and reuse water. Metropolitan and the Sanitation Districts would jointly develop this program to purify effluent from the Sanitation Districts' Joint Water Pollution Control Plant (JWPCP) using advanced treatment technologies to produce water that is near-distilled in quality and that would be equal to or better than the quality of water currently used to replenish groundwater basins in the Southern California region. The purified water would be delivered to Metropolitan's member agencies to meet their groundwater replenishment and storage requirements. A collaboration between the two districts could advance the reuse of water at a scale, timing, and strategic location to serve the direct needs of multiple member agencies for recharge of groundwater basins in Southern California, and to augment regional supplies for Metropolitan's service area. In addition, with the development of regulations for raw water augmentation, purified water may eventually be blended with imported supplies at Metropolitan's treatment plants and delivered to additional member agencies.

In October 2019, the agencies began operating the Regional Recycled Water Advanced Purification Center, a 0.5 million gallon per day demonstration facility. The facility will generate information needed for the potential future construction of a full-scale advanced water plant. It uses a unique application of membrane bioreactors designed to significantly increase efficiency in water recycling. Scientists and engineers will test the process, utilizing full-scale treatment modules, to ensure the resulting purified water meets the highest water quality standards. Once approved by regulators, this innovative process could be used throughout California and even applied around the globe. Following approval, additional treatment trains will be tested to determine the needed purification processes for a full-scale program.

The full-scale regional RRWP would produce up to 150 million gallons daily, enough to serve more than 500,000 homes. Purified water from the advanced treatment facility would be delivered through 60 miles of new pipelines to the region's groundwater basins, industrial facilities, and potentially two of Metropolitan's treatment plants. Metropolitan prepared feasibility analyses for the RRWP (the Feasibility Study, Report No. 1530) in November 2016 and Conceptual Planning Studies Report (Report 1618, February 21, 2019) in preparation for environmental review and preliminary design. Letters of intent have also been executed with key partners.

In November 2020, Metropolitan's Board of Directors approved the next phase of the program, environmental planning. In addition, the Board also approved an updated agreement with the Sanitation Districts, which further expands the partnership and allows for additional shared responsibilities and resources.

Future Supply Actions

Metropolitan supports the development of local supplies through the FSA Funding Program. FSA are low cost, low risk investments Metropolitan can take now to remove barriers to new supplies so that they can be accelerated in the future, if when needed. The FSA Funding Program is Metropolitan's primary vehicle for promoting innovative new approaches to local supply development. Under the FSA Funding Program, Metropolitan funds member agency studies addressing development challenges for groundwater, recycled water, stormwater and seawater desalination supplies. The goals of the FSA Funding Program include:

- Reduce barriers to future resource production
- Provide results that are unique, yet transferable to other areas in the region
- Advance the field of knowledge
- Represent a critical path to water resource implementation

Metropolitan implemented an initial round of FSA funding in 2013 and launched a second round of funding in 2019. Both rounds have funded a mix of white papers, pilot tests and demonstration studies. The program funds a maximum of $500,000 per study or per agency. In 2018, Metropolitan also co-funded six potable reuse projects and one agricultural reuse study under the FSA Funding Program with the Water Research Foundation. Metropolitan's nearly $1.0 million in co-funding supports WRF's $8.0 million Advancing Potable Reuse Initiative and helped match $4.5 million in State Water Resource Control Board grant funds. Table 3-12 provides a summary of the FSA funding.

Table 3-12
Summary of FSA Funding

	2013 FSA Member Agency Studies		2018 FSA Member Agency Studies		2018 WRF Potable Reuse Studies	
	Studies	**Funding**	**Studies**	**Funding**	**Studies**	**Funding**
Groundwater	4	$900,000	3	$661,000		
Recycled Water	5	$810,000	5	$1,265,000	7	$975,000
Stormwater	2	$814,000	4	865,000		
Seawater Desalination	2	$325,000	2	$365,000		
Total Funding	**13**	**$2,939,000**	**14**	**$3,156,000**	**7**	**$975,000**

Metropolitan also supports local supply development as a regional facilitator for seawater desalination and related resource issues. This includes assisting member agencies with technical issues, supporting member agency projects during permit hearings, coordinating responses to proposed regulations, and collaborating with the member agencies to address development challenges. Metropolitan helped launch and now participates in CalDesal, a consortium of water utility and private stakeholders promoting desalination as an element of California's future supply portfolio.

Achievements to Date

Metropolitan has continued to develop and refine its programs to encourage the involvement of its member agencies in water recycling, groundwater recovery, and desalination. Developing and managing these programs requires considerable coordination and refinement. Changing conditions over the last five years have reduced the costs of these options and allow Metropolitan to rely on these sources for future water supply.

Table 3-13 provides a summary of the status of local agency seawater desalination projects that are under development within Metropolitan's service area. Local agencies are considering several projects with the potential to produce up to 131 TAF, if developed.

Metropolitan is committed to providing financial assistance to the development of water recycling projects throughout its service area. Since 1982, Metropolitan has executed LRP contracts for 85 recycled water projects, 75 of which produced about 138 TAF in 2019. Local projects not receiving funding from Metropolitan provide an additional 370 TAF of recycled water to the region.

Since 1991, Metropolitan has executed GRP and LRP contracts for 27 recovered groundwater projects, 24 of which produced about 50 TAF in 2019. In addition to the projects under

Metropolitan's programs, about 62 TAF of degraded groundwater is recovered by agencies in Metropolitan's service area without Metropolitan's financial assistance.

Table 3-14 provides a summary of recycled water use and groundwater recovery in FY 2019-20. To date, Metropolitan has invested $510 million in recycling programs and $173 million for groundwater recovery. Table 3-15 provides a summary of the groundwater and recycled water production and incentive payments under Metropolitan's programs to date.

Table 3-13
Seawater Desalination Projects Under Development within Metropolitan's Service Area[1]

Project	Member Agency Service Area	Planned Capacity AF per Year	Status as of September 2020
Huntington Beach Seawater Desalination Project	Orange County Water District / Municipal Water District of Southern California	56,000	Permitting
West Basin Ocean Desalination Project	West Basin Municipal Water District	20,000 to 60,000	Environmental Impact Report
Doheny Desalination Project	South Coast Water District / Municipal Water District of Orange County	5,000 to 15,000	Permitting
Total: Potential Projects		**81,000 – 131,000**	

[1] Does not include potential seawater desalination projects in Mexico which could supply Metropolitan's service area through direct deliveries or through exchanges.

Table 3-14
FY 2019-20 Water Production from Recycling and Groundwater Recovery
(TAF)

Type of Project	With Metropolitan Funding	Without Metropolitan Funding	Total
Recycled Water[1]	71	370	441
Groundwater Recovery	50	62	112
Total	**121**	**432**	**553**

[1] Excluding Santa Ana River baseflow.

Table 3-15
Local Resources Program

	Recovered Groundwater	Recycled Water	Total
Projects			
Contracted	27	85	112
In Operation	24	76	100
Ultimate Yield (TAF)	124	348	472
Deliveries (TAF)			
FY 2019-2020	50	71	121
Since Inception	1,052	2,972	4,024
Payments ($ millions)			
FY 2019-2020	$4	$13	$17
Since Inception	$173	$510	$683

3.6 Surface Storage and Groundwater Management Programs: Within the Region

Since the 1950s, local water management in Metropolitan's service area has included the surface water storage and conjunctive use of groundwater. Conjunctive use of water refers to the use and storage of imported surface water supplies in groundwater basins and reservoirs during periods of abundance. This stored water is available for use during periods of low surface water supplies as a way of augmenting seasonal and multiyear shortages.

Background

Metropolitan established general long-term storage guidelines in its Water Surplus and Drought Management (WSDM) Plan. The WSDM Plan provides for flexibility during dry years, allowing Metropolitan to use storage for managing water quality, hydrology, SWP, and Colorado River issues. Dry-year surface storage yields have been characterized in several ways, including delivery capabilities over two- and three-year dry periods. The approach used in Metropolitan's resource planning assumes that dry-year surface storage can be used as needed and as available within the WSDM planning framework. In addition to surface reservoirs in the region, storage capacity in the region's groundwater basins allows for conjunctive use programs. In 2000, the Association of Ground Water Agencies (AGWA) published Groundwater and Surface Water in Southern California: A Guide to Conjunctive Use that estimated the potential for dry-year or long-term conjunctive use in Metropolitan's service area at approximately 4.0 MAF. In 2007, Metropolitan published the Groundwater Assessment Study that estimated 3.2 MAF of space in groundwater basins available for storage within Metropolitan's service area. Metropolitan's 1996 IRP calls for the development of conjunctive use programs with member agencies and groundwater basin managers to store surplus imported supplies in wet years to provide dry-year supplies.

To prepare for supply disruptions, Metropolitan and its member agencies have adopted goals for water storage within the region. Metropolitan has identified in-region storage that should be set aside for use in emergencies, such as a disruption to imported supplies due to a major seismic event at the San Andreas Fault.

Implementation Approach

Surface Storage

Since the beginning of Metropolitan's planning process, two significant changes have occurred to regional surface storage: (1) the construction of DVL, and (2) Metropolitan receiving operational control of 218,940 AF in Castaic Lake and Lake Perris.

<u>Diamond Valley Lake</u>

Construction of Southern California's newest and largest reservoir nearly doubled the area's surface water storage capacity. Transport of imported water to the lake began in November 1999, and the lake reached capacity in early 2003. DVL holds up to 810 TAF, some of which is for dry-year or seasonal storage, and the remainder for emergency storage.

<u>SWP Terminal Reservoirs</u>

Under the 1994 Monterey Agreement and Amendment, Metropolitan is permitted to withdraw up to 218,940 AF in the reservoirs at the southern terminals of the California Aqueduct. Access to this storage capacity in Castaic Lake (153,940 AF) and Lake Perris (65,000 AF) gives Metropolitan greater flexibility in handling supply shortages. Any amount of water withdrawn in a year must be replaced with supplies available to Metropolitan within five years.

Groundwater Storage

Many local groundwater storage programs have been implemented over the years to maximize the use of local water supplies. These programs have included the diversion of water flows into percolation ponds for recharging groundwater basins and the recovery of degraded groundwater.

- For many years, flood control agencies within Metropolitan's service area have captured and spread stormwater for groundwater replenishment. Local runoff and reclaimed water have been conserved via spreading grounds, injection wells, reservoirs, and unlined river channels. In addition, flood control agencies have operated seawater barrier projects in Los Angeles and Orange Counties to prevent seawater intrusion into the coastal groundwater basins.
- Water quality issues have raised serious concerns about the ability to sustain average annual production levels in some groundwater basins. For example, recently recognized threats to groundwater basins posed by emerging contaminants such as per- and polyfluoroalkyl substances (PFAS) have affected groundwater production in many areas. Groundwater levels have been augmented by groundwater water recovery projects discussed in Section 3.5.

Conjunctive use of the aquifers offers an important source of dry year supplies. Unused storage in Southern California groundwater basins can be used to optimize imported water supplies, and the development of groundwater storage projects allows effective management and regulation of the region's major imported supplies from the Colorado River and SWP. Over the years, Metropolitan has implemented conjunctive use through various programs. Typically, this storage takes place in one of two ways:

- Direct deliveries to storage – Metropolitan delivers recharge water directly to water storage facilities, including spreading sites and injection wells.
- In-lieu deliveries to storage – Metropolitan delivers water directly to a member agency's distribution system for use by the member agency rather than, or in-lieu of, pumping the groundwater it otherwise would have taken out of storage. The deferred local production results in water being left in local storage (surface or groundwater) for future use.

Metropolitan has developed a number of local programs to work with its member agencies to increase stored water in groundwater basins through conjunctive use. Conjunctive use agreements provide for storage of imported water that can be called for use by Metropolitan during dry, drought, or emergency conditions. During a dry period, Metropolitan has the option to call water stored in the groundwater basins pursuant to its contractual conjunctive use agreements. At the time of the call, the member agency pays Metropolitan the prevailing rate for that water. Metropolitan has drawn on dry-year supply from nine contractual conjunctive use storage programs to address shortages from the SWP and the Colorado River.

Metropolitan has also made use of the basins to manage its water supply resources through programs such as its cyclic agreements. Cyclic programs allow Metropolitan to deliver water into groundwater basin or surface water reservoir before the agency has a demand for water. Advanced deliveries allow Metropolitan to manage high-supply availability when its own storage capacity is limited. The member agency purchases the delivered water based on a long-term schedule agreed by the parties. Although cyclic programs do not hold stored water for Metropolitan, they provide water resource management flexibility, especially when storage capacity is restricted.

Achievements to Date

In 2000, Metropolitan entered an agreement with DWR to administer $45 million of Proposition 13 state bond funds for Metropolitan's Southern California Water Supply Reliability Projects Program. Metropolitan paired the $45 million of state funds with $35 million of Metropolitan capital funds to develop nine groundwater storage programs in partnership with member and retail agencies and groundwater basin managers. These nine contractual storage programs have an initial 25-year term and provide for storage of up to 212 TAF and dry-year yield of up to 70 TAF. These programs are summarized in Table 3-16. Since inception, the conjunctive use program has been exercised to store water in groundwater basins during wet periods and relied upon to extract that water during dry periods. For example, during the recent drought period from 2012 to 2016, the conjunctive use program provided 64,000 AF of dry year supply to help Metropolitan meet regional demands. As of January 2020, the conjunctive use storage balance is 61,000 AF.

In 2007, Metropolitan prepared the Groundwater Assessment Study Report in collaboration with its member agencies and with groundwater basin managers. The report finds that while there is substantial storage space in service area groundwater basins that could be used for conjunctive use, there are significant challenges that must be overcome in order to implement additional storage programs. Use of additional storage opportunity requires:

- Capture, delivery, and recharge of additional local and imported surface supplies;
- Improved capability to store available surplus surface supplies with adequate conveyance and recharge capacity; and
- Resolution of constraints including: remediation of contamination, institutional and legal issues, funding for significant investment in capital infrastructure, and incongruity between aquifer capability with overlying demand for water supplies.

To follow up on the findings of the Groundwater Assessment Study Report, Metropolitan initiated a series of seven groundwater workshops beginning in July 2008 among Metropolitan, member agencies, groundwater basin managers, and stakeholders to discuss challenges for increasing conjunctive use and to develop recommendations for addressing the challenges. The workgroup's recommendations were submitted as a Board Report to Metropolitan's Board of Directors and provided as input to Metropolitan's current planning process. The recommendations are as follows:

1. Enhance groundwater replenishment with increased stormwater, recycled water, and imported water recharge.
2. Streamline requirements, remove policy constraints, clarify procedures, increase coordination and sharing of information to accomplish recharge goals.
3. Develop flexible regional policies and programs that can be tailored to meet specific local needs of each groundwater basin.
4. Increase integration of local groundwater and regional water supplies with a proposal for a comprehensive modeling study to initiate review of innovative opportunities.
5. Use appropriate price signals to encourage conjunctive use and investments for storage.
6. Increase coordination among Metropolitan, member agencies, basin managers, groundwater producers, and stakeholders inclusive of collaboration for legislative, regulatory, and educational efforts in support of specific initiatives and funding needed for sound groundwater management.

Metropolitan has given updates of the Groundwater Assessment Study to the Board in 2011, 2015, and 2018.

Since 2013, Metropolitan has also been working with the SCWC Stormwater Task Force to evaluate the feasibility of further supporting groundwater production with increases in stormwater capture for groundwater replenishment. Metropolitan remains actively involved in the SCWC Stormwater Task Force. In 2019, the Stormwater Task Force developed a white paper that discussed innovative project implementation and enhanced operation and maintenance strategies. Metropolitan staff gave a presentation on the stormwater pilot program at the annual workshop on September 27, 2019. The workshop brought together more than 200 participants, including local agencies, regional planners, and non-government agencies for a discussion on regional stormwater issues. In 2020, due to the global pandemic, the Stormwater Task Force hosted a series of short informational webinars related to water resources development and innovative stormwater projects.

Table 3-16
Contractual Conjunctive Groundwater Projects

Project and Project Proponents	**Storage Capacity** (TAF)	**Dry-Year Yield** (TAF/Year)	**Storage Account Balance as of 01/01/2020** (TAF)
LOS ANGELES COUNTY			
Long Beach Conjunctive Use Project Long Beach	13.0	4.3	3
Foothill Area GW Storage Project Foothill MWD	9.0	3.0	0
Long Beach CUP: Expansion in Lakewood Long Beach	3.6	1.2	0
City of Compton Conjunctive Use Program City of Compton	2.3	0.8	0
Upper Claremont Heights Conjunctive Use Three Valleys MWD	3.0	1.0	1
ORANGE COUNTY			
Orange County GW Conjunctive Use Program OCWD, MWDOC	66.0	22.0	0
SAN BERNARDINO COUNTY			
Chino Basin Programs IEUA, TVMWD, Chino Basin Watermaster	100.0	33.0	49
Live Oak Basin Conjunctive Use Project Three Valleys MWD	3.0	1.0	0
RIVERSIDE COUNTY			
Elsinore Groundwater Storage Program Western MWD, Elsinore Valley MWD	12.0	4.0	8
Total	**211.9**	**70.3**	**61**

3.7 Water Use Reduction

In November 2009, Governor Arnold Schwarzenegger signed the Water Conservation Act of 2009 (SB X7-7) into law as part of the historic comprehensive water package designed to address the State's growing water challenges. The Act represented the culmination of efforts by water industry leaders (including Metropolitan), the environmental community, and the Legislature to enact legislation that would answer the governor's call for the state to reduce per capita water use 20 percent by the year 2020 (referred to as "20x2020") as part of a larger effort to ensure reliable water supplies for future generations and restore the Bay-Delta.

The 20x2020 legislation requires urban retail water suppliers to develop urban water use targets to help meet the 20 percent reduction in water use by 2020, with interim targets for 2015. The legislation provides flexibility in how targets are established and achieved. Per capita reductions can be accomplished through any combination of increased water conservation, improved water use efficiency, and increased use of recycled water to offset potable demand. Potable demand offsets can occur through direct reuse of recycled water, such as for irrigation, or IPR through groundwater replenishment and reservoir water augmentation. Retail water suppliers receive partial credit for past efforts in conservation and recycled water; therefore, not all agencies need to reduce demand by 20 percent in order to comply with the law.

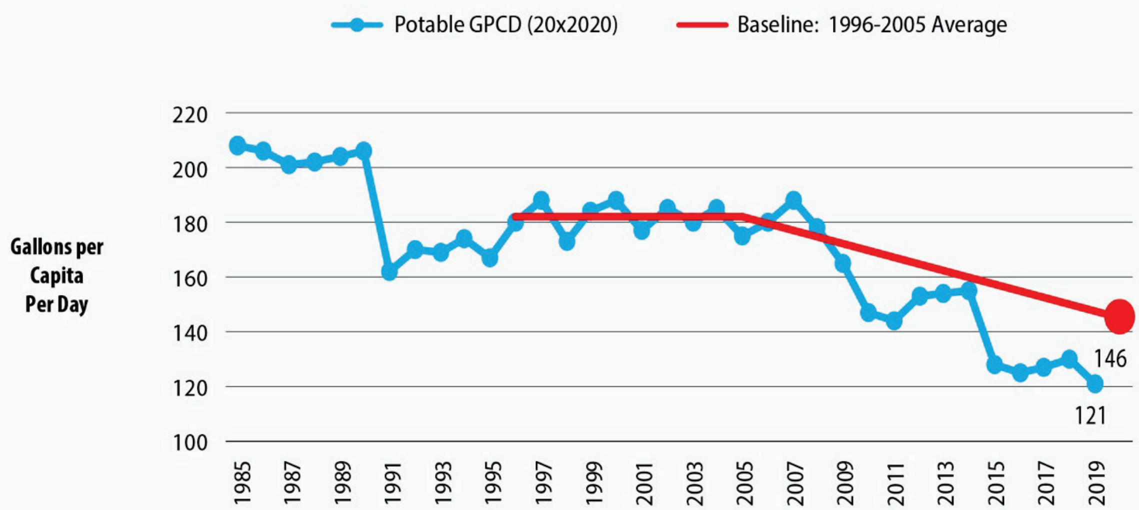
Achievement as of 2020

As a wholesale water agency, Metropolitan is not required to establish or report an urban water use reduction target. However, Metropolitan's regional conservation programs and local resource programs are designed to assist member agencies and retail water suppliers in the service area to comply with SB X7-7. These programs are described in Sections 3.4 and 3.5. Therefore, Metropolitan monitors the progress of its service area.

Based on an analysis of population, demand, and the methodologies for setting targets described in the legislation, Metropolitan's baseline per capita water use is 182 GPCD and the 2020 reduction target is 146 GPCD. From 2011 to 2014, there was a slight increase in per capita water use explained in part by continued economic recovery and drier weather as compared to previous years. With mandatory restrictions from the state and water supply allocation from Metropolitan, Metropolitan's 2015 UWMP reported an interim water use reduction achievement of 131 gallons per capita per day (GPCD), which is a 28 percent reduction from the baseline.

Over the last five years, Metropolitan continued to provide support for retail agency water use reduction efforts through technical assistance, legislation, code and standards updates, and financial incentives where needed to increase water use efficiency. Based on best available data as of January 2021, Metropolitan estimates a 2019 per capita water use of 121 GCPD, well exceeding Metropolitan's 2020 water use target of 146 GPCD with a 34 percent reduction from the baseline of 182 GPCD.

Figure 3-4 Potable Per Capita Water Use: 20% Reduction by 2020 Metropolitan's Service Area (Calendar Year)



Notes:

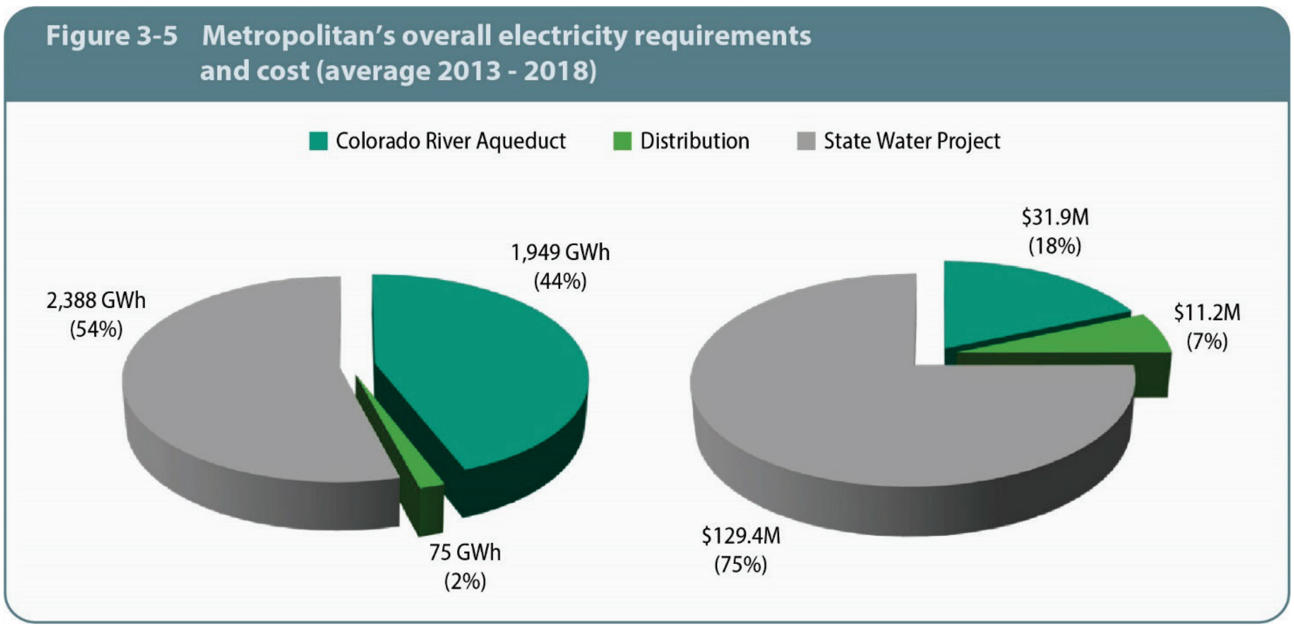
1. Calendar year data.
2. 2019 GPCD based on best available data as of January 2021 and is subject to change.
3. Baseline per capita water use based on 1996-2005 average (182 GPCD).
4. Target GPCD for 2020 based on 20% reduction from baseline (146 GPCD).

3.8 Energy Management Initiative

Metropolitan's mission is to provide its service area with an adequate and reliable supply of high-quality water to meet present and future needs in an environmentally and economically responsible way. The conveyance, treatment, and distribution of water is an energy-intensive and energy-dependent process, and as such, Metropolitan has goals of controlling operational costs and conserving valuable natural resources.

Metropolitan's net energy use and costs are dominated by the pumping (transport) required to import water via the Colorado River Aqueduct (CRA) and State Water Project (SWP) systems (Figure 3-5). Given that Metropolitan does not have direct control over operations of the SWP, its energy strategy focuses exclusively on the energy use and cost for CRA operations (wholesale power) and for Metropolitan's distribution, treatment, and office facilities (retail power), which on average total $43.1 million per year.

Figure 3-5
Metropolitan's overall electricity requirements and cost (average 2013-2018)



Over the past several decades, Metropolitan has implemented many energy initiatives that have reduced energy costs and use, while diversifying its energy portfolio. These have included 130 megawatts (MW) of small hydropower generating facilities, 5.5 MW of solar power generation installations[7], and a 50-year agreement executed in 2017 to receive low-cost carbon-free hydropower from Hoover Dam for CRA operations. Despite these efforts, external factors have resulted in increased energy costs. Five major drivers influence the future energy market and Metropolitan's corresponding energy sustainability strategy, including:

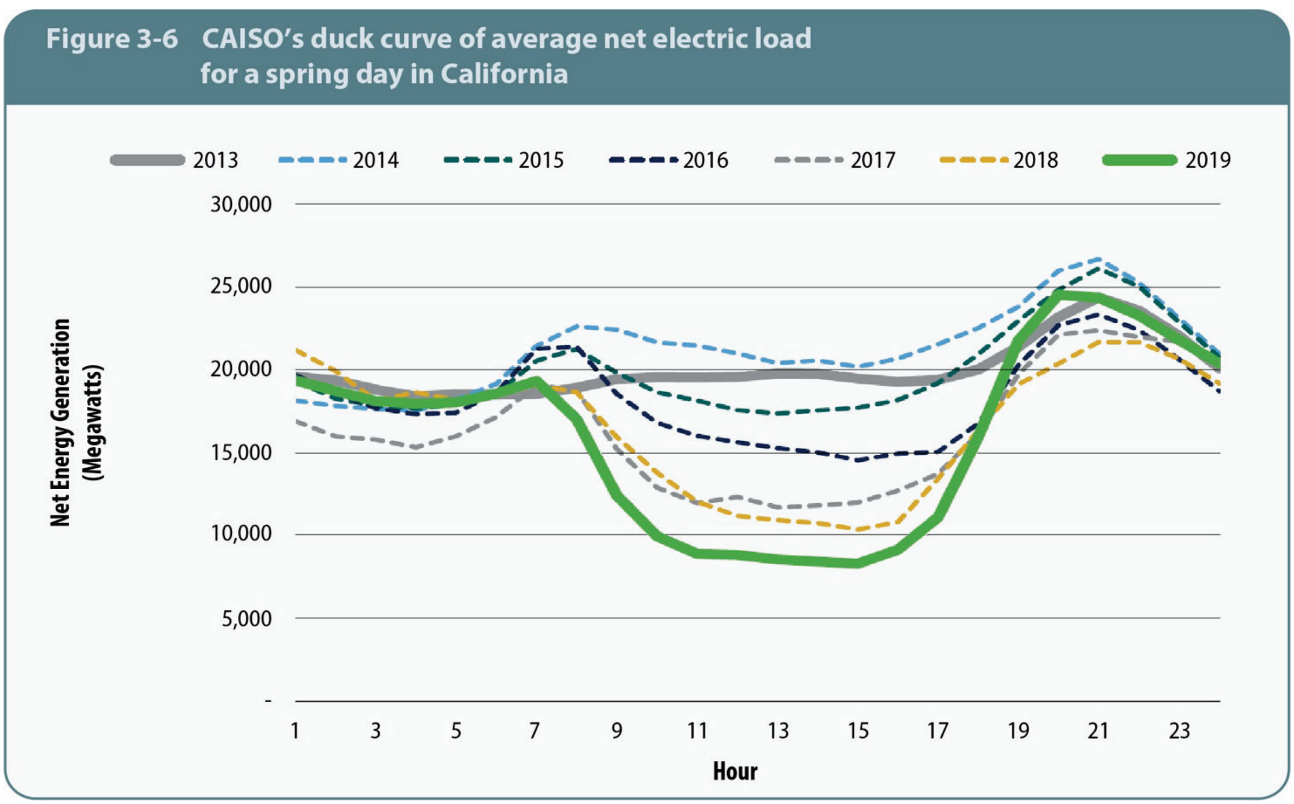
- *Progression of environmental regulations*. California is leading the nation with energy and environmental policy initiatives that are driving electrical grid changes. In particular, California's shift to renewables and carbon-free energy by 2045 (Senate Bill 100) is a primary

[7] This includes 5 MW of solar power capacity located at three of Metropolitan's treatment plants and 0.5 MW located at Diamond Valley Lake.

driver in future energy dynamics and will impact both the cost and volatility of energy markets.

- *Energy market pricing uncertainty*. Approximately 50 to 85 percent of Metropolitan's energy for CRA pumping is supplied from low-cost federal hydropower, and the balance is supplied from supplemental purchases of wholesale energy from the market. The adoption of recent policies and state goals in greenhouse gas (GHG) emission reductions and environmental protection are fundamentally changing the wholesale electric grid and its operation. The high penetration of renewable generation across the state resulted in the "duck curve" effect which has shifted peak prices from periods when demand is highest (typically midday) to periods in which solar generation declines (typically evening hours) (CAISO load minus solar generation is shown in Figure 3-6). In certain times of the year, a significant net load increase occurs when solar generation decreases at the end of the day. This increase must be mitigated by conventional fossil fired energy generators. This effect also creates over-generation during the middle of the day, which produces a "belly" appearance, and a steep ramp for fossil fuel generators during the late afternoon and evening, creating an "arch." The consequent changes in wholesale and retail energy price and structures are impacting hourly energy costs and operations at Metropolitan.

Figure 3-6
CAISO's duck curve of average net electric load for a spring day in California



Source: IEA, 2019

- *Grid reliability*. California has historically depended on fossil-fired generation to provide for the bulk of its energy needs, as well as peaking capacity and operating reserves to balance the system and compensate for system contingencies. The state's environmental policies to reduce fossil generation emissions and cooling water impacts have and will continue to result in the retirement of fossil generation throughout the state and the region. The transition to renewable, non-emitting generation creates challenges for grid operators without the traditional sources of on-demand, fast-ramping capacity.
- *Climate change and natural disasters*. Natural disasters and a changing climate pose substantial risks to the availability and price of energy for Metropolitan. While the timing and extent of these events are unpredictable, their effects can be anticipated and estimated. The main challenge for Metropolitan and its energy providers will be to develop and nimbly execute energy management initiatives that preserve a high degree of long-term flexibility and stable costs.
- *Technological advances and incentives*. New technological advancements and improved practices in the renewable energy and energy storage sectors provide viable options for Metropolitan's long-term energy management goals. For example, energy storage systems are able to capture the energy generated by renewables and store it until the energy is needed. Energy storage can address the power intermittency challenges from renewables and effectively increase utility resiliency and reliability. Several incentive and credit programs are also available, such as the California Public Utilities Commission Self-Generation Incentive Program, to further improve the economic feasibility of battery energy storage projects.

The evolution in California's energy mix and resulting uncertainty in the reliability and cost of energy supplies affect the affordability and reliability of Metropolitan's water supply operations. Metropolitan's review of its energy strategies, practices and projects is an important step to help position itself as a leader in energy sustainability.

In 2020, Metropolitan developed a new Energy Sustainability Plan (ESP) and an updated implementation roadmap, to formulate actions and strategies that best position Metropolitan to adapt to future wholesale and retail energy market changes for its CRA operations and conveyance and distribution system. The ESP's purpose is to foster informed energy management decisions through a framework of sustainable actions focused on energy cost containment, reliability, affordability, conservation and adaptation – now and into the future.

The ESP incorporates an adaptive energy management strategy and project implementation roadmap resulting in projects and initiatives that:

- Contain costs and reduce Metropolitan's exposure to energy price volatility
- Increase operational reliability and flexibility
- Move Metropolitan towards energy independence and sustainability
- Support Metropolitan's Climate Action Plan (CAP) effort to meet proposed GHG emissions reduction targets

Metropolitan's adaptive energy management strategy addresses issues surrounding energy management and cost mitigation. The energy strategy roadmap addresses near- to long-term energy issues and achieves Metropolitan's overarching goals by including projects that address both retail and wholesale energy markets, and energy management best practices. The recommended actions are impacted by numerous factors, considered as indicators in this plan, that will signal the acceleration or change of course for certain actions. The magnitude, nature, and timing of these signals will result in different responses and actions for Metropolitan in the long-term and will be continuously monitored over time.

Selected near-term actions (1-3 years) identified are:

- Implement reconfiguration of the Yorba Linda Power Plant feed to serve the Diemer water treatment plant (WTP) retail load behind the Southern California Edison meter.
- Implement battery storage projects at the Weymouth, Skinner, Jensen, and Mills WTPs and the OC-88 Pumping Plant.
- Evaluate implementation of islanded operations using battery storage for possible future microgrid operations.
- Monitor wholesale energy market developments for major changes to CRA energy costs and evaluate appropriate options, such as generation or energy storage.
- Assess pump modifications at Intake and Gene pumping plants to implement targeted application of variable-speed pump drives.
- Continue to monitor third-party developer projects for opportunities in retail and large-scale wholesale renewable energy and energy storage opportunities.

Metropolitan has made progress on two near-term actions. This includes initiating projects for battery storage at the Skinner, Jensen, and Weymouth treatment plants, as well as OC-88. To support implementation, Metropolitan has applied for $10.3 million in state incentives for these projects. The battery storage facilities will be configured as microgrids to optimize on-site solar generation and increase energy resilience.

Selected mid-term actions (4-7 years) include:

- Assess the performance of implemented Battery Energy Storage System projects and later implement the previously deferred project options based on first phase performance results.
- Implement renewable energy and/or energy storage projects with third-party developers, if determined feasible.
- Continue evaluating low/no carbon power for CRA pumping operations to hedge against rising carbon prices.
- Reevaluate small hydropower opportunities within the distribution system if project economics become favorable.

Metropolitan engages in several energy best practices to reduce Metropolitan's overall energy consumption. These practices focus on energy auditing, monitoring and benchmarking, cost optimization of process and pumping operations, energy efficient design and rehabilitation measures, and providing staff training and communication strategies for energy management. Energy efficiency opportunities that reduce energy usage are evaluated on a continuous basis for short- and long-term benefits to help reduce energy-related costs and GHG emissions.

Long-term planning over the next 10 years will adapt relevant actions and strategies to current conditions. The key goal for Metropolitan's long-term energy management plan is to continuously update the ESP, monitor implemented projects and initiatives, reassess the main market drivers to better understand potential project and energy management opportunities, and adjust the ESP and roadmap accordingly.

The framework is intended to be flexible by accommodating future projects, preferences, and localized needs, and to be adaptable as Metropolitan's goals and technology evolve. The roadmap provides a plan for implementation of the recommended energy projects and initiatives, while accounting for changes in the future. Signals assigned to each action will be monitored over time by Metropolitan staff to indicate when these actions and their economic and operational benefits can serve Metropolitan's needs.

Climate Action Plan

In 2016, California signed into law the country's most stringent GHG reduction target of 40 percent below 1990 levels by the year 2030, as well as a long-term goal of 80 percent below 1990 levels by 2050. In 2017, then Governor Brown signed EO B-55-18, which set an even more progressive long-term goal of carbon neutrality by 2045. While the state has not imposed specific GHG reduction requirements for public water agencies, its 2017 Climate Change Scoping Plan suggests that water agencies should move towards low carbon or net-zero carbon water management systems.

To help California achieve this ambitious goal, Metropolitan is in the process of developing its first ever Climate Action Plan (CAP), which will serve as a road map for reducing greenhouse gas (GHG) emissions from its operations and future construction projects. The CAP will meet the goals of the state by identifying and implementing a number of actions that will reduce Metropolitan's future GHG emissions. In addition, it will serve as a vehicle to streamline project evaluation of GHG impacts under the California Environmental Quality Act (CEQA Guidelines § 15183.5(b) Plans for Reduction of Greenhouse Gas Emissions). The CAP will include the following elements:

- A complete inventory of GHG emissions, both existing and projected
- A GHG reduction target aligned with state goals
- A strategy to reduce emissions to meet the GHG reduction target
- A plan to monitor and verify results
- Adoption of the plan in a public process

Emissions Inventory

Using standard accounting protocols from The Climate Registry (TCR)[8] and the International Council for Local Environmental Initiatives (ICLEI)[9], Metropolitan completed an emissions inventory of three source categories or scopes related to the operational control the organization has over the emission source.

- Scope 1 emissions consist of direct GHG emissions associated with fuel use, such as emissions from gasoline and diesel consumption by Metropolitan's vehicle fleet, propane and natural gas use at its facilities, and unintended fugitive emissions[10].
- Scope 2 emissions consist of indirect GHG emissions associated with the purchase and consumption of electricity used primarily for the transmission, treatment and distribution of water. Scope 2 also includes electricity transmission and distribution losses.

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[8] The Climate Registry. https://www.theclimateregistry.org/tools-resources/reporting-protocols/general-reporting-protocol/. Metropolitan's reported GHG emissions to The Climate Registry are shown in Appendix 10.

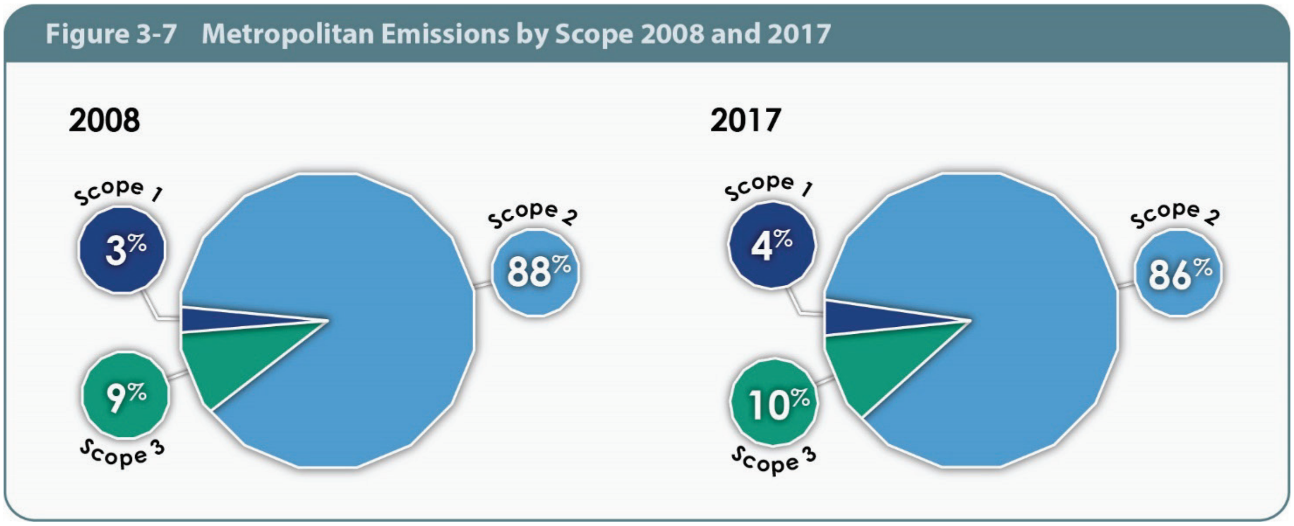
[9] ICLEI. 2010. Local Government Operations Protocol. http://icleiusa.org/ghg-protocols/.

[10] Fugitive emissions are emissions of gases or vapors from industrial equipment due to leaks or other unintended releases.

- Scope 3 emissions consist of other indirect GHG emissions not captured in Scope 1 or 2, such as those associated with employee commutes, waste generation, water consumption occurring at Metropolitan facilities, and emissions associated with construction projects.

Figure 3-7 illustrates the Metropolitan emissions by scope for calendar years 2008 and 2017.

Figure 3-7
Metropolitan Emissions by Scope 2008 and 2017.



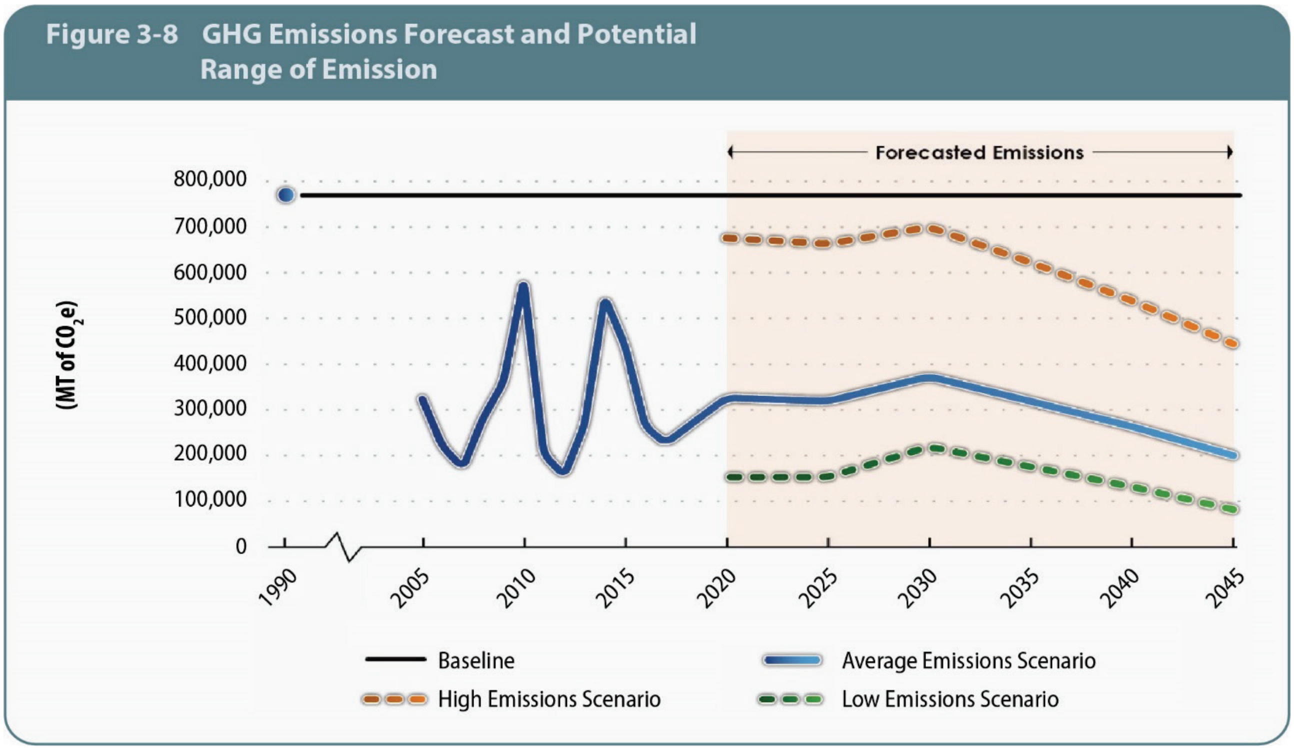
Emissions Forecast

In order to estimate the level of GHG emissions reductions necessary for Metropolitan to achieve its selected GHG reduction target and be consistent with the requirements for a qualified GHG emissions reduction plan, an emissions forecast was prepared based on Metropolitan projected energy demand and energy sources, the anticipated impact of future Metropolitan projects, the anticipated impact of existing energy efficiency and GHG reduction programs, and regional population growth assumptions.

As noted above, Metropolitan does not have direct control over operations of the SWP. Thus, Metropolitan's strategy focuses exclusively on reducing the GHG emissions associated with operation of the CRA, and operation and maintenance of Metropolitan's distribution, treatment, and office facilities. Water deliveries from the CRA require substantial electricity usage, as the water must be pumped up a total lift of 1,614 feet from the Colorado River before flowing by gravity into Metropolitan's distribution system.

CRA water deliveries vary significantly year-to-year based on water needs, rainfall, and availability of water from the SWP. To account for this variability in electricity use and related GHG emissions, three forecast scenarios were modeled to estimate the range of GHG emissions that will need to be reduced to reach Metropolitan's adopted GHG reduction target. A high emissions scenario represents a worst case scenario with extended drought and maximum pumping capacity from the CRA, an average emissions scenario is modelled by averaging pumping data from 2008 through 2017, and a low emissions scenario represents Metropolitan's lowest single year CRA pumping from 2008 through 2017 and high deliveries from the SWP. The results of the potential range of emission that will need to be offset in future years is shown in Figure 3-8. Baseline emissions for 1990 were estimated using the best available data. It is important to note that in all projections, GHG emissions taper off as a result of new California regulations that require all retail energy sold in California to be from 100 percent carbon-free energy by 2045.

Figure 3-8
GHG Emissions Forecast and Potential Range of Emission



GHG Reduction Target

Metropolitan is committed to achieving the state's GHG reduction goals. Therefore, Metropolitan has set its GHG reduction target to be consistent with the state target of 40 percent below 1990 levels by 2030. In addition, Metropolitan is committing to achieving net carbon neutrality by 2045. Metropolitan is well-situated to meet this goal.

Strategy to Meet GHG Reduction Goals

In conjunction with Metropolitan's Energy Management Initiative described above, a number of projects have been identified that will not only ensure Metropolitan's energy reliability, but also further Metropolitan's efforts to reach carbon neutrality by 2045, including developing solar and battery storage facilities, negotiating wholesale carbon-free energy contracts, improving pump efficiency, purchasing zero emission fleet vehicles, and implementing waste recycling techniques. Metropolitan may also leverage extensive land holdings to implement potential carbon sequestration programs that could generate carbon credits. Additional actions will depend on many variables that are not yet quantified, such as the rate of energy storage deployed by the State of California and its utilities, the cost of renewable energy, and the costs associated with infrastructure. Not only do many of these projects ensure energy reliability and reduce GHG emissions, but they may also provide a substantial net cost savings to Metropolitan through reduced energy costs and reduced costs to offset GHG emissions.

Monitoring and Reporting

Ensuring that Metropolitan is meeting its GHG reduction target is a cornerstone of an adopted GHG reduction plan. As such, Metropolitan will track its GHG emissions annually and update the CAP every five years to revise and refine the plan to capture any new measures and ensure Metropolitans is meeting its goals. Metropolitan currently reports verified GHG emissions to TCR's open and transparent GHG Registry. Appendix 10 of this plan contains additional information on Metropolitan's GHG emissions and overall energy intensity.

CAP Adoption

The CAP will be released for public review in spring 2021, with an expected Board adoption of the completed CAP in summer 2021. Metropolitan's unique emissions profile and commitment to environmental and energy sustainability ensure that it is situated to meet not only the state's adopted target of 40 percent below 1990 levels by 2030, but also the state's goal of carbon neutrality by 2045, guaranteeing that Metropolitan remains an industry leader.

Water Quality 4

Metropolitan's planning efforts recognize the importance of the quality of its water supplies. To the extent possible, Metropolitan responds to water quality concerns by protecting the quality of the source water and developing water management programs that maintain and enhance water quality. Contaminants that cannot be sufficiently controlled through protection of source waters must be handled through changed water treatment protocols or blending. These practices can increase costs and/or reduce operating flexibility. This section discusses source water quality and issues of concern affecting water management strategies and water supply reliability.

Background

Metropolitan's planning efforts for groundwater storage, recycled water, and other water management strategies require meeting specific water quality targets for imported water. Metropolitan has two major sources of water: the Colorado River and the State Water Project (SWP). Groundwater inflows are also received into the SWP through groundwater banking programs in the Central Valley. Each source has specific water quality issues, which are summarized in this section. For example, the water industry has had to respond to constituents of emerging concern (CECs). To date, Metropolitan has not identified any water quality risks that cannot be mitigated. However, based on current knowledge, a water quality issue that could potentially affect water management strategies and supply reliability in the future might be increases in the salinity of water resources. Under California's current drought conditions, decreased flows have altered Delta flow patterns and, while the effects of the drought have not been fully studied, there have been some observable changes in water quality such as increased salinity due to increased seawater intrusion. However, even under drought conditions, SWP salinity is significantly lower than Colorado River water salinity, and Metropolitan relies on blending imported water sources to mitigate for the higher salinity Colorado River water. During recent periods of drought, Metropolitan's SWP allocation has been reduced, including to a historical low of five percent in 2014 and twenty percent in 2015 and 2020, which affected blending operations. Metropolitan increased its deliveries of Colorado River water in 2014, 2015, and 2020, and subsequently, salinity in treatment plant influent increased overall from the higher Colorado River salinity levels. Metropolitan anticipates no significant reductions in water supply availability from imported sources due to water quality concerns, such as salinity, over the next five years.

Colorado River

High salinity levels remain a significant issue associated with Colorado River supplies. In addition, Metropolitan has been engaged in efforts to protect its Colorado River supplies from threats of uranium, perchlorate, and chromium-6, which are discussed later in this section. Metropolitan has also been active in efforts to protect these supplies from potential increases in nutrient loading due to agriculture and urbanization, as well as tracking the occurrence of CECs. Metropolitan fully expects its source water protection efforts to be successful, so the only foreseeable water quality constraint to the use of Colorado River water will be the need to blend (mix) it with SWP supplies to meet Metropolitan's Board-adopted salinity standards.

State Water Project

The key water quality issues for the SWP are disinfection byproduct precursors, in particular, total organic carbon, bromide, and low alkalinity. Metropolitan is working to protect the water quality of this source, but it has needed to upgrade its water treatment plants to deal adequately with disinfection byproducts. Disinfection byproducts result from total organic carbon and bromide in the source water reacting with disinfectants at the water treatment plant, and they may place some near-term restrictions on Metropolitan's ability to use SWP water. Low alkalinity water requires a higher percentage of total organic carbon removal in order to reduce disinfection byproduct formation. Metropolitan is overcoming these treatment restrictions through the use of ozone disinfection at its treatment plants, which has been implemented at all five of Metropolitan's treatment plants and blending SWP water with higher alkalinity Colorado River water. Arsenic is also of concern in some groundwater storage programs. Groundwater inflows into the California Aqueduct are managed to comply with regulations and protect downstream water quality while meeting supply targets. Additionally, nutrient levels are significantly higher in the SWP than within the Colorado River, leading to the potential for algal related concerns that can affect water management strategies. Metropolitan is engaged in efforts to protect the quality of SWP water from potential increases in nutrient loading from wastewater treatment plants.

Local Agency Supplies and Groundwater Storage

Drinking water standards for contaminants, such as arsenic, chromium-6, 1,2,3-trichloropropane, and other emerging constituents, such as per- and polyfluoroalkyl substances (PFAS), may add costs to the use of groundwater storage and may affect the availability of local agency groundwater sources. Although Metropolitan has not analyzed the direct effect of these water quality issues on local agency supply, these contaminants are not expected to significantly impact the availability of Metropolitan supplies, but may affect the availability of local agency supplies. This could affect demands on Metropolitan supplies if local agencies abandon impacted supplies in lieu of treatment options or use Metropolitan water to blend with their sources.

In summary, the major regional water quality concerns include the following:

- Salinity
- Perchlorate
- Total organic carbon and bromide (disinfection byproduct precursors)
- Nutrients (as they relate to algal productivity)
- Arsenic
- Uranium
- Chromium-6
- 1,2,3-trichlorpropane
- Constituents of emerging concern (e.g., NDMA, microplastics, and PFAS)

Metropolitan has taken several actions and adopted programs to address these contaminants and to ensure a safe and reliable water supply. These actions, organized by contaminant, are discussed below, along with other water quality programs that Metropolitan has been engaged in to protect its water supplies.

Issues of Potential Concern

Salinity

The State Water Resources Control Board's (SWRCB's) Division of Drinking Water (DDW), formerly the California Department of Public Health, established a secondary drinking water standard for salinity, commonly expressed as total dissolved solids (TDS), with a recommended maximum contaminant level (MCL) of 500 milligrams per liter (mg/L) and upper limit MCL of 1,000 mg/L. Imported water from the Colorado River has high salinity levels, so it must be blended (mixed) with lower-salinity water from the SWP to meet salinity management goals. Higher salinity levels in Colorado River water would increase the proportion of SWP supplies required to meet Metropolitan's Board-adopted imported water salinity objectives. High levels of salinity can impact various water uses such as limiting groundwater and recycled water uses, reducing the lifespan of household appliances, and reducing crop yields. These salinity impacts affect various sectors including residential, agricultural, commercial, industrial, utility, groundwater, and recycled water. Metropolitan adopted an imported water salinity goal because higher salinity could increase costs and reduce operating flexibility. For example,

1. If diminished water quality causes a need for membrane treatment to remove TDS, the process typically results in losses of up to 15 percent of the water processed. These losses would result in both an increased requirement for additional water supplies and environmental constraints related to brine disposal. In addition, the process is costly. However, only a portion of the imported water would need to be processed, so the possible loss in supplies is small.
2. High TDS in water supplies leads to high TDS in wastewater, which lowers the usefulness and increases the cost of recycled water.
3. Water quality degradation of imported water supply could limit the use of local groundwater basins for storage because of standards controlling the quality of water recharged to the basins.

In addition to the link between water supply and water quality, Metropolitan has identified economic benefits from reducing the TDS concentrations of water supplies. Estimates show that a reduction in salinity concentrations of 100 mg/L in both the Colorado River and SWP supplies will yield economic benefits of $95 million per year (1999 dollars) within Metropolitan's service area.[1] This economic benefit provides an additional incentive to reduce salinity concentrations within the region's water supplies.

<u>The Salinity Management Policy</u>

Considering all of these factors, Metropolitan's Board approved a Salinity Management Policy on April 13, 1999. The policy set a goal of achieving salinity concentrations in delivered water of less than 500 mg/L TDS when practical, understanding that hydrologic conditions will make this infeasible at times. It also identified the need for both local and imported water sources to be managed comprehensively to maintain the ability to use recycled water and groundwater. To achieve these targets, lower TDS SWP water supplies are blended with Colorado River supplies. Using this approach, the salinity target could be met an estimated seven out of ten years. In the other three years, hydrologic conditions would result in a reduced volume of SWP supplies and increased salinity. Due to drought conditions, the target goal was exceeded between 2008 and 2011 and again between 2013 and 2018. Metropolitan has alerted its local agencies that high

[1] Metropolitan Water District of Southern California and U.S. Bureau of Reclamation, Salinity Management Study: Final Report (June 1999)

salinity levels are inevitable under these drought conditions despite its best efforts. Metropolitan has also urged its member agencies to structure the operation of their local projects and groundwater supplies so they are prepared to mitigate the effect of higher salinity levels in imported waters.

The adoption of the Salinity Management Policy resulted from the completion of a Salinity Management Study in 1999. Metropolitan worked collaboratively with multiple stakeholders to complete the salinity study which assessed regional salinity problems and developed management strategies. Metropolitan is currently working with the USBR and Southern California Salinity Coalition to update the study. The current study objectives include updating the impact functions of the economic impact model and revising the salinity economic damage assessment for the Colorado River Salinity Control Forum Triennial Review; developing regional salinity indicators to increase awareness and facilitate salinity management in groundwater basins; and assessing Metropolitan's long-term capability of delivering low-salinity water supplies and determining whether new salinity operational goals should be established. In 2020, USBR completed a study updating the economic impact functions of the salinity model. The new model will be used to generate revised estimates for the Lower Colorado River Basin and can be used to update the estimates for Metropolitan's service area. The impacts estimated by the model are based on the change in economic costs from a 500 mg/L baseline condition and the projected elevated salinity concentrations from the Colorado River Simulation System (CRSS) long term planning model which incorporates current and future salinity control projects mainly in the Upper Colorado River Basin.

Within Metropolitan's service area, local water sources account for approximately half of the salt loading, and imported water accounts for the remainder. All of these sources must be managed appropriately to sustain water quality and supply reliability goals. The following sections discuss the salinity issues relevant to each of Metropolitan's major supply sources and other resources.

<u>Colorado River</u>

Colorado River water has the highest level of salinity of all of Metropolitan's sources of supply, averaging around 630 mg/L since 1976. Concern over salinity levels in the Colorado River has existed for many years.

To deal with the concern, the International Boundary and Water Commission approved Minute No. 242, Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River, in 1973, and the President approved the Colorado River Basin Salinity Control Act in 1974. High TDS in the Colorado River as it entered Mexico and the concerns of the seven basin states regarding the quality of Colorado River water in the United States drove these initial actions. To foster interstate cooperation on this issue, the seven basin states formed the Colorado River Basin Salinity Control Forum (Forum).

The salts in the Colorado River system are indigenous and pervasive, mostly resulting from saline sediments in the basin that were deposited in prehistoric marine environments. They are easily eroded, dissolved, and transported into the river system. The Colorado River Basin Salinity Control Program is designed to prevent a portion of this abundant salt supply from moving into the river system. The program targets the interception and control of non-point sources, such as surface runoff, as well as wastewater and saline hot springs. Examples of salinity control measures include improved irrigation practices, rangeland management, and the operation of a deep well brine injection project.

The Forum proposed, the states adopted, and the USEPA approved water quality standards in 1975, including numeric criteria and a plan for controlling salinity increases. The standards require that the plan ensure that the flow-weighted average annual salinity remain at or below the 1972 levels, while the Basin states continue to develop their 1922 Colorado River Compact-apportioned water supply. The Forum selected three points on the main stream of the lower Colorado River to measure the river's salinity. These points and numeric criteria are: (1) below Hoover Dam, 723 mg/L; (2) below Parker Dam, 747 mg/L; and (3) at Imperial Dam, 879 mg/L.

Per the Forum, concentrations of salts in the Colorado River cause approximately $454 million in quantified damages (2019 dollars) in the lower Basin each year.[2] The salinity control program has proven to be very successful and cost-effective. Salinity control projects remove over a million tons of salts from the Colorado River water annually, resulting in reduced salinity concentrations of over 100 mg/L as a long-term average.

During the high-water flows of 1983-1986, salinity levels in the Colorado River dropped to a historic low of 525 mg/L. However, during the 1987-1992 drought, higher salinity levels of 600 to 650 mg/L returned. TDS in Lake Havasu was measured at 662 mg/L in October 2015 and was 592 mg/L in October 2019. Salinity is projected to continue increasing as water development occurs throughout the Colorado River basin, particularly as the Upper Colorado River Basin States continue to develop their apportioned water reducing dilution in the Colorado River. Also, under drought conditions, Lake Powell has received higher salinity water, and as the system normalizes, salinity is expected to increase in the lower Colorado River as water from Lake Powell is released downstream.

State Water Project

Water supplies from the SWP have significantly lower TDS concentrations than the Colorado River, averaging approximately 250 mg/L in water supplied through the East Branch and 325 mg/L on the West Branch over the long-term, with short term variability as a result of hydrologic conditions.[3] Because of this lower salinity, Metropolitan blends SWP water with high salinity Colorado River water to reduce the salinity concentrations of delivered water. However, both the supply and the TDS concentrations of SWP water can vary significantly in response to hydrologic conditions in the Sacramento-San Joaquin watersheds.

As indicated above, the TDS concentrations of SWP water can vary widely over short periods of time. These variations reflect seasonal and tidal flow patterns, and they pose an additional problem for use of blending as a management tool to lower the higher TDS from the Colorado River supply. For example, during the 1977 drought, the salinity of SWP water reaching Metropolitan increased to 430 mg/L, and supplies became limited. During this same event, salinity at the SWP's Banks pumping plant exceeded 700 mg/L. Under similar circumstances in the future, Metropolitan's 500 mg/L TDS objective could only be achieved by reducing imported water from the Colorado River. Thus, it may be infeasible to maintain both the salinity objective and water supply reliability unless salinity concentrations of source supplies can be reduced.

A federal court ruling on a biological opinion issued in consultation with U.S. Fish and Wildlife Service addressing the effects of the water supply pumping operations on sensitive fish species in the Delta has limited SWP exports at specified times of the year since December 2007. These restrictions have increased reliance on higher salinity Colorado River water, impacting the ability at times to meet Metropolitan's goal of 500 mg/L TDS at its blending plants. Drought conditions leading to lower SWP water supply allocations in recent years also affect Metropolitan's ability to meet its salinity goal. The target goal was exceeded between 2008 and 2011 when water supply

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[2] Colorado River Basin Salinity Control Program–Briefing Document (March 20, 2019)

[3] The higher salinity in the West Branch deliveries is due to salt loadings from local streams, operational conditions, and evaporation at Pyramid and Castaic Lakes.

allocations were reduced to 35-50 percent. Similarly, the target goal was exceeded between 2013 and 2015 when restricted annual water supply allocations were reduced to 5-35 percent and were briefly reduced to a historical zero percent allocation in January 2014.

The SWP Water Service Contract Article 19 TDS objectives specify a ten-year average of 220 mg/L and a maximum monthly average of 440 mg/L. These objectives have not been met, and Metropolitan is working with DWR and other agencies on programs aimed at reducing salinity in Delta supplies. These programs aim to reduce salinity on the San Joaquin River through modifying agricultural drainage and developing comprehensive basin plans. In addition, operable gates and channel barriers have been placed in strategic locations in the Delta to impede transport of seawater derived salt. For the first time since 1977, in response to California's drought emergency, DWR installed a temporary rock barrier across False River in May 2015 to help limit salt intrusion from the San Francisco Bay into the central Delta. DWR is also leading the development of the Delta Conveyance Project, which involves water delivery upgrades that could reduce SWP salinity levels by diverting a greater percentage of lower salinity Sacramento River flows to the South Delta export pumps.

Recycled Water

Wastewater flows always experience significantly higher salinity concentrations than the potable water supply. Typically, each cycle of urban water use adds 250 to 400 mg/L of TDS to the wastewater. Salinity increases tend to be higher where specific commercial or industrial processes add brines to the discharge stream or where brackish groundwater infiltrates into the sewer system.

Where wastewater flows have high salinity concentrations, the use of recycled water may be limited or require more expensive treatment (e.g., reverse osmosis). Landscape irrigation and industrial reuse become problematic at TDS concentrations over 1,000 mg/L. Some crops such as strawberries and avocados are particularly sensitive to high TDS concentrations, and the use of high-salinity recycled water may reduce crop yields. In addition, water quality objectives in basin plans may lead to restrictions on the use of recycled water on lands overlying those groundwater basins.

These issues are exacerbated during times of drought, when the salinity of imported water supplies may increase salinity in wastewater flows and recycled water. Basin management plans and recycled water customers may restrict the use of recycled water at a time when its use would be most valuable. Therefore, to maintain the cost-effectiveness of recycled water, the salinity level of the region's potable water sources and wastewater flows must be controlled.

In May 2009, the SWRCB adopted a Recycled Water Policy to help streamline the permitting process and to help establish uniform statewide criteria for recycled water projects. The policy was amended in January 2013 and again in December 2018[4] to include baseline monitoring requirements for CECs. The amended policy includes updated annual volumetric reporting requirements for influent, effluent, and recycled water uses. This policy promotes the development of watershed- or basin-wide salt management plans (to be adopted by the respective Regional Boards) to meet water quality objectives and protect beneficial uses, rather than imposing project-by-project restrictions. The Recycled Water Policy identifies several criteria to guide recycled water irrigation or groundwater recharge project proponents in developing a Salt (and Nutrient) Management Plan (SNMP).

[4] https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2018/121118_7_final_amendment_oal.pdf

Groundwater Basins

Increased TDS in groundwater basins occurs either when basins near the ocean are overdrafted, leading to seawater intrusion, or when agricultural and urban return flows add salts to the basins. Much of the water used for agricultural or urban irrigation infiltrates into the aquifer, so where irrigation water is high in TDS or where the water transports salts from overlying soil, the infiltrating water will increase the salinity of the aquifer. In addition, wastewater discharges in inland regions may lead to salt buildup from fertilizer and dairy waste. In the 1950s and 1960s, high-TDS Colorado River water was used to recharge severely overdrafted aquifers and prevent saltwater intrusion, resulting in significant salt loadings to the region's groundwater basins.

In the past, these high salt concentrations have caused some basins within Metropolitan's service area to be unsuitable for municipal uses if left untreated. The Arlington Basin in Riverside and the Mission Basin in San Diego required demineralization before they could be returned to municipal service. The capacity of the larger groundwater basins makes them better able to dilute the impact of increasing salinity. While most groundwater basins within the region still produce water of acceptable quality, this resource must be managed carefully to minimize further degradation. Even with today's more heightened concern regarding salinity, approximately 600,000 tons of salts per year accumulate within the region, leading to ever-increasing salinity concentrations in many groundwater basins.[5] Drought conditions have further impacted salinity levels in recycled water, reflective of increased salinity levels in source water. Increased recycled water salinity levels make it difficult for dischargers to comply with water quality objectives for groundwater basins.

To protect the quality of groundwater basins, Regional Boards often place restrictions on the salinity concentrations of water used for basin recharge or for irrigation of lands overlying the aquifers. Those situations may restrict water reuse and aquifer recharge, or they may require expensive mitigation measures. SNMPs offer an opportunity for stakeholders to work with Regional Boards to address salt and nutrient issues regionally. The SNMP development process is locally driven and focuses on addressing all sources of salts and nutrients, instead of only regulating individual recycled water projects which may not address all sources impacting groundwater. The SNMP objectives include: optimizing recycled water use, protecting groundwater supply and beneficial uses, protecting agricultural beneficial uses, and protecting human health. SNMPs were to be completed by May 2014 with a possible two-year extension. After completion, SNMPs may be adopted in a Basin Plan Amendment.

Several SNMPs were completed by the completion deadline, while other plans were granted an extension for completion in 2016. The Santa Ana Region Basin Plan updated its TDS and Nitrogen Management Plan with a subsequent SNMP amendment in 2014. This SNMP highlights efforts to implement extensive groundwater recharge projects using recycled water in the Chino Basin and expansion of the GWRS in Orange County. The Central Basin and West Coast Basin SNMP was approved as an amendment to the Los Angeles Region Basin Plan in February 2015. This SNMP highlights existing and planned implementation measures to ensure future compliance with water quality objectives including increased recharge at seawater intrusion barriers, increased groundwater pump and treat by the Goldsworthy and Brewer Desalters, and increased recycled water use for irrigation. Multiple SNMPs have been completed in the San Diego Region, and basin plan amendments are being considered. SNMPs have also been approved for the Main San Gabriel Basin and the Raymond Basin.

[5] Metropolitan Water District of Southern California and U.S. Bureau of Reclamation, Salinity Management Study: Final Report (June 1999)

Perchlorate

Perchlorate compounds are used as a main component in solid rocket propellant and are also found in some types of munitions and fireworks. Perchlorate compounds quickly dissolve and become highly mobile in groundwater. Unlike many other groundwater contaminants, perchlorate neither readily interacts with the soil matrix nor degrades in the environment. Conventional drinking water treatment (as utilized at Metropolitan's water treatment plants) is not effective for perchlorate removal.

The primary human health concern related to perchlorate is its effect on the thyroid. Perchlorate can interfere with the thyroid's ability to produce hormones required for normal growth and development. Pregnant women who are iodine deficient and their fetuses, infants and small children with low dietary iodide intake, and individuals with hypothyroidism may be more sensitive to the effects of perchlorate.

DDW established a primary drinking water standard for perchlorate in 2007 with an MCL of 6 micrograms per liter (µg/L), and a detection limit for purposes of reporting (DLR) of 4 µg/L. In February 2015, the California Office of Environmental Health Hazard Assessment (OEHHA) lowered the public health goal (PHG)[6] for perchlorate from 6 µg/L to 1 µg/L. In response to the new PHG,[7] DDW reviewed the perchlorate MCL, but there was a lack of occurrence data below the DLR of 4 µg/L. In July 2020, due to improved analytical methods, and in order to evaluate a lower MCL, DDW proposed lowering the DLR for perchlorate initially to 2 µg/L, and subsequently to the PHG of 1 µg/L in a second phase effective January 1, 2024. On October 6, 2020, the SWRCB approved the proposal. There is currently no federal drinking water standard for perchlorate. On June 18, 2020, the USEPA withdrew its 2011 determination to regulate perchlorate under the SDWA and decided not to develop a federal MCL for perchlorate at the present time. Whether the USEPA should issue a national drinking water standard for perchlorate is the subject of ongoing litigation by the Natural Resources Defense Council. The case is currently on hold while EPA is reviewing its prior decision not to set a federal MCL for perchlorate for compliance with the President's Executive Order on "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis."

Perchlorate was first detected in Colorado River water in June 1997 and was traced back to Las Vegas Wash. The source of contamination was found to be emanating from two chemical manufacturing facilities in Henderson, Nevada: (1) the former Tronox, Inc. site, and (2) a facility owned by American Pacific Corporation (AMPAC).

Following the detection of perchlorate in the Colorado River, Metropolitan, along with USEPA and agencies in Nevada including the Nevada Division of Environmental Protection (NDEP), organized the forces necessary to successfully treat and decrease the sources of perchlorate loading. Under NDEP oversight, remediation efforts began in 1998, and treatment operations became fully operational in 2004. These efforts have reduced perchlorate loading into Las Vegas Wash from over 1,000 lbs/day (prior to treatment) to 50-90 lbs/day since early 2007. This has resulted in over 90 percent reduction of the perchlorate loading entering the Colorado River system. As of December 2020, remediation activities in Southern Nevada have resulted in the removal of more than 6,800 tons of perchlorate from the environment. In January 2009, Tronox filed for Chapter 11 bankruptcy protection citing significant environmental liabilities taken from the previous site owner. A settlement was reached in February 2011 which resulted in the

[6] A PHG is a concentration of a contaminant in drinking water that does not pose a significant risk to health.
[7] MCLs are required to be established at a level as close to a chemical's PHG as is technologically and economically feasible, placing primary emphasis on the protection of public health.

formation of the Nevada Environmental Response Trust (NERT). NERT initially received $81 million for cleanup efforts while pursuing additional funding sources.

In April 2014, Tronox reached a $5.15 billion settlement with its predecessors which awarded approximately $1.1 billion, directed to NERT, to clean up perchlorate and certain other contaminants at the former Tronox site in Henderson. The settlement, which represents one of the largest environmental recoveries in history, went into effect in January 2015 and helps to ensure adequate funds are available for site cleanup and protection of the downstream Colorado River. In December 2020, NERT's assets totaled approximately $1.28 billion. NERT is currently investigating remedial options for long-term soil and groundwater cleanup, as well as conducting a regional investigation of downgradient perchlorate-contaminated areas to further reduce loading into Las Vegas Wash. This would help ensure compliance with a potential reduction of California's perchlorate MCL of 6 μg/L, in light of the 1 μg/L PHG.

As a result of the aggressive clean-up efforts, perchlorate levels in Colorado River water at Lake Havasu have decreased significantly in recent years from a peak of 9 μg/L in May 1998. Levels have remained less than 6 μg/L since October 2002 and have been typically less than 2 μg/L since June 2006. Metropolitan routinely monitors perchlorate at over 30 locations within its system, and levels currently remain below 2 μg/L. Metropolitan has not detected perchlorate in the SWP since monitoring began in 1997.

Perchlorate has also been found in groundwater basins within Metropolitan's service area, largely from local sources. The vast majority of locations where perchlorate has been detected in the groundwater are associated with the manufacturing or testing of solid rocket fuels for the Department of Defense and the National Aeronautics and Space Administration (NASA), or with the manufacture, storage, handling, or disposal of perchlorate (such as Aerojet in Azusa in the Main San Gabriel Basin and the Jet Propulsion Laboratory/NASA in the Raymond Basin). Past agricultural practices using fertilizers laden with naturally occurring perchlorate have also been implicated in some areas. As of October 2020, per SWRCB's water quality database, reported monitoring results from 2011 to present indicate that 358 wells in the counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura have detected perchlorate in their service areas at levels greater than 4 μg/L, while 219 wells have detected levels greater than 6 μg/L.[8] Water systems may have installed treatment or removed wells from service due to perchlorate concentrations.

Metropolitan has investigated technologies to mitigate perchlorate contamination. Perchlorate cannot be removed using conventional water treatment. Nanofiltration and reverse osmosis do work effectively, but at a very high cost. Endeavour, LLC (which was formed in 2015 to continue operation of AMPAC's groundwater treatment system) and NERT utilize a biological fluidized bed reactor (FBR) process train for the cleanup of their Henderson sites. A number of sites in Southern California have successfully installed ion exchange systems to treat perchlorate impacted groundwater. In November 2009, a study of biological treatment for perchlorate removal in the City of Pasadena's groundwater was completed with funding provided through a Congressional mandate from USEPA to Metropolitan. The City of Pasadena decided to continue using ion exchange treatment for perchlorate removal and expanded treatment to two well sites.

Treatment options are available to recover groundwater supplies contaminated with perchlorate. However, it is very difficult to predict whether treatment will be pursued to recover all lost production because local agencies will make decisions based largely on cost

[8] DDW data reported from the SWRCB Groundwater Ambient Monitoring Assessment Program's web site: https://gamagroundwater.waterboards.ca.gov/. Numbers reported may change as the website is frequently updated. Also, the website includes additional source data reported by other entities.

considerations, ability to identify potentially responsible parties for cleanup, and the availability of alternative supplies.

Total Organic Carbon and Bromide

Disinfection byproducts (DBPs) form when source water containing high levels of total organic carbon (TOC) and bromide is treated with disinfectants such as chlorine or ozone. Studies have shown a link between certain cancers and DBP exposure. In addition, some studies have shown an association between reproductive and developmental effects and chlorinated water. While many DBPs have been identified and some are regulated under the Safe Drinking Water Act, there are others that are not yet known. Even for those that are known, the potential adverse health effects may not be fully characterized.

Water agencies began complying with new regulations to protect against the risk of DBP exposure in January 2002. This rule, known as the Stage 1 Disinfectants and Disinfection Byproducts (D/DBP) Rule, required water systems to comply with new MCLs and a treatment technique to improve control of DBPs. USEPA then promulgated the Stage 2 D/DBP Rule in January 2006 requiring systems to comply at terminus locations in the distribution system to be more representative of maximum residence time and to protect the public. Metropolitan has been in compliance with the Stage 2 D/DBP Rule since it became effective.

Existing levels of TOC and bromide in Delta water supplies present challenges for water utilities to maintain safe drinking water supplies and comply with regulations. Levels of these constituents in SWP water increase several-fold due to agricultural drainage and seawater intrusion as water moves through the Delta.

SWP water has also experienced lower alkalinity concentrations during years with increased snowmelt, particularly in 2017 and 2019. Low alkalinity requires higher TOC removal by treatment plants and potentially contributes to increased water corrosivity. As a corrosion control strategy, Metropolitan may blend low alkalinity SWP water with Colorado River Water, adjust effluent pH, and increase plant effluent alkalinity.

Source water quality improvements must be combined with cost-effective water treatment technologies to ensure safe drinking water at a reasonable cost. Metropolitan has five treatment plants: two that receive SWP water exclusively, and three that receive a blend of SWP and Colorado River water. In 2003 and 2005, Metropolitan completed upgrades to its SWP-exclusive water treatment plants, Mills and Jensen, respectively, to utilize ozone as its primary disinfectant. This ozonation process minimizes the production of certain regulated disinfection byproducts that would otherwise form in the chlorine treatment of SWP water. The non-ozone plants utilizing blended water met federal guidelines for these byproducts through managing the blend of SWP and Colorado River water. To maintain the byproducts at a level consistent with federal law, Metropolitan limited the percentage of water from the SWP for plants utilizing chlorine as the primary disinfectant. In 2010, 2015, and 2017, Metropolitan completed ozone upgrades at Skinner, Diemer, and Weymouth water treatment plants, respectively. The estimated ozone retrofit cost for all five treatment plants is over $1.1 billion.

Nutrients

Elevated levels of nutrients (phosphorus and nitrogen compounds) can stimulate nuisance algal and aquatic weed growth that affects water system operations and consumer acceptability, including the production of noxious taste and odor compounds and algal toxins. In addition to taste and odor and toxin concerns, increases in algal and aquatic weed biomass can impede flow in conveyances, shorten filter run times, increase solids production at drinking water treatment plants, and add to organic carbon loading. Further, nutrients can provide an increasing food source that may lead to the proliferation of quagga and zebra mussels, and other invasive biological species. Studies have shown phosphorus to be the limiting nutrient in both SWP and Colorado River supplies. Therefore, any increase in phosphorus loading has the potential to stimulate algal growth, leading to the concerns identified above.

SWP supplies have significantly higher nutrient levels than Colorado River supplies. Wastewater discharges, agricultural drainage, and nutrient-rich soils in the Delta are primary sources of nutrient loading to the SWP. Metropolitan and other drinking water agencies receiving Delta water have been engaged in efforts to minimize the effects of nutrient loading from Delta wastewater plants. The Sacramento Regional County Sanitation District (SRCSD), the primary discharger to the Sacramento River, is in the process of constructing wastewater treatment plant upgrades to comply with its 2010 discharge permit requirements for ammonia and nitrate removal. Excessive levels of ammonia are suspected to be altering the Delta's food web which, in turn, has implications for SWP supply reliability. SRCSD expects to complete its EchoWater Project by mid-2022, in compliance with the 2023 deadline, and has stated that the project will serve multiple benefits including improving water quality in the Sacramento River, protecting the fragile Delta ecosystem, and expanding recycled water use opportunities. The improvements include a biological nutrient removal process for ammonia and nitrate removal. The project also includes tertiary treatment processes for filtration and enhanced disinfection. In 2014, the City of Stockton Wastewater Treatment Plant, a discharger to the San Joaquin River, was issued a draft permit with a more stringent nitrate discharge limit consistent with the final discharge limits issued in SRCSD's permit. Due to the lower limit, the City of Stockton began to make plans to implement similar plant upgrades as SRCSD to comply with discharge permit requirements. Construction is planned to be completed in March 2023.

Metropolitan reservoirs receiving SWP water have experienced several taste and odor episodes in recent years. For example, between 2015 and June 2020, Metropolitan reservoirs experienced 13 taste and odor events requiring treatment. A taste and odor event can cause a reservoir to be bypassed and potentially have a short-term effect on the availability of that supply. Metropolitan has a comprehensive program to monitor and manage algae in its source water reservoirs. This program was developed to provide an early warning of algae related problems and taste and odor events to best manage water quality in the system.

The issue of cyanotoxins has become a growing concern as a result of increasing occurrences both nationally and internationally. For example, in August 2014, an algae bloom producing Microcystin in Lake Erie significantly affected the water supply for Toledo, Ohio, prompting the city to issue urgent notices to residents to not drink or boil the drinking water. This event stimulated state and federal legislation to develop health advisories and strategic plans for algal toxins. In June 2015, USEPA issued health advisories for two cyanobacterial toxins: Microcystins and Cylindrospermopsin. The health advisories serve as recommended precautionary levels and are not enforceable federal water quality standards. Cyanotoxins are included on the current Contaminant Candidate List (CCL4), which identifies contaminants considered for regulation under the Safe Drinking Water Act. USEPA has developed improved analytical methods for cyanotoxins to support nationwide monitoring for Microcystins, Anatoxin-a, and Cylindrospermopsin through the Unregulated Contaminant Monitoring Rule 4 program, which was published in 2016 and required monitoring to be conducted between 2018 and 2020. Metropolitan is complying with Unregulated Contaminant Monitoring Rule monitoring and reporting requirements. Although phosphorus levels are much lower in the Colorado River than in the SWP, this nutrient is still of concern. Despite relatively low concentrations (Colorado River has been considered an oligotrophic, or low-productivity, system), any additions of phosphorus to Colorado River water can result in increased algal growth. In addition, low nutrient Colorado River water is relied upon by Metropolitan to blend down the high nutrient SWP water in Metropolitan's blend reservoirs. With population growth expected to continue in the Las Vegas area in the future, ensuring high levels of treatment at wastewater treatment plants to maintain existing phosphorus levels will be critical in minimizing the operational, financial, and public health impacts associated with excessive algal growth and protecting downstream drinking water uses. Metropolitan and other affected drinking water agencies collaborate with wastewater dischargers in the Las Vegas area to protect the phosphorus-limited Colorado River. Since 2001, wastewater dischargers have undertaken considerable efforts to improve treated effluent water quality by removing phosphorus on a year-round basis. In 2005, dischargers also began optimizing their treatment processes to remove greater amounts of phosphorus, maintaining levels well below current permit requirements.

Although current nutrient loading is of concern for Metropolitan and is anticipated to have cost implications, with its comprehensive monitoring program and response actions to manage algal related issues, there should be no impact on availability of water supplies. Metropolitan's source water protection program will continue to focus on preventing future increases in nutrient loading as a result of urban and agricultural sources.

Arsenic

Arsenic is a naturally occurring element found in rocks, soil, water, and air. It is used in wood preservatives, alloying agents, certain agricultural applications, semi-conductors, paints, dyes, and soaps. Arsenic can get into water from the natural erosion of rocks, dissolution of ores and minerals, runoff from agricultural fields, and discharges from industrial processes. Long-term exposure to elevated levels of arsenic in drinking water has been linked to certain cancers, skin pigmentation changes, and hyperkeratosis (skin thickening).

In April 2004, OEHHA set a PHG for arsenic of 0.004 µg/L, based on lung and urinary bladder cancer risk. The MCL for arsenic in domestic water supplies was lowered to 10 µg/L, with an effective date of January 2006 in the federal regulations, and an effective date of November 2008 in the California regulations. Monitoring results submitted to California Department of Public Health (now DDW) since 2010 showed that arsenic is ubiquitous in drinking water sources, reflecting its natural occurrence. They also showed that many sources have arsenic detections above the 10 µg/L MCL. Southern California drinking water sources, by county, that contain concentrations of arsenic over 10 µg/L include San Bernardino (113 sources), Los Angeles (82 sources), Riverside (52 sources), San Diego (5 sources), Orange (10 sources), and Ventura (3 sources).[9]

The arsenic drinking water standard impacts both groundwater and surface water supplies. Historically, Metropolitan's water supplies have had low levels of this contaminant and did not require treatment changes or capital investment to comply with the standard. However, some of Metropolitan's water supplies from groundwater storage programs are at levels near the MCL. These groundwater storage projects are called upon to supplement flow only during low SWP allocation years. Under drought conditions, Metropolitan has further relied on groundwater storage programs and continues to participate in the California Aqueduct Pump-in Facilitation Group to ensure that water quality in the SWP is not adversely affected when considering water supply decisions. Metropolitan has had to restrict flow from one program to limit arsenic increases in the SWP. Implementation of an arsenic treatment facility, which is operated by a groundwater

[9] DDW data reported from the SWRCB Groundwater Ambient Monitoring Assessment Program's web site: https://gamagroundwater.waterboards.ca.gov/. Numbers reported may change as the website is frequently updated. Also, the website includes additional source data reported by other entities.

banking partner, has increased groundwater supply costs. Moreover, Metropolitan has invested in solids handling facilities at its treatment plants and implemented operational changes to manage arsenic in the treatment process residual solids.

The DLR for arsenic is 2 μg/L. Between 2010 and June 2020, arsenic levels in Metropolitan's water treatment plant effluents ranged from non-detect (< 2 μg/L) to 3.3 μg/L. For Metropolitan's source waters, levels in Colorado River water have ranged from 2.2 to 2.8 μg/L, while levels in SWP water have ranged from non-detect to 4.8 μg/L. Increasing coagulant doses at water treatment plants can reduce arsenic levels for delivered water.

Some member agencies may face greater problems with arsenic compliance due to naturally occurring arsenic in groundwater. Per the Water Replenishment District's 2018-2019 Regional Groundwater Monitoring Report, arsenic concentrations greater than the 10 μg/L MCL were detected in 9 of 220 Central Basin production wells.[10] Water supplies imported by the Los Angeles Department of Water and Power may also contain arsenic above the MCL. The cost of arsenic removal from these supplies could vary significantly.

Uranium

The U.S. Department of Energy (DOE) has completed about 66 percent of a project to move a 16-million-ton pile of uranium mill tailings near Moab, Utah, which lies approximately 750 feet from the Colorado River. Due to the proximity of the pile to the Colorado River, there is a potential for the tailings to enter the river as a result of a catastrophic flood event or other natural disaster. In addition, contaminated groundwater from the site is slowly seeping into the river. The DOE is responsible for remediating the site, which includes removal and offsite disposal of the tailings and onsite groundwater remediation.

Previous investigations have shown uranium concentrations contained within the pile at levels significantly above the California MCL of 20 picocuries per liter (pCi/L). Metropolitan has been monitoring for uranium in the CRA and at its treatment plants since 1986. Monitoring at Lake Powell began in 1998. Uranium levels measured at Metropolitan's intake have ranged from 1 to 6 pCi/L, well below the California MCL. Conventional drinking water treatment, as employed at Metropolitan's water treatment plants, can remove low levels of uranium; however, these processes would not be protective if a catastrophic event washed large volumes of tailings into the Colorado River. Public perception of drinking water safety is also of particular concern as to uranium.

Remedial actions at the site since 1999 have focused on removing contaminated water from the pile and groundwater. To date, over 5,300 pounds of uranium in contaminated groundwater have been removed. In July 2005, DOE issued its Final Environmental Impact Statement with the preferred alternative of permanent offsite disposal by rail to a disposal cell at Crescent Junction, Utah, located approximately 30 miles northwest of the Moab site.

Rail shipment and disposal of the uranium mill tailings pile from the Moab site began in April 2009 using American Recovery and Reinvestment Act 2009 funding which helped to accelerate initial cleanup efforts. Through September 2020, DOE has shipped over 10.9 million tons of mill tailings to the Crescent Junction disposal cell. DOE estimates completing movement of the tailings pile by 2034, depending on annual appropriations. Metropolitan continues to track progress of the remediation efforts and work with Congressional representatives to support increased annual appropriations and expedite cleanup.

[10] *Regional Groundwater Monitoring Report Water Year 2018-2019, Los Angeles County, California*, prepared by Water Replenishment District, March 2020.

Another uranium-related issue began receiving attention in 2008 due to a renewed worldwide interest in nuclear energy and a resulting increase in uranium mining claims filed throughout the western United States. Of particular interest were thousands of mining claims filed near Grand Canyon National Park and the Colorado River. Metropolitan sent letters to the Secretary of the Interior to highlight source water protection and consumer confidence concerns related to uranium exploration and mining activities near the Colorado River, and advocate for close federal oversight over these activities. In 2009, Secretary of the Interior Ken Salazar announced a two-year hold on new mining claims on 1 million acres adjacent to the Grand Canyon to allow necessary scientific studies and environmental analyses to be conducted. In January 2012, Secretary Salazar formally signed a 20-year moratorium on new uranium and other hard rock mining claims. The moratorium has been challenged by a number of industry groups and was most recently upheld by a U.S. District Court in September 2014. Meanwhile, local conservation groups continue to defend the moratorium and are seeking additional protection of lands with mines that have been inactive for long periods of time but may resume operations. Although of no direct impact to Metropolitan due to its upstream location and resulting dilution, in August 2015, an accidental release of wastewater from an abandoned mine in southwest Colorado demonstrated the potential threat that mining activities can have on public health and the environment. In 2020, the DOE released a strategy to revive and expand nuclear fuel production which would be of interest to Metropolitan if projects are in proximity to the Colorado River.

Chromium-6

Chromium is a naturally occurring element found in rocks, soil, plants, and animals. Chromium-3 is typically the form found in soils and is an essential nutrient that helps the body use sugar, protein, and fat. Chromium-6 is used in electroplating, stainless steel production, leather tanning, textile manufacturing, dyes and pigments, wood preservation, and as an anti-corrosion agent. Chromium occurs naturally in deep aquifers and can also enter drinking water through discharges of dye and paint pigments, wood preservatives, chrome plating liquid wastes, and leaching from hazardous waste sites. In drinking water, chromium-6 is very stable and soluble, whereas chromium-3 is not very soluble. Chromium-6 is the more toxic species and is known to cause lung cancer in humans when inhaled, but the health effects in humans from ingestion are still in question. There is evidence that when chromium-6 enters the stomach, gastric acids may reduce it to chromium-3. However, recent studies conducted by the National Toxicology Program have shown that chromium-6 can cause cancer in animals when administered orally.

Effective July 1, 2014, California's Office of Administrative Law approved a primary drinking water standard of 10 μg/L for chromium-6. In May 2017, the Superior Court of Sacramento County issued a judgment invalidating California's MCL of 10 μg/L for chromium-6 on the basis that CDPH (now DDW), had not properly considered the economic feasibility of complying with the MCL. DDW therefore rescinded the chromium-6 MCL. However, chromium-6 remains regulated as part of total chromium. California's MCL for total chromium is 50 μg/L. In February 2020, DDW released a white paper discussion on an updated economic feasibility analysis of chromium-6 treatment for the consideration of a new chromium-6 MCL. USEPA regulates chromium-6 as part of the total chromium drinking water standard of 100 μg/L and is currently evaluating whether a new federal drinking water standard for chromium-6 is warranted based on new health effects information.

Metropolitan utilizes an analytical method with a minimum reporting level of 0.03 μg/L, which is less than the State DLR of 1 μg/L. In the past 5 years, the results from all of Metropolitan's source and treated waters are less than the State DLR. The following summarizes chromium-6 levels found in Metropolitan's system:

In the past 5 years, results of source and treated water monitoring for chromium-6 indicate the following:

- Levels in Colorado River water are mostly not detected (<0.03 μg/L), but when detected, levels range from 0.03 to 0.085 μg/L. SWP levels range from 0.03 to 1.0 μg/L. Treated water levels range from 0.03 to 0.8 μg/L.
- There is a slight increase in chromium-6 in the treated water from the oxidation (chlorination and ozonation) of natural background chromium (total) to chromium-6.
- Colorado River monitoring results upstream and downstream of the site of a Pacific Gas and Electric (PG&E) gas compressor station located along the Colorado River near Topock, Arizona (discussed below) have ranged from not detected (<0.03 μg/L) to 0.06 μg/L.
- Chromium-6 in Metropolitan's groundwater pump-in storage programs in the Central Valley has ranged from not detected (< 1 μg/L) to 8.9 μg/L in 2014, with the average for the different programs ranging from < 1 μg/L to 3 μg/L.

PG&E used chromium-6 as an anti-corrosion agent in its cooling towers at the Topock site from 1951 to 1985. Wastewater from the cooling towers was discharged from 1951 to 1968 into a dry wash next to the station. Monitoring wells show the plume concentration has peaked as high as 16,000 μg/L in groundwater. Since 2004, PG&E has operated an interim groundwater extraction and treatment system that is protecting the Colorado River. This interim treatment system will be taken offline in September 2021 and replaced by the long-term groundwater remedy system. Quarterly monitoring of the river has shown levels of chromium-6 less than 1 μg/L, which are considered background levels. The California Department of Toxic Substances Control (DTSC) and the U. S. Department of the Interior are the lead state and federal agencies overseeing the cleanup efforts. Metropolitan participates through various stakeholder workgroups and partnerships that include state and federal regulators, Indian tribes, and other stakeholders (e.g., Colorado River Board) involved in the corrective action process. In January 2011, a final treatment remedy was selected, and an Environmental Impact Report was certified. In November 2015, PG&E completed the final remedy design based on the selected remedy which involves the installation of an in-situ bioremediation treatment system. In April 2015, DTSC required the preparation of a Subsequent Environmental Impact Report (EIR) to address new design details. The Subsequent EIR was certified in April 2018. Construction of Phase 1, consisting of an In-situ reduction zone, began in October 2018 and is expected to be completed in 2021. Phase 2, consisting of a freshwater injection system, is anticipated to begin construction in 2023 and last about one year. Operation of the treatment system will run for an estimated 30 years.

The federal- and state-approved technologies for removing total chromium from drinking water include coagulation/filtration, ion exchange, reverse osmosis, and lime softening. For several years, the cities of Glendale, Burbank, and Los Angeles have been voluntarily limiting chromium-6 levels in their drinking water to 5 μg/L, even after the MCL was rescinded in 2017.

1,2,3-Trichloropropane (1,2,3-TCP)

1,2,3-TCP is a chlorinated hydrocarbon with high chemical stability. It is a manmade chemical found at industrial or hazardous waste sites. It has been used as a cleaning and degreasing solvent and also is associated with pesticide products.

At its July 18, 2017 public meeting, the SWRCB adopted an MCL of 5 parts per trillion (ppt) for 1,2,3-TCP, and related requirements, including establishing a DLR, identifying the best available technology for treatment, and setting public notification and consumer confidence report language. The regulations also included a method for public water systems to substitute existing water quality data for initial monitoring requirements under certain circumstances. Under the new regulation, drinking water agencies are required to perform quarterly monitoring of 1,2,3-TCP. There have been no detections of this chemical in Metropolitan's system. However, 1,2,3-TCP has been detected above the new MCL in groundwater wells of three of Metropolitan's groundwater storage program partners through monitoring performed by these agencies. Levels detected in groundwater wells of the Arvin-Edison Water Storage District are the highest and impact the ability of Metropolitan to put water and take return water under that program. Metropolitan has temporarily suspended operation of this program until the water quality concerns can be further evaluated and managed. The levels of 1,2,3-TCP detected in Metropolitan's other groundwater storage programs are much lower and impact fewer groundwater wells. Metropolitan is evaluating the effects of TCP on the return capability of those programs. Southern California counties that have detected concentrations of 1,2,3-TCP in drinking water sources at or over 5 ppt since 2010 include San Bernardino (48 sources), Los Angeles (63 sources), Riverside (24 sources), San Diego (10 sources), and Ventura (3 sources).[11]

Constituents of Emerging Concern

N-Nitrosodimethylamine

N-Nitrosodimethylamine (NDMA) is part of a family of organic chemicals called nitrosamines. NDMA is a chloramine disinfection by-product, and it is the most abundantly detected nitrosamine in drinking water systems. Metropolitan utilizes chloramines as a secondary disinfectant at its treatment plants. Wastewater treatment plant discharges can contribute organic matter into source waters, which react with chloramines to form NDMA at drinking water treatment plants. Certain coagulation aid polymers used in water treatment, e.g., polydiallyldimethylammonium chloride (polyDADMAC), can also contribute to NDMA formation. Some NDMA control measures are being used to avoid adverse impacts on Southern California drinking water supplies. Metropolitan is involved in several projects to understand the impact of different treatment processes on NDMA and its precursors at drinking water treatment plants and in distribution systems. Certain pre-oxidation processes, such as chlorine and ozone, have been shown to destroy NDMA precursors. Additional studies are being conducted to better understand how polyDADMAC contributes to NDMA formation and to identify measures to reduce polymer-derived NDMA formation.

USEPA considers NDMA to be a probable human carcinogen. USEPA placed NDMA on the Contaminant Candidate List 4 (CCL4). Although there is no federal regulation for nitrosamines in drinking water, DDW set a notification level of 0.01 µg/L each for NDMA and two other nitrosamines. Occurrences of NDMA in treated water supplies at concentrations greater than 0.01 µg/L are recommended to be included in a utility's annual Consumer Confidence Report. In December 2006, OEHHA set a PHG for NDMA of 0.003 µg/L. Since 1999, Metropolitan has conducted voluntary monitoring of the five treatment plant effluents and representative distribution system locations semi-annually. NDMA is the only detected nitrosamine in Metropolitan's treated water systems, and it is in the range of non-detect (<0.002 µg/L) to 0.006 µg/L. NDMA or a broader class of nitrosamines may likely be the next class of disinfection by-products to be regulated by USEPA.

[11] DDW data reported from SWRCB Groundwater Ambient Monitoring Assessment Program's web site: https://gamagroundwater.waterboards.ca.gov/. Numbers reported may change as the website is frequently updated. Also, the website includes additional source data reported by other entities.

Pharmaceuticals and Personal Care Products

Pharmaceuticals and personal care products (PPCPs) are a growing concern to the water industry. Numerous studies have reported the occurrence of these emerging contaminants in treated wastewater, surface water, and sometimes, in finished drinking water in the United States and around the world. The use of ozone in treatment processes may have a beneficial effect on PPCP removal in drinking water. The sources of PPCPs in the aquatic environment include (but may not be limited to) treated wastewater and industrial discharge, agricultural run-off, and leaching of municipal landfills. Currently, there is no evidence of human health risks from long-term exposure to the low concentrations (low ng/L; parts per trillion) of PPCPs found in some drinking water. Furthermore, there are no regulatory requirements for PPCPs in drinking water. USEPA included 14 PPCPs on the CCL3 and 10 PPCPs on the CCL4, nine of which are carried over from the CCL3; however, currently there are no standardized analytical methods for these compounds. USEPA's strategy for addressing PPCPs involves strengthening analytical methods, conducting source studies, improving public understanding of PPCPs in water, building partnerships and promoting stewardship opportunities, and taking regulatory action when appropriate.

In 2007, Metropolitan implemented a short-term monitoring program to determine the occurrence of PPCPs and other organic wastewater contaminants in Metropolitan's treatment plant effluents and selected source water locations within the Colorado River and SWP watersheds. Currently, PPCP monitoring is conducted on an annual basis for Metropolitan's source waters and treatment plants. Some PPCPs have been detected at very low ng/L levels, which is consistent with reports from other utilities. However, analytical methods are still being refined, and more work is required to fully understand occurrence issues. Metropolitan has been actively involved in studies related to PPCPs, including analytical methods improvements, and characterization of drinking water sources in California.

Microplastics

In 2018, Senate Bill No. 1422 added Section 116376 to the Health and Safety Code, which required the SWRCB to adopt a definition of microplastics in drinking water on or before July 1, 2020. Section 116376 also requires the SWRCB on or before July 1, 2021, to: (1) adopt a standard methodology to be used in the testing of drinking water for microplastics; (2) adopt requirements for four years of testing and reporting of microplastics in drinking water, including public disclosure of those results; (3) if appropriate, consider issuing a notification level or other guidance to help consumer interpretations of the results of the testing required; and (4) accredit qualified laboratories in California to analyze microplastics. No other states have defined microplastics. Knowledge in the microplastics field has been primarily provided by the European Union. On June 16, 2020, the SWRCB adopted a definition, acknowledging the definition is a work in progress, and stated the SWRCB will re-visit the microplastic definition as knowledge in the field progresses. The definition reads: '*Microplastics in Drinking Water' are defined as solid polymeric materials to which chemical additives or other substances may have been added, which are particles which have at least three dimensions that are greater than 1nm and less than 5,000 micrometers (µm). Polymers that are derived in nature that have not been chemically modified (other than by hydrolysis) are excluded.* Metropolitan is participating in a study with the Southern California Coastal Water Research Project to develop analytical methods for microplastics.

Per- and Polyfluoroalkyl Substances (PFAS)

Drinking water containing perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS) – and the larger family of per- and polyfluoroalkyl substances (PFAS) – has become an increasing concern due to the persistence of these chemicals in the environment and their tendency to accumulate in groundwater.

In August 2019, the SWRCB's Division of Drinking Water (DDW) updated its guidelines for local water agencies to follow in detecting and reporting the presence of these chemicals in drinking water. The guidelines lower the notification levels from 14 parts per trillion (ppt) to 5.1 ppt for PFOA and from 13 ppt to 6.5 ppt for PFOS. These levels are based on updated health recommendations from the Office of Environmental Health Hazard Assessment (OEHHA), which is part of the California Environmental Protection Agency. Notification levels are non-regulatory, precautionary health-based measures for concentrations of chemicals in drinking water that warrant notification and further monitoring and assessment. If a chemical concentration is greater than its notification level in drinking water that is provided to consumers, DDW recommends that the utility inform its customers and consumers about the presence of the chemical and about health concerns associated with exposure to it. The SWRCB also set new response levels (RLs) of 10 parts per trillion (ppt) for PFOA and 40 ppt for PFOS based on a running four quarter average. Previously, the RL was 70 ppt for the total concentration of the two contaminants combined. A response level is set higher than a notification level and represents a chemical concentration level at which DDW recommends a water system consider taking a water source out of service or providing treatment if that option is available to them. In March 2021, DDW issued an NL of 0.5 parts per billion (ppb) and an RL of 5 ppb for perfluorobutane sulfonic acid (PFBS), another PFAS chemical. The NL for PFBS is 100 times higher than the NLs for PFOA and PFOS. Metropolitan sources have not been affected by PFBS, but Metropolitan has not yet evaluated potential PFBS impacts on its member agencies' sources. DDW has also asked OEHHA to recommend NLs for six other PFAS compounds consistently detected in California drinking water sources: perfluorohexane sulfonic acid (PFHxS), perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA), and 4,8-dioxia-3H-perflourononanoic acid (ADONA). Legislation which took effect on January 1, 2020 (California Assembly Bill 756), requires that water systems that receive a monitoring order from the SWRCB and detect levels of PFAS that exceed their respective RLs must either take the drinking water source out of use or provide specified public notification if they continue to supply water above the RL.

In addition to the updated notification levels, DDW has requested that OEHHA develop PHGs for both PFOA and PFOS, the next step in the process of establishing MCLs in drinking water. As of the writing of this UWMP, draft PHGs have not been released. Other chemicals in the broader group of PFAS may be considered later, either individually or grouped, as data permits. On March 19, 2021, OEHHA announced its intent to list PFOA as a carcinogen under the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). On March 26, 2021, OEHHA announced its review of the carcinogenic hazard of PFOS for possible listing under Proposition 65. That same day, OEHHA also announced its assessment of the reproductive toxicity of PFDA, PFHxS, PFNA, and perfluoroundecanoic acid (PFUnDA) for possible listing under Proposition 65. Comments regarding whether PFOA meets the criteria to be listed as a carcinogen under Proposition 65 were due by May 3, 2021. The public had until May 10, 2021, to submit information relevant to the assessment of the carcinogenicity of PFOS and the reproductive toxicity of PFDA, PFHxS, PFNA, and PFUnDA. In November 2017, OEHHA listed PFOA and PFOS as chemicals known to cause reproductive toxicity under Proposition 65. Proposition 65 requires businesses to provide warnings to Californians about significant exposures to chemicals that cause cancer, birth defects or other reproductive harm. Proposition 65 also prohibits California businesses from knowingly discharging significant amounts of listed chemicals into sources of drinking water.

On the federal level, U.S. EPA announced on January 19, 2021 that it is considering whether to designate PFOA and PFOS as hazardous substances under the Comprehensive Environmental Responsibility and Liability Act (CERCLA) and/or hazardous waste under the Resource Conservation and Recovery Act (RCRA). On February 22, 2021, U.S. EPA announced its proposed revisions to the Unregulated Contaminant Monitoring Rule (UCMR 5) for public water systems which includes monitoring for 29 PFAS in drinking water. The proposal would require pre-sampling preparations in 2022, sample collection from 2023-2025, and reporting of final results through 2026. Comments on U.S. EPA's proposal will be due within 60 days after it is published in the Federal Register. On March 3, 2021, U.S. EPA published its final regulatory determination to regulate PFOA and PFOS in drinking water. EPA has 24 months to propose maximum contaminant level goals (MCLG) and MCLs for PFOA and PFOS. Following that deadline, EPA has 18 months to publish final MCLGs and MCLs for PFOA and PFOS.

PFOA and PFOS were introduced in the 1940s and widely used in firefighting foams and in grease and stain-resistant, non-stick coatings in a variety of consumer products such as food paper packaging, carpets, furniture and cookware. The main route of exposure to PFOA and PFOS is through ingestion. While consumer products have been a large source of exposure to these chemicals for most people, drinking water has become an increasing concern due to the persistence of PFAS chemicals in the environment and their tendency to accumulate in groundwater. Groundwater contamination typically has been associated with an industrial facility where these chemicals were manufactured or used in other products, such as airfields and military bases where the chemicals have been used for firefighting or in areas near landfills that accept items containing PFAS.

Metropolitan has not detected PFOA or PFOS in its raw water. In 2019, Metropolitan detected in its supplies low levels of PFHxA, which is not acutely toxic or carcinogenic and is not currently regulated in California or at the federal level. No other PFAS have been detected in Metropolitan's imported or treated supplies. However, some of its member agencies have experienced detections in their groundwater wells. As DDW moves to establish MCLs for PFOA and PFOS, Metropolitan's member agencies may be confronted with the choice of implementing treatment or inactivating their affected sources to remain in compliance with DDW regulations. This may cause those systems to supplement their water needs with increased purchases of Metropolitan water.

1,4-Dioxane

1,4-dioxane has been used as a stabilizer for solvents, in particular 1,1,1- trichloroethane (TCA), and a solvent in its own right, as well as in a number of industrial and commercial applications. 1,4-dioxane is an emerging contaminant. In response to the occurrence data and potential adverse health effects, a notification level for 1,4-dioxane of 1 μg/L was established. The response level for 1,4-dioxane is 35 μg/L.

The SWRCB set a notification level of 1 μg/L for 1,4-dioxane in drinking water in November 2010, revising an earlier notification level of 3 μg/L set in March 1998 that was based on a risk determination by the U.S. EPA and concurrence from OEHHA. In August 2010, U.S. EPA revised its 1,4-dioxane risk evaluation, lowering the recommended levels in drinking water by nearly 10-fold to 0.35 μg/L. Following U.S. EPA's reevaluation of risk, the SWRCB revised the notification level to 1 μg/L in November 2010, considering analytical limitations at the time. On January 22, 2019, the SWRCB asked OEHHA to establish a PHG for 1,4-dioxane. OEHHA's PHG will be used by the SWRCB to set an MCL for 1,4-dioxane in drinking water.

Advanced oxidation treatment is currently the water industry's preferred treatment technology for 1,4-dioxane. However, DDW has not yet adopted a Best Available Technology for 1,4-dioxane treatment.

There are currently 90 wells in Los Angeles County and 21 wells in Orange County that have detected 1,4-dioxane over the NL in the last three years.[12]

Other Water Quality Programs

In addition to monitoring for and controlling specific identified chemicals in the water supply, Metropolitan has undertaken several programs to protect the quality of its water supplies. These programs are summarized below.

Source Water Protection

Source water protection is the first step in a multi-barrier approach to provide safe and reliable drinking water. In accordance with California's Surface Water Treatment Rule, Title 22 of the California Code of Regulations, DDW requires large utilities delivering surface water to complete a Watershed Sanitary Survey every five years to identify possible sources of drinking water contamination, evaluate source and treated water quality, and recommend watershed management activities that will protect and improve source water quality. The most recent sanitary surveys for Metropolitan's water sources are the Colorado River Watershed Sanitary Survey – 2015 Update and the State Water Project Watershed Sanitary Survey – 2016 Update.[13] The next Sanitary Surveys for the watersheds of the Colorado River and the SWP will report on watershed and water quality issues through 2020.

Metropolitan has an active source water protection program and continues to advocate on numerous issues to protect and enhance SWP and Colorado River water quality. As part of its source water protection program, Metropolitan monitors and forecasts source water quality, including closely monitoring the biology and limnology of lakes and aqueducts. Monitoring is conducted to comply with regulatory requirements, respond to water quality events, assess temporal variability, advise operations, and investigate emerging constituents and invasive species.

Colorado River Water Quality Partnerships

Metropolitan collaborates with external partners to asses and manage watershed threats to Colorado River water quality. Metropolitan is a member of the Clean Colorado River Sustainability Coalition, which was formed in 1997 and focuses on protecting and enhancing the Colorado River through monitoring and analysis of water quality to assure and sustain high quality water for all users of the Colorado River. In 2011, Metropolitan formed the Lower Colorado River Water Quality Partnership with SNWA and Central Arizona Project to identify and implement collaborative solutions to address water quality issues facing the Colorado River. Metropolitan also participated in the Lake Mead Water Quality Forum, which was formed in 2012, and its Lake Mead Ecosystem Monitoring Workgroup subcommittee. The Lake Mead Water Quality Forum's goals were to support the protection of human health and the environment and to preserve and improve the water quality of the Las Vegas Wash, Las Vegas Bay, and Lake Mead (and as a

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[12] DDW data reported from SWRCB Groundwater Ambient Monitoring Assessment Program's web site: https://gamagroundwater.waterboards.ca.gov/. Numbers reported may change as the website is frequently updated. Also, the website includes additional source data reported by other entities.

[13] Metropolitan Water District of Southern California, *Colorado River Watershed Sanitary Survey, 2015 Update*. For the State Water Project, the sanitary survey report was prepared on behalf of the State Water Project Contractors Authority, in 2016, and was titled *California State Water Project 2016 Watershed Sanitary Survey Update*.

result, the Colorado River). In addition, as discussed earlier, Metropolitan is a member of the Colorado River Basin Salinity Control Forum which facilitates coordination between Basin states and federal agencies on salinity matters and the implementation of the Colorado River Basin Salinity Control Program.

SWP Water Quality Programs

Metropolitan supports DWR policies and programs aimed at maintaining or improving the quality of SWP water delivered to Metropolitan. In particular, Metropolitan supported the DWR policy to govern the quality of non-project water conveyed by the California Aqueduct. In addition, Metropolitan has supported the expansion of DWR's Municipal Water Quality Investigations Program beyond its Bay-Delta core water quality monitoring and studies to include enhanced water quality monitoring and forecasting of the Delta and SWP. These programs are designed to provide early warning of water quality changes that will affect treatment plant operations both in the short-term (hours to weeks) and up to seasonally. The forecasting model is currently suitable for use in a planning mode. It is expected that with experience and model refinement, it will be suitable to use as a tool in operational decision making.

Metropolitan has implemented selective withdrawals from storage programs and exchanges to improve water quality. Although these programs were initially designed to provide dry-year supply reliability, they can also be used to store SWP water at periods of better water quality so the stored water may be withdrawn at times of lower water quality, thus diluting SWP water deliveries. Although elevated arsenic levels have been a concern in one groundwater banking program, there are also short-term water quality benefits that can be realized through storage programs, such as groundwater pump-ins into the California Aqueduct with lower TOC levels (as well as lower bromide and TDS, in some programs).

Regulatory and Legislative Actions

Metropolitan conducts technical reviews of regulatory and legislative actions that may have an effect on the quality of Metropolitan's source waters. These may include changes in federal and state water quality standards; California Environmental Quality Act (CEQA) documents for projects or programs within Metropolitan's source watersheds; National Pollutant Discharge Elimination System permits for wastewater discharges into the Delta or Colorado River systems; and regulations or statewide policies and permits affecting source water quality or reservoir management issues.

In addition, Metropolitan advocates and provides funding requests for key source water protection priorities, including the Moab uranium tailings cleanup and Colorado River salinity control. In 2020, Metropolitan also co-sponsored SB 996 with the California Municipal Utilities Association to establish a statewide CEC program, which has been re-introduced as SB 230 in 2021's legislative session.

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Coordination and Public Outreach

5

Collaborative Regional Planning

Southern California meets its water challenges through collaborative long-range planning, bringing local perspectives and data together with expert knowledge of hydrology, climate change, demographics, and economics. Metropolitan's 2020 Urban Water Management Plan (UWMP) was developed as part of the ongoing 2020 Integrated Water Resources Plan (IRP) planning process and provides a representation of Metropolitan's planning elements reported under the conditions required by the Act. Together, these plans serve as the reliability road map for the region. The planning process involved extensive coordination with Southern California's wholesale and retail water agencies, as well as municipal service providers and public planning agencies. Outreach efforts sought to engage the general public, businesses, environmental organizations, diverse communities, cities, counties, and other stakeholders with an interest in the future of Southern California's water supplies.

This chapter describes how Metropolitan's process to develop the 2020 UWMP, Appendix 11 to the 2015 UWMP, and Water Shortage Contingency Plan (WSCP) complies with the provisions for coordination and public outreach in the Urban Water Management Planning Act included as part of the California Water Code (CWC) §10610, et seq.

Concurrent Planning with the 2020 Integrated Water Resources Plan

Metropolitan and its member agencies used a scenario planning approach for the 2020 IRP. Instead of focusing on a target for future water supply needs, this approach encouraged broader thinking and discussion on possible future conditions for local and imported water supply and retail demand, and the policy implications for Metropolitan. Adaptive management during implementation will allow flexibility in how the region prepares for the supply and demand conditions that are becoming more likely. The planning started with identifying drivers of change for water supply and demand, understanding how they interact, and then assessing the potential scale of impact in the future. Data sources were identified that could be used for quantitative and qualitative analysis. The detailed analyses of future local and imported water supplies; economic growth, demographics and water demands; and changing hydrology were incorporated into the 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP. The IRP planning effort and policy discussions continued into 2021.

Board of Directors Oversight

Metropolitan's Board of Directors provided oversight throughout the ongoing process for the development of the 2020 IRP that informed the preparation of the 2020 UWMP. The Board established the Integrated Resources Plan Special Committee (IRP Committee) to provide focused involvement of the Metropolitan Board for the preparation of these plans. The IRP Committee has 14 members, and all Board members are invited to attend and participate in discussions. The meetings are held online due to COVID-19 concerns. They are open to the public, and the public is invited to provide comments at each meeting. The IRP Committee held 12 meetings between February 2020 and March 2021, as summarized in Table 5-1.

Table 5-1
Summary of Metropolitan Board of Directors IRP Committee Meetings

Date	Committee	Topic
February 25, 2020	IRP Committee	Overview of the planning process, introduction to scenario planning, identify major policy areas
April 28, 2020	IRP Committee	Review process and scenario planning, identify relevant policy questions
May 26, 2020	IRP Committee	Review schedule, overview of stakeholder outreach
June 23, 2020	IRP Committee	Discuss drivers of change and method for constructing scenarios
July 28, 2020	IRP Committee	Qualitative and quantitative assessment for scenarios, collaboration with member agencies
August 17, 2020	IRP Committee	IRP purpose and benefit; development of an example scenario
September 22, 2020	IRP Committee	Draft scenarios and analysis
October 27, 2020	IRP Committee	Scenario assumptions and preliminary analysis of drivers
December 15, 2020	IRP Committee	Draft retrospective of the 2015 IRP, preliminary gap analysis and policy implications of the 2020 IRP
January 26, 2021	IRP Committee	Comments and feedback on 2015 IRP retrospective report, 2020 IRP policy discussion
February 23, 2021	IRP Committee	Policy discussion on portfolio development, preparation for workshops with demand and climate experts
March 23, 2021	IRP Committee	Workshop with water demand experts

Coordination with Member Agencies and Other Organizations

Metropolitan coordinated the preparation of the 2020 UWMP, Appendix 11 to the 2015 UWMP, and the WSCP with its 26 member agencies, wastewater management agencies, municipal service providers, groundwater management agencies, cities and counties within which Metropolitan provides water supplies, and regional planning agencies. The extensive regional coordination is consistent with the requirements of CWC Sections 10610.2(a)(4), 10620(d)(3), 10621(b), 10641, and 10642. With the WSCP initially included as part of the 2020 UWMP and the content of Appendix 11 to the 2015 UWMP the same as the content of Appendix 11 to the 2020 UWMP, the required coordination, notification, hearing, and adoption of the WSCP and Appendix 11 to the 2015 UWMP were accomplished side by side and concurrently with the 2020 UWMP process. Additionally, the WSDM Plan and WSAP, which are planning components included as part of the WSCP, were previously developed through extensive coordination with member agencies and various stakeholders and adopted by Metropolitan's Board in 1999 and 2008, respectively, and subsequent revisions to the WSAP were adopted in 2009, 2010, 2011, and 2014.

Metropolitan collaborated with its member agencies through the Member Agency Managers meetings and an IRP Member Agency Technical Workgroup, as well as the UWMP Coordination Meetings with member agencies and other appropriate agencies. These meetings provided an opportunity to share information, discuss scenario development and data analysis, and review draft analyses of future supply and demand. A summary of the meetings is provided in Table 5-2. In addition, Metropolitan staff met with member agency staff individually and provided presentations to member agency boards upon request.

Work with the member agencies was structured to complement presentations and discussions with the IRP Committee. Presentations and discussions with the Member Agency Technical Workgroup were incorporated into the following Member Agency Managers meetings. The feedback from the Member Agency Managers was then used to develop the presentations for the upcoming IRP Committee meetings. The Committee discussion and direction provided to staff informed the preparation of analysis and materials for the next Member Agency Technical Workgroup. This iterative process allowed for regular input and discussion, an essential element of scenario planning.

The first step in the planning process was to identify the drivers of change, those external factors that could impact future water supply and demand for the region. Over several months, Metropolitan worked with the Board, member agencies, stakeholders and the public to identify a broad range of drivers, understand how the drivers interact, and assess the potential scale of impact on water supply and demand. An important part of the discussion focused on how the impact of drivers could be evaluated qualitatively and quantitatively. The member agencies made recommendations on data and methodologies that could be used, and the draft analyses led to refinements.

Using the requirements for the UWMP, Metropolitan analyzed the data provided by the member agencies, other regional planning organizations such as SCAG and SANDAG, the California Department of Water Resources, and the U.S. Bureau of Reclamation. Local and imported water supplies were included, as well as demand management programs, regulations, and public acceptance of conservation as a way of life. Metropolitan prepared the data in five-year increments for conditions under normal water year, single dry year, and for droughts lasting at least five years as required in CWC Section 10631. The analyses were shared with the member agencies for their feedback, and to assist with their preparation and adoption of their plans. When requested, Metropolitan staff met individually with the member agencies to review the data sets and discuss any agency-specific questions or issues. Regional issues and analysis methodologies were discussed during the technical workgroup meetings and the Member Agency Managers meetings. Preliminary estimates of demand and supply were included in the Final Draft 2020 UWMP and draft Appendix 11 to the 2015 UWMP distributed to the member agencies in December 2020. Further refinements of demand and supply estimates were included in the Public Review drafts of the 2020 UWMP and draft Appendix 11 to the 2015 UWMP that were prominently posted on Metropolitan's website in February 2021, March 2021, and April 2021.

Public Outreach during IRP/UWMP/Appendix 11/WSCP Preparation

Metropolitan involved environmental and non-governmental organizations, businesses, academia, diverse communities, and the public in the preparation of the IRP, 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP. Public outreach provides an invitation and a means for the public to provide input on the region's future water supply reliability. Metropolitan's three key objectives for public involvement in the preparation of the 2020 IRP, 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP are as follows:

- Ensure that the planning process is understandable and accessible to anyone who has an interest in Southern California's water resources and water supply reliability
- Provide opportunities for learning, dialogue, and input
- Create a pathway to encourage continued engagement in future policy discussions

"Water Tomorrow" is Metropolitan's brand to build awareness of long-range planning efforts and programs for water reliability. The website MWDWaterTomorrow.com links the IRP, 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP. It provides key information on the IRP and IRP Committee presentations, as well as notice of stakeholder workshops. Metropolitan shares news and updates about the IRP and UWMP through Metropolitan's e-newsletter and social media on several platforms. Metropolitan also provides speakers for community, governmental and business organizations throughout its service area.

To encourage public involvement during the planning process, Metropolitan held two public workshops in May 2020 using an online platform due to COVID-19 concerns. The workshops introduced the scenario planning approach and focused on drivers of change, opening up dialogue and discussion among stakeholders across the region. Over 500 stakeholders participated, sharing their ideas on what could drive future water supply and demand conditions. Throughout the planning process the public was invited to provide comments at each IRP Committee meeting and to view the presentations and listen to the board discussions.

The third outreach objective looks to the future. One of Metropolitan's overarching communication goals is to develop the general public's knowledge of water resource issues and the range of solutions available to Southern California. An informed public is better able to contribute to the discussions and understand the implications and opportunities afforded by decisions. Metropolitan is building on the momentum for the IRP, 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP planning efforts to encourage continued public involvement in water issues. Stakeholders will continue to receive updates through MWDWaterTomorrow.com, social media, and e-news.

2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP Public Notice and Adoption

CWC Section 10632 requires urban water suppliers to prepare a detailed WSCP. While the WSCP is its own independent plan that may be revised at any point in time, it is initially included as part of the 2020 UWMP.

Metropolitan provided notice of the availability of the draft 2020 UWMP (including Appendix 11 which will also be a new Appendix 11 to its 2015 UWMP) and the WSCP, and notice of the public hearing to consider adoption of both plans and Appendix 11 as an addendum to its 2015 UWMP, in accordance with CWC Sections 10621(b) and 10642, and Government Code Section 6066, and Chapter 17.5 (starting with Section 7290) of Division 7 of Title 1 of the Government Code. The public review drafts of the 2020 UWMP, Appendix 11 to the 2015 UWMP, and the WSCP were posted prominently on Metropolitan's website, mwdh2o.com, on February 1, 2021, more than 60 days in advance of the public hearing on April 12, 2021. The notice of availability of the documents was sent to Metropolitan's member agencies, as well as to cities and counties in Metropolitan's service area. In addition, a public notice advertising the public hearing in English and Spanish was published in 12 Southern California newspapers. The notification in English language newspapers was published on February 1 and 8, 2021. The notification was also published on January 28-30, 2021 and February 1, 4-6, and 8, 2021 in Spanish language newspapers, satisfying the requirement for non-English language notification. Copies of: (1) the notification letter sent to the member agencies, cities and counties in Metropolitan's service area, and (2) the notice published in the newspapers are included in this section. Table 5-3 provides a list of participating member agencies and other appropriate agencies that Metropolitan coordinated with in its regional planning, as well as the cities and counties that were notified about the preparation of its 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP. In addition, the list of newspaper publications is included in Table 5-4.

Metropolitan held the public hearing for the draft 2020 UWMP, draft Appendix 11 to the 2015 UWMP, and draft WSCP on April 12, 2021, at the Board's Water Planning and Stewardship Committee meeting, held online due to COVID-19 concerns. On May 11, 2021, Metropolitan's Board determined that the 2020 UWMP and the WSCP are consistent with the Act and accurately represent the water resources plan for Metropolitan's service area. In addition, Metropolitan's Board determined that Appendix 11 to both the 2015 UWMP and the 2020 UWMP includes all of the elements described in Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs. tit. 23, § 5003) which need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action. As stated in Resolutions 9279, 9280, and 9281, the Board adopted the 2020 UWMP, Appendix 11 to the 2015 UWMP, and the WSCP, and authorized their submittal to the State of California. Copies of Resolutions 9279, 9280, and 9281 are included in this section.

Submission and Availability of Final 2020 UWMP, Appendix 11 to 2015 UWMP, and WSCP

In fulfillment of CWC Sections 10632(c) and 10645(a) and (b), Metropolitan's final 2020 UWMP, Appendix 11 to its 2015 UWMP, and its WSCP were posted on the mwdh2o.com website in May 2021, following their adoption by the Metropolitan Board. This satisfies the requirement to make the plans available for public review and to make the WSCP available to Metropolitan's customers (which are its member agencies).

In fulfillment of CWC Sections 10632(c), 10635(c), and 10644(a)(1), Metropolitan also mailed copies of the final 2020 UWMP, Appendix 11 to the 2015 UWMP, and the WSCP (in electronic pdf format) to the California State Library and all cities and counties within Metropolitan's service area within 30 days of Board adoption.

In fulfillment of CWC Section 10621(f) and Sections 10644(a)(1), (2), and (b), Metropolitan's final 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP were electronically submitted to the State of California through DWR's WUE data website https://wuedata.water.ca.gov/secure/ in June 2021.

Table 5-2
2020-2021 Member Agency Participation

Date	Group	Topic
May 5, 2020	Member Agency UWMP Coordinators and Consultants	UWMP Member Agency Coordination Meeting #1 – Kickoff of UWMP Process
May 13, 2020	Member Agency Technical Workgroup	IRP schedule and process, drivers of change brainstorm
May 15, 2020	Member Agency Managers Meeting	IRP schedule and process, drivers of change brainstorm
June 10, 2020	Member Agency Technical Workgroup	Drivers of change survey, process for constructing scenarios
June 12, 2020	Member Agency Managers Meeting	Drivers of change survey, process for constructing scenarios
June 30, 2020	Member Agency UWMP Coordinators and Consultants	UWMP Member Agency Coordination Meeting #2 – Coordination with DWR on Guidebook Development and Reduced Delta Reliance Reporting
July 15, 2020	Member Agency Technical Workgroup	Drivers of change, qualitative and quantitative assessment
July 17, 2020	Member Agency Managers Meeting	Drivers of change, qualitative and quantitative assessment
August 5, 2020	Member Agency Technical Workgroup	Qualitative and quantitative assessment
August 6, 2020	Member Agency Managers Meeting	Qualitative and quantitative assessment
August 12, 2020	Member Agency Technical Workgroup	Qualitative and quantitative assessment
August 21, 2020	Member Agency Managers Meeting	IRP progress, draft scenario framework
August 24, 2020	Member Agency Meeting: IEUA	Coordination meeting on IEUA UWMP preparation
September 10, 2020	Member Agency Meeting: MWDOC	Kickoff meeting on UWMP preparation with MWDOC Retail Agencies
September 16, 2020	Member Agency Technical Workgroup	Draft scenario framework, narrative summaries
September 18, 2020	Member Agency Managers Meeting	Draft scenario framework, assumptions
September 28, 2020	Member Agency Meeting: SDCWA	Coordination meeting on UWMP preparation (Reduced Delta Reliance)
October 8, 2020	Member Agency UWMP and IRP Coordinators and Consultants	Technical Meeting on IRP Analysis, Local Supply Information Exchange, Reduced Delta Reliance Reporting
October 14, 2020	Member Agency Technical Workgroup	Draft scenario assumptions, preliminary analysis

Table 5-2 (continued)
2020-2021 Member Agency Participation

Date	Group	Topic
October 16, 2020	Member Agency Managers Meeting	Draft scenario assumptions, preliminary analysis
November 13, 2020	Member Agency Managers Meeting	Imported water supply analysis; preliminary results for UWMP and IRP scenarios
November 24, 2020	Member Agency Technical Workgroup	Preliminary assumptions and gap analysis for IRP scenarios
November 30, 2020	Member Agency UWMP Coordinators, Sanitation Districts, Groundwater Managers, and Stakeholders	UWMP Member Agency Coordination Meeting #3 – Discussion of Final Draft UWMP
December 11, 2020	Member Agency Managers Meeting	IRP update and preliminary results for UWMP
January 15, 2021	Member Agency Managers Meeting	UWMP update and discussion of reliability for IRP
February 12, 2021	Member Agency Managers Meeting	Scenario refinements, engaging local agencies for groundwater, surface water and local projects
February 22, 2021	Member Agency Technical Workgroup	Scenario and gap analysis refinements, engaging local agencies for groundwater, surface water and local projects; preparation for workshops with demand and climate experts
March 12, 2021	Member Agency Managers Meeting	Discussion on workshops with water demand and climate change experts
March 18, 2021	Member Agency UWMP Coordinators and Consultants	UWMP status update, Reduced Delta Reliance reporting, Understanding Alternative Forecasts and Projections for Demand on Metropolitan

Table 5-3
Water Supplier Information Exchange

6 Counties			
Los Angeles	Orange	Riverside	San Bernardino
San Diego	Ventura		
136 Cities			
Agoura Hills	Fillmore	Long Beach	Rosemead
Aliso Viejo	Fontana	Los Alamitos	San Clemente
Arcadia	Fountain Valley	Lynwood	San Dimas
Artesia	Fullerton	Malibu	San Fernando
Azusa	Garden Grove	Manhattan Beach	San Gabriel
Bell Gardens	Gardena	Maywood	San Jacinto
Bellflower	Glendale	Menifee	San Marcos
Bradbury	Glendora	Mission Viejo	San Marino
Buena Park	Hawaiian Gardens	Monrovia	Santa Ana
Burbank	Hermosa Beach	Monterey Park	Santa Fe Springs
Calabasas	Hidden Hills	Moorpark	Santa Monica
Camarillo	Huntington Beach	Murrieta	Seal Beach
Carson	Imperial Beach	National City	Sierra Madre
Chino	Industry	Newport Beach	Signal Hill
Chino Hills	Inglewood	Norco	Simi Valley
Chula Vista	Irvine	Norwalk	Solana Beach
Claremont	Irwindale	Ontario	South El Monte
Compton	La Canada Flintridge	Oxnard	South Gate
Corona	La Habra	Palos Verdes Estates	South Pasadena
Covina	La Habra Heights	Paramount	Stanton
Cudahy	La Mesa	Pasadena	Temecula
Culver City	La Mesa	Perris	Temple City
Cypress	La Mirada	Pico Rivera	Thousand Oaks
Dana Point	La Palma	Placentia	Torrance
Del Mar	La Puente	Pomona	Upland
Diamond Bar	La Verne	Port Hueneme	Ventura
Downey	Laguna Beach	Poway	Villa Park
Duarte	Laguna Hills	Rancho Cucamonga	Vista
Eastvale	Laguna Niguel	Rancho Palos Verdes	Walnut
El Cajon	Laguna Woods	Rancho Santa Margarita	West Hollywood
El Monte	Lake Elsinore	Redondo Beach	Westlake Village
El Segundo	Lake Forest	Riverside	Westminster
Encinitas	Lakewood	Rolling Hills	Whittier
Escondido	Lawndale	Rolling Hills Estates	Wildomar

Table 5-3
Water Supplier Information Exchange (continued)

26 Member Agencies			
Anaheim	Foothill MWD	Municipal Water District of Orange County	Three Valleys MWD
Beverly Hills	Fullerton	Pasadena	Torrance
Burbank	Glendale	San Diego County Water Authority	Upper San Gabriel Valley MWD
Calleguas MWD	Inland Empire Utilities Agency	San Fernando	West Basin MWD
Central Basin MWD	Las Virgenes MWD	San Marino	Western MWD
Compton	Long Beach	Santa Ana	
Eastern MWD	Los Angeles	Santa Monica	
9 Groundwater Basin Management Organizations			
Santa Margarita River Watermaster	Ventura County Watershed Protection District	Water Replenishment District	Upper Los Angeles River Area Watermaster
San Bernardino County Flood Control District	Chino Basin Watermaster	Main San Gabriel Basin Watermaster/	Orange County Water District
Raymond Basin Management Board			
Other Agencies / Planning Organizations			
Los Angeles County Sanitation Districts	City of Los Angeles Bureau of Sanitation	Southern California Association of Governments	Western Riverside Council of Governments
Orange County Sanitation District	City of San Diego Metropolitan Wastewater Department	City of San Diego Recycled Water Section Public Utilities Department	San Diego Association of Governments
California State Water Contractors			

Table 5-4
Newspaper Publication of Public Hearing Notification

English Language Newspapers		
Los Angeles County	Los Angeles Times	February 1 and 8, 2021
Orange County	Orange County Register	February 1 and 8, 2021
San Bernardino	Inland Valley Daily Bulletin	February 1 and 8, 2021
Ventura County	Ventura County Star	February 1 and 8, 2021
Riverside County	Press Enterprise	February 1 and 8, 2021
San Diego County	San Diego Union Tribune	February 1 and 8, 2021
Spanish Language Newspapers		
Los Angeles County	La Opinion	February 1 and 8, 2021
Orange County	Excelsior	January 29, 2021 and February 5, 2021
San Bernardino	El Chicano	January 28, 2021 and February 4, 2021
Ventura County	VIDA Ventura County	January 28, 2021 and February 4, 2021
Riverside County	La Prensa Hispana	January 29, 2021 and February 5, 2021
San Diego County	Fronteras	January 30, 2021 and February 6, 2021

(Notification per California Water Code § 10621(b) and § 10642)
Letter Notifying Cities and Counties

February 1, 2021 [Sent via US Mail to Member Agencies, City Managers, and County Administrators]

Notice of Public Hearing on The Metropolitan Water District of Southern California's Draft 2020 Urban Water Management Plan (UWMP), Draft Appendix 11 to the 2015 UWMP, and Draft Water Shortage Contingency Plan

The Metropolitan Water District of Southern California (Metropolitan) cordially invites you to participate and provide comments at a public hearing on the draft 2020 Urban Water Management Plan (UWMP), draft Appendix 11 as an addendum to the 2015 UWMP, and draft Water Shortage Contingency Plan (WSCP). The UWMP presents Metropolitan's long-term plan for ensuring water supply reliability and water quality for the region. The draft 2020 UWMP complies with California state law requiring urban water suppliers to prepare and update urban water management plans every five years. The draft WSCP includes Metropolitan's efficient management and planned actions to respond to actual water shortage conditions. Metropolitan's WSCP satisfies the requirements of the California Water Code. The draft Appendix 11 to both the 2015 UWMP and the 2020 UWMP includes all of the elements described in Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs. tit. 23, § 5003) which need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action. The hearing will be held as part of the meeting of the Water Planning and Stewardship Committee whose board members are helping to shape a public dialogue on the future of water management and conservation in the region. The meeting details are as follows:

> **Water Planning and Stewardship Committee Meeting**
> **Monday, April 12, 2021 at 10:00 AM**
> **(expected time; please confirm time 7 days prior to meeting)**
> **Teleconference Participation Only**
> **No Physical Meeting Location**
>
> As a result of the COVID-19 emergency and the Governor's Executive Orders to protect public health by limiting public gatherings and requiring social distancing, at this time, this meeting is scheduled to occur via remote presence.
>
> The Water Planning and Stewardship Committee meeting will be live streamed and recorded and may be accessed using the following link:
> http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Pages/default.aspx.
> (Please check this website for final time of the Public Hearing.)

The draft 2020 UWMP, draft Appendix 11 to the 2015 UWMP, and draft WSCP are posted on Metropolitan's website, mwdh2o.com, for your review. Public input is encouraged and will be considered during finalization of the 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP. Written comments are due by **April 12, 2021**.

If you would like to get more information or send comments, please contact Edgar Fandialan at efandialan@mwdh2o.com.

Very Truly Yours,
Brad Coffey
Manager, Water Resource Management Group

(Published on February 1 and 8, 2021 for English language newspapers and January 28-30, 2021 and February 1, 4-6, and 8, 2021 for Spanish language newspapers per California Water Code § 10642, Government Code § 6066, and Chapter 17.5 of the Government Code)

PUBLIC HEARING SCHEDULED ON

DRAFT 2020 URBAN WATER MANAGEMENT PLAN, DRAFT APPENDIX 11 TO 2015 URBAN WATER MANAGEMENT PLAN, AND DRAFT WATER SHORTAGE CONTINGENCY PLAN

The Metropolitan Water District of Southern California (Metropolitan) will hold a public hearing on **Monday, April 12, 2021** to receive comments on its draft 2020 Urban Water Management Plan (UWMP), draft Appendix 11 as an addendum to its 2015 UWMP, and its draft Water Shortage Contingency Plan (WSCP).

The hearing will be held as part of the meeting of the Water Planning and Stewardship Committee whose board members are helping to shape a public dialogue on the future of water management and conservation in the region. The meeting is at:

Water Planning and Stewardship Committee Meeting
Monday, April 12, 2021 at 10:00 AM
Teleconference Participation Only
No Physical Meeting Location

As a result of the COVID-19 emergency and the Governor's Executive Orders to protect public health by limiting public gatherings and requiring social distancing, at this time, this meeting is scheduled to occur via remote presence.

The Water Planning and Stewardship Committee meeting will be live streamed and recorded and may be accessed using the following link:
http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Pages/default.aspx.
(Please check this website for final time of the Public Hearing.)

The UWMP presents Metropolitan's long-term plan for ensuring water supply reliability and water quality for the region. The draft 2020 UWMP complies with California state law requiring urban water suppliers to prepare and update urban water management plans every five years. The draft Appendix 11 to both the 2020 UWMP and the 2015 UWMP includes all of the elements described in Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs. tit. 23, § 5003) which need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action. The draft WSCP includes Metropolitan's efficient management and planned actions to respond to actual water shortage conditions. Metropolitan's draft WSCP satisfies the requirements of the California Water Code.

The draft 2020 UWMP, draft Appendix 11, and the draft WSCP are available on Metropolitan's website, mwdh2o.com. Public input is encouraged and will be considered during finalization of the 2020 UWMP, Appendix 11, and the WSCP. Metropolitan will accept written comments on the draft plans and draft Appendix 11. All written comments must be received by **April 12, 2021**.

To send comments or for more information on the draft 2020 UWMP, draft Appendix 11, and draft WSCP, please contact Edgar Fandialan of Metropolitan's Water Resource Management Group at efandialan@mwdh2o.com.

Resolution Adopting the 2020 Urban Water Management Plan

Resolution 9279

RESOLUTION
OF THE BOARD OF DIRECTORS
OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
ADOPTING THE 2020 URBAN WATER MANAGEMENT PLAN

WHEREAS, the Urban Water Management Planning Act requires urban water suppliers providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually to prepare and adopt, in accordance with prescribed requirements, an urban water management plan every five years; and

WHEREAS, the Urban Water Management Planning Act specifies the requirements and procedures for adopting such urban water management plans; and

WHEREAS, the Board of Directors of The Metropolitan Water District of Southern California has duly reviewed, discussed, and considered the 2020 Urban Water Management Plan and has determined the 2020 Urban Water Management Plan to be consistent with the Urban Water Management Planning Act and to be an accurate representation of the water resources plan for The Metropolitan Water District of Southern California.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of The Metropolitan Water District of Southern California that, on May 11, 2021, this District hereby adopts this 2020 Urban Water Management Plan for submittal to the State of California.

I HEREBY CERTIFY that the foregoing is a full, true and correct copy of a resolution adopted by the Board of Directors of The Metropolitan Water District of Southern California, at its meeting held on May 11, 2021.

Judy Abdo

Secretary of the Board of Directors
of The Metropolitan Water District
of Southern California

Resolution Adopting the Appendix 11 Addendum to the 2015 Urban Water Management Plan

Resolution 9280

**RESOLUTION
OF THE BOARD OF DIRECTORS
OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
ADOPTING APPENDIX 11 AS AN ADDENDUM TO THE 2015 URBAN WATER MANAGEMENT PLAN**

WHEREAS, the Urban Water Management Planning Act requires urban water suppliers providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually to prepare and adopt, in accordance with prescribed requirements, an urban water management plan every five years; and

WHEREAS, the Urban Water Management Planning Act specifies the requirements and procedures for amending and adopting such urban water management plans; and

WHEREAS, the Board of Directors of The Metropolitan Water District of Southern California has duly reviewed, discussed, and considered Appendix 11 as an addendum to Metropolitan's 2015 Urban Water Management Plan and has determined Appendix 11 to be consistent with the Urban Water Management Planning Act and includes all of the elements described in Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs., tit. 23, § 5003, subd. (c)(1)) which need to be included in a water supplier's urban water management plan to support a certification of consistency for one or more future water supply covered actions in the Sacramento-San Joaquin Delta.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of The Metropolitan Water District of Southern California that, on May 11, 2021, this District hereby adopts this Appendix 11 to the 2015 Urban Water Management Plan for submittal to the State of California.

I HEREBY CERTIFY that the foregoing is a full, true and correct copy of a resolution adopted by the Board of Directors of The Metropolitan Water District of Southern California, at its meeting held on May 11, 2021.

Judy Abdo

Secretary of the Board of Directors
of The Metropolitan Water District
of Southern California

Resolution Adopting the Water Shortage Contingency Plan

Resolution 9281

RESOLUTION
OF THE BOARD OF DIRECTORS
OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
ADOPTING THE WATER SHORTAGE CONTINGENCY PLAN

WHEREAS, the Urban Water Management Planning Act requires urban water suppliers providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually to prepare and adopt, in accordance with prescribed requirements, a water shortage contingency plan;

WHEREAS, the Urban Water Management Planning Act specifies the requirements and procedures for adopting such Water Shortage Contingency Plans;

WHEREAS, the Urban Water Management Planning Act requires urban water suppliers to conduct an annual water supply and demand assessment (Annual Assessment) each year and to include in their water shortage contingency plans the procedures they use to conduct the Annual Assessment;

WHEREAS, the procedures used to conduct an Annual Assessment include, but are not limited to, the written decision-making process that an urban water supplier will use each year to determine its water supply reliability;

WHEREAS, The Metropolitan Water District of Southern California's (Metropolitan's) water shortage contingency plan provides that by June of each year, Metropolitan staff will present a completed Annual Assessment for approval by Metropolitan's Board of Directors or by the Board's authorized designee with expressly delegated authority for approval of Annual Assessment determinations;

and

WHEREAS, the Board of Directors of The Metropolitan Water District of Southern California has duly reviewed, discussed, and considered such Water Shortage Contingency Plan and has determined the Water Shortage Contingency Plan to be consistent with the Urban Water Management Planning Act and to be an accurate representation of the planned actions during shortage conditions for The Metropolitan Water District of Southern California.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of The Metropolitan Water District of Southern California that, on May 11, 2021, this District hereby adopts this Water Shortage Contingency Plan for submittal to the State of California and expressly authorizes the General Manager of The Metropolitan Water District of Southern California to approve the Annual Assessment each year.

I HEREBY CERTIFY that the foregoing is a full, true and correct copy of a resolution adopted by the Board of Directors of The Metropolitan Water District of Southern California, at its meeting held on May 11, 2021.

Judy Abdo

Secretary of the Board of Directors
of The Metropolitan Water District
of Southern California

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Appendix 1

DEMAND FORECAST

Appendix 1
DEMAND FORECAST

Forecast Overview

Retail water demand forecasting is essential for planning total water requirements in Metropolitan's service area. Retail water demand can be met with conservation, local supplies, or imported supplies. As a wholesale imported water supplier, Metropolitan's long-term plans focus on the future demands for Metropolitan's supplies. In order to project the need for resources and system capacity, Metropolitan begins with a long-term projection of retail water demands.

Total retail demands include:

- Retail Municipal and Industrial (M&I) — Retail M&I demands represent urban water use within the region including residential, commercial, industrial, and institutional water uses. To forecast retail M&I demands, Metropolitan uses econometric models that have been adapted for conditions in Southern California. The econometric models are statistical models that can capture and explain the impacts of long-term socioeconomic trends on retail M&I demands. The econometric models incorporate projections of demographic and economic variables from regional transportation planning agencies to produce forecasts of water demand.
- Retail Agricultural Demand — Retail agricultural demands consist of water use for irrigating crops. Metropolitan's member agencies provide projections of agricultural water use based on many factors, including farm acreage, crop types, historical water use, and land use conversion. Metropolitan relies on member agencies' projections of agricultural demands.
- Seawater Barrier Demand — Seawater barrier demands represent the amount of water needed to hold back seawater intrusion into the coastal groundwater basins. Groundwater management agencies determine the barrier requirements based on groundwater levels, injection wells, and regulatory permits.
- Replenishment Demand — Replenishment demands represent the amount of water member agencies plan to use to replenish their groundwater basins in order to maintain sustainable basin health and production.

Retail M&I Demand Forecast

In forecasting retail M&I water demand, Metropolitan utilizes an econometric model (the Metropolitan Water District – Econometric Demand Model or MWD-EDM) developed by The Brattle Group (January 2015). MWD-EDM utilizes multiple regression, which is generally favored by academics and practitioners for long-term water demand analysis. It uses demand relationships based on actual observed behavior to consider the effect of anticipated changes in demand factors on long-term demand.

MWD-EDM is comprised of three separate regression models described below. Each model is developed using historical water consumption, socio-demographic, and economic data specific to the sector:

- Single-Family Residential (SFR) Model — SFR water demand is modeled as a function of price, weather, retailer level housing, socio-demographic characteristics, and member agency level fixed effects. The model used water consumption data from 153 retailers with 3,000 accounts or more in Metropolitan's service area. The dataset, ranging from 1994 to 2011, consisted of 1,225 observations and represented 80 percent of all SFR accounts from all 26 Metropolitan member agencies.

- Multi-family Residential (MFR) Model — MFR demand is modeled as a function of price, retailer level housing, socio-demographic characteristics, and member agency level fixed effects. Water consumption data, ranging from 1994 to 2011, was collected from 53 water retailers consisting of 469 observations and representing 23 out of 26 Metropolitan member agencies.
- Commercial, Industrial, and Institutional (CII) Model — CII demand is modeled as a function of price, weather, employment, the share of employment in the manufacturing sector, and member agency level fixed effects. Water consumption data, ranging from 1994 to 2011, was collected from 75 water retailers consisting of 709 observations and representing 25 out of 26 Metropolitan member agencies.

The SFR and MFR models forecast average monthly household consumption before conservation, while the CII model forecasts average monthly consumption per employee. Table A.1-1 shows the dependent and the covariates uses in the econometric models for each sector.

Table A.1-1
MWD-EDM Variables

Sector	Dependent Variable	Independent Variable (Covariate)
SFR	Water-Use Per Household	Total Average Cost Total Average Cost x Median Lot Size Annual precipitation Average Max Temperature Median Income Average Household Size Median Lot Size
MFR	Water-Use Per Household	Median Tier Price Median Income Median Lot Size Average Household Size
CII	Water-Use Per Employee	Median Tier Price Cooling Degree Days Average Max Temperature Share of Employment In Manufacturing Median Tier Price x Share of Manufacturing

Total retail M&I demand is the product of projected household/employee and the average monthly consumption.

Price Elasticity

Price elasticity of demand is a measure used in economics to show the responsiveness of the quantity of water demanded to a change in its price. The assumed price increase reduces the water use. This reduction can be assessed in MWD-EDM and is considered a conservation savings due to price or "price-effect." Consumers can respond to price increases by installing water-conserving fixtures and appliances such as high-efficiency toilets. However, many of the fixture-based conservation savings options are already factored into Metropolitan's Conservation Savings Model. As more water efficient fixtures are installed, the impact of changing water using behavior through price or rates is reduced. Consider consumers who respond to rate increases by taking shorter showers. Their behavior adjustment will save less water if they use a water-efficient low-flow showerhead compared to a regular showerhead. This effect is known as demand hardening. In order to avoid double-counting conservation savings and account for demand hardening, the impact of price elasticity is reduced. In MWD-EDM, price elasticity is adjusted by 33 percent in 2019 and 66 percent by 2045. Price-effect savings are reduced (and demands increased) as a result of this adjustment. The elasticity is reduced in proportion to increases in conservation savings from the conservation model. Reducing price elasticity to 1/3 of its originally estimated levels is based on professional judgment, assuming that much of the easily obtained water use efficiencies will be achieved by 2020 but allowing for new conservation technologies.

Fixed Effects

MWD-EDM forecasts retail M&I demand for each of the 26 member agencies. To account for the differences observed between each agency, MWD-EDM uses the fixed effects or the constant term that represents the member agency specific intercepts that account for all time-invariant unobserved factors common to an agency.

Demographics

Demographics are recognized by the water industry as drivers of water demand. Metropolitan's retail demand modelling is driven by key demographics such as projected population, households, employment, and median household income.

Metropolitan uses demographic growth projections produced by two regional transportation planning agencies: Southern California Association of Governments (SCAG) and San Diego Association of Governments (SANDAG). Together they represent more than 200 cities in Southern California and produce long-term transportation plans for sustainable communities. Among other responsibilities, SCAG and SANDAG also prepare projections of population, households, income, and employment for their regions. Both planning agencies update their regional growth forecasts approximately every four years, at different times. SCAG is the regional planning agency for six counties: Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura. SANDAG is the regional planning agency for San Diego County. Significantly, SCAG's and SANDAG's official growth projections are backed by environmental reports. These regional growth forecasts provide the core assumptions underlying Metropolitan's retail demand forecasting model.

In May 2020, SCAG approved the 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) for federal transportation conformity purposes, certified the Connect SoCal program environmental impact report (PEIR), and delayed for up to 120 days approval of the plan for other purposes primarily due to the COVID-19 pandemic. This enabled SCAG to submit the plan to the Federal Highway Administration and Federal Transit Administration for review prior to the June 1, 2020, deadline, as required by the federal Clean Air Act. SCAG subsequently approved Connect SoCal in its entirety in September 2020. SCAG's related growth forecast (RTP-20) projects growth in employment, population, and households at the regional, county, jurisdictional, and sub-jurisdictional levels. The regional and county growth forecasts reflect recent and past trends and expert-derived demographic and economic assumptions for Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura Counties. Metropolitan uses the forecast for every county except Imperial, which is outside of Metropolitan's service area. In preparing its demographic and growth forecast, Metropolitan relied on SCAG's 2020 Demographics and Growth Forecast Proposed Final Technical Report to the RTP/SCS. The report includes information on social factors affecting water management such as race, ethnicity, and cultures. As noted in SCAG's report, Southern California is one of the most diverse regions in the nation in race and ethnicity. Race and ethnicity are important for demographers to consider while forecasting since fertility and household formation have strong cultural underpinnings that vary based on these categories.

In October 2019, SANDAG adopted the San Diego Forward: The 2019 Federal Regional Transportation Plan that utilized Version 17 of the SANDAG Series 14 Regional Growth Forecast (SANDAG Series 14). The forecast is a comprehensive projection of the regional demographic, economic, and housing trends for the San Diego region that was developed through a collaborative effort with experts in demography, housing, the economy and other disciplines, and the close cooperation of the local planning directors and their staff. Metropolitan uses the forecast for the San Diego County Water Authority's service area in the retail demand forecast.

Effects of the COVID-19 Pandemic on SCAG's and SANDAG's Forecasts

Both SCAG and SANDAG's forecasts were developed prior to the advent of the COVID-19 global pandemic. For this reason, assumptions about the pandemic's effects on future growth are not reflected in the demographic forecast data used in this UWMP. Although long-term impacts are extremely uncertain, the region is currently experiencing acute and potentially lasting disruptions across a wide range of economic and lifestyle activities that in turn may unsettle pre-pandemic expectations for future household formation, migration, fertility, and life expectancy.

After approving Connect SoCal in May 2020 for the limited purpose of federal air quality conformity, SCAG engaged in a stakeholder outreach process to learn more from stakeholders about how they have been impacted by COVID-19 and learn how Connect SoCal could be better positioned as a tool for recovery and regional resilience. Activities included engagement with regional planning working groups, direct outreach to stakeholders, focus groups with community-based organizations, a public survey, and a public virtual townhall. Given the living nature of Connect SoCal and its existing focus on the need to develop regional resilience strategies targeting vulnerable communities, SCAG staff did not recommend specific modifications or clarifications to Connect SoCal in response to the pandemic at the time. Rather, staff recommended that policy changes and plan updates be considered through future board action informed by its implementation planning and regular processes for updating the Regional Transportation Plan/Sustainable Communities Strategy. With its September 2020 final adoption, SCAG accepted the Connect SoCal in its entirety without substantive changes to the growth forecast.

Forecasts Used by Metropolitan

Metropolitan uses the forecast approved by SCAG in May 2020. During the period between May and September 2020, the cities of Anaheim, Chino, Duarte, Malibu, and some unincorporated areas of Los Angeles and San Bernardino counties made adjustments to the forecast to reflect changes in their general plan capacities and entitlements. The total household change resulted in 0.29% of the region's Transportation Analysis Zones (TAZ) and jobs were shifted in 0.77% of TAZs. Given the timing and the small scale change in the forecast, Metropolitan continues to use the May 2020 release for its planning activities. For the San Diego region, Metropolitan uses a version of SANDAG Series 14 provided by the San Diego County Water Authority.

Trends in Southern California

Population

According to the California Department of Finance, the population in Metropolitan's service area was approximately 19.0 million in 2020. SCAG and SANDAG estimate the population in Metropolitan's service area will reach 20.1 million in 2025 and 22.0 million by 2045. The historical and projected population for the service area, by county, is shown in Figure A.1-1. While Los Angeles County leads in total population, the inland areas of Riverside and San Bernardino counties are projected to grow at the fastest rates over the next ten years. Generally speaking, however, annual growth rates will slow for all counties between 2010 and 2045. In part, this is due to changing patterns of migration, as well as aging of the overall population. It also reflects the effects of the recession of the late 2000s and the ongoing restructuring of the Southern California economy.

Employment

Within Metropolitan's service area, employment growth is likely to occur unevenly across the six counties. Over the 25-year period between 2020 and 2045, the greatest employment increases are expected to occur in Riverside, Los Angeles, and San Diego Counties with estimated increases of 208, 375, and 237 thousand jobs respectively. Relative to existing employment, Riverside and San Bernardino counties are expected to have the highest rates of employment growth.

Figure A.1-2 and Table A.1-3 summarize the projected growth of commercial, industrial, and institutional employment in Metropolitan's service area. The 2020 urban employment number includes the effects of the COVID-19 pandemic based on analysis by the California Employment Development Department (EDD). The EDD estimated a 7 percent decrease in employment in Metropolitan's service area from 2019 to 2020. Employment projections for 2021 through 2023 are based on recovery rates from the UCLA Anderson Forecast. Long-term employment is based on SCAG and SANDAG's forecasts. Total urban employment is expected to increase from 8.6 million in 2020 to about 10.3 million in 2045. This increase of about 12 percent is less than the projected population increase of 14 percent, suggesting a slight decrease in the employed population over time due to aging population.

Figure A.1-1 Actual and Projected Population

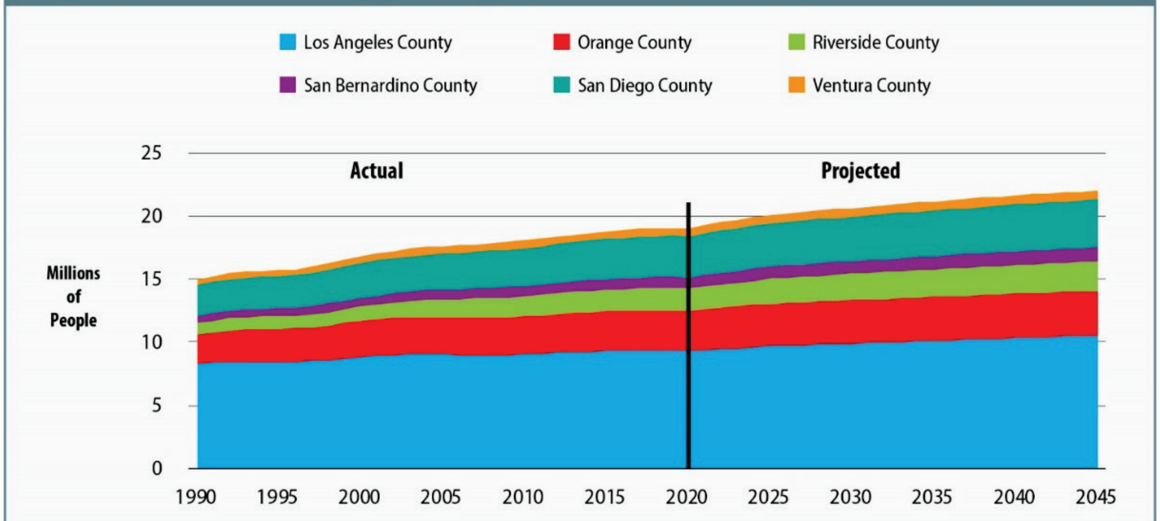
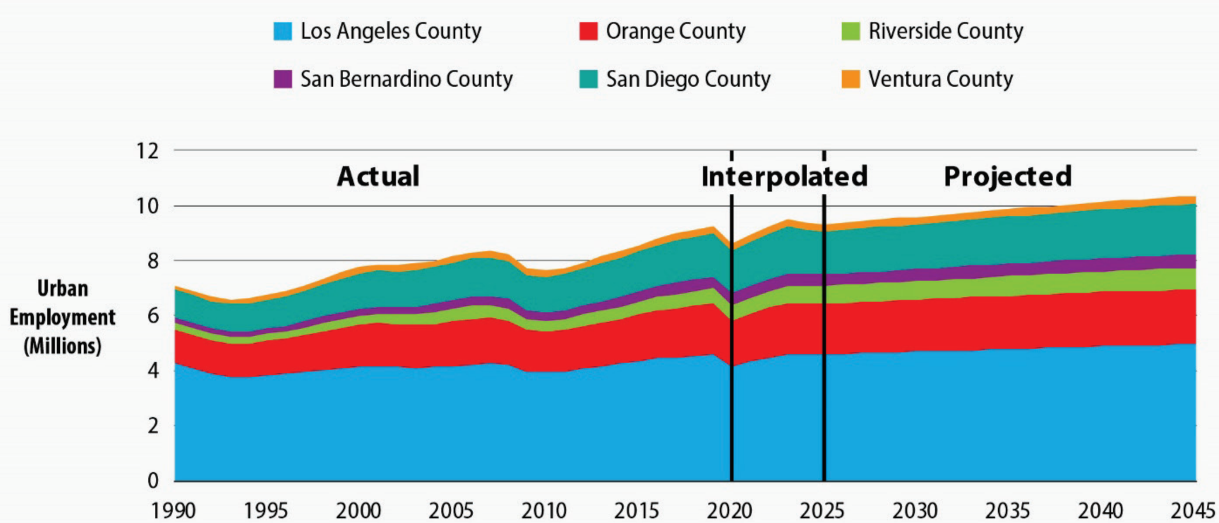


Figure A.1-2 Actual and Projected Urban Employment



Residential Consumers

Southern California's regional planning agencies have forecast residential housing growth in all parts of the Metropolitan service area. These forecasts are shown in Figure A.1-3 and Table A.1-4. The total occupied housing stock is expected to increase more than 20 percent between 2020 and 2045, growing from 6.3 to around 7.6 million households. Much of this growth will likely occur in hotter inland areas of Southern California. Within the service territory, the household occupancy size (household population divided by total occupied dwelling units) is projected to decline slightly from about 3.0 persons per unit currently to 2.9 persons per unit by 2045.

Permits for new residential housing construction are another indicator of the future growth in water demand. Figure A.1-4 shows the pattern of historical growth in residential housing permits between 1970 and 2019. The effect of economic cycles can clearly be seen over time with the precipitous fall in housing construction during the 2007 to 2010 recession being most notable. Overall housing construction has made a modest recovery since 2011. However, in a departure from the previous trend since the late 1980s that favored single-family homes, new dwellings built since 2011 have been mostly multifamily units.

Figure A.1-3 Actual and Projected Households

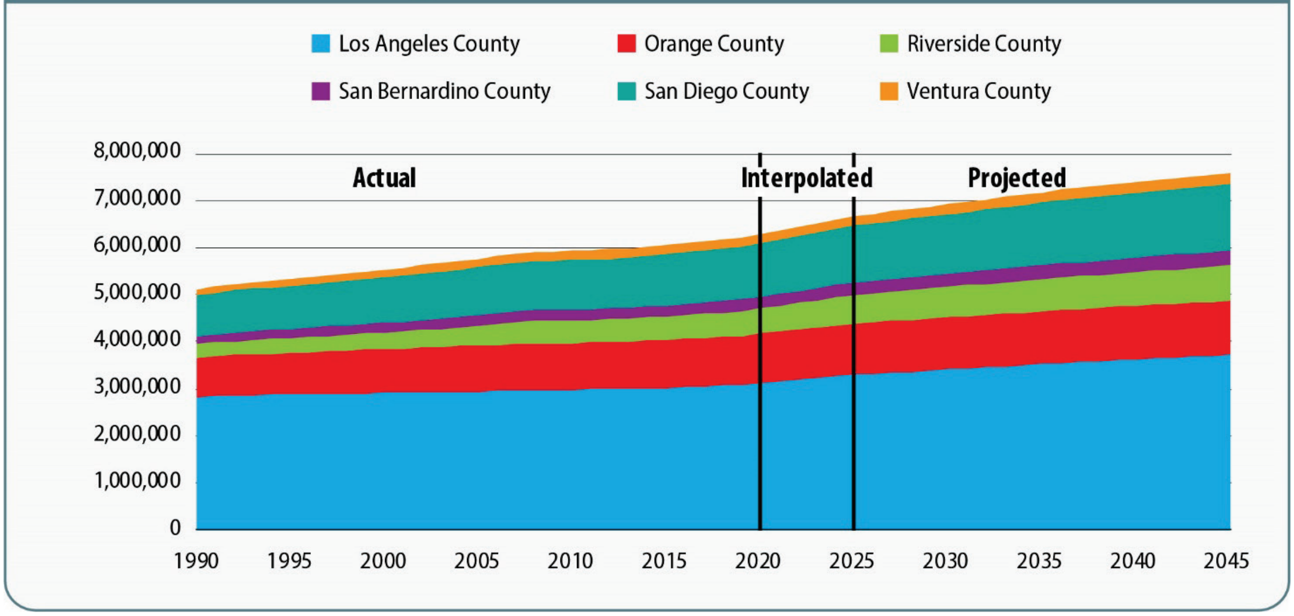
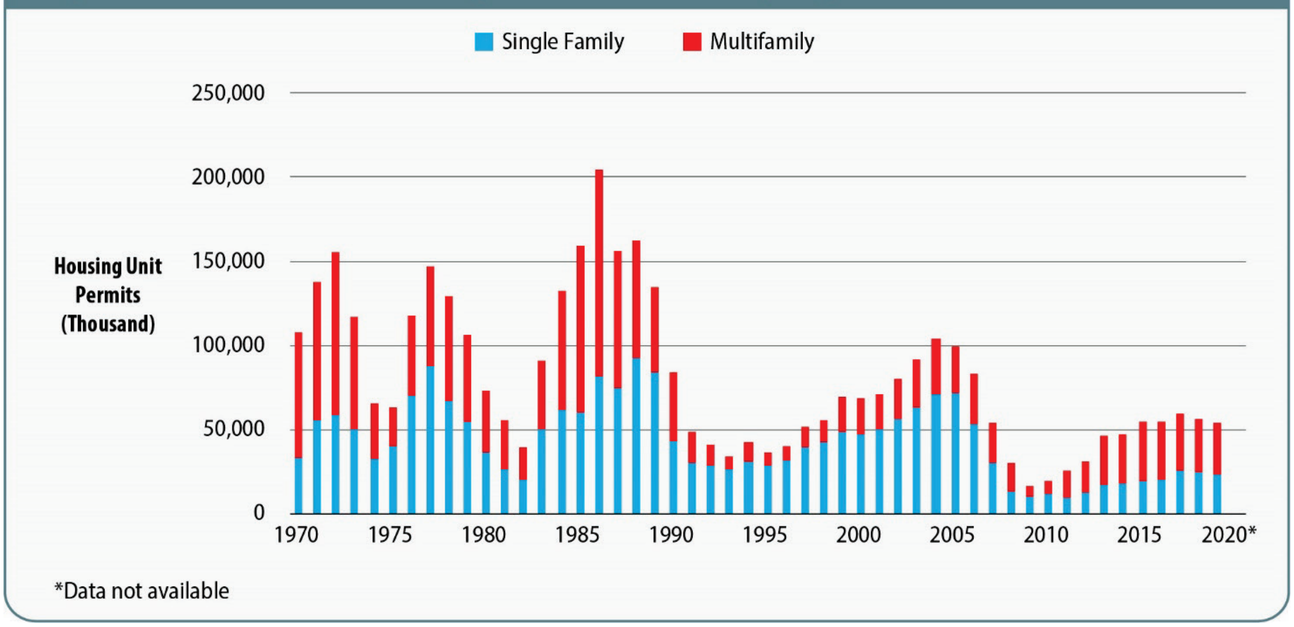


Figure A.1-4 Residential Housing Permits in Six-County Region



Water Demands

As shown in Figure A.1-5, actual retail municipal and industrial (M&I) water demands in 2019 were 2.92 million acre-feet (MAF), which is approximately the same as in 1983. This is due to a number of factors including a higher than normal precipitation, an aggressive outreach campaign and mandatory water use restriction in 2015. Water demand in 2020 is estimated to be 3.1 MAF. In addition, agricultural water use is estimated to be 144 TAF. Similar to M&I demand, agricultural demand was also impacted ty the 2015 drought restriction. By 2045, under average conditions, retail agricultural demand is expected to be about 123 TAF.

Retail Demand

It is estimated that total M&I water use will grow from 3.1 MAF in 2020 to 3.5 MAF in 2045. All water demand projections assume normal weather conditions. Future changes in estimated water demand assume continued water savings due to conservation measures such as water savings resulting from plumbing codes, price effects, and the continuing implementation of utility-funded conservation BMPs. Retail demand was greatly reduced in 2015 due to extraordinary response to statewide calls for a 25 percent reduction in water use in light of historic drought conditions. Between 2020 and 2045, regional water use will grow slowly as driven by population and economic growth while water use efficiency increases.

By County

M&I water demand is not expected to grow uniformly across counties. Consistent with the general pattern of future demographic distributions, the largest absolute increases in urban water demands are expected to occur in Los Angeles and Riverside Counties, with respective estimated increases of about 109 TAF and 108 TAF between 2020 and 2045.

By Sector

Water use can also be broken down by sector. Between 2020 and 2045, single-family residential water use is expected to increase by 9 percent (Table A.1-8), while multifamily water use is estimated to increase by 28 percent (Table A.1-9). Table A.1-10 shows estimated nonresidential water use decreasing by 5 percent between 2020 and 2045.

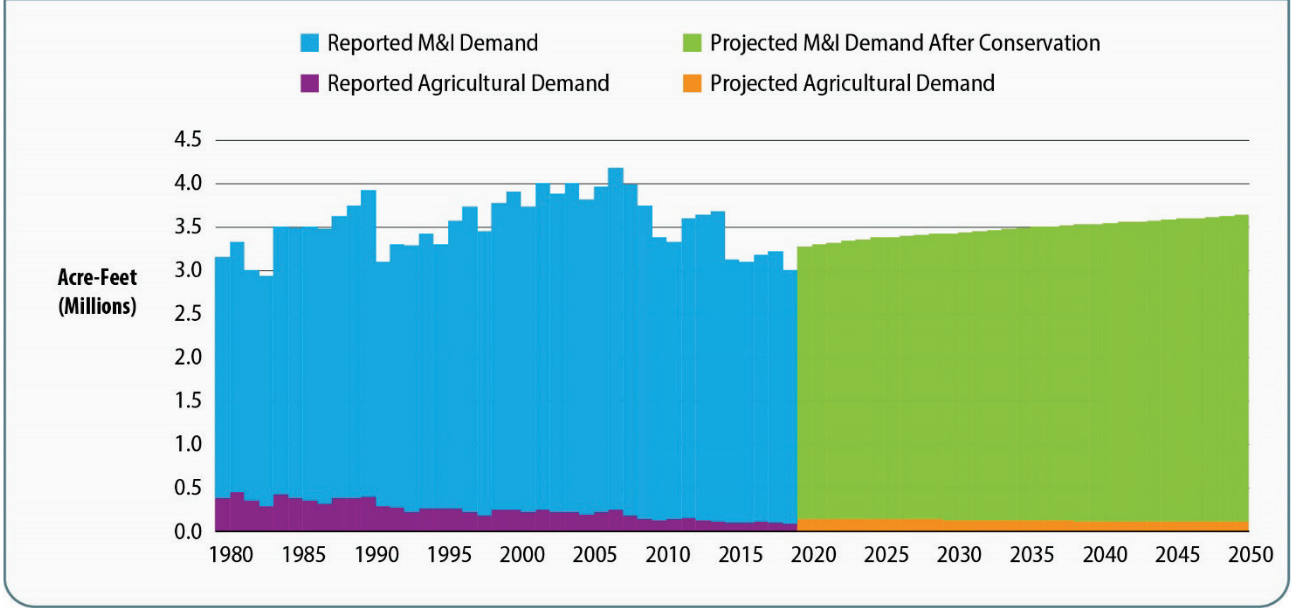
Residential Water Use

While single-family homes are estimated to account for about 60 percent of the total occupied household in 2020, they are responsible for about 75 percent of total residential water demands (Tables A.1-8 and A.1-9). This is consistent with the fact that single-family households are known to use more water than multifamily households (e.g., those residing in duplexes, triplexes, apartment buildings and condo developments) on a per housing-unit basis. This is because single-family households tend to have more persons living in the household; they are likely to have more water-using appliances and fixtures; and they tend to have more landscaping.

Nonresidential Water Use

Nonresidential water use represented approximately 18 percent of the total M&I demands in Metropolitan's service area in 2020 (Table A.1-10). This includes water that is used by businesses, services, government, institutions (such as hospitals and schools), and industrial (or manufacturing) establishments. Within the commercial/institutional category, the top water users include schools, hospitals, hotels, amusement parks, colleges, laundries, and restaurants. In Southern California, major industrial users include electronics, aircraft, petroleum refining, beverages, food processing, and other industries that use water as a major component of the manufacturing process.

Figure A.1-5 Actual and Projected Retail Water Demand



Conservation Savings

Table A.1-12 shows estimated conservation savings resulting from active conservation programs ("Active"), ongoing conservation from natural replacement of plumbing fixtures ("Code-Based"), and conservation induced by projected increases in the real price of water ("Price"). Code-Based savings account for the largest share of total conservation. However, aggressive utility-funded conservation programs have made a significant contribution in this area. For example, Metropolitan-assisted programs were responsible for an estimated 213 TAF in savings during FY 2019-20 and nearly 3.27 MAF in cumulative conservation savings since FY 1990/91.

Projected M&I Demand by Sector

Table A.1-13 provides a summary of municipal and industrial demands, broken down by sector, along with each sector's share of total retail demand. In 2020, residential use accounted for about 82 percent of total projected M&I demand, while non-residential use constituted nearly 18 percent of projected M&I demand. These shares are projected to have a slight increase on residential and a slight decrease on CII by about 2 percent in 2045. System losses and unmetered use are expected to remain relatively constant over this period at about 5 percent.

Table A.1-2 Population Growth in Metropolitan's Service Area (July)

(Acre-feet)

	Actual				Estimated			Projected		
County	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
Los Angeles County	8,833,000	9,025,000	9,010,000	9,277,000	9,275,000	9,692,000	9,894,000	10,118,000	10,332,000	10,538,000
Orange County	2,854,000	2,954,000	3,012,000	3,148,000	3,184,000	3,353,000	3,433,000	3,491,000	3,524,000	3,527,000
Riverside County	1,120,000	1,409,000	1,620,000	1,719,000	1,813,000	1,987,000	2,105,000	2,191,000	2,271,000	2,344,000
San Bernardino County	706,000	783,000	810,000	843,000	872,000	946,000	987,000	1,031,000	1,075,000	1,119,000
San Diego County	2,730,000	2,863,000	2,989,000	3,169,000	3,261,000	3,442,000	3,536,000	3,624,000	3,709,000	3,789,000
Ventura County	541,000	583,000	616,000	635,000	630,000	669,000	679,000	690,000	699,000	709,000
Metropolitan's Service Area	**16,784,000**	**17,617,000**	**18,057,000**	**18,791,000**	**19,035,000**	**20,089,000**	**20,634,000**	**21,145,000**	**21,610,000**	**22,026,000**

Source: US Census, CA Department of Finance, SCAG's 2020 Regional Transportation Plan (RTP-20) and SANDAG's Series 14 Growth Forecast (version 17).
Growth forecasts do not include COVID-19 impacts.
Note: Totals may not foot due to rounding differences

Table A.1-3 Urban Employment Growth in Metropolitan's Service Area (July)

(Acre-feet)

	Actual				Estimated			Projected		
County	2000	2005	2025	2025	2025	2025	2025	2035	2040	2045
Los Angeles County	4,180,000	4,163,000	3,945,000	4,351,000	4,164,000	4,602,000	4,696,000	4,795,000	4,900,000	4,977,000
Orange County	1,498,000	1,618,000	1,482,000	1,677,000	1,656,000	1,833,000	1,884,000	1,926,000	1,958,000	1,979,000
Riverside County	346,000	451,000	401,000	488,000	582,000	641,000	675,000	711,000	752,000	787,000
San Bernardino County	255,000	322,000	302,000	366,000	402,000	422,000	441,000	459,000	478,000	497,000
San Diego County	1,258,000	1,358,000	1,296,000	1,450,000	1,531,000	1,558,000	1,626,000	1,700,000	1,766,000	1,822,000
Ventura County	218,000	235,000	221,000	238,000	239,000	251,000	257,000	263,000	268,000	272,000
Metropolitan's Service Area	**7,755,000**	**8,147,000**	**7,647,000**	**8,570,000**	**8,574,000**	**9,307,000**	**9,579,000**	**9,854,000**	**10,122,000**	**10,334,000**

Source: US Census, CA Department of Finance, SCAG's 2020 Regional Transportation Plan (RTP-20) and SANDAG's Series 14 Growth Forecast (version 17).
Growth forecasts do not include COVID-19 impacts.
Note: Totals may not foot due to rounding differences

Table A.1-4 Occupied Housing Growth in Metropolitan's Service Area

(Acre-feet)

	Actual				Estimated			Projected		
County	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
Los Angeles County	2,909,000	2,944,000	2,981,000	3,017,000	3,113,000	3,300,000	3,408,000	3,520,000	3,622,000	3,720,000
Orange County	937,000	974,000	993,000	1,017,000	1,057,000	1,089,000	1,103,000	1,124,000	1,143,000	1,154,000
Riverside County	357,000	432,000	484,000	504,000	539,000	609,000	655,000	688,000	719,000	746,000
San Bernardino County	204,000	220,000	232,000	238,000	249,000	269,000	282,000	295,000	309,000	323,000
San Diego County	963,000	1,016,000	1,045,000	1,081,000	1,131,000	1,195,000	1,265,000	1,335,000	1,389,000	1,427,000
Ventura County	170,000	185,000	195,000	199,000	203,000	209,000	213,000	218,000	221,000	224,000
Metropolitan's Service Area	**5,540,000**	**5,771,000**	**5,930,000**	**6,056,000**	**6,292,000**	**6,671,000**	**6,926,000**	**7,180,000**	**7,403,000**	**7,594,000**

Source: US Census, CA Department of Finance, SCAG's 2020 Regional Transportation Plan (RTP-20) and SANDAG's Series 14 Growth Forecast (version 17).
Growth forecasts do not include COVID-19 impacts.
Note: Totals may not foot due to rounding differences

Table A.1-5 Total Retail Demand in Metropolitan's Service Area with Conservation

(Acre-feet)

	Actual							Projected		
County	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
Los Angeles County	1,740,000	1,655,000	1,432,000	1,314,000	1,347,000	1,391,000	1,404,000	1,427,000	1,441,000	1,457,000
Orange County	660,000	631,000	553,000	510,000	541,000	543,000	545,000	547,000	548,000	547,000
Riverside County	474,000	492,000	472,000	423,000	474,000	506,000	531,000	550,000	563,000	579,000
San Bernardino County	250,000	261,000	253,000	203,000	225,000	227,000	225,000	228,000	230,000	237,000
San Diego County	659,000	621,000	533,000	558,000	559,000	578,000	591,000	604,000	616,000	626,000
Ventura County	132,000	156,000	152,000	125,000	140,000	141,000	141,000	142,000	142,000	143,000
Metropolitan's Service Area	**3,915,000**	**3,816,000**	**3,395,000**	**3,133,000**	**3,286,000**	**3,386,000**	**3,437,000**	**3,498,000**	**3,540,000**	**3,589,000**

Table A.1-6 Total Retail M&I Demand in Metropolitan's Service Area with Conservation

(Acre-feet)

	Actual				Projected					
County	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
Los Angeles County	1,738,000	1,653,000	1,431,000	1,313,000	1,346,000	1,389,000	1,403,000	1,426,000	1,440,000	1,455,000
Orange County	643,000	621,000	551,000	506,000	537,000	540,000	543,000	545,000	546,000	545,000
Riverside County	360,000	417,000	409,000	380,000	416,000	450,000	475,000	493,000	508,000	524,000
San Bernardino County	247,000	250,000	224,000	176,000	201,000	209,000	215,000	222,000	229,000	236,000
San Diego County	554,000	530,000	506,000	542,000	521,000	531,000	545,000	559,000	570,000	581,000
Ventura County	124,000	144,000	140,000	109,000	122,000	123,000	123,000	124,000	124,000	125,000
Metropolitan's Service Area	**3,666,000**	**3,615,000**	**3,261,000**	**3,026,000**	**3,143,000**	**3,242,000**	**3,304,000**	**3,369,000**	**3,417,000**	**3,466,000**

Table A.1-7 Total Retail Agricultural Demand in Metropolitan's Service Area

(Acre-feet)

	Actual				Projected					
County	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
Los Angeles County	1,800	1,700	1,000	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Orange County	17,000	9,600	1,800	3,900	4,500	3,300	2,000	2,000	2,000	2,000
Riverside County	113,500	75,200	63,200	43,000	57,500	56,100	56,600	57,100	54,600	55,000
San Bernardino County	2,100	11,300	28,900	26,500	23,800	18,200	9,800	5,800	1,100	1,100
San Diego County	105,600	91,300	27,100	16,800	38,400	47,100	46,400	45,700	45,600	45,600
Ventura County	7,500	12,600	11,800	15,600	18,400	18,300	18,400	18,700	18,400	18,400
Metropolitan's Service Area	**247,500**	**201,700**	**133,800**	**107,100**	**143,900**	**144,300**	**134,500**	**130,600**	**123,000**	**123,400**

Table A.1-8 Single Family Retail Demand in Metropolitan's Service Area
Average Year (Acre-feet)

County	Projected 2020	2025	2030	2035	2040	2045
Los Angeles County	740,000	766,000	765,000	767,000	771,000	776,000
Orange County	294,000	295,000	296,000	297,000	299,000	300,000
Riverside County	297,000	320,000	339,000	352,000	362,000	373,000
San Bernardino County	113,000	117,000	122,000	126,000	131,000	137,000
San Diego County	320,000	327,000	327,000	329,000	332,000	337,000
Ventura County	85,000	87,000	87,000	88,000	88,000	89,000
Metropolitan's Service Area	1,849,000	1,912,000	1,936,000	1,959,000	1,983,000	2,012,000

Table A.1-9 Multi-family Retail Demand in Metropolitan's Service Area
Average Year (Acre-feet)

County	Projected 2020	2025	2030	2035	2040	2045
Los Angeles County	317,000	338,000	353,000	377,000	392,000	409,000
Orange County	93,000	95,000	96,000	99,000	101,000	102,000
Riverside County	47,000	51,000	53,000	57,000	60,000	63,000
San Bernardino County	27,000	29,000	30,000	31,000	33,000	34,000
San Diego County	110,000	117,000	128,000	140,000	149,000	156,000
Ventura County	11,000	11,000	11,000	12,000	12,000	12,000
Metropolitan's Service Area	605,000	641,000	671,000	716,000	747,000	776,000

Table A.1-10 Commercial, Industrial and Institutional Retail Demand in Metropolitan's Service Area
Average Year (Acre-feet)

County	Projected 2020	2025	2030	2035	2040	2045
Los Angeles County	219,000	213,000	211,000	208,000	201,000	195,000
Orange County	122,000	122,000	123,000	121,000	118,000	115,000
Riverside County	47,000	51,000	53,000	54,000	55,000	56,000
San Bernardino County	47,000	48,000	49,000	49,000	49,000	49,000
San Diego County	73,000	70,000	71,000	71,000	70,000	68,000
Ventura County	18,000	18,000	18,000	17,000	17,000	16,000
Metropolitan's Service Area	526,000	522,000	525,000	520,000	510,000	499,000

Table A.1-11 Unmetered Use in Metropolitan's Service Area

Average Year (Acre-feet)

County				Projected		
	2020	2025	2030	2035	2040	2045
Los Angeles County	70,000	72,000	73,000	74,000	75,000	76,000
Orange County	27,000	27,000	28,000	28,000	28,000	28,000
Riverside County	25,000	27,000	29,000	30,000	31,000	32,000
San Bernardino County	14,000	15,000	15,000	16,000	16,000	17,000
San Diego County	17,000	18,000	18,000	18,000	19,000	19,000
Ventura County	7,000	7,000	7,000	7,000	7,000	7,000
Metropolitan's Service Area	160,000	166,000	170,000	173,000	176,000	179,000

Table A.1-12 Conservation Savings in Metropolitan's Service Area – 1980 Base Year

(Acre-feet)

County		Estimated						Projected		
	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
Los Angeles	166,000	235,000	297,000	368,000	440,000	467,000	485,000	499,000	521,000	546,000
Orange County	55,000	81,000	107,000	132,000	151,000	155,000	157,000	162,000	168,000	173,000
Riverside	22,000	37,000	52,000	66,000	78,000	89,000	97,000	106,000	116,000	126,000
San Bernardino	10,000	16,000	22,000	28,000	32,000	35,000	38,000	40,000	44,000	48,000
San Diego	56,000	78,000	96,000	116,000	137,000	149,000	165,000	183,000	202,000	220,000
Ventura	9,000	13,000	16,000	20,000	24,000	25,000	27,000	29,000	31,000	32,000
Active, Code, Price	**317,000**	**460,000**	**590,000**	**729,000**	**862,000**	**920,000**	**968,000**	**1,020,000**	**1,081,000**	**1,145,000**
Pre-1990 Conservation	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Total Conservation	**567,000**	**710,000**	**840,000**	**979,000**	**1,112,000**	**1,170,000**	**1,218,000**	**1,270,000**	**1,331,000**	**1,395,000**

Table A.1-13 Projected Municipal and Industrial Demands by Sector

(Acre-feet)

Sector		Historical						Projected		
	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
Single-Family	2,269,000	2,237,000	2,018,000	1,872,000	1,849,000	1,911,000	1,935,000	1,959,000	1,984,000	2,011,000
Multi-Family	743,000	732,000	660,000	613,000	605,000	641,000	672,000	715,000	747,000	775,000
Non-Residential	655,000	646,000	583,000	541,000	527,000	520,000	524,000	520,000	510,000	499,000
System Losses/Unmetered	198,000	195,000	176,000	163,000	161,000	166,000	169,000	173,000	176,000	178,000
Metropolitan Total	3,865,000	3,810,000	3,437,000	3,189,000	3,142,000	3,239,000	3,301,000	3,367,000	3,416,000	3,464,000

Appendix 2

EXISTING REGIONAL WATER SUPPLIES

Appendix 2
EXISTING REGIONAL WATER SUPPLIES

Water used in Metropolitan's service area comes from both local and imported sources. Local sources include groundwater, surface water, and recycled water. Sources of imported water include the Colorado River, the State Water Project (SWP), and the Owens Valley/Mono Basin. On average over the last 10 years (from 2011 to 2020), local sources met about 49 percent of the water needs, while imported sources supplied the remaining 51 percent.

The City of Los Angeles imports water from the Owens Valley/Mono Basin east of the Sierra Nevada through the Los Angeles Aqueduct (LAA). This water currently meets about 5 percent of the region's water needs based on a ten-year average from 2011 to 2020 but is dedicated for use by the City of Los Angeles. Metropolitan provides imported water supplies to meet the remaining 46 percent of the region's water needs based on the same ten-year period. These imported supplies are received through Metropolitan's Colorado River Aqueduct (CRA) and the SWP's California Aqueduct. Table A.2-1 and Figure A.2-1 show the historical sources of local and imported supplies within Metropolitan's service area.

Table A.2-2 shows the quantities of Metropolitan water used by member agencies during the last ten years (2011 to 2020). Metropolitan's largest water customers are the San Diego County Water Authority (25 percent), City of Los Angeles (16 percent), and Municipal Water District of Orange County (12 percent).

The following sections describe the current supply sources in more detail. The main body of the Urban Water Management Plan contains descriptions of planned future supplies.

Local Water Supplies

Local sources of water available to the region include surface water, groundwater, recycled water, and seawater desalination. Some of the major river systems in Southern California have been developed into systems of dams, flood control channels, and percolation ponds for supplying local water and recharging groundwater basins. For example, the San Gabriel and Santa Ana Rivers capture over 90 percent of the runoff in their watersheds. The Los Angeles River system, however, is not as efficient in capturing runoff. In its upper reaches, which make up 25 percent of the watershed, most runoff is captured with recharge facilities. In its lower reaches, which comprise the remaining 75 percent of the watershed, the river and its tributaries are lined with concrete, so there are no recharge facilities. The Santa Clara River in Ventura County is outside of Metropolitan's service area, but it replenishes groundwater basins used by water agencies within Metropolitan's service area. Other rivers in Metropolitan's service area, such as the Santa Margarita and San Luis Rey, are essentially natural replenishment systems.

Table A.2-1
Sources of Water Supply to the Metropolitan Service Area
(Acre-Feet)[1]

Calendar Year	Local Supplies[4]	L.A. Aqueduct	Colorado River Aqueduct[2]	State Water Project[3]	Total
1976	1,424,000	430,000	778,000	638,000	3,270,000
1977	1,432,000	275,000	1,277,000	209,000	3,193,000
1978	1,339,000	472,000	710,000	576,000	3,096,000
1979	1,512,000	493,000	784,000	532,000	3,321,000
1980	1,551,000	515,000	791,000	560,000	3,416,000
1981	1,593,000	465,000	791,000	827,000	3,676,000
1982	1,504,000	483,000	686,000	737,000	3,410,000
1983	1,551,000	519,000	850,000	410,000	3,329,000
1984	1,762,000	516,000	1,150,000	498,000	3,926,000
1985	1,698,000	496,000	1,018,000	728,000	3,939,000
1986	1,679,000	515,000	1,001,000	756,000	3,952,000
1987	1,608,000	428,000	1,175,000	763,000	3,974,000
1988	1,659,000	360,000	1,199,000	957,000	4,175,000
1989	1,676,000	274,000	1,189,000	1,215,000	4,355,000
1990	1,595,000	107,000	1,183,000	1,458,000	4,343,000
1991	1,547,000	181,000	1,252,000	625,000	3,605,000
1992	1,631,000	177,000	1,153,000	744,000	3,704,000
1993	1,546,000	289,000	1,144,000	663,000	3,642,000
1994	1,649,000	133,000	1,263,000	845,000	3,890,000
1995	1,719,000	444,000	933,000	451,000	3,546,000
1996	1,842,000	422,000	1,089,000	663,000	4,016,000
1997	1,902,000	436,000	1,125,000	724,000	4,187,000
1998	1,902,000	467,000	941,000	521,000	3,830,000
1999	2,034,000	309,000	1,072,000	792,000	4,206,000
2000	1,899,000	255,000	1,217,000	1,473,000	4,845,000
2001	1,846,000	267,000	1,245,000	1,119,000	4,477,000
2002	1,844,000	179,000	1,198,000	1,415,000	4,636,000
2003	1,790,000	252,000	676,000	1,561,000	4,278,000
2004	1,760,000	203,000	741,000	1,802,000	4,506,000
2005	1,758,000	369,000	707,000	1,525,000	4,358,000
2006	1,861,000	379,000	514,000	1,695,000	4,448,000
2007	1,984,000	129,000	696,000	1,648,000	4,457,000
2008	1,942,000	147,000	896,000	1,037,000	4,023,000
2009	1,959,000	137,000	1,044,000	908,000	4,048,000
2010	1,839,000	251,000	837,000	1,129,000	4,071,000
2011	1,779,000	355,000	445,000	1,379,000	3,991,000
2012	1,979,000	167,000	455,000	1,252,000	3,794,000
2013	1,963,000	65,000	986,000	974,000	4,019,000
2014	1,923,000	64,000	1,168,000	607,000	3,729,000
2015	1,714,000	33,000	1,178,000	593,000	3,480,000
2016	1,795,000	96,000	961,000	1,009,000	3,812,000
2017	1,751,000	380,000	282,000	1,473,000	3,833,000
2018	1,816,000	246,000	757,000	845,000	3,633,000
2019	1,735,000	345,000	298,000	1,232,000	3,611,000
2020	1,787,000	183,000	687,000	588,000	3,245,000

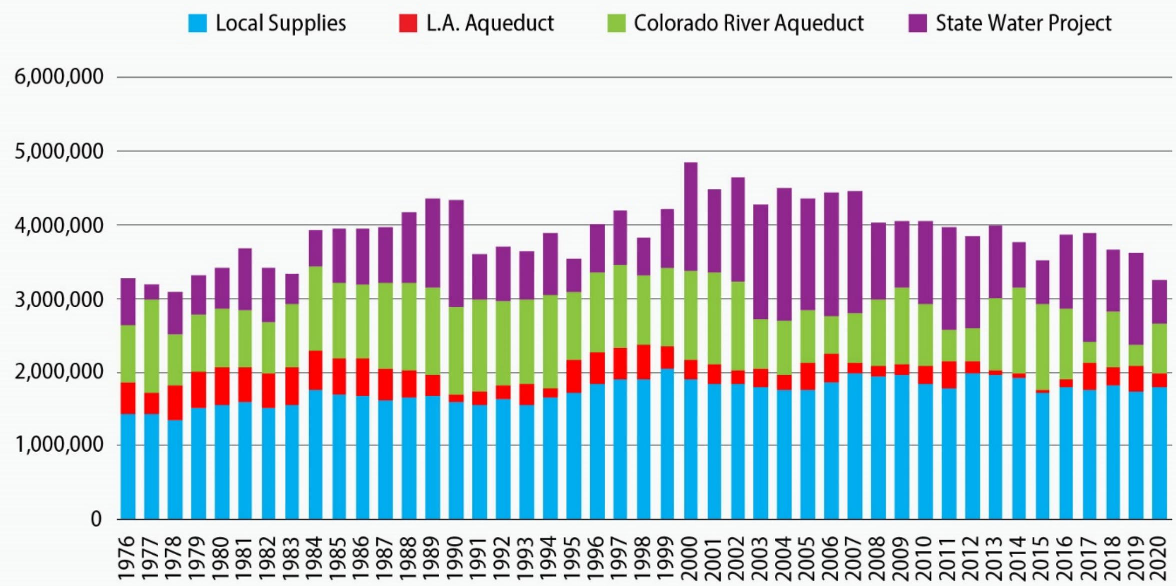
1. Not including system losses.
2. Colorado River Aqueduct supplies are gross Havasu diversions less return flows, deliveries to USBR, Mexico, and storage.
3. State Water Project Supplies include Table A, Art. 21, Art. 14(b), Art. 12(d), Art. 12(e), Art. 55, draws from storage & carryover, DWCV & other exchanges, transfers, Drought Water Bank and Dry Year Pool Purchases, Pools A&B, Flood Water, wheeling, Port Hueneme lease, and SBVMWD Purchases.
4. Local Supplies includes local groundwater, surface water, recycled water, groundwater recovery, and seawater desalination used for MI, AG, SW or GW recharge in MWD service area. Include Santa Ana River Baseflow at Prado Dam for groundwater recharge. Based on best available data at the time of publication, subject to updates without notice. Data for 2020 not available and is estimated based on historical data.

Table A.2-2 Historical Metropolitan Water Deliveries to Member Agencies

(Acre-feet) Calendar Year

Member Agency	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
City of Anaheim	29,000	20,000	20,000	18,000	14,000	13,000	26,000	15,000	13,000	39,000
City of Beverly Hills	10,000	11,000	11,000	12,000	10,000	9,000	10,000	10,000	10,000	10,000
City of Burbank	18,000	15,000	15,000	16,000	12,000	12,000	19,000	12,000	18,000	6,000
Calleguas Municipal Water District	97,000	106,000	112,000	96,000	77,000	86,000	92,000	93,000	90,000	90,000
Central Basin Municipal Water District	67,000	38,000	36,000	30,000	58,000	61,000	24,000	24,000	17,000	21,000
City of Compton	2,000	2,000	1,000	0	0	0	0	20	40	0
Eastern Municipal Water District	90,000	99,000	98,000	102,000	76,000	84,000	89,000	93,000	94,000	93,000
Foothill Municipal Water District	8,000	8,000	9,000	10,000	7,000	7,000	9,000	8,000	7,000	9,000
City of Fullerton	10,000	10,000	9,000	9,000	7,000	5,000	9,000	7,000	5,000	6,000
City of Glendale	18,000	18,000	19,000	19,000	15,000	15,000	15,000	16,000	14,000	16,000
Inland Empire Utilities Agency	76,000	57,000	64,000	68,000	38,000	44,000	62,000	67,000	66,000	44,000
Las Virgenes Municipal Water District	20,000	21,000	24,000	20,000	17,000	18,000	18,000	20,000	17,000	20,000
City of Long Beach	43,000	30,000	35,000	37,000	35,000	28,000	24,000	26,000	25,000	30,000
City of Los Angeles	120,000	328,000	439,000	403,000	384,000	318,000	115,000	218,000	103,000	244,000
Municipal Water District of Orange County	262,000	207,000	216,000	263,000	178,000	196,000	237,000	213,000	143,000	134,000
City of Pasadena	18,000	18,000	21,000	21,000	17,000	17,000	18,000	20,000	20,000	18,000
San Diego County Water Authority	407,000	455,000	492,000	571,000	501,000	436,000	358,000	374,000	319,000	308,000
City of San Fernando	20	110	70	110	0	0	0	0	0	0
City of San Marino	310	840	1,050	1,110	970	970	960	950	960	1,600
City of Santa Ana	16,000	12,000	15,000	11,000	10,000	4,000	14,000	9,000	7,000	8,000
City of Santa Monica	6,000	7,000	6,000	5,000	3,000	3,000	4,000	4,000	3,000	5,000
Three Valleys Municipal Water District	65,000	64,000	69,000	67,000	53,000	67,000	60,000	67,000	71,000	62,000
City of Torrance	17,000	17,000	17,000	17,000	14,000	16,000	16,000	15,000	14,000	15,000
Upper San Gabriel Valley Municipal Water District	35,000	16,000	30,000	22,000	50,000	46,000	46,000	56,000	103,000	15,000
West Basin Municipal Water District	112,000	117,000	121,000	118,000	109,000	109,000	113,000	117,000	113,000	111,000
Western Municipal Water District of Riverside County	72,000	79,000	76,000	82,000	58,000	65,000	71,000	73,000	54,000	68,000
Total of All Agencies	1,618,000	1,756,000	1,956,000	2,018,000	1,744,000	1,660,000	1,450,000	1,558,000	1,327,000	1,374,000

Figure A.2-1 Sources of Supply to Metropolitan's Service Area



Notes:

1. Not including system losses.
2. Colorado River Aqueduct supplies are gross Havasu diversions less return flows, deliveries to USBR, Mexico, and storage.
3. State Water Project Supplies include Table A, Art. 21, Art. 14(b), Art. 12(d), Art. 12(e), Art. 55, draws from storage & carryover, DWCV & other exchanges, transfers, Drought Water Bank and Dry Year Pool Purchases, Pools A&B, Flood Water, wheeling, Port Hueneme lease, and SBVMWD Purchases.
4. Local Supplies includes local groundwater, surface water, recycled water, groundwater recovery, and seawater desalination used for MI, AG, SW or GW recharge in MWD service area. Include Santa Ana River Baseflow at Prado Dam for groundwater recharge. Based on best available data at the time of publication, subject to updates without notice. Data for 2020 not available and is estimated based on historical data.

Local supplies fluctuate in response to variations in rainfall. During prolonged periods of below-normal rainfall, local water supplies decrease. Conversely, prolonged periods of above-normal rainfall increase local supplies. Sources of groundwater basin replenishment include local precipitation, runoff from the coastal ranges, and artificial recharge with imported water supplies. In addition to runoff, recycled water provides an increasingly important source of replenishment water for the region.

Major Groundwater Basins

From 2011-2020, groundwater sources accounted for an average of about 92 percent of the local water supplies, which are found in many basins throughout the Southern California region and provide an annual average total production of about 1.27 MAF per year. Figure A.2-2 shows the locations of the groundwater basins within Metropolitan's service area. Groundwater yield comes from passive recharge from the percolation of rainfall and stream runoff and active recharge from spreading and injection of captured stormwater, recycled water, and imported water. In certain major drainage areas, runoff is retained in flood control reservoirs and released into spreading basins for percolation into the ground. In Los Angeles County, many groundwater recharge facilities located along the upper reaches of the Los Angeles River and San Gabriel River systems provide recharge to San Fernando, Raymond, Main San Gabriel, Central, and West Coast groundwater basins. The Orange County Water District operates a system of diversion structures and recharge basins along the Santa Ana River that captures much of the storm runoff, as well as water from reclamation facilities in Riverside and San Bernardino counties. Storm runoff is also diverted to recharge basins in the Chino Basin. This water, which would otherwise flow into the Pacific Ocean, is allowed to percolate into the underlying aquifers so it may be pumped for local use when needed. Recycled water use for groundwater recharge has increased steadily. The Water Replenishment District of Southern California (WRD) has spread recycled water at the Montebello Forebay to recharge Central and West Coast basins for many years and has expanded this practice with the completion of the WRD Albert Robles Center for Water Recycling and Environmental Learning in 2019. The Inland Empire Utilities Agency (IEUA) provides recycled water for recharge of the Chino Basin. Orange County Water District has implemented the Groundwater Replenishment System (GWRS) to recharge over 100 TAF per year of highly-treated recycled water to the Orange County Basin. Highly treated recycled water is also used at seawater barriers in the West Coast, Central, and Orange County basins and has largely replaced use of imported water for this purpose.

Almost all major groundwater basins in Southern California are either adjudicated or managed by special districts or agencies. Over 95 percent of the groundwater used in Metropolitan's service area is produced from adjudicated or managed groundwater basins. Adjudicated basins in the region include: Raymond Basin, Upper Los Angeles River Area basins (which include San Fernando, Sylmar, Verdugo, and Eagle Rock Basins), Main San Gabriel Basin, Puente Basin, Central Basin, West Coast Basin, Six Basins, Hemet-San Jacinto Basin, Chino Basin, and Cucamonga Basin. The Orange County Groundwater Basin is managed by Orange County Water District; portions of the Ventura County Basins are managed by the Fox Canyon Groundwater Management Agency; and the West San Jacinto Basins are managed by Eastern Municipal Water District. In general, these basins have management plans that include protection from seawater intrusion in the coastal region, water quality deterioration, and excessive lowering of water levels. Groundwater basin managers address treatment of contamination, manage recharge and storage programs, and monitor extraction, water levels, and water quality.

Major River Systems and Reservoirs

Local surface water resources consist of runoff captured in storage reservoirs and diversions from streams. Reservoirs hold the runoff for later direct use, and diversions from streams are delivered directly to local water systems. As Table A.2-3 shows, local water agencies currently own and operate 33 reservoirs. These reservoirs provide a storage capacity of approximately 862 TAF. The historic average yield of these local surface supplies, which come from reservoir releases and stream diversions, is about 87 TAF per year from 2011-2020. The annual yield varies widely between wet and dry years, and most reservoirs that capture local surface runoff are operated with minimal carry-over storage. San Diego County has the greatest storage capacity for these types of reservoirs, with approximately 84 percent of the total local agency storage capacity in Metropolitan's service area.

In addition to the storage that is owned and operated by local agencies, Metropolitan operates DVL, Lake Skinner, and Lake Mathews. DVL stores water imported during years of ample supply. DVL's 810 TAF capacity is used to augment supplies to meet dry year and seasonal needs, and also provides supply for the region during an emergency period. While Lake Skinner and Lake Mathews are largely used for system operations, they may also be used to augment supplies during dry years and emergencies, if necessary and available. Table A.2-4 lists the Metropolitan-owned reservoirs with significant storage capacity.

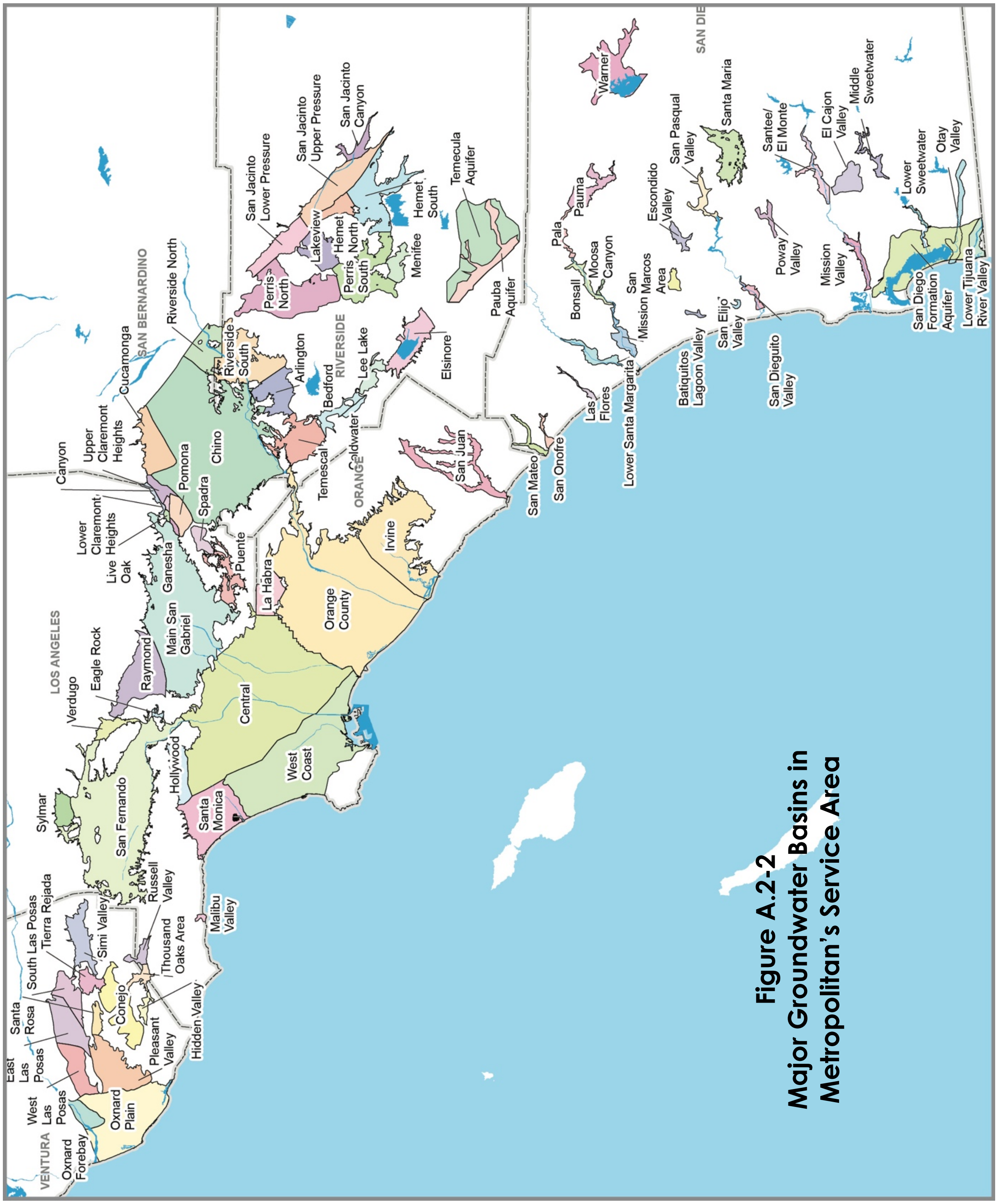


Figure A.2-2
Major Groundwater Basins in Metropolitan's Service Area

Table A.2-3
Local Storage Reservoirs in Metropolitan's Service Area
(Acre-feet)

Member Agency/Sub-agency	Reservoir	Storage Capacity
Eastern MWD		
Rancho California WD	Vail Lake	45,207
Lake Hemet MWD	Lake Hemet	12,750
Las Virgenes MWD	Westlake Reservoir	9,500
City of Los Angeles	Los Angeles	10,170
	Encino	9,800
	Stone Canyon	10,800
	Hollywood	4,200
MWD of Orange County		
Irvine Ranch WD & Serrano ID	Santiago	25,000
San Diego County Water Authority		
Carlsbad MWD	Maerkle	600
Escondido, City of	Dixon	2,606
	Wohlford	2,783
Fallbrook PUD	Red Mountain	1,335
Helix WD	Cuyamaca	8,195
	Jennings	9,790
Poway, City of	Poway	3,432
	Morro Hill	465
Ramona MWD	Ramona	12,000
San Diego County Water Authority	Olivenhain – CWA	24,774
San Diego, City of	Barrett	34,806
	El Capitan	112,807
	Hodges	13,401
	Lower Otay	47,067
	Miramar	6,682
	Morena	50,694
	Murray	4,684
	San Vicente	249,358
	Sutherland	29,508
San Dieguito WD	San Dieguito	883
Sweetwater Authority	Loveland	25,400
	Sweetwater	28,079
Valley Center MWD	Turner	1,612
Vista Irrigation District	Henshaw	51,774
Western MWD of Riverside		
Temescal Water Company	Railroad Canyon	12,000
Total		**862,162**

Table A.2-4
Total Storage Capacity of Metropolitan's Reservoirs
(Thousands Acre-feet)

Reservoir	Capacity
Diamond Valley Lake	810
Lake Skinner[1]	44
Lake Mathews[1]	182

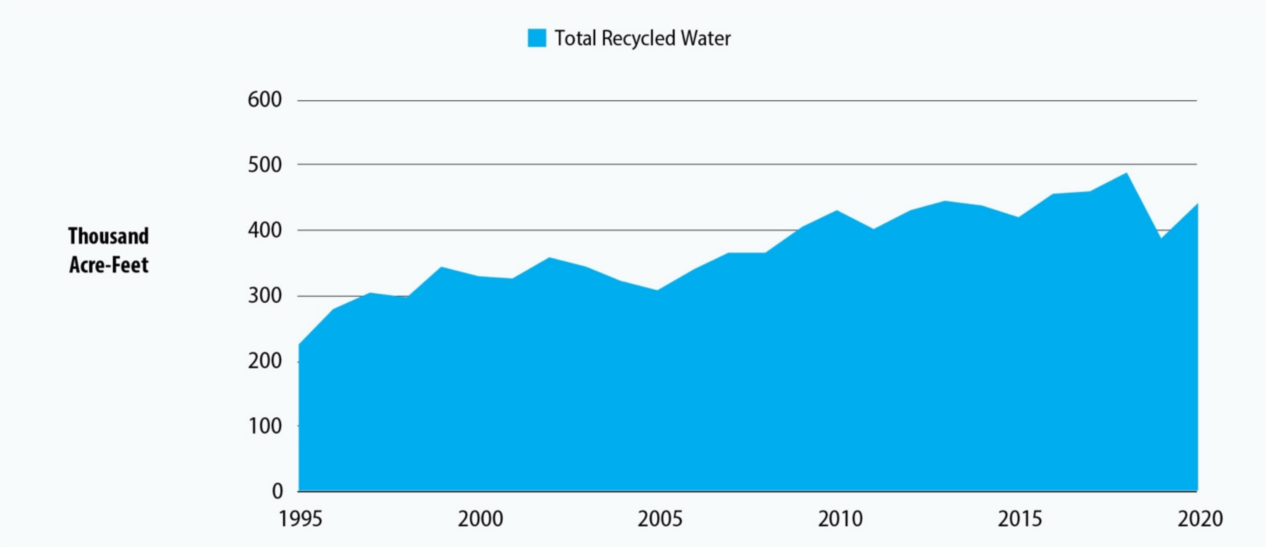
[1] These are used for operations and not primarily for dry year storage.

Lastly, Castaic and Perris are the terminal reservoirs to the West Branch and East Branch of the California Aqueduct operated by DWR. Through the Monterey Amendment to its SWP water service contract, Metropolitan has access to 219 TAF of flexible storage capacity in these SWP terminal reservoirs.

Water Recycling and Groundwater Recovery

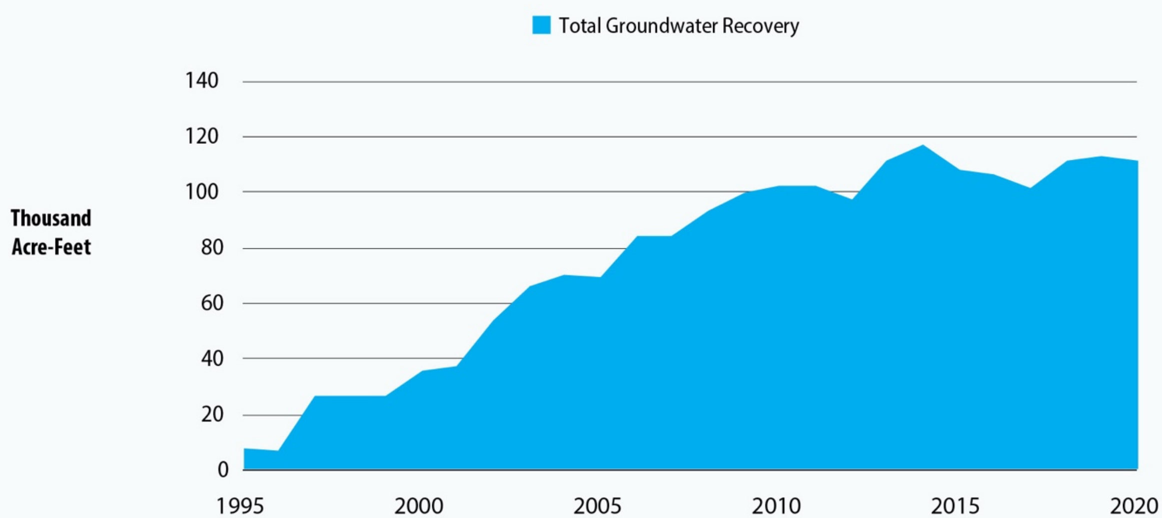
Water recycling projects involve treating wastewater to a level that is acceptable and safe for many non-potable applications. This resource is providing an increasing level of local water. In 1982, Metropolitan began helping to fund its member agencies' recycled water projects. Since that time, Metropolitan has invested approximately $510 million. In fiscal year 2019-20, water recycling projects in which Metropolitan has invested produced over 71 TAF. Local agency projects that did not receive financial assistance from Metropolitan produced an additional 320 TAF, and approximately 50 TAF of Santa Ana River base flow were used to recharge the Orange County basin. This brings the regional total to 441 TAF of recycled water use. Figure A.2-3 demonstrates the increase in this regional supply for direct use.

Figure A.2-3 Recycled Water



In addition, local agencies have implemented several projects to recover contaminated or degraded groundwater for potable uses. The groundwater recovery projects use a variety of treatment technologies to remove nitrates, volatile organic compounds, perchlorate, color, and salt. In 1991, Metropolitan began helping fund its member agencies' groundwater recovery projects. Since that time, Metropolitan has invested approximately $173 million. In FY 2019-20, these groundwater recovery projects produced 50 TAF. Other member agency projects that did not receive funding from Metropolitan produced another 62 TAF, for a regional total of 112 TAF. Figure A.2-4 shows this increase in supply.

Figure A.2-4 Groundwater Recovery



Imported Water

Most member agencies and retail water suppliers depend on imported water for a portion of their water supply. For some member agencies, Metropolitan supplies most of the water used within that agency's service area, while others obtain varying amounts of water from Metropolitan to supplement local supplies. For example, Los Angeles and San Diego (the largest and second largest cities in the state) have historically obtained up to 85 percent of their water from imported sources. These imported water requirements are similar to those of other metropolitan areas within the state, such as San Francisco and other cities around the San Francisco Bay.

Figure A.2-5 shows the conveyance facilities for the state's imported water supplies. Descriptions of each of the imported sources of water available to Metropolitan's service area follow. Justification for projected water supplies from these sources is provided in Appendix 3.

Colorado River

A number of water agencies within California have rights to divert water from the Colorado River. Through the Seven Party Agreement (1931), seven agencies recommended apportionments of California's share of Colorado River water within the state. Table A.2-5 shows the historic apportionment of each agency, and the priority accorded that apportionment.

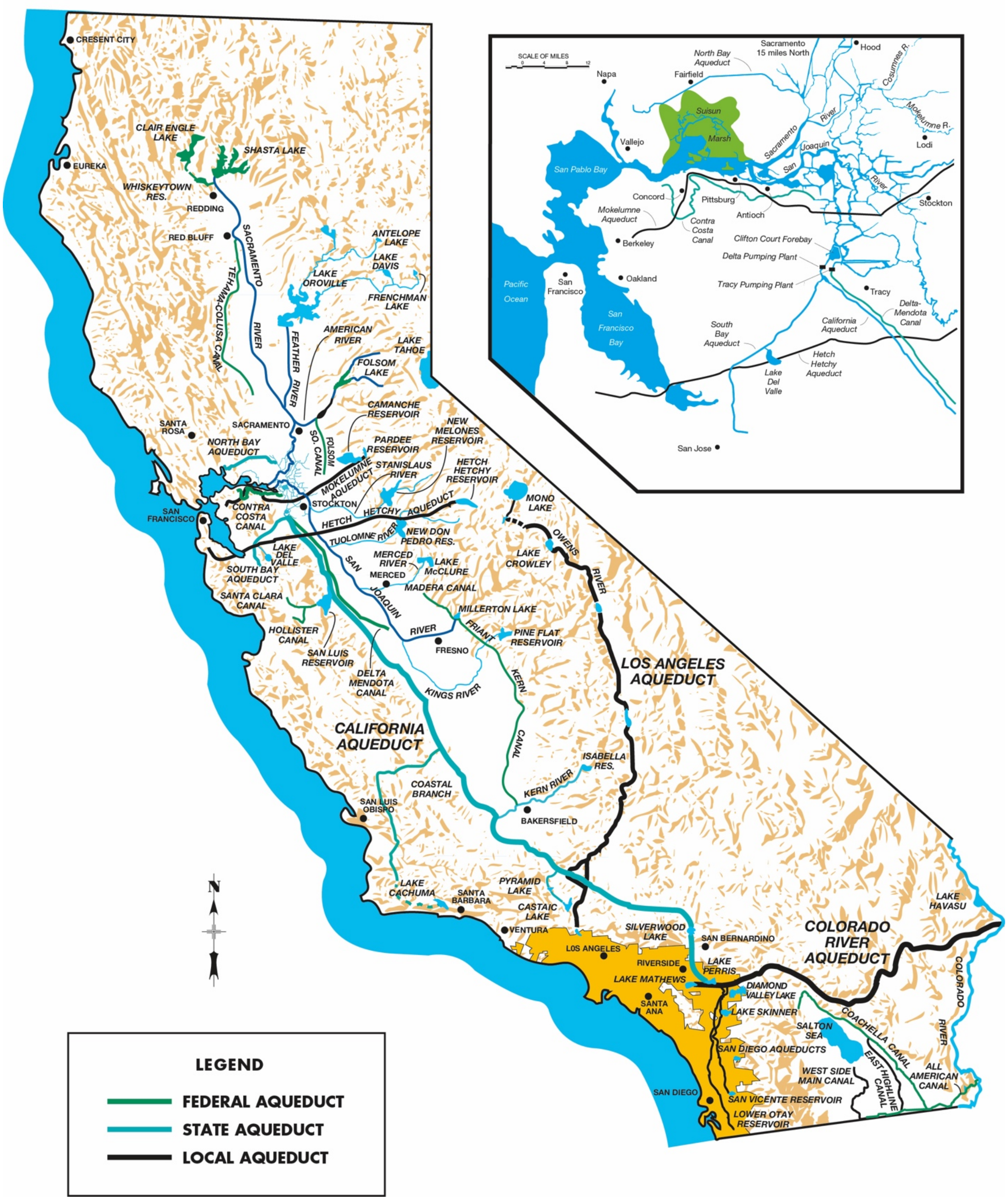
Table A.2-5
Priorities in Seven Party Agreement and Water Delivery Contracts

Priority	Description	TAF Annually
1	Palo Verde Irrigation District – gross area of 104,500 acres of land in the Palo Verde Valley	
2	Yuma Project (Reservation Division) – not exceeding a gross area of 25,000 acres in California	
3(a)	Imperial Irrigation District and land in Imperial and Coachella Valleys[1] to be served by All American Canal	3,850
3(b)	Palo Verde Irrigation District –16,000 acres of land on the Lower Palo Verde Mesa	
4	Metropolitan Water District of Southern California for use on the coastal plain of Southern California	550
Subtotal		4,400
5(a)	Metropolitan Water District of Southern California for use on the coastal plain of Southern California	550
5(b)	Metropolitan Water District of Southern California for use on the coastal plain of Southern California[2]	112
6(a)	Imperial Irrigation District and land in Imperial and Coachella Valleys[1] to be served by the All American Canal	
6(b)	Palo Verde Irrigation District –16,000 acres of land on the Lower Palo Verde Mesa	300
7	Agricultural Use in the Colorado River Basin in California	
	Total Prioritized Apportionment	**5,362**

[1] The Coachella Valley Water District now serves Coachella Valley.

[2] In 1946, the City of San Diego, the San Diego County Water Authority, Metropolitan, and the Secretary of the Interior entered into a contract that merged and added the City of San Diego's rights to store and deliver Colorado River water to the rights of Metropolitan. The conditions of that agreement have long since been satisfied.

Figure A.2-5
MAJOR WATER CONVEYANCE FACILITIES IN CALIFORNIA



The water is delivered to Metropolitan's service area by way of the CRA, which has a rated capacity of approximately 1,700 cfs. The CRA conveys water 242 miles from its Lake Havasu intake to its terminal reservoir, Lake Mathews, near the City of Riverside. Conveyance losses along the CRA of 10 TAF per year reduce the amount of Colorado River water received in the coastal plain.

Since the date of the original contract, several events have occurred that changed the dependable supply that Metropolitan expects from the Colorado River. The most significant event was the 1964 U.S. Supreme Court decree in *Arizona v. California* that reduced Metropolitan's dependable supply of Colorado River water to 550 TAF per year. The reduction in dependable supply occurred with the commencement of Colorado River water deliveries to the Central Arizona Project. In 1987, Metropolitan entered into a contract with the U.S. Bureau of Reclamation (USBR) for an additional 180 TAF per year of surplus water when surplus water is available. In addition, Metropolitan has obtained a minimum of approximately 85 TAF per year of Colorado River water since 1996 through a conservation program with the Imperial Irrigation District.

In 1979, the Present Perfected Rights (PPRs) of certain Indian reservations, cities, and individuals along the Colorado River were quantified. These PPRs predate the Seven Party Agreement, but the rights holders were not included in the Seven Party Agreement prioritizing California's use and storage of Colorado River water.

In 1999, under the auspices of the Colorado River Board of California, a draft plan, "California's Colorado River Water Use Plan," was developed. The Colorado River Board of California protects California's rights and interests in the resources provided by the Colorado River and represents California in discussions and negotiations regarding the Colorado River and its management. The overall purpose of California's Colorado River Water Use Plan is to provide Colorado River water users with a framework by which programs, projects, and other activities may be coordinated and cooperatively implemented. This framework specified how California would make the transition from relying on surplus water supplies from the Colorado River to living within its normal (basic) water supply apportionment.

To implement these plans, a number of agreements have been executed. In October 2003, representatives from Metropolitan, IID, and Coachella Valley Water District (CVWD) executed the Quantification Settlement Agreement (QSA) and several other related agreements. Parties involved include the San Diego County Water Authority (SDCWA), the California Department of Water Resources (DWR), the California Department of Fish and Wildlife, the U.S. Department of the Interior, and the San Luis Rey Indian Water Rights Settlement Parties. The QSA quantifies the use of water under the third priority of the Seven Party Agreement and allows for implementation of agricultural conservation, land management, and other programs identified in Metropolitan's 1996 IRP. Quantification of the third priority provides the needed numeric baseline from which conservation and transfer programs may be measured. The QSA has helped California reduce its reliance on Colorado River down to its normal apportionment (4,400 TAF).

The quantification of the agricultural priorities under the QSA provided for the water saved under the Palo Verde Land Management and Crop Rotation Program to be made available to Metropolitan. This program provides up to 133 TAF of water to be available to Metropolitan in certain years and will supply a minimum of 33 TAF per year.

SDCWA is participating in QSA-related projects that are providing additional water supplies that the agency exchanges with Metropolitan for receipt of Metropolitan deliveries. First, the water conserved by these projects is made available to Metropolitan. In exchange, Metropolitan is delivering an amount of Metropolitan water equal to the amount of Colorado River water conserved by IID for SDCWA. Second, federal law allocates a portion of the water available as a result of the Coachella Canal Lining Project and the All-American Canal Lining Project for the benefit of parties, including five Indian Bands, and two non-Indian municipal water purveyors (San Luis Rey Settlement Parties) involved in litigation over water rights to the San Luis Rey River in San Diego County. Metropolitan has agreed to exchange that water and provide an equal amount of water to the United States for use by the San Luis Rey Settlement Parties, and SDCWA has agreed to convey the water when capacity is available for use within the Settlement Parties' service areas. The remainder of the water available as a result of the canal lining projects, up to the cap specified in the Metropolitan-SDCWA exchange agreement, is exchanged with SDCWA.

In October 2004, Southern Nevada Water Authority (SNWA) and Metropolitan entered into a storage and interstate release agreement. Under this program, SNWA can request that Metropolitan store unused Nevada apportionment. The amount of water which Metropolitan diverted through 2015 under this agreement was over 422 TAF. In subsequent years, SNWA may request return of approximately 330 TAF. It is expected that SNWA will not request return of stored water until after 2026.

In December 2007, the Secretary of the Interior approved the adoption of specific interim guidelines for reductions in Colorado River water deliveries during declared shortages and coordinated operations of Lake Powell and Lake Mead. These guidelines provide water release criteria from Lake Powell and water storage and water release criteria from Lake Mead during shortage, normal, and surplus conditions in the Lower Basin; provide a mechanism for the storage and delivery of conserved system and non-system water in Lake Mead; and modify and extend interim surplus guidelines through 2026. The Record of Decision and accompanying agreement among the Colorado River Basin States protect reservoir levels by reducing deliveries during drought periods, encourage agencies to develop conservation programs, and allow the states to develop and store new water supplies. The Colorado River Basin Project Act of 1968 insulates California from shortages in all but the most extreme hydrologic conditions.

In May 2006, Metropolitan and the USBR executed an agreement for a demonstration program that allowed Metropolitan to leave conserved water in Lake Mead that Metropolitan would otherwise have used in 2006 and 2007. The water left in Lake Mead must have been made available through extraordinary conservation measures, which was accomplished in 2006 and 2007 through savings realized under the Palo Verde Land Management, Crop Rotation, and Water Supply Program. This demonstration program was an activity eligible for creation of Extraordinary Conservation Intentionally Created Surplus (ICS) under the provisions of the December 2007 federal guidelines for the operation of Lake Powell and Lake Mead. Metropolitan continued to store water in Lake Mead through extraordinary conservation measures as provided in the December 2007 federal guidelines in 2009, 2010, 2011, 2012, 2016, 2017, 2018, and 2019. Metropolitan took delivery of a portion of its extraordinary conservation ICS in 2013, 2014, and 2015. As of January 1, 2020, Metropolitan had approximately 866 TAF of extraordinary conservation ICS water in Lake Mead.

The December 2007 federal guidelines provided Colorado River contractors the ability to create System Efficiency ICS through development and funding of system efficiency projects. To that end, in 2008 the Central Arizona Water Conservation District, SNWA, and Metropolitan contributed funds for the construction of the Drop 2 (Brock) Reservoir by the USBR. The purpose of the Drop 2 reservoir is to increase the capacity to regulate deliveries of Colorado River water at Imperial Dam, reducing the amount of water released downstream, and therefore lost from storage in Lake Mead, by approximately 70 TAF annually. In return for funding one-sixth of the project cost, 100 TAF of water stored in Lake Mead was assigned to Metropolitan as System

Efficiency ICS in 2008. Metropolitan also created approximately 24 TAF of System Efficiency ICS by contributing to a one-year pilot operation of the Yuma Desalting Plant. Overall, from 2008-2011, Metropolitan created over 124 TAF of System Efficiency ICS As of January 1, 2020, Metropolitan had approximately 89 TAF of System Efficiency ICS water in Lake Mead.

In November 2012, as part of the implementation of Minute 319 to the 1944 water treaty between the U.S. and Mexico, Metropolitan executed an agreement with the USBR and other Lower Colorado River Basin stakeholders to fund a pilot water conservation program in the Mexicali Valley region of Mexico in exchange for a portion of the conserved water received as Binational ICS (BICS) stored in Lake Mead, converted from Intentionally Created Mexican Allocation (ICMA). The Minute 319 pilot program was completed in 2017, and Metropolitan received 23,750 AF of BICS, which remained stored in Lake Mead as of January 1, 2020. In September 2017, Metropolitan executed a similar agreement as part of the implementation of Minute 323, through which Metropolitan expects to receive up to 27,275 AF of BICS between 2020 and 2026.

In May 2019, in response to ongoing conditions in the Colorado River Basin and concern over water levels in Lake Mead, Metropolitan, the Secretary of the Interior, and representatives of state governments and water agencies throughout the Colorado River Basin executed the *Agreement Concerning Colorado River Drought Contingency Management and Operations* (DCP). Exhibit 1 of Attachment B to the DCP—*Lower Basin Drought Contingency Operations* (LBOps)—specifies certain changes to the management of Lake Mead. Key provisions include increases in the cumulative allowable ICS storage in Lake Mead for each state, greater flexibility in annual ICS storage limits, and the requirement for Lower Basin states to make contributions to Lake Mead storage ("DCP contributions") when water levels drop below elevation 1075 feet. California DCP contributions are required when Lake Mead levels drop below elevation 1045 feet.

Metropolitan is undertaking ongoing efforts to maintain and improve the flexibility and quality of its water supply from the Colorado River. Section 3.1 of this Plan describes current programs and plans related to flexibility, and Section 4 describes water quality programs.

State Water Project

The State Water Project, which is owned by the state and operated by DWR, is the second source of Metropolitan's imported water supplies. The SWP comprises 32 storage facilities (reservoirs and lakes), 662 miles of aqueduct, and 25 power and pumping plants.

The SWP conveys water from Northern California to the north and south of the San Francisco Bay Area and areas south of the Bay Delta region. Water from the SWP originates at Lake Oroville, which is located on the Feather River in Northern California. That water, along with all additional unused water from the watershed, flows into the Sacramento/San Joaquin Delta. Water from the Delta is then either pumped to water users in the San Francisco Bay area or transported through the California Aqueduct to water users in Central and Southern California.

DWR contracted to deliver water in stages to 32 SWP contractors, with an ultimate delivery of 4,172 TAF per year. Three contractors have had their contract amounts taken on by other contractors; currently, DWR is delivering water to 29 SWP contractors. Metropolitan is the largest, with a contractual amount of 1,911 TAF per year, or approximately 46 percent of the total contracted amount. Metropolitan receives deliveries of SWP supplies via the California Aqueduct at Castaic Lake in Los Angeles County, Devil Canyon Afterbay in San Bernardino County, and Box Springs Turnout and Lake Perris in Riverside County. The first delivery of SWP water to Metropolitan occurred in 1972.

The initial facilities of the SWP, completed in the early 1970s, were designed to meet the original needs of the SWP contractors. It was intended that additional SWP facilities would be built over time to meet projected increases in contractors' delivery needs. Each contractor's SWP contract provided for a buildup in contractual amount over time, with most contractors reaching their maximum annual contractual amount by the year 1990. Since the completion of the initial SWP facilities in the early 1970s, major improvements to the system have included: four new pumps added to the Banks Pumping Plant at the Delta, the completion of the Coastal Branch, and the East Branch enlargement. Even with these improvements, however, there are still significant capacity constraints within the SWP that limit the delivery capability of the full contracted amount. During the same time, the contractors' needs for water from the SWP have increased. As a result, the contractors' demands for SWP water currently exceed the dependable yield.[1] Metropolitan has developed groundwater storage programs with Semitropic Water Storage District, Arvin-Edison Water Storage District, Kern Delta Water District, and Antelope Valley-East Kern Water Agency to supplement the available water supply.

The amount of contractual supplies DWR approves for delivery varies annually with contractor demands and projected water supplies from tributary sources to the Delta, based on snowpack in the Sierra Nevada, reservoir storage, operational constraints, and demands of other water users. Deliveries to Metropolitan reached a high of 1,802 TAF in calendar year 2004. Metropolitan experienced shortages in SWP supplies in fiscal years 1991 and 1992, with reduced deliveries of 391 TAF and 710 TAF, respectively.[2] SWP deliveries were limited to a record low 5 percent of contractual amount in 2014 and 20 percent of contractual amount in 2015. For calendar year 2021, the SWP allocation decreased from an initial allocation of 10 percent to 5 percent based on on-going dry conditions. The five percent SWP allocation for Metropolitan in 2014 and 2021 represents the lowest in the history of the SWP.

In recent years, the listing of several fish species in the Sacramento/San Joaquin River Delta (Delta) under both state and federal Endangered Species Acts has constrained SWP operations and created more uncertainty in SWP supply reliability. These listed species include Delta smelt, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, green sturgeon, and Longfin smelt (state-listed only). In August 2020, DWR released the SWP Delivery Capability Report. The report shows that current SWP delivery capability has been negatively impacted by two significant factors. The first is the 2018 Addendum to the Coordinated Operation Agreement (COA), which increased State Water Project obligations to meet in-basin uses and decreased the ability of the State Water Project to export water relative to the Central Valley Project. The second major factor is operational changes by DWR to maintain higher levels of storage in Lake Oroville, made in part to ensure sufficient supplies to meet increased COA obligations. Additionally, the report shows a reduction in future delivery capability because of climate change, which is altering the hydrologic conditions in the State.

Metropolitan is undertaking ongoing efforts to maintain and improve the reliability and quality of its water supply from the State Water Project. Sections 3.2 and 3.3 in this Plan describe current programs and plans for reliability, and Chapter 4 addresses water quality issues.

Los Angeles Aqueduct

The City of Los Angeles imports water from the eastern Sierra Nevada through the Los Angeles Aqueduct (LAA). The original LAA, completed in 1913, imported water from the Owens Valley. In 1940, the aqueduct was extended to the Mono Basin. A second aqueduct, which parallels the original, was completed in 1970.

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[1] The dependable yield of the existing SWP facilities is considered to be the delivery capability during a critically dry seven-year period.

[2] These numbers are Metropolitan's allocated contractual amount. Total water deliveries to Metropolitan's service area are shown in Table A.2-1.

Prior to the 1990-1991 drought, the City of Los Angeles had imported an average of 440 TAF of water annually from the combined Owens Valley/Mono Basin system, of which about 90 TAF came from the Mono Basin. In 1986, the aqueduct delivered a record 520 TAF of water.

In the late 1980s, a series of court injunctions limited the amount of water that Los Angeles could receive from its aqueduct system. In 1990, these limitations, along with a persistent drought, limited the delivery from the aqueduct to only 106 TAF. The Mono Lake Water Rights Decision (Decision) in September of 1994 ended the litigation in the Mono Basin, while negotiations continued with Inyo County on the fate of the Owens Valley water supply. In the Decision, the state ruled that Mono Lake should rise 17 feet over the next 25 years. During this time, Los Angeles would only be permitted to divert a fraction of its historical amounts. After the lake had risen, the City of Los Angeles would still be allowed only significantly reduced diversions. However, the high precipitation during the 1990s allowed increased diversions of water to the LAA to occur at a much earlier time frame than had been foreseen at the time of the Decision.

More recently, the LAA diversions of water from the Owens Valley came under additional pressure. Diversion of water from the Owens River had led to the drying up of Owens Lake by the end of the 1920s. This dry lakebed became a major source of windblown dust, resulting in EPA pressure to develop a State Implementation Plan to bring the region into compliance with federal air quality standards. In 1998, the Los Angeles Department of Water and Power entered into a Memorandum of Agreement with the Great Basin Air Pollution Control District that specified actions needed to control the problem. These actions included shallow flooding and managed vegetation at various lakebed locations. An estimated 54 TAF per year will be required to maintain the dust control measures, further restricting the water available for diversion through the LAA. More recently, the city has been required to restore portions of the Owens River, which could further restrict the water that can be provided from this source. During the last 5 years (2015 to 2019), LAA supplies ranged from a high of 380 TAF in 2017 to a low of 33 TAF in 2015.

Historic Total Regional Water Supplies

The previous sections have presented the various sources of Metropolitan and the region's water supply. The amount of water supplied by each local and imported source from 1976 through 2020 appears in Table A.2-1. The imported supplies represent the amount of water imported into Metropolitan's service area, not the amount delivered to member agencies, which is shown in Table A.2-2. The difference between Metropolitan's imports and deliveries is water placed into or withdrawn from storage.

Appendix 3

JUSTIFICATIONS FOR SUPPLY PROJECTIONS

Appendix 3
JUSTIFICATIONS FOR SUPPLY PROJECTIONS

The California Water Code (CWC) Section 10631 requires that urban water suppliers identify and quantify, to the extent practicable, the existing and planned sources of water available to them over five-year increments to 20 years or as far as data is available. This CWC section further requires urban suppliers to include a detailed description of all water supply projects and water supply programs that may be undertaken to meet the total projected water use. This Appendix provides the basis for the water supply available to Metropolitan as contained in this plan, by each major source of supply. Such bases and proofs are required for supply verification under the legislation.

Throughout this Appendix, references are made to Metropolitan's operating budget and its long-term capital investment plan. The most recent operating budget (for fiscal years 2020-21 and 2021-22) was adopted at the April 14, 2020 meeting of Metropolitan's Board of Directors. A copy of the budget summary and the Capital Investment Plan for fiscal years 2020-21 and 2021-22 can be found at:
http://mwdh2o.com/PDF_Who_We_Are/Biennial%20Budget%20–%20Fiscal%20Years%202020-21%20and%202021-22.pdf.

Another document of interest related to Metropolitan's water supply planning is its annual report to the state Legislature in compliance with Senate Bill 60 of 1999 (Hayden).[1] Senate Bill 60 requires that Metropolitan report on its progress in increasing its emphasis on cost-effective conservation, recycling, and groundwater recharge.

A.3.1. Colorado River Aqueduct Deliveries

A. Colorado River Supplies

Metropolitan obtains water from the Colorado River under its Boulder Canyon Project Section 5 water delivery contract with the Secretary of the Interior providing for permanent service. A number of programs have been developed over the years to enhance and manage Colorado River supplies available under its water delivery contract. Appendix 2 describes the history of water supplies and the expected availability from this source, and Section 3.1 of the 2020 UWMP describes the agreements for water supplies.

Rationale for the Expected Supply

Historical Record

Water supply under Metropolitan's Boulder Canyon Project Section 5 water delivery contract has been delivered since 1939. By existing contract, it is expected to be available in perpetuity because of California's senior water rights to use of Colorado River water.

[1] Metropolitan Water District of Southern California, *Annual Progress Report to the California State Legislature: Achievements in Conservation, Recycling and Groundwater Recharge (February 2021)*, which can be found at http://www.mwdh2o.com/PDF_About_Your_Water/Annual_Achievement_Report.pdf. The legislation requiring this information can be found at http://www.leginfo.ca.gov/pub/99-00/bill/sen/sb_0051-0100/sb_60_bill_19990916_chaptered.pdf. Similar reports have been filed with the Legislature since 2000.

The historical record for available Colorado River water indicates that Metropolitan's contracted Colorado River supply has been available in every year and can reasonably be expected to be available over the next 20 years. Through 2002 the volume of water available and diverted from the Colorado River has been up to the annual capacity of the Colorado River Aqueduct of approximately 1.25 MAF. Since 2003, increased use by the other Colorado River basin states and persistent dry conditions in the Colorado River Basin has reduced the firm available supply to its 550 TAF Priority 4 entitlement.

Written Contracts or Other Proof

Metropolitan's entitlement to Colorado River water is based on a series of interstate compacts, federal laws, agreements, court decrees, and guidelines collectively known as "The Law of the River,"[2] which govern the distribution and management of Colorado River water. The following documents specifically determine Metropolitan's dependable supplies:

1931 Seven Party Agreement.[3] The 1931 Agreement recommended California's Colorado River use priorities and has no termination date. The priorities to water available for use in California held by Palo Verde Irrigation District (PVID), Yuma Project (Reservation Division), Imperial Irrigation District (IID), Coachella Valley Water District (CVWD), and Metropolitan are shown in Table A.2-5. These priorities are incorporated into the water delivery contracts that the Secretary of the Interior executed with the California agencies in the 1930s for water from Lake Mead. Metropolitan holds Priority 4 to California's basic apportionment of Colorado River water and utilizes this water – 550 TAF per year. Metropolitan also holds Priority 5 to 662 TAF per year. Appendix 2 describes the current status of water available under these priorities.

Metropolitan's Basic Contracts.[4] Metropolitan's 1930, 1931, and 1946 basic contracts with the Secretary of the Interior permit the delivery of 1.212 MAF per year when sufficient water is available. Metropolitan's 1987 surplus flow contract for up to 180 TAF with USBR permits the delivery of water to fill the remainder of the Colorado River Aqueduct when water is available.

Consolidated Court Decree.[5] The 1964 U.S. Supreme Court Decree confirmed the Arizona, California, and Nevada basic apportionments of 2.8 MAF per year, 4.4 MAF per year, and 300 TAF per year, respectively. The 1964 Decree also permits the Secretary of the Interior to make water available that is unused by one of the states for use in the other two states. In addition, it permits the Secretary of the Interior to make surplus water available. The Consolidated Decree issued on March 27, 2006, by the U.S. Supreme Court in Arizona v. California consolidated into one decree the initial 1964 decree, the 1979 supplemental decree, the 1984 second supplemental decree, the 2000 third supplemental decree, and the 2006 approval of settlements reached on the water rights claim of the Fort Yuma Indian Reservation. The Consolidated Decree quantified present perfected rights (PPRs) to the use of Colorado River water by certain Indian reservations, federal wildlife refuges, and other users.

2003 Quantification Settlement Agreement (QSA). The QSA and several other related agreements were executed in October 2003.[6] The QSA quantifies the use of water under the third priority of the Seven Party Agreement, and further allocates 38 TAF of the sixth priority to

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[2] A description of many of these documents can be found at http://www.usbr.gov/lc/region/pao/lawofrvr.html.

[3] This agreement among the seven California agencies was dated August 18, 1931, and was codified in federal regulations promulgated by the Secretary of the Interior on September 28, 1931.

[4] Including contract number Ilr-645 dated April 9, 1930, supplemented September 28, 1931.

[5] The Consolidated Decree entered by the U.S. Supreme Court on March 27, 2006, in *Arizona v. California, et al.,* can be found at http://www.usbr.gov/lc/region/pao/pdfiles/scconsolidateddecree2006.pdf.

[6] These agreements can be found at http://www.iid.com/water/library/qsa-water-transfer.

Metropolitan. The QSA provides the numeric baseline needed to measure conservation and transfer programs, and it allows for implementation of agricultural conservation, land fallowing, and other programs identified in Metropolitan's IRP. Although this agreement does not directly impact Metropolitan's entitlements, Metropolitan agreed to forbear consumptive use when necessary so that the Secretary of the Interior can satisfy the uses of holders of miscellaneous and Indian present perfected rights in excess of 14.5 TAF.

2005 Settlement Agreement with Quechan Indian Tribe. In 2005, Metropolitan entered into a settlement agreement in Arizona v. California with the Quechan Indian Tribe and other parties. The Tribe uses Colorado River water on the Fort Yuma Indian Reservation. Under the settlement agreement, the Tribe, in addition to the amounts of water decreed for the benefit of the Reservation in the 1964 decree in Arizona v. California, is entitled to (a) 20 TAF of diversions from the Colorado River, or (b) the amount necessary to supply the consumptive use required for irrigation of a specified number of acres, and for the satisfaction of related uses, whichever is less. Of the additional diversions, 13 TAF became available to the Tribe in 2006. An additional 7 TAF becomes available to the Tribe in 2035. Metropolitan agreed to provide annual incentive payments to the Tribe if the Tribe forbore diversion of the additional water, thereby allowing Metropolitan to divert it.

Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead. In December 2007, the Secretary of the Interior approved a Record of Decision establishing specific interim guidelines for reductions in Colorado River water deliveries in the Lower Basin during declared shortages and coordinated operations of Lake Powell and Lake Mead. These guidelines provide water release criteria from Lake Powell and water storage and water release criteria from Lake Mead during shortage, normal, and surplus conditions in the Lower Basin, and provide a mechanism for Metropolitan to store and take delivery of conserved system and non-system water in Lake Mead. In December 2020, the seven Colorado River Basin States sent a letter to the Secretary of Interior giving notice that the Basin States have begun the process of reconsultation regarding the 2007 interim guidelines. The Basin States and major water contractors, including Metropolitan, will be involved in reconsultation and development of new guidelines for the management and operation of Lake Powell and Lake Mead after the term of the 2007 interim guidelines ends in 2026.

Lower Basin Drought Contingency Plan. In April 2019, the President signed legislation directing the Secretary of the Interior to sign and implement four DCP agreements related to the Upper and Lower Basin DCPs without delay. The agreements were executed and became effective on May 20, 2019 and will continue to be effective through 2026. The Lower Basin Drought Contingency Plan Agreement requires California, Arizona and Nevada to contribute defined volumes of water to Lake Mead ("DCP Contributions") when lake elevations drop below certain levels. California would begin making these contributions if USBR modeling projects Lake Mead's elevation to be at or below 1,045 feet (relative to mean sea level) on January 1. Lake Mead elevation in January 2020 was 1,090 feet. Depending on the lake's elevation, California's annual contributions would range from 200 to 350 TAF. Pursuant to intrastate implementation agreements that terminate in 2026, Metropolitan is responsible for 93 percent of any California DCP Contribution that may be required under the Lower Basin DCP. CVWD is responsible for 7 percent of California's required DCP Contributions.

Implementation of the Lower Basin DCP enhances Metropolitan's ability to store water in Lake Mead and to ensure that water in storage can be delivered at a later date. The Lower Basin DCP increases the total volume of water that California may store in Lake Mead as ICS by 200 TAF. Water stored as ICS will be available for delivery as long as Lake Mead's elevation remains above 1,025 feet. Previously, that water would likely have become inaccessible below a Lake Mead elevation of 1,075 feet. DCP Contributions may be made through conversion of existing ICS. These types of DCP Contributions become DCP ICS. DCP Contributions may also be made by leaving water in Lake Mead to which there was a legal right of delivery. This type of DCP Contribution becomes system water and may not be recovered. Rules are set for delivery of DCP ICS through 2026 and between 2027 to 2057.

Financing

Metropolitan's operating budget (referenced at the beginning of this appendix) includes the cost of delivering Colorado River water and the payment to the Quechan Indian Tribe, which is paid from water sales revenue.

Federal, State, and Local Permits/Approvals

Metropolitan's fourth priority Colorado River water is currently available, and this priority assures delivery of the basic apportionment.

B. IID - Metropolitan Conservation Program

Source of Supply

The IID-Metropolitan Conservation Program provides an annual supply that is delivered to Metropolitan's service area via its Colorado River Aqueduct (CRA). In 1988, Metropolitan executed a Conservation Agreement to fund water efficiency improvements within IID's service area in return for the right to divert the water conserved by those improvements. The program consists of structural and non-structural measures, including the concrete lining of existing canals, the construction of local reservoirs and spill-interceptor canals, installation of non-leak gates, and automation of the distribution system. Other implemented projects include the delivery of water to farmers on a 12-hour basis rather than a 24-hour basis and improvements in on-farm water management.

Expected Supply Capability

The IID-Metropolitan Conservation Program activity began in 1990, has been fully operational since 1998, and makes available 105 TAF of conserved water annually from 2016 onward. The initial program agreement provided CVWD the option to call up to about 45 TAF per year if needed to meet its demands. Execution of the QSA reduced CVWD's option to a maximum of 20 TAF. This water is available to Metropolitan if not required by CVWD, but the minimum supply to Metropolitan has been increased to 85 TAF from 2016 onward through a second amendment to the agreement, and the clarification on the number of 12-hour deliveries that would be included in the program through a letter agreement. This amount was further increased to 90 TAF from 2020-2026 under the 2019 Second Amendment to the Delivery and Exchange Agreement with CVWD, with the remainder of CVWD's option (15 TAF) available for Metropolitan's delivery to CVWD at Whitewater.

Rationale for the Expected Supply

<u>Historical Record</u>

The IID-Metropolitan Conservation Program has been fully operational since 1998. Existing agreements have extended the initial term to at least 2041 or 270 days after the termination of the QSA, whichever is later, and they guarantee Metropolitan a minimum of 85 TAF per year from 2016 onward. A 2019 amendment increases the minimum to 90 TAF from 2020 to 2026.

With operations beginning in 1990, the program has conserved as much as 109.46 TAF per year to date. By an amendment to the program agreement beginning in 2007 and a 2014 letter agreement, the annual conserved water yield will be 105 TAF. The historical record indicates that

Metropolitan's expected minimum supply of 85 TAF per year (and 90 TAF from 2020 to 2026) would be available over at least the next 26 years.

Written Contracts or Other Proof

Metropolitan's annual supply from the IID-Metropolitan Conservation Program is based on three agreements and amendments to those agreements.

1988 IID-Metropolitan Conservation and Use of Conserved Water Agreement. This Agreement was executed in December 1988 by IID and Metropolitan for a 35-year term following completion of program implementation (1998–2033).

1989 Approval Agreement. This Agreement secured the approval of PVID and CVWD to not divert an amount of water equal to the amount conserved except under limited circumstances. The Agreement was executed in December 1989.

1989 Supplemental Approval Agreement. This Agreement was executed in December 1989 between Metropolitan and CVWD to coordinate Colorado River diversions and the use of the conserved water provided by the Program.

2003 Amendments to 1988 Agreement and 1989 Approval Agreement. These amendments revise Metropolitan's potential obligation to reduce its use of the conserved water yield in favor of its use by CVWD down to 20 TAF annually. Any of this water not used by CVWD would be available to Metropolitan. The amendments also extended the term of the IID-Metropolitan conservation program through December 31, 2041, or 270 days beyond the termination of the QSA.

2007 Amendments to 1988 Agreement and 1989 Approval Agreement. These amendments specify that beginning in 2007, the annual conserved water yield has and will be 105 TAF with continued operation of 24 tailwater pump back systems, of which up to 20 TAF would be made available to CVWD upon its request.

2014 Letter Agreement Related to the 1988 Agreement. This letter agreement specifies that beginning in 2016, the annual conserved water yield has and will be 105 TAF, of which up to 20 TAF would be made available to CVWD upon its request. This amendment also removes tailwater recovery systems from the conservation actions and quantifies the yield and number of 12-hour deliveries that are included in the program.

2019 Second Amendment to Delivery and Exchange Agreement Between Metropolitan and Coachella for 35 TAF. The second amendment was executed in December 2019 between Metropolitan and CVWD for the exchange of additional water during the period from 2020 through 2026. Metropolitan will be guaranteed 90 TAF per year from 2020 to 2026, with the remaining amount that CVWD could call (15 TAF) available for Metropolitan's delivery to CVWD at whitewater.

Financing

Construction of the water efficiency improvements under this Program have been funded and put into operation. Metropolitan's five-year financial forecast in the budget includes the cost of operating, maintaining, and delivering the conserved water under the IID--Metropolitan Conservation Program.

Federal, State, and Local Permits/Approvals

A comprehensive environmental review process supported implementation.

EIR for Program. The IID Board certified the final EIR for the Program in December 1986.[7]

Supplemental EIR for Program. The IID Board certified the final EIR for the Completion Program in June 1994.[8]

Program EIR for Quantification Settlement Agreement. Metropolitan's Board certified the final Program EIR for the QSA in June 2002.[9]

Addendums to the QSA Final Program EIR. Metropolitan's Board adopted the Addendum to the QSA Final Program EIR in December 2002 and a second addendum in September 2003. Metropolitan's Board also adopted the Findings of Fact and Statement of Overriding Considerations, and Mitigation and Monitoring and Reporting Program at that time.

C. Palo Verde Irrigation District Land Management, Crop Rotation and Water Supply Program

Source of Supply

At its May 11, 2004 meeting, Metropolitan's Board authorized a 35-year land management, crop rotation, and water supply program with the PVID. Under the program, participating landowners in PVID are being paid to reduce their water use by not irrigating a portion of their land. A maximum of 29 percent of lands within PVID can be fallowed in any given year. Under the terms of the QSA, water savings within the PVID service area are made available to Metropolitan. PVID has the first priority for Colorado River water under the water delivery contracts with the USBR. Implementation of the program began in January 2005. The agreement also specifies that the participating landowners will fallow land in an amount equal to 25% of the landowner's total maximum fallowing commitment during each year.

Expected Supply Capability

It is estimated that the PVID/Metropolitan Program would provide up to 133 TAF per year of additional Colorado River water. This water would be available in any year as needed and in accordance with the provisions described in the agreements with Palo Verde Valley landowners and PVID.

Rationale for the Expected Supply

Historical Record
Metropolitan and PVID tested the concept of developing a water supply for Metropolitan by entering into an agreement in 1992.[10] Agreements were signed with landowners and lessees in the Palo Verde Valley to forego irrigation for a two-year period from August 1992 to July 1994. Water unused by PVID, in the amount of 186 TAF, was stored in Lake Mead for Metropolitan. Both PVID and Metropolitan signed approved Principles of Agreement in 2001. PVID issued the Final

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[7] Imperial Irrigation District, *Final EIR, Proposed Water Conservation Program and Initial Water Transfer, Imperial Irrigation District,* October, 1986. SCH Number: 1986012903.
[8] Imperial Irrigation District, *Final EIR for Modified East Lowline and Trifolium Interceptors, and Completion Projects*, May 1994. SCH Number: 1992071061.
[9] Coachella Valley Water District, Imperial Irrigation District, Metropolitan, San Diego County Water Authority, *Final Program EIR, Implementation of the Colorado River Quantification Settlement Agreement*, June 2002, SCH Number 2000061034.
[10] Presented to Metropolitan's Board at its regular meeting on January 14, 1992.

EIR for the Proposed Palo Verde Irrigation District Land Management, Crop Rotation and Water Supply Program in September 2002.[11]

Implementation of the program began in January 2005. In March 2009, Metropolitan and PVID entered into a one-year supplemental fallowing program within PVID that provided for the fallowing of additional acreage, with savings of 24.1 TAF in 2009 and 32.3 TAF in 2010.

Calendar Year	**Volume of Water Saved** (TAF)
2005	108.7
2006	105.0
2007	72.3
2008	94.3
2009	120.2
2010	116.3
2011	122.2
2012	73.7
2013	32.8
2014	43.0
2015	94.5
2016	125.4
2017	119.4
2018	95.7
2019	44.5
2020	50.0 (estimated)

Written Contracts or Other Proof

Contracts for this program are listed below.

August 2004 Forbearance and Fallowing Program Agreement. This agreement establishes the PVID/Metropolitan Program, which provides for a solicitation of and provisional approval of landowner participation offers, specifies the process for incorporating offers into agreements with landowners, and states the terms and conditions for fallowing, including payments made by Metropolitan.

Landowner Agreements for Fallowing in PVID. These agreements specify an escrow process to consummate the transaction, an easement deed to encumber land for fallowing, a tenant agreement to subordinate a tenant's lease to the agreement and easement, and an encumbrance agreement to subordinate any encumbrance (e.g., a mortgage) to the easement. These agreements also state the landowner's fallowing obligation, payments to be made by Metropolitan, and land management measures to be implemented.

[11] SCH Number 2001101149.

Financing

Metropolitan's annual O&M budget (referenced above) includes the cost of the PVID/Metropolitan Program.

Federal, State and Local Permits

EIR for Program. A Notice of Preparation for the PVID/Metropolitan Program was published on October 29, 2001. PVID issued the Final EIR for the Proposed Palo Verde Irrigation District Land Management, Crop Rotation, and Water Supply Program in September 2002 (see reference above).

D. Land Management of Metropolitan Owned Lands in Palo Verde Valley

Source of Supply

In 2017 and 2018, Metropolitan executed new farm leases on 20,478 irrigable acres that it owns in the Palo Verde valley. These leases provide economic incentives for farmers leasing the land to grow less water-intensive crops, generating additional water savings beyond what is achieved by the Land Management, Crop Rotation, and Water Supply Program. The leases also allow Metropolitan and its lessees to collaborate on other types of conservation, such as high-efficiency irrigation and precision irrigation practices. Under the terms of the QSA, water savings within the PVID service area are made available to Metropolitan.

Expected Supply Capability

Metropolitan's lands in PVID generate water savings through the existing PVID Land Management, Crop Rotation and Water Supply Program. Changes in land management through cropping and irrigation practices generate an additional 14 - 25 TAF annually, compared to a baseline of 2015-16 water use. Because all Metropolitan-owned lands are enrolled in the fallowing program, the savings from agricultural practices depend on the fallowing call for each year, with a high call resulting in lower savings due to lower baseline usage.

Rationale for the Expected Supply

Field water use in PVID is currently measured as applied water rather than consumptive use. The baseline applied water use on Metropolitan's lands was 10.6 AF per acre in 2015-16. In 2017, 2018, and 2019, the applied water use was 8.0 to 8.5 AF per acre, representing a 20% to 25% decrease below baseline. If the consumptive water use is assumed to be half of the applied water use, then the consumptive savings on Metropolitan lands are 1.1 – 1.3 AF per acre.

Metropolitan leases 20,478 irrigable acres in the valley, but depending on the fallowing call, only 13,152 to 19,001 acres are in production in any given year. A 1.1 – 1.3 AF per acre decrease results in 14 to 25 TAF of additional supply per year, depending on the call.

Financing

Metropolitan's annual O&M budget includes the cost of the PVID land management program.

Federal, State and Local Permits

This program is not subject to any permits or environmental impact reviews under federal, state, or local laws.

E. Metropolitan-CVWD Delivery and Exchange Agreement for 35,000 Acre-Feet

Source of Supply

Metropolitan delivers to CVWD up to 35 TAF from Metropolitan's available State Water Project (SWP) Table A supply without condition on the actual Department of Water Resources (DWR) allocation for that year. As CVWD does not have a connection to the SWP, the water is delivered to CVWD by an exchange with Colorado River water. Metropolitan takes delivery of the Table A supply in conjunction with forgoing diversion of an equal volume of its Colorado River supply, effectively leaving this water in the River for diversion by CVWD at Imperial Dam. Exchange deliveries may also be made at the CRA Whitewater service connection or through the Metropolitan-CVWD-Desert Water Agency Advance Delivery Agreement. This program represents a net debit to Metropolitan's supplies.

A second source of supply governs an additional 15 TAF a year obligation from 2020-2026 under the 2019 Second Amendment to the Delivery and Exchange Agreement. However, the source of the increase is water CVWD can call from the IID/MWD Conservation Program, which is Colorado River water. Therefore, this portion of the exchange is described in greater detail in the IID/MWD Conservation Program section. This water is a one-for-one exchange and does not represent a net change to Metropolitan's supplies.

Expected Capability

Up to 35 TAF of Metropolitan's SWP Table A supply will be delivered annually to CVWD by exchange.

Rationale for the Expected Supply

This program is undertaken pursuant to the Delivery and Exchange Agreement between Metropolitan and Coachella for 35 TAF dated October 10, 2003 and is a QSA-related agreement.

Program Facilities

Metropolitan takes delivery of the Table A supply from the East Branch of the California Aqueduct at Devil Canyon Afterbay. At Metropolitan's request, the USBR releases a portion of Metropolitan's available Colorado River supply from Lake Mead for diversion by CVWD at Imperial Dam and conveyance through the All-American Canal System.

Historical Record

Since the 2003 execution of the QSA and the Delivery and Exchange Agreement, the following volumes of exchange water were delivered to CVWD at Imperial Dam:

Calendar Year	**Volume of Exchange Water** (AF)
2003	0
2004	0
2005	0
2006	34,958
2007	0
2008	0
2009	0
2010	10,000
2011	0

Calendar Year	Volume of Exchange Water (AF)
2012	0
2013	0
2014	0
2015	313
2016	0
2017	0
2018	0
2019	0
2020	0

Written Contracts or Other Proof

2003 Delivery and Exchange Agreement. This agreement between Metropolitan and CVWD provides for the delivery of up to 35 TAF of Metropolitan SWP Table A supply by exchange with Colorado River water.

2019 Second Amendment to Delivery and Exchange Agreement Between Metropolitan and Coachella. The second amendment was executed in December 2019 between Metropolitan and CVWD for the exchange of additional water during the period from 2020 through 2026. Metropolitan will exchange an average of 15 TAF per year with CVWD between 2020 and 2026. The source of this water is the portion of the IID/MWD Conservation Program that is subject to call by CVWD.

Federal, State, and Local Permits/Approvals

Program EIR for Quantification Settlement Agreement. Metropolitan's Board certified the final Program EIR for the QSA in June 2002.[12]

Addendums to the QSA Final Program EIR. Metropolitan's Board adopted the Addendum to the QSA Final Program EIR in December 2002 and a second addendum in September 2003. Metropolitan's Board also adopted the Findings of Fact and Statement of Overriding Considerations, and Mitigation and Monitoring and Reporting Program at that time.

September 2002 Final Program EIR for Coachella Valley Water Management Plan and State Water Project Entitlement Transfer. The final Program EIR for the Coachella Valley Water Management Plan and SWP Entitlement Transfer was certified by the CVWD on October 8, 2002.

F. SNWA and Metropolitan Storage and Interstate Release Agreement

Source of Supply

The source of supply is SNWA's unused Nevada apportionment of Colorado River water made available to Metropolitan for diversion and storage. In later years, Metropolitan would return water through reduced diversions of Colorado River water made at the request of SNWA.

[12] Coachella Valley Water District, Imperial Irrigation District, Metropolitan, San Diego County Water Authority, Final Program EIR, Implementation of the Colorado River Quantification Settlement Agreement, June 2002, SCH Number 2000061034.

Expected Supply Capability

As of January 1, 2020, over 422 TAF had been diverted by Metropolitan since 2004. Of the amount that has been stored, 330 TAF is available for return to SNWA.

Returns to SNWA are limited to no more than 30 TAF annually unless Metropolitan agrees to a larger amount. In 2020 and 2021, SNWA may request return of an amount equal to the shortage allocated by the Secretary of the Interior to Nevada, though they are not expected to do so. If the Secretary of the Interior apportions less than 280 TAF of basic apportionment for use in Nevada, SNWA may request the return of up to 50 TAF, 1 acre-foot for each acre-foot less than Nevada's 280 TAF basic apportionment.

If less than 75 TAF has been returned, then during each year prior to 2027 for which Lake Mead begins the year at or below elevation 1,045 feet, Metropolitan will create 50 TAF of Intentionally Created Surplus (ICS) in Lake Mead, until the combined sum of ICS and the amount of water returned to SNWA equals 75 TAF. Prior to 2027, Metropolitan would be able to request delivery of this ICS during a year in which Lake Mead begins the year at or above elevation 1,080 feet.

Rationale for the Expected Supply

Program Facilities

Water is diverted through the CRA by Metropolitan. To return the water to SNWA, Metropolitan would reduce its CRA diversions, and the Secretary of the Interior would make water available to SNWA at Lake Mead.

Historical Record

The annual volumes of water diverted into the CRA, and the volume of water stored for SNWA by Metropolitan are as follows:

Calendar Year	Volume of Water Diverted (AF)	Volume of Water Stored for SNWA (AF)
2004	10,000	10,000
2005	10,000	10,000
2006	5,000	5,000
2007	0	0
2008	45,000	45,000
2009	0	0
2010	0	0
2011	0	0
2012	62,839	41,892
2013	75,000	50,000
2014	65,000	43,333
2015	150,000	125,000
2016	0	0
2017	0	0
2018	0	0
2019	0	0
2020	0	0

No water has been returned to SNWA.

Written Contracts or Other Proof

2004 Storage and Interstate Release Agreement. This agreement among Metropolitan, the Colorado River Commission of Nevada, SNWA, and the United States provides for the Secretary of the Interior to make available to Metropolitan for diversion and storage unused Nevada apportionment. In subsequent years, the agreement provides for Metropolitan to make water available to SNWA by forgoing diversion of a portion of its available Colorado River supply.

Operational Agreement. As amended on August 11, 2009, on October 24, 2012, and on October 19, 2015, the Operational Agreement specifies the conditions under which Metropolitan would divert and store unused Nevada apportionment through 2026 and the return of water to SNWA.

G. Lower Colorado Water Supply Project

Source of Supply

Groundwater is pumped by the Lower Colorado Water Supply Project wells near the All-American Canal and is discharged to the Canal. IID reduces its net diversions of Colorado River water by an amount equal to the amount of Project water discharged into the Canal, permitting entities along the Colorado River that do not have rights or have insufficient rights to divert Colorado River water to obtain a supply of water. In 2007, Metropolitan entered into a contract with the USBR and the City of Needles to utilize the unused Project capacity.

Expected Capability

Metropolitan estimates that it received 8.8 TAF of Lower Colorado Water Supply Project water in 2020.

Rationale for the Expected Supply

Program Facilities

Two Lower Colorado Water Supply Project wells pump water into the All-American Canal. The groundwater level in one of the wells declined to the point that it could not operate at capacity with existing equipment. Replacement equipment to restore pumping capacity was installed. Two new Project wells became operational in 2016 and brought the pumping capacity to the full 10,000 AFY project capacity.

Historical Record

Metropolitan has received the following amounts of Lower Colorado Water Supply Project water:

Calendar Year	**Volume of Water** (AF)
2007	5,011
2008	6,300
2009	2,349
2010	3,872
2011	3,611
2012	3,253
2013	4,208
2014	6,109
2015	6,722
2016	6,647
2017	6,851

Calendar Year	Volume of Water (AF)
2018	9,469
2019	9,554
2020	8,800 (estimated)

Written Contracts or Other Proof

2007 Lower Colorado Water Supply Project Contract among the United States, the City of Needles, and Metropolitan. This contract, as amended in 2010 and 2020, provides for the United States to deliver Colorado River water to Metropolitan, the availability of which results from the pumping of Lower Colorado Water Supply Project groundwater and the exchange of such water.

Financing

Metropolitan's O&M budget includes the cost associated with receipt of Lower Colorado Water Supply Project water.

H. Lake Mead Storage Program, Drop 2 (Brock) Reservoir Funding, Yuma Desalting Plant Pilot Project, Binational Intentionally Created Surplus, and the Lower Basin Drought Contingency Plan

Source of Supply

Water has been and will be stored in Lake Mead as Intentionally Created Surplus (ICS) through extraordinary conservation measures, such as water saved through the Palo Verde Irrigation District Land Management, Crop Rotation, and Water Supply Program.

Water has been and will be stored in Lake Mead as ICS through system efficiency measures, such as Metropolitan's funding contributions toward construction of the Drop 2 (Brock) Reservoir near the All-American Canal and pilot operation of the Yuma Desalting Plant.

Water will be stored in Lake Mead as Binational ICS through implementation of pilot conservation projects in Mexico.

Water has been stored in Metropolitan's service area for IID as excess conservation.

Expected Capability

Metropolitan may create as much as 400 TAF of Extraordinary Conservation ICS water in a single year less the amount that may be created by IID, which could be as much as 25 TAF. In any given year, if Arizona and Nevada create less than their respective maximums, according to provisions in the Lower Basin Drought Contingency Plan (DCP) Metropolitan may create above 400 TAF, provided that all entities in the Lower Basin create no more than 625 TAF combined.

As stipulated in the DCP, upon creation, 10 percent of the Extraordinary Conservation ICS is deducted, resulting in additional system water stored in Lake Mead and leaving 90 percent of the water available for release to Metropolitan, without additional annual evaporation losses.

Under the DCP, the amount of Extraordinary Conservation ICS accumulated in Lake Mead for Metropolitan is limited to 1.7 MAF less the amount accumulated by IID which could be as much as 50 TAF and less the amount of Binational ICS stored by both IID and Metropolitan. Per the DCP, Arizona is also allowed to request 50 TAF of California Extraordinary Conservation ICS accumulation space. It is expected that Arizona will do so by the end of 2021.

Metropolitan may take delivery of as much as 400 TAF of Extraordinary Conservation ICS from Lake Mead in a year less the amount delivered to IID, which could be as much as 50 TAF, as long as Lake Mead's elevation remains above 1,025 feet.

Under the DCP, Metropolitan must also store defined volumes of water in Lake Mead at specified lake levels. California would begin making contributions if Lake Mead's elevation is projected to be at or below 1,045 feet (relative to mean sea level) on January 1. Depending on the lake's elevation, California's contributions would range from 200 to 350 TAF a year ("DCP Contributions"). Pursuant to intrastate implementation agreements that terminate in 2026, Metropolitan is responsible for 93 percent of any California DCP Contribution that may be required under the Lower Basin DCP. CVWD is responsible for 7 percent of California's required DCP Contributions.

As of January 1, 2020, Metropolitan has 89 TAF of System Efficiency ICS stored in Lake Mead. There are no evaporation losses charged to stored System Efficiency ICS. Metropolitan may take delivery of as much as 24 TAF of this System Efficiency ICS resulting from pilot operation of the Yuma Desalting Plant and 25 TAF of this System Efficiency ICS resulting from construction of the Drop 2 (Brock) Reservoir annually. The USBR may reduce this delivery if it determines a reduction is necessary to avoid a shortage.

Binational ICS is provided for through domestic agreements related to Minutes to the 1944 Treaty between the United States and Mexico. Metropolitan received 23.75 TAF of Binational ICS in Lake Mead in 2017 under Minute 319. Under Minute 323 Metropolitan will receive 27,275 AF of Binational ICS in Lake Mead between 2020 and 2026.

Additionally, under the California ICS Agreement, rather than storing conserved water in Lake Mead, IID may, with the written consent of Metropolitan, have up to 25 TAF of this water delivered to Metropolitan for storage in any one calendar year. Upon request by IID, Metropolitan would return 90 percent of the stored water to IID with the remaining 10 percent left for Metropolitan's use. A 2015 Amendment allowed IID to increase the amount of water it could deliver to Metropolitan for storage from 2015 to 2017. Metropolitan would return 95 percent of the stored water to IID, with additional 3 percent reductions in return obligation each year starting in 2020. Also, Metropolitan may make temporary use of IID's Extraordinary Conservation ICS accumulated in Lake Mead. As of January 1, 2020, Metropolitan has stored approximately 168 AF of IID's conserved water.

Rationale for the Expected Supply

Program Facilities

This program makes use of Lake Mead and the CRA.

Historical Record

From 2006 to 2010, Metropolitan created approximately 201.5 TAF of Extraordinary Conservation ICS.

In 2008, the USBR assigned to Metropolitan 100 TAF of water stored in Lake Mead as System Efficiency ICS due to Metropolitan's contributions to the Drop 2 Reservoir project, and Metropolitan diverted 34 TAF of that water.

In 2010 and 2011, the USBR assigned to Metropolitan 16.75 TAF and 7.647 TAF of water stored in Lake Mead as System Efficiency ICS, respectively, due to Metropolitan's contributions to the Yuma Desalting Plant pilot project.

From 2011 to 2012, Metropolitan created approximately 348.7 TAF of Extraordinary Conservation ICS.

From 2013 through 2015, Metropolitan took delivery of approximately 475.6 TAF of Extraordinary Conservation ICS.

From 2016 to 2019, Metropolitan created approximately 896.7 TAF of Extraordinary Conservation ICS.

In 2017, Metropolitan received 23.75 TAF of Binational ICS.

As of January 1, 2020, Metropolitan's Extraordinary Conservation ICS, System Efficiency ICS, and Binational ICS volumes in Lake Mead were approximately 866 TAF, 89.4 TAF, and 23.8 TAF respectively, and no DCP Contributions to Lake Mead have been required.

Written Contracts or Other Proof

2007 Lower Colorado River Basin Intentionally Created Surplus Forbearance Agreement among the Arizona Department of Water Resources, PVID, IID, the City of Needles, CVWD, Metropolitan, SNWA, and the Colorado River Commission of Nevada. This agreement sets forth the rules under which ICS water is developed, stored in, and delivered from Lake Mead. It also provides for IID storing conserved water with Metropolitan under certain conditions.

2007 California Agreement for the Creation and Delivery of Extraordinary Conservation Intentionally Created Surplus among Metropolitan, PVID, IID, CVWD, and the City of Needles. This agreement determines the conditions under which California contractors receiving Colorado River water may store and deliver water from Lake Mead.

2007 Agreement among the United States, the Colorado River Commission of Nevada, and the SNWA for the Funding and Construction of the Lower Colorado River Drop 2 Storage Reservoir Project. This agreement provides for: the United States to design and construct the Drop 2 Storage Reservoir Project; SNWA to fund the capital cost of the Project; the United States to credit SNWA's ICS account with 600 TAF of System Efficiency ICS; and allows Metropolitan to become a party to the agreement, requiring that Metropolitan provide funding for a portion of the capital cost.

2007 Delivery Agreement between the United States and Metropolitan. This agreement provides the procedures for creating ICS water and guarantees delivery of the water to Metropolitan.

2008 Metropolitan Notice of Election to Participate as a Party to the Drop 2 Funding Agreement. This notice requires Metropolitan to provide funding for a portion of the capital cost of the Drop 2 Storage Reservoir Project, and the United States to credit Metropolitan's ICS account with 100 TAF of System Efficiency ICS, reducing the amount of System Efficiency ICS in SNWA's account by an equal amount.

2009 Agreement among the United States, Metropolitan, the Colorado River Commission of Nevada, SNWA, and the Central Arizona Water Conservation District for a Pilot Project for Operation of the Yuma Desalting Plant. This agreement provides for the allocation of the costs for the preparation and pilot operation of the Yuma Desalting Plant.

2010 Yuma Desalting Plant Pilot Project Delivery Agreement between the United States and Metropolitan. This agreement secures delivery of the ICS water created and specifies the manner in which this water will be accounted.

2012 Agreement among the United States, Metropolitan, the Colorado River Commission of Nevada, SNWA, and the Central Arizona Water Conservation District for a Pilot Program for the Conversion of Intentionally Created Mexican Allocation to Intentionally Created Surplus. This agreement provides for the allocation of the costs among the agencies for the implementation of pilot conservation projects within Mexico and the allocation of 95 TAF of conserved water among the non-federal agencies as Binational ICS in Lake Mead.

2012 Interim Operating Agreement for Implementation of Minute No. 319 of the International Boundary and Water Commission. This agreement among the United States, the Upper Basin states, and Lower Basin states' agencies, including Metropolitan, sets forth the rules under which Intentionally Created Mexican Allocation is to be converted to Binational ICS for storage in and delivery from Lake Mead.

2012 Lower Colorado River Basin Forbearance Agreement for Binational Intentionally Created Surplus. This agreement among the state of Arizona, the Colorado River Commission of Nevada and SNWA, and California Colorado River water contractors, including Metropolitan, ensures that the Binational ICS made available to a contractor that invests in a project in Mexico cannot be claimed by another contractor in another state.

2012 Binational ICS Delivery Agreement. This agreement between Metropolitan and the United States secures delivery of the Binational ICS water made available by exchange and specifies the manner in which this water would be accounted.

2013 Agreement between Metropolitan and IID Regarding Binational Intentionally Created Surplus. This agreement allows IID to provide a payment to Metropolitan of up to 50 percent of the financial contribution to be made to the United States by Metropolitan for the implementation of pilot conservation projects within Mexico. As a result of IID's payment, Metropolitan received 23.75 TAF and IID received 23.75 TAF of Binational ICS in 2017.

2015 Amendment 2 to the California Agreement for the Creation and Delivery of Extraordinary Conservation Intentionally Created Surplus. This agreement between Metropolitan, PVID, IID, CVWD, and the City of Needles increased both IID's put capacity and cumulative capacity limits on storing conserved water with Metropolitan during the three-year period from 2015-2017.

2017 Agreement among the United States, Metropolitan, the Colorado River Commission of Nevada, SNWA, IID, and the Central Arizona Water Conservation District for a Pilot Program for the Conversion of Mexico's Water Reserve to Binational ICS. This agreement provides for the allocation of the costs among the agencies for the implementation of pilot conservation projects in Mexico and the allocation of 109.1 AF of conserved water to the non-federal agencies as Binational ICS in Lake Mead.

2017 Interim Operating Agreement for Implementation of Minute No. 323. This agreement between the United States, the Upper Basin states, and Lower Basin states' agencies, including Metropolitan, sets forth the rules under which Intentionally Created Mexican allocation is to be converted to Binational ICS for storage in and delivery from Lake Mead.

2017 Binational ICS Agreement. This agreement between the state of Arizona, the Colorado River Commission of Nevada and SNWA, and California Colorado River water contractors, including Metropolitan, ensures that the Binational ICS made available to a contractor that invests in a project in Mexico cannot be claimed by another contractor in another state.

2017 Binational ICS Delivery Agreement. This agreement between Metropolitan and the United States secures delivery of the Binational ICS water made available by exchange and specifies the way this water would be accounted for.

2019 Lower Basin Drought Contingency Plan. This agreement creates additional guidelines under which ICS water is developed, stored in, and delivered from Lake Mead.

I. Metropolitan/Bard Seasonal Fallowing Program

Source of Supply

At its December 2019 meeting, Metropolitan's Board authorized a 7-year seasonal fallowing program with the Bard Water District (Bard). Under the program, participating farmers in Bard are being paid to reduce their water use by not irrigating a portion of their land. A maximum of 3,000 acres can be fallowed in any given year. Under the terms of the QSA, water savings within the Bard service area are made available to Metropolitan. Bard Unit, as part of the Yuma Project, has the first priority for Colorado River water under the water delivery contracts with the USBR. Implementation of the program began in March 2020.

Expected Supply Capability

It is estimated that the Seasonal Fallowing Program would provide up to 6 TAF per year of additional Colorado River water. This water would be available in any year as needed and in accordance with the provisions described in the agreements with Bard Unit farmers and Bard.

Rationale for the Expected Supply

<u>Historical Record</u>

Metropolitan and Bard tested the concept of developing a water supply for Metropolitan by entering into agreements for a two-year Metropolitan/Bard Water District Land Management and Seasonal Fallowing Pilot Program. Agreements were signed with farmers, with written consent from landowners if leasing land, in the Bard Unit to forego irrigation for two summers between March and July in 2016 and 2017. Water unused by Bard was about 2.3 TAF and was stored in Lake Mead for Metropolitan. Bard was issued a categorical exemption for the Proposed Metropolitan/Bard Seasonal Fallowing Pilot Program in January 2016.[13] Implementation of the program began in March 2016.

<u>Written Contracts or Other Proof</u>

<u>December 2019 Agreement for the Implementation of a Seasonal Land Fallowing Program.</u> This agreement establishes the Bard/Metropolitan Program, which provides for a solicitation of farmer interest in participation in the program, specifies the process for incorporating eligible lands into agreements with farmers, and states the terms and conditions for fallowing, including payments made by Metropolitan.

<u>Agreement for Seasonal Fallowing in Bard Unit (Farmer Fallowing Agreements).</u> These agreements specify the process for farmers in the Bard Unit to participate in the Program. These agreements establish the fallowing period, the eligibility criteria for the fallowed land, the farmers' fallowing obligations, payments to be made by Metropolitan, and the land management measures to be implemented.

<u>May 2020 First Amendment Agreement for the Implementation of a Seasonal Land Fallowing Program.</u> This amendment clarifies Metropolitan's method of calculating fallowed acreage for the Program. To ensure Metropolitan only provides funding to lands that could have been otherwise irrigated, the amendments defines which acres within the Bard Unit are "fallowable" and therefore eligible for participation in the Program. The parties did not make changes to the Metropolitan Board-approved terms of the original December 2019 agreement.

[13] SCH Number 2001101149.

Financing

Metropolitan's annual O&M budget (referenced above) includes the cost of the Metropolitan/Bard Program. Metropolitan will provide an annual incentive per acre of irrigable land fallowed. The agreement provides for escalating the incentive every year using the Consumer Price Index. Metropolitan will pay for 75 percent of the incentive to the participating farmer and 25 percent to Bard.

J. Exchange with SDCWA

Source of Supply

SDCWA has acquired conserved Colorado River water reaching an annual volume of 277.7 TAF by 2023. SDCWA makes this water available at Lake Havasu for Metropolitan diversion, where Metropolitan takes possession of the water and provides a matching volume from Metropolitan's blended supplies to SDCWA by exchange in equal monthly amounts. The conserved water is acquired by SDCWA through its transfer agreement with the Imperial Irrigation District (IID) and from the lining of the All-American and Coachella canals.

Under the transfer agreement with IID, the stabilized annual transfer volume of 200 TAF is generated from conservation of water through on-farm efficiency conservation arrangements made by IID with its customers and other system efficiency measures.

The Coachella Canal Lining Project consists of a 35-mile concrete-lined canal, including siphons, which replaced an earthen canal. The project was completed in December 2006 and conserves 30,850 AF annually. The All-American Canal Lining Project consists of a concrete-lined canal constructed parallel to 23 miles of earthen canal, was completed in 2009 conserving 67,700 AF annually.

Pursuant to the QSA and related agreements, the 98,550 AF of water resulting from these projects annually is allocated as follows: 16,000 AF to the San Luis Rey Settlement Parties in San Diego County, 77,700 AF to SDCWA, and 4,850 AF for Coachella Canal Lining Project mitigation, with the amount not needed for mitigation becoming available to SDCWA.

Expected Supply Capability

In 2021, the IID transfer to SDCWA reaches 205 TAF, reduces to 202.5 TAF in 2022, then stabilizes at 200 TAF per year in 2023, which will be made available to Metropolitan for exchange each year through 2047. At least 77.7 TAF of canal lining water will be made available to Metropolitan for exchange each year through 2112. After 2022, the annual volume SDCWA will make available to Metropolitan is limited to 277.7 TAF.

Rationale for the Expected Supply

<u>Historical Record</u>

The IID transfers to SDCWA began in 2003 for a volume of 10,000 AF and have ramped up each year thereafter according to a defined schedule, reaching 192.5 TAF in 2020.

Conserved water from the All-American Canal Lining Project first became available in 2008 when 7,385 AF was allocated to SDCWA, increased to 54,429 AF in 2009, reached 56,200 AF in 2010, and has continued at that volume through 2020.

Conserved water from the Coachella Canal Lining Project first became available in 2006 when 687 AF was allocated to SDCWA and ranged from 21,511 AF to 25,759 AF from 2007 through 2019.

SDCWA has made available to Metropolitan all of this conserved water at Lake Havasu, where Metropolitan took possession and managed the water at its complete discretion for the benefit of all member agencies. Of the volume received at Lake Havasu Metropolitan delivered an equal volume to SDCWA by exchange from a blend of sources that were available to Metropolitan at a price that is less than its full service rate.

Written Contracts or Other Proof

Amended and Restated Agreement between The Metropolitan Water District of Southern California and the San Diego County Water Authority for the Exchange of Water. This October 10, 2003, agreement provides for Metropolitan delivery of Exchange Water to SDCWA in exchange for conserved Colorado River water SDCWA makes available to Metropolitan at Lake Havasu.

Agreement Between Imperial Irrigation District And San Diego County Water Authority For Transfer Of Conserved Water. This April 9, 1998, agreement, as amended, provides for IID to conserve water for transfer to SDCWA and establishes the price SDCWA pays to IID for the conserved water.

Allocation Agreement. This October 10, 2003, agreement among the United States, CVWD, IID, SDCWA, Metropolitan, and the San Luis Rey Settlement Parties provides for the allocation of water conserved from the All-American Canal Lining Project and the Coachella Canal Lining Project, and Metropolitan's assignment to SDCWA of it rights to both canal lining projects.

Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement. By this October 10, 2003, agreement, among the Secretary of the Interior. CVWD, IID, SDCWA, and Metropolitan, the Secretary agreed to deliver IID-SDCWA transfer water and canal lining water allocated to SDCWA to Metropolitan's Colorado River Aqueduct Intake at Lake Havasu for diversion by Metropolitan.

Financing

Metropolitan's annual O&M budget (referenced above) incorporates the price that SDCWA pays for Metropolitan delivery of Exchange Water, which is less than Metropolitan full service rate.

K. Exchange with the United States

Source of Supply

The Coachella Canal Lining Project consists of a 35-mile concrete-lined canal, including siphons, which replaced an earthen canal. The project was completed in December 2006 and conserves 30,850 AF annually. The All-American Canal Lining Project consists of a concrete-lined canal constructed parallel to 23 miles of earthen canal, was completed in 2009 conserving 67,700 AF annually.

Pursuant to the QSA and related agreements, the 98,550 AF of water resulting from these projects annually is allocated as follows: 16,000 AF to the San Luis Rey Settlement Parties in San Diego County, 77,700 AF to SDCWA, and 4,850 AF for Coachella Canal Lining Project mitigation, with the amount not needed for mitigation becoming available to SDCWA.

The United States furnishes the 16 TAF allocated to the San Luis Rey Settlement Parties at Metropolitan's Colorado River Intake on Lake Havasu. Metropolitan takes possession of the water and by exchange delivers an equal volume of Metropolitan's blended supplies to SDCWA. By separate agreement SDCWA conveys the water to the San Luis Rey Settlement Parties.

Expected Supply Capability

So long as water conserved by the All-American Canal Lining Project and Coachella Canal Lining Project is allocated to and available for use by the San Luis Rey Settlement Parties, the United States will make 16 TAF available for diversion by Metropolitan in perpetuity.

Rationale for the Expected Supply

Historical Record

The allocation of canal lining water to the San Luis Rey Settlement Parties was 172 AF in 2006, 4,500 AF in 2007, 6,013 AF in 2008, 15,648 AF in 2009, and 16,000 AF each year thereafter. The United States has made this water to available for diversion by Metropolitan. Through May 31, 2017, all water furnished by the United States at Lake Havasu was available for use by Metropolitan for the benefit of all member agencies. Beginning June 1, 2017, Metropolitan took possession of the water furnished by the United States and managed that water at its complete discretion for the benefit of all member agencies and delivered an equal volume to SDCWA by exchange from a blend of sources that were available to Metropolitan at a discounted price paid by the United States.

Written Contracts or Other Proof

Allocation Agreement. This October 10, 2003, agreement among the United States, CVWD, IID, SDCWA, Metropolitan, and the San Luis Rey Settlement Parties provides for the allocation of water conserved from the All-American Canal Lining Project and the Coachella Canal Lining Project, and Metropolitan's assignment to SDCWA of it rights to both canal lining projects.

Agreement Relating to Supplemental Water Among The Metropolitan Water District of Southern California, The San Luis Rey Settlement Parties, and The United States. This October 10, 2003, agreement provides that the United States will furnish to Metropolitan up to 16 TAF per year of water conserved by the canal lining projects for the benefit of the San Luis Rey Settlement Parties.

Financing

Metropolitan's annual O&M budget (referenced above) incorporates the price that United States pays for Metropolitan delivery of Exchange Water, which is less than Metropolitan full service rate, and the delivery of an equal volume by exchange to SDCWA.

L. Programs Under Development

Expansion of the Palo Verde Irrigation District (PVID) Land Management Program: Additional fallowing agreements may be developed in subsequent years as needed.

Quechan Seasonal Fallowing Program: The Quechan Indian tribe has expressed interest in participating in a fallowing program similar to the Bard Water District Seasonal Fallowing Program. Such a program is under consideration.

A.3.2 California Aqueduct Deliveries

A. State Water Project Deliveries

Source of Supply

The State Water Project (SWP) provides imported water to the Metropolitan service area and has provided from 25 to 50 percent of Metropolitan's supplies. In accordance with its contract with the Department of Water Resources (DWR), Metropolitan has a Table A allocation of 1,911,500 AF per year under contract from the SWP. Actual deliveries have never reached this amount. The availability of SWP supplies for delivery through the California Aqueduct over the next 18 years is estimated according to the historical record of hydrologic conditions, existing system capabilities as may be influenced by environmental permits, requests of the SWC, and the SWP contract provisions for allocating Table A, Article 21 supplies, and other SWP deliveries including San Luis carryover to each contractor. As shown in this 2020 UWMP, the estimates of SWP deliveries to Metropolitan are based on DWR's 2019 SWP Delivery Capability Report.

As part of its contract with DWR, Metropolitan pays both the fixed costs of financing SWP facilities construction and the variable costs of operations, maintenance, power, and replacement costs for water delivered each year. SWP water is delivered to Metropolitan through the East Branch at Devil Canyon Power Plant afterbay, along the Santa Ana Valley Pipeline, and at Lake Perris. Metropolitan takes delivery from the West Branch at Castaic Lake.

Expected Supply Capability

The Edmund G. Brown California Aqueduct transports Metropolitan's supplies from the SWP. The quantity of water available for export through the California Aqueduct can vary significantly year to year. The amount of precipitation and runoff in the Sacramento and San Joaquin watersheds, system reservoir storage, regulatory requirements, and contractor demands for SWP supplies impact the quantity of water available to Metropolitan.

Rationale for the Expected Supply

Metropolitan and 28 other public entities have contracts with the State of California for SWP water. These contracts require the state, through DWR, to use reasonable efforts to develop and maintain the SWP supply. SWP contractors have the right to participate in the system, with an entitlement to water service from the SWP and the right to use the portion of the SWP conveyance system necessary to deliver water to them. The state has made significant investment in infrastructure. It has constructed 28 dams and reservoirs, 26 pumping and generation plants, and about 660 miles of aqueducts. More than 25 million California residents benefit from SWP water. DWR estimates that with current facilities and regulatory requirements, the project will deliver approximately 2.4 MAF under average hydrology considering regulatory requirements from the SWRCB Water Quality Control Plan, the USFWS and NMFS biological opinions and the CDFW Incidental Take Permit. In addition, these estimates incorporate 2018 amendments to the Coordinated Operations Agreement between the SWP and CVP.

On a yearly basis, DWR estimates the amount of supplies that are available for that year. Metropolitan uses a forecasting method for SWP deliveries based on historical patterns of precipitation, runoff, and actual deliveries of water.

Further, under the water supply contract, DWR is required to use reasonable efforts to maintain and increase the reliability of service to Metropolitan. As discussed in a subsequent section, DWR is participating in the Bay-Delta process to achieve these requirements.

Historical Record

The historical record shows significant accomplishments by DWR in providing its contractors with SWP water supplies. Through 2018, the SWP has delivered over 103 MAF to its contractors. The maximum annual water supply was delivered in 2017, and totaled 3.77 MAF, exceeding the previous record delivery of 3.75 MAF in 2005. In 2006 and 2011 the project delivered 3.7 MAF. DWR has continued to invest in SWP facilities to deliver water to its contractors.

Written Contracts or Other Proof

1960 Contract between the State of California and The Metropolitan Water District of Southern California for a Water Supply. This contract, initially executed in 1960 and amended numerous times since, is the basis for SWP deliveries to Metropolitan. It requires DWR to make reasonable efforts to secure water supplies for Metropolitan and its other contractors. The contract expires in 2035. In December 2018, Metropolitan signed a Contract Extension Amendment that would extend the contract term to 2085. The amendment is not effective until approval of the December 2018 validation action filed by DWR in Sacramento County Superior Court, which is still pending.

Financing

Metropolitan's payments for its State Water contract obligation are approved each year by its Board of Directors and currently constitute approximately a third of the annual budget.

Federal, State and Local Permit/Approvals

Operation of the SWP. The DWR is responsible for acquiring, maintaining, and complying with numerous federal and state permits for operation of the SWP. Metropolitan has been active in monitoring the issues affecting its contract with DWR.

EIR for the East Branch Enlargement. In April 1984, DWR prepared and finalized an EIR for the Enlargement of the East Branch of the Governor Edmund G. Brown California Aqueduct.

EIR for the Harvey O. Banks Pumping Plant. In January 1986, DWR prepared and finalized an EIR for the additional pumping units at Harvey O. Banks Delta Pumping Plant.

EIR for the Mission Hills Extension. In 1990, DWR prepared and finalized an EIR for the SWP Coastal Branch, Phase II and Mission Hills Extension.

East Branch Extension Project Phase 1. In 1998, DWR completed an EIR to extend the East Branch of the California Aqueduct to provide service to San Gorgonio Pass Water Agency. Phase 1 was completed in 2002.

State Water Resources Control Board Water Quality Control Plan for the San Francisco/ Sacramento-San Joaquin Delta Estuary (Bay-Delta WQCP), Sacramento-San Joaquin Bay-Delta Estuary Revised Water Right Decision 1641 (D-1641), March 2000.

National Marine Fisheries Service Biological Opinion on Long Term Operation of the Central Valley Project and the State Water Project, October 2019.

U.S. Fish and Wildlife Service Biological Opinion for the Reinitiation of Consultation on the Coordinated Operations of the Central Valley Project and State Water Project, October 2019.

California Department of Fish and Wildlife Incidental Take Permit for Long-Term Operation of the State Water Project in the Sacramento-San Joaquin Delta, March 2020.

B. *Port Hueneme Lease of Ventura Table A*

Source of Supply

Metropolitan has a right to delivery of up to 1,850 AF of Table A from the Ventura County Watershed Protection District (Ventura), one of 29 SWP contractors, via a sublease agreement with the Port Hueneme Water Agency (Port Hueneme). United Water Conservation District, one of three agencies holding a contract right to Ventura Table A supply, leases this portion of their total 5,000 AF of Table A to Port Hueneme, who in turn subleases the Table A to Metropolitan. The long-term lease is a condition of the 1996 annexation of the Port Hueneme service area to Calleguas Municipal Water District and Metropolitan.

Expected Supply Capability

The amount of supply available to Metropolitan under the long-term lease is up to 1,850 AF of Ventura Table A. This water supply is in addition to Metropolitan's Table A, and the amount available each year is determined by the SWP allocation, with 1,850 AF available at a 100 percent allocation.

Rationale for the Expected Supply

The DWR estimates the amount of supplies that are available each year. Metropolitan uses a forecasting method for SWP deliveries based on historical patterns of precipitation, runoff and actual deliveries of water.

Historical Record

Metropolitan has taken delivery of Port Hueneme Lease water since 1997. These supplies are delivered to Metropolitan from the West Branch of the California Aqueduct and have ranged from 93 AF under a 5 percent allocation to 1,850 AF under a 100 percent allocation.

Written Contracts or Other Proof

Port Hueneme Water Agency Annexation. By Minute Item 41728, dated January 9, 1996, Metropolitan's Board adopted Resolution 8487 granting the concurrent annexation of Annexation No. 32 to Calleguas Municipal Water District and The Metropolitan Water District of Southern California, and fixing Metropolitan's terms and conditions for the annexation.

1996 Sublease Agreement. The Port Hueneme and Metropolitan executed a sublease agreement to facilitate annual delivery to Metropolitan of up to 1,850 AF of Ventura Table A that is leased to Port Hueneme by United Water Conservation District.

Financing

Financial obligations to DWR related to the 1,850 AF Port Hueneme Lease supply, including variable transportation charges for delivery, remain the responsibility of the Ventura County Watershed Protection District.

Federal, State, and Local Permits/Approvals

DWR is responsible for acquiring, maintaining, and complying with numerous Federal and State permits for operation of the SWP.

C. Desert Water Agency/Coachella Valley Water District/Metropolitan Water Exchange and Advance Delivery Programs

Source of Supply

The Desert Water Agency (DWA) and CVWD, both in Riverside County, have rights to SWP deliveries, but do not have any physical connections to the SWP facilities. Both agencies are adjacent to the CRA. For DWA and CVWD to obtain water equal to their SWP allocations, Metropolitan has agreed to exchange an equal quantity of its Colorado River water for DWA and CVWD's SWP water. DWA has a SWP Table A contract right of 55.75 TAF per year, and CVWD has a SWP Table A contract right of 138.35 TAF per year, for a total of 194.1 TAF per year. Additionally, CVWD has a long-term water supply agreement for 9.5 to 16.5 TAF annually from Rosedale Rio-Bravo Water Storage District.

Expected Supply Capability

Under the existing agreements, Metropolitan provides water from its CRA to DWA and CVWD in exchange for SWP deliveries. Metropolitan can deliver additional water to its DWA/CVWD service connections, permitting these agencies to store water. When supplies are needed, Metropolitan can then receive its full Colorado River supply, as well as the SWP allocation from the two agencies, while the two agencies can rely on the stored water for meeting their water supply needs. The amount of DWA and CVWD SWP Table A water available to Metropolitan depends on total SWP deliveries and varies from year to year.

In addition to their Table A and long-term water supplies, DWA and CVWD, subject to available capacity, may take delivery of SWP supplies available under Article 21, the Turn-back Pool Program, and non-SWP water supplies they may acquire and convey through the SWP facilities. These other supplies are delivered to DWA and CVWD by exchange with Metropolitan in the same manner as Table A deliveries. DWA and CVWD are participants in the Yuba Dry Year Water Purchase Program. Additionally, DWA participated in the 2009 Drought Water Bank and the 2015-2016 Multi-Year Water Pool Demonstration Program.

Rationale for the Expected Supply

The DWR estimates the amount of supplies that are available each year. Metropolitan uses a forecasting method for SWP deliveries based on historical patterns of precipitation, runoff and actual deliveries of water.

Historical Record

DWA and CVWD Exchange Program is currently in operation. The Advance Delivery Agreement has been in place since 1984. Since 1973, Metropolitan has been taking delivery of these agencies' SWP Table A water and has provided equivalent water to those agencies from Metropolitan's Colorado River supplies. Metropolitan has also been delivering water in advance of the amount needed under the exchange agreements. With water having been delivered in advance, Metropolitan can reduce deliveries to DWA and CVWD as needed. The Advance Delivery Account is a key tool for managing abundant SWP supplies. In 2017, Metropolitan managed an 85 percent SWP allocation in part by making 245 TAF of advance deliveries, bringing the account balance up to 325 TAF by the end of the year.

Written Contracts or Other Proof

1967 and 1983 Water Exchange Contract and Agreements. The DWA and CVWD Program is currently in operation. The DWA and CVWD water exchange contract has been in place since 1967, was amended in 1972, and was modified with execution of additional agreements in 1983.

1984 Advance Delivery Agreement. The Advance Delivery Agreement allows Metropolitan to supply DWA and CVWD with Colorado River water in advance of the time these agencies are entitled to receive water under the exchange agreements. In future years, Metropolitan can recover this water by reducing its deliveries under the exchange agreements.

The 2003 Exchange Agreement. DWA, CVWD, and Metropolitan executed the 2003 Exchange Agreement under which Metropolitan transferred 88.1 TAF and 11.9 TAF of its SWP Table A water to DWA and CVWD, respectively, reducing Metropolitan's Table A volume from 2,011.5 TAF to 1,911.5 TAF. The 2003 Exchange Agreement became operational in calendar year 2005 with the execution of letter agreements among DWA, CVWD, and Metropolitan governing its implementation. The exhibits to the November 9, 2004, and November 19, 2007, letter agreements also modify certain provisions of the Water Exchange Contract and Agreements and the Advance Delivery Agreement.

November 2012 Letter Agreement. CVWD and Metropolitan executed the letter agreement to deliver non-SWP water in exchange for Colorado River water under which CVWD arranged for the delivery of up to 16.5 TAF per year of water to Metropolitan provided by Rosedale-Rio Bravo Water Storage District to CVWD. Metropolitan delivers to CVWD an equal amount of Colorado River water.

2019 Amended and Restated Agreement for Exchange and Advance Delivery. In December 2019, CVWD, DWA, and Metropolitan executed an amendment to the exchange and delivery agreements in order to provide greater certainty for water supply and financial planning, simplify implementation of the exchange, provide Metropolitan with additional revenue, and improve dry-year water supply reliability.

Financing

The funds for deliveries under this Program are included in Metropolitan's O&M budget and Long-Range Finance Plan (referenced above).

Federal, State, and Local Permits/Approvals

DWR is responsible for acquiring, maintaining, and complying with numerous Federal and State permits for operation of the SWP.

July 26, 1983, CVWD Negative Declaration, Whitewater River Spreading Area expansion Phase 1.

February 1983, DWA Final EIR for the proposed extension of time for utilizing Colorado River water to recharge the upper Coachella Valley groundwater basins to the year 2035, Volume I and II, April 1983, Volume III.

September 2002, Final Program EIR for Coachella Valley Water Management Plan and SWP Entitlement Transfer was certified by CVWD on October 8, 2002.

In 2020, an application was filed with the Bureau of Land Management to renew and amend the existing Right-of-way grant for groundwater replenishment purposes on the Whitewater River Groundwater Replenishment Facility.

D. Semitropic Water Banking and Exchange Program

Source of Supply

The agreement between Semitropic Water Storage District (Semitropic) and Metropolitan was executed in February 1994. Semitropic obtains water from the SWP through its contracts with the Kern County Water Agency. SWP supplies irrigate an area of 161,200 acres within Semitropic's service area. When this surface water is not available, these growers withdraw water from the underlying aquifer. The agreement between Semitropic and Metropolitan allows Metropolitan to make use of 350 TAF of storage in Semitropic's groundwater basin. In years of plentiful supply, Metropolitan can deliver available SWP supplies to Semitropic through the California Aqueduct. During dry years, Metropolitan can withdraw this stored water. Five other banking partners participate in this Program and use 650 TAF of storage in Semitropic's groundwater basin.

Expected Supply Capability

The Semitropic-Metropolitan Program provides Metropolitan with the capacity to store up to 350 TAF of water under the current agreement. During dry years, Metropolitan can recover its stored water through a combination of direct pumping of the groundwater and delivery of Semitropic's SWP Table A water in the California Aqueduct. In 2014, Metropolitan amended the program to increase the return yield by an additional 13.2 TAF per year that has since been reduced to 6.7 TAF. The minimum annual yield available to Metropolitan from the program is currently 38.2 TAF, and the maximum annual yield is 229.77 TAF depending on the available unused capacity and the SWP allocation. The average annual supply capability for a single dry year similar to 1977 is 45 TAF. For a five-year consecutive drought condition similar to the period of 1988-1992, the expected supply capability is 50 TAF.

Rationale for the Expected Supply

Historical Record

The Semitropic-Metropolitan Water Banking and Exchange Program has been operational since 1994. With existing agreements, it will continue to operate over the term of 41 years (1994 to 2035). By the end of 2020, the program had 261 TAF in its storage account.

Written Contracts or Other Proof

1992 Turn-in/out Construction, Operation and Maintenance Agreement. This Agreement was executed in 1992 by DWR and Semitropic to allow construction, operation, and maintenance of the Semitropic California Aqueduct Turn in/out.

1993 Temporary Semitropic-Metropolitan Water Banking Agreement. This Agreement was executed in February 1993 by Semitropic and Metropolitan to allow the storage of available Metropolitan supplies in advance of execution of the long-term agreement.

1994 Semitropic/Metropolitan Water Banking and Exchange Agreement. This Agreement was executed in December 1994 by Semitropic and Metropolitan to implement the program for a 41-year term (1994-2035).

1995 Point of Delivery Agreement. This agreement, with DWR, Kern County Water Agency, and Metropolitan, allows Metropolitan to divert water from the California Aqueduct into Semitropic's service area.

1995 Introduction of Local Water into the California Aqueduct. This agreement, with DWR, Kern County Water Agency, and Semitropic, allows Metropolitan to receive water from the program into the California Aqueduct.

2014 Amendment to Increase Program Yield. The amendment increased Metropolitan's minimum return yield by 13,200 acre-feet per year.

Financing

Metropolitan's O&M budget (referenced above) includes payments for the Semitropic Program.

Federal, State, and Local Permits/Approvals

Final EIR. Semitropic acting as the lead agency under CEQA and Metropolitan acting as a responsible agency jointly completed the EIR for the Program. The EIR was certified by Semitropic in July 1994 and adopted by Metropolitan in August 1994.

Regulatory Approvals. All regulatory approvals are in place, and the program is operational.

E. Arvin-Edison Water Management Program

Source of Supply

The Arvin-Edison Water Storage District (Arvin-Edison) manages the delivery of local groundwater and water imported into its service area from the Central Valley Project's (CVP) Millerton Reservoir via the Friant-Kern Canal. The surface water service area consists of 132,000 acres of predominantly agricultural land, and to a minor degree, municipal and industrial uses. It is situated in Kern County. Arvin-Edison operates its supplies conjunctively, storing water in the underlying aquifer when imported supplies are available and withdrawing that water when the availability of imported supplies is reduced. In 1997, Metropolitan entered into an agreement with the Arvin-Edison Water Storage District. The agreement allows Metropolitan to store available water in Arvin-Edison's groundwater basin, either through direct spreading operations, or through deliveries to growers in Arvin-Edison's service area. Similar to Arvin-Edison's own usage, this previously stored water could be withdrawn when the availability of imported supplies to Metropolitan is reduced.

Expected Supply Capability

The Arvin-Edison/Metropolitan Program provides Metropolitan with the capacity to store up to 350 TAF of water under the current agreement. During dry years, Metropolitan can recover its stored water either through direct pumping of the groundwater or through exchange. Based on the terms and conditions of the program agreement, the return of water to Metropolitan ranges from a minimum of 40 TAF per year (peak 4-month summer period) up to 110 TAF (over a 12-month period). Metropolitan staff are currently working to overcome a new challenge of detections of 1,2,3-trichloropropane (TCP) above the Maximum Contaminant Level (MCL) of five parts per trillion (ppt) in wells that are part of the Arvin-Edison/Metropolitan Program. These levels of TCP impact Metropolitan's ability to put water and take return water under that program. As a result, Metropolitan has temporarily suspended operation of the program until the water quality concerns can be further evaluated and managed.

Rationale for the Expected Supply

Historical Record

The Arvin-Edison/Metropolitan Water Management Program has been operational since 1997. With existing agreements, it will continue to operate over the term of 38 years (1997 to 2035). By the end of 2020, the program had 142 TAF in its storage account.

Written Contracts or Other Proof

1997 Arvin-Edison/Metropolitan Water Management Agreement. This Agreement was executed in December 1997 by Arvin-Edison and Metropolitan to implement the program for a 30-year term (1997-2027).

1998 Turn-in/out Construction and Maintenance Agreement. This Agreement was executed in 1998 by DWR, Kern County Water Agency, Arvin-Edison, and Metropolitan to allow construction, operation and maintenance of the Arvin-Edison California Aqueduct Turn in/out.

1998-2002 Water Delivery and Return Agreements. These agreements, with DWR, Kern County Water Agency, Arvin-Edison, and Metropolitan, allow Metropolitan to divert water from, and introduce water to, the California Aqueduct.

2004 Point of Delivery Agreement. This agreement, with DWR, Kern County Water Agency, and Metropolitan, allows Metropolitan to divert water from the California Aqueduct into Arvin-Edison's service area.

2004 Introduction of Water into the California Aqueduct. This agreement, with DWR, Kern County Water Agency, and Arvin-Edison, allows Metropolitan to receive water from the program into the California Aqueduct.

2007 First Amended and Restated Agreement Between Arvin-Edison Water Storage District and The Metropolitan Water District of Southern California for a Water Management Program. This amendment increased the maximum storage level to 350 TAF, extended the agreement term to 2035, and provided for the construction of the South Canal Improvement Project. The project increases the reliability of Arvin-Edison returning higher water quality to the California Aqueduct.

Financing

Metropolitan's O&M budget (referenced above) includes payments for the Arvin-Edison Program.

Federal, State, and Local Permits/Approvals

Environmental Status: A Negative Declaration was completed in 1996.

An Addendum to the 1996 Negative Declaration was completed in 2003.

A Negative Declaration for the Arvin-Edison South Canal Improvement Project was completed in 2007.

Regulatory Approvals: All regulatory approvals are in place, and the program is operational.

F. San Bernardino Valley Municipal Water District Program

Source of Supply

The San Bernardino Valley Municipal Water District Program allows Metropolitan to purchase a dependable annual supply, as well as an additional supply for dry year needs. Under this program, Metropolitan purchases water provided to San Bernardino Valley Municipal Water District (Valley District) from its annual SWP water allocation. Valley District delivers the purchased supplies to Metropolitan's service area through the coordinated use of facilities and interconnections within the water conveyance system of the two districts.

The purchased SWP supply is provided to Metropolitan as direct deliveries of annual SWP water through the California Aqueduct to Metropolitan's service area, as well as deliveries of SWP water to the San Bernardino groundwater basin that will subsequently be delivered to Metropolitan's service area. Under this program, Metropolitan purchases surplus Valley District supplies on a fixed price schedule based on the final SWP allocation each calendar year.

To facilitate the transfer, the program also provides the coordinated use of existing facilities, including the Valley District's Foothill Pipeline and the Inland Feeder, to improve the conveyance capabilities of the delivery of SWP water to the service areas of both districts. The intertie between the Foothill Pipeline and the Inland Feeder has been constructed and was operational as of December 2002. This intertie allows Metropolitan to move SWP water from the East Branch of the California Aqueduct through the Foothill Pipeline and Inland Feeder, into DVL and the CRA. As a result of this intertie, Metropolitan has an alternative conveyance capacity of 260 cfs into Metropolitan's system should an outage occur on the upper section of the Inland Feeder.

Expected Supply Capability

The program changed from the minimum purchase program to a surplus program. Valley District will provide Metropolitan surplus SWP supplies likely in higher than normal SWP allocations. The historical average for the program is expected to be around 13 TAF per year.

Rationale for the Expected Supply

Historical Record

The San Bernardino Valley Municipal Water District Program began operations in 2001 and ended in 2016. Since its inception in 2001, this program has delivered 200 TAF to Metropolitan. Metropolitan and Valley District approved a new Coordinated Operating Agreement in 2021 that will provide Metropolitan surplus Valley District supplies and emergency mutual aid.

Written Contracts or Other Proof

Metropolitan's annual and dry-year supplies from the San Bernardino Valley Municipal Water District Program are based on Metropolitan Board actions and agreements.

2000 Board Approval of Coordinated Operating Agreement. In June 2000, Metropolitan's Board authorized entering into a Coordinated Operating Agreement between Metropolitan and Valley District to develop projects that could provide benefits to both districts through the coordinated use of facilities and SWP supplies.

2000 Coordinated Operating Agreement. The Coordinated Operating Agreement between Metropolitan and Valley District was executed in July 2000.

2001 Board Approval of the Coordinated Use Agreement. In April 2001, Metropolitan's Board authorized entering into the Coordinated Use Agreement for Conveyance Facilities and SWP Water Supplies between Metropolitan and Valley District for the purchase of dependable annual and dry year supplies by Metropolitan.

2001 Coordinated Use Agreement. The Coordinated Use Agreement for Conveyance Facilities and SWP Water Supplies between Metropolitan and Valley District for the purchase of dependable annual and dry year supplies by Metropolitan was executed May 2001. The Agreement is effective as of July 1, 2001, for an "evergreen" term (10-years with automatic annual extensions unless otherwise notified).

2021 Coordinated Operating Agreement. The Coordinated Operating Agreement between Metropolitan and Valley District was approved by Metropolitan's Board in March 2021. The agreement will terminate on December 31, 2035 unless there is an extension of the SWP Contract.

Financing

Metropolitan's O&M budget (referenced above) includes the funds to purchase Program water.

Federal, State, and Local Permits/Approvals

The Program became effective July 1, 2001. An environmental review process and regulatory approval supported implementation.

Final EIR. Final Regional Water Facilities Master Plan EIR dated February 1, 2001, was certified by Valley District, as lead agency, and by Metropolitan, as responsible agency. Notices of determinations were filed by Valley District and Metropolitan on May 29, 2001, and April 18, 2001, respectively.

State Water Contractors' Review. In May 2001, the SWC reviewed and issued a letter supporting the program.

DWR Review. DWR agreed to the program in December 2001.

G. San Gabriel Valley Municipal Water District Program

Source of Supply

The San Gabriel Valley Municipal Water District Program allows Metropolitan to exchange supplies to provide additional water for normal and dry year needs. Under this program, Metropolitan delivers supplies to the City of Sierra Madre, a San Gabriel Valley MWD member agency. In exchange for Metropolitan delivering one acre-foot, San Gabriel Valley MWD returns two acre-feet to Metropolitan in the Main San Gabriel Basin, up to 5 TAF. For any exchange amount less than 5 TAF, Metropolitan purchases the balance of the 5 TAF. The program provides increased reliability to Metropolitan by allowing additional water to be delivered to Metropolitan's member agencies Three Valleys MWD and Upper San Gabriel Valley MWD that rely upon the Main San Gabriel Basin for their supplies.

Expected Supply Capability

The average annual supply capability for a single dry year similar to 1977 is a net 2 TAF. For a five-year consecutive drought condition similar to the period of 1988-1992, the expected supply capability is 2 TAF.

Rationale for the Expected Supply

Historical Record

The San Gabriel Valley Municipal Water District Program began operations in 2013 and is expected to be renewed continually in the future. Since its inception in 2013, the program has completed the exchange and purchase of 30.66 TAF, with a net increase to Metropolitan's supply by an additional 19.5 TAF.

Written Contracts or Other Proof

Metropolitan's dependable annual and dry-year supplies from the San Gabriel Valley Municipal Water District Program are based on Metropolitan Board action and agreement.

2013 San Gabriel Valley MWD Exchange and Purchase Agreement. The agreement between Metropolitan and San Gabriel Valley MWD was executed in September 2013.

2013 Board Approval of the San Gabriel Valley MWD Exchange and Purchase Agreement. In August 2013, Metropolitan's Board authorized entering into the agreement with San Gabriel Valley MWD.

Financing

Metropolitan's O&M budget (referenced above) includes the funds to purchase water.

Federal, State, and Local Permits/Approvals

The Program became effective as of September 2013. An environmental review process supported implementation.

CEQA Compliance. The proposed action involved an exchange and purchase agreement associated with the leasing, licensing, and operating of existing public water conveyance facilities with negligible or no expansion of use and no possibility of significantly impacting the physical environment.

H. Antelope Valley East Kern Water Agency Exchange and Storage Program

Source of Supply

The Antelope Valley East Kern Water Agency (AVEK) Program allows Metropolitan to both exchange and store SWP supplies to provide additional water for normal and dry year needs. Under this program, AVEK provides Metropolitan its unused SWP supplies. For every two acre-feet provided by AVEK, Metropolitan will return one acre-foot. The exchange program when implemented is expected to deliver 30 TAF over ten years, with 10 TAF available in dry years. At this time, the Department of Water Resources has not approved the exchange program element. Metropolitan has storage capability in the groundwater basin, with a capacity of 30 TAF, and a dry year return capability of 10 TAF.

Expected Supply Capability

The average annual supply capability for a single dry year similar to 1977 is 3 TAF for each program. For a five-year consecutive drought condition similar to the period of 1988-1992, the expected supply capability is 4 TAF for each program.

Rationale for the Expected Supply

Historical Record

The AVEK Program started providing benefits in 2017. By the end of 2020, the program had 27 TAF in its storage account.

Written Contracts or Other Proof

Metropolitan's dependable annual and dry-year supplies from the AVEK Exchange and Storage Program are based on Metropolitan Board action and proposed agreement.

2015 Board Approval of the AVEK Exchange and Storage Agreement. In November 2015, Metropolitan's Board authorized entering into the agreement with AVEK.

Financing

Metropolitan's Board authorized up $16.6 million for the program with additional funds, if needed, from Metropolitan's O&M budget (referenced above).

Federal, State, and Local Permits/Approvals

The storage element of the Program became effective after the agreement was executed in 2016. The Department of Water Resources has not approved the exchange program element at this time.

CEQA Compliance. The proposed action involved an exchange and purchase agreement associated with the leasing, licensing, and operating of existing public water conveyance facilities with negligible or no expansion of use and no possibility of significantly impacting the physical environment.

I. High Desert Water Bank

Source of Supply

The High Desert Water Bank with Antelope Valley East Kern Water Agency (AVEK) allows Metropolitan to store supplies to provide additional water for normal and dry year needs. Metropolitan has a storage capability in the groundwater basin, with a capacity of 280 TAF, and a dry year return capability of 70 TAF. The program is planned to be fully operational in 2024.

Expected Supply Capability

The High Desert Water Bank is currently under design and construction. When the High Desert Water Bank is completed, the program would provide 70 TAF of additional water supply capability in a dry year.

Rationale for the Expected Supply

Historical Record

The High Desert Water Bank is expected to be fully operational in 2024. The program may be providing recharge capability earlier. By the end of 2020, the program has yet to store water in its storage account.

Written Contracts or Other Proof

2019 Board Approval of the High Desert Water Bank Agreement. In April 2019, Metropolitan's Board authorized entering into the agreement with AVEK.

Financing

Metropolitan's Board authorized up $131 million for construction of the program with additional funds for program operation.

Federal, State, and Local Permits/Approvals

CEQA Compliance. The Metropolitan Board reviewed and considered AVEK's adopted Mitigated Negative Declaration and took related CEQA action.

J. Bay-Delta Improvements

Source of Supply

Improving the water supply reliability of the State Water Project (SWP) is a primary focus of Metropolitan's long-term planning efforts. Metropolitan's strategy is to reduce its dependence on SWP supplies during dry years, when risks to the Bay-Delta ecosystem are greatest, and to maximize its deliveries of available SWP water during wetter years to store in surface reservoirs and groundwater basins for later use during droughts and emergencies.

State resource agencies and various water user entities are currently engaged in the development of the Delta Conveyance Project (DCP), which would include new diversion and conveyance facilities in the Delta necessary to restore and protect the reliability of SWP water deliveries and, potentially, Central Valley Project (CVP) water deliveries south of the Delta, consistent with the State's Water Resilience Portfolio. The DCP objectives are to address sea level rise, climate change and extreme weather events; minimize the potential for public health and safety impacts from reduced quantity and quality of SWP water deliveries, and potentially CVP water deliveries, south of the Delta resulting from a major earthquake that causes breaching of Delta levees; protect the ability of the SWP, and potentially the CVP, to deliver water when hydrologic conditions result in the availability of sufficient amounts, consistent with the requirements of state and federal law and contractual commitments; and to provide operational flexibility to improve aquatic conditions in the Delta and better manage risks of further regulatory constraints on project operations.

The SWP conveys water from the western slope of the Sierra Nevada to water users both north and south of the Bay-Delta. Specifically, SWP water is delivered to Metropolitan's service area through a system of reservoirs, the Bay-Delta, pumping plants, and the California Aqueduct. Owned and operated by the California Department of Water Resources (DWR), the SWP provides municipal and agricultural water to 29 State Water Contractors. Annual deliveries for the SWP average about 1.96 MAF. Municipal uses account for about 60 percent of annual deliveries, with the remaining 40 percent going to agriculture.

SWP supplies are estimated using the 2019 SWP Delivery Capability Report distributed by DWR in August 2020. The 2019 Delivery Capability Report presents the current DWR estimate of the amount of water deliveries for current (2019) conditions and conditions 20 years in the future. These estimates incorporate regulatory requirements in accordance with the SWRCB Water Quality Control Plan, the USFWS and NMFS biological opinions and the CDFW Incidental Take Permit. In addition, these estimates incorporate 2018 amendments to the Coordinated Operations Agreement between the SWP and CVP. Future capability estimates also reflect the potential impacts of climate change and sea level rise. Under the 2019 Delivery Capability Report, the delivery estimates for the SWP for 2019 conditions as percentage of Table A amounts are seven percent, equivalent to 134 TAF for Metropolitan, under a single dry-year (1977) condition and 58 percent, equivalent to 1.1 MAF for Metropolitan, under long-term average conditions.

In dry, below-normal conditions, Metropolitan has increased the supplies received from the California Aqueduct by developing flexible Central Valley/SWP storage and transfer programs. The goal of these storage/transfer programs is to develop additional dry-year supplies that can be conveyed through the available Banks pumping capacity to maximize deliveries through the California Aqueduct during dry hydrologic conditions and regulatory restrictions.

Delta Conveyance Project

In 2000, several State and federal agencies released the CALFED Bay Delta Programmatic Record of Decision ("ROD") and Environmental Impact Report/Environmental Impact Statement ("EIR/EIS") that outlined and disclosed the environmental impacts of a 30-year plan to improve the Bay-Delta's ecosystem, water supply reliability, water quality, and levee stability. The CALFED ROD remains in effect and many of the State, federal, and local projects begun under CALFED continue.

Building on CALFED and other Bay-Delta planning activities, in 2006 multiple state and federal resource agencies, water agencies, and other stakeholder groups entered into a planning agreement for the Bay-Delta Conservation Plan ("BDCP"). The BDCP was originally conceived as a comprehensive conservation strategy for the Bay-Delta designed to restore and protect ecosystem health, water supply, and water quality within a stable regulatory framework to be implemented over a 50-year time frame with corresponding long-term permit authorizations from fish and wildlife regulatory agencies. The BDCP included both alternatives for new water conveyance infrastructure and extensive habitat restoration in the Bay-Delta.

In 2015, the State and federal lead agencies proposed an alternative implementation strategy and new alternatives to the BDCP to provide for the protection of water supplies conveyed through the Bay-Delta and the restoration of the ecosystem of the Bay-Delta, termed "California WaterFix" and "California EcoRestore," respectively. In this alternative approach, DWR and the

Bureau of Reclamation would implement planned water conveyance improvements as a stand-alone project. Ecosystem improvements and habitat restoration more generally (California EcoRestore) would be undertaken under a more phased approach than previously contemplated by the BDCP and would not be linked with the California WaterFix project or permits. Accelerated restoration actions totaling 30,000 acres of tidal marsh habitat were proposed to be undertaken in the coming decade to provide public benefits for listed fish in the Bay-Delta.

In his State of the State address delivered February 12, 2019, Governor Newsom announced that he did not "support WaterFix as currently configured" but does "support a single tunnel." On April 29, 2019, Governor Newsom issued Executive Order N-10-19, directing several agencies to (among other things), "inventory and assess… [c]urrent planning to modernize conveyance through the Bay Delta with a new single tunnel project." In light of the Governor's announcement and Executive Order, DWR withdrew all approvals and environmental compliance documentation associated with California WaterFix.

On January 15, 2020, DWR issued a Notice of Preparation of Environmental Impact Report for the Delta Conveyance Project. Planning, environmental review and conceptual design work by DWR for a proposed single tunnel project is expected to take approximately 18 to 36 months.

California EcoRestore

The main objective under the EcoRestore Program is to pursue at least 30,000 acres of Delta habitats. These restoration programs would include projects and actions that are in compliance with pre-existing regulatory requirements designed to improve the overall health of the Delta. Other priority restoration projects would also be identified by the Delta Conservancy and other local governments. Funding would be provided through multiple sources including state bonds and other state-mandated funds, SWP/CVP contractors funds as part of existing regulatory obligations, and from various local and federal partners.

As of May 2020, 32 projects have been identified that restore more than the targeted 30,000 acres of habitat, including a projected 18,580 acres of floodplain, 14,000 acres of tidal habitat, 3,500 acres of non-tidal wetlands and 1,650 acres of riparian and upland habitat. To date, 12 projects have been completed, four more are under construction, and the remaining 16 projects are planned to begin construction by 2021.

Sites Reservoir

Sites Reservoir first emerged as part of a second stage of the SWP proposed in the 1980s, which included a peripheral canal and other northern California water-related projects. In 1996, the project was further analyzed by DWR and USBR as part of the CALFED Bay-Delta process. The CALFED process resulted in a Programmatic Record of Decision that recommended implementation of the project as a component of the Preferred Program Alternative. In 2010, the Sites Project Authority was formed as a joint powers authority to continue moving forward with development of the Sites Reservoir project.

Sites Reservoir would be located north of Sacramento, about 10 miles west of the town of Maxwell. The project includes water storage reservoir of 1.3 to 1.5 MAF and would require the construction of two large dams up to 310 feet high and nine smaller saddle dams. The water stored in the reservoir would be diverted from the Sacramento River during high flow events and returned to the Sacramento River during dry and critical years, thereby providing additional dry-year water for environmental flows and project partners including CVP and SWP agencies south of the Delta.

The current operations model estimates the annual water yield of Sites Reservoir at approximately 240 TAF per year. This model utilizes upstream Sacramento River flow and fishery criteria, assumed in earlier phases of the Project. Additional modeling analyses will continue to be conducted as further refinements are made to Project operations and projected regulatory requirements, including proposed Delta Conveyance operations. Implementation of the proposed Delta Conveyance Project would allow for greater yields south of the Delta. DWR estimates that if the Project were operational in 2016 (categorized as a 'below-normal' water year for the Sacramento River), the reservoir could have captured 448 TAF of water supplies. Final Project formulation and annual operations will determine how the firm yield will be divided between meeting water supply and environmental improvements funded by state Proposition 1 grant and federal Water Infrastructure Investment for the Nation (WIIN) Act appropriations.

In 2020, the Sites Project Authority and its participating agencies conducted an internal value-planning effort to minimize potential project costs and impacts. That effort resulted in a project cost reduction of over $2 billion (i.e., $5.2B to $2.9B). The Sites Project Authority is recommending a new workplan and schedule that will move the project forward through the end of 2021. This 16-month workplan (Phase 2) will focus on the continued development and possible revision of project permits and environmental planning documents, and the development of a final feasibility report, and a draft operations plan.

An initial feasibility study and Administrative Draft Environmental Impact Report (EIR) were completed in 2013 by DWR. A Public Draft EIR/Environmental Impact Statement (EIS) for the Project was released by the Sites Project Authority (state lead agency) and the USBR (federal lead agency) in August 2017. However, with the completion of the recent value-planning process, a Revised Draft EIR and Supplemental EIS will need to be released due to the smaller Project footprint and operational changes. The Revised Draft EIR and Supplemental EIS are scheduled to be released in July 2021, with a Final EIR/EIS completed in mid-2022.

Water Quality Control Plan for the Bay-Delta/Voluntary Agreements

The State Water Resources Control Board (SWRCB) is continuing its phased review and update of the 2006 Water Quality Control Plan for the Bay-Delta (Bay-Delta WQCP). Phase 1 focuses on the southern Delta salinity objectives for the protection of agriculture, San Joaquin River flow objectives for the protection of fish and wildlife, and a program of implementation for achieving those objectives. Phase 2 considers the comprehensive review of the other elements of the Bay-Delta WQCP, including but not limited to Sacramento River and Delta outflow objectives.

The SWRCB has also encouraged all stakeholders to work together to reach one or more voluntary agreements for consideration by the SWRCB that could implement the proposed amendments to the Bay-Delta WQCP through a variety of tools, while seeking to protect water supply reliability. Metropolitan is participating in the Phase 2 proceedings and voluntary agreement negotiations.

In December 2018, the SWRCB adopted the Plan amendments and Final Substitute Environmental Document for Phase 1, which establishes the Lower San Joaquin River flow objectives and revised southern Delta salinity objectives. On February 25, 2019, the Office of Administrative Law approved the Plan amendments, which are now in effect, although enforceable obligations to implement the water quality objectives will be imposed in future proceedings involving the specific exercise of the SWRCB's water right or water quality authority. Various stakeholders filed suit against the SWRCB challenging the Phase 1 amendments.

The Phase 1 amendments are highly controversial because they include new requirements for the San Joaquin River tributaries (Stanislaus, Tuolumne, and Merced Rivers) of 40-percent of unimpaired outflow, with an adaptive range between 30-percent and 50-percent for the protection of fish and wildlife beneficial uses. Unimpaired flow is the flow that would accumulate in surface waters in response to rainfall and snowmelt and flow downstream if there were no reservoirs or diversions to change the quantity, timing, and magnitude of flows. Modeling of this objective shows significant reductions in water supplies available for human consumptive use during most water year types. While the southern Delta salinity objective for the protection of agricultural beneficial uses has been amended to 1.0 dS/m EC (a measure of salinity), the Phase 1 amendments continue the United States Bureau of Reclamation's existing obligation to meet 0.7 dS/m EC on the Lower San Joaquin River at Vernalis.

As part of Phase 2 proceedings, the SWRCB released a framework document in July 2018 focused on the Sacramento River and its tributaries, Delta eastside tributaries, Delta interior Delta flows and Delta outflows. The framework describes changes that will likely be proposed by SWRCB staff through formal proposed amendments and supporting environmental documents. The proposed changes include certain unimpaired flow requirements for the Sacramento River and its salmon-bearing tributaries. an inflow level of 45-percent to 65-percent of unimpaired flow, with a starting point of 55-percent.

The SWRCB has also encouraged all stakeholders to work together to reach one or more voluntary agreements for consideration by the SWRCB that could implement the proposed amendments to the Bay-Delta WQCP through a variety of tools, while seeking to protect water supply reliability. In July of 2019, the State submitted to the SWRCB an update on the voluntary agreement processes. On February 4, 2020, the State agencies released a framework for voluntary agreements that outlined a 15-year program to improve environmental conditions, in an adaptive way, through new flows dedicated to the environment and providing additional habitat. The California Natural Resources Agency and the California Environmental Protection Agency are leading an effort to negotiate voluntary agreements to improve conditions for native fish through an unprecedented commitment to increased flows for the environment, creation of 60,000 acres of new and restored habitat, and $5 billion in new funding for environmental improvements and science. If successful, these agreements will implement the SWRCB's legally required update to the Bay-Delta WQCP and improve conditions for native fish through a broad set of tools. The agreements hold the potential to achieve meaningful landscape-scale solutions to meet the needs of the Delta and its major rivers, reconnect our floodplains and wetlands to the rivers and estuary, and comprehensively manage these vital watersheds. Metropolitan is participating in the Phase 2 proceedings and voluntary agreement discussions.

Rationale for the Expected Supply

Implementation Status

Expected supplies are projected in accordance with the approved implementation.

Written Contracts or Other Proof

Metropolitan Board Actions and Policies:

Policy Principles Regarding Long-term Actions for the Sacramento-San Joaquin River Delta approved in April 2006.

Delta Action Plan Framework approved in June 2007.

Delta Conveyance Criteria approved in September 2007.

Execution of Initial Funding Agreement approved in December 2008.

Execution of Amendments to Planning Agreement approved in December 2009.

Execution of Planning Agreement Amendment (additional funds) approved in July 2010.

Execution of Amendment to Memorandum of Agreement approved in August 2011.

Authorized Funding and Entered into Project Agreement with Sites Project Authority for Phase 1, April 2017.

Authorized Funding and Entered into Project Agreement with Sites Project Authority for 2019 Workplan, February 2019.

Appropriated Funding and Authorized Amendment to 2019 Reservoir Project Agreement with Sites Project Authority to Allow Participation in Phase 2 Workplan, November 2020.

Board action on "Water Management Tools" approved February 2021.

Board vote on California WaterFix, October 2017.

Board vote on California WaterFix, July 2018.

Board vote on Funding Agreement with DWR for Metropolitan's share of the Delta Conveyance Project planning and pre-construction costs, and execution of an amendment to the Joint Powers Agreement for Delta Conveyance Design and Construction Authority, December 2020.

Supporting Agreements and Contracts:

Bay-Delta Accord approved in December 1994.

CALFED Framework, June 2000.

Lower Yuba River Accord, May 2008.

Delta Reform Act Legislation enacted in 2009.

State and Federal Funding:

Proposition 204 funds approved by voters in November 1996.

Proposition 13 funds approved by voters in March 2000.

Proposition 50 funds approved by voters in November 2002.

Proposition 1, approved by the voters in 2014, authorized $7.545 billion in general obligation bonds for state water supply infrastructure projects, including surface and groundwater storage, ecosystem and watershed protection and restoration, and drinking water protection.

Annual federal appropriations from 1998 to present, authorized in annual Energy and Water Development Appropriations balls and the CALFED Bay-Delta Authorization Act.

California Water Commission approved $816 million of Proposition 1 funding for Sites Reservoir, July 2018

Financing

The Delta Conveyance Project would be paid for by public water agencies that would receive the water supply reliability benefits.

California EcoRestore is a program separate from the Delta Conveyance Project and the prior California WaterFix planning efforts. The state would pursue at least 30,000 acres of Delta habitat restoration over the next few years, pursuant to pre-existing regulatory requirements such as the 2008 and 2009 Biological Opinions and various enhancements to improve the overall health of the Delta ecosystem and its native fish and wildlife species. Proposition 1 funds and other state public dollars will be directed exclusively for public benefits unassociated with any regulatory compliance responsibilities.

Federal, State, and Local Permits/Approvals

CALFED's Bay-Delta Program.

CALFED Programmatic EIR/EIS finalized in July 2000.

Record of Decision issued in August 2000 for the final Programmatic EIR/EIS regarding the CALFED Bay-Delta Program.

K. Kern Delta Water Management Program

Source of Supply

In December 1999, Metropolitan advertised a request for proposals for participation in "The California Aqueduct Dry-year Transfer Program." As a result of this request for proposals, four programs, including one from the Kern Delta Water District (Kern Delta), were selected for further consideration. In 2001, Metropolitan entered into Principles of Agreement with Kern Delta for the development of a dry-year supply program. Kern Delta serves 125,000 acres of actively farmed highly productive farmland located in the San Joaquin Valley portion of southern Kern County. Kern Delta has under contract 180 TAF per year of good quality, highly reliable pre-1914 Kern River water and 25.5 TAF per year of SWP Table A contract right (under contract with Kern County Water Agency).

The dry-year supply program between Kern Delta and Metropolitan involves the storage of water with Kern Delta. In years of plentiful supply, the agreement allows Metropolitan to store water in Kern Delta's groundwater basin, either through direct spreading operations or through deliveries to growers in Kern Delta's service area. Metropolitan has the ability to store up to 250 TAF of water. Agreement provisions may allow for storage beyond this amount. When needed, Metropolitan can recover its stored water either through direct pumping of the groundwater or exchange at a rate of 50 TAF per year. The program duration will be from 2002 to 2027 with provisions that allow the water to be withdrawn until 2033.

Expected Supply Capability

The Kern Delta/Metropolitan Program provides Metropolitan with the capacity to store up to 250 TAF of water at any one time. When needed, Metropolitan can recover its stored water either through direct pumping of the groundwater or exchange at a rate of 50 TAF per year.

Rationale for the Expected Supply

<u>Implementation Status</u>

Expected supplies are projected in accordance with accepted detailed groundwater modeling that has been accomplished for the program. In addition, the Kern Delta/Metropolitan Water Management Program was operational and accepting water for storage by fall of 2003. By the end of 2020, the program had 181 TAF in its storage account.

<u>Written Contracts or Other Proof</u>

<u>2001 Kern Delta/Metropolitan Principles of Agreement.</u> Principles of agreement were entered into between Kern Delta and Metropolitan in June 2001, covering program costs, operational aspects, and risks/responsibilities.

<u>2002 Kern Delta and Metropolitan Boards of Directors Approval.</u> These actions approved execution of the long-term agreement, which delineates program operations, costs, and risks/responsibilities

Financing

Metropolitan's O&M budget (referenced above) includes payments for the Kern Delta/ Metropolitan Program.

Federal, State, and Local Permits/Approvals

Kern Delta, acting as lead agency under CEQA, has prepared a full EIR. As part of this EIR, Kern Delta published a Notice of Preparation and held meetings with the general public, interested agencies, and resource agencies. In November 2002, the Final EIR was certified by Kern Delta and adopted by Metropolitan.

L. Central Valley / State Water Project Storage and Water Transfers

Source of Supply

Around 34 MAF of water (80 percent of California's developed water) is delivered for agricultural use every year. Over half of this water is used in the Central Valley; and much of it is delivered by, or adjacent to, SWP and Central Valley Project (CVP) conveyance facilities. This allows for the voluntary transfer of water to many urban areas, including Metropolitan's service area, via the California Aqueduct.

In recent years, a portion of this agricultural water supply has been secured by Metropolitan through mutually beneficial transfer agreements:

The Governor's Water Bank (Bank) in 1991, 1992, 1994, and 2009 secured 75 to 820 TAF per year of water supply. Further, the DWR's Dry Year Water Purchase Program (Purchase Program) in 2001, 2002, and 2003 secured a total of 162 TAF. DWR established and administered the Bank and the Purchase Program by facilitating purchasing water from willing sellers and transferring the water to those with critical needs using the SWP facilities. Sellers, such as farmers and water districts, made water available for the Bank and Purchase Program by fallowing crops, shifting crops, releasing surplus reservoir storage, and by substituting groundwater for surface supplies.

In 2003, Metropolitan secured options to purchase approximately 145 TAF of water from willing sellers in the Sacramento Valley during the irrigation season. Using these options, Metropolitan purchased approximately 125 TAF of water for delivery to the California Aqueduct.

In 2005, Metropolitan, in partnership with three other SWC, secured options to purchase approximately 130 TAF of water from willing sellers in the Sacramento Valley during the irrigation season, of which Metropolitan's share was 113 TAF. Metropolitan also had the right to assume the other SWC options if they chose not to exercise their options. Due to improved hydrologic conditions, Metropolitan and the other SWC did not exercise these options.

In December 2007, Metropolitan entered into a long-term agreement with DWR providing for Metropolitan's participation in the Yuba Dry Year Water Purchase Program between Yuba County Water Agency and DWR that was approved by the SWRCB as part of the Yuba River Accord. This program provides for transfers of water from the Yuba County Water Agency during dry years through the year 2025, and Metropolitan has purchased approximately 200 TAF to date.

In 2008, Metropolitan, in partnership with eight other SWC, purchased approximately 40 TAF of water from willing sellers in the Sacramento Valley during the irrigation season, of which Metropolitan's share was approximately 27 TAF.

In 2009, Metropolitan participated in the Governor's Water Bank, which purchased approximately 74 TAF, of which Metropolitan's share was approximately 36.9 TAF.

In 2010, Metropolitan in partnership with three other SWC, secured approximately 100 TAF of water from willing sellers in the Sacramento Valley, of which Metropolitan's share was approximately 88 TAF.

In 2010, Metropolitan purchased approximately 18 TAF of water from CVP Contractors located in the San Joaquin Valley. In addition, Metropolitan entered into an unbalanced exchange agreement that resulted in Metropolitan receiving approximately 37 TAF.

In 2015, Metropolitan, in partnership with eight other SWC, secured approximately 20 TAF of water from willing sellers in the Sacramento Valley, of which Metropolitan's share was approximately 12 TAF.

In addition, Metropolitan has secured water transfer supplies under the Multi-Year Water Pool Demonstration Program. In 2013, 2015, and 2016, Metropolitan secured 30 TAF, 1.3 TAF, and 7 TAF, respectively. Unlike the other transfer programs discussed herein, which were derived from agricultural sellers, a portion of these transfer supplies came from urban sellers.

Expected Supply Capability

The combined effect of the 2019 National Marine Fisheries Service's and United States Fish and Wildlife Service's biological opinions and the 2020 California Department of Fish and Wildlife's Incidental Take Permit have resulted in uncertainty in how the CVP and SWP will be operated to facilitate water transfers. The new state and federal permits result in the SWP being required to dedicate approximately 200 TAF on average to additional outflow, in addition to the SWP being required to reduce water diversions under a larger number of environmental conditions. The CVP is not subject to the same state permit requirements and will be diverting more frequently, particularly in April and May. There are also new limits on the CVP's ability to use the SWP's facilities for water transfers, particularly when the SWP is under heightened export limits, which could impact how water transfer deals are structured. While the new state and federal permits allow the water transfer window to be extended through November, the 2020 state Incidental Take Permit includes new November export limits on the SWP; and when these limits are triggered, the CVP would also be precluded from using SWP facilities. Under the new permit, the SWP is further obligated to implement a new water transfer monitoring program, which will increase costs to the SWP water contractors.

Rationale for the Expected Supply

Historical Record

Metropolitan has made rapid progress in developing SWP transfer programs. This progress may be attributed to several factors, including Metropolitan dedicating additional staff to identify, develop, and implement SWP transfer programs; increased willingness of Central Valley agricultural interests to enter into transfer programs with Metropolitan; and Metropolitan staff's ability to work with DWR and USBR staff to facilitate SWP storage and transfer programs. The availability of dry year supplies has been demonstrated by the annual water purchase programs described above. In addition, Metropolitan participates in longer-term programs to secure water like the Yuba Accord and the Multi-Year Water Pool Demonstration Program.

The historical record for purchases from the Bank, Purchase Program, Metropolitan-initiated Central Valley programs, Yuba Accord, and Multi-Year Demonstration Program, as well as the number of sellers and buyers participating in these Programs, are strong indicators that there are significant amounts of water that can be purchased through spot market or long-term water transfers during dry years. This historical record from 1991 through 2016 is summarized in Table A.3-1 below. Metropolitan did not purchase supplies from nor participated in any dry year transfer programs from 2017 through 2020.

Approximately 20-35 percent of these north of the Delta water transfers are dedicated to improving Delta water quality to comply with regulations governing Delta pumping.

<u>Written Contracts or Other Proof</u>

With near record-low precipitation in California in recent years, Governor Edmund G. Brown Jr. issued several executive orders to expedite processing of water transfers within the state:

Executive Order B-21-13 (May 20, 2013): The Department of Water Resources and the State Water Resources Control Board are to "take immediate action to address the dry conditions and water delivery limitations by doing the following: … (1) Expedite processing of one-year water transfers for 2013 and assist water transfer proponents and suppliers as necessary, provided that the transfers will not harm other legal users of water and will not unreasonably affect fish, wildlife, or other in-stream beneficial uses; (2) The SWRCB shall expedite review and processing of water transfer petitions in accordance with the applicable provisions of the Water Code; (3) The DWR shall expedite and facilitate water transfer proposals in accordance with applicable provisions of the Water Code..."

January 1, 2014 Drought Proclamation: "The Department of Water Resources and the State Water Resources Control Board will expedite the processing of water transfers, as called for in Executive Order B-21-13. Voluntary water transfers from one water right holder to another enables water to flow where it is needed most."

April 25, 2014 Drought Proclamation: "The Department of Water Resources and the State Water Resources Control Board will immediately and expeditiously process requests to move water to areas of need, including requests involving voluntary water transfers, forbearance agreements, water exchanges, or other means. If necessary, the Department will request that the Water Board consider changes to water right permits to enable such voluntary movements of water."

Executive Order B-29-15 (April 1, 2015): "The Department shall immediately consider voluntary crop idling water transfer and water exchange proposals of one year or less in duration that are initiated by local public agencies and approved in 2015 by the Department subject to the criteria set forth in Water Code section 1810." [This executive order incorporated by reference the previous drought proclamations.]

In February 2021, Metropolitan's Board approved a water management amendment to the State Water Contract that provides greater water management flexibility with transfers and exchanges of SWP water within the SWP service area. The amendment will provide increased opportunities among the State Water Project Contractors to work together on programs that will improve the management of existing SWP water.

Table A.3-1
Historical Record of MWD Central Valley Water Transfers

Program	Purchases (AF per year) Total	Metropolitan	Participants Sellers	Buyers
1991 Governor's Water Bank	820,000	215,000	351	13
1992 Governor's Water Bank	193,246	10,000	18	16
1994 Governor's Water Bank	220,000	100	6	15
2001 Dry-Year Purchase Program	138,806	80,000	9	8
2003 MWD Water Transfer Program	146,230[1]	126,230	11	1
2005 SWC Water Transfer Program	127,275[2]	0	3	4
2008 SWC Water Transfer Program	39,152	26,621	4	8
2009 Governor's Water Bank	47,505	36,900	10	9
2010 SWC Water Transfer Program	98,959	88,159	11	4
2013 Multi-Year Water Pool Demo	92,232	30,000	4	9
2015 Multi-Year Water Pool Demo	3,000	1,374	1	14
2015 SWC Water Transfer Program	19,686	12,358	5	9
2016 Multi-Year Water Program	15,000	6,871	2	9

[1] Quantities denote options Metropolitan secured, of which 20,000 AF were not exercised due to improved hydrologic conditions.

[2] Quantities denote options Metropolitan secured, but were not exercised due to improved hydrologic conditions.

Agreements Between Sellers and Buyers. Since 1991, Metropolitan has entered into Central Valley water transfer agreements in eleven years with sellers, or DWR acting in an intermediary capacity for the Drought Water Bank. The essential terms and conditions for negotiating purchases, including maximum offering price, quantity of water needed, and the timing of delivery, were established in these agreements.

1999 Board Directive. Metropolitan's Board has authorized water transfers in accordance with the Water Surplus and Drought Management Plan (WSDM Plan) adopted in April 1999. The WSDM Plan is a comprehensive policy guideline for managing Metropolitan's water supply during periodic surplus and shortage conditions. During shortage conditions, the plan specifies the type, priority, and timing of drought actions, including the purchase of transfers on the spot market that could be taken in order to prevent or mitigate negative impacts on retail demands.

Financing

Funds for Central Valley water transfers are included in Metropolitan's O&M budget (referenced above).

Federal, State, and Local Permits/Approvals

Environmental documentation for the Drought Water Bank. In November 1993, DWR prepared and finalized a programmatic EIR for the operation of the Drought Water Bank during future drought events. In 2009, an emergency CEQA exemption was issued to support the Drought Water Bank.

Individual CEQA and NEPA documents for Metropolitan's 2003, 2005, and 2008 Central Valley water transfer programs. Individual sellers prepared CEQA documentation to support their transfers. In addition, the USBR prepared NEPA documentation for those transfers requiring federal approval.

M. Mojave Storage Program

Source of Supply

Water from Metropolitan's SWP supply is delivered to Mojave Water Agency through SWP facilities for deposit into an exchange account managed by Mojave. Returns to Metropolitan are made on an acre-foot-for-acre-foot basis (i.e., no losses) at Metropolitan's request by exchange with Mojave's SWP supplies delivered through SWP facilities, subject to rules reserving a minimum annual SWP supply for use by Mojave.

Expected Supply Capability

Through 2021, Metropolitan can annually withdraw the Mojave Water Agency's SWP contractual amounts in excess of 10%. After 2021, the withdrawal rate lowers, reserving 20% of Mojave Water Agency's SWP contractual amounts. Under a 100% allocation, the State Water Contract provides Mojave Water Agency 82.8 TAF of water.

Rationale for the Expected Supply

Implementation Status

Presently, the Mojave Water Agency is not accepting additional water from Metropolitan. As of January 2021, Metropolitan has approximately 19 TAF remaining in storage. Without additional deliveries to the exchange account, the program may not be able to provide return supplies beyond 2025.

Written Contracts or Other Proof

2003 Mojave Water Agency and Metropolitan Boards of Directors Approval. These actions approved the Mojave Water Agency Groundwater Recharge and Exchange Demonstration Project.

2003 Agreement for a Demonstration Water Exchange Program. Provided for a demonstration water exchange between Metropolitan and the Mojave Water Agency for the immediate benefit of both agencies and for the purpose of determining what mutual benefits can result from increased coordinated management of water and facilities. Provides for Metropolitan to deliver up to 75,000 AF for an exchange through December 2004 and the return of water to Metropolitan by December 2014.

2005 Mojave Water Agency and Metropolitan Boards of Directors Approval. These actions approved a one-year extension of the period for Metropolitan to deliver up to the maximum amount of 75,000 AF for an exchange and a one-year extension of the return of water supply to Metropolitan.

2005 First Amendment to the Agreement for a Demonstration Water Exchange Program. Provides for a one-year extension of the period for Metropolitan to deliver up to the maximum amount of 75,000 AF for an exchange and a one-year extension of the return of water supply to Metropolitan.

2011 Mojave Water Agency and Metropolitan Boards of Directors Approval. These actions approved an amendment to the Agreement for a Demonstration Water Exchange Program to provide for a longer term Water Storage Program for Metropolitan to store up to an additional 390,000 acre-feet of SWP supplies through 2035.

2011 Amended Agreement for a Water Storage Program. Establishes the Water Storage Program under which Metropolitan to store up to an additional 390,000 acre-feet of SWP supplies through 2035 for subsequent return by Mojave Water Agency.

Financing

Metropolitan O&M budget includes payments to deliver Metropolitan's SWP supplies to Mojave Water Agency and the recovery on that water by exchange with Mojave Water Agency's SWP supplies.

Federal, State, and Local Permits/Approvals

The Mojave Water Agency, as the Lead Agency, adopted a Final Environmental Impact Report on January 26, 2006, for the Mojave Water Agency Water Supply Reliability and Groundwater Replenishment Program (SCH#2005041103), adopted a mitigation monitoring and reporting program, and filed a Notice of Determination with the State Clearinghouse on January 31, 2006. Metropolitan's Board certified the CEQA documents as a Responsible Agency on July 12, 2011.

On September 8, 2011, Metropolitan and Mojave Water Agency entered into a Point of Delivery Agreement with DWR providing for the delivery of Metropolitan's SWP supplies to Mojave Water Agency and the return to Metropolitan through an exchange of Mojave's SWP supplies.

N. Yuba Accord Dry Year Purchase Program

Source of Supply

As part of a comprehensive settlement of a State Water Resources Control Board (SWRCB) proceeding in which the Yuba County Water Agency (YCWA) is required to increase Yuba River fishery flows, referred to as the "Yuba River Accord" (Accord), YCWA reached agreement with DWR and USBR to sell a portion of the water it would be required to release, plus additional water made available by reoperation of YCWA's storage reservoirs and groundwater substitution. DWR entered into a purchase agreement with YCWA under which one-half of the water available for purchase would be available to SWP contractors that elected to participate in the purchase program.

Under this 25-year program, the price for water is set by the agreement between DWR and the YCWA. There are four categories of water sold, and the price for each type of water depends on hydrology.

Expected Supply Capability

Metropolitan's share of the water made available under the Yuba Accord Dry Year Purchase Program is approximately 25 percent. Should other participating contractors decline to purchase their respective shares, that water is allocated to the remaining interested participating contractors. Metropolitan's likely share of assured YCWA transfer water would be at least 13,750 AF in dry years and up to 35,000 AF or more in other years. These volumes are as provided by YCWA north-of-the-Delta and are subject to conveyance losses through the Delta to the Banks Pumping Plant (approximately 20 to 35 percent).

Rationale for the Expected Supply

Historical Record

Actual volumes purchased by Metropolitan since program inception were as follows:

Year	Purchased Volume (AF)
2008	26,430
2009	42,915
2010	67,068
2011	0
2012	0
2013	14,548
2014	10,962
2015	8,192
2016	0
2017	0
2018	21,131
2019	0
2020	8,950 Estimate

Written Contracts or Other Proof

DWR-YCWA Purchase Agreement. This December 4, 2007, agreement provides the annual determination of the amount of water to be made available by YCWA and purchased by DWR. The agreement also specifies the costs of various categories of water to be made available under a variety of hydrologic conditions.

DWR-Metropolitan Participation Agreement. This December 21, 2007, agreement provides Metropolitan's election to purchase water made available by YCWA to DWR and the scheduling delivery of the purchased water. The agreement provides for mechanisms for Metropolitan payments to DWR that are due to YCWA under the DWR-YCWA Purchase Agreement.

Amended DWR-Metropolitan Participation Agreement. This December 5, 2014, amendment established prices for surface water transfer supplies between 2016 and 2020 and clarifies YCWA's rights to sell to third parties.

Amended DWR-Metropolitan Participation Agreement. The amendment, executed in September 2020, established new prices for surface water transfer supplies between 2020 and 2025.

Financing

Funds for purchases of water from the Yuba Accord Dry Year Purchase Program are included in Metropolitan's O&M budget (referenced above).

Federal, State, and Local Permits/Approvals

SWRCB Order WR 2008-0014. Approval of YCWA's petition to modify revised Water Right Decision 1644 related to Water Right Permits 15026, 15027, and 15030 (Applications 5632, 15204, and 15574), and petition for long-term transfer of up to 200,000 AF of water per year from YCWA to the DWR and the USBR under Permit 15026 (Application 5632) - Lower Yuba River in Yuba County.

O. 2011 Coordinated Operating, Water Storage, Exchange and Delivery Agreement among Metropolitan, Municipal Water District of Orange County, and Irvine Ranch Water District

Source of Supply

In July 2010, Metropolitan's Board authorized the Coordinated Operating, Water Storage, Exchange and Delivery Agreement among Metropolitan, Municipal Water District of Orange County (MWDOC), and Irvine Ranch Water District (IRWD). The agreement allows Metropolitan to manage additional SWP supplies obtained from other State Water Contractors. The SWP supplies are obtained through unbalanced exchanges with other State Water Contractors and stored in IRWD storage facilities along the California Aqueduct. Metropolitan maintains ownership and control over the SWP supplies that would be later delivered into the region. MWDOC and IRWD receive a benefit that when the storage programs operate consistent with Metropolitan's Water Supply Allocation Plan, MWDOC and IRWD would receive an extraordinary supply benefit. MWDOC continues to pay the full-service rate for the water generated and delivered under the program.

Expected Supply Capability

The average annual supply benefit is estimated at around 2,000 AFY which can vary drastically based on hydrologic conditions. The maximum supply benefit during a water supply allocation may be as high as 28,750 AF if IRWD has sufficiently developed supplies in storage.

Rationale for the Expected Supply

The expected supply is estimated on the SWP Supplies that the program typically develops through 2020.

Historical Record

The program has allowed Metropolitan to acquire additional supplies through unbalanced exchanges with Antelope Valley-East Kern Water Agency, Dudley Ridge Water District, and Santa Barbara County Flood Control and Water Conservation District.

Written Contracts or Other Proof

2011 Coordinated Operating, Water Storage, Exchange and Delivery Agreement among Metropolitan, Municipal Water District of Orange County, and Irvine Ranch Water District.

Financing

Metropolitan does not fund the exchanges or storage program. IRWD is responsible for the normal program costs. There are provisions where Metropolitan can utilize the program facilities on a limited basis and would reimburse actual operating costs.

A.3.3 In-Region Storage and Supplies

A. Surface Storage

Source of Supply

Surface storage is a critical element of Southern California's water resources strategy. Because California experiences dramatic swings in weather and hydrology, surface storage is important to regulate those swings and mitigate possible supply shortages. Surface storage provides a means of storing water during normal and wet years for later use during dry years, when imported supplies are limited. Since the early twentieth century, DWR and Metropolitan have constructed surface water reservoirs to meet emergency, drought/seasonal, and regulatory water needs for Southern California. These reservoirs include Pyramid Lake, Castaic Lake, Elderberry Forebay, Silverwood Lake, Lake Perris, Lake Skinner, Lake Mathews, Live Oak Reservoir, Garvey Reservoir, Palos Verdes Reservoir, Orange County Reservoir, and Metropolitan's DVL. Some reservoirs such as Live Oak Reservoir, Garvey Reservoir, Palos Verdes Reservoir, and Orange County Reservoir, which have a total combined capacity of about 3,500 AF, are used solely for regulating purposes. The remaining surface reservoirs are primarily used to meet emergency, drought, and seasonal requirements. The total gross storage capacity for these larger remaining reservoirs is 1,757,600 AF. However, not all of the gross storage capacity is available to Metropolitan; dead storage and storage allocated to others reduce the amount of storage that is available to Metropolitan to 1,665,200 AF.

Expected Supply Capability

Surface storage reservoirs are an important tool that allows Metropolitan to meet the water needs of its service area. As discussed in the EIR for the Eastside Reservoir (DVL) Project dated October 1991 and Metropolitan's IRP, the allocation of available surface storage can be divided into two primary components: emergency and drought/seasonal. As specified by Metropolitan's Board of Directors in the Final EIR for DVL, "Metropolitan shall maintain sufficient water reserves within its service area to supplement local production during an emergency or severe water shortage." With DVL in operation, Metropolitan can now re-operate the surface reservoirs and meet the Board's stated objectives.

<u>Updated Emergency Storage Objective</u>

Metropolitan established its original criteria for determining emergency storage requirements in the October 1991 Final Environmental Impact Report for the Eastside Reservoir, which is now named Diamond Valley Lake. These criteria were again discussed in the 1996 IRP. Metropolitan's Board approved both of these documents. Emergency storage requirements are based on the potential of a major earthquake that would damage all supply aqueducts isolating Southern California from its imported water sources. In 2019, Metropolitan and its member agencies completed a process to update the regional planning estimate of Metropolitan's Emergency Storage Objective. This emergency storage represents the amount of water that Metropolitan would store for the region in preparation for a catastrophic earthquake that would damage the aqueducts that transport imported water supplies to Southern California, including: the Colorado River Aqueduct, both the East and West branches of the California Aqueduct, and the Los Angeles Aqueduct. The emergency storage allows Metropolitan to deliver reserve supplies to the member agencies to supplement local production. This helps avoid severe water shortages during periods when the imported water aqueducts may be out of service. The Emergency Storage Objective considers a six- and twelve-month outage period for the imported supply aqueducts incorporating latest seismic information and operational flexibility of Metropolitan's system, a retail water demand cutback ranging from 25 to 35 percent considering the level of conservation that the region achieved during the recent drought, and an aggregated loss of 10 to 20 percent of local supplies accounting for factors could affect local production during emergency conditions. Under this update, Metropolitan's Emergency Storage Objective was set to 750 TAF, as this level of storage would prevent severe water shortages to the region given new information on expected recovery durations. The emergency storage volume represents a planning estimate for the amount of water that Metropolitan would store for the region in preparation for a catastrophic earthquake or other disaster. It is not intended to set a basis or a policy for allocating or apportioning storage for any individual member agency. A detailed description of Metropolitan's Emergency Storage Objective is included in Appendix 8.

The storage reserved in system reservoirs for emergency purposes is shown in Table A.3-2.

Updated Storage Requirements for Dry-Year Supply and Seasonal Needs

Storage capacity in system reservoirs, including DVL, is also earmarked for dry-year supply and system regulation purposes. Dry-year supply storage within Metropolitan's service area is required to meet the additional water demands that occur during single-year and extended droughts. As specified in the Final EIR for DVL and further discussed in the IRP, this storage requirement is defined as the difference between average-year demand and above average demand during dry years. In addition to dry-year storage, seasonal storage is required to meet seasonal peak demands, which are defined as the difference between average winter demands and average summer demands. The dry-year supply and seasonal storage also provide sufficient reserves to permit approximately five percent downtime for rehabilitation, repair, and maintenance of raw water transmission facilities.

Table A.3-2
Surface Storage Utilization
(acre-feet per year)

Forecast Year	2025	2030	2035	2040	2045
MWD Dry-Year/Seasonal Surface Storage					
DVL, Mathews, Skinner	596,000	596,000	596,000	596,000	596,000
Flexible Storage in Castaic & Perris	217,000	217,000	217,000	217,000	216,000
Subtotal of Dry-Year/Seasonal Storage	**813,000**	**813,000**	**813,000**	**813,000**	**812,000**
MWD Emergency Storage					
DVL, Mathews, Skinner	436,000	436,000	436,000	436,000	436,000
Emergency Storage in DWR Reservoirs	381,000	381,000	381,000	381,000	381,000
Subtotal of Emergency Storage	**817,000**	**817,000**	**817,000**	**817,000**	**817,000**
Total MWD Surface Storage	**1,630,000**	**1,630,000**	**1,630,000**	**1,630,000**	**1,629,000**

Historical Record

Metropolitan has a contract with the DWR that allows use of its terminal reservoirs, such as Castaic Lake on the West Branch and Lake Perris on the East Branch of the California Aqueduct (see Section A.3.3.B for a discussion of Metropolitan's contractual rights to storage in these DWR reservoirs). In addition, Metropolitan owns and operates surface reservoirs such as Lake Skinner, Lake Mathews, and DVL to enhance water supply reliability for its member agencies.

Written Contracts or Other Proof of Usage

The surface reservoirs used by Metropolitan are available either by contract (in the case of the DWR terminal reservoirs) or by construction of its own facilities. The following historical record is provided:

November 1960 Contract between the State of California Department of Water Resources and the Metropolitan Water District of Southern California for a Water Supply. This Contract and its numerous amendments describe Metropolitan's legal access to and obligations for the operation of the SWP for the benefit of its Contractors. Metropolitan has an entitlement to 1,911,500 AF of water each year subject to availability. The terms of this Contract describe Metropolitan's rights to and obligations for the terminal surface reservoirs for water supply purposes.

November 1974 Memorandum of Understanding and Agreement on Operation of Lake Skinner. This MOU and the January 2005 Amendment, signed by Metropolitan and other affected parties, govern Metropolitan's operations of Lake Skinner in Riverside County. The DWR Division of Safety and Dams also reviews monitoring data on the safety of the dam annually.

November 1994 Memorandum of Understanding on Operation of Domenigoni Valley Reservoir (now known as Diamond Valley Lake). This MOU, signed by Metropolitan and other affected parties, governs Metropolitan's operations of DVL in Riverside County. The DWR Division of Safety and Dams also reviews monitoring data on the safety of the dam annually.

Elderberry Forebay Contract for Conditions for Use. Conditions for use of storage are described in the contract between the DWR, State of California, and the Department of Water and Power, City of Los Angeles, for Cooperative Development, West Branch, California Aqueduct; Amendment No. 1, July 3, 1969; and Amendment No. 4, June 27, 1985.

June 2002 Division of Safety of Dams Certificate of Approval. The DWR, Division of Safety of Dams issued the Certificate of Approval for operation of DVL in early 2000, with three conditions. These conditions were: (1) Satisfactory operation of the butterfly valves and emergency gate in the inlet/outlet tower, (2) completion of the Tank Saddle Cutoff remediation, and (3) completion of the Signal Spillway. Metropolitan completed these conditions in 2001, and DVL is currently operational in accordance with the Certificate of Approval.

October 1991 Final EIR for the Eastside Reservoir Project (DVL). The EIR established criteria for integrating the operations of Metropolitan's reservoirs and DWR's southern reservoirs for emergency purposes. These criteria also provided that Metropolitan reservoirs could be expected to withdraw all drought storage water within a two-year period.

B. Flexible Storage Use of Castaic Lake and Lake Perris

Source of Storage

Metropolitan's flexible storage accounts in Castaic Lake and Lake Perris, which are SWP reservoirs, are 153,940 AF and 65,000 AF, respectively. These accounts provide Metropolitan with dry-year supply that is independent of the Table A allocation. Metropolitan can withdraw water from these reservoirs in addition to its allocated supply in any year on an as-needed basis. Withdrawn water must be replaced from supplies available to Metropolitan within five years of each withdrawal. This "flexible storage" is available in Castaic Lake to Metropolitan, Ventura County Flood Control and Water Conservation District, and to Santa Clarita Valley Water Agency. It is available in Lake Perris to Metropolitan only.

Expected Supply Capability

The dry-year supply available to Metropolitan from the flexible storage use of Castaic Lake and Lake Perris totals 218,940 AF, made up of 153,940 AF in Castaic Lake and 65,000 AF in Lake Perris. Table A.3-3 shows the use of this available supply in accordance with Metropolitan's operating criteria.

Table A.3-3
Estimated Water Supplies Available for Metropolitan's Use Under the Flexible Storage Use of Castaic Lake and Lake Perris[1]
(TAF per year)

Year	Five Year Drought (1988-1992)	Single Dry Year (1997)
2025	43	217
2030	43	217
2035	43	217
2040	43	217
2045	43	217

[1]Source: Metropolitan's operating criteria.

Rationale for the Expected Supply

<u>Implementation Status</u>

Express provisions related to flexible storage have been incorporated in Metropolitan's SWP contract since 1995. The operating options have been available for use since that time and will continue to be in effect as a part of the SWP contracts.

<u>Historical Record</u>

Metropolitan has exercised the flexible storage provision on numerous occasions and withdrew the full contract amount during calendar year 2014. The full amount was replaced by the beginning of 2017. Its use is based on existing contract provisions.

<u>DWR Bulletin 132-94.</u> The use of Castaic Lake and Lake Perris is determined in accordance with the proportionate use factors from Bulletin 132-94, Table B, upon which capital cost repayment obligations are based. Based on its capital repayment obligations, Metropolitan's proportionate use of Castaic Lake is 96.2 percent and of Lake Perris is 100 percent. Per its SWP contract, Metropolitan has express rights to use certain portions of the SWP's southern reservoirs independently of DWR to supply water in amounts in addition to approved SWP deliveries.

<u>Metropolitan's SWP Contract.</u> Metropolitan's SWP contract was amended in 1995 to include Article 54, "Usage of Lakes Castaic and Perris." This article provides flexible storage to contractors participating in repayment of the capital costs of Castaic Lake and Lake Perris. Each contractor shall be permitted to withdraw up to a Maximum Allocation from Castaic Lake and Lake Perris. These contractors may withdraw a collective Maximum Allocation up to 160 TAF in Castaic Lake and 65 TAF in Lake Perris, which shall be apportioned among them pursuant to the respective proportionate use factors, as shown in Table A.3-4 below.

Financing

The cost associated with the withdrawal and replacement of water in the flexible storage is included in Metropolitan's annual payments under the State Water Contract.

Federal, State, and Local Permits/Approvals

The flexible storage provision became effective in 1995. DWR has the approval authority to affect changes in the operations and usage of existing SWP facilities, including Castaic Lake and Lake Perris.

Table A.3-4
Flexible Storage Allocations

Participating Contractor	Proportionate Use Factor	Maximum Flexible Storage Allocation (AF)
Castaic Lake		
Metropolitan	.96212388	153,940
Ventura County Flood Control and Water Conservation District	.00860328	1,376
Santa Clarita Valley Water Agency	.02927284	4,684
Total Castaic Lake	1.00000000	160,000
Lake Perris[1]	1.00000000	65,000
Metropolitan		

[1] The 2003 Exchange Agreement among Metropolitan, CVWD, and DWA, among other things, transferred to CVWD and DWA a portion of Metropolitan's capacity in the California Aqueduct and the East Branch including Lake Perris. However, Metropolitan's rights to the full 65,000 AF of Lake Perris flexible storage account was retained by Metropolitan.

C. *Metropolitan Surface Reservoirs*

Source of Supply

Storage capacity in Metropolitan reservoirs, including Lake Skinner, Lake Mathews, Live Oak Reservoir, Garvey Reservoir, Palos Verdes Reservoir, Orange County Reservoir, and DVL, is earmarked to meet emergency, dry-year/seasonal, and system regulation needs, as these have been defined above.

Expected Supply Capability

The total available storage capacity for all Metropolitan-controlled surface reservoirs (Metropolitan-owned and DWR terminal reservoirs) is 1,632,000 AF. As discussed earlier, approximately 750,000 AF has been set aside to meet the emergency storage objective of the service area. After accounting for emergency storage, the surface storage available in Metropolitan-owned reservoirs to meet dry-year/seasonal requirements is presented in Table A.3-5.

Rationale for the Expected Supply

Program Facilities

Major facilities for Lake Mathews include an earthen dam to impound water and a recently completed new outlet tower. Major facilities for Lake Skinner include an earthen dam to impound water, an outlet tower, an inlet from the San Diego Canal to deliver water into the reservoir, a water treatment filtration facility, and recreational facilities consisting of a marina, parks, swimming areas, golf course, and hiking trails. Major facilities at DVL include three earthen dams to impound water, an inlet/outlet tower, a secondary inlet from the Inland Feeder, a large pumping station to deliver water into the reservoir, and power generating facilities. Recreational facilities consisting of a marina, parks, swimming areas, golf course, hiking trails, equestrian trails, and lodging are planned.

Historical Record

DVL has been operational for over 20 years. Lake Mathews and Lake Skinner have been in service since the 1940s and 1970s, respectively.

November 1974 Memorandum of Understanding and Agreement on Operation of Lake Skinner. This MOU and the January 2005 Amendment, signed by Metropolitan and other affected parties, govern Metropolitan's operations of Lake Skinner in Riverside County. The DWR Division of Safety and Dams also reviews monitoring data on the safety of the dam annually.

October 1991 Final EIR for the Eastside Reservoir Project (DVL). The EIR established criteria for integrating the operations of Metropolitan's reservoirs and DWR's southern reservoirs for emergency purposes. These criteria also provided that Metropolitan reservoirs could be expected to withdraw all drought storage water within a two-year period.

November 1994 Memorandum of Understanding on Operation of Domenigoni Valley Reservoir (now known as Diamond Valley Lake). This MOU, signed by Metropolitan and other affected parties, governs Metropolitan's operations of DVL in Riverside County. The DWR Division of Safety and Dams also reviews monitoring data on the safety of the dam annually.

June 2002 Division of Safety of Dams Certificate of Approval. The DWR Division of Safety of Dams issued the Certificate of Approval for operation of DVL in early 2000, with three conditions. These conditions were: (1) satisfactory operation of the butterfly valves and emergency gate in the inlet/outlet tower, (2) completion of the Tank Saddle Cutoff remediation, and (3) completion of the Signal Spillway. Metropolitan completed these conditions in 2001, and DVL is currently operational in accordance with the Certificate of Approval.

Table A.3-5
Estimated Supplies Available from Metropolitan's Surface Storage Program Capabilities
(acre-feet per year)

Forecast Year	Five Year Drought (1988-92)	Single Dry Year (1977)
2025	161,000	807,000
2030	161,000	809,000
2035	161,000	808,000
2040	161,000	808,000
2045	161,000	806,000

Source: Metropolitan analysis

Financing

The capital cost of DVL, Lake Mathews, and Lake Skinner was financed by a combination of revenue bonds and operating revenues. Annual operating costs, including maintenance and pumping, are included in Metropolitan's annual O&M budget (referenced above).

Federal, State, and Local Permits/Approvals

All necessary permits have been obtained. A permit to generate and sell power has been acquired from the Federal Energy Regulatory Commission. No further regulatory permits are required.

D. Groundwater Conjunctive Use Programs

Source of Supply

Metropolitan's IRP established the strategy to store imported water that is most available during wet years in surface reservoirs or groundwater aquifers for later use during droughts and emergencies. In this way, Metropolitan can reduce its reliance on direct deliveries from the SWP and the Colorado River during dry years when competing demands by other users and risks to the watershed ecosystems are greatest. Metropolitan has implemented a conjunctive use program for imported water storage in groundwater basins within the service area based upon policy principles adopted in 2000.

In 2007, Metropolitan published the Groundwater Assessment Study which estimated 3.2 MAF of available storage space in groundwater basins. Due to drought and the subsequent decline in water levels, it is estimated that storage in the groundwater basins has declined about 700 TAF from 2000 to 2019. Additionally, the 2020 IRP may lead to policies and strategies for ensuring sustainable groundwater production in light of a potential for extended multiple-year dry conditions.

Rationale for the Expected Supply

<u>Implementation Status</u>

The status of implementation for the groundwater conjunctive use programs has been described above.

<u>Historical Record</u>

In 2000, Metropolitan entered an agreement with DWR to administer $45 million of Proposition 13 state bond funds for Metropolitan's Southern California Water Supply Reliability Projects Program. Metropolitan paired the $45 million of state funds with $35 million of Metropolitan capital funds to develop nine groundwater storage programs in partnership with member and retail agencies and groundwater basin managers. These nine contractual storage programs have an initial 25-year term and provide for storage of up to 212 TAF and dry-year yield of up to 70 TAF. These programs are summarized in Table 3-16. Since inception, the conjunctive use program has been exercised to store water in groundwater basins during wet periods and relied upon to extract that water during dry periods. For example, during the recent drought period from 2012 to 2016, the conjunctive use program provided 64,000 AF of dry year supply to help Metropolitan meet regional demands. As of January 2020, the conjunctive use storage balance is 61,000 AF.

Metropolitan has also implemented a Cyclic Program to help capture additional imported supplies that would otherwise be lost to the region, when available storage capacity is limited. Under the Cyclic Program, Metropolitan delivers imported water supplies to the member agencies for storage in their local groundwater basin or surface water reservoir in advance of the demand for the water for a future use. The member agency purchases the water based on a mutually agreed upon schedule but has full discretion on the use of the stored water. The Cyclic Program creates additional flexibility for managing Metropolitan's water supplies.

Metropolitan has ten-year cyclic agreements with the City of Burbank, City of Pasadena, Calleguas Municipal Water District, Eastern Municipal Water District, Municipal Water District of Orange County, San Diego County Water Authority, and Western Municipal Water District. These agreements commenced between 2017 and 2019. In addition to these agreements, Metropolitan has existing agreements with two other member agencies. The Cyclic Storage Agreement with Upper San Gabriel Valley MWD allows pre-delivery and storage of up to 100 TAF of imported water. The agreement was originally signed in 1975 for a term of five years and has been extended in five-year increments. The agreement currently expires in November 2023. Metropolitan amended this agreement in August 2019 to increase the storage amount to up to 200 TAF. Metropolitan is working with Upper San Gabriel Valley MWD to enter into a new ten-year agreement. The Cyclic Storage Agreement with Three Valleys MWD allows for pre-delivery and storage of up to 40 TAF. This agreement was originally signed in 1991 for a term of five years and has been extended in five-year increments. Metropolitan entered into a new agreement that increased the storage amount to 50 TAF and expires in June 2030. Both agreements are expected to be renewed repeatedly in the future.

<u>Written Contracts or Other Proof</u>

Metropolitan's dry-year supply from the groundwater conjunctive use programs is based on Metropolitan's Board actions and agreements.

Proposition 13 Groundwater Conjunctive Use Programs.

Metropolitan Water District published the Groundwater Assessment Study Report in 2007 in collaboration with its member agencies and groundwater basin managers documenting existing use and development of groundwater resources in Metropolitan's service area and estimating additional groundwater basin storage potential.

Principles for groundwater storage adopted by the Metropolitan Board in January 2000.

Resolution for Proposition 13 Funds adopted by the Metropolitan Board in October 2000.

Agreement executed with the DWR for Interim Water Supply Construction Grant Commitment Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection (Proposition 13, Chapter 9, Article 4) providing for Metropolitan to administer $45 million in state Proposition 13 grant funds for groundwater reliability programs; October 2000.

Agreement executed for Long Beach Conjunctive Use Project, July 2002, amended in July 2003, October 2005, and November 2008.

Agreement executed for Live Oak Conjunctive Use Project, October 2002.

Agreement executed for Foothill Area Groundwater Storage Project, February 2003, amended in August 2006, April 2008, and February 2009.

Agreement executed for Chino Basin Programs, June 2003, amended in May 2004, August 2004, August 2005, May 2008, March 2009, September 2009, July 2010, and January 2015.

Agreement executed for Orange County Groundwater Storage Program, June 2003, amended in July 2004, December 2005, and July 2008.

Agreement executed for Compton Conjunctive Use Program, February 2005.

Agreement executed for Long Beach Conjunctive Use Project — Expansion in Lakewood, July 2005, amended in April 2006, August 2007, November 2008, and February 2010.

Agreement executed for Upper Claremont Basin Groundwater Storage Program, September 2005, amended in April 2008.

Agreement executed for Elsinore Basin Conjunctive Use Program, December 2006, amended in May 2008.

All of these programs have an initial 25-year term, with provision for renewal or extension after that period.

Financing

Financing has been supplied from multiple sources as discussed below:

Financing from Proposition 13 and Additional Groundwater Storage Programs.

Proposition 13 funds ($45 million) were allocated to Metropolitan by the state in May 2000 for the development of local groundwater storage projects.

Metropolitan has executed groundwater storage funding agreements for nine storage programs, expended $45 million of the Proposition 13 funds, and appropriated over $35 million of Metropolitan capital funds for the storage programs in the Orange County and Chino groundwater basins. All nine storage programs have completed facilities and are currently active. Metropolitan began calling for production of stored water beginning in 2007.

Table A.3-6 provides details on groundwater storage programs.

Federal, State, and Local Permits/Approvals

<u>Long Beach Conjunctive-use Storage Project.</u> Environmental documentation for the Long Beach Conjunctive-use Storage Project was certified by the City of Long Beach in August 2001.

<u>Live Oak Basin Conjunctive-use Storage Project.</u> Environmental documentation for the Live Oak Basin Conjunctive-use Storage Project was certified by Three Valleys MWD in January 2002.

<u>Foothill Area Groundwater Storage Project.</u> Environmental documentation for the Foothill Area Groundwater Storage Project was certified by Foothill Municipal Water District in January 2003.

<u>Chino Basin Programs Groundwater Storage Project.</u> Environmental documentation for the Chino Basin Programs Groundwater Storage Project was certified by Inland Empire Utility Agency in December 2002.

<u>Long Beach Conjunctive Use Storage Project — Expansion in Lakewood.</u> Environmental documentation for the project was certified by the City of Lakewood in May 2005.

<u>City of Compton Conjunctive Use Program.</u> Environmental documentation for the project was certified by the City of Compton in December 2004.

<u>Orange County Groundwater Conjunctive Use Program.</u> Environmental documentation for the project was certified by Orange County Water District in March 1999 and in July 2002.

<u>Upper Claremont Basin Groundwater Storage Program.</u> Environmental documentation for the project was certified by Three Valleys MWD in July 2005.

<u>Elsinore Basin Conjunctive Use Program.</u> Environmental documentation for the project was certified by Elsinore Valley MWD in February 2004.

E. Program under Development

Regional Recycled Water Program

The Regional Recycled Water Program (RRWP), a partnership with the Los Angeles County Sanitation Districts, will purify wastewater to produce high quality water that could be used again. The RRWP would produce up to 150 MGD of purified water from the Joint Water Pollution Control Plant in Carson for groundwater replenishment, industrial use, and potentially raw water augmentation. The agencies have been working together for over 10 years on the program. As a first step toward full implementation, Metropolitan and the Sanitation Districts cooperated to complete the Advanced Purification Center in 2019. The Advanced Purification Center is a 0.5 million gallon per day demonstration facility that will generate information needed for the potential future construction of a full-scale recycled water facility. It uses a unique application of membrane bioreactors designed to significantly increase efficiency in water recycling. Scientists and engineers will test the process, utilizing full-scale treatment modules, to ensure the resulting purified water meets the highest water quality standards. Once approved by regulators, this innovative process could be used throughout California and even applied around the globe.

Metropolitan and the Sanitation Districts are continuing to move forward with the program, to enhance their partnership and begin the next phase of the program. Metropolitan's Board approved proceeding with the environmental planning phase of the project in November 2020.

Table A.3-6
Metropolitan's In-Region Groundwater Storage Programs

Program	Metropolitan Agreement Partners	Program Term	Max Storage AF	Dry-Year Yield AF/Yr
Long Beach Conjunctive Use Storage Project (Central Basin)	Long Beach	June 2002-2027	13,000	4,300
Foothill Area Groundwater Storage Program (Monkhill/ Raymond Basin)	Foothill MWD	February 2003-2028	9,000	3,000
Orange County Groundwater Conjunctive Use Program	MWDOC OCWD	June 2003-2028	66,000+	22,000
Chino Basin Conjunctive Use Programs	IEUA TVMWD Watermaster	June 2003-2028	100,000	33,000
Live Oak Basin Conjunctive Use Project (Six Basins)	TVMWD City of La Verne	October 2002-2027	3,000	1,000
City of Compton Conjunctive Use Project (Central Basin)	Compton	February 2005-2030	2,289	763
Long Beach Conjunctive Use Program Expansion in Lakewood (Central Basin)	Long Beach	July 2005-2030	3,600	1,200
Upper Claremont Basin Groundwater Storage Program (Six Basins)	TVMWD	Sept. 2005- 2030	3,000	1,000
Elsinore Basin Conjunctive Use Storage Program	Western MWD Elsinore Valley MWD	May 2008- 2033	12,000	4,000
Total			**211,889**	**70,263**

Table A.3-7
Colorado River
Program Capabilities
Year 2025
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Basic Apportionment – Priority 4	550,000	550,000	550,000
DCP Contribution Reduction[1]	0	0	0
IID/MWD Conservation Program	105,000	105,000	105,000
Priority 5 Apportionment (Surplus)	0	0	0
PVID Land Management, Crop Rotation, and Water Supply Program	99,000	130,000	117,000
Bard Seasonal Fallowing Program	6,000	6,000	6,000
Lower Colorado Water Supply Project	9,000	9,000	9,000
Lake Mead ICS Storage Program	400,000	400,000	400,000
Binational ICS	17,000	0	42,000
Forbearance for Present Perfected Rights	0	0	0
CVWD SWP/QSA Transfer Obligation	(50,000)	(50,000)	(50,000)
DWCV SWP Table A Obligation	(47,000)	(12,000)	(113,000)
DWCV Advance Delivery Account	47,000	12,000	113,000
IID Payback	(20,000)	(20,000)	(20,000)
SNWA Agreement Payback	0	0	0
Subtotal of Current Programs	***1,116,000***	***1,130,000***	***1,159,000***
Programs Under Development			
Additional Transfer Programs	0	0	0
Subtotal of Proposed Programs	***0***	***0***	***0***
Additional Colorado River Exchange Supplies			
Exchange with SDCWA	278,000	278,000	278,000
Exchange with United States	16,000	16,000	16,000
Subtotal of Additional Colorado River Supplies	***294,000***	***294,000***	***294,000***
Maximum CR Supply Capability2	**1,410,000**	**1,424,000**	**1,453,000**
Less CRA Capacity Constraint (amount above 1.25 MAF)	*(160,000)*	*(174,000)*	*(203,000)*
Maximum Expected CRA Deliveries[3]	**1,250,000**	**1,250,000**	**1,250,000**

[1] DCP contribution beyond capacity of ICS accounts.
[2] Total amount of supplies available without taking into consideration CRA capacity constraint.
[3] The CRA delivery capacity is 1.25 MAF annually.

Table A.3-7
Colorado River
Program Capabilities
Year 2030
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Basic Apportionment – Priority 4	550,000	550,000	550,000
DCP Contribution Reduction[1]	0	0	0
IID/MWD Conservation Program	85,000	85,000	85,000
Priority 5 Apportionment (Surplus)	0	0	0
PVID Land Management, Crop Rotation, and Water Supply Program	130,000	130,000	117,000
Bard Seasonal Fallowing Program	6,000	6,000	6,000
Lower Colorado Water Supply Project	9,000	9,000	9,000
Lake Mead ICS Storage Program	337,500	337,500	337,500
Binational ICS	51,000	51,000	51,000
Forbearance for Present Perfected Rights	(2,000)	(2,000)	(2,000)
CVWD SWP/QSA Transfer Obligation	(35,000)	(35,000)	(35,000)
DWCV SWP Table A Obligation	(49,000)	(12,000)	(113,000)
DWCV Advance Delivery Account	49,000	12,000	113,000
IID Payback	0	0	0
SNWA Agreement Payback	(22,000)	(22,000)	(22,000)
Subtotal of Current Programs	***1,109,500***	***1,109,500***	***1,096,500***
Programs Under Development			
Additional Transfer Programs	0	0	0
Subtotal of Proposed Programs	***0***	***0***	***0***
Additional Colorado River Exchange Supplies			
Exchange with SDCWA	278,000	278,000	278,000
Exchange with United States	16,000	16,000	16,000
Subtotal of Additional Colorado River Supplies	***294,000***	***294,000***	***294,000***
Maximum CR Supply Capability[2]	**1,403,500**	**,403,500**	**1,390,500**
Less CRA Capacity Constraint (amount above 1.25 MAF)	*(153,500)*	*(153,500)*	*(140,500)*
Maximum Expected CRA Deliveries[3]	**1,250,000**	**1,250,000**	**1,250,000**

[1] DCP contribution beyond capacity of ICS accounts.
[2] Total amount of supplies available without taking into consideration CRA capacity constraint.
[3] The CRA delivery capacity is 1.25 MAF annually.

Table A.3-7
Colorado River
Program Capabilities
Year 2035
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Basic Apportionment – Priority 4	550,000	550,000	550,000
DCP Contribution Reduction[1]	0	0	0
IID/MWD Conservation Program	85,000	85,000	85,000
Priority 5 Apportionment (Surplus)	0	0	0
PVID Land Management, Crop Rotation, and Water Supply Program	130,000	130,000	117,000
Bard Seasonal Fallowing Program	6,000	6,000	6,000
Lower Colorado Water Supply Project	9,000	9,000	9,000
Lake Mead ICS Storage Program	337,500	337,500	337,500
Binational ICS	51,000	0	51,000
Forbearance for Present Perfected Rights	(2,000)	(2,000)	(2,000)
CVWD SWP/QSA Transfer Obligation	(35,000)	(35,000)	(35,000)
DWCV SWP Table A Obligation	(51,000)	(12,000)	(113,000)
DWCV Advance Delivery Account	51,000	12,000	113,000
IID Payback	0	0	0
SNWA Agreement Payback	(22,000)	(22,000)	(22,000)
Subtotal of Current Programs	***1,109,500***	***1,058,500***	***1,096,500***
Programs Under Development			
Additional Transfer Programs	0	0	0
Subtotal of Proposed Programs	***0***	***0***	***0***
Additional Colorado River Exchange Supplies			
Exchange with SDCWA	278,000	278,000	278,000
Exchange with United States	16,000	16,000	16,000
Subtotal of Additional Colorado River Supplies	***294,000***	***294,000***	***294,000***
Maximum CR Supply Capability[2]	**1,403,500**	**1,352,500**	**1,390,500**
Less CRA Capacity Constraint (amount above 1.25 MAF)	*(153,500)*	*(102,500)*	*(140,500)*
Maximum Expected CRA Deliveries[3]	**1,250,000**	**1,250,000**	**1,250,000**

[1] DCP contribution beyond capacity of ICS accounts.
[2] Total amount of supplies available without taking into consideration CRA capacity constraint.
[3] The CRA delivery capacity is 1.25 MAF annually.

Table A.3-7
Colorado River
Program Capabilities
Year 2040
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Basic Apportionment – Priority 4	550,000	550,000	550,000
DCP Contribution Reduction[1]	0	0	0
IID/MWD Conservation Program	85,000	85,000	85,000
Priority 5 Apportionment (Surplus)	0	0	0
PVID Land Management, Crop Rotation, and Water Supply Program	130,000	130,000	117,000
Bard Seasonal Fallowing Program	6,000	6,000	6,000
Lower Colorado Water Supply Project	9,000	9,000	9,000
Lake Mead ICS Storage Program	350,000	337,500	337,500
Binational ICS	0	0	0
Forbearance for Present Perfected Rights	(2,000)	(2,000)	(2,000)
CVWD SWP/QSA Transfer Obligation	(35,000)	(35,000)	(35,000)
DWCV SWP Table A Obligation	(53,000)	(12,000)	(113,000)
DWCV Advance Delivery Account	53,000	12,000	113,000
IID Payback	0	0	0
SNWA Agreement Payback	(22,000)	(22,000)	(22,000)
Subtotal of Current Programs	***1,071,000***	***1,058,500***	***1,045,500***
Programs Under Development			
Additional Transfer Programs	0	0	0
Subtotal of Proposed Programs	***0***	***0***	***0***
Additional Colorado River Exchange Supplies			
Exchange with SDCWA	278,000	278,000	278,000
Exchange with United States	16,000	16,000	16,000
Subtotal of Additional Colorado River Supplies	***294,000***	***294,000***	***294,000***
Maximum CR Supply Capability[2]	**1,365,000**	**1,352,500**	**1,339,500**
Less CRA Capacity Constraint (amount above 1.25 MAF)	*(115,000)*	*(102,500)*	*(89,500)*
Maximum Expected CRA Deliveries[3]	**1,250,000**	**1,250,000**	**1,250,000**

[1] DCP contribution beyond capacity of ICS accounts.
[2] Total amount of supplies available without taking into consideration CRA capacity constraint.
[3] The CRA delivery capacity is 1.25 MAF annually.

Table A.3-7
Colorado River
Program Capabilities
Year 2045
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Basic Apportionment – Priority 4	550,000	550,000	550,000
DCP Contribution Reduction[1]	0	0	0
IID/MWD Conservation Program	85,000	85,000	85,000
Priority 5 Apportionment (Surplus)	0	0	0
PVID Land Management, Crop Rotation, and Water Supply Program	130,000	130,000	117,000
Bard Seasonal Fallowing Program	6,000	6,000	6,000
Lower Colorado Water Supply Project	9,000	9,000	9,000
Lake Mead ICS Storage Program	343,750	343,750	343,750
Binational ICS	0	0	0
Forbearance for Present Perfected Rights	(2,000)	(2,000)	(2,000)
CVWD SWP/QSA Transfer Obligation	(35,000)	(35,000)	(35,000)
DWCV SWP Table A Obligation	(53,000)	(12,000)	(113,000)
DWCV Advance Delivery Account	53,000	12,000	113,000
IID Payback	0	0	0
SNWA Agreement Payback	0	0	0
Subtotal of Current Programs	***1,086,750***	***1,086,750***	***1,073,750***
Programs Under Development			
Additional Transfer Programs	0	0	0
Subtotal of Proposed Programs	***0***	***0***	***0***
Additional Colorado River Exchange Supplies			
Exchange with SDCWA	278,000	278,000	278,000
Exchange with United States	16,000	16,000	16,000
Subtotal of Additional Colorado River Supplies	***294,000***	***294,000***	***294,000***
Maximum CR Supply Capability[2]	**1,380,750**	**1,380,750**	**1,367,750**
Less CRA Capacity Constraint (amount above 1.25 MAF)	*(130,750)*	*(130,750)*	*(117,750)*
Maximum Expected CRA Deliveries[3]	**1,250,000**	**1,250,000**	**1,250,000**

[1] DCP contribution beyond capacity of ICS accounts.
[2] Total amount of supplies available without taking into consideration CRA capacity constraint.
[3] The CRA delivery capacity is 1.25 MAF annually.

Table A.3-7
California Aqueduct
Program Capabilities
Year 2025
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
MWD Table A [1]	459,000	122,000	1,108,000
DWCV Table A	47,000	12,000	113,000
San Luis Carryover [2]	56,000	282,000	282,000
Article 21 Supplies	0	0	25,000
San Gabriel Valley MWD Exchange and Purchase	2,000	2,000	2,000
Yuba River Accord Purchase	12,800	14,000	6,000
Central Valley Storage and Transfers			
Semitropic Program	50,000	45,000	68,000
Arvin Edison Program[3]	0	0	0
Mojave Storage Program	0	0	0
Antelope Valley/East Kern Acquisition and Storage	20,000	70,000	70,000
Kern Delta Program	38,000	50,000	50,000
Transfers and Exchanges	50,000	50,000	50,000
Subtotal of Current Programs	***734,800***	***647,000***	***1,774,000***
Programs Under Development			
San Bernardino Valley Water District Program	0	0	13,000
Subtotal of Proposed Programs	***0***	***0***	***13,000***
Maximum Supply Capability	**734,800**	**647,000**	**1,787,000**

[1] Includes Port Hueneme Lease.
[2] Includes DWCV carryover.
[3] Take and put amounts limited due to water quality considerations.

Table A.3-7
California Aqueduct
Program Capabilities
Year 2030
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
MWD Table A [1]	479,000	122,000	1,108,000
DWCV Table A	49,000	12,000	113,000
San Luis Carryover [2]	57,000	283,000	283,000
Article 21 Supplies	0	0	22,000
San Gabriel Valley MWD Exchange and Purchase	2,000	2,000	2,000
Yuba River Accord Purchase	0	0	0
Central Valley Storage and Transfers			
Semitropic Program	50,000	45,000	68,000
Arvin Edison Program[3]	0	0	0
Mojave Storage Program	0	0	0
Antelope Valley/East Kern Acquisition and Storage	43,000	70,000	70,000
Kern Delta Program	42,000	50,000	50,000
Transfers and Exchanges	50,000	50,000	50,000
Subtotal of Current Programs	***772,000***	***634,000***	***1,766,000***
Programs Under Development			
San Bernardino Valley Water District Program	0	0	13,000
Subtotal of Proposed Programs	***0***	***0***	***13,000***
Maximum Supply Capability	**772,000**	**634,000**	**1,779,000**

[1] Includes Port Hueneme Lease.
[2] Includes DWCV carryover.
[3] Take and put amounts limited due to water quality considerations.

Table A.3-7
California Aqueduct
Program Capabilities
Year 2035

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
MWD Table A [1]	499,000	122,000	1,108,000
DWCV Table A	51,000	12,000	113,000
San Luis Carryover [2]	57,000	283,000	283,000
Article 21 Supplies	0	0	20,000
San Gabriel Valley MWD Exchange and Purchase	2,000	2,000	2,000
Yuba River Accord Purchase	0	0	0
Central Valley Storage and Transfers			
Semitropic Program	50,000	45,000	68,000
Arvin Edison Program[3]	0	0	0
Mojave Storage Program	0	0	0
Antelope Valley/East Kern Acquisition and Storage	43,000	70,000	70,000
Kern Delta Program	42,000	50,000	50,000
Transfers and Exchanges	50,000	50,000	50,000
Subtotal of Current Programs	***794,000***	***634,000***	***1,764,000***
Programs Under Development			
San Bernardino Valley Water District Program	0	0	13,000
Subtotal of Proposed Programs	***0***	***0***	***13,000***
Maximum Supply Capability	**794,000**	**634,000**	**1,777,000**

(acre-feet per year)

[1] Includes Port Hueneme Lease.
[2] Includes DWCV carryover.
[3] Take and put amounts limited due to water quality considerations

Table A.3-7
California Aqueduct
Program Capabilities
Year 2040
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
MWD Table A [1]	519,000	122,000	1,108,000
DWCV Table A	53,000	12,000	113,000
San Luis Carryover [2]	57,000	283,000	283,000
Article 21 Supplies	0	0	18,000
San Gabriel Valley MWD Exchange and Purchase	2,000	2,000	2,000
Yuba River Accord Purchase	0	0	0
Central Valley Storage and Transfers			
Semitropic Program	50,000	45,000	68,000
Arvin Edison Program[3]	0	0	0
Mojave Storage Program	0	0	0
Antelope Valley/East Kern Acquisition and Storage	43,000	70,000	70,000
Kern Delta Program	42,000	50,000	50,000
Transfers and Exchanges	50,000	50,000	50,000
Subtotal of Current Programs	***816,000***	***634,000***	***1,762,000***
Programs Under Development			
San Bernardino Valley Water District Program	0	0	13,000
Subtotal of Proposed Programs	***0***	***0***	***13,000***
Maximum Supply Capability	**816,000**	**634,000**	**1,775,000**

[1] Includes Port Hueneme Lease.
[2] Includes DWCV carryover.
[3] Take and put amounts limited due to water quality considerations.

Table A.3-7
California Aqueduct
Program Capabilities
Year 2045
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
MWD Table A [1]	519,000	122,000	1,108,000
DWCV Table A	53,000	12,000	113,000
San Luis Carryover [2]	56,000	282,000	282,000
Article 21 Supplies	0	0	18,000
San Gabriel Valley MWD Exchange and Purchase	2,000	2,000	2,000
Yuba River Accord Purchase	0	0	0
Central Valley Storage and Transfers			
Semitropic Program	50,000	45,000	68,000
Arvin Edison Program[3]	0	0	0
Mojave Storage Program	0	0	0
Antelope Valley/East Kern Acquisition and Storage	20,000	70,000	70,000
Kern Delta Program	42,000	50,000	50,000
Transfers and Exchanges	50,000	50,000	50,000
Subtotal of Current Programs	***792,000***	***633,000***	***1,761,000***
Programs Under Development			
San Bernardino Valley Water District Program	0	0	13,000
Subtotal of Proposed Programs	***0***	***0***	***13,000***
Maximum Supply Capability	**792,000**	**633,000**	**1,774,000**

[1] Includes Port Hueneme Lease.
[2] Includes DWCV carryover.
[3] Take and put amounts limited due to water quality considerations.

Table A.3-7
In-Region Supplies and Programs
Program Capabilities
Year 2025
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Metropolitan Surface Storage			
(DVL, Mathews, Skinner)	118,000	590,000	590,000
Flexible Storage in Castaic & Perris	43,000	217,000	217,000
Groundwater Storage			
Conjunctive Use	33,000	68,000	68,000
Subtotal of Current Programs	***194,000***	***875,000***	***875,000***
Programs Under Development			
Subtotal of Proposed Programs	***0***	***0***	***0***
Maximum Supply Capability	**194,000**	**875,000**	**875,000**

Table A.3-7
In-Region Supplies and Programs
Program Capabilities
Year 2030
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Metropolitan Surface Storage			
(DVL, Mathews, Skinner)	118,000	592,000	592,000
Flexible Storage in Castaic & Perris	43,000	217,000	217,000
Groundwater Storage			
Conjunctive Use	36,000	68,000	68,000
Subtotal of Current Programs	***197,000***	***877,000***	***877,000***
Programs Under Development			
Subtotal of Proposed Programs	***0***	***0***	***0***
Maximum Supply Capability	**197,000**	**877,000**	**877,000**

Table A.3-7
In-Region Supplies and Programs
Program Capabilities
Year 2035
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Metropolitan Surface Storage (DVL, Mathews, Skinner)	118,000	591,000	591,000
Flexible Storage in Castaic & Perris	43,000	217,000	217,000
Groundwater Storage			
Conjunctive Use	36,000	68,000	68,000
Subtotal of Current Programs	***197,000***	***876,000***	***876,000***
Programs Under Development			
Subtotal of Proposed Programs	***0***	***0***	***0***
Maximum Supply Capability	**197,000**	**876,000**	**876,000**

Table A.3-7
In-Region Supplies and Programs
Program Capabilities
Year 2040
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Metropolitan Surface Storage (DVL, Mathews, Skinner)	118,000	591,000	591,000
Flexible Storage in Castaic & Perris	43,000	217,000	217,000
Groundwater Storage			
Conjunctive Use	36,000	68,000	68,000
Subtotal of Current Programs	***197,000***	***876,000***	***876,000***
Programs Under Development			
Subtotal of Proposed Programs	***0***	***0***	***0***
Maximum Supply Capability	**197,000**	**876,000**	**876,000**

Table A.3-7
In-Region Supplies and Programs
Program Capabilities
Year 2045
(acre-feet per year)

Hydrology	Five Year Drought (1988-1992)	Single Dry Year (1977)	Normal Year (1922-2017)
Current Programs			
Metropolitan Surface Storage (DVL, Mathews, Skinner)	118,000	589,000	589,000
Flexible Storage in Castaic & Perris	43,000	217,000	217,000
Groundwater Storage			
Conjunctive Use	36,000	68,000	68,000
Subtotal of Current Programs	***197,000***	***874,000***	***874,000***
Programs Under Development			
Subtotal of Proposed Programs	***0***	***0***	***0***
Maximum Supply Capability	**197,000**	**874,000**	**874,000**

Table A.3-8
Colorado River
Supply Characterization[1] Year 2021-2025
Repeat of 1988-1992 Hydrologies
(acre-feet per year)

Hydrology	2021	2022	2023	2024	2025
Current Programs					
Basic Apportionment – Priority 4	550,000	550,000	550,000	550,000	550,000
DCP Contribution Reduction[2]	0	0	0	0	0
IID/MWD Conservation Program	105,000	105,000	105,000	105,000	105,000
Priority 5 Apportionment (Surplus)	0	0	0	0	0
PVID Land Management, Crop Rotation, and Water Supply Program	42,000	64,000	130,000	130,000	130,000
Lower Colorado Water Supply Project	9,000	9,000	9,000	9,000	9,000
Bard Seasonal Fallowing Program	6,000	6,000	6,000	6,000	6,000
Lake Mead ICS Storage Program	400,000	400,000	400,000	100,000	100,000
Binational ICS	33,000	33,000	0	0	0
Forbearance for Present Perfected Rights	0	0	0	0	(2,000)
CVWD SWP/QSA Transfer Obligation	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)
DWCV SWP Table A Obligation	(22,000)	(95,000)	(28,000)	(45,000)	(35,000)
DWCV Advance Delivery Account	22,000	95,000	28,000	45,000	35,000
SNWA Agreement Payback	0	0	0	0	0
IID Payback	(20,000)	(20,000)	(20,000)	(20,000)	(20,000)
Subtotal of Current Programs	***1,075,000***	***1,097,000***	***1,130,000***	***830,000***	***828,000***
Additional Colorado River Exchange Supplies					
Exchange with SDCWD	283,000	281,000	278,000	278,000	278,000
Exchange with United States	16,000	16,000	16,000	16,000	16,000
Subtotal of Additional Colorado River Supplies	***299,000***	***297,000***	***294,000***	***294,000***	***294,000***
Maximum CR Supply Capability[3]	**1,374,000**	**1,394,000**	**1,424,000**	**1,124,000**	**1,122,000**
Less CRA Capacity Constraint (amount above 1.25 MAF)	*(124,000)*	*(144,000)*	*(174,000)*	*0*	*0*
Subtotal of CR Core Supplies	**919,000**	**866,000**	**996,000**	**979,000**	**987,000**
Subtotal of CR Storage	**331,000**	**384,000**	**254,000**	**145,000**	**135,000**
Maximum Expected CRA Deliveries[4]	**1,250,000**	**1,250,000**	**1,250,000**	**1,124,000**	**1,122,000**

[1] Supply characterization for the Drought Risk Assessment is based on core supplies as defined in WSCP Appendix 4. Flexible and storage supplies from CR, SWP, and In-Region may be exercised as supply augmentation action to any potential core supply shortfall.
[2] DCP contribution beyond capacity of ICS accounts.
[3] Total amount of supplies available without taking into consideration CRA capacity constraint.
[4] The CRA delivery capacity is 1.25 MAF annually.

Table A.3-8
California Aqueduct
Supply Characterization[1] Year 2021-2025
Repeat of 1988-1992 Hydrologies
(acre-feet per year)

Hydrology	2021	2022	2023	2024	2025
Current Programs					
MWD Table A[2]	221,000	940,000	274,000	442,000	345,000
DWCV Table A	22,000	95,000	28,000	45,000	35,000
Article 21 Supplies	0	0	0	0	0
San Gabriel Valley MWD Exchange and Purchase	2,000	2,000	2,000	2,000	2,000
Subtotal of SWP Core Supplies	***245,000***	***1,037,000***	***304,000***	***489,000***	***382,000***
San Luis Carryover[3]	200,000	0	69,000	0	0
Yuba River Accord Purchase	14,000	11,000	14,000	11,000	14,000
Central Valley Storage and Transfers					
Semitropic Program	40,000	0	40,000	44,000	41,000
Arvin Edison Program[4]	0	0	0	0	0
Mojave Storage Program	0	0	0	0	0
Antelope Valley/East Kern Acquisition and Storage	27,000	0	27,000	0	11,000
Kern Delta Program	50,000	0	50,000	50,000	40,000
Transfers and Exchanges	50,000	50,000	50,000	50,000	50,000
Subtotal of SWP Flexible and Storage Programs	***381,000***	***61,000***	***250,000***	***155,000***	***156,000***
Programs Under Development					
San Bernardino Valley Water District Program	0	0	0	0	0
Subtotal of Proposed Programs	***0***	***0***	***0***	***0***	***0***
Maximum Supply Capability	**626,000**	**1,098,000**	**554,000**	**644,000**	**538,000**

[1] Supply characterization for the Drought Risk Assessment is based on core supplies as defined in WSCP Appendix 4. Flexible and storage supplies from CR, SWP, and In-Region may be exercised as supply augmentation action to any potential core supply shortfall.
[2] Includes Port Hueneme lease.
[3] Includes DWCV carryover.
[4] Take and put amounts limited due to water quality considerations.

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Appendix 4

WATER SHORTAGE CONTINGENCY PLAN

Appendix 4
WATER SHORTAGE CONTINGENCY PLAN

This Water Shortage Contingency Plan (WSCP) complies with California Water Code (CWC) Section 10632, which requires that every urban water supplier shall prepare and adopt a WSCP as part of its urban water management plan (UWMP). Section 10632.2 provides, "An urban water supplier shall follow, where feasible and appropriate, the prescribed procedures and implement determined shortage response actions in its water shortage contingency plan...or reasonable alternative actions, provided that descriptions of the alternative actions are submitted with the annual water shortage assessment report pursuant to Section 10632.1." Notwithstanding, the CWC does not prohibit an urban water supplier from taking actions not specified in its WSCP, if needed, without having to formally amend its UWMP or WSCP.

The WSCP is a guide for the Metropolitan Water District of Southern California's (Metropolitan's) intended actions during water shortage conditions. It is meant to improve preparedness for droughts and other impacts on water supplies by describing the process used to address varying degrees of water shortages. Certain elements of the WSCP are required by the CWC, including response actions that align with six standard water shortage levels based on water supply conditions, as well as shortages resulting from catastrophic supply interruptions. The WSCP also describes Metropolitan's procedures for conducting an Annual Water Supply and Demand Assessment (Annual Assessment) that is required by CWC Section 10632.1 and is to be submitted to the California Department of Water Resources (DWR) on or before July 1 of each year, or within 14 days of receiving final allocations from the State Water Project (SWP), whichever is later.

Metropolitan's WSCP is included as Appendix 4 to its 2020 UWMP which will be submitted to DWR by July 1, 2021. However, this WSCP is created separately from Metropolitan's 2020 UWMP and can be amended, as needed, without amending the UWMP.

Organization of this Document

The WSCP covers the required elements as set forth by CWC Section 10632. Because Metropolitan is a wholesale urban water supplier, elements that pertain only to retail water suppliers are not addressed in this WSCP.[1] The document contains eight sections. Section A.4.1 is an introduction that explains the purpose of the WSCP and provides background on Metropolitan's service area and system. Section A.4.2 is a summary of the water supply analysis and water reliability findings from the 2020 UWMP, pursuant to CWC Section 10635. Section A.4.3 is a description of procedures to conduct and approve the Annual Assessment. Section A.4.4 explains the WSCP's six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, 50, and more than 50 percent shortages and describes the WSCP's shortage response actions that align with the defined shortage levels. Section A.4.5 addresses communication protocols and procedures to inform customers, the public, interested parties, and local, regional, and state governments regarding any current

[1] WSCP elements that apply specifically to retailer water suppliers are: (1) a description of customer compliance, enforcement, appeal, and exemption procedures for triggered response actions (CWC Section 10632(a)(6)); (2) a description of the cost of compliance with Chapter 3.3 (commencing with Section 365) of Division 1 (CWC Section 10632(a)(8)(c)); and (3) monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance and to meet state reporting requirements (CWC Section 10632(a)(9)).

or predicted shortages and any resulting shortage response actions. Section A.4.6 is a description of the legal authorities that enable Metropolitan to implement and enforce its shortage response actions. Section A.4.7 is a description of the financial consequences of and responses for drought conditions. Section A.4.8 addresses reevaluation and improvement procedures for monitoring and evaluating the functionality of the WSCP and describes the process to adopt, submit, and amend the WSCP.

A.4.1 Background Information on Metropolitan

Background

Metropolitan is a public agency organized in 1928 by a vote of the electorate of 13 Southern California cities. The agency was enabled by the adoption of the original Metropolitan Water District Act (MWD Act) by the California Legislature "for the purpose of developing, storing, and distributing water for domestic purposes." The MWD Act also allows Metropolitan to sell "surplus water not needed or required for domestic or municipal uses within the district for beneficial purposes." In 1992, the Metropolitan Board of Directors adopted the following mission statement:

> *"To provide its service area with adequate and reliable supplies of high-quality water to meet present and future needs in an environmentally and economically responsible way."*

Water used in Southern California comes from several sources. The investments that Metropolitan has made and its ongoing efforts in many different areas coalesce toward its goal of long-term regional water supply reliability. The first function of Metropolitan was building the Colorado River Aqueduct (CRA) to convey water from the Colorado River. Deliveries through the CRA to member agencies began in 1941 and supplemented the local water supplies of the Southern California member cities. In 1960, to meet growing water demands in its service area, Metropolitan contracted with DWR for participation in the SWP, which delivers water to Metropolitan's service area via the California Aqueduct. SWP deliveries began in 1972. Metropolitan currently receives imported water from both of these sources: (1) Colorado River via the CRA, and (2) the SWP via the California Aqueduct. Beyond its core imported supplies from the Colorado River and SWP, Metropolitan actively supports efforts to develop storage and groundwater management programs, and to increase conservation, water recycling, groundwater recovery, and seawater desalination projects.

Service Area

Metropolitan's service area covers the Southern California coastal plain. It extends about 200 miles along the Pacific Ocean from the city of Oxnard to the north to the international boundary with Mexico to the south, and it reaches as far as 70 miles inland from the coast. The total area served is approximately 5,200 square miles, and it includes portions of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties. Table A.4-1 shows that although only 14 percent of the land area of the six Southern California counties is within Metropolitan's service area, approximately 86 percent of the population of those counties resides within Metropolitan's boundaries.

Table A.4-1
July 1, 2020 Area and Population in the
Six Counties of Metropolitan's Service Area

County	Total County	In Metropolitan Service Area	Percent in Metropolitan
Land Area (Square Miles)			
Los Angeles County	4,061	1,408	35%
Orange County	789	699	89%
Riverside County	7,208	1,057	15%
San Bernardino County	20,052	242	1%
San Diego County	4,200	1,420	34%
Ventura County	1,845	365	20%
Metropolitan's Service Area	**38,155**	**5,191**	**14%**
Population (Persons)			
Los Angeles County	10,172,000	9,275,000	91%
Orange County	3,191,000	3,184,000	100%
Riverside County	2,449,000	1,813,000	74%
San Bernardino County	2,184,000	872,000	40%
San Diego County	3,352,000	3,261,000	97%
Ventura County	841,000	630,000	75%
Metropolitan's Service Area	**22,189,000**	**19,035,000**	**86%**

Metropolitan is currently composed of 26 member agencies, including 14 cities, 11 municipal water districts, and one county water authority. Metropolitan is a water wholesaler with no retail customers. It provides treated and untreated water to its member agencies.

Metropolitan's 26 member agencies deliver to their customers a combination of local groundwater, local surface water, recycled water, desalinated seawater, and imported water received from Metropolitan. For some member agencies, Metropolitan supplies all the water used within that agency's service area, while others obtain varying amounts of water from Metropolitan to supplement local supplies. Between 2011 and 2020, Metropolitan has provided between 40 and 50 percent of the municipal, industrial, and agricultural water used in its service area. The remaining water supply comes from local wells, local surface water, recycling, and the city of Los Angeles' aqueducts from the Owens Valley/Mono Basin east of the Sierra Nevada. Member agencies also implement conservation programs that can be considered part of their supplies.

Some member agencies provide retail water service, while others provide water to their local area as wholesalers. Table A.4-2 shows Metropolitan's member agencies and the type of service that they provide. As shown in the table, 15 member agencies provide retail service to customers, nine provide only wholesale service, and two provide a combination of both. Metropolitan's member agencies serve residents in 152 cities and 89 unincorporated communities. Throughout Metropolitan's service area, approximately 250 retail water suppliers directly serve the population.

Table A.4-2
Metropolitan's Member Agencies and Type of Water Service Provided

Member Agency	Retail or Wholesale
Los Angeles County	
Beverly Hills, City of	Retail
Burbank, City of	Retail
Central Basin Municipal Water District	Wholesale
Compton, City of	Retail
Foothill Municipal Water District	Wholesale
Glendale, City of	Retail
Las Virgenes Municipal Water District	Retail
Long Beach, City of	Retail
Los Angeles, City of	Retail
Pasadena, City of	Retail
San Fernando, City of	Retail
San Marino, City of	Retail
Santa Monica, City of	Retail
Three Valleys Municipal Water District	Wholesale
Torrance, City of	Retail
Upper San Gabriel Valley Municipal Water District	Wholesale
West Basin Municipal Water District	Wholesale
Orange County	
Anaheim, City of	Retail
Fullerton, City of	Retail
Municipal Water District of Orange County	Wholesale
Santa Ana, City of	Retail
Riverside County	
Eastern Municipal Water District	Retail & Wholesale
Western Municipal Water District	Retail & Wholesale
San Bernardino County	
Inland Empire Utilities Agency	Wholesale
San Diego County	
San Diego County Water Authority	Wholesale
Ventura County	
Calleguas Municipal Water District	Wholesale

Reliability Planning

Metropolitan continuously engages in planning for various aspects of its water management, including operations, long-term reliability, and emergency response. These planning efforts include the 1996 Integrated Water Resources Plan (IRP) and its three updates in 2004, 2010, and 2015; the 2020 IRP (currently in development); the WSCP; the Water Surplus and Drought Management (WSDM) Plan; the Water Supply Allocation Plan (WSAP); the Emergency Storage Objective; and the Seismic Risk Assessment and Mitigation Plan. Collectively, they provide a policy framework, operating guidelines, and resource targets for Metropolitan to ensure regional water supply reliability.

The IRP is Metropolitan's evolving long-term plan to assure adequate water supplies for Southern California. The first IRP was adopted in 1996 to address the complexity of developing, maintaining and delivering water to meet changing demands in the face of growing challenge. The IRP has been updated several times over the past 25 years. In 2020, Metropolitan started development of a new IRP that incorporates planning for multiple future scenarios to address an extended range of uncertainty. While Metropolitan coordinates regional supply planning through its inclusive IRP process, Metropolitan's member agencies also conduct their own planning analyses, including their own urban water management plans, and may develop projects independently of Metropolitan.

The WSCP is designed to be consistent with the WSDM Plan and the WSAP described below. Throughout the year, Metropolitan evaluates member agency demands, available water supplies, and existing water storage levels on a monthly basis to determine the appropriate actions identified in the WSDM Plan.

The 1999 WSDM Plan provides policy guidance for managing regional water supplies during surplus and shortage conditions. Similar in concept to the WSCP, the WSDM Plan provides an overall vision for operational supply management and characterizes a flexible sequence of actions to minimize the probability of severe shortages and reduce the likelihood of extreme shortages. WSDM Plan principles guide the specific actions to be taken under WSCP shortage stages (see section A.4.4). Data collection, continual analysis, and monthly reporting processes of WSDM Plan implementation will form the basis for Metropolitan's Annual Water Supply Demand Assessment that will be provided annually to the state beginning in July 2022. The WSDM Plan is included as Attachment A to this WSCP.

The WSAP is Metropolitan's policy and formula for equitably allocating available water supplies to the member agencies during extreme water shortages when Metropolitan determines it is unable to meet all of its demands. The WSAP is included as Attachment B to this WSCP.

The Emergency Storage Objective is the regional planning estimate for emergency storage, which represents the amount of water that Metropolitan would hold in storage for the region in preparation for a catastrophic earthquake that would damage the aqueducts that transport imported water supplies to Southern California: the CRA, both the East and West branches of the California Aqueduct, and the Los Angeles Aqueduct. In 2019, Metropolitan and its member agencies completed a process to update the planning estimate of Metropolitan's Emergency Storage Objective. The emergency storage allows Metropolitan to deliver reserve supplies to the member agencies to supplement local production. This helps avoid severe water shortages during periods when the imported water aqueducts may be out of service.

Beginning January 2020, CWC Section 10632.5 mandates urban water suppliers to include in their UWMP a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities. For Metropolitan, this requirement was addressed as part of developing its resilience strategy and is presented in detail in Metropolitan's seismic resiliency reports in Appendix 9 to the 2020 UWMP, which are incorporated herein by reference.

A.4.2. Analysis of Water Supply Reliability

Besides the WSCP, the Urban Water Management Planning Act requires suppliers to conduct two other planning analyses to evaluate supply reliability. The first is a Water Reliability Assessment that compares the total water supply sources available to the water supplier with long-term projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The second is a Drought Risk Assessment that evaluates a drought period that lasts five consecutive water years starting from the year following when the assessment is conducted.

Metropolitan completed its Water Reliability Assessment and Drought Risk Assessment as part of the 2020 UWMP. Through the Water Reliability Assessment, Metropolitan determined that, under the conditions required by the Urban Water Management Planning Act, it has supply capabilities sufficient to meet expected demands from 2025 through 2045 under a single dry-year condition and a period of drought lasting five consecutive water years, as well as in a normal water year hydrologic condition. Metropolitan's near-term Drought Risk Assessment revealed that its supply capabilities are expected to exceed its projected water use for the year 2022. However, estimates of projected water supply and use reveal that there could be a possible shortfall of core supplies in 2021, 2023, 2024, and 2025. This shortfall is largely triggered by the assumed low supply conditions from the SWP under a repeat of the historical condition of 1988 to 1992, which is modeled at 12% for 2021, 15% for 2023, 23% for 2024, and 18% for 2025. Actual supply conditions for the next five years may prove different from historic supply conditions. The WSCP shows Metropolitan's potential shortage response actions if such shortfalls were to happen. The Drought Risk Assessment projected supplies and demands for the years 2021 through 2025 using the driest five-year sequence.

Metropolitan's principal sources of water supplies are the SWP and the Colorado River. Metropolitan receives water delivered from the SWP under State Water Contract provisions, including contracted supplies, use of carryover storage in San Luis Reservoir, and surplus supplies. Metropolitan holds rights to Colorado River water for CRA diversion at Lake Havasu. Water management programs supplement these Colorado River supplies. To secure additional supplies, Metropolitan has groundwater banking partnerships and water transfer and storage arrangements within and outside its service area.

Hydrologic conditions and environmental regulations can have a significant impact on Metropolitan's imported water supply sources. For Metropolitan's SWP supplies, precipitation in California's northern Sierra Nevada during the fall and winter helps replenish storage levels in Lake Oroville, a key SWP facility. The source of Metropolitan's Colorado River supplies is primarily the watersheds of the Upper Colorado River Basin in the states of Colorado, Utah, and Wyoming. Although precipitation is primarily observed in the winter and spring, summer storms are common and can affect water supply conditions. Hydrologic variability, potential climate change, and regulatory risk are embedded in Metropolitan's modeling efforts. Metropolitan's modeling utilizes historical hydrologic conditions from 1992 to 2017 to simulate expected demands on Metropolitan supplies, as well as capacities and constraints of its storage facilities and supply programs. While potential impacts from climate change remain subject to study and debate, climate change is among the uncertainties that Metropolitan seeks to address through its various planning processes. Metropolitan's 2020 IRP is further addressing ways to account for and mitigate these uncertainties.

As demonstrated by the findings of both the Water Reliability Assessment and the Drought Risk Assessment, Metropolitan is able to mitigate the challenges posed by hydrologic variability, potential climate change, and regulatory risk on its imported supply sources through the significant storage capabilities it has developed over the last two decades, both dry-year and emergency storage.

A.4.3. Annual Water Supply and Demand Assessment Procedures

As an urban water supplier, Metropolitan is required under CWC Section 10632(a)(2) to prepare and submit an "annual water supply and demand assessment" (Annual Assessment). The Annual Assessment is a determination of Metropolitan's near-term outlook for supplies and demands and how a perceived shortage may relate to WSCP shortage stage response actions in the current calendar year. This determination will be based on known circumstances and information available to Metropolitan at the time of analysis. Starting in 2022, the Annual Assessment will be due by July 1 of every year, as indicated by CWC Section 10632.1. CWC Section 10632.1 also states that "*[a]n urban water supplier that relies on imported water from the State Water Project or the Bureau of Reclamation shall submit its annual water supply and demand assessment within 14 days of receiving its final allocations, or by July 1 of each year, whichever is later*." The Annual Assessment and related reporting are to be conducted based on the procedures described in this WSCP. This section describes Metropolitan's procedures for conducting the Annual Assessment, which include: (1) the written decision-making process to determine water supply reliability; and (2) the key data inputs and assessment methodology to evaluate water supply reliability for the current year and one dry year.

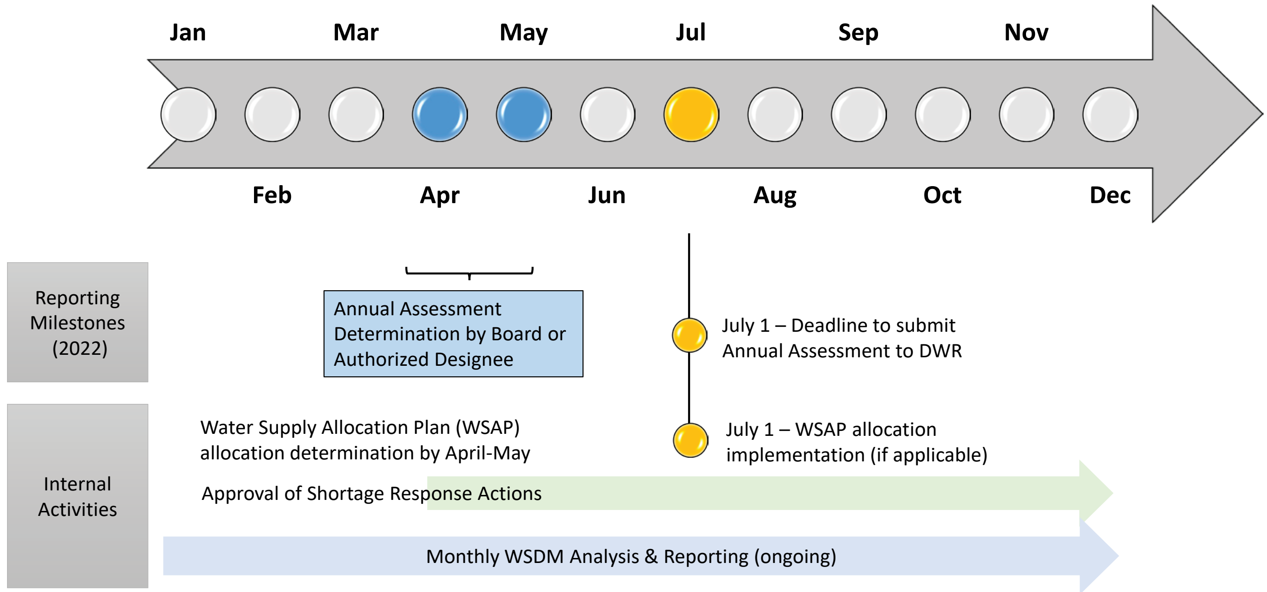
Steps to Approve the Annual Assessment Determination

The Annual Assessment will be primarily based on Metropolitan's ongoing WSDM supply-demand tracking process which is exhibited in monthly reporting to the Board of Directors throughout the year. WSDM planning activities involve examination of developing demand and supply conditions for the calendar year, as well as considerations of potential actions consistent with the WSDM Plan. These monthly analyses provide key information for Metropolitan to manage resources to meet a range of estimated demands and adjust to changing conditions throughout the year.

As a water supply wholesaler, Metropolitan's water demands are a function of retail-level demands and local water production. Water from Metropolitan serves as a supplemental source of supply for its 26 member agencies. For many member agencies, their primary source of water is produced locally from groundwater basins, surface reservoirs, recycled water projects, groundwater recovery projects, and seawater desalination. When local supplies are not enough to meet retail demands, member agencies purchase supplemental water from Metropolitan. Some member agencies rely heavily on Metropolitan due to limited local supplies. As described below, Metropolitan collects estimates of projected consumptive and replenishment water demands from its member agencies. This information is adjusted to determine unconstrained demands for the purpose of the Annual Assessment shortage percentage evaluation.

By June, Metropolitan staff will present a completed Annual Assessment for approval by the Board of Directors or by the Board's authorized designee with expressly delegated authority for approval of Annual Assessment determinations. This presentation will include a request that the approval of the Annual Assessment determination also appropriately triggers any recommended specific shortage response actions resulting from the assessment. Upon approval, Metropolitan staff will then formally submit the Annual Assessment to DWR by July 1. Figure A.4-1 provides a graphic representation of the decision-making process.

Figure A.4-1
Sample Annual Assessment Decision-Making Timeline



Data Inputs and Assessment Methodology

This section describes how Metropolitan will evaluate water supply reliability for the current year and one dry year for the purpose of the Annual Assessment. The Annual Assessment determination will be based on considerations of available core water supplies, unconstrained water demand, and infrastructure considerations. The difference between core water supplies and unconstrained demand will be used to determine what, if any, shortage stage is expected under the WSCP framework. The standard shortage stage percentage will be calculated by dividing the difference between core supplies and unconstrained demand by unconstrained demand. This calculation will be performed separately for anticipated current year conditions and for an assumed dry year condition.

Locally Applicable Evaluation Criteria

Because shortages are based on the difference between expected core supplies and unconstrained demand under current year and dry year conditions, the locally-applicable evaluation criteria to be used in the Annual Assessment for determining a shortage include the following:

- Characterization of current year and dry year scenarios based on best-available data, including anticipated hydrologic conditions for Metropolitan's supply source watersheds in the Colorado River basin and Northern California, as well as for local conditions in Metropolitan's service area in Southern California.
- Estimation of available core supplies (see below) for current year and dry year scenarios
- Estimation of unconstrained demands (see below) for current year and dry year scenarios

Together, these three criteria provide the necessary information to calculate shortage percentages by dividing the difference between core supplies and unconstrained demand by unconstrained demand, under current year and dry year scenarios. These criteria findings will also be given additional context and influenced by infrastructure considerations discussed below which will differ from year to year.

The information and analyses that comprise the Annual Assessment will be based on ongoing planning processes that include the monthly WSDM supply-demand reporting. The Annual Assessment represents a mid-year evaluation at a given point in time; even after formal approval and submittal of the Annual Assessment determination by July 1, Metropolitan will continue to monitor emerging supply and demand conditions and take appropriate actions consistent with the flexibility and adaptiveness inherent to this WSCP. Some locally-applicable conditions that affect Metropolitan's wholesale supply and demand, such as the Higher Priority Water Use Adjustment for Colorado River use (see below), local supply production, annual SWP allocations, the status of Metropolitan storage accounts, the status of the local groundwater basins, changed water use practices, and local economic activity entail a high degree of uncertainty and can differ significantly from earlier projections throughout the year.

Description and Quantification of Each Source of Water Supply (Core Supplies)

Metropolitan's core water supplies are counted as the supply component of the Annual Assessment. Core supplies include estimated water supplies from the Colorado River and the SWP for the current year. Imported core supplies vary from year to year and are influenced by annual weather and hydrology, as well as demand by other higher priority users and operational and regulatory factors.

Because core supplies are used every year, they are differentiated from the WSCP's shortage response actions for supply augmentation; supply augmentation actions are comprised of Metropolitan's portfolio of water storage reserves and flexible supply sources that are available on an as-needed basis.

Metropolitan's core supplies come from several programs, which are shown in Table A.4-3 and described below.

Table A.4-3
Core Water Supplies

Source	Core Supply
Colorado River	Colorado River Basic Apportionment Higher Priority Water Use Adjustment to Colorado River Basic Apportionment IID/MWD Conservation Program PVID Fallowing Program Bard Water District Seasonal Fallowing Program Lower Colorado Water Supply Project Exchange with SDCWA Exchange with the United States
State Water Project	MWD SWP Table A SWP Article 21 Interruptible Supplies SWP Port Hueneme Lease of Ventura Table A Desert Water Agency/Coachella Valley Water District/Metropolitan Water Exchange and Advance Delivery Programs San Gabriel Valley Municipal Water District Program

Colorado River

Colorado River Basic Apportionment

Metropolitan built, owns, and operates the 242-mile CRA. The CRA originates at Lake Havasu on the Colorado River and winds through a series of pump stations and reservoirs through the California desert to its terminal reservoir at Lake Mathews in Riverside County. The CRA has a full delivery capacity of about 1.25 MAF.

The state of California holds a 4.4 MAF per year normal apportionment to Colorado River water. Metropolitan has the Fourth Priority right to normal apportionment of 550,000 AF per year of the State's normal apportionment. Metropolitan also holds the Fifth Priority right for an additional 662,000 AF per year which is utilized during surplus conditions or when supplies from other Colorado River users are available.

Higher Priority Water Use Adjustment to Metropolitan's Colorado River Basic Apportionment

Entitlements to use Colorado River water in California under priorities 1, 2, and 3 are limited to 3.85 MAF per year. Priority 3(a) is held by the Imperial Irrigation District and the Coachella Valley Water District (CVWD) totaling 3.43 MAF. After accounting for contractual conservation and transfers, any unused volume available to Priority 3(a) becomes available for use by Metropolitan. Of the 3.85 MAF, the remaining 420,000 AF is available for use under priorities 1, 2, and 3(b) held by the Palo Verde Irrigation District and the Yuma Project lands within California. Any unused amount from this volume is available for use by Metropolitan, however, Metropolitan must forego its otherwise available Colorado River supplies to meet annual uses under priorities 1, 2, and 3(b) that are in excess of 420,000 AF. Lastly, there are additional high-priority "present perfected rights" within California not incorporated into the priorities, for which Metropolitan must forego its otherwise available Colorado River supplies to meet uses of present perfected rights that exceed 14,500 AF. The net sum of these volumes is the "higher priority water use adjustment" to Metropolitan's base supply.

Imperial Irrigation District-Metropolitan Conservation Program

Since 1988, Metropolitan has funded water conservation programs within Imperial Irrigation District's (IID) service area. The amount of water conserved from these programs is then transferred to Metropolitan. Conservation approaches range from distribution system improvements (such as canal lining, spill capture and the installation of non-leak irrigation gates) to efficient on-farm water management practices (such as delivering water to farmers on a 12-hour rather than a 24-hour basis). Through this program, a total of 105,000 AF per year of water is conserved and made available to Metropolitan.

Palo Verde Irrigation District Land Management, Crop Rotation and Water Supply Program

In 2005, Metropolitan entered a 35-year program with the Palo Verde Irrigation District (PVID). Under the program, participating farmers in PVID are paid to reduce their water use by leaving acreage unirrigated. A base amount of 25 percent of the program acreage must be fallowed every year. Metropolitan may elect to call for additional acreage to be fallowed up to 90.3%. Fallowing calls must be made at least one year in advance by July 31 of each year and would take effect on August 1 of the following year. The reduced consumptive use due to fallowed lands reduces uses under priorities 1, 2, and 3(b), thereby increasing the Colorado River water supply available to Metropolitan. The fallowing program saves a minimum of 33,000 AF per year and up to 133,000 AF in certain years.

Metropolitan/Bard Seasonal Fallowing Program

At its December 2019 meeting, Metropolitan's Board authorized a 7-year seasonal fallowing program with the Bard Water District (Bard). Under the program, participating farmers in Bard are being paid to reduce their water use by not irrigating a portion of their land. A maximum of 3,000 acres can be fallowed in any given year. Under the terms of the QSA, water savings within the Bard service area are made available to Metropolitan. Bard Unit, as part of the Yuma Project, has the first priority for Colorado River water under the water delivery contracts with the USBR. Implementation of the program began in March 2020. It is estimated that the Seasonal Fallowing Program would provide up to 6,000 AF per year of additional Colorado River water. This water would be available in any year as needed and in accordance with the provisions described in the agreements with Bard Unit farmers and Bard.

Lower Colorado Water Supply Project

Groundwater is pumped by the Lower Colorado Water Supply Project near the All-American Canal and is discharged to the Canal. IID reduces its net diversions of Colorado River water by an amount equal to the amount of Project water discharged into the Canal, permitting entities along the Colorado River that do not have rights or have insufficient rights to divert Colorado River water to obtain a supply of water. In 2007, Metropolitan entered into a contract with the USBR and the City of Needles to utilize the unused Project capacity.

Exchange with the San Diego County Water Authority (SDCWA)

SDCWA has acquired conserved Colorado River water reaching an annual volume of 277.7 TAF by 2023. SDCWA makes this water available at Lake Havasu for Metropolitan diversion, where Metropolitan takes possession of the water and provides a matching volume from Metropolitan's blended supplies to SDCWA by exchange in equal monthly amounts. The conserved water is acquired by SDCWA through its transfer agreement with IID and from the lining of the All-American and Coachella canals.

Under the transfer agreement with IID, the stabilized annual transfer volume of 200 TAF is generated from conservation of water through on-farm efficiency conservation arrangements made by IID with its customers and other system efficiency measures.

The Coachella Canal Lining Project consists of a 35-mile concrete-lined canal, including siphons, which replaced an earthen canal. The project was completed in December 2006 and conserves 30,850 AF annually. The All-American Canal Lining Project consists of a concrete-lined canal constructed parallel to 23 miles of earthen canal and was completed in 2009, conserving 67,700 AF annually.

Pursuant to the QSA and related agreements, the 98,550 AF of water resulting from these projects annually is allocated as follows: 16,000 AF to the San Luis Rey Settlement Parties in San Diego County, 77,700 AF to SDCWA, and 4,850 AF for Coachella Canal Lining Project mitigation.

Exchange with the United States

Of the 16 TAF allocated to the San Luis Rey Settlement Parties from the All-American and Coachella canal lining projects, the United States furnishes this water at Metropolitan's Colorado River Intake on Lake Havasu. Metropolitan takes possession of the water and by exchange delivers an equal volume of Metropolitan's blended supplies to SDCWA. By separate agreement, SDCWA conveys the water to the San Luis Rey Settlement Parties. So long as water conserved by the All-American Canal Lining Project and Coachella Canal Lining Project is allocated to and available for use by the San Luis Rey Settlement Parties, the United States will make 16 TAF available for diversion by Metropolitan in perpetuity.

State Water Project

Table A Contract Amount

In accordance with its participation contract with DWR, Metropolitan's basic contract amount is for 1,911,500 AF per year. This represents the amount of water supply that would be available to Metropolitan in years where there is sufficient water supply for the SWP to deliver 100 percent of its total contract amounts. The amount of supply actually available on an annual basis is allocated to the State Water Contractors based on their proportionate Table A amounts.

DWR estimates the amount of supplies that are available each year. Metropolitan uses a forecasting method for SWP deliveries based on historical patterns of precipitation, runoff and actual deliveries of water. Annual SWP allocations have ranged from 5 percent to 100 percent of the Table A contract amounts.

Article 21 Interruptible Supplies

Metropolitan has a contract to water supplies that are made available on an intermittent basis. Storm flows can occasionally make water supplies available that are in excess to the Table A allocation. State Water Contractors can take delivery of these supplies, with their rights being based on their proportional Table A contract amounts. Historically, Article 21 interruptible supplies have ranged from 0 to 240,000 AF annually.

SWP Port Hueneme Lease of Ventura Table A

Metropolitan has a right to delivery of up to 1,850 AF of Table A supply from the Ventura County Watershed Protection District (Ventura), one of 29 SWP contractors, via a sublease agreement with the Port Hueneme Water Agency (Port Hueneme). United Water Conservation District, one of three agencies holding a contract right to Ventura Table A supply, leases this portion of their total 5,000 AF of Table A supply to Port Hueneme, which in turn subleases the Table A supply to Metropolitan. The long-term lease is a condition of the 1996 annexation of the Port Hueneme service area to Calleguas Municipal Water District and Metropolitan. This water supply is in addition to Metropolitan's Table A, and the amount available each year is determined by the SWP allocation, with 1,850 AF available at a 100 percent allocation.

Desert Water Agency/Coachella Valley Water District/Metropolitan Water Exchange and Advance Delivery Programs

The Desert Water Agency (DWA) and CVWD, both in Riverside County, have rights to SWP deliveries, but do not have any physical connections to the SWP facilities. Both agencies are adjacent to the CRA. For DWA and CVWD to obtain water equal to their SWP allocations, Metropolitan has agreed to exchange an equal quantity of its Colorado River water for DWA and CVWD's SWP water. DWA has a SWP Table A contract right of 55.75 TAF per year, and CVWD has a SWP Table A contract right of 138.35 TAF per year, for a total of 194.1 TAF per year. Additionally, CVWD has a long-term water supply agreement for 9.5 to 16.5 TAF annually from Rosedale Rio-Bravo Water Storage District.

Under the existing agreements, Metropolitan provides water from its CRA to DWA and CVWD in exchange for SWP deliveries. Metropolitan can deliver additional water to its DWA/CVWD service connections, permitting these agencies to store water. When supplies are needed, Metropolitan can then receive its full Colorado River supply, as well as the SWP allocation from the two agencies, while the two agencies can rely on the stored water for meeting their water supply needs. The amount of DWA and CVWD SWP Table A water available to Metropolitan depends on total SWP deliveries and varies from year to year.

In addition to their Table A and long-term water supplies, DWA and CVWD, subject to available capacity, may take delivery of SWP supplies available under Article 21, the Turn-back Pool Program, and non-SWP water supplies they may acquire and convey through the SWP facilities. These other supplies are delivered to DWA and CVWD by exchange with Metropolitan in the same manner as Table A deliveries. DWA and CVWD are participants in the Yuba Dry Year Water Purchase Program. Additionally, DWA participated in the 2009 Drought Water Bank and the 2015-2016 Multi-Year Water Pool Demonstration Program.

San Gabriel Valley Municipal Water District Program

The San Gabriel Valley Municipal Water District Program allows Metropolitan to exchange supplies to provide additional water for normal and dry year needs. Under this program, Metropolitan delivers supplies to the City of Sierra Madre, a San Gabriel Valley Municipal Water District member agency. In exchange for Metropolitan delivering one AF, San Gabriel Valley Municipal Water District returns two AF to Metropolitan in the Main San Gabriel Basin, up to 5 TAF. For any exchange amount less than 5 TAF, Metropolitan purchases the balance of the 5 TAF. The program provides increased reliability to Metropolitan by allowing additional water to be delivered to Metropolitan member agencies that rely upon the Main San Gabriel

Basin for their supplies – Three Valleys Municipal Water District and Upper San Gabriel Valley Municipal Water District.

Unconstrained Demands

For the purpose of the Annual Assessment and WSCP, CWC Section 10632(a)(2)(B)(i) directs Metropolitan to use current year "unconstrained demand" when assessing water supply reliability. The WSCP and Annual Assessment define unconstrained demand as expected water use in the current assessment year, based on recent water use, and before any projected shortage response actions that may be taken under the WSCP. Unconstrained demand is distinguished from observed demand, which may be constrained by preceding, ongoing, or future actions, such as emergency supply allocations during a multi-year drought. WSCP shortage response actions, if any are in place, that result in extraordinary demand reductions in the current year to constrain demand are inherently extraordinary; routine activities such as ongoing conservation programs and regular operational adjustments are not considered as constraints on demands.

To forecast near-term demands, Metropolitan begins by gathering data from its member agencies. In July of each year, member agencies submit their five-year demand forecasts to Metropolitan. Metropolitan uses this information as the foundation for forecasting demands. As the year progresses, the member agency forecasts are compared to the current demand trend. This comparison allows Metropolitan to adjust member agency forecasts to current conditions, while collaborating with member agencies as needed.

Metropolitan builds upon member agency demand projections to develop its own near-term forecast for its monthly WSDM supply-demand reporting. This forecast considers additional factors such as historical demand trends, changes in local supply production, weather trends, water-use efficiency trends, retail demand estimates, and updated estimates from member agencies.

Because these forecasted demands would be "constrained" observed demands rather than unconstrained demands, Metropolitan will adjust its near-term demand forecast for the Annual Assessment to account for extraordinary demand management measures that Metropolitan may intend or have already put into effect for the current year. Extraordinary demand management measures may include intensified communication and public outreach, and shortage allocations to its member agency customers through implementation of Metropolitan's WSAP. Non-extraordinary water savings from regular conservation and community outreach activities are considered part of Metropolitan's baseline demands and are not counted again for assessments of unconstrained demand.

Water Conditions for Current Year Available Supply Considering Current Year Conditions and One Dry Year

CWC Section 10632(a)(2)(B)(ii) requires the Annual Assessment to determine "*current year available supply, considering hydrological and regulatory conditions in the current year and one dry year.*" The Annual Assessment will include two separate estimates of Metropolitan's annual water supply and unconstrained demand using: 1) current year conditions, and 2) assumed dry year conditions. Accordingly, the Annual Assessment's shortage analysis will present separate sets of findings for the current year and dry year scenarios. The CWC does not specify the characteristics of a dry year, allowing discretion to the Supplier. Metropolitan will use this discretion to refine and update its assumptions for a dry year scenario in each Annual Assessment as information becomes available.

In the 2020 UWMP, the "single dry year" is characterized to resemble conditions as a year in which conditions reflect the lowest water supply available to the Supplier. Metropolitan developed estimates of future demands and supplies from local sources and from Metropolitan sources based on 96 years (1922-2017) of historic hydrologic conditions. Supply and demand analyses for the single-dry year case was based on conditions affecting the SWP as this supply availability fluctuates the most among Metropolitan's sources of supply. Based on the 96-year period, 1977 was the single driest year for SWP supplies to Metropolitan. In addition, staff analysis of the 8-river index indicated that 1977 was the single driest year from 1922 through 2017. The 8-river index is used by DWR and other water agencies as an estimate of the unimpaired runoff (or natural water production) of the Sacramento and San Joaquin River basins, which are sources of water for the SWP.

Infrastructure Considerations

The Annual Assessment will consider any infrastructure issues that may pertain to near-term water supply reliability, including repairs, construction, and environmental mitigation measures that may temporarily constrain capabilities, as well as any new projects that may add to system capacity.

Metropolitan operates a distribution system that is flexible and adaptable allowing delivery of supplies from a combination of SWP, Colorado River, and regional storage sources to meet demands throughout its service area, as shown in Figure A.4-2. System distribution capabilities and limitations can add complexity to near-term reliability. For example, a portion of Metropolitan's service area currently cannot be served by Colorado River supplies. In the event of very low SWP supplies and available storage along the SWP system, Metropolitan's operations may be acutely challenged to meet SWP-only demands even though in that same year total supplies including Colorado River supplies may exceed total demands.

Metropolitan also has five regional water treatment plants, with capacities presented in Table A.4-4. Portions of Metropolitan's service area may receive water treated by one or a combination of several of these water treatment plants. Over the last 40 years, Metropolitan effectively delivered to its member agencies water supplies to meet demands ranging from 1.2 MAF per year to over 2.5 MAF per year.

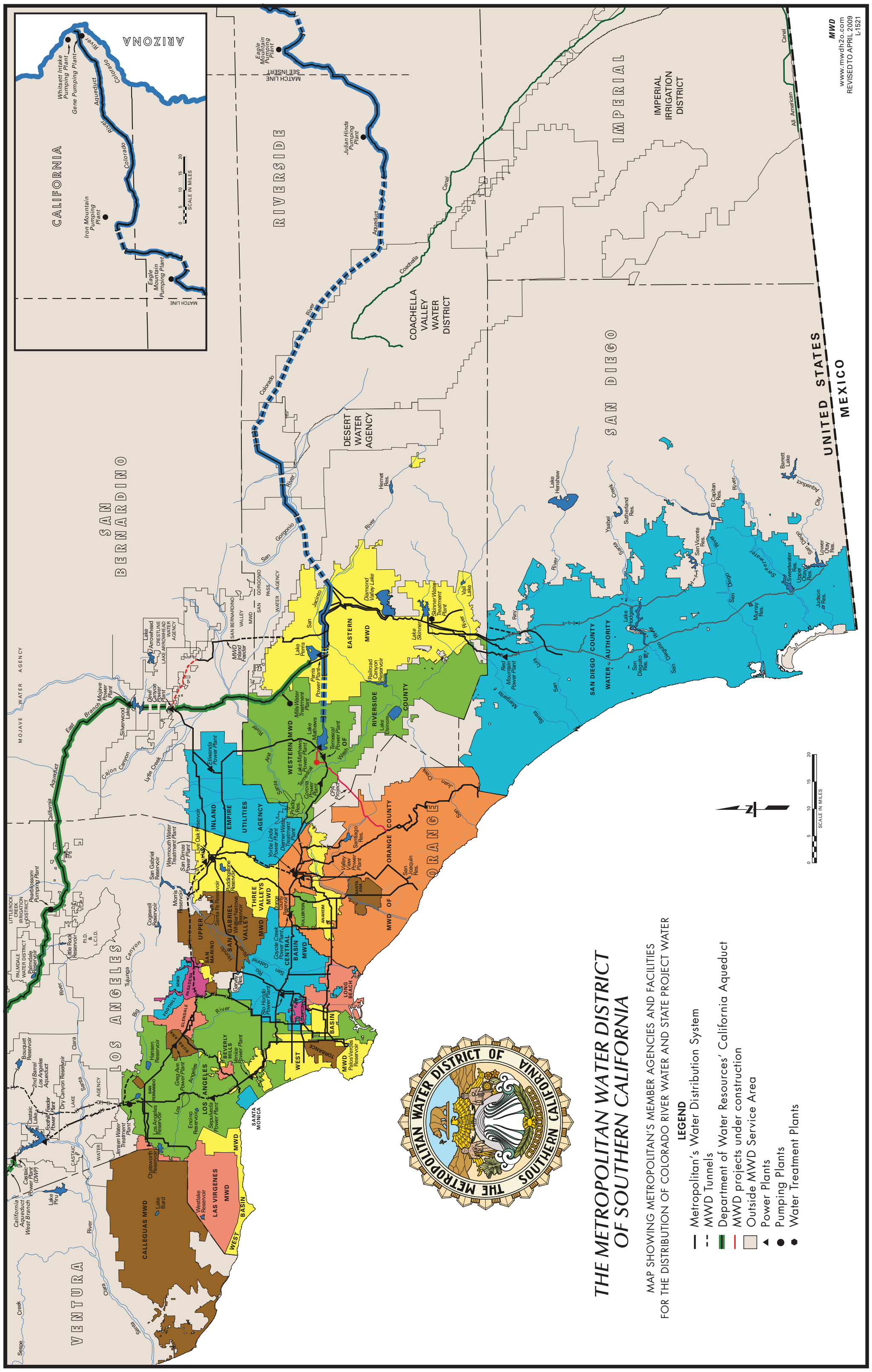
Table A.4-4
Metropolitan's Water Treatment Plants

Water Treatment Plant	Capacity (in MGD)
Jensen	750
Weymouth	520
Diemer	520
Mills	220
Skinner	350

Note: Rated capacity. Effluent capacities may be less to account for backwash.

Metropolitan and its member agencies continue to implement system improvements and modifications to effectively increase system flexibility during both normal operations when imported supplies are available and during extraordinary times when SWP supplies are reduced to maximize the use of more readily available Colorado River water and Diamond Valley Lake supplies.

Figure A.4-2
Metropolitan's Service Area



Throughout each year, Metropolitan regularly carries out preventive and corrective maintenance of its facilities. Metropolitan plans and performs shutdowns to inspect and repair pipelines and facilities and support capital improvement projects. These shutdowns involve a high level of planning and coordination within Metropolitan, as well as with member agencies, other affected organizations, contractors, and the community. These shutdowns are scheduled to ensure that major portions of the distribution system are not out of service at the same time. Operational flexibility within Metropolitan's system and the cooperation of member agencies allow shutdowns to be successfully completed while continuing to meet all system demands.

Metropolitan's Infrastructure Reliability Strategy helps to ensure long-term reliable performance of the system in an efficient and cost-effective manner. Infrastructure reliability is addressed through three programs: the Maintenance Management Program, the Infrastructure Protection Plan, and the Dam Safety Program. The activities performed under these programs allow for Metropolitan to extend the life span of its facilities and equipment and improve the overall reliability of the entire conveyance, treatment, and distribution system. In addition, seismic resiliency issues are addressed in the Seismic Risk Assessment and Mitigation Plan, which is included in Appendix 8 to the 2020 UWMP and incorporated herein by reference.

In the event that Metropolitan anticipates that an infrastructure issue is likely to impede or expand Metropolitan's capability to convey, treat, or distribute water during the current year, then the issue would be documented, and the determination of water reliability in the Annual Assessment would be adjusted accordingly.

Other Factors

Water quality is of paramount importance to water supply reliability. Metropolitan owns and operates five water treatment plants. Metropolitan is a national leader in providing safe drinking water that meets increasingly stringent standards, testing for over 400 constituents and performing nearly 200,000 water quality tests annually on samples gathered throughout its distribution system. Metropolitan's Water Quality Laboratory analyzes these samples to ensure that Metropolitan's delivered water meets or surpasses all state and federal drinking water standards. Because treatment to remove specific contaminants can be more costly than measures to protect water at the source, Metropolitan also actively supports improved watershed protection programs for its source waters in the Colorado River and SWP. For the Annual Assessment, any known issues related to water quality will be considered for their potential effects on water supply reliability.

A.4.4. Shortage Levels and Shortage Response Actions

Six Standard Water Shortage Levels

As required by California Water Code Section 10632(a)(3)(A), the WSCP is framed around six standard water shortage levels that correspond to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortages. As shown in Table A.4-5, each of the six shortage levels represents an increasing gap between Metropolitan's estimated core supplies and unconstrained demand as determined in the Annual Assessment. As explained above, shortage percentages will be calculated by dividing the difference between core supplies and unconstrained demand by unconstrained demand. This calculation will be performed separately for anticipated current year conditions and for assumed dry year conditions. Shortage levels also apply to catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other emergency events. The shortage levels are defined in terms of the percent shortfall of supplies against demands.

Shortage Response Actions

California Water Code Section 10632(a)(4) requires the WSCP to specify shortage response actions that align with the defined shortage levels, and include, at a minimum, all of the following:

- Locally appropriate supply augmentation actions
- Locally appropriate demand reduction actions to adequately respond to shortages
- Locally appropriate operational changes
- Additional, mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions (Not applicable to Metropolitan)
- An estimate of the extent to which the gap between supplies and demand will be reduced by implementation of each action.

As indicated in Table A.4-5, shortage responses will be customized to meet the circumstances for the particular shortage. Because circumstances can change at any time, Metropolitan's shortage responses actions will be adjusted accordingly throughout the year. To determine specific actions that would be taken at each standard shortage level, Metropolitan will evaluate conditions specific to cost, timing, distribution needs and capabilities, and other variables that include SWP allocation, Colorado River conditions, demand reduction measures, supply program take capacities, and storage balances.

Shortages are characterized not merely by shortfalls in annual core water supplies, but also by the water balances in Metropolitan's storage programs. Thus, a 10 percent shortfall in core supplies could be met entirely with stored water if storage levels are high. If storage levels are already depleted, the same shortfall in core supplies could potentially require a more complex mix of supply augmentation and demand reduction actions. In the most severe situations, allocating shortages to member agencies through the WSAP would address any remaining shortages not already mitigated by supply augmentation and lesser demand reduction actions.

Metropolitan has invested extensively in a diverse portfolio of supply sources and system resiliency to prepare for a wide range of possible challenging conditions. Metropolitan follows the principles of its WSDM Plan, which was adopted in 1999 and provides policy guidance for managing regional water supplies to achieve reliability. It identifies a broad sequence of actions during surpluses and shortages to minimize probability of severe shortages, based on detailed modeling of Metropolitan's existing and expected resource mix. The WSDM Plan recognizes the link between surplus and shortages and integrates planned operational actions with respect to both conditions. The WSDM Plan is included as Attachment A to this document.

Table A.4-5
Shortage Stages and Response Actions

Shortage Stage	Shortage Percentage	Shortage Response	
1	Up to 10%	Take from Storage Execute Flexible Supplies Implement Voluntary Demand Reduction Implement Water Supply Allocation Plan	• 0 to 100% met by Storage • 0 to 100% met by Flexible Supplies • 0 to 20% of total retail water use met by implementing Communication Plan • 0 to 50% of total base demand met by WSAP supply allocation
2	10% to 20%	Take from Storage Execute Flexible Supplies Implement Voluntary Demand Reduction Implement Water Supply Allocation Plan	• 0 to 100% met by Storage • 0 to 100% met by Flexible Supplies • 0 to 20% of total retail water use met by implementing Communication Plan • 0 to 50% of total base demand met by WSAP supply allocation
3	20% to 30%	Take from Storage Execute Flexible Supplies Implement Voluntary Demand Reduction Implement Water Supply Allocation Plan	• 0 to 100% met by Storage • 0 to 100% met by Flexible Supplies • 0 to 20% of total retail water use met by implementing Communication Plan • 0 to 50% of total base demand met by WSAP supply allocation
4	30% to 40%	Take from Storage Execute Flexible Supplies Implement Voluntary Demand Reduction Implement Water Supply Allocation Plan	• 0 to 100% met by Storage • 0 to 100% met by Flexible Supplies • 0 to 20% of total retail water use met by implementing Communication Plan • 0 to 50% of total base demand met by WSAP supply allocation
5	40% to 50%	Take from Storage Execute Flexible Supplies Implement Voluntary Demand Reduction Implement Water Supply Allocation Plan	• 0 to 100% met by Storage • 0 to 100% met by Flexible Supplies • 0 to 20% of total retail water use met by implementing Communication Plan • 0 to 50% of total base demand met by WSAP supply allocation
6	More than 50%	Take from Storage Execute Flexible Supplies Implement Voluntary Demand Reduction Implement Water Supply Allocation Plan Take from Emergency Storage, if needed	• 0 to 100% met by Storage • 0 to 100% met by Flexible Supplies • 0 to 20% of total retail water use met by implementing Communication Plan • 0 to 50% of total base demand met by WSAP supply allocation • Take from emergency storage during a catastrophic event

Supply Augmentation Actions

Generally, Metropolitan's first response to any gap between core supplies and demand is to make optimal use of its supply augmentation options consisting of draws from flexible supply programs and storage reserves listed in Table A.4-6. To supplement its core water supplies from the SWP and Colorado River, Metropolitan has developed and actively manages a portfolio of water supply programs, including water transfer, storage and exchange agreements, the supplies created by which are conveyed through available CRA capacity or the California Aqueduct. Metropolitan pursues voluntary water transfer and exchange programs with other entities to help mitigate supply/demand imbalances and provide additional dry-year supply sources. Metropolitan has also developed significant storage capacity in reservoirs and groundwater banking programs both within and outside of the Southern California region. In a hypothetical single dry year assessment within the 2020 Urban Water Management Plan, Metropolitan could take up to approximately 1.8 MAF in a single year to meet dry year demands. Actual take capabilities would depend on various factors including water balances, location, and operational constraints.

Flexible Supplies

Metropolitan can augment its core Colorado River supplies through agreements with other agencies that have rights to use such water. Metropolitan determines the delivery schedule of these supplies throughout the year based on changes in the availability of SWP and to a smaller extent the higher priority water use adjustment for Colorado River water.

In addition to the basic SWP contract provisions, Metropolitan has other contract rights that facilitate augmentation of its SWP supply. Each SWP contractor has the right to use the facilities to move water supplies associated with agreements, water transfers, and water exchanges at the incremental cost. Metropolitan utilizes this ability in conveying water obtained through a number of agreements and exchanges with agencies in California's Central Valley north of the Bay-Delta and southward to Southern California.

Storage

A key component of Metropolitan's water supply capability is the amount of water in Metropolitan's storage facilities and programs in which surplus amounts of water in normal and wet years are captured until needed to augment core supplies. Metropolitan has developed an extensive storage portfolio made up of units within and outside Metropolitan's service area that includes both dry-year and emergency storage capacity. Such units, totaling approximately 6.0 MAF, include reservoirs, conjunctive use and other groundwater storage programs within the service area, and groundwater and surface storage accounts outside the service area delivered through the CRA or SWP. Consistent with the Emergency Storage Objective that was revised in 2019, approximately 750,000 AF of total stored water is emergency storage reserved for use in the event of supply interruptions from earthquakes or similar emergencies.

Table A.4-6
Supply Augmentation Actions: Flexible Supplies and Storage

Source	Flexible Supplies	Storage
Colorado River		Lake Mead Intentionally Created Surplus (ICS) Storage Program Southern Nevada Water Agency Storage and Interstate Release Agreement Desert Water Agency/Coachella Valley Water District Advanced Delivery Account Imperial Irrigation District Storage
State Water Project	SWP Transfers: State Water Contractors Buyers Group SWP Transfers: Yuba Accord Dry-Year Purchase San Bernardino Valley Municipal Water District Program	SWP Carryover DWR Flexible Storage (Castaic Lake and Lake Perris) SWP Banking Programs
In-Region		Diamond Valley Lake Lake Mathews Lake Skinner Conjunctive Use Programs (CUP)

Demand Reduction Actions

Demand reduction actions are extraordinary measures taken to temporarily constrain water demand during a shortage. For the purpose of the WSCP and the Annual Assessment, it is important to separate temporary reductions in demand from baseline conservation as they relate to constrained and unconstrained demands. WSCP demand reduction actions result in constrained demands. Water savings from WSCP demand reduction actions must be factored into estimates of unconstrained demands for Annual Assessment shortage determinations. Intensity of demand reduction measures will vary by the severity of shortage and availability of other cost-effective supply augmentation measures. Early demand reduction actions tend to be voluntary measures that are comprised of outreach and education actions from Metropolitan's WSCP Communication Plan (see following section A.4.5). More severe conditions may necessitate supply allocations to wholesale customers through implementation of the WSAP. Table A.4-7 shows the demand reduction measures available to Metropolitan.

Table A.4-7
Demand Reduction Actions

	Demand Reduction Actions
Voluntary Measures	Implement Communication Plan (May apply to Shortage Levels 1-6, Crisis) • Public information campaigns • Community outreach and media relations • Public opinion research • Interagency and intergovernmental coordination
Mandatory Measures	Implement Water Supply Allocation Plan (May apply to Shortage Levels 1-6, Crisis)

Benefits of public information campaigns include rapid implementation and raising public awareness of the severity of the water shortage. For this reason, public information campaigns are included as a Demand Reduction Action in the WSCP. According to the American Water Works Association, water savings from this measure alone range from 5 to 20 percent, depending on the time, money, and effort spent.[2] If public outreach targets between 5 and 10 percent of population, then demand would be assumed to be reduced by 5 to 20 percent of the 5 to 10 percent. The size of media campaign is correlated with the number of people being reached.

Implement Communications Plan

Metropolitan's WSCP Communication Plan details Metropolitan's action-oriented strategy for education, outreach, and coordination during each WSCP standard shortage stage and in response to a catastrophic loss of supply. See the following section A.4.5 for the WSCP Communications Plan.

Enhanced Conservation Program

Although not considered as a WSCP demand reduction action because of their limited effect in the immediate term, Metropolitan administers regional conservation programs and co-funds member agency conservation programs designed to achieve greater water use efficiency in residential, commercial, industrial, institutional, and landscape uses. Metropolitan may implement extraordinary measures to temporarily enhance conservation during a shortage which include, but are not limited to, increasing rebates, reducing program eligibility requirements, working with rebate vendors to create in-store marketing and direct outreach to businesses, increasing direct install efforts with member agencies and partners, and working with water retailers and retail customers to develop onsite leak prevention programs. While the savings from conservation programs may not be realized quickly enough to mitigate the need for other shortage response actions, water-efficient device retrofit rebates, landscape conversions, and leak prevention all contribute to ongoing structural water savings. Conservation device retrofits help to recover storage in future years by lowering demands in all years, not only shortage years.

[2] American Water Works Association. 2019. Manual of Water Supply Practices – M60, Second Edition: Drought Preparedness and Response. p. 35

Water Supply Allocation Plan

Under most conditions, Metropolitan can meet all of its service area's wholesale water needs. However, during severe water shortage situations when pubic information campaigns and enhanced conservation programs are insufficient to generate the needed demand reduction, Metropolitan may find it necessary to temporarily limit and allocate supplies to its member agencies. Metropolitan's WSAP allocates Metropolitan's water supplies among its member agencies, based on the principles contained in the WSDM Plan, to mitigate drawdowns from water storage reserves. The WSAP was originally approved by Metropolitan's Board in February 2008 and has been implemented three times since its adoption, most recently in April 2015. The WSAP provides a formula for equitable distribution of limited water supplies. If needed, a WSAP action is typically approved in the month of April with implementation beginning in the following July. This allows Metropolitan's member agencies time to prepare and to adjust their estimates for Metropolitan current year supply for their own WSCP Annual Assessments.

The WSAP allocation is a costly shortage response action that places acute burdens upon member agencies and the public. Other shortage response actions are generally preferred to the extent practicable. Metropolitan's overall strategy considers WSAP allocations to be a fallback option to address any remaining shortages when supply augmentation actions and other demand management measures are insufficient to meet demand reduction objectives. For reference, the WSAP is included as Attachment B to this document.

Operational Changes

During shortage conditions, operations may be affected by supply augmentation or demand reduction responses. For example, Metropolitan may temporarily alter maintenance cycles, defer planned system outages, and adjust the flow and routing of water through its system to more effectively distribute available supply across the service area, including areas that are currently only able to be served by SWP water supplies.

Because of the extensive and complex nature of Metropolitan's conveyance and distribution system, and the varying levels of local supplies available among each of the member agencies, by necessity, any supply-related shortage response actions triggered under the WSCP would be carefully chosen to optimally match available resources with specific localized demands by the member agencies.

Metropolitan's diversified portfolio of water supplies presents operational opportunities and challenges during droughts. Because water resources available to the Metropolitan service area come from three geographically distinct regions—Northern California, the Colorado River, and local resources—a relatively dry year affecting one of these three regions can be offset by relatively abundant supplies from the other two regions. For example, a year of ample precipitation within Metropolitan's service area tends to depress demand and enhances local water resources, further reducing demands on imported supplies. A wet year in the Sacramento-San Joaquin watersheds increases the SWP allocation, facilitating reduced diversions from the Colorado River in favor of storing supplies in Lake Mead or in the Desert Water Agency/Coachella Valley Water District Advanced Delivery Account. Conversely, a shortfall on the SWP may require system operational modifications to maximize Colorado River diversions and the delivery of Colorado River supplies to areas normally served with SWP supplies. Metropolitan's Colorado River core supplies are relatively stable from year to year and are less subject to severe supply reductions.

Additional Mandatory Prohibitions (not applicable)

California Water Code Section 10632(a)(4)(D) calls for "additional, mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions" to be included among the WSCP's shortage response actions. However, this item is not applicable to Metropolitan. As a regional wholesaler, Metropolitan does not dictate or control the end uses of water by retail consumers.

Shortage Response Action Effectiveness

As shown in Table A.4-5, WSCP shortage response actions will be implemented to reflect the overall conditions facing Metropolitan and the resources available in that given year. Supply augmentation actions consisting of stored water and as-needed flexible supplies are expected to address between 0 to 100 percent of anticipated shortages for any shortage stage, depending on availability of those supplies; in lesser WSCP shortage stages, it is likely that shortages can be completely addressed through supply augmentation.

Efficacy of demand reduction efforts is difficult to estimate or predict, but water savings are a function of the extent to which public information campaigns reach water users and the degree of consumer response to those messages. Given the estimate of between 5 to 20 percent effectiveness described above, in concept, up to 20 percent of retail demands could be reduced if a successful media campaign reached and influenced the entire service area population. Consistent with the WSCP Communications Plan in the following section A.4.5, anticipated shortages will involve an appropriately-sized outreach campaign to address the targeted demand reduction, which depends on the combined effectiveness of other shortage response actions.

As shown in Table A.4-8 below, the WSAP is designed to reduce demands by up to approximately 50 percent of the WSAP's calculated base demand. The WSAP contains 10 levels of allocation, and each level is approximated to generate an additional 5 percent reduction from base demands. Table A.4-8 gives examples of estimated savings by each WSAP level using a hypothetical base demand of 1.8 MAF. Actual reductions and base demands are based on a formula that includes various factors such as actual local supply production, population growth, and conservation. The WSAP is expected to address any remaining shortage not met by other shortage response actions.

Table A.4-8
Water Supply Allocation Plan Levels

WSAP Level	Approximate Percent Reduction	Example Base Demand	Estimated Demand Reduction
1	5%	1.8 MAF	90,000 AF
2	10%		180,000 AF
3	15%		270,000 AF
4	20%		360,000 AF
5	25%		450,000 AF
6	30%		540,000 AF
7	35%		630,000 AF
8	40%		720,000 AF
9	45%		810,000 AF
10	50%		900,000 AF

Catastrophic Interruption of Water Supplies

Metropolitan's Emergency Storage Objective is a planning estimate that represents the amount of water that Metropolitan would hold in storage for the region in preparation for a catastrophic earthquake that would damage the aqueducts that transport imported water supplies to Southern California, including: the Colorado River Aqueduct, both the East and West branches of the California Aqueduct, and the Los Angeles Aqueduct. Emergency storage allows Metropolitan to deliver reserve supplies to the member agencies to supplement local production. This helps avoid severe water shortages during periods when the imported water aqueducts may be out of service.

The Emergency Storage Objective considers a six- and twelve-month outage period for the imported supply aqueducts incorporating latest seismic information and operational flexibility of Metropolitan's system, a retail water demand cutback ranging from 25 to 35 percent considering the level of conservation that the region achieved during the recent drought, and an aggregated loss of 10 to 20 percent of local supplies accounting for factors that could affect local production during emergency conditions.

In 2019, Metropolitan and its member agencies completed a process to update the Emergency Storage Objective, which was set at 750,000 AF. This level of storage would prevent severe water shortages to the region given new information on expected recovery durations. The emergency storage volume represents a planning estimate for how much water Metropolitan would store for the region in preparation for a catastrophic earthquake or other disaster. It is not intended to set a basis or a policy for allocating or apportioning storage for any individual member agency.

As an additional tool, in July 2019, the Board adopted amendments to Metropolitan's Administrative Code enabling deliveries of member agency water supplies in Metropolitan's system in an emergency. These deliveries are intended to provide Metropolitan's member agencies the ability to deliver member agency water through Metropolitan's system under specific emergency conditions. Emergency deliveries can only be made if Metropolitan is unable to make deliveries to a member agency due to physical damage to Metropolitan's system resulting from a natural disaster or other emergency, and there are no alternate means for Metropolitan or the member agency to provide service to an area without the use of a portion of Metropolitan's system.

Metropolitan's strategy for catastrophic water shortage conditions is further discussed in Appendix 8 to the 2020 UWMP and incorporated herein by reference.

Emergency Freshwater Pathway (Sacramento-San Joaquin Delta)

DWR has estimated that in the event of a major earthquake in or near the Delta, water supplies could be interrupted for up to three years, posing a significant and unacceptable risk to the California business economy. A post-event strategy would provide necessary water supply protections to avert this catastrophe. Such a plan has been coordinated through DWR, the Army Corps of Engineers, USBR, California Office of Emergency Services, Metropolitan, and the State Water Contractors. Additional information on the creation of an emergency freshwater pathway and other actions in the Delta is included in Section 2.5 of the 2020 UWMP and incorporated herein by reference.

Emergency Response Plans

Metropolitan also has two Emergency Response Plans: one dated March 2019 that has been in place long-term and is updated periodically; and a second dated September 2020, prepared pursuant to the requirements of the recently-enacted America's Water Infrastructure Act of 2018. The two plans work in conjunction. Together, Metropolitan's Emergency Response Plans present Metropolitan's organization and strategy for response to emergencies caused by natural hazards, malevolent acts, or other unavoidable circumstances. Metropolitan operates in accordance with the California Standardized Emergency Management System, the Incident Command System, and the National Incident Management System. The Emergency Response Plans provide guidelines for evaluating an emergency situation, responding to an emergency, and activating Incident Command Posts and the Emergency Operations Center. They also describe the Emergency Response Organization. Although the plans provide a framework for emergency response, they do not attempt to identify and discuss every potential situation or problem that may occur during an emergency. The plans will be exercised and updated regularly.

Seismic Risk Assessment and Mitigation Plan

Although the magnitude of damages resulting from a significant seismic event are impossible to predict, Metropolitan's water conveyance and distribution facilities are designed either to withstand a maximum probable seismic event or to minimize the potential repair time in the event of damage. Metropolitan's holistic strategy for seismic resilience follows a "defense in depth" multi-layered approach for managing risk. Metropolitan's Seismic Resilience Strategy has three primary objectives:

1. Provide a diversified water supply portfolio, system flexibility, and emergency storage
2. Prevent damage to water delivery infrastructure in probable seismic events and limit damage in extreme events
3. Minimize water delivery interruptions through a dedicated emergency response and recovery organization

Beginning January 2020, CWC Section 10632.5 mandates urban water suppliers to include in their UWMPs a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities. For Metropolitan, the required seismic risk assessment and mitigation plan is part of its resilience strategy and is included in Metropolitan's 2020 UWMP Appendix 9: Seismic Risk Assessment and Mitigation Plan and incorporated herein by reference.

A.4.5. WSCP Communications Plan

Introduction

Following the record-breaking drought of 2012-2016, Metropolitan concentrated on building on its conservation and education outreach programs to emphasize water efficiency as a sustainable way of life, rather than solely a response to dry conditions or drought. Messaging has encouraged behavioral changes that can be sustained regardless of weather and uses tools and technology that can be implemented to permanently save water in homes and businesses, particularly outdoors where up to 70% of total water use occurs. These efforts have helped solidify a conservation ethic across Southern California, supporting a $1.5 billion investment in conservation, recycling and groundwater recovery since 1990. When combined with additional investments in storage, local supply development and programs to increase water storage reserves in wet years, the region is well positioned to withstand future droughts. Still, in response to the challenges of climate change and other abnormal supply conditions, increased water efficiency will still be necessary. And as those conditions become more prevalent, effective communication strategies and a common understanding of necessary actions between water agencies, the public, elected officials and other key stakeholders become even more important should the district need to activate the WSCP. These relationships and communication tools must be well-established to be successful. To that end, water providers should aim to communicate to customers in the following areas:[3]

1. Steps customers should take to plan for and protect themselves in emergency situations, ranging from abnormal to catastrophic water supply conditions
2. Actions water providers are taking to plan for and respond to these emergency situations
3. Efforts to invest and maintain critical water infrastructure
4. Steps water providers are taking to prepare for and respond to emergency situations that could impact water supplies – from drought to natural disasters

Several factors influence the communication strategies needed to address the diverse characteristics of Metropolitan's 5,200 square-mile service area, particularly when there is an urgent need for conservation. As a wholesaler serving 26 member agencies and a diverse region that is home to 19 million people, no single communication message or strategy connects with everyone in the region. Furthermore, state and local water regulations during periods of drought or supply shortages can result in a broad range of water-saving requirements and goals across the region. Qualitative research from previous droughts has also provided valuable insight on attitudes and behaviors toward water conservation, including drought fatigue, water quality concerns, increasing water rates and equity issues. These factors, though inherently complex, are conducive to collaboration that elevates the importance of drought resiliency. This section of the WSCP describes the basic communications strategies needed to help Metropolitan effectively communicate vital information for each of the six standard water shortage levels that represent changes from normal reliability. The six standard water shortage levels depicted in this communications plan correspond to:

- Progressively increasing estimated shortage conditions: up to 10, 20, 30, 40, 50, and greater than 50% shortage compared to the normal reliability conditions

[3] Source: 2019 Statewide Survey of Residential Customers Covering Water

Collaboration

Collaboration with its member agencies is central to Metropolitan's outreach plans during drought, water shortages or other demand management periods. Developing and delivering a concise regional message in multiple languages is made possible through consistent coordination with member agencies and their constituents. Metropolitan's External Affairs group regularly engages and interacts with member agency staff in several capacities, including but not limited to the following groups:

- Member agency managers
- Legislative and government affairs representatives
- Water use efficiency/conservation coordinators
- Public information officers
- Education coordinators

In addition to member agency coordination, Metropolitan interacts with agencies and organizations outside of the region, including:

- Department of Water Resources
- State Water Resources Control Board
- Association of California Water Agencies
- California Municipal Utilities Association
- Colorado River Water Users Association
- California Water Efficiency Partnership
- Alliance for Water Efficiency
- Other state and federal agencies

As seen in past droughts, the methods of communication within these groups and the frequency of meetings fluctuate based on the changing needs of our member agencies and their key audiences. Water shortage conditions are ever-evolving, therefore remaining flexible yet focused not only reduces the risk of discordance, it also ensures key audiences throughout Southern California receive timely, valuable and cohesive information.

As mentioned, Metropolitan's WSCP includes six levels of potential shortage. The water-savings actions associated with each level of shortage will vary greatly, and Metropolitan recognizes the many different approaches to properly respond to each WSCP level. This section provides a general description of messaging strategies that would be implemented at each level, leading up to more focused crisis communication strategies. The plans need to be adaptable and cannot offer one-size-fits-all approaches. Metropolitan management and/or Board of Directors could also call for specific messaging strategies that address unique shortage scenarios.

Key Audiences

Communicating to various stakeholders is essential during normal supply periods and becomes increasingly more involved during water shortages. Below is a list of key audiences:

- Member agencies and their customers
- General public

- State, federal and local elected officials and their district office staff
- Homeowners and renters
- Multi-family property owners/managers/landlords
- Business associations/chambers of commerce
- Commercial-industrial property owners/managers
- Landscape contractors/suppliers
- Restaurant/hotel industries
- School districts/educators/students
- Building and construction trade associations
- Community/civic leaders
- Land-use agencies
- Environmental groups
- Community-based and non-profit organizations
- Non-English-speaking populations
- Disadvantaged/under-invested communities

Communicating to these audiences requires varying levels of involvement depending on the status of supply conditions. Feedback, research, and leveraging existing relationships are central to an effective communications plan; therefore, External Affairs and Water Resource Management staff will continue to coordinate closely with member agencies, stakeholders, and governing agencies on an ongoing basis to ensure appropriate messaging is culturally competent and provided in multiple languages to reflect the region's demographics.

Goals and Objectives

Metropolitan's communications goals are rooted in the following guiding principles:

- Motivate key audiences to:
    - Increase conservation
    - Follow voluntary or mandatory water use guidelines
    - Participate in water-saving incentive programs
    - Encourage family, friends, neighbors and colleagues to do all the above
- Raise awareness about:
    - Water shortage and/or drought conditions
    - Water sources, supplies and reserves
    - Local, regional and state regulations
- Educate key audiences about:
    - Water supply reliability
    - Water infrastructure and delivery
    - Water quality

- Prepare the region for:
  - Varying water supply conditions
  - Escalating supply shortage levels

Standard Communication

Conservation as a way of life remains central to messaging during normal supply conditions. Regional rebate programs, indoor and outdoor water use efficiency, investments to maintain infrastructure, emergency preparedness, local supply programs, water quality, and regional supply reliability are among some of the themes that make up a normal supply period's communications mix to encourage ongoing conservation actions. Below is a snapshot of the various strategies involved:

- Media relations (news releases and advisories, interviews, op-eds)
- Social media (Twitter, Instagram, Facebook, YouTube, LinkedIn)
- Websites and Blogs
  - mwdh2o.com
  - bewaterwise.com
  - socalwatersmart.com
- Digital, print and other paid media marketing
- Search engine optimization
- E-newsletters
- Community events
- Education outreach
- Business outreach

Level 1 Communications – up to 10% Shortage

This section addresses communications strategies Metropolitan uses during periods of 10% water shortage conditions. In addition to the district's ongoing communications efforts, a 10% shortage would require the following elements:

- Media relations and communications
  - Maintain media relations activities with enhanced communication about the specific need to conserve; provide media with regional water supply conditions and Metropolitan's shortage response action updates
    - Press releases, advisories, op-eds, direct outreach to media to drive earned media opportunities
    - Ethnic media outreach in multiple languages
  - Produce and distribute fact-based informational materials such as fact sheets, podcasts, and B-roll video
- Social media
  - Emphasize ways to conserve immediately (shorter showers, less watering, links to tools on bewaterwise.com, etc.), as well as continued promotion of conservation as a way

of life initiatives such as regional water use efficiency incentives and other rebate programs including the district's Turf Replacement Program

    - Paid social media boosting to target the district's entire service area

  - Encourage member agency co-branding and messaging continuity

    - Share social media creative with the public information officer working group and conservation coordinators

- Web

  - Establish a SharePoint site for member agency and public to download all water supply and conservation materials

  - Update all Metropolitan websites with pertinent conservation and water supply information and highlight such information

  - Provide links to local watering restrictions and conservation efforts

- Member agency coordination

  - Enhance collaboration and communication with member agencies to streamline messaging

  - Involve member agencies in development of a communications plan

  - Provide regular campaign updates to member agency managers, staff and board members.

  - Provide member agencies with campaign outreach materials (newsletter articles, creative design, bill inserts, etc.) for customization and distribution

- Community outreach

  - Make water supply conditions and conservation messaging a key component of all regular community outreach

  - Make additional, specialized outreach to inform non-profit organizations and civic/community leaders about water supply conditions and conservation efforts

    - Community events/webinars

    - Non-profit organization e-newsletters

- Education outreach

  - Update district curriculum to reflect the enhanced need to conserve and make water supply conditions and conservation messaging a key component of all regular education outreach

  - Communicate to K-12 school districts and colleges/universities about the need for increased conservation

  - Provide regional water and environmental education programs with materials addressing the need for increased conservation

- Legislative and government affairs

  - Coordinate with local, state and other elected officials in the region about the need to conserve

  - Encourage officials to promote these efforts to constituents

In addition:

- Work with member agencies to target key industries or groups to raise awareness about water-use efficiency programs and regional water supply conditions
  - Restaurants
  - Hotels/motels
  - Public agencies
- Research and public opinion
  - Conduct research to gain insights on public opinion, attitudes and beliefs toward conservation and water shortage levels
  - Message testing with key audiences

Level 2 Communications – up to 20% Shortage

In a more severe supply shortage or demand management period, Metropolitan will continue actions outlined in Level 1 communications strategies, and add the following efforts, which are designed to address a 20% percent mandatory conservation under the WSCP:

- Media relations and communications
  - Paid advertising – Execute a multimedia, multilingual regional advertising campaign to reflect a more urgent message emphasizing the need for compliance with mandatory water-use restrictions. Place paid advertisements in the following platforms:
    - Out of Home (billboards, bulletins, bus shelter ads)
    - Radio
    - Television
    - Digital
    - Grassroots
  - Host press conference to discuss current water shortage conditions, shortage response actions, and outlook
  - Coordinate with other regional or state agencies for greater impact and reach
- Social media
  - Emphasize a clear and practical message conveying mandatory water-use restrictions, drought conditions and ways to save water
  - Establish more targeted and focused social media advertising strategies – targeted boosting and messaging
- Member agency coordination
  - Meet with member agencies to streamline a more urgent and serious campaign tone
  - Coordinate paid media flights with member agencies to leverage regional exposure and distribution
  - Provide multimedia and multilingual campaign materials for member agency customization

- Community outreach
    - Coordinate with community-based organizations and leaders with higher impact, reach and credibility
    - Inform, debrief and prepare community/civic leaders to become water conservation ambassadors in their respective communities
- Legislative and government affairs
    - Increase briefing activity with state and local officials on water supply conditions, shortage response actions, and water conservation advertising campaign

In addition:

- Help prepare and distribute materials about restrictions, ordinances and guidelines through stakeholder communication channels, including but not limited to:
    - Business organizations
    - Civic organizations
    - Elected officials
    - Building/plumbing/construction associations
    - Building managers
    - Landscape contractors
- Increase outreach efforts to key associations and interest groups throughout the region, emphasizing immediate conservation goals

Level 3 and 4 Communications – up to 30% or 40% Shortage

In addition to Level 2 communications strategies, the following efforts will address an even more severe shortage of 30%-40% mandatory conservation under the WSCP:

- Media relations and communications
    - Increase media relations activities, with an added emphasis on the severe regional water supply conditions, the shortage response actions triggered or expected to be triggered, and the mandatory need to conserve
    - Host news conference in multiple languages alongside high-level public officials to highlight severity and extreme measures needed
    - Continue the following with greater frequency and stronger, more critical messaging:
        - Paid advertising campaign
        - Press releases, advisories, op-eds, etc.
        - Direct media outreach offering pre-recorded radio and TV interviews
        - Ethnic media outreach in multiple languages
- Social media
    - Messaging shift to reflect severity of supply conditions and shortage response actions triggered or expected to be triggered– conservation is mandatory to maintain day-to-day activity and future supplies, quality of life now being impacted

- Web
  - Make conservation messaging front and center on all websites
- Community Outreach
  - Host a community leader briefing, bringing together representatives from community-based organizations from across the region to learn about the severity of water supply conditions
- Member agency coordination
  - Continue to streamline messaging about WSCP level escalation to ensure message continuity throughout the region
  - Help member agencies address local and mandatory conservation needs
  - Coordinate with member agencies on any updated messages and campaign activities emphasizing extreme actions that must be taken
- Legislative and government affairs
  - Outreach to legislative leadership at state and federal level to raise awareness at high levels

In addition:

- Specialized targeted outreach to:
  - Special interest groups
  - Public agencies
  - County and city departments
- Assess the goals and objectives of regional rebate programs, begin a shift toward immediate water-saving actions
- Research and public opinion
  - Conduct public opinion research studies including focus groups to determine attitudes and beliefs toward extreme conservation levels in order to effectively communicate severity of supply conditions and the mandatory need to conserve

Level 5-6 Communications – 50% Shortage or more

The severity of this level of the WSCP calls for immediate, extreme conservation measures and a focus on water use for health and safety only. As with previous levels, communications strategies at this level of the WSCP incorporate and build upon ongoing efforts.

Key Communications Strategies

- Consider establishing a Joint Information Center (JIC) to pool crisis communications among emergency responders and affected local, state and federal agencies
- Produce and distribute fact-based informational materials such as fact sheets, podcasts, and B-roll video
- Host a press conference to announce the severity of water shortage level and shortage response actions triggered or anticipated to be triggered, to be held in conjunction with regional and/or state emergency response and public health authorities

- Emphasize work being done by Metropolitan and its member agencies to alleviate the impacts of such a severe shortage
- Focus on the need for residential and commercial customers across the region to do their part to get through the crisis situation
- Offer vulnerable populations increased assistance, in coordination with regional emergency response teams
- Keep the media and key stakeholders informed with frequent supply condition reports
- Shift from traditional advertising campaign efforts to emergency and crisis communication approach
- Messaging is no longer conservation-focused, begin shift to crisis response communications protocols

Crisis Communications – Catastrophic Shortage

In the event of a catastrophic shortage due to an infrastructure failure and/or natural disaster, Metropolitan will enact its crisis communications plan in accordance with local, regional, state and federal emergency response guidelines that ensure a coordinated effort and effective response. This plan utilizes the Standard Emergency Management System, the Incident Command System and the National Incident Management System.

Strategic Message Development

- In an emergency, communications messages will be created in a complex environment in which the tensions of multidirectional information flows must be balanced with the need for strategic message development

Message Dissemination

Communication efforts will center on the core identified tasks: providing information to the public and external audiences. Information dissemination tools:

- Website (mwdh2o.com, bewaterwise.com)
- Social Media (Twitter, Facebook, Instagram, YouTube)
- MetAlert Emergency Notification System + RSS Feeds
- Press Releases and statements
- Participation in joint information centers

Information Dissemination

- Public Information
  - Activate and manage the mechanisms for responding to public requests for information via social media, telephone, in writing, or by e-mail
  - Prepare Metropolitan's telephone operators for responding to and monitoring calls related to emergency incidents; brief them and provide scripts on how to respond to questions and where to direct calls for other requests
  - Work with subject matter experts to create situation-specific fact sheets, Q&A documents and updates
  - Respond to requests and inquiries from special interest groups

- Oversee and manage Metropolitan's emergency response website if needed, in addition to mwdh2o.com, social media, telephone, and public email correspondence response systems; establish and maintain links to other emergency response websites
  - Manage the development and testing of messages and materials for cultural and language requirements of special populations
  - Post updates on social media channels. Monitor and respond to comments as needed/appropriate
- Member agencies, partnering agencies and elected/legislative officials:
  - The Public Information Officer (PIO) or Crisis Communications Team will communicate, as needed, with the PIOs for member agencies and other partnering agencies
  - Help organize and facilitate official meetings and briefings to provide information and receive input from member agencies, other partners or stakeholders
  - Notify legislative/elected officials as needed

A.4.6. Legal Authorities

This section describes the legal authorities that empower Metropolitan to implement and enforce its shortage response actions. Metropolitan is a wholesale water provider organized as a cooperative of 26 voluntary members. Metropolitan was formed pursuant to the Metropolitan Water District Act, Statutes 1969, chapter 209, codified at California Water Code, Appendix Section 109 (the "MWD Act"). Pursuant to the MWD Act, Metropolitan has the express and implied statutory authority to "[p]rovide, sell, and deliver water at wholesale for municipal and domestic uses and purposes," among other powers. (MWD Act, §§ 120, 130.) To accomplish the provision of water, Metropolitan is also expressly authorized to promote and implement conservation programs, including during times of water shortage. (MWD Act, § 130.5.)

Metropolitan also has authority under the California Water Code to implement supply shortage programs. (Cal. Water Code, §§ 350-359, 375-378.) For example, Section 375(a) of the Water Code provides:

> *Notwithstanding any other provision of the law, any public entity which supplies water at retail or wholesale for the benefit of persons within the service area or area of jurisdiction of the public entity may, by ordinance or resolution adopted by a majority of the members of the governing body after holding a public hearing upon notice and making appropriate findings of necessity for the adoption of a water conservation program, adopt and enforce a water conservation program to reduce the quantity of water used by those persons for the purpose of conserving the water supplies of the public entity.*

Cal. Water Code, § 375(a). Water Code Section 375(b) also provides the authority for pricing to encourage water conservation.

> *With regard to water delivered for other than agricultural uses, the ordinance or resolution may specifically require the installation of water-saving devices that are designed to reduce water consumption. The ordinance or resolution may also encourage water conservation through rate structure design.*

Metropolitan's Board of Directors has approved many policies and rules, codified in Metropolitan's own Administrative Code, which further provide Metropolitan the authority to ensure the availability of its water during times of shortages. For example, Administrative Code Section 3107 requires that any territory annexed to Metropolitan comply with Metropolitan's water use efficiency guidelines.

The Board has also ratified various policies and rules to implement a Water Supply Allocation Plan (WSAP) to address shortage conditions. Metropolitan's WSAP provides a standardized methodology for allocating supplies during times of shortage. The WSAP is authorized pursuant to the following Board actions:

- By Minute Item 43514, dated April 13, 1999, the Board adopted the WSDM Plan.
- By Minute Item 44005, dated June 17, 2000, the General Manager has the authority to reduce Interim Agriculture Water Program deliveries up to 30 percent prior to imposing any mandatory allocation under the WSDM Plan.
- By Minute Item 47393, dated February 12, 2008, the Board adopted the WSAP.
- By Minute Item 48376, dated August 17, 2010, the Board approved adjustments to the WSAP.

- By Minute Item 48803, dated September 12, 2011, the Board approved adjustments to the WSAP.
- By Minute Item 74526, dated February 11, 2014, the Board adopted the Water Supply Alert Resolution.
- By Minute Item 49979, dated December 9, 2014, the Board approved adjustments to the WSAP.

In addition to the statutes and other legal authorities set forth above, Metropolitan is empowered to implement and enforce its shortage response actions pursuant to various resolutions. For example, on April 11, 2016, Metropolitan's Board voted to adopt Metropolitan's 2015 UWMP and authorized its submittal to the State of California as stated in Resolution 9209. Metropolitan's 2015 UWMP contains Metropolitan's December 2014 WSAP in Appendix 4. Metropolitan's 2015 UWMP also describes in Section 2.4 Metropolitan's WSAP and WSDM Plan, which guides Metropolitan's planning and operations during both shortage and surplus conditions. Similarly, on May 11, 2021, Metropolitan's Board voted to adopt Metropolitan's UWMP and WSCP as stated in Resolutions 9279 and 9281, respectively. These two Resolutions authorize Metropolitan to implement and enforce its shortage response actions contained in the WSCP, which is attached as Appendix 4 to the 2020 UWMP.

Additionally, numerous agreements allow Metropolitan to take its core supplies and shortage response actions. Core supplies and supply augmentation actions are authorized by the agreements shown in 2020 UWMP Appendix 3: Justifications for Supply Projections, which include:

Colorado River Supplies

- 1931 Seven Party Agreement dated August 18, 1931
- Metropolitan's 1930, 1931, and 1946 water delivery contracts with the Secretary of the Interior
- Consolidated Decree of the Supreme Court of the United States in *Arizona v. California*
- 2003 Quantification Settlement Agreement (QSA) and related agreements
- 2005 Settlement Agreement with Quechan Indian Tribe
- Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead
- 1988 IID-Metropolitan Conservation and Use of Conserved Water Agreement
- 1989 Approval Agreement
- 1989 Supplemental Approval Agreement
- August 2004 Forbearance and Fallowing Program Agreement with PVID
- Landowner Agreements for Fallowing in PVID
- 2003 Delivery and Exchange Agreement between Metropolitan and Coachella Valley Water District
- 2004 Storage and Interstate Release Agreement among Metropolitan, the Colorado River Commission of Nevada, Southern Nevada Water Authority, and the United States
- 2007 Lower Colorado Water Supply Project Contract among the United States, the City of Needles, and Metropolitan

- 2007 Lower Colorado River Basin Intentionally Created Surplus Forbearance Agreement among the Arizona Department of Water Resources, PVID, IID, the City of Needles, CVWD, Metropolitan, SNWA, and the Colorado River Commission of Nevada
- 2007 California Agreement for the Creation and Delivery of Extraordinary Conservation Intentionally Created Surplus among Metropolitan, PVID, IID, CVWD, and the City of Needles
- 2007 Agreement among the United States, the Colorado River Commission of Nevada, and the SNWA for the Funding and Construction of the Lower Colorado River Drop 2 Storage Reservoir Project
- 2007 Delivery Agreement between the United States and Metropolitan
- 2008 Metropolitan Notice of Election to Participate as a Party to the Drop 2 Funding Agreement
- 2009 Agreement among the United States, Metropolitan, the Colorado River Commission of Nevada, SNWA, and the Central Arizona Water Conservation District for a Pilot Project for Operation of the Yuma Desalting Plant
- 2010 Yuma Desalting Plant Pilot Project Delivery Agreement between the United States and Metropolitan
- 2012 Agreement among the United States, Metropolitan, the Colorado River Commission of Nevada, SNWA, and the Central Arizona Water Conservation District for a Pilot Program for the Conversion of Intentionally Created Mexican Allocation to Intentionally Created Surplus
- 2012 Interim Operating Agreement for Implementation of Minute No. 319 of the International Boundary and Water Commission
- 2012 Lower Colorado River Basin Forbearance Agreement for Binational Intentionally Created Surplus
- 2012 Binational ICS Delivery Agreement
- 2013 Agreement between Metropolitan and IID Regarding Binational Intentionally Created Surplus
- 2015 Amendment 1 to the California Agreement for the Creation and Delivery of Extraordinary Conservation Intentionally Created Surplus
- 2017 Agreement among the United States, Metropolitan, the Colorado River Commission of Nevada, SNWA, IID, and the Central Arizona Water Conservation District for a Pilot Program for the Conversion of Mexico's Water Reserve to Binational ICS
- 2017 Interim Operating Agreement for Implementation of Minute No. 323
- 2017 Binational ICS Agreement
- 2017 Binational ICS Delivery Agreement
- 2019 Lower Basin Drought Contingency Plan
- December 2019 Agreement for the Implementation of a Seasonal Land Fallowing Program
- Agreement for Seasonal Fallowing in Bard Unit (Farmer Fallowing Agreements

- May 2020 First Amended Agreement for the Implementation of a Seasonal Land Fallowing Program
- Agreement Relating to Supplemental Water among The Metropolitan Water District of Southern California, the San Luis Rey Settlement Parties, and the United States
- Amended and Restated Agreement between The Metropolitan Water District of Southern California and the San Diego County Water Authority for the Exchange of Water. This October 10, 2003 agreement provides for Metropolitan delivery of Exchange Water to SDCWA in exchange for conserved Colorado River water SDCWA makes available to Metropolitan at Lake Havasu.
- Agreement Between Imperial Irrigation District And San Diego County Water Authority For Transfer Of Conserved Water. This April 9, 1998 agreement, as amended, provides for IID to conserve water for transfer to SDCWA and establishes the price SDCWA pays to IID for the conserved water.
- Allocation Agreement. This October 10, 2003 agreement among the United States, CVWD, IID, SDCWA, Metropolitan, and the San Luis Rey Settlement Parties provides for the allocation of water conserved from the All-American Canal Lining Project and the Coachella Canal Lining Project, and Metropolitan's assignment to SDCWA of it rights to both canal lining projects.
- Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement. By this October 10, 2003 agreement, among the Secretary of the Interior. CVWD, IID, SDCWA, and Metropolitan, the Secretary agreed to deliver IID-SDCWA transfer water and canal lining water allocated to SDCWA to Metropolitan's Colorado River Aqueduct Intake at Lake Havasu for diversion by Metropolitan.

State Water Project Supplies

- 1960 Contract between the State of California and The Metropolitan Water District of Southern California for a Water Supply
- Port Hueneme Water Agency Annexation: By Minute Item 41728, dated January 9, 1996, Metropolitan's Board adopted Resolution 8487 granting the concurrent annexation of Annexation No. 32 to Calleguas Municipal Water District and The Metropolitan Water District of Southern California, and fixing Metropolitan's terms and conditions for the annexation
- 1996 Sublease Agreement between the Port Hueneme Water Agency and Metropolitan
- 1967 and 1983 Water Exchange Contract and Agreements with Desert Water Agency and Coachella Valley Water District
- 1984 Advance Delivery Agreement with Desert Water Agency and Coachella Valley Water District
- The 2003 Exchange Agreement with Desert Water Agency and Coachella Valley Water District
- November 2012 Letter Agreement with Coachella Valley Water District
- 2019 Amended and Restated Agreement for Exchange and Advance Delivery with Desert Water Agency and Coachella Valley Water District
- 1997 Arvin-Edison/Metropolitan Water Management Agreement

- 1998 Turn-in/out Construction and Maintenance Agreement between DWR, Kern County Water Agency, Arvin-Edison, and Metropolitan
- 1998-2002 Water Delivery and Return Agreements with DWR, Kern County Water Agency, Arvin-Edison, and Metropolitan
- 2004 Point of Delivery Agreement with DWR, Kern County Water Agency, and Metropolitan
- 2004 Introduction of Water into the California Aqueduct with DWR, Kern County Water Agency, and Arvin-Edison
- 2007 First Amended and Restated Agreement Between Arvin-Edison Water Storage District and The Metropolitan Water District of Southern California for a Water Management Program
- 2000 Coordinated Operating Agreement between Metropolitan and San Bernardino Valley Municipal Water District
- 2001 Coordinated Operating Agreement between Metropolitan and San Bernardino Valley Municipal Water District
- 2011 Coordinated Operating, Water Storage, Exchange and Delivery Agreement among Metropolitan, Municipal Water District of Orange County, and Irvine Ranch Water District
- 2013 San Gabriel Valley MWD Exchange and Purchase Agreement
- 2019 Board Approval of the High Desert Water Bank Agreement with Antelope Valley East Kern Water Agency
- 2001 Kern Delta/Metropolitan Principles of Agreement
- 2002 Kern Delta and Metropolitan Boards of Directors Approval
- 2007 DWR-Yuba County Water Agency Purchase Agreement
- 2007 DWR-Metropolitan Yuba Dry Year Program Participation Agreement
- 2014 Amended DWR-Metropolitan Yuba Dry Year Program Participation Agreement
- 2019 Amended and Restated Agreement Among The Metropolitan Water District of Southern California, Coachella Valley Water District, and Desert Water Agency for the Exchange and Advance Delivery of Water
- 2020 Amended DWR-Metropolitan Yuba Dry Year Program Participation Agreement
- 2021 Coordinated Operating Agreement. The Coordinated Operating Agreement between Metropolitan and San Bernardino Valley District was approved by Metropolitan's Board in March 2021. The agreement will terminate on December 31, 2035 unless there is an extension of the SWP Contract.
- <u>2013 San Gabriel Valley MWD Exchange and Purchase Agreement.</u> The agreement between Metropolitan and San Gabriel Valley MWD was executed in September 2013.
- <u>2013 Board Approval of the San Gabriel Valley MWD Exchange and Purchase Agreement.</u> In August 2013, Metropolitan's Board authorized entering into the agreement with San Gabriel Valley MWD.

In-Region Storage and Supplies

- November 1974 Memorandum of Understanding and Agreement on Operation of Lake Skinner
- November 1994 Memorandum of Understanding on Operation of Domenigoni Valley Reservoir (now known as Diamond Valley Lake)
- Elderberry Forebay Contract for Conditions for Use
- June 2002 Division of Safety of Dams Certificate of Approval
- October 1991 Final EIR for the Eastside Reservoir Project (Diamond Valley Lake)
- 1995 amendment to Metropolitan's SWP contract to include Article 54, "Usage of Lakes Castaic and Perris"
- November 1974 Memorandum of Understanding and Agreement on Operation of Lake Skinner
- June 2002 Division of Safety of Dams Certificate of Approval
- Principles for groundwater storage adopted by the Metropolitan Board in January 2000
- Resolution for Proposition 13 Funds adopted by the Metropolitan Board in October 2000
- Agreement executed with the DWR for Interim Water Supply Construction Grant Commitment Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection (Proposition 13, Chapter 9, Article 4) providing for Metropolitan to administer $45 million in state Proposition 13 grant funds for groundwater reliability programs; October 2000
- Agreement executed for Long Beach Conjunctive Use Project, July 2002, amended in July 2003, October 2005, and November 2008
- Agreement executed for Live Oak Conjunctive Use Project, October 2002
- Agreement executed for Foothill Area Groundwater Storage Project, February 2003, amended in August 2006, April 2008, and February 2009
- Agreement executed for Chino Basin Programs, June 2003, amended in May 2004, August 2004, August 2005, May 2008, March 2009, September 2009, July 2010, and January 2015
- Agreement executed for Orange County Groundwater Storage Program, June 2003, amended in July 2004, December 2005, and July 2008
- Agreement executed for Compton Conjunctive Use Program, February 2005
- Agreement executed for Long Beach Conjunctive Use Project — Expansion in Lakewood, July 2005, amended in April 2006, August 2007, November 2008, and February 2010
- Agreement executed for Upper Claremont Basin Groundwater Storage Program, September 2005, amended in April 2008
- Agreement executed for Elsinore Basin Conjunctive Use Program, December 2006, amended in May 2008

These agreements are described in more detail in Appendix 3 to Metropolitan's 2020 UWMP.

If necessary, Metropolitan shall declare a water shortage emergency in accordance with CWC Chapter 3 (commencing with Section 350) of Division 1. In addition, Metropolitan shall coordinate with any city or county within which it provides water supply services for the possible proclamation of a local emergency, as defined in Section 8558 of the Government Code.

A.4.7. Financial Consequences of and Responses for Drought Conditions

A water shortage may be created by a reduction in water supply, an increase in water demand, or a combination of both. Metropolitan's shortage response actions include supply augmentation, demand management, and operational flexibility, all of which could impact Metropolitan financially. For example, exercising the options to take water from supply augmentation programs may increase costs. Similarly, operational changes could result in higher system costs and lower revenues from on-system hydropower generation, and an increase in conservation and outreach efforts would also increase costs. On the other hand, if core supplies from the SWP or the Colorado River were reduced, variable power costs to move water into the service area would likely decrease. Additionally, effective demand management during shortages tends to decrease Metropolitan's water sales when effective, thereby potentially reducing revenue for Metropolitan. From these various financial effects, there is a potential for expenditures exceeding revenues more than budgeted, thereby requiring unanticipated draws from reserves.

Variation in the amount of revenues is already part of Metropolitan's financial planning. Revenues vary according to regional weather and the availability of statewide water supplies. In dry years, local demands increase, and Metropolitan may receive higher than anticipated revenues due to increased sales volumes. In contrast, in wet years, demands decrease, and revenues drop due to lower sales volumes. In addition, statewide supply shortages such as those in 2009 and 2015 also affect Metropolitan's revenues. Such revenue surpluses and shortages could cause instability in water rates. To mitigate this risk, Metropolitan maintains financial reserves, with a minimum and target balance, to stabilize water rates during times of reduced water sales. The reserves hold revenues collected during times of high water sales and are used to offset the need for revenues during times of low sales. Metropolitan's practice of using reserves to buffer unexpected increases or decreases in budgeted revenue also applies to unexpected expenditure increases or decreases resulting from shortage responses.

Metropolitan uses its financial reserves to mitigate the impacts of water shortages. This policy applies to each of the six shortage levels described in this WSCP. Financial reserves create a buffer to reduce the financial impact of the water shortage. Other mitigation actions such as reducing operations and maintenance expenses, deferring capital projects, and rates/charges increases are part of Metropolitan's biennial budget and rate design cycle, are not used routinely to mitigate financial impacts of water shortage response actions.

Metropolitan's reserve policy provides for a minimum reserve requirement and target amount of unrestricted reserves at June 30 of each year. Funds in excess of the target amount are to be utilized for capital expenditures in lieu of the issuance of additional debt, or for the redemption, defeasance or purchase of outstanding bonds or commercial paper as determined by the Board. However, if the fixed charge coverage ratio (the amount necessary to cover all fixed costs) is at or above 1.2, amounts over the minimum may be expended for any lawful purpose of Metropolitan, as determined by the Board. Therefore, unrestricted reserves are intended to be available to address Metropolitan's shortage response actions, as well as the consequences of those actions, so long as its fixed charge coverage ratio is at or above 1.2.

A.4.8. WSCP Adoption and Refinement Procedures

WSCP Public Notice and Adoption

Metropolitan provided notice of the availability of the draft 2020 UWMP (including Appendix 11 which will also be a new Appendix 11 to its 2015 UWMP) and WSCP, and notice of the public hearing to consider adoption of both plans and Appendix 11 to the 2015 UWMP in accordance with CWC Sections 10621(b) and 10642, and Government Code Section 6066, and Chapter 17.5 (starting with Section 7290) of Division 7 of Title 1 of the Government Code. The public review drafts of the 2020 UWMP, Appendix 11 to the 2015 UWMP, and the WSCP were posted prominently on Metropolitan's website, mwdh2o.com, on February 1, 2021, more than 60 days in advance of the public hearing on April 12, 2021. The notice of availability of the documents was sent to Metropolitan's member agencies, as well as to cities and counties in Metropolitan's service area. In addition, a public notice advertising the public hearing in English and Spanish was published in 12 Southern California newspapers. The notification in English language newspapers was published on February 1 and 8, 2021. The notification was published on January 28-30, 2021 and February 1, 4-6, and 8, 2021 in Spanish language newspapers, satisfying the requirement for non-English language notification. Copies of: (1) the notification letter sent to the member agencies, cities and counties in Metropolitan's service area, and (2) the notice published in the newspapers are included in the 2020 UWMP Section 5. Table 5-3 in the 2020 UWMP provides a list of participating member agencies and other appropriate agencies that Metropolitan coordinated with in its regional planning, as well as the cities and counties that were notified about the preparation of its 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP. In addition, the list of newspaper publications is included in Table 5-4.

Metropolitan held the public hearing for the draft 2020 UWMP, draft Appendix 11 to the 2015 UWMP, and draft WSCP on April 12, 2021, at the Board's Water Planning and Stewardship Committee meeting, held online due to COVID-19 concerns. On May 11, 2021, Metropolitan's Board determined that the 2020 UWMP and the WSCP are consistent with the MWD Act and accurately represent the water resources plan for Metropolitan's service area. In addition, Metropolitan's Board determined that Appendix 11 to both the 2015 UWMP and the 2020 UWMP includes all of the elements described in Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs. tit. 23, § 5003) which need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action. As stated in Resolutions 9279, 9280, 9281, the Board adopted the 2020 UWMP, Appendix 11 to the 2015 UWMP, and the WSCP and authorized their submittal to the State of California. Copies of Resolutions 9279, 9280, 9281 are included in the 2020 UWMP Section 5, and Resolution 9281 for the WSCP is attached to this WSCP as Attachment C.

Submission and Availability of Final 2020 UWMP, Appendix 11 to 2015 UWMP, and WSCP

In fulfillment of CWC Sections 10632(c) and 10645(a) and (b), Metropolitan's final 2020 UWMP, Appendix 11 to its 2015 UWMP, and its WSCP were posted on the mwdh2o.com website in May 2021, following their adoption by the Metropolitan board. This satisfies the requirement to make the plans available for public review and to make the WSCP available to Metropolitan's customers (which are its member agencies).

In fulfillment of CWC Sections 10632(c), 10635(c) and 10644(a)(1), Metropolitan also mailed copies of the final 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP (in electronic pdf format) to the California State Library and all cities and counties within Metropolitan's service area within 30 days of Board adoption.

In June 2021, in fulfillment of CWC Section 10621(f) and Sections 10644(a)(1), (2), and (b), Metropolitan's final 2020 UWMP, Appendix 11 to the 2015 UWMP, and WSCP were electronically submitted to the State of California through DWR's WUE data website https://wuedata.water.ca.gov/secure/.

WSCP Reevaluation and Improvement Procedures

The WSCP will be periodically re-evaluated to ensure that its shortage risk tolerance is adequate and the shortage response actions are effective and up to date based on lessons learned from implementing the WSCP. The WSCP will be revised and updated during the UWMP update cycle to incorporate updated and new information. For example, new supply augmentation actions will be added, and actions that are no longer applicable for reasons such as program expiration will be removed. However, if revisions to the WSCP are warranted before the UWMP is updated, the WSCP will be updated outside of the UWMP update cycle. In the course of preparing the Annual Assessment each year, Metropolitan staff will routinely consider the functionality the overall WSCP and will prepare recommendations for Metropolitan's Board of Directors if changes are found to be needed.

ATTACHMENTS

Attachment A – Water Surplus and Drought Management Plan

Attachment B – Water Supply Allocation Plan

Attachment C – WSCP Resolution 9281

List of Acronyms and Abbreviations

AF	Acre-feet
CRA	Colorado River Aqueduct
CUP	Conjunctive Use Programs
CVWD	Coachella Valley Water District
CWC	California Water Code
DWA	Desert Water Agency
DWR	California Department of Water Resources
IID	Imperial Irrigation District
IRP	Integrated Water Resources Plan
ICS	Lake Mead Intentionally Created Surplus
MAF	Million Acre-feet
MWD	The Metropolitan Water District of Southern California
MWD Act	Metropolitan Water District Act
PVID	Palo Verde Irrigation District
QSA	Quantification Settlement Agreement
SNWA	Southern Nevada Water Authority
SWP	State Water Project
TAF	Thousand Acre-Feet
USBR	United States Bureau of Reclamation
UWMP	Urban Water Management Plan
WSAP	Water Supply Allocation Plan
WSCP	Water Shortage Contingency Plan
WSDM	Water Surplus and Drought Management

Attachment A

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

WATER SURPLUS AND DROUGHT MANAGEMENT PLAN

REPORT NO. 1150

AUGUST 1999

ACKNOWLEDGMENTS

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WATER SURPLUS AND DROUGHT MANAGEMENT PLAN

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

The Water Surplus and Drought Management (WSDM) Plan for the Metropolitan Water District of Southern California (Metropolitan) is a ten-year plan that will be used to direct Metropolitan's resource operations to help attain the region's 100% reliability goal. The WSDM Plan recognizes the interdependence of surplus and shortage actions and is a coordinated plan that utilizes all available resources to maximize supply reliability. The overall objective of the WSDM Plan is to ensure that shortage allocation of Metropolitan's imported water supplies is not required.

The central effort in developing the WSDM Plan was a participatory process involving Metropolitan and its member agencies. Metropolitan staff and member agency representatives coordinated the Plan's development during a series of meetings of the Rate Refinement Team.

To lay a foundation for the WSDM Plan, participants in the Rate Refinement Process developed a set of proposed WSDM Principles and Implementation Goals which were subsequently adopted by the Metropolitan Board of Directors in September 1998. These Principles and Implementation Goals outline fundamental policies for guiding surplus and shortage management and establish a basis for dealing with shortages in an equitable and efficient manner.

WSDM PRINCIPLES AND IMPLEMENTATION GOALS

Guiding Principle

- Metropolitan will encourage storage of water during periods of surplus and work jointly with its Member Agencies to minimize the impacts of water shortages on the region's retail consumers and economy during periods of shortage.

Supporting Principles

- Maintain an ongoing coordinated effort among Metropolitan and its Member Agencies to encourage efficient water use, develop cost-effective local resource programs, and inform the public on water supply and reliability issues

- Encourage local and regional storage during periods of surplus and use of storage during periods of shortage

- Manage and operate Metropolitan's regional storage and delivery system in coordination with local facilities to capture and store surplus water in local groundwater and surface reservoirs

- Arrange for secure sources of additional water from outside the region for use during periods of shortage

- Call upon sources of additional water from outside the region and water stored locally to meet the needs of consumers and protect the economy during periods of shortage

WSDM Plan Implementation Goals

- Avoid mandatory import water allocations to the extent practicable

- Equitably allocate imported water on the basis of agencies' needs

  Considerations to create an equitable allocation of imported water may include:

  - Impact on retail consumers and economy
  - Reclamation/Recycling
  - Conservation
  - Population and economic growth
  - Investment in local resources
  - Change and/or loss of local supply
  - Participation in Metropolitan's Non-firm (interruptible) programs
  - Investment in Metropolitan's facilities

- Encourage storage of surplus supplies to mitigate shortages and improve water quality

SURPLUS AND SHORTAGE ACTIONS

The region's ability to implement a long-term WSDM Plan results from the significant investments Metropolitan and its member agencies have made in a variety of resources since 1991. These additional resources include increased local conservation and water recycling, improvements in the reliability of imported supplies, increased regional storage, and increased conjunctive use groundwater programs. Together these improvements allow a comprehensive approach to water management.

The growing variety of resources available to the region is transforming Metropolitan from an agency with relatively modest storage capacity to one that will have storage sufficient to manage many shortages without impacts to its member agencies or retail customers. To attain this level of reliability, all storage programs and facilities, along with conservation, recycling, and other programs, must be managed as an integrated set of regional resources. To accomplish this, the WSDM Plan establishes the linkage between surplus and shortage resource management actions.

When imported supplies exceed projected demands for imported water within Metropolitan's service area, Metropolitan can operate available storage facilities to maximize the benefits of stored water to its member agencies. A number of factors affect Metropolitan's ability to divert surplus water into storage. Some of these factors include facility outages, system capacity, water quality (including requirements for managing total dissolved solids), and varying supply and demand patterns. The WSDM Plan provides a description of storage options available to Metropolitan and a framework for storing water in these programs and facilities when surplus supplies are available.

Except in severe or extreme shortages (defined in the Introduction) or emergencies, Metropolitan's resource management will allow shortages to be mitigated without impacting retail Municipal and Industrial (M&I) customers. A list of resource management actions and their descriptions are provided below. This list emphasizes critical storage programs and facilities, and conservation programs that make up part of Metropolitan's response to shortages. The order in which these actions are presented does not imply the exact operational management of resources that would occur during a shortage, rather it represents a general framework and guide. In fact, several actions are likely to be taken concurrently. Many factors will dictate the exact order in which these actions will be taken during shortages. One action, however, will have an assigned prioritization: the curtailment of Full Service (firm) deliveries will be last. The following summarizes the drought actions:

- Draw on storage in the Eastside Reservoir Project
- Draw on out-of-region storage in Semitropic and Arvin-Edison
- Reduce/suspend long-term seasonal and groundwater replenishment deliveries
- Draw on contractual groundwater storage programs in the region
- Draw on State Water Project (SWP) terminal reservoir storage (per Monterey Agreement)
- Call for extraordinary drought conservation and public education
- Reduce Interim Agricultural Water Program (IAWP) deliveries
- Call on water transfer options contracts
- Purchase transfers on the spot market
- Implement the allocation of Metropolitan's imported supplies to its member agencies

For the ten-year period addressed by the WSDM Plan, 1999-2008, the majority of shortage contingencies will be managed by withdrawals from storage, groundwater management and options transfers. Shortages managed using these actions would not impact the quantity of water delivered to member agencies for consumptive uses. In fact, when coupled with other drought actions such as extraordinary conservation and reduction of agricultural deliveries, it is fully expected that an allocation of firm imported water supplies will not be necessary during the next ten years. Under this worse-case scenario, an approach to allocate Metropolitan's firm imported water supplies in a fair and equitable manner will be developed.

The overall policy objective of the allocation method will be to minimize the impacts to any one agency and the region as a whole. To meet that objective, the method of allocating firm imported supply will account for:

- Each agency's demands on Metropolitan,
- Each agency's local resources
- Each agency's total retail demands.

The WSDM Plan allocation method would address each of these supply and demand components and account for each agency's conservation and recycled water programs. A pricing structure will be coupled with the WSDM allocation method to accomplish two goals:

- Encourage conservation and water recycling
- Ensure that the regional impact of the shortage is as small as possible

To provide as much water as possible without changing wholesale prices, the allocation of all available supplies will be made at the prevailing rates for firm deliveries. In order to encourage conservation to the level of allocation, the rate for agency usage from 100-102% of its allocation will be the Full Service rate plus $175. Usage above 102% of allocated supply will be charged at three times the Full Service rate. Any substantial change in Metropolitan's water rate structure may require these rates to be revised.

During severe or extreme shortage conditions, public outreach will play a critical role in shaping consumer response. Public information campaigns will send clear signals if extraordinary drought conservation is required. An effective public information campaign requires a joint effort among Metropolitan and its member agencies. Under this Plan, the administration of the Public Information and Government Affairs program will be the responsibility of a Drought Program Officer (DPO). The DPO will be responsible for integrating the various activities in these areas, coordinating efforts with Metropolitan's Board of Directors and member agencies, and designing the region-wide messages for the general public and various target audiences. Important constituencies are residential users, industrial and institutional users, business interests, agricultural users, elected officials, officials of various agencies such as the Department of Water Resources, and the media.

INTEGRATED RESOURCES MANAGEMENT

Throughout the Integrated Resources Planning process and the development of the WSDM Plan, extensive analysis of resource management strategies focused on maximizing supply reliability while minimizing overall resource costs. Various management strategies were analyzed trader shortage scenarios based on historical hydrologic data. The WSDM Plan presents a resource management framework to guide Metropolitan's integrated approach to supply management.

The resource management framework does not dictate a scripted response to shortage or surplus. The framework recognizes the complexity and variety of conditions that require action. Supporting this framework are general rules that describe the actions to be taken in each stage of surplus or shortage. These rules depend on shortage stage, account for monthly delivery requirements, and depend on when various supplies would be available.

One of the fundamental trade-offs in dealing with supply shortages is the need to maintain flexibility while providing supply certainty to member agencies and consumers. A central focus of the WSDM Plan is the analysis of information about supplies and demands. When do various pieces of information about the supply/demand balance become more certain? When should this information impact policy-making and trigger various resource actions? The WSDM Plan addresses these questions and the actual implementation of the Plan during a shortage.

Appendix A of this report provides a ten-year simulation of projected demands and supplies showing an example of how the region can maintain 100% reliability.

INTRODUCTION

The Metropolitan Water District of Southern California (Metropolitan) provides water to a service area covering approximately 5,200 square miles. Over 16.5 million people live within the service area, which supports a $500 billion economy. Metropolitan provides supplemental supplies to twenty-seven member agencies, both retail and wholesale agencies, who in turn provide water to over three hundred cities and local agencies providing supplies at the retail level. In recent years Metropolitan supplemental deliveries have accounted for about one-half to two-thirds of the region's total water demands. With supplies from its Colorado River Aqueduct (CRA) and the State Water Project (SWP), Metropolitan delivers water for municipal and industrial (M&I) uses, agricultural uses, and augmentation of local storage.

As part of the implementation of the regional Integrated Resources Plan (IRP), Metropolitan and its member agencies have developed the Water Surplus and Drought Management (WSDM) Plan for Southern California. This ten-year plan will direct Metropolitan's resource operations to help attain the region's 100% reliability goal. Over this ten-year period, the WSDM Plan will be updated to account for changes impacting supplies from the Colorado River and California's Bay-Delta. In the past, Metropolitan has developed drought management plans that simply addressed shortage actions and primarily focused on issues of short-term conservation and allocation of imported water. The WSDM Plan recognizes the interdependence of surplus and shortage actions and is a coordinated plan that utilizes all available resources to maximize supply reliability. The overall goal of the WSDM Plan is to ensure that shortage allocation of Metropolitan's imported water supplies is no---At required.

Because it addresses both surplus and shortage contingencies, the WSDM Plans draws clear distinctions among the terms *surplus, shortage, severe shortage,* and *extreme shortage.*

Surplus*: Supplies are sufficient to allow Metropolitan to meet Full Service demands, make deliveries to all interruptible programs (replenishment, long-term seasonal storage, and agricultural deliveries), and deliver water to regional and local facilities for storage.*

Shortage*: Supplies are sufficient to allow Metropolitan to meet Full Service demands and make partial or full deliveries to interruptible programs, sometimes using stored water and voluntary water transfers.*

Severe Shortage*: Supplies are insufficient and Metropolitan is required to make withdrawals from storage, call on its water transfers, and possibly call for extraordinary drought conservation and reduce deliveries under the IAWP.*

Extreme Shortage*: Supplies are insufficient and Metropolitan is required to allocate available imported supplies.*

WSDM PRINCIPLES AND IMPLEMENTATION GOALS

The central effort in developing the WSDM Plan was a participatory process involving Metropolitan and its member agencies. Metropolitan staff and member agency representatives coordinated the Plan's development during a series of meetings of the Rate Refinement Team and the Integrated Resources Planning Workgroup. To lay a foundation for the WSDM Plan, participants in the Rate Refinement Process developed a set of "WSDM Principles and Implementation Goals."

Guiding Principle

- Metropolitan will encourage storage of water during periods of surplus and work jointly with its Member Agencies to minimize the impacts of water shortages on the region's retail consumers and economy during periods of shortage.

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  Considerations to create an equitable allocation of imported water may include:
  - Impact on retail consumers and economy
  - Reclamation/Recycling
  - Conservation
  - Population and economic growth
  - Investment in local resources
  - Change and/or loss of local supply
  - Participation in Metropolitan's Non-firm (interruptible) programs
  - Investment in Metropolitan's facilities.

- Encourage storage of surplus supplies to mitigate shortages and improve water quality

REGIONAL RESOURCES AND DEMANDS

Southern California receives its water supplies from a variety of different sources, both local to the region and imported from outside the region. These sources are summarized below.

Local Supplies

Local supplies include groundwater pumping of local aquifers, surface reservoir production, recycled water, and supplies imported through wheeling arrangements or through the Los Angeles Aqueduct, which is owned and operated by the City of Los Angeles. Local supplies have, in the past, provided as much as 2.1 million acre-feet (maf) of water to meet the region's water demands. By far the largest component of local supplies is groundwater pumping, providing over 75% of historical local supplies.

Colorado River Supplies

The distribution and management of Colorado River water is governed by a complex body of laws, court decrees, compacts, agreements, regulations, and an international treaty collectively known as the "Law of the River." Metropolitan's entitlement is established by the fourth and fifth priorities of California's Seven Party Agreement, included in Metropolitan's 1931 and 1946 contracts with the Secretary of the Interior. These priorities provide 550,000 acre-feet (af) per year and 662,000 af per year, respectively. In addition, Metropolitan holds a surplus water contract for delivery of 180,000 af. The physical capacity of the CRA is slightly in excess of 1.3 maf per year, based on a pumping capacity of 1,800 cubic feet per second (cfs). Metropolitan's long-held objective is to maximize the availability of Colorado River water, up to the maximum capacity of the CRA, subject to environmental, contractual, legal, political, financial, and institutional constraints. A California 4.4 Plan is being developed among California parties that will help ensure that full CRA deliveries are maintained, while addressing the concerns of the other Colorado River basin states that rely on the river. The California 4.4 Plan includes core transfers (such as the IID/MWD conservation agreement and the proposed IID/SDCWA transfer), system conservation (such as the lining of the All American Canal), offstream storage (such as the Arizona groundwater storage program), dry year option transfers (such as PVID land fallowing), and river re-operations.

State Water Project

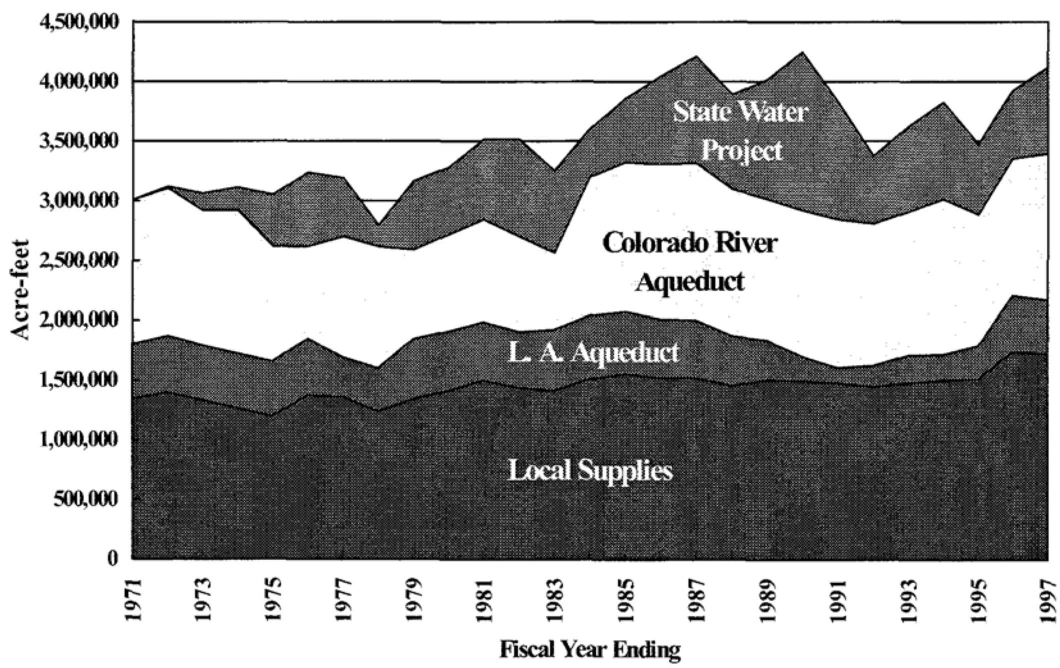
Metropolitan is one of 29 water agencies that have contracted with the State of California, through the Department of Water Resources (DWR), for water deliveries from the SWP system. Metropolitan's contracted entitlement is for 2.01 maf per year, or about 48 percent of the total contracted entitlement of 4.2 maf per year. SWP deliveries to Metropolitan are made via the SWP's California Aqueduct.

Initial SWP facilities, completed in the early 1970's, have produced average supply yields adequate to meet just over half of the total contracted entitlement. While it was intended that additional SWP facilities would be constructed as SWP contractor demands increased up to their contracted entitlements, few facilities have been constructed since that time.

The SWP obtains its supplies primarily from the Sacramento River Basin. About half of the total supply diverted from the Delta for the SWP is regulated flow from the Feather River (a tributary to the Sacramento River), while the other half is unregulated flow from runoff downstream of Sacramento River reservoirs and from other rivers that flow into the Delta. The Sacramento River watershed is subject to wide annual variations in total runoff. The Sacramento River Index (SRI), which measures runoff in the watershed, has averaged about 18 maf per year over the last 90 years. However, runoff varies widely from year to year. For example, the SRI measured 7.8 mafin 1994 and 32.5 mafin 1995.

Figure 1 shows the historical total regional supply production by type. As shown in Figure 1, water supplies were as high as 4.25 mafin 1990 and within two years dropped to 3.4 mar, a 20% decrease.

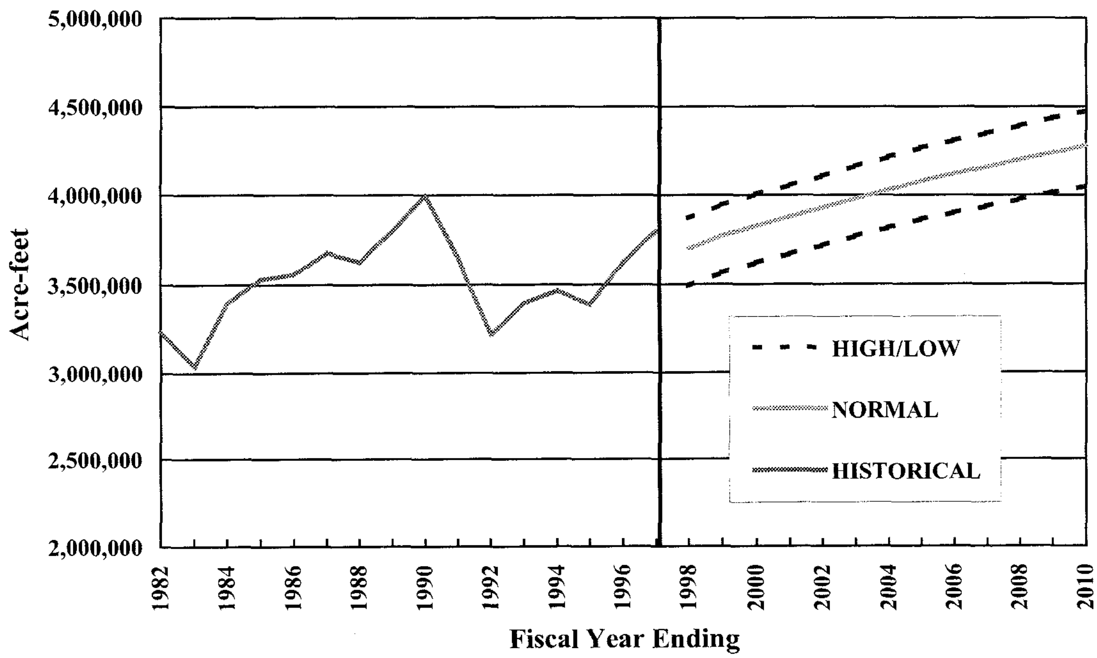
Figure 1. Historical Supply Production by Type of Supply



RETAIL DEMANDS

From 1982 through 1995, the region experienced retail water demands averaging 3.5 mar. In dry years retail demands are approximately 5 to 7% greater than normal years, while demands in wet years are about 6 to 8% below normal demands. Under normal weather conditions, assuming full implementation of conservation best management practices, total regional retail demands are projected to increase from about 3.7 mar in 1997 to almost 4.3 mar in 2010. Without conservation, demands in 2010 would be about 10 to 12% greater than projected. Increases in retail demand are driven by demographics and economics, including changes in population, housing, employment, and income. Figure 2 shows the historical and projected retail demands in Metropolitan's service area.

Figure 2. Regional Retail Water Demands



The historical variability in demands from 1982 to 1997 is mainly due to weather and the economy. In 1983, extreme wet weather caused a significant drop in retail demands. During the period from 1985 to 1990, hot and dry weather coupled with a strong economy resulted in increased demand from 3.5 maf to 4.0 maf, a 14% increase. In 1991, the 5th year of a prolonged drought, conditions forced many communities to implement mandatory supply reductions. These mandatory reductions coupled with extraordinary drought conservation caused a 10 to 15% decrease in retail demands for the region. In addition, the period between 1992 and 1995 was very wet (with the exception of 1994, which was dry), and was a period of severe economic recession. Southern California alone lost some 700,000 jobs from 1990 through 1995. The combination of wet weather, economic recession, and conservation resulted in demands decreasing by over 17%.

DEMANDS ON METROPOLITAN

For many member agencies, Metropolitan's water deliveries represent a supplemental supply. Most member agencies have local water supplies, but agencies differ in how much their supplies alone can meet their respective retail demands. Local supplies are often base-loaded (maximized subject to various constraints) and purchases from Metropolitan are used to meet remaining demands. In addition, to meeting consumptive demands, Metropolitan's deliveries are used to replenish local groundwater and surface reservoirs. To project demands on Metropolitan, projections of member agency's retail water demands and local water supplies are made. Local supplies are then subtracted from retail demands to get consumptive demands on Metropolitan. A projection of Metropolitan's long-term seasonal and replenishment deliveries are made based on safe groundwater yield and weather/hydrology.

Metropolitan forecasts its demands for three different broad categories: Full Service, Seasonal (reservoir storage and groundwater replenishment delivered for shift or long-term storage purposes and sold at a discount), and Agricultural (deliveries of water sold at a discount for agricultural use). Overall, demands on Metropolitan can vary -+ 11 to 18% from normal conditions due to weather and hydrology.

The following four figures show historical and projected demands on Metropolitan by category. Figure 3 shows Basic Water Deliveries, Figure 4 shows Seasonal Water Deliveries, Figure 5 shows Interim Agricultural Water Program (IAWP) Deliveries, and Figure 6 shows Total Water Deliveries for Metropolitan.

Figure 3. MWD Basic Water Deliveries

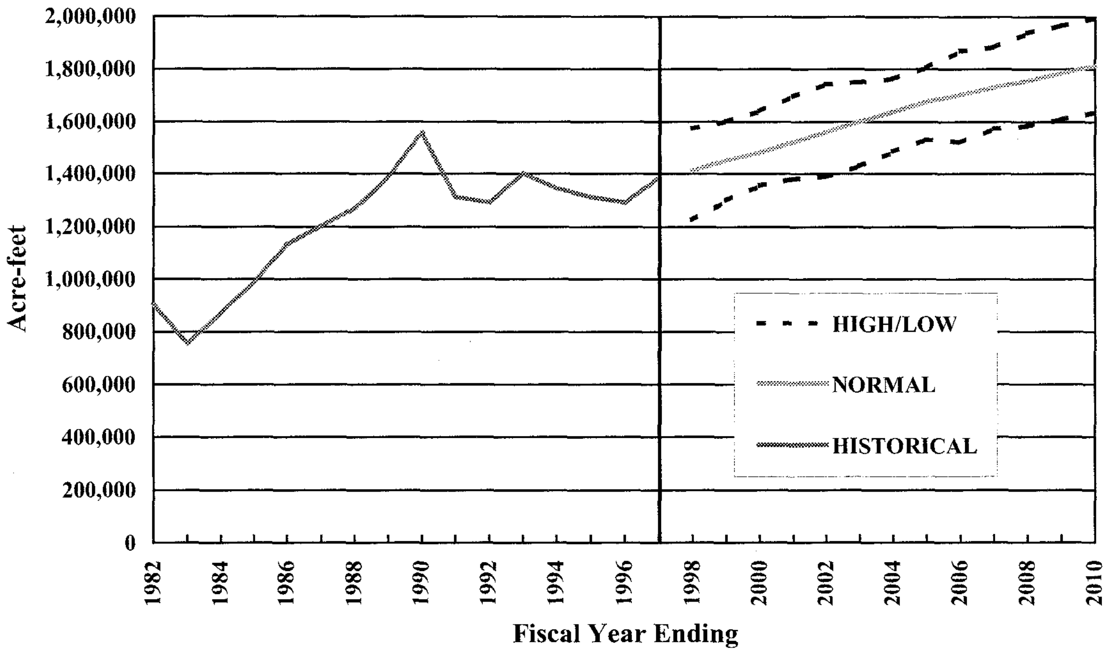


Figure 4. MWD Seasonal Water Deliveries

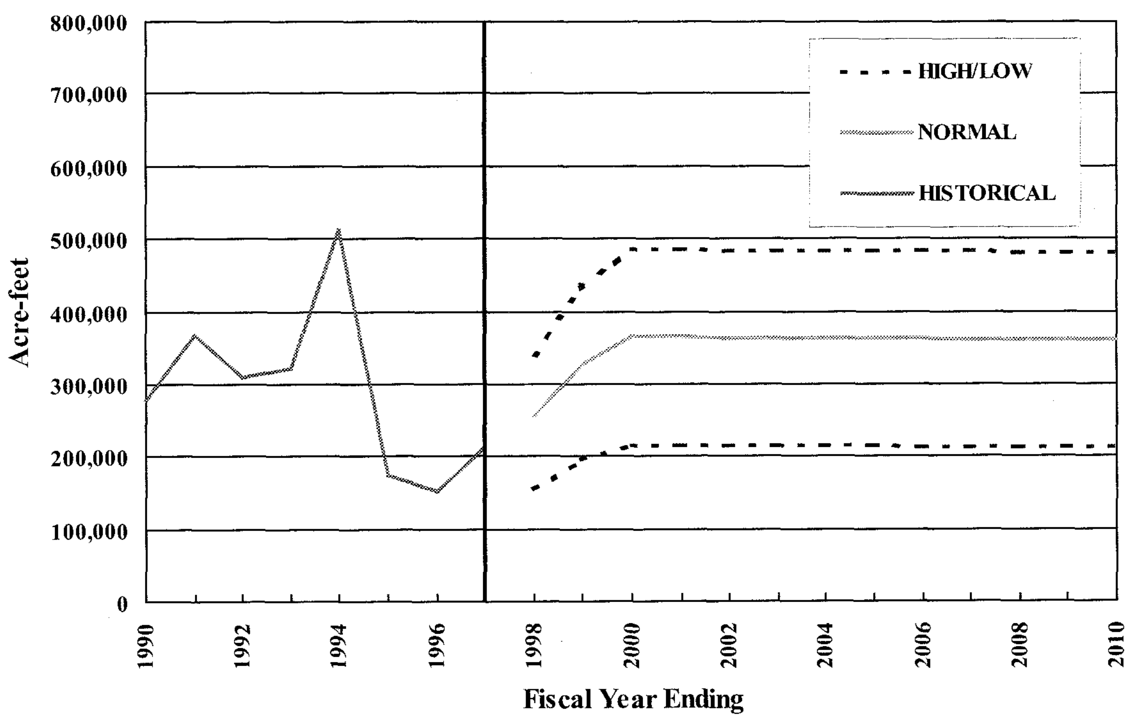


Figure 5. MWD Interim Agricultural Water Program (IAWP) Deliveries

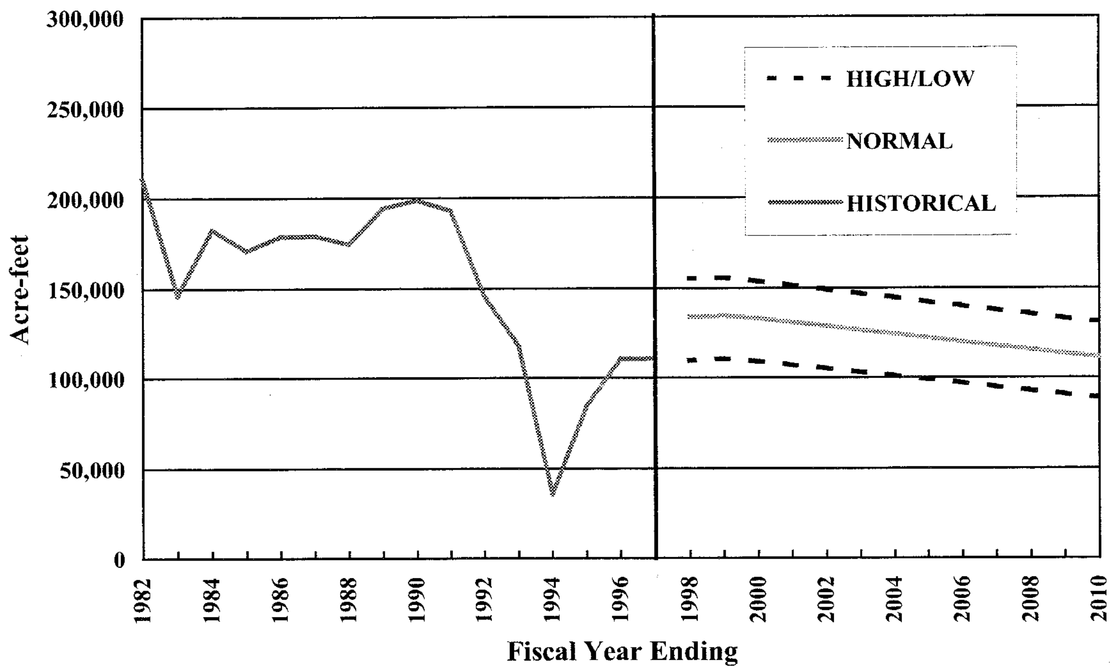
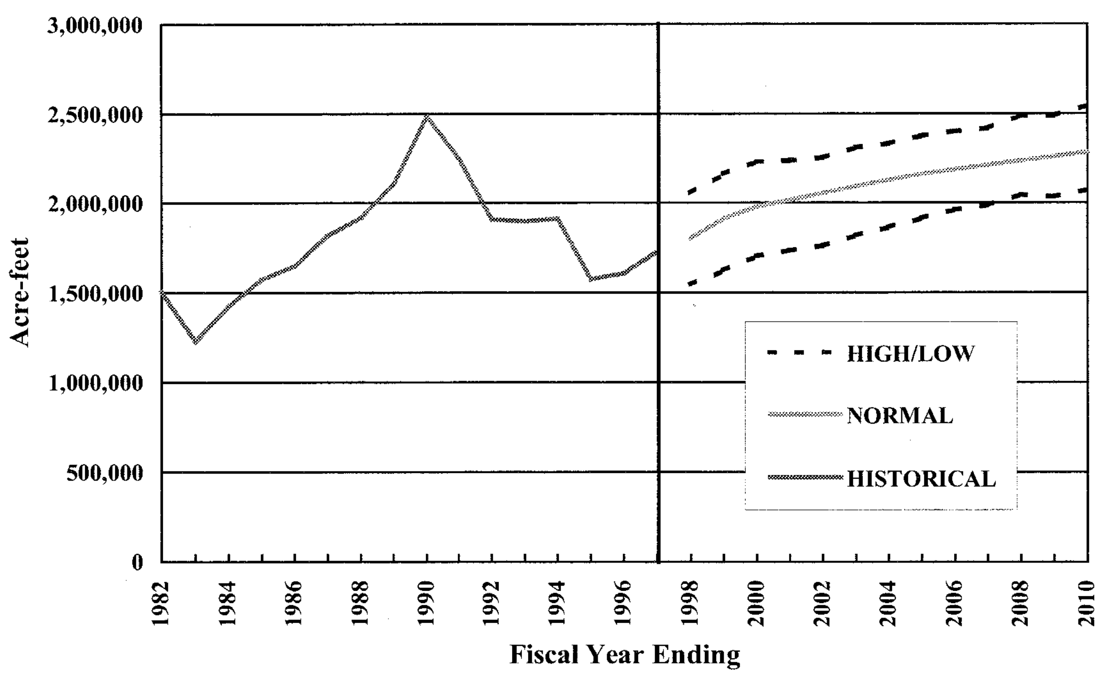


Figure 6. MWD Total Water Deliveries



INTEGRATED RESOURCES PLANNING

To ensure supply reliability under various drought conditions, Metropolitan and its member agencies developed an Integrated Resources Plan (IRP). The IRP, adopted by Metropolitan's Board of Directors in January 1996 and periodically updated, guides Metropolitan's resource and capital improvements investments. The region's ability to develop a long-term WSDM Plan results from the significant investments Metropolitan and its member agencies have made in resources since 1991. To date, these investments include:

- Local supplies: Metropolitan co-funded over 23 local projects and 200 conservation programs that will yield a total of 160,000 af per year.

- **Colorado River Aqueduct:** Metropolitan developed transfers and storage programs to help ensure a full aqueduct. The landmark Metropolitan/Imperial Irrigation District Conservation Program (IID), will result in a savings of 107,000 af per year. Storage programs in Arizona and California, combined with the IID savings, yield a total of 280,000 af of annual core, dry year options, and storage supply.

- **State Water Project:** Metropolitan and other parties negotiated the Bay-Delta Accord and the Monterey Amendment. The Bay-Delta Accord and subsequent efforts will increase the reliability of Metropolitan's entitlement deliveries. The Monterey Amendment provides access to 220,000 af of SWP storage.

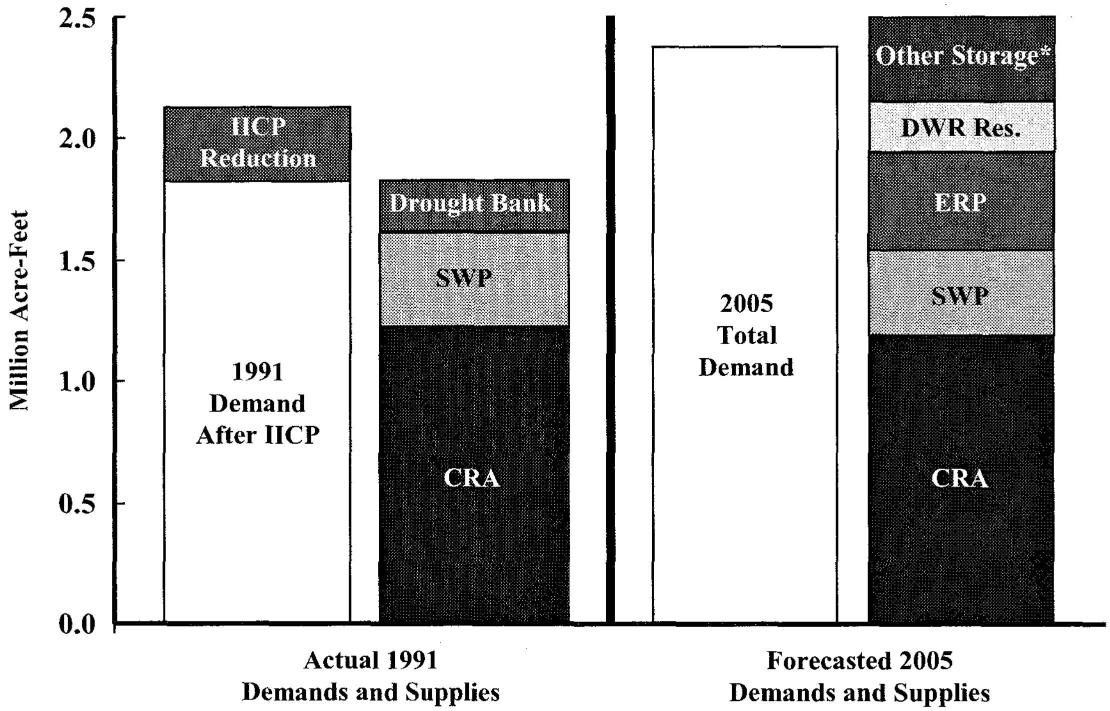
- **In-Basin Storage:** Metropolitan is constructing the Eastside Reservoir Project, with 800,000 af of storage (400,000 af of which is emergency storage for use in case of facility failure as a result of earthquake or other event).

- **Groundwater Conjunctive Use Storage:** Metropolitan developed a conjunctive use storage program in the North Las Posas Basin in Ventura County with an anticipated capacity of 210,000 af and a dry-year withdrawal rate of up to 70,000 af.

- **Transfers and Storage:** Metropolitan developed the Semitropic Storage Program, with 350,000 af of storage and dry-year withdrawals averaging about 60,000 af. Metropolitan also approved the Arvin-Edison Storage and Transfer Program, with 250,000 af of storage and dry-year withdrawals averaging about 70,000 af. Metropolitan is also exploring storage and transfer programs with the Coachella Valley Water District and the Cadiz Land Company.

As a result of these investments, it is anticipated that Metropolitan and its member agencies will be 100% reliable over the next 10 years even under a repeat of the 1991 drought condition. Figure 7 compares actual Metropolitan demands and supplies during 1991 (the last year in a multiyear severe drought) and projected demands and supplies in year 2005 (assuming a repeat of 1991 conditions). In 1991, the region faced shortages that required Metropolitan to allocate water under the Incremental Interruption and Conservation Plan (IICP). The reduction in deliveries came after demands had already been reduced as a result of local conservation. In addition, water had to be purchased from the Governor's drought emergency water bank. By the year 2005 with the investments made to date, Metropolitan's additional water supplies will be more than adequate to meet demands under a repeat of the 1991 drought event--even with increased demands due to growth.

Figure 7. Historical and Projected Metropolitan Supplies and Demands Under Drought Conditions



* Groundwater management, Semitropic Storage Program, and Arvin-Edison Storage Program

SURPLUS AND SHORTAGE RESOURCE ACTIONS

Metropolitan's investments in water resources, facilities, and programs has transformed it from an agency with relatively modest storage capacity to one that will have storage sufficient to manage many shortages without negative impacts to its member agencies or retail customers. To attain this level of reliability, storage programs and facilities, along with conservation, recycling, and other programs, must be managed as an integrated set of regional resources. To accomplish this, the WSDM Plan recognizes the linkage between surplus and shortage resource management actions.

SURPLUS ACTIONS

The combination of Metropolitan's regional storage facilities, such as Lake Mathews, Lake Skinner, the future Eastside Reservoir Project, and the storage capacity available to Metropolitan in Castaic Lake and Lake Perris as a result of the Monterey Amendment, allows Metropolitan great flexibility in managing its water resources. The development of storage programs both outside and within the service area provides even greater flexibility in storing surplus water. Each of the storage facilities and programs plays an important role in achieving Metropolitan's reliability goal.

When imported supplies exceed projected demands for imported water within Metropolitan's service area, Metropolitan can operate storage facilities to maximize stored water to benefit its member agencies. A number of factors affect Metropolitan's ability to divert surplus water into storage. Some of these factors include facility outages, system capacity, water quality (including requirements for managing total dissolved solids), and varying supply and demand patterns. This section provides a description of storage options available to Metropolitan and a framework for storing water in these programs and facilities when surplus supplies are available.

Storage of Colorado River Supplies

Metropolitan has participated in a number of programs to maximize the reliability of supplies from the Colorado River. The landmark Metropolitan/Imperial Irrigation District Conservation Program will result in a savings of 107,000 af per year. These supplies will increase the reliability of Metropolitan's entitlement of Colorado River water. Other programs yield shortage benefits by increasing amounts of water stored for use during shortages. Between August 1992 and July 1994, Metropolitan and the Palo Verde Irrigation District conducted a Test Land Fallowing Program. Approximately 20,000 acres of farmland in the Palo Verde Valley were not irrigated, saving 186,000 af of water which was stored in Lake Mead for later use by Metropolitan. With Arizona and Nevada water agencies, Metropolitan is participating in a Central Arizona Groundwater Storage Demonstration Program that has encouraged the storage of water. To date, 139,000 af of supplies have been stored in groundwater basins in Central Arizona. The Desert Coachella program is an exchange and storage program with agencies situated along the Colorado River Aqueduct. Metropolitan releases Colorado River water for storage in the Coachella Groundwater Basin. Metropolitan then exchanges these supplies for the participating agencies' SWP supplies. These programs serve as models for future programs that could increase the reliability of Colorado River supplies. Metropolitan continues to explore other possible options that would increase the reliability of supplies. The California 4.4 Plan is being developed among California parties to increase storage programs for Colorado River supplies. In addition to core transfers and conservation programs, the California 4.4 Plan includes offstream storage (such as the Arizona groundwater storage program), dry year option transfers (such as PVID land fallowing), and river re-operations. These programs, in conjunction with favorable supply determinations by the Secretary of Interior, will ensure the highest possible reliability of Colorado River supplies.

In addition to the programs mentioned above, the Colorado River system itself contributes to the high reliability of Metropolitan's Colorado River supplies. Currently, the average Colorado River runoff exceeds basin-wide demands by over 1.0 maf per year. The Colorado River system also contains a great deal of reservoir storage capacity. The total storage capacity in the Colorado River Basin is approximately 60 maf, almost four times the Colorado River's average annual flow. For much of 1997, system storage levels were at 80% or more of total capacity. These factors allow the Bureau of Reclamation, operators of the Colorado River system, to store significant supplies for use during shortages.

Storage of State Water Project Supplies

Total storage capacity is a critical factor in comparing the operations of the Colorado River system with the SWP. On average, both systems have similar amounts of water available on an annual basis. The SWP's watersheds in the Sacramento River Basin have produced about 18 maf per year over the long term, as represented by the Sacramento River Index (SRI.) Long-term runoff on the Colorado River has averaged more than 16 maf annually since 1906. However, the ability to carry over unused water from a wet year for use in a dry year differs substantially between the two systems. State Water Project storage facilities have storage capacity of about 4.5 maf, while system storage in the Colorado River Basin totals nearly 60 maf. This gives the operators of the Colorado River reservoirs much more flexibility in storing unused water from a wet year for use in a subsequent dry year.

When water from the SWP cannot be put to immediate use in Metropolitan's service area, the water may be stored for future use. Provided storage capacity is available, the water may remain in either Oroville Reservoir (as SWP storage for delivery to all contractors the following year) or San Luis Reservoir (as carryover storage assigned to Metropolitan). Through the carryover storage program, as amended by the Monterey Amendment, Metropolitan can place a maximum of 200,000 af per year of allocated supplies in SWP surface reservoirs. The program also allows for carryover storage in non-project facilities, including surface reservoirs and groundwater basins. In the case of carryover storage in San Luis Reservoir, SWP supplies allocated to but unused by a contractor may, under certain conditions, be assigned as carryover if storage capacity is available at the end of the calendar year. However, carryover water stored for a contractor has lower priority than storage of SWP water and consequently "spills" first as San Luis Reservoir fills.

Also, in a wet year such as 1995, low demands may allow DWR to operate San Luis Reservoir nearly full, eliminating any possibility of contractor carryover storage into the following year. As a result, carryover storage on the SWP may not be possible, and even when possible, is subject to spilling.

Due to these carryover storage limitations, Metropolitan has invested a great deal to expand its ability to store surplus SWP supplies. Metropolitan has entered into a number of water transfer and storage agreements. The Semitropic Water Banking and Exchange program allows Metropolitan to store up to 350,000 afin the groundwater basin underlying the Semitropic Water Storage District. The storage and withdrawal capacities of the program are shared with other participants in the storage program, with Metropolitan's share equaling 35%. Dry-year withdrawals will average about 60,000 af.

Metropolitan and the Arvin-Edison Water Storage District have developed a program that allows Metropolitan to store water in the groundwater basin in the Arvin-Edison service area. The program would allow the storage and withdrawal of 250,000 af of supplies over the next 25430 years. Dry-year withdrawals will average about 70,000 af.

Storage in Regional Facilities

In addition to the storage of Colorado River and SWP supplies outside the region, Metropolitan has established a number of programs for storing supplies within the region. Metropolitan owns and operates two main surface reservoirs, Lake Mathews and Lake Skinner, which have a combined storage of about 226,000 af. Only a small portion of this capacity is available for shortages, with the balance being used to regulate flows in Metr0Politan's delivery system. The Eastside Reservoir Project, currently under construction, will have a total capacity of 800,000 af, with approximately 400,000 af of operational drought and seasonal storage and 400,000 af of emergency storage. Through the Monterey Amendment, Metropolitan obtained the fight to use up to 220,000 af of water stored in the SWP terminal reservoirs. However, withdrawals from these terminal reservoirs must be replaced within five years.

Metropolitan and its member agencies have established the cyclic storage program to increase storage in groundwater basins within the service area. Regional groundwater basins offer an economical way for Metropolitan to improve supply reliability by storing water within the service area. This makes water readily accessible in times of need, either in emergency situations or during shortages. Some limitations are imposed by the fact that such water can generally only be used through pumping from the groundwater basin by an overlying member agency or local agency. Storage in groundwater basins takes place either by direct replenishment (spreading or injection), or through in-lieu means. Spreading (or injection) is desirable because direct measurement of the amount of stored water is a relatively simple, verifiable transaction. The main disadvantage to direct spreading is that spreading can occur only under certain conditions. For example, spreading cannot occur when spreading facilities are being used to capture local storm runoff for flood control purposes, or when the amount of local runoff precludes the need for imported water to replenish the basins. Also, spreading basins require frequent maintenance to assure maximum efficiency. These and other conditions can limit the ability to deliver water for spreading at a time when surplus supplies are available.

In-lieu replenishment allows most member agencies to participate in groundwater replenishment without needing direct access to replenishment facilities. Their wells, in effect, become their replenishment facilities. Both direct and in-lieu replenishment from 1986 through 1990 served the region well during the critical drought years from 1991 through 1993.

The overall objective of the various storage programs is to maximize the availability of imported water during times of need by storing surplus water in a strategic manner and utilizing the storage available within the region. Many factors affect the availability of storage capacity and Metropolitan's ability to move water to and from various facilities. After reviewing the full range of shortage actions available to Metropolitan, a framework for prioritizing the full range of surplus and shortage actions will be presented.

In addition to pricing incentives used to encourage local agencies to store water in groundwater basins, Metropolitan has developed a conjunctive use contractual storage program with the Calleguas MWD in the North Las Posas Basin. Metropolitan will fund the construction of wells which will be called upon to meet demands during dry years. This program will yield a dry year supply of about 70,000 af.

SHORTAGE ACTIONS

Except in severe or extreme shortages or emergencies, Metropolitan's management of available resources will allow shortages to be mitigated without negatively impacting retail M&I demands. Below is a list of drought actions that will be taken during periods of shortage. The goal of these actions is to avoid, to the extent practicable, the allocation of Metropolitan's firm supplies. The order in which these actions are presented does not imply the exact operational management of resources that would occur. In fact, several actions are likely to be taken concurrently. Many factors dictate the particular order in which actions will be taken during an actual shortage, although it is clear that the last action will be the curtailment of firm deliveries to the member agencies.

- Draw on storage in the Eastside Reservoir Project
- Draw on out-of-region storage in Semitropic and Arvin-Edison
- Reduce/suspend long-term seasonal and groundwater replenishment deliveries
- Draw on contractual groundwater storage programs in the region
- Draw on SWP terminal reservoir storage (per Monterey Agreement)
- Call for extraordinary drought conservation and public education
- Reduce IAWP deliveries
- Call on water transfer options contracts
- Purchase transfers on the spot market
- Implement an allocation of Metropolitan's imported supplies to its member agencies

Even with dedicated programs to meet the reliability goal for the region, proper management and operations of these resources is critical to ensure reliability. The prioritization of both surplus and shortage actions need to account for several important criteria. It is also important to recognize that these criteria will need to be balanced. The criteria include:

Location: Out-of-region storage is more vulnerable than in-basin-storage due to the risks of seismic events. To only maximize out-of-region storage will put reliability at risk.

Take capacity: Surface reservoirs generally have the ability to be filled and drawn down very quickly. Certain groundwater storage programs have limited take capacities--requiring several years at full take capacity to withdraw **all** available storage. Stored water will be balanced so that dry year supplies are maximized.

Cost: Programs vary with respect to their marginal operating costs. Program actions will be taken to maximize supply reliability while minimizing cost.

Flexibility: Not all storage programs and transfers offer the same flexibility to Metropolitan. Some programs can only meet specific overlying demands, while others can meet demands anywhere in the system.

DESCRIPTIONS OF RESOURCE ACTIONS

Draw on storage in the Eastside Reservoir Project: Withdrawals from the Eastside Reservoir Project would provide a flexible supply for meeting a shortage. Eastside Reservoir Project supplies can be drawn upon quickly. The amount of water drawn from the Eastside Reservoir Project before exercising other shortage actions will depend on the severity of the shortage and the overall condition of other resources available to Metropolitan.

Draw on out-of-region storage in Semitropic and Arvin-Edison programs: Out-of-region programs such as Semitropic and Arvin-Edison provide cost-effective shortage supplies. These supplies also provide flexibility, as they can be distributed as effectively as any SWP supplies coming into Metropolitan's service area. Exercising these programs relatively early in the order of actions reduces the risk of leaving supplies out-of-region. Based upon the ratio of storage capacity to take capacity, these programs will generally provide supplies over several years. This provides the rationale for calling on these programs relatively early in a shortage.

Reduce Long-Term Seasonal and Replenishment Deliveries, and call on cyclic storage accounts: Certain interruptible supply programs provide benefits during shortage. Reducing deliveries to interruptible programs established for storage purposes, while continuing expected levels of groundwater production, allows limited supplies to go toward meeting direct consumptive uses. In addition, calling on cyclic storage accounts can extend the replenishment needs for several years. Most replenishment supplies would be expected to be interruptible for a minimum of two years before agencies would be allowed to claim a local supply adjustment on such supplies. Some programs have longer interruption requirements. For example, most Groundwater Recovery Programs are governed by contracts that require supply production through a three-year interruption in service.

Draw on contractual groundwater storage programs: In-region contractual groundwater programs provide cost-effective supplies that would be drawn upon during shortages. These programs are also limited by their take capacities and generally have several years of withdrawals in storage. For this reason, these programs might be called upon before withdrawing heavily from surface reservoir storage.

Draw on SWP terminal reservoir storage: The storage available in the SWP terminal reservoirs provides a flexible and cost-effective shortage supply. Supplies withdrawn from this program must be replaced within five years of withdrawal. For this reason, the storage in these reservoirs would be reserved for more serious shortage conditions and would be utilized after the programs and facilities listed above were used to meet the shortage.

Call for extraordinary drought conservation: Voluntary conservation programs have historically been effective in reducing water demand during drought. However, voluntary conservation programs are not without impact to the retail customer and can be perceived as a failure of water agencies to properly plan for shortages. Therefore, the call for extraordinary drought conservation will only be taken with the consent of Metropolitan's Board of Directors.

Reduce agricultural deliveries: The Interim Agricultural Water Program (IAWP) offers interruptible water to southern California's agricultural industry at discounted rates. These supplies will be interrupted as part of Metropolitan's shortage actions. Metropolitan will work with IAWP participants to provide as much advance warning of interruption as possible. The IAWP reflects current policies toward agricultural water users. The policies underlying this program are due to be reviewed during the ten-year period of the WSDM Plan. The WSDM Plan will be changed accordingly.

Call on water transfer option contracts: Transfer options programs provide cost-effective supplies when the region is faced with reducing deliveries to meet consumptive demands. These programs might also be used to increase storage levels in Metropolitan storage facilities. Replenishment of these facilities reduces the risk of leaving available supplies outside the region and helps to protect the region during extended shortages.

Purchase transfers on the spot market: During the 1987-92 drought, the Drought Water Bank proved to be one mechanism for California to reduce the overall impacts of the shortage. However, the cost of spot market supplies may cause Metropolitan to use them as a last increment of supply before the region implements reductions in M&I deliveries. It is likewise possible that availability and cost will make spot market options more favorable under certain conditions. If this occurs then spot market supplies will be sought prior to calls on option transfers. However, participation in the spot market may be restricted to those agencies that have already taken significant actions in response to the shortage.

Implement allocation plan: As the final stage in responding to shortages, Metropolitan will implement an allocation plan to deliver reduced supplies to its member agencies. The issues of allocation and the methods of allocation are outlined in the following section.

ALLOCATION OF SUPPLY FOR M&I DEMANDS

The equitable allocation of supplies is addressed by the Implementation Goals established for the WSDM Plan, with the first goal being to "avoid mandatory import water allocations to the extent practicable." The second fundamental goal is to "equitably allocate imported water on the basis of agencies' needs." Factors for consideration in establishing the equitable allocation include retail and economic impacts, recycled water production, conservation levels, growth, local supply production, and participation and investment in Metropolitan's system and programs. In the event of an extreme shortage an allocation plan will be adopted in accordance with the principles of the WSDM Plan.

INTEGRATED RESOURCE MANAGEMENT STRATEGY

Throughout the Integrated Resources Planning process and the development of the WSDM Plan, extensive analysis of resource management strategies focused on maximizing supply reliability while minimizing overall resource costs. Various management strategies were analyzed under shortage scenarios based on historical hydrologic data. Certain strategies yield high reliability but incur very high costs. This is the case for strategies that utilize relatively costly transfer programs early in a shortage while maintaining high storage levels. If a shortage is short, this results in high transfer costs and shortage storage programs that are not fully utilized. Other strategies draw more heavily on storage early in a shortage and do not use options transfer programs. Later in a shortage, the yields from these transfer programs, combined with low yields from depleted storage facilities, might not make up for continuing or deepening shortages. Overall, such approaches may be inexpensive to pursue at the wholesale level but have high costs associated with retail level impacts. The resource management framework presented results from extensive analysis of various strategies for managing available resources under a variety of surplus and shortage conditions. Although the extent to which various actions are exercised may still vary depending on specific shortage conditions, the ordering presented does reflect Metropolitan's anticipated order of actions during shortages.

RESOURCE MANAGEMENT FRAMEWORK

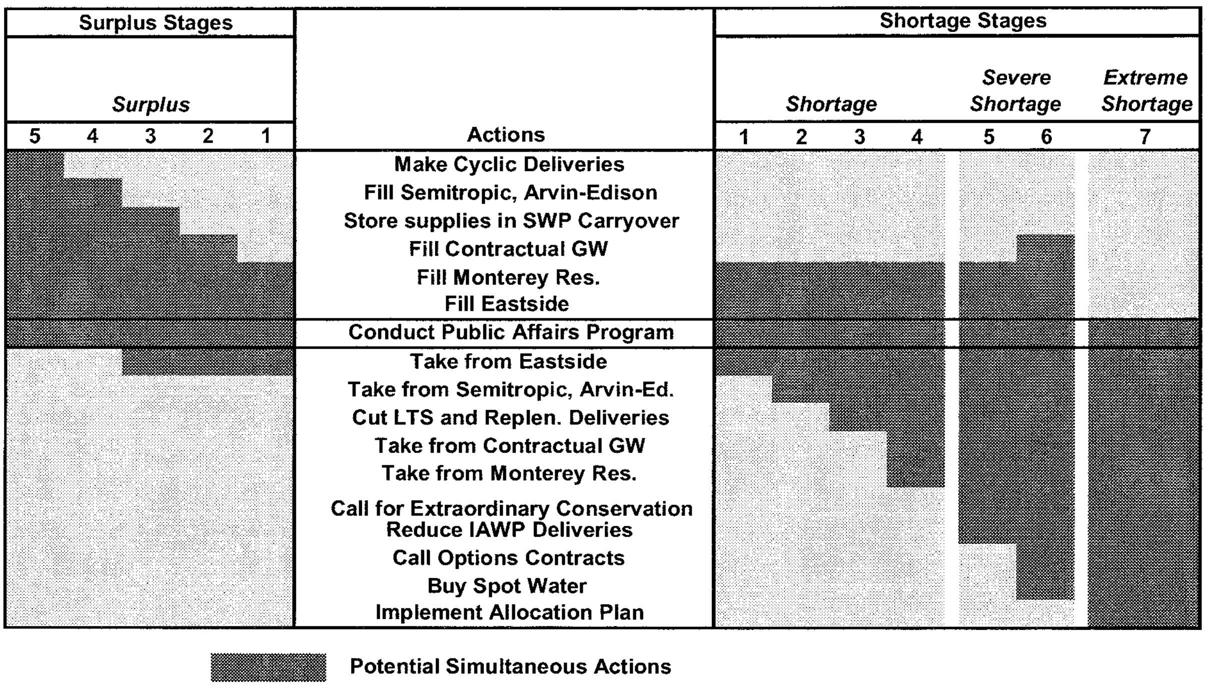
The analysis of surplus and shortage actions yields a water management framework that accounts for the degree or "stage" of surplus and shortage. These stages are defined by parameters such as storage levels and expected SWP supplies. Each stage has associated actions that could be taken as part of the response to prevailing shortage conditions. For example, Surplus Stage 1 might have as associated actions to place water in the highest-priority storage resources. Figure 8 shows the mapping between actions and stages. The darkly shaded diagonal area identifies actions that can be undertaken concurrently, while the lightly shaded areas show actions that will not be taken. For example, Metropolitan will not withdraw water from most storage resources during a surplus.

Figure 8 highlights several aspects of the WSDM Plan's approach to supply management. First and most importantly, it does not dictate a response to shortage or surplus. The framework recognizes the complexity and variety of conditions that could require various responses. Supporting this framework are general "rule curves" that dictate the extent to which particular actions are taken in various stages of surplus or shortage. For example, the rule curves indicate approximately how much water should be taken from the Eastside Reservoir Project before calling on supplies from the Semitropic or Arvin-Edison storage programs. If a shortage were greater than the desired initial withdrawal from the Eastside Reservoir Project, then Stage 2 actions would be taken. The rule curves for a particular resource would take into account shortage stage, monthly delivery requirements, and when various supplies are available.

Surplus and Shortage Stages are determined by the total amount of water that would be stored or produced by exercising the actions in that Stage. Overall storage levels in each stage are determined by the extent to which storage is increased or reduced by earlier actions. Therefore, each Stage is defined by supplies (stored or produced) and an approximate overall level of storage remaining in all resources. Up through Shortage Stage 4, the actions taken will not result in negative impacts to any consumptive uses. Shortage Stages 1 through 4 constitute shortage management without retail level impacts. The conservation efforts and reductions in IAWP deliveries in Shortage Stage 5 will result in retail impacts.

Action by the Metropolitan Board of Directors would be required before actions corresponding to Stages 5, 6, and 7.

Figure 8. Resource Stages and Actions Matrix



The Stages and Actions Matrix (Figure 8) is read from the center moving outward. Moving from the center to the left, are actions that Metropolitan will take during surplus conditions. For instance, in a Stage 3 Surplus, Metropolitan will be adding water to the Eastside Reservoir Project, the Monterey Reservoirs (if any water is due for repayment), Contractual Groundwater Programs, and carryover storage on the State Water Project. Moving from the center to the right are actions that Metropolitan will take during periods of shortage. For instance, in a Stage 3 Shortage, Metropolitan will be pulling water from the Eastside Reservoir Project, the Semitropic and Arvin Edison programs, and interrupting deliveries of Long-Term Seasonal and Replenishment program water. In addition, the Stages and Actions Matrix allows for surplus actions to be taken during shortages and vice versa, but these actions are strictly a result of prudent water management. For example, in a Stage 6 Shortage, Figure 8 shows Metropolitan potentially filling the Eastside Reservoir Project, the Monterey Reservoirs, and contractual groundwater programs while calling on spot transfers and buying spot water. Through these actions Metropolitan will be ensuring that water supply opportunities during a drought are realized--ultimately adding to the drought reserves of southern California.

Figure 8 also highlights the on-going efforts by Metropolitan and its member agencies in the conduct of public outreach and active conservation programs. Through all conditions, effective pubilc outreach and conservation programs are an integral part of Metropolitan's management of resources. In addition to ongoing conservation and water efficiency programs, Stage 5 of the Stages and Actions Matrix calls for participation of the citizens of southern California to take extraordinary conservation measures to cut water demand during droughts.

As with the listing of shortage actions earlier in the report, the Stages/Actions matrix in Figure 8 only highlights certain programs and response actions. However, unlike the discussion of actions earlier, Figure 8 is intended to convey Metropolitan's currently anticipated ordering for those actions listed. As the supply and demand outlooks, programs, and other factors continue to change, the analysis of the ordering of actions will continue during the ten-year period of the WSDM Plan.

SUPPLY CERTAINTY AND THE TIMING OF RESOURCE ACTIONS

One of the fundamental trade-offs in dealing with supply shortages is the need to maintain flexibility while providing supply certainty to member agencies and consumers. A central focus of the WSDM Plan is the analysis of information about supplies and demands. When do various pieces of information about the supply/demand balance become more certain? When should this information impact policy-making and trigger various resource actions? The WSDM Plan addresses these questions and the actual implementation of the Plan during a shortage.

Figure 9 shows a hypothetical shortage year. With respect to the supply and demand outlook, a typical shortage year will have periods of certainty and stability, and other periods of relative uncertainty and transition. Important supply components--such as the SWP, CRA, Los Angeles Aqueduct (LAA), and local supplies--are closely monitored through the early part of the year. These supplies and demands are fairly well-known through the April-September period. Storage is assessed in the post-summer period and decisions about certain programs, such as long-term (LT) seasonal deliveries could be made at this time.

Figure 9. Water Supply Outlook Throughout the Year

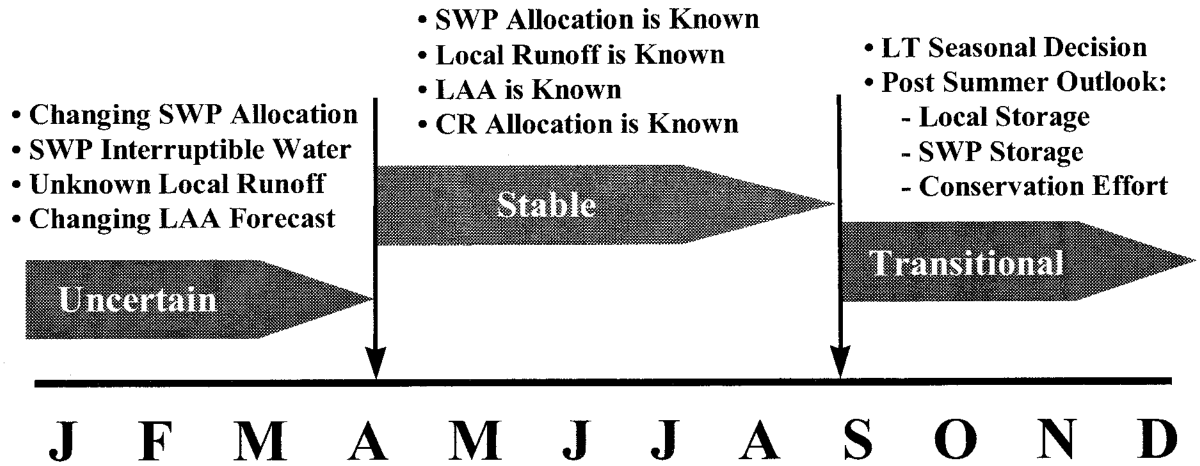
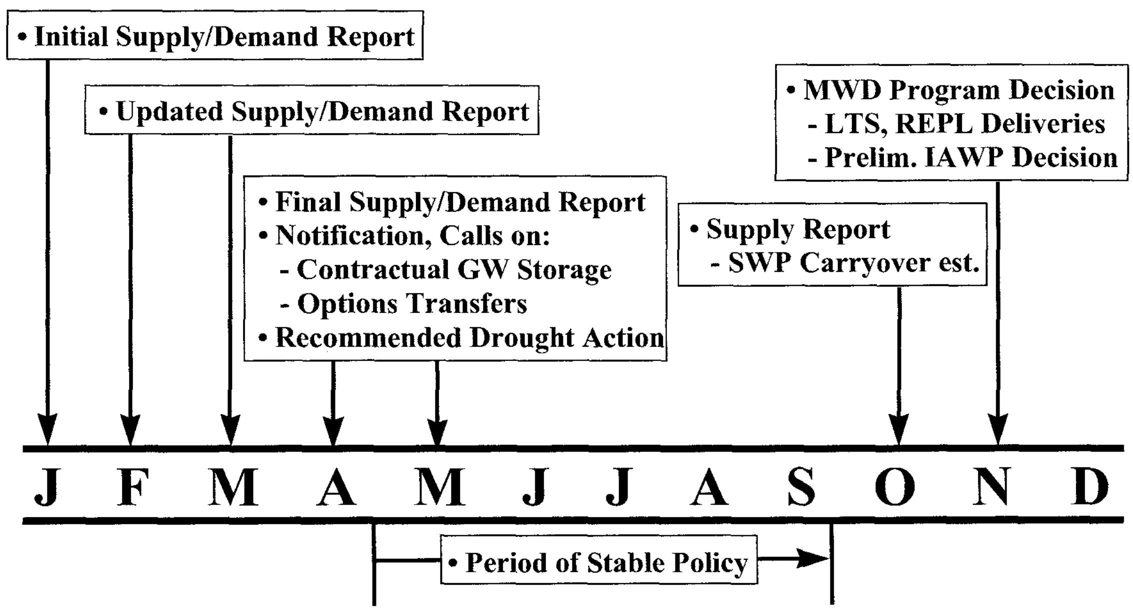


Figure 10 presents the annual schedule for actions taken in response to shortage conditions. Starting in January, an initial supply/demand report will be presented to the Metropolitan Board of Directors. SWP allocations are still only estimates in January and become more certain towards April and May. Demands for Metropolitan deliveries depend in part on how the winter hydrology develops and the condition of local supplies. These factors start to become known during the February-March period and will be reported to the Board in the Supply Report Update. By April-May, the outlook for imported supplies is known to a fairly high degree of certainty and a Final Supply Report will be produced. The May-September period will be one in which the import supply situation does not change drastically and drought policies can be implemented. Demands can be more or less than anticipated as a result of unusually hot or cool weather. At the end of summer, carryover SWP storage will be determined. October through December is a transitional period during which early assessments of available supplies for the following year will be made. During this period, Board actions would determine the management of various Metropolitan programs such as long-term seasonal (LTS) and IAWP deliveries. The following list presents major information and decision points during the year.

Month	Information/Action
January	Initial Supply/Demand Reports
February, March	Updated Supply/Demand Reports
April, May	Final Supply/Demand Report
	Notification on Contractual GW and Options Transfer Programs
	Recommended Drought Actions
May-September	Stable Policy Period
October	Supply and Carryover Storage Report
November	MWD Program Decisions - LT Seasonal, Replenishment, IAWP

Figure 10. One Year of a Hypothetical Shortage - Supply and Demand Reports and Response Actions



PUBLIC OUTREACH AND CONSERVATION

Mechanisms are already in place to implement most of the water management actions and programs that are addressed in the WSDM Plan. Under the majority of supply and demand conditions, the actions of Metropolitan's Board of Directors, the General Manager, the operational activities of Metropolitan, and its member agencies would constitute all actions necessary to mitigate the shortage. Several aspects of the WSDM Plan, however, require additional attention to the administration of programs and actions. In particular, a shortage contingency requires special programs in the areas of public and governmental affairs and conservation. Metropolitan maintains an on-going public information program to encourage efficient water use. Public outreach programs are conducted at all times under both surplus and shortage conditions (see Figure 8). The actions discussed in this section constitute special actions in times of shortage.

During shortage conditions, public outreach will play a critical role in shaping consumer response. Public information campaigns need to send clear signals if extraordinary drought conservation is to achieve needed reductions in demands. Given Metropolitan's diverse set of customers and the varying impacts that shortages can have on different consumer groups, an effective public information campaign will require a joint effort among Metropolitan and its member agencies. Under this Plan, the administration of the Public Information and Government Affairs programs will be the responsibility of a Drought Program Officer (DPO). The DPO will be responsible for integrating the various activities in these areas, coordinating efforts with Metropolitan's Board of Directors and member agencies, and designing the region-wide messages for the general public and various target audiences. Important constituencies that have been identified in the process are residential users, business interests, agricultural users, elected officials, officials of various agencies (such as the Department of Water Resources), and the media.

Many conservation programs, such as Metropolitan's ultra-low flush toilet rebate program, are driven by member agency requests. Based on history, Metropolitan expects member agency requests to increase during droughts. Metropolitan is committed to increasing overall conservation program funding to meet member agency requests during droughts and attain higher levels of savings. These programs will be implemented by Metropolitan and member and local agency conservation staff. As many of the short-term conservation objectives during a shortage would be dependent upon an effective public information program, the Drought Program Officer will also be responsible for monitoring the effectiveness of the augmented conservation programs. A monthly conservation reporting process will be implemented. Quarterly estimates of regional conservation will be developed to track the progress of various actions in mitigating the shortage.

APPENDIX A: RESOURCE AND STORAGE SIMULATION

The Water Surplus and Drought Management Plan (WSDM Plan) uses the Stages and Actions Matrix (Figure 8) as a guide for the operation of storage and transfers for the next ten years, 1999-2008**.** Metropolitan asserts that the investments that Metropolitan and its member agencies have made in water supply and storage, managed in a coordinated manner as presented in the WSDM Plan, will be sufficient to assure that retail firm water demands will be met 100% of the time through the year 2008. Metropolitan performed an extensive analysis of projected water demands, current and expected water supplies, along with hydrologic variations to support this assertion. Appendix A presents a summary of this analysis which includes statistical probabilities of actions under the WSDM Plan and two illustrative examples of how supply resources may be used in the future under worst-case drought events. Although the WSDM Plan is intended to be in effect through 2008, for the purposes of analysis the planning horizon was extended through 2010.

The WSDM Plan seeks to define the operational envelope for the Metropolitan system into the near future. Although the WSDM Plan only looks out ten years, it nonetheless involves the operation of some storage and water transfer projects that have not yet become fully operational. This makes the estimation of storage and transfers operations difficult. Compounding this problem is the lack of certainty around future demands, economic conditions, or even the weather over the next ten years. To manage these uncertainties, Metropolitan has developed a computer based simulation model called the Integrated Resources Planning Simulation Model or IRPSIM.

IRPSIM uses a modeling method known as sequentially indexed monte-carlo simulation. Simply put, the model looks at projected regional retail demand and supplies of water over the next twelve years and adjusts each, up or down, based on an assumed pattern of future weather. For instance, if Metropolitan expected the weather over the next twelve years (1999-2010) to be the same as the last twelve years (1987-1998), then IRPSIM would adjust the projected 1999 demands and supplies based on the historical 1987 hydrology, and adjust the projected 2000 demands and supplies using the historical 1988 hydrology, and so on. One obvious drawback to this approach is that Metropolitan does not know what future weather will be. Therefore, Metropolitan runs the models over and over again until all recorded hydrologies, 70 in all, have been tried. In this way, Metropolitan can look at probabilistic results of being in shortage year by year through 2010.

Although the projections of water supplies used in this analysis required certain assumptions to be made, they were based on most likely or probable outcomes. In most cases, projected water supplies represented projects that are currently operational, under construction, or in the final stages of negotiations. The following represents a summary of these assumptions:

- Local recycling and groundwater recovery: assumes currently operational projects with expected increases in supply yield as demand increases

- Conjunctive use groundwater storage: assumes Las Posas (under final stages of construction) and implementation of similar programs which are under negotiation (such as Raymond, Orange, and Chino Basins)

- Semitropic and Arvin-Edison storage: assumes use of both programs which are operational with water already stored

- Eastside Reservoir Project: assumes use of non-emergency storage from the reservoir currently under construction and an initial fill projected to start in approximately one year

- The Monterey Reservoirs: assumes use of State Water Project terminal reservoir supplies, Castaic and Perris Reservoirs, per the Monterey Amendment

- Colorado River Aqueduct: assumes a full aqueduct through the implementation of the California Plan (including lining of All American and Coachella canals, SD/IID water transfer/exchange, conjunctive use off-aqueduct storage, and river re-operations)

- State Water Project: assumes continuance of Bay-Delta Accord (with only current facilities)

One way of viewing the result of Metropolitan's WSDM Plan analyses is by summary statistics. Table A- 1 gives the probabilities of shortage actions over the next twelve years.

Table A-1. Probability of Shortage Stage[1] by Forecast Year

1999	13%	13%	11%	7%	3%	0%	O%
2000	13%	13%	11%	9%	3%	O%	0%
2001	19%	17%	13%	10%	6%	O%	0%
2002	19%	17%	13%	10%	4%	1%	0%
2003	19%	19%	14%	11%	4%	0%	0%
2004	20%	19%	16%	13%	4%	0%	0%
2005	21%	19%	17%	13%	6%	O%	O%
2006	21%	19%	19%	13%	6%	0%	0%
2007	23%	20%	19%	13%	4%	0%	0%
2008	26%	21%	19%	16%	6%	1%	0%
2009	26%	24%	19%	17%	6%	1%	0%
2010	26%	26%	19%	19%	6%	1%	O%

Table A-1 can be read in one of two ways, by column or row. The Stage 7 column indicates that there are no historical weather conditions that require allocation over the next twelve years. This is the single most important conclusion of the WSDM Plan analysis. The Stage 6 column indicates that only in a few years--2002, and 2008 through 2010--would Metropolitan need have a need for option or spot transfer water. Read by row, Table A-1 indicates that in the year 2008 there is a 21% likelihood of taking some water from the Eastside Reservoir Project, a 19% likelihood of taking water from Semitropic or Arvin-Edison storage programs, a 17% likelihood of interrupting long-term seasonal and replenishment deliveries for two years, and so on. It should be noted that these probabilities represent the best current estimates by Metropolitan, but are based entirely on historical weather conditions. Conditions that fall outside of historical ranges, either in duration or severity, are not represented by this data.

Another way to view the WSDM Plan analysis is by observing the operation of a single hydrology. Table A-2 provides an example of resource operations for the period 1999 through 2010 assuming a repeat of the 1923 through 1934 hydrology. The table provides descriptions of hydrologic conditions to aid in understanding the example.

[1] Stage 1 consists of withdrawal from the Eastside Reservoir Project. Stage 2 consists of the above plus withdrawals from the Semitropic and Arvin-Edison water storage and transfer projects. Stage 3 consists of the above plus an interruption of Long-Term Seasonal and Replenishment discount water. Stage 4 consists of the above plus withdrawal from contractual groundwater programs and the Monterey Reservoirs. Stage 5 consists of the above plus a call for extraordinary drought conservation and interruption in agricultural discount water. Stage 6 consists of the above plus calls on option contract water and purchases of water on the open market. Stage 7 consists of the above plus allocation of remaining shortages. For a full description of stages and action, see Surplus and Shortage Resource Actions section and Figure 8 above.

For instance, 1923 was considered to be a dry year in southern California (defined as less than 9 inches of rain at the Los Angeles Civic Center) and is categorized by the California Department of Water Resources (DWR) as a below normal year for State Water Project deliveries. In this example, 1923 weather increases southern California's demand for water and decreases imported State Water Project supplies. The Colorado River Aqueduct supplies are influenced by yet another hydrologic indicator, but for the next ten year Metropolitan expects the Aqueduct to be full.

Table A-2 indicates that retail water demands in 1999, assuming a 1923 hydrology, will be 3.979 million acre-feet (maf). Adding expected long-term seasonal and replenishment demands of 0.165 maf gives a regional total water demand of 4.144 maf. After subtracting local supplies of 2.192 maf, which are also adjusted for 1923 weather, Metropolitan expects to see a demand of 1.952 maf. In 1999, under a 1923 hydrology, Metropolitan expects to see 2.954 maf of supply. This is enough to meet all expected demands and put over 1.0 maf into storage.

The 1923 through 1934 hydrology is significant because it starts and ends dry with little recovery in the middle. However, even in these most adverse conditions the actions proposed by the WSDM Plan provides the region with enough water to avoid shortage allocation. Again the most important result of this example is read from the last line, which indicates that there are no remaining shortages through 2008

Table A-3 provides a second example of using the 1980 through 1991 hydrology. This hydrology contains the most significant drought in recent record, ending with a critically dry year on the State Water Project that is expected to yield a mere 0.389 maf. However, even under these conditions the WSDM Plan provides a method to avoid firm water allocation.

The analyses performed using the prioritized action of the Stages and Actions Matrix support Metropolitan's assertion that water supply reliability can be attained through the use of regional storage, interruption of discounted water supplies, and transfers. And, through the implementation of the WSDM Plan, Metropolitan does not expect to allocate firm water deliveries for at least the next ten years.

Table A-2. A Simulation of Water Supplies and Demands 1923-1934 Hydrology

Forecast Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Hydrology Year	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934
Hydrologic Conditions												
Southern California Year Type	Dry	Dry	Dry	Wet	Wet	Dry	Dry	Normal	Wet	Normal	Wet	Normal
Sacramento River Index D1630 Year Type	Below Normal	Critically Dry	Dry	Dry	Wet	Above Normal	Critically Dry	Dry	Critically Dry	Dry	Critically Dry	Critically Dry
Demands												
Retail Demand	3.979	4.152	4.149	4,018	4.005	**4.249**	4.237	4.223	4.280	4.280	4.407	4.500
Long-term/Replenishment Demand	0.165	0.182	0.226	0.188	0.149	0.176	0,213	0.203	0.164	0.175	0.141	0.163
Total Demand	4.144	4.334	4.375	4.205	4.154	4.425	4.450	4.426	4,443	4.455	4.548	4,663
Local Supplies												
Groundwater Production	1.529	1.545	1.537	1.288	1.299	1.575	**1.568**	1.434	1.307	1.439	1.318	1.454
L. A. Aqueduct Production	0.383	0,287	0.304	0.316	0.392	0.302	0,245	0.235	0.174	0,324	0.251	0.220
Recycling Production	0.152	0.162	0.174	0.186	0,197	0.207	0.217	0.230	0,242	0.254	0.266	0.277
Surface Production	0,128	0,089	0,076	0.116	0.154	0.147	0.108	0.094	0,133	0,136	0.151	0.145
Total Local Supply	2,192	2.084	2.091	1.905	2,043	2.231	2,139	1.993	1.856	2.153	1.986	2,097
Total MWD Demand	1.952	2.250	2,284	2,300	2.112	2.194	2.311	2.433	2.587	2.302	2.562	2.566
MWD Supply Sources												
Colorado River Aqueduct Supply	1.200	1.200	1.200	1.200	1.200	**1.200**	1.200	1.200	1.200	1.200	1.200	1.200
State Water Project Supply	1.754	0.812	0.783	1.280	1.678	1.438	0,764	1.163	0,589	0.843	0.559	0.620
MWD Cyclic Groundwater Deliveries	0.000	0.060	0.060	0.000	0.000	0,000	0.060	0,060	0.060	0.059	0.000	0.000
Eastside Reservoir	0.000	0.066	0.058	0.000	0.000	0.000	0,060	0.010	0.425	0.023	0.219	0.041
Arvin/Semitropic Groundwater Storage	0.000	0.111	0.115	0,000	0.000	0,000	0,119	0,000	0.115	0.117	0.059	0.041
Longterm Seasonal Demand Cuts	0.000	0,000	0,166	0.000	0.000	0.000	0.153	0.000	0.104	0,116	0.000	0.000
Cyclic Benefits	0.000	0.000	0.000	0.000	0.000	0.000	0,000	0,000	0,000	0,000	0.060	0.060
Contractual Groundwater Storage	0.000	0.000	0.000	0,000	0.000	0.000	0.000	0,000	0.095	0.000	0.095	0.084
DWR Reservoirs (Monterey Agreement)	0.000	0.000	0,000	0.000	0.000	0.000	0.000	0.000	0,000	0,000	0.131	0.088
Voluntary Conservation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0,000	0.000	0.206	0.210
MWD Ag Cuts	0.000	0.000	0.000	0.000	0.000	0,000	0.000	0.000	0.000	0.000	0.033	0.031
Central Valley Transfers	0.000	0.000	0,000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.193
Storage Puts	1.003	0.000	0.097	0.180	0.549	0.438	0.045	0.000	0,000	0.056	0.000	0.000
Remaining Shortage	0,000	0,000	0.000	0,000	0.000	0.000	0.000	0,000	0.000	0.000	0.000	0.000

Table A-3. A Simulation of Water Supplies and Demands 1980-1991 Hydrology

Forecast Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Hydrology Year	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934
Hydrologic Conditions												
Southern California Year Type	Wet	Normal	Normal	Wet	Dry	Dry	Wet	Normal	Normal	Dry	Dry	Normal
Sacramento River Index D1630 Year Type	Above Normal	Dry	Wet	Wet	Wet	Dry	Wet	Dry	Critically Dry	Dry	Critically Dry	Critically Dry
Demands												
Retail Demand	3.781	4.170	3.930	3.647	4.308	4.250	4.151	4.281	4.380	4.550	4.663	4.497
Lon£1-term/Replenishment Demand	0.105	0.141	0.171	0.101	0.136	0.187	0.183	0.201	0.191	0.219	0.224	0.214
Total Demand	3.886	4.311	4.101	3.748	4.444	4.437	4.334	4.483	4.572	4.769	4.887	4.712
Local Supplies												
Groundwater Production	1.292	**1.440**	**1.381**	1.248	1.546	1.565	1.275	1.413	1.438	1.588	1.600	1.446
L. A. Aqueduct Production	0.462	0.372	0.499	0.529	0.516	O.367	0.472	0.400	0.326	0.278	0.213	0.223
Recycling Production	0.152	0.162	0.174	0.186	0.197	0.207	0.217	0.230	0.242	0.254	0.266	0.277
Surface Production	0.225	0.175	0.154	0.194	0.195	0.151	0.115	0.116	0.115	0.081	0.068	0.081
Total Local Supply	2.131	2.149	2.208	2.156	2.455	2.290	2.081	2.159	2.122	2.200	2,146	2.027
Total MWD Demand	1.755	2.162	1.894	1.591	1.989	2.147	2.253	2.324	2.450	2.569	2.741	2.684
MWD Supply Sources												
Colorado River Aqueduct Supply	1.200	1.200	1.200	1,200	1.200	1.200	1.200	1.200	**1.200**	1.200	1.200	1.200
State Water Project Supply	1.561	1.441	1.725	1.886	1.643	1.590	1.441	1.292	0.611	1.285	0.877	0.389
MWD Cyclic Groundwater Deliveries	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.060	0.060	0.060
Eastside Reservoir	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.199	0.024	0.222	0.209
Arvin/Semitropic Groundwater Storage	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.115	0.000	0.122	0.104
Long-term Seasonal Demand Cuts	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.131	0.000	0.164	0.154
Cyclic Benefits	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Contractual Groundwater Storage	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.133	0.000	0.095	0.085
DWR Reservoirs (Monterey Agreement)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.216
Voluntary Conservation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.235
MWD Ag Cuts	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032
Central Valley Transfers	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Storage Puts	1.006	0.260	0.344	0.240	0.200	0.200	0.388	0.168	0.000	0.000	0.000	0.000
Remaining Shortage	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Attachment B

Water Supply Allocation Plan

December 2014 Revision

Metropolitan Water District of

Southern California

Inside cover: Photo courtesy of Cora Edmonds/ArtXchange for the Healing Planet

Water Supply Allocation Plan

Table of Contents

List of Tables and Figures

Figure 1: Base Period Retail Demand Calculation 28
Figure 2: Allocation Year Retail Demand Calculation 29
Figure 3: Allocation Year Wholesale Demand Calculation 30
Figure 4: WSAP Allocation Regional Shortage Level 4 33

List of Acronyms

AF – Acre-feet
CUP – Groundwater Conjunctive Use Program
CWD – County Water District
DWP – Drought Management Plan
IAWP – Interim Agricultural Water Program Reductions and Rates
IICP – Incremental Interruption and Conservation Plan
IRP – Integrated Resources Plan
GPCD – Gallons per Capita per Day
M&I – Municipal and Industrial
MWD – Municipal Water District
RUWMP – Regional Urban Water Management Plan
SWP – State Water Project
WSAP – Water Supply Allocation Plan
WSDM – Water Surplus and Drought Management

Definitions

Extraordinary Supplies- Deliberate actions taken by member agencies to augment the total regional water supply only when Metropolitan is allocating supplies through the WSAP.

Groundwater Recovery- The extraction and treatment of groundwater making it usable for a variety of applications by removing high levels of chemicals and/or salts.

In-lieu deliveries- Metropolitan-supplied water bought to replace water that would otherwise be pumped from the groundwater basins.

Seawater Barrier- The injection of fresh water into wells along the coast to protect coastal groundwater basins from seawater intrusion. The injected fresh water acts like a wall, blocking seawater that would otherwise seep into groundwater basins as a result of pumping.

Section 1: Introduction

Calendar Year 2007 introduced a number of water supply challenges for the Metropolitan Water District of Southern California (Metropolitan) and its service area. Critically dry conditions affected all of Metropolitan's main supply sources. In addition, a ruling in the Federal Courts in August 2007 provided protective measures for the Delta Smelt in the Sacramento-San Joaquin River Delta which brought uncertainty about future pumping operations from the State Water Project. This uncertainty, along with the impacts of dry conditions, raised the possibility that Metropolitan would not have access to the supplies necessary to meet total firm demands[1] and would have to allocate shortages in supplies to the member agencies.[2]

In preparing for this possibility, Metropolitan staff worked jointly with the member agency managers and staff to develop a Water Supply Allocation Plan (WSAP). The WSAP includes the specific formulas for calculating member agency supply allocations and the key implementation elements needed for administering an allocation should a shortage be declared. The WSAP became the foundation for the urban water shortage contingency analysis required under Water Code Section 10632 and was incorporated into Metropolitan's 2010 Regional Urban Water Management Plan (RUWMP).

Section 2: Development Process

Member Agency Input

Between July 2007 and February 2008, Metropolitan staff worked cooperatively with the member agencies through a series of member agency manager meetings and workgroups to develop a formula and implementation plan to allocate supplies in case of shortage. These workgroups provided an arena for in-depth discussion of the objectives, mechanics, and policy aspects of the different parts of the WSAP. Metropolitan staff also met individually with fifteen member agencies for detailed discussions of the elements of the recommended proposal. Metropolitan introduced the elements of the proposal to many nonmember retail agencies in its service area by providing presentations and feedback to a number of member agency caucuses, working groups, and governing boards. The discussions, suggestions, and comments expressed by the member agencies during this process contributed significantly to the development of this WSAP.

Board of Directors Input

Throughout the development process Metropolitan's Board of Directors was provided with regular progress reports on the status of this WSAP, with oral reports in September, October, and December 2007, an Information Board of Directors Letter with a draft of the WSAP in November 2007, and a Board of Directors Report with staff recommendations in January 2008. Based on Water Planning and Stewardship Committee discussion of the staff recommendations and further review of the report by

[1] Firm demands are also referred to as uninterruptable demands; likewise non-firm demands are also called interruptible demands.
[2] See Appendix A: Metropolitan Member Agencies.

the member agencies, refinements were incorporated into the WSAP for final consideration and action in February 2008. The WSAP was adopted at the February 12, 2008 Board of Directors meeting.[3]

The 12-Month Review Process

When the Board adopted the WSAP in February 2008, the decision specified a formal revisit of the WSAP commencing in February 2010. The scheduled revisit was meant to ensure the opportunity for Metropolitan staff and the member agencies to re-evaluate the WSAP and recommend appropriate changes to the Board of Directors.

In April 2009, the Board voted to implement the WSAP for the first time. The WSAP was implemented at a Level 2 allocation level, and was in effect for the period of July 1, 2009, through June 30, 2010. Since implementation of the 2009/10 WSAP began in July 2009, a number of practical issues relating to the WSAP were identified by staff and the member agencies for further consideration during the 12-Month Review Process. Metropolitan staff engaged with the member agencies in a formal review of the WSAP from January through May 2010. During the review process the member agency managers participated in a series of six workshops. The focus of these workshops was to facilitate in-depth discussion on WSAP-related issues and lessons learned since the WSAP was implemented in July 2009. The proposed adjustments to the WSAP developed during the review process were adopted at the August 17, 2010 Board of Directors meeting[4].

The Three-Year Review Process

The Board action to adopt of the WSAP in February 2008 also directed staff to review the WSAP formula three years after the February 2008 adoption. February 2011 marked the three-year anniversary since the adoption of the WSAP. Similar to the 12-Month Review Process, the purpose of the Three-Year Review Process was to provide an opportunity for Metropolitan staff and the member agencies to re-evaluate the plan and recommend appropriate changes for board consideration.

Metropolitan staff met with the member agencies in a formal review of the WSAP from February through August 2011. Staff and member agency managers participated in a series of eleven workshops. Proposed adjustments to the WSAP developed during the process were adopted at the September 13, 2011 Board of Directors meeting.[5]

[3] A complete listing of member agency meetings and Board of Directors reporting activities is contained in Appendix B: Water Supply Allocation Plan Process Timeline.

[4] A complete listing of member agency meetings and Board of Directors reporting activities is contained in Appendix C: 12-Month Review Process and Results.

[5] A complete listing of member agency meetings and Board of Directors reporting activities is contained in Appendix D: Three-Year Review Process and Results.

2014 Review Process

In 2014, California was challenged with a third year of severe drought.[6] Metropolitan managed its operations through significant use of regional storage reserves. It was anticipated that end of year total dry storage reserves would approach levels similar to those when the WSAP was last implemented in 2009.

Following discussion at the June 2014 Water Planning and Stewardship Committee, Metropolitan staff convened a member agency working group to revisit the WSAP. The purpose of the working group was to collaborate with member agencies to identify potential revisions to the WSAP in preparation for mandatory supply allocations in 2015. There were eight working group meetings and three discussions at the monthly Member Agency Managers' Meetings.

The process focused on three areas of the WSAP: the Base Period, the Allocation Formula, and the Allocation enforcement mechanism. Proposed adjustments to the WSAP developed during the process were adopted at the December 9, 2014 Board of Directors meeting. [7]

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[6] The Governor of California proclaimed a State of Emergency due to drought conditions on January 17, 2014 and, on April 24, 2014 issued an Executive Order proclaiming a continued State of Emergency noting drought conditions have persisted for the last three years and authorizing adoption and implementation of emergency regulations.

[7] A complete listing of member agency meetings and Board of Directors reporting activities is contained in Appendix E: 2014 Review Process and Results.

Section 3: Review of Historical Shortage Plans[8]

The WSAP incorporates key features and principles from the following historical shortage allocation plans but will supersede them as the primary and overarching decision tool for water shortage allocation.

Interruptible Water Service Program

As part of the new rate structure implemented in 1981, Metropolitan's Board of Directors adopted the Interruptible Water Service Program (Interruptible Program) which was designed to address short-term shortages of imported supplies. Under the Interruptible Program, Metropolitan delivered water for particular types of use to its member agencies at a discounted rate. In return for this discounted rate, Metropolitan reserved the right to interrupt delivery of this Interruptible Program water so that available supplies could be used to meet municipal and industrial demands.

Incremental Interruption and Conservation Plan

The ability to interrupt specific deliveries was an important element of Metropolitan's strategy for addressing shortage conditions when it adopted the Incremental Interruption and Conservation Plan (IICP) in December 1990. Reductions in IICP deliveries were used in concert with specific objectives for conservation savings to meet needs during shortages. The IICP reduced Interruptible Service deliveries in stages and provided a pricing incentive program to insure that reasonable conservation measures were implemented.

1995 Drought Management Plan

The 1995 Drought Management Plan (DMP) was a water management and allocation strategy designed to match supply and demand in the event that available imported water supplies were less than projected demands. Adopted by the Metropolitan Board of Directors in November 1994, the 1995 DMP was a short-term plan designed to provide for the 1995 calendar year only. The primary objective of the 1995 DMP was to identify methods to avoid implementation of mandatory reductions. The 1995 DMP included various phases and a step-by-step strategy for evaluating supply and demand conditions and utilizing Metropolitan's available options, with the final phase being implementation of the revised IICP.

1999 Water Surplus and Drought Management Plan

Metropolitan staff began work on the Water Surplus and Drought Management (WSDM) Plan in March 1997 as part of the Integrated Water Resources Plan (IRP), which was adopted by Metropolitan's Board of Directors in January 1996. The IRP established regional water resource targets, identifying the need for developing resource management policy to guide annual operations. The WSDM Plan defined Metropolitan's resource management policy by establishing priorities for the use of regional resources to achieve the region's reliability goal identified in the IRP. In April 1999, Metropolitan's Board of Directors adopted the WSDM Plan.

[8] A summary of the key elements in the following allocation plan is found in Appendix F: Summary of Historical Shortage Plans.

The WSDM Plan also included a set of principles and considerations for staff to address when developing specific allocation methods. The WSDM Plan stated the following guiding principle to be followed in developing any future allocation scheme:

> *"Metropolitan will encourage storage of water during periods of surplus and work jointly with its member agencies to minimize the impacts of water shortages on the region's retail consumers and economy during periods of shortage."*[9]

This principle reflects a central desire for allocation methods that are both equitable and minimize regional hardship to retail water consumers. The specific considerations postulated by the WSDM Plan to accomplish this principle include the following:[10]

- The impact on retail customers and the economy
- Allowance for population and growth
- Change and/or loss of local supply
- Reclamation/Recycling
- Conservation
- Investment in local resources
- Participation in Metropolitan's interruptible programs
- Investment in Metropolitan's facilities.

Section 4: Water Supply Allocation Formula

Based on the guiding principle and considerations described in the WSDM Plan, Metropolitan staff and the member agencies developed a specific formula for allocating water supplies in times of shortage. The formula seeks to balance the impacts of a shortage at the retail level while maintaining equity on the wholesale level, and takes into account growth, local investments, changes in supply conditions and the demand hardening[11] aspects of non-potable recycled water use and the implementation of conservation savings programs. The formula, described below, is calculated in three steps: base period calculations, allocation year calculations, and supply allocation calculations.[12] The first two steps involve standard computations, while the third section contains specific methodology developed for this WSAP.

Base Period Calculations

The first step in calculating a water supply allocation is to estimate water supply and demand using a historical base period with established water supply and delivery data. The base period for each of the different categories of demand and supply is calculated using data from the fiscal years (July through June) ending 2013 and 2014.[13]

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[9] WSDM Plan, p. 1. Emphasis added.

[10] WSDM Plan, p. 2.

[11] Demand hardening is the effect that occurs when all low-cost methods of decreasing overall water demand have been applied (e.g., low-flow toilets, water recycling) and the remaining options to further decrease demand become increasingly expensive and difficult to implement.

[12] Detailed operational elements of these objectives and a numerical example are discussed in Appendix G: Water Supply Allocation Formula Example.

[13] Exceptions to this methodology are noted in the descriptions of base period calculations.

Base Period Local Supplies: Local supplies for the base period are calculated using a two-year average of groundwater production, groundwater recovery, Los Angeles Aqueduct supply, surface water production, and other imported supplies. Non-potable recycling production is not included in this calculation due to its demand hardening effect.

Base Period Wholesale Demands: Demands on Metropolitan for the base period are calculated using a two-year average of firm purchases and in-lieu deliveries to long-term groundwater replenishment, conjunctive use, cyclic, and supplemental storage programs.

Base Period Retail Demands: Total retail-level municipal and industrial (M&I) demands for the base period are calculated by adding the Base Period Wholesale Demands and the Base Period Local Supplies. This estimates an average total demand for water from each agency.

Base Period Mandatory Conservation Credit: Metropolitan allows a consultation process that enables member agencies to describe mandatory water use restrictions and/or rationing restrictions that were in place within their service areas during the Base Period. Restrictions may vary among agencies but include restricted water uses, fines, and water budget or penalty based rate structures that are enacted by the governing body of the member agency or retail agency. Following the consultation process, Metropolitan staff will recommend adjustments based on evidence of reduced GPCD. To qualify for an adjustment, GPCD reductions would have to be observed that are beyond those expected from the agency's ongoing conservation efforts and trends.

Allocation Year Calculations

The next step in calculating the water supply allocation is estimating water needs in the allocation year. This is done by adjusting the base period estimates of retail demand for population or economic growth and changes in local supplies.

Allocation Year Retail Demands: Total retail M&I demands for the allocation year are calculated by adjusting the Base Period Retail Demands for baseline inflation and growth.

Baseline Inflation Adjustment: Baseline inflation occurs when non-potable recycling or conservation is developed after the Base Period. The development of these supplies reduces actual demands for water in the Allocation Year. Because non-potable-recycling and conservation are excluded from the WSAP formula, the actual need for water in the Allocation year is overestimated. The Baseline Inflation Adjustment removes increases in non-potable recycling and conservation annually from the Base Period forward to better reflect the true need for water in the Allocation Year.

Growth Adjustment: The growth adjustment is calculated using the estimated actual annual rate of population growth at the county level, as generated by the California Department of Finance, whenever possible. For years without complete data, the growth rate is calculated using an average of the three most recent years available. Growth will be allocated based on historical per capita water use during the Base Period, with a cap equal to Metropolitan's IRP Target for Water Use Efficiency. For allocation years up to and including 2014, the cap will be 163 GPCD, and for allocation years 2015-2020 the cap will reduce linearly from 163 to 145 GPCD. On an appeals basis, member agencies may request that their adjustment be calculated using member agency level population growth. A weighted combination of actual population and actual employment growth rates may also be requested.

Allocation Year Local Supplies: Allocation Year Local Supplies include groundwater production, groundwater recovery, Los Angeles Aqueduct supply, surface water production, seawater desalination, and other imported supplies. Estimates of Allocation Year Local Supplies are provided by the member agencies upon implementation of a WSAP. If estimates are not provided, Metropolitan will use the sum of the Base Period Local Supplies and Base Period In-Lieu Deliveries as a default. Agencies may provide updated estimates at any time during the Allocation Year to more accurately reflect their demand for Metropolitan supplies.

Extraordinary Supplies: Under the WSAP formula, local supply production in the Allocation Year can either be designated as a "planned" supply, or as an "extraordinary" supply.[14] This is an important designation for a member agency because the two types of supplies are accounted for differently in the WSAP formula. Local supplies classified at Extraordinary Supply are only partially included (scaled depending on the WSAP Level) as local supplies. This has the effect of providing significantly more benefit to the member agency in terms of total water supply that is available to the retail customer.[15]

Allocation Year Wholesale Demands: Demands on Metropolitan for the allocation year are calculated by subtracting the Allocation Year Local Supplies from the Allocation Year Retail Demands.

Water Supply Allocation Calculations

The final step is calculating the water supply allocation for each member agency based on the allocation year water needs identified in Step 2. The following table displays the elements that form the basis for calculating the supply allocation. Each element and its application in the allocation formula are discussed below.

Table 1: Shortage Allocation Index

(a) Regional Shortage Level	(b) Wholesale Minimum Percentage	(c) Maximum Retail Impact Adjustment Percentage
1	92.5%	2.5%
2	85.0%	5.0%
3	77.5%	7.5%
4	70.0%	10.0%

[14] Appendix H: Board Policy Principles on Determining the Status of Extraordinary Supply lists the key Board principles used in determining if a supply qualifies as an Extraordinary Supply.
[15] See Appendix G: Water Supply Allocation Formula Example for specific allocation formulae.

5	62.5%	12.5%
6	55.0%	15.0%
7	47.5%	17.5%
8	40.0%	20.0%
9	32.5%	22.5%
10	25.0%	25.0%

Regional Shortage Level: The WSAP formula allocates shortages of Metropolitan supplies over ten levels.

Wholesale Minimum Allocation: The Wholesale Minimum Allocation ensures a minimum level of Metropolitan supplied wholesale water service to each member agency.

Maximum Retail Impact Adjustment: The purpose of this adjustment is to ensure that agencies with a high level of dependence on Metropolitan do not experience disparate shortages at the retail level compared to other agencies when faced with a reduction in wholesale water supplies. The Maximum Retail Impact Percentage is prorated on a linear scale based on each member agency's dependence on Metropolitan at the retail level. This percentage is then multiplied by the agency's Allocation Year Wholesale Demand to determine an additional allocation.

Conservation Demand Hardening Credit: The Conservation Demand Hardening Credit addresses the increased difficulty in achieving additional water savings at the retail level that comes as a result of successful implementation of water conserving devices and conservation savings programs. To estimate conservation savings, each member agency will establish a historical baseline Gallons Per Person Per Day (GPCD) calculated in a manner consistent with California Senate Bill SBx7-7.[16] Reductions from the baseline GPCD to the Allocation Year are used to calculate the equivalent conservation savings in acre-feet. The Conservation Demand Hardening Credit is based on an initial 10 percent of the GPCD-based Conservation savings plus an additional 5 percent for each level of Regional Shortage set by the Board during implementation of the WSAP. The credit will also be adjusted for:

- The overall percentage reduction in retail water demand
- The member agency's dependence on Metropolitan

The credit is calculated using the following formula:

Conservation Demand Harding Credit = Conservation Savings x (10% + Regional Shortage Level Percentage) x (1 +((Baseline GPCD – Allocation Year GPCD)/Baseline GCPD)) x Dependence on MWD Percentage

[16] California Department of Water Resources, February 2011, "Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use. Available at: http://www.water.ca.gov/wateruseefficiency/sb7/docs/MethodologiesCalculatingBaseline_Final_03_01_2011.pdf

This provides a base demand hardening credit equal to 10 percent of conservation savings and increases the credit as deeper shortages occur, which is when conservation demand hardening has a bigger impact on the retail consumer. The credit also increases based on the percentage of an agency's demand that was reduced through conservation. This accounts for increased hardening that occurs as increasing amounts of conservation are implemented. Lastly, the credit is scaled to the member agency's dependence on Metropolitan to ensure that credits are being applied to the proportion of water demand that is being affected by reductions in Metropolitan supply.

Minimum Per-Capita Water Use Credit: This adjustment creates a minimum per capita water use threshold. Member agencies' retail-level water use is compared to two different thresholds. The proposed minimum thresholds are based upon compliance guidelines established under Senate Bill X7-7.

- 100 GPCD total water use
- 55 GPCD residential water use

Agencies that fall below either threshold under the WSAP will receive additional allocation from Metropolitan to bring them up to the minimum GPCD water use level. If an agency qualifies under both thresholds, the one resulting in the maximum allocation adjustment will be given.[17] To qualify for this credit, member agencies must provide documentation of the total agency level population and the percent of retail level demands that are residential; no appeal is necessary.

Total WSAP Allocation: The allocation to an agency for its M&I retail demand is the sum of the Wholesale Minimum Allocation, the Retail Impact Adjustment, the Conservation Demand Hardening Credit, and the Minimum Per-Capita Water Use Credit.[18]

Total Metropolitan Supply Allocations: In addition to the WSAP Allocation described above, agencies may also receive separate allocations of supplies for and seawater barrier and groundwater replenishment demands. Allocations of supplies to meet seawater barrier demands are to be determined by the Board of Directors independently but in conjunction with the WSAP. Separating the seawater barrier allocation from the WSAP allocation allows the Board to consider actual barrier requirements in the Allocation Year and address the demand hardening issues associated with cutting seawater barrier deliveries. According to the principles outlined for allocating seawater barrier demands, allocations should be no deeper than the WSAP Wholesale Minimum Percentage implemented at that time.

The WSAP also provides a limited allocation for drought-impacted groundwater basins based on the following framework:[19]

[17] See Appendix J: Per Capita Water Use Minimum Example for specific minimum per-capita water use credit formulae and example.
[18] See Appendix G: Water Supply Allocation Formula Example for specific allocation formulae.
[19] See Appendix L: Groundwater Replenishment Allocation for more information.

1. Metropolitan staff will hold a consultation with the requesting member agency and the appropriate groundwater basin manager to document whether the basin is in one of the following conditions:
    a. Groundwater basin overdraft conditions that will result in water levels being outside normal operating ranges during the WSAP allocation period; or
    b. Violations of groundwater basin water quality and/or regulatory parameters that would occur without imported deliveries
2. An allocation is provided based on the verified need for groundwater replenishment. The allocation would start with a member agency's ten-year average purchases of imported groundwater replenishment supplies (excluding years in which deliveries were curtailed). The amount would then be reduced by the declared WSAP Regional Shortage Level.

Section 5: WSAP Implementation

The WSAP will take effect if a regional shortage is declared by the Board of Directors. The following implementation elements are necessary for administering the WSAP during a time of shortage. These elements cover the processes needed to declare a regional shortage level as well as provide information pertaining to the allocation surcharge.

Allocation Period

The allocation period covers twelve consecutive months, from July of a given year through the following June. This period was selected to minimize the impacts of varying State Water Project (SWP) allocations and to provide member agencies with sufficient time to implement their outreach strategies and rate modifications.

Setting the Regional Shortage Level

Metropolitan staff is responsible for recommending a Regional Shortage Level for the Board of Directors' consideration. The recommendation shall be based on water supply availability, and the implementation of Metropolitan's water management actions as outlined in the WSDM Plan. Metropolitan staff will keep the Board of Directors apprised to the status of water supply conditions and management actions through monthly reports to the Water Planning and Stewardship Committee. To further facilitate staff in the development of a recommended regional shortage level, member agency requests for local supply adjustments shall be submitted by April 1st.

Metropolitan's Board of Directors, through the Water Planning and Stewardship Committee, is responsible for approving the final Regional Shortage Level at its April meeting. By the April meeting, the majority of the winter snowfall accumulation period will have passed and will allow staff to make an allocation based on more stable water supply estimates. Barring unforeseen large-scale circumstances, the Regional Shortage Level will be set for the entire allocation period, which will provide the member agencies an established water supply level for their planning.

Exit Strategy

While the Board ultimately has discretion to implement or lift and allocation at any point of time during the year; the WSAP includes a two-part exit strategy that is meant to streamline the WSAP implementation decision making process.

- If the Board decides to implement the WSAP, then any current WSAP allocation would remain in place until the end of the Allocation Year.
- If the Board decides not to implement the WSAP, then any current WSAP allocation would be terminated concurrent with the Board decision.

Allocation Appeals Process

An appeals process is necessary for the administration of any changes or corrections to an agency's allocation. Metropolitan's General Manager will designate, subsequent to a declaration of an allocation by the Board of Directors, an Appeals Liaison as the official point of contact for all information and inquiries regarding appeals. All member agency General Managers will be notified in writing of the name and contact information of the Appeals Liaison. Only appeals that are made through the Appeals Liaison and in accordance with the provisions outlined in Appendix N: Allocation Appeals Process will be evaluated. Basis for appeals claims can include but are not limited to:

- Adjusting erroneous historical data used in base period calculations
- Adjusting for population growth rates
- Determining if a local supply qualifies as Extraordinary Supply

Additional details and a checklist for the appeals process are available in Appendix N: Allocation Appeals Process and Appendix O: Appeals Submittal Checklist.

Allocation Surcharge

Member agency allocations are supported by an Allocation Surcharge. The Allocation Surcharge is charged to water use above the Member Agency allocation and is charged in addition to Metropolitan's standard rates for water service. Allocation Surcharges will only be assessed to the extent that an agency's total annual usage exceeds its total annual allocation. Any revenues collected through the Allocation Surcharge will be applied towards Metropolitan's Water Management Fund, which is used to in part to fund expenditures in dry-year conservation. No billing or assessment of allocation surcharges rates will take place until the end of the twelve-month allocation period.

Allocation Surcharge: The application of the Allocation Surcharge structure is a two tier structure that provides a lower level of Allocation Surcharge for minor overuse of allocations and a higher level of Allocation Surcharge for major overuse of allocations. The structure and applicable Allocation Surcharges are listed in Table 2.

Table 2: Allocation Surcharge			
Water Use	**Base Water Rate**[20]	**Allocation Surcharge**[21]	**Total Rate**
100% of Allocation	Tier 1	0	Tier 1
Between 100% and 115%	Tier 1	$1,480	Tier 1 + ($1,480)
Greater than 115%	Tier 1	$2,960	Tier 1 + ($2,960)

Qualifying Income-Based Rate Allocation Surcharge Adjustment:[22] Any Allocation Surcharges incurred by a member agency under the WSAP will be adjusted to reflect the extent to which retail customers within a member agency's service area are served under a "lifeline" or similar qualified discounted rate program based on income or ability to pay ("Income-Based Rate").

Any member agency who is assessed Allocation Surcharges under the WSAP may submit an acre-foot equivalent of water used by retail customers served under a qualifying Income-Based Rate.[23] This amount of water use would be multiplied by the percentage of retail-level reduction in allocation year demand necessary for that member agency to avoid exceeding its WSAP allocation. The monetary amounts resulting from these acre feet are subtracted from the total monetary amounts incurred by an agency for exceeding its allocation. In the case that the monetary amounts associated with the Income-Based Rate are greater than the total Allocation Surcharges an agency incurs, no Allocation Surcharges will be incurred. The end result of this adjustment is that the member agency will not be subject to Allocation Surcharges for the use of water by their retail customers served under a qualifying Income-Based Rate.

Growth Rate Allocation Surcharge Adjustment": In recognition of member agency differences in geography and climate, a Growth Rate Allocation Surcharge Adjustment will be given to any agency that exceeds its WSAP Allocation. The Allocation Surcharge reduction will be based on the difference in acre-feet between the Growth Adjustment applied at Metropolitan's IRP planning goal rate, and the greater of the following:

- The IRP planning goal rate adjusted for the member agency's ETo, or
- The member agency's certified and documented 20x2020 targeted GPCD

If both of these alternatives result in a lower growth adjustment than the IRP planning goal, no Allocation Surcharge reduction will be made.

[20] The base water rate shall be the applicable water rate for the water being purchased. In most cases, it will be the Tier 1 rate (plus Treatment Surcharge for treated water deliveries). However, it is possible that the water being purchased would be in the amount that would put an agency beyond its Tier 1 limit. In that case, the base water rate will be the Tier 2 rate (plus Treatment Surcharge for treated water deliveries).

[21] Allocation Surcharge is applied to water use in excess of an agency's WSAP allocation.

[22] See Appendix K: Qualifying Income-Based Rate Allocation Surcharge Adjustment Example for specific penalty adjustment formulae and example.

[23] Appropriate documentation and certification will be required.

Tracking and Reporting

Subsequent to a declared regional shortage by the Board of Directors, Metropolitan staff will produce monthly reports of each member agency's water use compared to its allocations based on monthly delivery patterns to be submitted by the member agency. In order to produce these reports, member agencies are requested to submit their local supply use on a monthly basis and certify end of allocation year local supply use. These reports and comparisons are to be used for the purposes of tracking and communicating potential underage/overage of an agency's annual allocations.

Key Dates for Water Supply Allocation Implementation

The timeline for implementation of an allocation is shown in Table 3. A brief description of this timeline follows:

January to March: Water Surplus and Drought Management reporting occurs at Metropolitan's Water Planning and Stewardship Committee meetings. These reports will provide updated information on storage reserve levels and projected supply and demand conditions.

April: Member agencies report their projected local supplies for the coming allocation year. This information is incorporated in staff analysis of storage reserves and projected supply and demand conditions in order to provide an allocation recommendation to the Board. Metropolitan's Board will consider whether an allocation is needed. A declaration of an allocation will include the level of allocation to be in effect for the allocation year. Likewise, member agencies will report their projected demands and local supplies needed to meet seawater barrier and groundwater replenishment requirements for the allocation year. Metropolitan's Board will consider whether allocations for seawater barrier demands and groundwater replenishment demands are needed independently from the WSAP allocation decision.**July 1st**: If the Board declared an allocation in April, then it will be effective starting July 1st. The allocation level will be held through June 30th, barring unforeseen circumstances. Member agencies will now be requested to submit their local supply use on a monthly basis and certify end of allocation year local supply use. Local production data must be reported to Metropolitan by the end of the month following the month of use (use in July must be reported by the end of August). This information will be combined with Metropolitan sales information in order to track retail water use throughout Metropolitan's service area. Each month Metropolitan will report on member agency water sales compared to their allocation amounts.

June 30th: The allocation year is complete.

July: Member agency local supplies must be certified for the month of June, the last month of the previous allocation year.

August: Metropolitan will calculate each member agency's total potable water use based on local supply certifications and actual sales data for the allocation year of July through June. Allocation surcharges will be assessed for usage above a given member agency's final adjusted allocation (reflecting the actual local supply and imported water use that occurred in the allocation year).

Table 3: Board Adopted Allocation Timeline					
Year	**Month**	**Year 1 Board Decision**	**Year 1 Allocation Year**	**Year 2 Board Decision**	**Year 2 Allocation Year**
Year 1	January				
	February				
	March				
	April	Declaration *			
	May				
	June				
	July		**Effective Period** Continuous Tracking of Member Agency Local Supply and Imported Water Use		
	August				
	September				
	October				
	November				
	December				
Year 2	January				
	February				
	March				
	April			Declaration *	
	May				
	June				
	July				**Effective Period** Continuous Tracking of Member Agency Local Supply and Imported Water Use
	August		Assess		
	September				
	October				
	November				
	December				
Year 3	January				
	February				
	March				
	April				
	May				
	June				

*Member agency projections of local supplies are due on April 1st to assist Metropolitan staff in determining the need for an allocation in the coming allocation year.

Appendix A: Metropolitan Member Agencies

Table 4: Member Agencies		
City of Anaheim	City of Glendale	City of San Marino
City of Beverly Hills	Inland Empire Utilities Agency	City of Santa Ana
City of Burbank	Las Virgenes MWD	City of Santa Monica
Calleguas MWD	City of Long Beach	Three Valleys MWD
Central Basin MWD	City of Los Angeles	City of Torrance
City of Compton	MWD of Orange County	Upper San Gabriel MWD
Eastern MWD	City of Pasadena	West Basin MWD
Foothill MWD	San Diego CWA	Western MWD
City of Fullerton	City of San Fernando	

Source: http://mwdh2o.com/WhoWeAre/Member-Agencies/

Appendix B: Water Supply Allocation Plan Process Timeline

July 2007

- City of Long Beach Water Department staff briefing
- Member Agency Managers/Member Agency Workgroup meeting
- Northern Managers Group meeting
  - Foothill MWD, City of Pasadena, City of Long Beach, Calleguas MWD, City of Los Angeles, West Basin MWD, City of Burbank, Three Valleys MWD, City of Glendale, Upper San Gabriel MWD

August 2007

- Central Basin MWD staff briefing
- Eastern MWD staff briefing
- San Diego CWA staff briefing
- Member Agency Managers/Member Agency Workgroup meeting
- Western MWD staff briefing
- City of Beverly Hills staff briefing

September 2007

- Member Agency Subgroup meetings
  - MWD of Orange County, San Diego CWA, West Basin MWD, Central Basin MWD
- MWD of Orange County staff briefing
- Member Agency Workgroup meeting
- Member Agency Workgroup meeting
- MWD Board of Directors Oral Report

October 2007

- Inland Empire Utilities Agency staff briefing
- Central Basin MWD Caucus Meeting (included sub-agencies)
- Three Valleys MWD staff briefing
- MWD of Orange County staff briefing
- West Basin MWD staff briefing
- MWD Board of Directors Oral Report

November 2007

- West Basin MWD Caucus Meeting (included sub-agencies)
- West Basin Water Users Association presentation
- Walnut Valley MWD staff briefing (sub-agency of Three Valleys MWD)
- Foothill MWD Managers Meeting (included sub-agencies)
- Central Basin MWD staff briefing
- City of Claremont City Council (sub-agency of Three Valleys MWD)
- MWD Board of Directors Information Letter with Draft Proposal

December 2007

- Northern Managers Group Meeting
- California Department of Public Health staff briefing
- City of Long Beach Water Department staff briefing
- Santa Ana River Watershed Project Authority presentation
- Foothill MWD Managers Meeting (included sub-agencies)
- MWD Board of Directors Oral Report

January 2008

- Northern Managers Group Meeting
- Water Replenishment District Board of Directors presentation
- Three Valleys MWD staff briefing
- Member Agency Conservation Coordinator's Group presentation
- Member Agency Managers/Member Agency Workgroup meeting
- City of Chino Hills presentation (sub-agency of IEUA)
- Member Agency Workgroup meeting
- Hemet/San Jacinto Exchange Club presentation
- MWD Board of Directors Report with Staff Recommended Water Supply Allocation Plan

February 2008

- MWD of Orange County and Irvine Ranch WD staff briefing
- MWD Board of Directors Action Item
- San Gabriel Valley Water Association Meeting
- Orange County Water Policy Meeting
- SCAG Water Policy Task Force Meeting

Appendix C: 12-Month Review Process and Results

January 2010

- WSAP 12-Month Review Process workshop #1
  - Focused discussion of WSAP issues identified by Metropolitan staff and by member agencies since the July 2009 implementation began.

February 2010

- WSAP 12-Month Review Process workshop #2
  - Continuation of focused discussion
- WSAP 12-Month Review Process workshop #3
  - Continuation of focused discussion

March 2010

- WSAP 12-Month Review Process workshop #4
  - Continuation of focused discussion
- MWD Board of Directors information item
  - Review of potential modifications to the WSAP definition of Extraordinary Supply

April 2010

- WSAP 12-Month Review Process workshop #5
  - Recap of identified issues and discussion of Metropolitan staff proposals for adjustments to the WSAP
- Member Agency Managers Meeting
  - Update on the 12-Month Review Process
- WSAP 12-Month Review Process workshop #6
  - Discussion of WSAP issues related to groundwater replenishment
- Member Agency Managers conference call
  - Clarification of WSAP definition for Extraordinary Supply

May 2010

- Member Agency Managers Meeting
  - Discussion of proposed Extraordinary Supply policy principles and WSAP Local Supply certification process.
- Member Agency Managers conference call
  - Discussion of proposed Extraordinary Supply policy principles

June 2010

- MWD Board of Directors action item

July 2010

- MWD Board of Directors information item
  - Review of proposed adjustments to the WSAP developed in the 12-Month Review Process

August 2010

- MWD Board of Directors action item

Resulting Changes

- Removed references to Gains and Losses of Local Supply
    - Removed references in the WSAP to “gains and losses of local supplies” in order to better facilitate the accounting of historical base year and allocation year local supplies. This change did not affect the WSAP formula or allocations.
- Removed references to the Regional Shortage Percentage
    - Removed references to the “Regional Shortage Percentage” in the WSAP to reduce unintended confusion between calculation factors and shortage amounts. This change did not affect the WSAP formula or allocations.
- Included the Retail Impact Adjustment in all shortage levels
    - Included the Retail Impact Adjustment for Regional Shortage Levels 1 and 2. This change results in additional allocations to Metropolitan-dependent agencies under Level 1 and Level 2 regional shortages.
- Revised the accounting of Extraordinary Supplies
    - Revised the methodology for accounting of Extraordinary Supply in the WSAP formula by:
        - Removing the Base Period Local Supply threshold provision,
        - Removing the sliding-scale sharing mechanism from the formula, and
        - Including the full amount of the Extraordinary Supply in the calculation of the Retail Impact Adjustment.
- Included a Minimum Per Capita Water Use Threshold
    - Developed a minimum water use credit based on two GPCD water use thresholds. Member agencies would receive additional Metropolitan allocation for an acre-foot equivalent of GPCD below the minimum threshold. Member agency water use, on a gallon per capita per day (GPCD) basis, is compared to the following minimum thresholds established under Senate Bill X7-7 (Water Conservation Act of 2009)
        - 100 GPCD total use or
        - 55 GPCD residential indoor use
- Excluded Seawater Barrier from the WSAP Formula
    - Excluded seawater barrier supplies from the WSAP Base Period and Allocation Year local supply calculations. This allows the Board to determine allocations for seawater barrier demands separately from the WSAP.

Appendix D: Three-Year Review Process and Results

February 2011

- WSAP 3-Year Review Process workshop #1
    - Review of the existing WSAP policy formula; review of the process timeline; and focused discussion of WSAP issues identified by Metropolitan staff and by member agencies since the WSAP's adoption in February 2008

March 2011

- WSAP 3-Year Review Process workshop #2
    - Discussion of issues related to local supplies and baseline inflation due to adjustments for recycling in the WSAP formula
- WSAP 3-Year Review Process workshop #3
    - Continuation of prior workshop

April 2011

- WSAP 3-Year Review Process workshop #4
    - Discussion of issues and alternatives related to base period selection and baseline inflation in the WSAP formula
- WSAP 3-Year Review Process workshop #5
    - Discussion of recommendations to address baseline inflation in the WSAP formula

May 2011

- WSAP 3-Year Review Process workshop #6
    - Discussion of issues and alternatives for the growth adjustment methodology in the WSAP formula
- WSAP 3-Year Review Process workshop #7
    - Continuation of prior workshop

June 2011

- WSAP 3-Year Review Process workshop #8
    - Continuation of prior workshop, discussion of WSAP implementation exit strategy
- WSAP 3-Year Review Process workshop #9
    - Continuation of exit strategy discussion, discussion of baseline inflation due to conservation and related conservation demand hardening issues

July 2011

- WSAP 3-Year Review Process workshop #9
    - Continued discussion of baseline inflation and conservation issues, and discussion of sharing allocations between agencies with common local resources

August 2011

- WSAP 3-Year Review Process workshop #10
    - Discussion of WSAP Allocation Year timing vs. Tier 1-Tier 2 rate cycle timing, discussion of approaches for encouraging completion of WSAP local supply certifications
- Review WSAP at Member Agency Managers Meeting
    - Discussion of proposed WSAP adjustments to address baseline inflation issues, revise the growth adjustment methodology, and establish a WSAP exit strategy

September 2011

- MWD Board of Directors action item

Resulting Changes

- Baseline Inflation Adjustment
    - Removed non-potable recycling and conservation from the WSAP baseline
        - Increases in recycling and conservation will be subtracted annually from the Base Period forward
        - The annual population growth rate will be applied after deducting the annual increases in recycling and conservation
        - If an agency ends up in allocation penalty, a penalty reduction will be applied in an amount equal to the Code-Based and rate Structure conservation savings that were removed from the WSAP baseline
- Changed the Growth Adjustment methodology
    - Growth will be allocated at historical per capita rate capped at the 2010 Integrated Water Resource Plan (IRP) Target for Water Use Efficiency
        - For years up to and including 2014, the cap will be 163 GPCD
        - For years 2015-2020, the cap will reduce linearly from 163 to 145 GPCD
    - If an agency exceeds its allocation, a penalty reduction will be applied based on either:
        - The differential Evapotranspiration (ETo) of its service area compared to the MWD average, or
        - Certified and documented 20 x 2020 targeted GPCD
- Exit Strategy
    - Clarified the course of action for an existing WSAP allocation when Metropolitan's Board makes a declaration decision for the following WSAP year
        - If there is an allocation for the next year, then the current allocation stays in place
        - If there is no allocation for the next year, then the current allocation is lifted concurrent with the April decision

Appendix E: 2014 Review Process and Results

July 2014

- WSAP Workgroup Meeting #1
  - First meeting of the 2014 WSAP Review process; review of the existing WSAP policy and formula; review of the process timeline; began discussion of issues related to base period selection
- WSAP Workgroup Meeting #2
  - Discussion of base period selection

August 2014

- WSAP Workgroup Meeting #3
  - Continuation of prior workshop discussion; comparison of base period alternatives

September 2014

- WSAP Workgroup Meeting #4
  - Discussion of a base period proposal; discussion of replenishment issues in the WSAP; discussion of 2015 water supply scenarios
- Review WSAP at Member Agency Managers Meeting
  - Review of WSAP workgroup process; discussion on issues related to base period, demand hardening, and local resources development
- WSAP Workgroup Meeting #5
  - Review of base period recommendation; discussion of issues regarding agencies in mandatory conservation during a base period; discussion on replenishment in the WSAP

October 2014

- WSAP Workgroup Meeting #6
  - Continuation of prior workshop discussion; discussion of alternative methods for conservation demand hardening credit; discussion of new and existing local supplies
- Review WSAP at Member Agency Managers Meeting
  - Review of WSAP workgroup process; discussion of issues related to base period and demand hardening

November 2014

- WSAP Workgroup Meeting #7
  - Review and discussion of issues and potential methods for base period selection and adjustment, replenishment allocation, and conservation demand hardening credit; review of estimated effects of potential WSAP changes at the regional level
- WSAP Workgroup Meeting #8
  - Review of proposed recommendations for the WSAP based on workgroup discussion
- Review WSAP at Member Agency Managers Meeting
  - Review of proposed recommendations for the WSAP based on workgroup discussion

Resulting Changes

- Base Period Update to FY2013 and FY2014
    - Changed the WSAP Base Period from calendar years 2004-2006 to fiscal years ending July 2013 and 2014
    - Mandatory Conservation Adjustment
        - Agencies with mandatory conservation in effect during the base period (FY 2013 and/or FY 2014) may qualify for a demand hardening adjustment, adjustment is subject to a consultation process that includes consideration historical demand and GPCD information

- Modify Conservation Demand Hardening Credit
    - Replaced device calculation-based estimates of conservation savings with a GPCD-based method
        - Conservation savings are calculated by comparing GPCD from a historical baseline to the Allocation Year; the difference is converted to acre-feet using the Allocation Year population.
            - Baseline GCPD is 10-year average ending between 2004 and 2010, with gross water, using gross water use minus non-potable recycled water production and documented historical population
    - Replaced formula for calculating the credit for each Regional Shortage Level
    - Conservation Demand hardening credit will be based on an initial 10 percent of GPCD-based conservation savings plus an additional 5 percent for each level of Regional Shortage; the credit will also be adjusted for the overall percentage reduction in retail water demand and the member agency's dependence on Metropolitan.
- Allocation Surcharge
    - Replaced the WSAP Penalty Rate with an Allocation Surcharge based on the estimated cost of Turf Replacement conservation programs

Appendix F: Summary of Historical Shortage Plans

These five elements incorporated into the WSAP have, in four out of five instances, been used in previous shortage plans. Both the IICP and the 1995 DMP used a historical base period calculation, adjusted for growth, made local supply adjustments, and used conservation hardening credits in their formulations. The retail impact adjustment is the only feature of the WSAP that has not been used historically.

Table 5: Historical Shortage Plan Overview

Plan Element	1991 IICP	1995 DMP	WSAP
Historical Base Period	√	√	√
Growth Adjustment	√	√	√
Local Supply Adjustment	√	√	√
Conservation Hardening Credit	√	√	√
Retail Impact Adjustment			√

Appendix G: Water Supply Allocation Formula Example

The following example gives a step-by-step description of how the formula would be used to calculate an allocation of Metropolitan supplies for a hypothetical member agency. All numbers are hypothetical for the purpose of the example and do not reflect any specific member agency.

Step 1: Calculate Base Period Retail Demand

Base Period Local Supplies: Calculated using a two-year average of groundwater (gw), groundwater recovery (gwr), Los Angeles Aqueduct supply (laa), surface water (sw), seawater desalination (sd), and other non-Metropolitan imported supplies (os). For the purpose of this example, assume that the two year average is 59,000 af.

$$[(gw1+gwr1+laa1+sw1+sd1+os1) + (gw2+gwr2+laa2+sw2+sd2+os2)] \div 2 = 59{,}000 \text{ af}$$

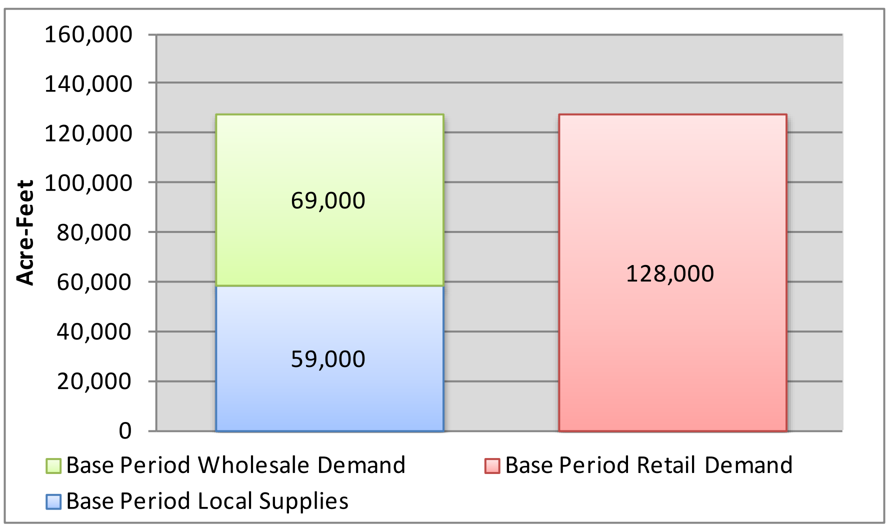
Base Period Wholesale Demands: Calculated using the same two-year time period as the Base Period Local Supplies. The Base Period Wholesale Demands include firm purchases (fp) and in-lieu deliveries to long-term groundwater replenishment (il), conjunctive use (cup), cyclic (cyc), and supplemental storage programs (ss). For the purpose of this example, assume that the two year average is 69,000 af.

$$[(fp^1++il^1+cup^1+cyc^1+ss^1) + (fp^2+il^2+cup^2+cyc^2+ss^2)] \div 2 = 69{,}000 \text{ af}$$

Base Period Retail Demands: Calculated as the sum of the Base Period Local Supplies and Base Period Wholesale Demand.

$$59{,}000 + 69{,}000 = 128{,}000 \text{ af}$$

Figure 1: Base Period Retail Demand Calculation



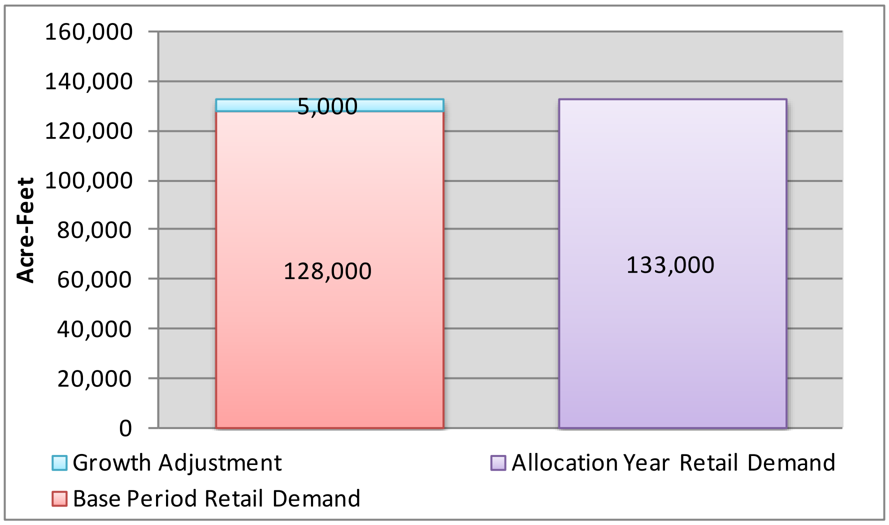
Calculate Adjustment for Base Period Mandatory Rationing (if applicable): The hypothetical agency used in this example is assumed not to qualify for the Base Period Mandatory Rationing Adjustment. A detailed discussion of the adjustment methodology can be found in Appendix I: Base Period Rationing Adjustment Example.

Step 2: Calculate Allocation Year Retail Demand

Allocation Year Retail Demand: Calculated by adjusting the Base Period Retail Demand for any baseline inflation and growth that occurred since the Base Period.

128,000 af + 5,000 af (net adjustment to retail demand) = 133,000 af

Figure 2: Allocation Year Retail Demand Calculation



Step 3: Calculate Allocation Year Wholesale Demand

Allocation Year Local Supplies: Estimates of Allocation Year Local Supplies are provided by the member agencies upon implementation of a WSAP. If estimates are not provided, Metropolitan will use the sum of the Base Period Local Supplies and Base Period In-Lieu Deliveries as a default. Agencies may provide updated estimates at any time during the Allocation Year to more accurately reflect their demand for Metropolitan supplies. For this example assume that the Allocation Year Local Supplies total 65,000 acre-feet.

Allocation Year Local Supplies = 65,000 af

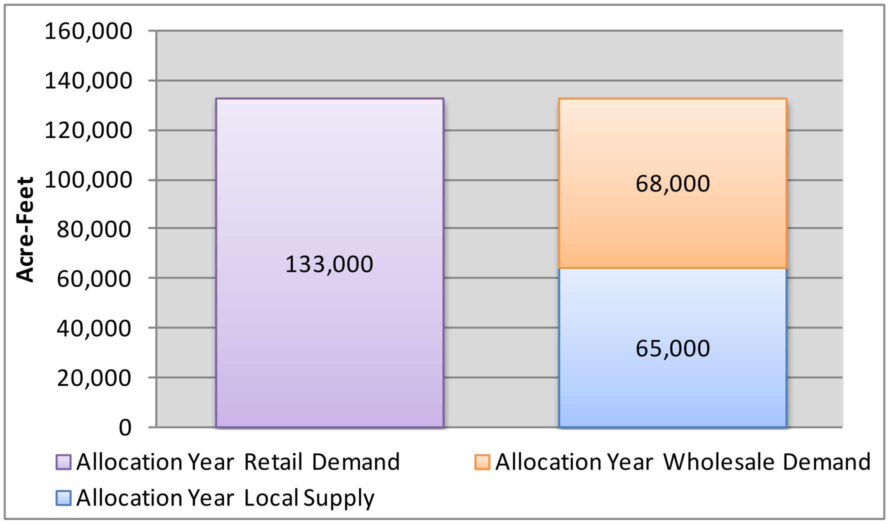
For this example assume also that this agency has an additional 5,000 acre-feet of supplies that meet the determinations for Extraordinary Supply. These supplies are withheld from the allocation formula except for in calculating the Retail Impact Adjustment Allocation.

Extraordinary Local Supplies = 5,000 af

Allocation Year Wholesale Demands: Calculated by subtracting the Allocation Year Local Supplies (65,000 af) from the Allocation Year Retail Demands (133,000 af).

133,000 af - 65,000 af = 68,000 af

Figure 3: Allocation Year Wholesale Demand Calculation



Step 4: Calculate the Wholesale Minimum Allocation

Wholesale Minimum Percentage: Calculate from Table 1 for Regional Shortage Level 4.

Table 1: Shortage Allocation Index		
(a) Regional Shortage Level	(b) Wholesale Minimum Percentage	(c) Maximum Retail Impact Adjustment Percentage
4	70.0%	10.0%

Wholesale Minimum Allocation: Calculated by multiplying the agency's Allocation Year Wholesale Demand (68,000 af) by the Wholesale Minimum Percentage (70%) from the Table 1 for Regional Shortage Level 4.

68,000 af * 70% = 47,600 af

Step 5: Calculate the Retail Impact Adjustment Allocation

Maximum Retail Impact Adjustment Percentage: Calculate from Table 1 for Regional Shortage Level 4.

Retail Impact Adjustment Allocation: Calculated first by determining the agency's dependence on Metropolitan by dividing the Allocation Year Wholesale Demand (68,000 af) minus the Extraordinary Supply (5,000 af) by the Allocation Year Retail Demand (133,000 af) and multiplying by 100.

[(68,000 af - 5,000 af)/ 133,000 af] * 100 = 47%

Next, this percentage dependence on Metropolitan (47%) is multiplied by the Maximum Retail Impact Percentage for Shortage Level 4 (10%).

47% * 10% = 4.7%

This percentage is now multiplied by the Allocation Year Wholesale Demand (68,000 af) for the Retail Impact Adjustment Allocation.

68,000 af * 4.7% = 3,221 af

Step 7: Calculate the Conservation Demand Hardening Adjustment

Calculate Baseline GPCD: To estimate conservation savings, each member agency will establish a historical baseline GPCD calculated in a manner consistent with California Senate Bill SBx7-7, using a 10 or 15-year average ending between 2004 and 2010, using gross water use minus non-potable recycle water production and documented historical population. For this example assume that the Baseline GPCD is 154 GPCD

Baseline GPCD = 154 GPCD

Calculate Allocation Year GPCD: Next, calculate the allocation year GPCD by converting the Allocation Year Retail Demand to GPCD and dividing by the Allocation Year Population from the WSAP. For this example the Allocation Year Retail Demand is 133,000 AF (see Step 2 above) and assume the Allocation Year Population is 905,000 persons. The resulting GPCD is 131 GPCD.

Allocation Year GPCD = 133,000 af/year * 325,851 gallons/af ÷ 365 days/year ÷ 905,000 persons = 131 GPCD

Calculate Reduction in GPCD: Subtract Allocation Year GPCD from Baseline GPCD to determine the GPCD Reduction.

GPCD Reduction = 154 GPCD – 131 GPCD = 23 GPCD

Calculate Conservation Savings: Convert the GPCD Reduction to the equivalent annual conservation savings in acre-feet, using the Allocation Year Population.

$$\text{Conservation Savings} = \frac{(\text{(GPCD Reduction)} \times 365 \text{ days/yr} \times \text{Population})}{325{,}851 \text{ gallons/af}}$$

Conservation Savings = 23 x 365 x 905,000 ÷ 325,851 = 23,316 af

Multiply by Regional Shortage Level Percentage: Multiply the Conservation Savings by 10 percent plus an additional 5 percent for each level of Regional Shortage (see Step 4 above). This example assumes a Regional Shortage Level of 4. This scales the hardening credit by the level of regional shortage, thereby increasing the credit as deeper shortages occur when demand hardening has a larger impact on the retail consumer.

23,316 af x (10% + (4 x 5%) = 6,995 af

Multiply by Conservation Savings Percentage: Next, multiply by the percentage of an agency's demand that was reduced through conservation. This scales the hardening by the total percentage reduction to recognize that increased hardening occurs as increasing amounts of conservation are implemented.

Conservation Savings Percentage = 1 + ((Baseline GPCD – Allocation Year GPCD)/Baseline GPCD)

Conservation Savings Percentage = 1+ ((154 GPCD – 131 GPCD)/154 GPCD) = 115%

6,995 af x 115% = 8,044 af

Multiply by Dependence on MWD: Next, multiply by the agency's percentage dependence on MWD as shown in Step 5 above. This scales the credit to the member agency's dependence on MWD to ensure that credits are being applied to the proportion of water demand that is being affected by reductions in MWD's supply. For this example, dependence on MWD is 47%.

8.044 af x 47% = 3,781 af

Summary: The Conservation Demand Hardening Adjustment calculation is summarized by the following formula:

Conservation Demand Hardening Adjustment = Conservation Savings x (10% + Regional Shortage Level %) x (1+Conservation%) x Dependence on MWD %

Conservation Demand Hardening Adjustment = 23,316 af x (10% + (4 x 5%)) x (115%) x (47%) = 3,781 af

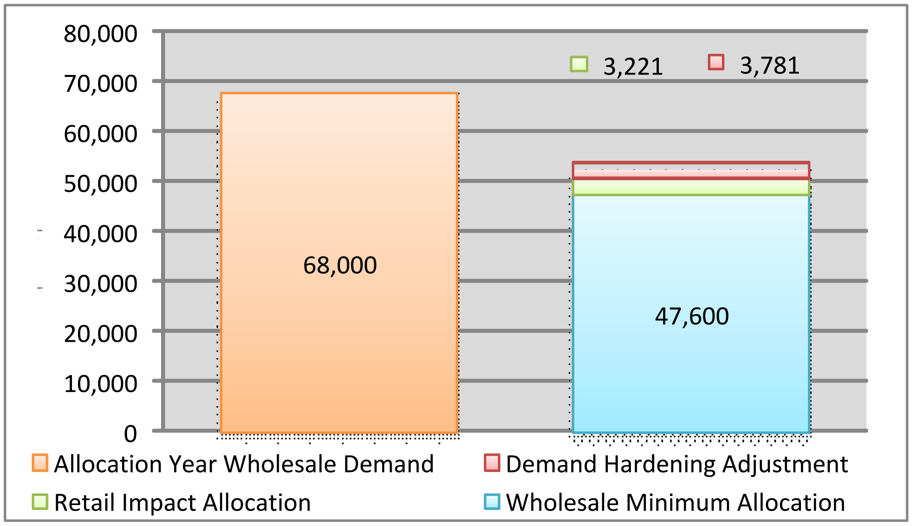
Step 8: Calculate the Low Per-Capita Adjustment Allocation: The hypothetical agency used in this example is assumed not to qualify for the Low Per-Capita Adjustment. A detailed discussion and example of the Low Per-Capita Adjustment calculation can be found in Appendix J: Per Capita Water Use Minimum Example.

Step 9: Calculate the total WSAP Allocation

WSAP Allocation: Calculated by adding the Wholesale Minimum Allocation (47,600 af), the Maximum Retail Impact Adjustment (3,221 af), the Demand Hardening Adjustment (3,781 af), and the Low Per-Capita Adjustment (0 af).

47,600 af + 3,221 af + 3,781 af + 0 af = 54,602 af

Figure 4: WSAP Allocation Regional Shortage Level 4



Step 10: Calculate total retail level reliability

Retail level reliability: Calculated by adding the WSAP Allocation (54,602 af), the Allocation Year Local Supply (65,000 af) and the Extraordinary Local Supply (5,000 af) and dividing by the Allocation Year Retail Demand (133,000 af).

(54,602 af + 65,000 af + 5,000 af) ÷ 133,000 af = 93.7%

Total Metropolitan Supply Allocations: In addition to the WSAP Allocation described above, agencies may also receive separate allocations of supplies for groundwater replenishment and seawater barrier demands. More information on the groundwater replenishment allocation is located in Appendix L: Groundwater Replenishment Allocation.

Appendix H: Board Policy Principles on Determining the Status of Extraordinary Supply

At the June 8, 2010 Water Planning and Stewardship Committee meeting Metropolitan's Board of Directors adopted the following policy principles to guide staff in determining the Extraordinary Supply status of future member agency supply programs.

No Negative Impacts to Other Member Agencies

A potential Extraordinary Supply for a member agency should not decrease the amount of Metropolitan water supply that would be available to the other member agencies in a WSAP. Programs that utilize Metropolitan supplies as a primary or in-lieu source or as a means of payback or future replenishment may have the effect of decreasing supplies, available to other agencies, if designated as Extraordinary Supply.

Provides Supply in Addition to Existing Regional Supplies

A potential Extraordinary Supply should provide a water supply that increases the overall water supplies that are available to the region in a WSAP. A program that is designed to move existing regional supplies from year to year would not qualify.

Specifically Designed Program or Supply Action

A potential Extraordinary Supply must be intentionally created and operated to provide additional supply yield. Normal variations in existing and planned local supply programs would not qualify.

Intended for Consumptive Use in a WSAP

A potential Extraordinary Supply should be designed with the primary intention to deliver water supply to a member agency only at a time when Metropolitan is allocating supplies. Programs designed to deliver water on a regular basis would not qualify. Exceptions for reasonable use of a supply program for emergency or other extenuating local circumstances should be considered.

Fully Documented Resource Management Actions

A potential Extraordinary Supply should have a full description as to the source, transmission, distribution, storage, and delivery of the water supply.

These principles are intended to identify deliberate actions taken by member agencies to augment supplies only when Metropolitan is allocating supplies through the WSAP. Production from existing local supplies, programs that are operated on an ongoing basis, and incidental increases in water supply would not qualify as Extraordinary Supply. The intent of the Extraordinary Supply designation is to recognize programs and actions that are additive to the total regional water supply as the region continues to confront the water supply challenges from drought and regulatory conditions. To that end, any supply actions taken after the initial implementation of the WSAP in July 2009 that utilize Metropolitan supplies either as a primary source, or to refill or replenish an incurred obligation or deficit at a future date would not qualify as Extraordinary Supply.

Appendix I: Base Period Mandatory Rationing Adjustment

Agencies that were under mandatory water use restrictions during the Base Period may have water use that is lower due to the mandatory actions already taken. Without adjusting for this, those agencies could be required to enforce even higher levels of restrictions under an allocation than those agencies that had not started mandatory restrictions.

To qualify for a Base Period Mandatory Rationing Adjustment, the member agency must provide Metropolitan staff with the following information:

- Time period when the mandatory conservation was in effect; it must be in effect during the Base Period
- A statement, with documentation, of how drought restrictions comply with the following Mandatory Conservation qualifications:
    - Governing Body-authorized or enacted
    - Includes mandatory demand reduction actions, restrictions or usage limitations including penalty-backed water budgets
    - Enforced by assessing penalties, fines, or rates based upon violating restrictions or exceeding usage limitations
- If the agency in question is a retail subagency, then the retailer's base period water demands during the Base Period in order to determine proportion to the member agency's total demand
- Historical data to construct GPCD base and trend for the consultation

Calculating the Base Period Rationing Adjustment involves following steps:

- Use the Baseline GPCD 10 or 15-year period selected by member agency for the Conservation Demand Hardening Adjustment calculation.
- Interpolate from the GPCD value of the midpoint of the Baseline GPCD period to the average GPCD of the two years preceding the agency's mandatory conservation
- Extrapolate to the WSAP Base Period (FY2013 and FY2014)
- Calculate the difference between estimated and observed GPCD for FY2013 and FY2014
- Convert to Acre-Feet and add to the member agency's Base Period Retail Demands

Appendix J: Per-Capita Water Use Minimum Example

This adjustment creates a minimum per capita water use threshold. Member agencies' retail-level water use under the WSAP is compared to two different thresholds. The minimum water use levels are based on compliance guidelines for total and residential water use established under Senate Bill X7-7.

Total Retail Level Use: 100 GPCD
Residential Retail Level Use: 55 GPCD

Agencies that fall below either threshold under the WSAP would receive additional allocation from Metropolitan to bring them up to the minimum GPCD water use level. To qualify for this credit, member agencies must provide documentation of the total agency level population and the percent of retail level demands that are residential; no appeal is necessary.

The following example gives a step-by-step description of how the Low Per-Capita Water Use Adjustment would be calculated for a hypothetical member agency. All numbers are hypothetical for the purpose of the example and do not reflect any specific member agency. This example was calculated using the following assumptions:

Allocation Year Retail Demand: 50,000 acre-feet
Allocation Year Local Supplies: 25,000 acre-feet;
Allocation Year Wholesale Demand: 25,000 acre-feet
Base Period Conservation: 5,000 acre-feet
Agency Population: 375,000
Percent of Retail Demands that are Residential: 60%

Step 1: Calculate Total Retail-Level Allocation Year Supplies

Table 6 shows the Allocation Year Local Supply, WSAP Allocation, and the total Allocation Year Supplies for the example agency at each Regional Shortage Level. The WSAP Allocation was calculated using the methodology detailed in Appendix G: Water Supply Allocation Formula Example and the assumptions listed above.

Table 6: Total Retail Level Allocation Year Supplies			
Regional Shortage Level	**Allocation Year Local Supply**	**WSAP Allocation**	**Total Allocation Year Supply**
1	25,000	23,594	48,594
2	25,000	22,188	47,188
3	25,000	20,781	45,781
4	25,000	19,375	44,375
5	25,000	17,969	42,969
6	25,000	16,563	41,563
7	25,000	15,156	40,156
8	25,000	13,750	38,750
9	25,000	12,344	37,344
10	25,000	10,938	35,938

Step 2: Calculate the Equivalent Total and Residential GPCD

The next step is to calculate the equivalent water use in gallons per capita per day (GPCD) for the Total Allocation Year Supply. The following equation shows the GPCD calculation under Regional Shortage Level 10.

35,938 af * 325,851 gallons ÷ 375,000 people ÷ 365 days = 85.6 GPCD

The residential per-capita water use is calculated in the same manner. Based on the assumption that 60% of the agency demands are residential, the following equation shows the residential GPCD calculation under Regional Shortage Level 10.

35,938 af * 60% * 325,851 gallons ÷ 375,000 people ÷ 365 days = 51.3 GPCD

Step 3: Compare the Total and Residential GPCD to the Minimum Water Use Thresholds

The next step is to compare the total GPCD water use to the 100 GPCD total water use threshold. In a Regional Shortage Level 10, the WSAP results in an allocation that is 14.4 GPCD below the minimum threshold.

100 GPCD – 85.6 GPCD = 14.4 GPCD

Likewise the residential GPCD water use is compared to the 55 GPCD residential water use threshold.

55 GPCD – 51.3 GPCD = 3.7 GPCD

Step 4: Determine the Allocation Adjustment in Acre-Feet

The final step is to calculate the acre-foot equivalent of the GPCD that fell below the minimum threshold. In a Regional Shortage Level 10, the adjustment provides 6,068 acre-feet of additional allocation to the agency; the results for Shortage Levels 1-10 are shown in Table 7.

14.4 GPCD ÷ 325,851 gallons * 375,000 people * 365 days = 6,068 acre-feet

Table 7: Total Per-Capita Water Use Adjustment				
Regional Shortage Level	Allocation Year Supply	Equivalent GPCD	GPCD Below Threshold	Allocation Adjustment
1	48,594	115.7	0	0
2	47,188	112.3	0	0
3	45,781	109.0	0	0
4	44,375	105.6	0	0
5	42,969	102.3	0	0
6	41,563	98.9	1.1	443
7	40,156	95.6	4.4	1,849
8	38,750	92.3	7.7	3,255
9	37,344	88.9	11.1	4,662
10	35,938	85.6	14.4	6,068

Again, this step is repeated for the residential water use. In a Regional Shortage Level 10, the adjustment provides 1,540 acre-feet of additional allocation to the agency; the residential water use results for Regional Shortage Levels 1-10 are shown in Table 8.

$$3.7 \text{ GPCD} \div 325{,}851 \text{ gallons} * 375{,}000 \text{ people} * 365 \text{ days} = 1{,}540 \text{ acre-feet}$$

Table 8: Residential Per-Capita Water Use Adjustment				
Regional Shortage Level	Allocation Year Supply	Equivalent GPCD	GPCD Below Threshold	Allocation Adjustment
1	29,156	69.4	0	0
2	28,313	67.4	0	0
3	27,469	65.4	0	0
4	26,625	63.4	0	0
5	25,781	61.4	0	0
6	24,938	59.4	0	0
7	24,094	57.4	0	0
8	23,250	55.4	0	0
9	22,406	53.3	1.7	697
10	21,563	51.3	3.7	1,540

Agencies that fall below either threshold under the WSAP would receive additional allocation from Metropolitan to bring them up to the minimum GPCD water use level. If an agency qualifies under both thresholds, the one resulting in the maximum allocation adjustment would be given. Under this example the agency would receive 6,068 acre-feet of additional allocation in a Regional Shortage Level 10.

Appendix K: Qualifying Income-Based Rate Allocation Surcharge Adjustment Example

The following example provides a step by step description of how the qualifying income-based rate allocation surcharge adjustment is calculated. To qualify for this adjustment, member agencies must provide documentation showing the amount of retail demands that are covered by a qualifying income-based rate; no appeal is necessary.

The following list summarizes the allocation year demands, local supplies, and allocation as calculated in Appendix G: Water Supply Allocation Formula Example for a hypothetical agency under a Level 4 Regional Shortage. For detailed instructions on how to calculate these figures, reference Appendix G: Water Supply Allocation Formula Example.

Allocation Year Retail Demand: 133,000 acre-feet
Allocation Year Local Supplies: 68,000 acre-feet;
Level 4 WSAP Allocation: 52,735 acre-feet

Step 1: Allocation Surcharge Calculation

(a) **Water Use above Allocation:** The first step in calculating the income-based rate Allocation Surcharge adjustment is to calculate the agency's total Allocation Surcharge under the WSAP. If the agency did not incur any Allocation Surcharge from the allocation year, the income-based rate allocation surcharge adjustment would not apply. For the purpose of this example, the agency used 61,000 acre-feet of MWD supplies in the allocation year. This represents 8,265 acre-feet of use above the water supply allocation.

WSAP Allocation	52,735 af
Actual MWD Water Use	61,000 af
Use Above WSAP Allocation	8,265 af

(b) **Total Allocation Surcharge:** In this example the agency used 115.7% of its water supply allocation. 7,910 of the 8,265 acre-feet of use above the allocation would be assessed the Allocation Surcharge at an amount of $1,480 per acre-foot and 354 of the 8,265 acre-feet of use above the allocation would be assessed the Allocation Surcharge at an amount of $2,960.

Between 100% and 115% of Allocation	7,910 af	$1,480/af	$11,706,800
Greater than 115% of Allocation	354 af	$2,960/af	$1,047,840
Total	8,265 af		$12,754,640

Step 2: Effective Income-Based Rate Cutback

(a) **Calculate Retail Cutback:** The second step in calculating the income-based rate allocation surcharge adjustment is to calculate the amount of supply cutback that would have been expected from qualifying income-based rate customers under the WSAP. Using the water supply allocation that was calculated above, the total retail level impact on the agency can be determined. In this example the agency receives a retail level cutback of 15,265 acre-feet, or 11.5% of their retail level demand.

WSAP Allocation + Allocation Year Local Supplies	117,735 af
Allocation Year Retail Demand	133,000 af
Effective Cutback	**15,265 af (11.5%)**

(b) **Income-based Rate Customer Retail Cutback:** To calculate the effective income-based rate cutback, the amount of demand covered by a qualifying income-based rate is multiplied by the effective retail level cutback. For this example assume that the agency has 10,000 acre-feet of qualifying demands.

Qualifying Income-Based Rate Demand	10,000 af
Effective Cutback Percentage	11.5%
Effective Income-Based Rate Cutback	**1,148 af**

(c) **Income-based Rate Cutback Allocation Surcharge:** Once the effective cutback has been calculated, the amount of Allocation Surcharge that is associated with qualifying income-based rate customers can be determined.

Between 100% and 115% of Allocation	794 af	$1,480/af	$1,175,120
Greater than 115% of Allocation	354 af	$2,960/af	$1,047,840
Total	**1,148 af**		**$2,222,960**

(d) **Adjusted Allocation Surcharge Calculation:** Finally, the Allocation Surcharge attributable to qualifying income-based rate customers is subtracted from the total Allocation Surcharge that was calculated above to determine the qualifying income-based rate adjusted allocation surcharge. In the case that the monetary amounts associated with the Income-Based Rate are greater than the total amounts an agency incurs, no Allocation Surcharge will be incurred.

Total Allocation Surcharge	$12,754,640
Qualifying Income-Based Rate Allocation Surcharge	$2,222,960
Qualifying Income-Based Rate Adjusted Allocation	**$10,531,680**

Appendix L: Groundwater Replenishment Allocation

Groundwater basins help provide vital local supplies that can buffer the region from short-term drought impacts. Longer droughts can result in reductions to the many sources of water that replenish groundwater basins, resulting in lower basin levels and potential impacts to the overlying consumptive demands. Limited imported deliveries under these conditions may help avoid impacts to the basins that may be drawn out of their normal operating range or subject to water quality or regulatory impacts. To this end, Metropolitan provides a limited allocation for drought impacted groundwater basins based on the following framework:

a) Staff hold a consultation with qualifying member agencies who have taken groundwater replenishment deliveries since 2010 and the appropriate groundwater basin managers to document whether their basins are in one of the following conditions:
    i. Groundwater basin overdraft conditions that will result in water levels being outside normal operating ranges during the WSAP allocation period; or
    ii. Violations of groundwater basin water quality and/or regulatory parameters that would occur without imported deliveries.

b) Provide an allocation based on the verified need for groundwater replenishment. The allocation would start with a member agency's ten-year average purchases of imported groundwater replenishment supplies (excluding years in which deliveries were curtailed). The amount would then be reduced by the declared WSAP Regional Shortage Level (5 percent for each Regional Shortage Level).

c) Any allocation provided under this provision for drought impacted groundwater basins is intended to help support and maintain groundwater production for consumptive use. As such, a member agency receiving an allocation under this provision will be expected to maintain groundwater production levels equivalent to the average pumping in the Base Period. Any adjustments to a member agency's M&I allocation due to lower groundwater production would be reduced by deliveries made under this provision.

d) Agencies for which this allocation does not provide sufficient supplies for the needs of the groundwater basin may use the WSAP Appeals Process to request additional supply (subject to Board approval). The appeal should include a Groundwater Management Plan that documents the need for additional supplies according to the following tenets:
    i. Maintenance of groundwater production levels;
    ii. Maintenance of, or reducing the further decline of, groundwater levels;
    iii. Maintenance of key water quality factors/indicators;
    iv. Avoidance of permanent impacts to groundwater infrastructure or geologic features; and
    v. Consideration of severe and/or inequitable financial impacts.

Final amounts and allocations will be determined following the consultations with groundwater basin managers and member agencies.

Appendix M: Water Rates, Charges, and Definitions

Table 9: Water Rates and Charges Dollars per acre-foot (except where noted)			
Rate	Effective 1/1/2014	Effective 1/1/2015	Effective 1/1/2016
Tier 1 Supply Rate	$148	$158	$156
Tier 2 Supply Rate	$290	$290	$290
System Access Rate	$243	$257	$259
Water Stewardship Rate	$41	$41	$41
System Power Rate	161	$126	$138
Tier 1	$593	$582	$594
Tier 2	$735	$714	$728
Treatment Surcharge	$297	$341	$348
Full Service Treated Volumetric Cost			
Tier 1	$890	$923	$942
Tier 2	$1,032	$1,055	$1,076
Readiness-to-Serve Charge (millions of dollars)	$166	$158	$153
Capacity Charge (dollars per cubic foot second)	$8,600	$11,100	$10,900

Definitions:

(1) **Tier 1 Supply Rate -** recovers the cost of maintaining a reliable amount of supply.

(2) **Tier 2 Supply Rate** - set at Metropolitan's cost of developing additional supply to encourage efficient use of local resources**.**

(3) **System Access Rate** – recovers a portion of the costs associated with the delivery of supplies.

(4) **System Power Rate** – recovers Metropolitan's power costs for pumping supplies to Southern California.

(5) **Water Stewardship Rate** – recovers the cost of Metropolitan's financial commitment to conservation, water recycling, groundwater clean-up and other local resource management programs.

(6) **Treatment Surcharge** – recovers the costs of treating imported water.

(7) **Readiness-to-Serve Charge -** a fixed charge that recovers the cost of the portion of system capacity that is on standby to provide emergency service and operational flexibility.

(8) **Capacity Charge** – the capacity charge recovers the cost of providing peak capacity within the distribution system.

Source: http://www.mwdh2o.com/WhoWeAre/Management/Financial-Information

Appendix N: Allocation Appeals Process

Step 1: Appeals Submittal

All appeals shall be submitted to the Appeals Liaison in the form of a written letter signed by the member agency General Manager. Each appeal must be submitted as a separate request, submittals with more than one appeal will not be considered. The appeal request is to include:

- A designated member agency staff person to serve as point of contact.
- The type of appeal (erroneous baseline data, loss of local supply, etc.).
- The quantity (in acre-feet) of the appeal.
- A justification for the appeal which includes supporting documentation.

A minimum of 60 days are required to coordinate the appeals process with Metropolitan's Board process.

Step 2: Notification of Response and Start of Appeals Process

The Appeals Liaison will phone the designated member agency staff contact within 3 business days of receiving the appeal to provide an initial receipt notification, and schedule an appeals conference. Subsequent to the phone call, the Liaison will send an e-mail to the Agency General Manager and designated staff contact documenting the conversation. An official notification letter confirming both receipt of the appeal submittal, and the date of the appeals conference, will be mailed within 2 business days following the phone contact

Step 3: Appeals Conference

All practical efforts will be made to hold an appeals conference between Metropolitan staff and member agency staff at Metropolitan's Union Station Headquarters within 15 business days of receiving the appeal submittal. The appeals conference will serve as a forum to review the submittal materials and ensure that there is consensus understanding as to the spirit of the appeal. Metropolitan staff will provide an initial determination of the size of the appeal (small or large) and review the corresponding steps and timeline for completing the appeals process.

Steps 4-7 of the appeals process differ depending upon the size of the appeal

Small Appeals

Small appeals are defined as those that would change an agency's allocation by less than 10 percent, or are less than 5,000 acre-feet in quantity. Small appeals are evaluated and approved or denied by Metropolitan staff.

Step 4: Preliminary Decision

Metropolitan staff will provide a preliminary notice of decision to the member agency within 10 business days of the appeals conference. The preliminary decision timeline may be extended to accommodate requests for additional information, data, and documentation. The Appeals Liaison will mail a written letter to the member agency staff contact and General Manager, stating the preliminary decision and the rationale for approving or denying the appeal.

Step 5: Clarification Conference

Following the preliminary decision the Appeals Liaison will schedule a clarification conference. The member agency may choose to decline the clarification conference if they are satisfied with the preliminary decision. Declining the clarification conference serves as acceptance of the preliminary decision, and the decision becomes final upon approval by Metropolitan's executive staff.

Step 6: Final Decision

Metropolitan staff will provide a final notice of decision to the member agency within 10 business days of the clarification conference, pending review by Metropolitan's executive staff. The Appeals Liaison will mail a written letter to the member agency staff contact and General Manager, stating the final decision and the rationale for the decision. A copy of the letter will also be provided to Metropolitan executive staff.

Step 6a: Board Resolution of Small Appeal Claims

Member agencies may request to forward appeals that are denied by Metropolitan staff to the Board of Directors through the Water Planning and Stewardship Committee for final resolution. The request for Board resolution shall be submitted to the Appeals Liaison in the form of a written letter signed by the member agency General Manager. This request will be administered according to Steps 6 and 7 of the large appeals process.

Step 7: Board Notification

Metropolitan staff will provide a report to the Board of Directors, through the Water Planning and Stewardship Committee, on all submitted appeals including the basis for determination of the outcome of the appeal.

Large Appeals

Large appeals are defined as those that would change an agency's allocation by more than 10 percent, and are larger than 5,000 acre-feet. Large appeals are evaluated and approved or denied by the Board of Directors.

Step 4: Preliminary Recommendation

Metropolitan staff will provide a preliminary notice of recommendation to the member agency within 10 business days of the appeals conference. The preliminary decision timeline may be extended to accommodate requests for additional information, data, and documentation. The Appeals Liaison will mail a written letter to the member agency staff contact and General Manager, stating the preliminary recommendation and the rationale for the recommendation. A copy of the draft recommendation will also be provided to Metropolitan executive staff.

Step 5: Clarification Conference

Following the preliminary recommendation the Appeals Liaison will schedule a clarification conference. The member agency may choose to decline the clarification conference if the satisfied with preliminary recommendation. Declining the clarification conference signifies acceptance of the preliminary recommendation, and the recommendation becomes final upon approval by Metropolitan's executive staff.

Step 6: Final recommendation

Metropolitan staff will provide a final notice of recommendation to the member agency within 10 business days of the clarification conference, pending review by Metropolitan executive staff. The Appeals Liaison will mail a written letter to the member agency staff contact and General Manager, stating the final recommendation and the rationale for the recommendation. A copy of the final recommendation will also be provided for Metropolitan executive review.

Step 7: Board Action

Metropolitan staff shall refer the appeal to the Board of Directors through the Water Planning and Stewardship Committee for approval.

Appendix O: Appeals Submittal Checklist

Appeal Submittal

- ☐ Written letter (E-mail or other electronic formats will not be accepted)
- ☐ Signed by the Agency General Manager

Mailed to the appointed Metropolitan Appeals Liaison

Contact Information

- ☐ Designated staff contact
  - o Name
  - o Address
  - o Phone Number
  - o E-mail Address
- ☐ General Manager
  - o Name
  - o Address
  - o Phone Number
  - o E-mail Address

Type of Appeal

- ☐ State the type of appeal
  - o Erroneous historical data used in base period calculations
    - Metropolitan Deliveries
    - Local Production
    - Growth adjustment
    - Conservation savings
  - o Exclusion of physically isolated areas
  - o Extraordinary supply designation
  - o Groundwater Replenishment Allocation
  - o Base Period Mandatory Rationing Adjustment
  - o Other

Quantity of Appeal

- ☐ State the quantity in acre-feet of the appeal

Justification and Supporting Documentation

- ☐ State the rationale for the appeal
- ☐ Provide verifiable documentation to support the stated rationale
  - o Examples of verifiable documentation Include, but are not limited to:
    - Billing Statements
    - Invoices for conservation device installations
    - Basin Groundwater/Watermaster Reports
    - California Department of Finance economic or population data
    - California Department of Public Health reports

Attachment C

Resolution Adopting the Water Shortage Contingency Plan

Resolution 9281

**RESOLUTION
OF THE BOARD OF DIRECTORS
OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
ADOPTING THE WATER SHORTAGE CONTINGENCY PLAN**

WHEREAS, the Urban Water Management Planning Act requires urban water suppliers providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually to prepare and adopt, in accordance with prescribed requirements, a water shortage contingency plan;

WHEREAS, the Urban Water Management Planning Act specifies the requirements and procedures for adopting such Water Shortage Contingency Plans;

WHEREAS, the Urban Water Management Planning Act requires urban water suppliers to conduct an annual water supply and demand assessment (Annual Assessment) each year and to include in their water shortage contingency plans the procedures they use to conduct the Annual Assessment;

WHEREAS, the procedures used to conduct an Annual Assessment include, but are not limited to, the written decision-making process that an urban water supplier will use each year to determine its water supply reliability;

WHEREAS, The Metropolitan Water District of Southern California's (Metropolitan's) water shortage contingency plan provides that by June of each year, Metropolitan staff will present a completed Annual Assessment for approval by Metropolitan's Board of Directors or by the Board's authorized designee with expressly delegated authority for approval of Annual Assessment determinations;

and

WHEREAS, the Board of Directors of The Metropolitan Water District of Southern California has duly reviewed, discussed, and considered such Water Shortage Contingency Plan and has determined the Water Shortage Contingency Plan to be consistent with the Urban Water Management Planning Act and to be an accurate representation of the planned actions during shortage conditions for The Metropolitan Water District of Southern California.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of The Metropolitan Water District of Southern California that, on May 11, 2021, this District hereby adopts this Water Shortage Contingency Plan for submittal to the State of California and expressly authorizes the General Manager of The Metropolitan Water District of Southern California to approve the Annual Assessment each year.

I HEREBY CERTIFY that the foregoing is a full, true and correct copy of a resolution adopted by the Board of Directors of The Metropolitan Water District of Southern California, at its meeting held on May 11, 2021.

Judy Abdo

Secretary of the Board of Directors
of The Metropolitan Water District
of Southern California

Appendix 5

LOCAL PROJECTS

(From 2020 IRP local supply survey and Member Agency Coordination)

Table A.5-1
Recycled Water Projects

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
City of Anaheim		
Anaheim GWRS Purchases	120	2011
Anaheim Water Recycling Demonstration Project	110	2014
City of Burbank		
Burbank Recycled Water System Project	1,300	1967
Burbank Recycled Water System Expansion Project - Phase I	850	1995
Burbank Recycled Water System Expansion Project - Phase II	960	2009
Calleguas Municipal Water District		
Camrosa Water Reclamation Facility Project	1,600	1997
City of Camarillo Recycled Distribution System	1,502	1955
Conejo Creek Diversion Project	9,000	2003
Lake Sherwood Reclaimed Water System	420	1997
Oak Park/North Ranch Recycled Water Distribution System	1,300	1994
Oxnard Advanced Water Purification Facility Project Phase I	5,000	2015
Simi Valley Recycled Water Project	90	2001
VCWWD No. 1 WWTP Recycled Water Distribution System	1,100	2003
Central Basin Municipal Water District		
Albert Robles Center for Water Recycling & Environmental Learning	10,000	2020
Century/Rio Hondo Reclamation Program	5,000	1992
Cerritos Reclaimed Water System	1,750	1978
Cerritos Reclamation Extension Project	260	1993
Lakewood Water Reclamation Project	500	1989
Montebello Forebay Groundwater Recharge Project	54,500	1962
Eastern Municipal Water District		
Eastern Recycled Water System Expansion Project	5,000	2012
Original Customers, Reach 1 Phase I & Reach 2	28,950	1966
Rancho California Reclamation Expansion Project - Rancho Division	5,250	1993
Rancho California Reclamation Project - Rancho Division	225	1989
Reach 1 Phase II	1,700	2000
Reach 16 Phase I	707	2006
Reach 16 Phase II	Not Provided	Not Provided
Reach 3 & Reach 7	4,830	2012
Foothill Municipal Water District		
La Cañada Flintridge Country Club Controlled Access Irrigation	90	1962
City of Glendale		
Glendale Water Reclamation Project	400	1986
Glendale Water Reclamation Expansion Project	500	1992
Glendale Verdugo-Scholl and Brand Park Project	1,760	1995

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Inland Empire Utilities Agency		
Ely Basin Groundwater Recharge	14,000	1999
IEUA Regional Recycled Water Distribution System	13,500	1998
Regional Sewage Service Contract	3,500	1972
Las Virgenes Municipal Water District		
Calabasas Project	900	Not Provided
Calabasas Reclaimed Water System Extension Project	700	1989
Las Virgenes Reclamation Project	2,700	1984
Las Virgenes Valley Project	500	Not Provided
City of Long Beach		
Alamitos Barrier Reclaimed Water Project	3,025	2005
Leo J. Vander Lans Water Treatment Facility Expansion Project	3,475	2018
Long Beach Reclamation Project	1,700	1986
Long Beach Recycled Water System Expansion Phase I	2,750	2004
Original Customers	400	1980
THUMS	1,429	1981
City of Los Angeles		
Burbank Deliveries to Los Angeles	9	2018
Central City/Elysian Park Project Phase I - Taylor Yard Park	150	2009
Downtown Water Recycling Project	2,116	2018
Griffith Park South Water Recycling Project	450	2019
Hansen Area Water Recycling - Hansen Dam Golf Course	500	2015
Hansen Area Water Recycling Phase I Project	2,115	2008
Harbor Water Recycling Project	5,000	2005
Los Angeles Greenbelt Project	1,766	1993
North Atwater Area Water Recycling Project	50	2015
Original Deliveries from West Basin Reclamation Program	740	1996
Sepulveda Basin Water Reclamation Project Phase IV	445	2010
Sepulveda Basin Water Reclamation Project Phases I - III	1,500	2007
South Gardena Lateral	95	2019
Van Nuys Area Water Recycling Project	150	2011
Municipal Water District of Orange County		
Capistrano Valley Non-Domestic Water System	565	1989
Capistrano Valley Non-Domestic Water System Expansion Project	1,011	2006
El Toro Recycled Water System	260	1998
El Toro Recycled Water System Expansion Project - Phase I	1,050	2015
El Toro Recycled Water System Expansion Project - Phase II	350	2019
Green Acres Reclamation Project - Coastal MWD & Orange County	2,480	1991
GWRS Initial Expansion	30,000	2015
GWRS Phase I	74,880	2008

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Irvine Reclamation Expansion Project - Post 2003 Michelson & Los Alisos Dual Distribution System	8,500	2008
Irvine Reclamation Expansion Project - Pre 2003 Michelson & Los Alisos Dual Distribution System	1,500	Not Provided
Irvine Reclamation Project - Post 1983 Michelson System	10,000	1986
Irvine Reclamation Project - Pre 1983 Michelson System	6,000	1967
Moulton Niguel Reclamation Project - Phases I & II	470	1968
Moulton Niguel Reclamation Project - Phases III & IV	9,276	1993
San Clemente Recycled Water System Expansion Project	1,000	2015
San Clemente Water Reclamation Project	500	1990
San Clemente Water Reclamation Project - Municipal Golf Course	200	1957
Santa Margarita - Irvine Ranch Recycled Water Purchase Agreement	321	2001
Santa Margarita Advanced Purified Water Project	300	2018
Santa Margarita Chiquita Water Reclamation Project	2,772	2005
Santa Margarita Oso Water Reclamation Expansion Project	3,600	1988
Santa Margarita Oso Water Reclamation Project	1,200	1978
South Laguna Reclamation Expansion Project	0	1991
South Laguna Reclamation Project	860	1985
Trabuco Canyon Reclamation Expansion Project	800	1992
Trabuco Canyon Reclamation Project	280	1987
City of Santa Ana		
Green Acres Reclamation Project - Santa Ana	320	2008
City of Santa Monica		
Santa Monica Urban Runoff Recycling Facility	210	2005
San Diego County Water Authority		
4S Ranch WRF/ Olivenhain MWD	1,145	2003
Camp Pendleton Marine Corps Base Recycled Water System	1,950	1997
Connection #1 - North City Water Reclamation Plant/City of San Diego	465	2003
Connection #2 - North City Water Reclamation Plant/City of San Diego	25	2003
Del Mar San Elijo WRF/ San Elijo JPA	130	2000
Del Mar San Elijo WRF/ San Elijo JPA additional verifiable expansions	20	2000
Encina Basin Phases I & II - Carlsbad WRF/ Carlsbad MWD	2,315	1993
Encina Basin Phases I & II - Carlsbad WRF/ Carlsbad MWD additional verifiable expansions	135	1993
Encina Basin Phases I & II - Gafner WRF/ Leucadia CWD	260	1993
Encina Basin Phases I & II - Gafner WRF/ Leucadia CWD additional verifiable expansions	15	1993
Encina Basin Phases I & II - Meadowlark WRF (via Mahr Reservoir)/Vallecitos WD	2,425	1993
Encina Basin Phases I & II - Meadowlark WRF (via Mahr Reservoir)/Vallecitos WD additional verifiable expansions	140	1993

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Fallbrook Public Utility District Water Reclamation Project	1,200	1990
Fallbrook Public Utility District Water Reclamation Project Verifiable Expansions	500	Not Provided
Hale Avenue Resources Recovery Facility (HARRF)/City of Escondido	993	2004
Hale Avenue Resources Recovery Facility (HARRF)/City of Escondido additional verifiable expansions	127	2004
Hale Avenue RRF/City of Escondido HGWRP/Rincon MWD	648	2004
Hale Avenue RRF/City of Escondido HGWRP/Rincon MWD Verifiable Expansions	1,352	2004
Northwest Quadrant/Meadowlark WRF/Vallecitos WD	728	2009
Oceanside Water Reclamation Project	200	1992
Oceanside Water Reclamation Project Additional Verifiable Expansion	4,840	1992
Olivenhain SEJPA1-Quail Gardens	110	2000
Olivenhain SEJPA1-Quail Gardens additional verifiable expansions	13	2000
Olivenhain SEJPA2-Village Park, Manchester/Phase I	210	2000
Olivenhain SEJPA2-Village Park, Manchester/Phase I additional verifiable expansions	26	2000
Otay Recycled Water System Phases I & II	7,062	1991
Padre Dam Reclaimed Water System Phase I	850	1998
San Diego Northern Recycled Water Distribution System	12,619	1998
San Diego Northern Recycled Water Distribution System - deliveries to Poway	645	2009
San Diego Southern Recycled Water Distribution System	1,154	2006
San Dieguito San Elijo WRF/ San Elijo JPA	620	2000
San Dieguito San Elijo WRF/ San Elijo JPA additional verifiable expansions	80	2000
San Vicente Recycled Water System	230	1996
San Vicente Recycled Water Treatment Upgrades	340	2010
Santa Fe ID San Elijo WRF/ San Elijo JPA	530	2000
Santa Fe ID San Elijo WRF/ San Elijo JPA additional verifiable expansions	70	2000
Santa Maria Recycled Water System	400	1999
Santee Lakes Existing Project	65	1959
Santa Fe Valley WRF/Rancho Santa Fe CSD	153	2003
Woods Valley Ranch Water Reclamation Facility Phase I	47	2005
Three Valleys Municipal Water District		
City Industry Regional Recycled Water Project - Rowland Portion	1,017	2008
City Industry Regional Recycled Water Project - Walnut Valley Portion	2,135	2008
Pomona Recycled Water Distribution System	1,500	1973
Rowland Non-Potable Water System	340	1985
Walnut Valley Recycled Water System	1,100	1986
Walnut Valley Recycled Water System Expansion Project	500	1993

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
City of Torrance		
Torrance Recycled Water Purchases	7,800	1995
Upper San Gabriel Valley Municipal Water District		
City of Industry Recycled Water Distribution System	8,500	1983
County Sanitation Districts of Los Angeles County Deliveries	4,475	1978
Direct Reuse Project - Phase I	1,600	2003
Direct Reuse Project - Phase IIA Rosemead Extension	720	2011
Direct Reuse Project - Phase IIA Whittier Narrows Project	2,258	2006
Direct Reuse Project - Phase IIB Industry (Packages 1 - 4)	1,963	2011
Rose Hills Expansion	530	2015
South El Monte Recycled Water Expansion Project (Packages 1 - 5)	72	2019
West Basin Municipal Water District		
West Basin Water Recycling Program Phase I - IV	29,460	1995
West Basin Water Recycling Program Phase V	8,000	2013
Western Municipal Water District of Riverside County		
Corona Reclaimed Water Distribution System	4,750	2007
Elsinore Valley Horsethief Canyon Recycled Water System	400	1985
Elsinore Valley Railroad Canyon Recycled Water System	1,000	1984
Elsinore Valley Wildomar Recycled Water Project	300	2014
Jackson Street Recycled Water Pipeline Project - Phase 1	820	2018
Rancho California Reclamation Expansion Project - Rancho Division	750	1993
Rancho California Reclamation Project - Santa Rosa Division	225	1989
Riverside Recycled Water Program Phase	260	1997
Western Water Recycling Facility	900	1940
Western Water Recycling Facility Upgrade Project	1,300	2014

Under Construction Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Central Basin Municipal Water District		
CBMWD Recycled Water System Expansion Phase 1 (Gateway Cities)	500	2022
City of Los Angeles		
Los Angeles Groundwater Replenishment Project Initial Phase	7,000	2024
Los Angeles Groundwater Replenishment Project Second Phase	4,000	2026
North Hollywood Area Water Recycling Project	300	2025
Pershing Drive Recycled Water Pipeline Project	750	2022
Sepulveda Basin Sports Complex Water Recycling Project Phases I & II	350	2021
Terminal Island Recycled Water Expansion Project	8,000	2025
Westside Area Water Recycling Project	150	2021

Under Construction Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Municipal Water District of Orange County		
GWRS Final Expansion	29,150	2023
Santa Margarita Water District Trampas Canyon RW Reservoir	5,000	2020
San Diego County Water Authority		
East County Advanced Water Purification Program	12,882	2025
Escondido Membrane Filtration Reverse Osmosis Facility (Hale Avenue Resources Recovery Facility (HARRF)/City of Escondido)	3,280	2025
Oceanside Pure Water and Recycled Water Expansion Phase I Project	6,000	2025
Oceanside Pure Water and Recycled Water Expansion Phase I Project Additional Verifiable Yield	720	2025
San Diego Pure Water North City Phase I	33,600	2025
City of Santa Monica		
Advanced Water Treatment	1,100	2021
Santa Monica Urban Runoff Recycling Facility Upgrades	350	2021
Upper San Gabriel Valley Municipal Water District		
La Puente Valley County Water District Recycled Water Project	60	2024

CEQA Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
City of Anaheim		
Anaheim South Recycled Water Project	850	2027
Central Basin Municipal Water District		
West San Gabriel Recycled Water Expansion Project (Montebello Hills)	240	2020

Conceptual Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Calleguas Municipal Water District		
Camarillo Water Reclamation Plant Effluent Transfer Pipeline	1,120	2025
City of Camarillo Recycled Distribution System Expansion	2,583	2025
Oxnard Advanced Water Purification Facility Project - Phase II	5,000	2025
Oxnard Aquifer Storage and Recovery Completion	Not Provided	2024
Oxnard Aquifer Storage and Recovery Wells #2 and #3	Not Provided	2024
VCWWD No. 1 WWTP Recycled Water Distribution System Expansion Phase I	500	2025
Central Basin Municipal Water District		
City of Monterey Park Recycled Water Expansion Project	750	Not Provided
East Los Angeles Recycled Water Expansion Project	500	Not Provided
La Mirada Recycled Water Expansion Project	900	Not Provided

Conceptual Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
City of Compton		
Recycled Water Feasibility Study	262	2025
Eastern Municipal Water District		
Purified Water Replenishment, Phase I	4,000	2023
Purified Water Replenishment, Phase II	8,000	2035
Rancho Indirect Potable Reuse Project	4,000	2025
Foothill Municipal Water District		
Descanso Gardens MBR Plant	Not Provided	Not Provided
City of Glendale		
Public Works Yard Recycled Water Main Extension Project	80	Not Provided
Inland Empire Utilities Agency		
IEUA Regional Recycled Water Distribution System Expansion Ph I & II	33,000	Not Provided
Las Virgenes Municipal Water District		
Pure Water Project	3,100	2030
City of Los Angeles		
Airport Police Facility Water Recycling Project	39	2024
Extension to ConRAC Water Recycling Project	10	2024
Forest Lawn Tank	450	2024
Harbor Connection to Joint Pollution Control Plant	3,500	2023
Harbor Extension On Gaffey	4,500	2023
Harbor Extension on Port of LA Right-of-Way	1,000	2022
Second Dominguez Gap Connection and Harbor Potable Backup	6,661	2021
Terminal Island Recycled Water Expansion Project	1,000	2021
Municipal Water District of Orange County		
Moulton Niguel Reclamation Project - Phase V	2,000	2025
Santa Margarita Chiquita Water Reclamation Expansion Project	3,000	Not Provided
Santa Margarita Recycled Water Conversion Projects	2,420	Not Provided
City of Pasadena		
Pasadena Non-Potable Water Project - Ph I	700	Not Provided
Pasadena Non-Potable Water Project - Ph II: Southern Extension I	400	2023
Pasadena Non-Potable Water Project - Ph III: Southern Extension II	900	2027
Pasadena Non-Potable Water Project - Ph IV: Annandale Extension	280	2030
Pasadena Non-Potable Water Project - Ph V: Northwestern Extension	390	2033
Pasadena Non-Potable Water Project - Ph VI: Northeastern Extension	390	2036
San Diego County Water Authority		
Additional Planned - Carlsbad WRF/ Carlsbad MWD	495	2025
Connection #1 - North City Water Reclamation Plant/City of San Diego (Extension 153)	489	2030
East County Advanced Water Purification Program Expansion	2,803	2045
Escondido Potable Reuse Project	5,000	2035

Conceptual Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Hale Avenue Resources Recovery Facility (HARRF)/City of Escondido Additional Planned Expansions	6,800	2025
Indirect Potable Recharge	900	2020
Joint RW Transmission Project with SFID and OMWD/TBD (Bridges)	400	2030
Lilac Hills Ranch WRF/VCMWD	294	2035
Los Flores and Santa Margarita Basin Injection Project	1,320	2020
Lower Moosa Canyon Water Reclamation Facility Treatment Process Upgrade and Reclamation System	700	2020
Meadowlark Water Reclamation Facility Direct Potable Reuse	2,200	2030
Meadowood Water Reclamation Facility	143	2025
North County One Water Program - Carlsbad MWD	3,500	2035
North County One Water Program - Olivenhain MWD	2,500	2035
North County One Water Program - Poway	2,000	2035
North County One Water Program - San Dieguito WD	2,000	2035
North County One Water Program - Santa Fe ID	3,000	2035
North County One Water Program - Vallecitos WD	5,500	2030
North District Recycled Water Project Phase I	4,400	2030
North Village Water Reclamation Facility	105	2040
Olivenhain - SEJPA 1 (Gardenview Rd)	44	2030
Olivenhain SEJPA 3 (Manchester Avenue Phases I and II)	40	2025
Rancho Cielo Project	100	2030
Ray Stoyer Expansion	317	2025
San Diego Pure Water Phases II	59,360	2035
Welk Water Reclamation Facility	140	2025
Woods Valley Ranch Water Reclamation Facility Phase II	184	2020
Woods Valley Ranch Water Reclamation Facility Phase III	168	2030
City of Santa Monica		
Santa Monica Connection	100	Not Provided
Three Valleys Municipal Water District		
Los Angeles County Fairplex Recharge	1,000	2020
Pomona Recycled Water Distribution System Expansion	1,000	2020
Recharge in Chino Basin	2,405	2025
Western Municipal Water District of Riverside County		
Corona Reclaimed Water Distribution System Expansion	1,760	2020
Demineralization of Recycled Water	550	2026
Elsinore Valley Horsethief Canyon Recycled Water System Expansion	500	2022
Indirect Potable Reuse Project	5,700	2035
Jackson Street Recycled Water Pipeline Project - Phase 2	2,550	Not Provided
Riverside Habitat, Parks & Water Project (RHPWP)	10,000	2025

Table A.5-2
Groundwater Recovery Projects

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
City of Beverly Hills		
Beverly Hills Desalter Project	2,600	2003
Maple Wells (Shallow Wells)	350	2020
City of Burbank		
Burbank Operable Unit/Lockheed Valley Plant	11,000	1996
Calleguas Municipal Water District		
Round Mountain Water Treatment Plant	1,000	2014
Tapo Canyon Groundwater Treatment Plant	1,000	2010
Central Basin Municipal Water District		
Juan Well Filter Facility	900	2001
Water Quality Protection Plan	5,807	2007
Eastern Municipal Water District		
Menifee Basin Desalter Project	3,360	2002
Perris I Desalter	4,500	2006
Foothill Municipal Water District		
Glenwood Nitrate Water Reclamation Project	1,600	1993
Olive Avenue IX GAC Groundwater Treatment Plant	2,000	2004
City of Glendale		
Glendale Operable Unit	7,700	2001
Verdugo Park Water Treatment Plant	1,000	1997
Inland Empire Utilities Agency		
Chino Basin Desalination Program Phase I	9,600	2000
Chino Basin Desalination Program Phase II & III	12,800	2006
Las Virgenes Municipal Water District		
Westlake Wells-Tapia WRF Intertie Project	150	2000
Municipal Water District of Orange County		
Capistrano Beach Desalter Project	1,300	2007
Deep Aquifer Treatment System	8,000	2002
El Toro Groundwater Remediation Project	4,000	2007
Garden Grove Nitrate Blending Project	4,000	1990
Irvine Desalter Project	6,700	2007
IRWD Wells 21 & 22 Desalter	6,400	2013
Mesa Water Reliability Facility	8,941	2001
San Juan Basin Desalter Project Phase I	4,800	2004
Tustin 17th Street Desalter	3,200	1996
Tustin Main St Treatment Plant	2,000	1989
San Diego County Water Authority		
Mission Basin Desalter Facility Phases I & II	2,800	1994

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Richard A. Reynolds Groundwater Desalination Facility	3,600	2000
Richard A. Reynolds Groundwater Desalination Facility Expansion	2,600	2017
Three Valleys Municipal Water District		
Cal Poly Pomona Water Treatment Plant	250	2016
Harrison Groundwater Treatment Facility	981	2008
Towne Groundwater Treatment Plant & Well 3 Treatment Facility	4,678	1997
City of Torrance		
Robert W. Goldsworthy Desalter	2,400	2002
Robert W. Goldsworthy Desalter Expansion	2,600	2019
West Basin Municipal Water District		
C. Marvin Brewer Desalter	1,524	1993
Western Municipal Water District of Riverside County		
Arlington Basin Groundwater Desalter Project	6,100	1990
Chino Basin Desalination Program Phases II & III	12,800	2006
Existing Groundwater Threshold	9,500	2001
Temescal Basin Desalting Facility Project	10,000	2001

Under Construction Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Calleguas Municipal Water District		
North Pleasant Valley Regional Desalter	3,800	2020
Eastern Municipal Water District		
Perris II Desalter	5,400	2021
San Diego County Water Authority		
Fallbrook Groundwater Desalter Project	3,100	2025

CEQA Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Calleguas Municipal Water District		
Los Robles Golf Course Groundwater Utilization Project	930	Not Provided

Conceptual Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
City of Beverly Hills		
La Brea Subbasin Groundwater Development	1,700	2023
City of Burbank		
Deliveries from North Hollywood Operable Unit's offline wells	Not Provided	2022

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Calleguas Municipal Water District		
Moorpark Desalter Project	5,000	2030
Santa Rosa Basin Desalter	1,000	2025
Simi Groundwater Basin Reverse Osmosis Desalter	830	2025
Simi Valley Desalter Project	5,500	2025
Eastern Municipal Water District		
Perris North Basin Groundwater Contamination Prevention and Remediation Program	6,750	2023
City of Los Angeles		
West Coast Basin Brackish Water Reclamation	8,000	2024
San Diego County Water Authority		
Middle Sweetwater River Basin Groundwater Well System	1,000	2035
Otay Mesa Lot 7 Groundwater Well System	400	2035
Rancho del Rey Brackish Groundwater Development	500	2035
San Dieguito River Basin Groundwater Recovery and Treatment Project	1,120	2025
San Marcos Groundwater Basin Supply Options	2,000	2030

Table A.5-3
Seawater Desalination Projects

Existing Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
San Diego County Water Authority		
Claude "Bud" Lewis Carlsbad Desalination Plant - Carlsbad MWD	2,500	2015
Claude "Bud" Lewis Carlsbad Desalination Plant - SDCWA	50,000	2015
Claude "Bud" Lewis Carlsbad Desalination Plant - Vallecitos WD	3,500	2015

CEQA Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
Municipal Water District of Orange County		
Doheny Ocean Desalination Project	16,800	2025
Huntington Beach Seawater Desalination Project	56,000	2027
West Basin Municipal Water District		
West Basin Seawater Desalination Project	21,500	2030

Conceptual Projects	Ultimate Yield/Capacity (Acre-Feet)	Online Date
San Diego County Water Authority		
Otay Mesa Conveyance and Disinfection System Project (Purchase)	6,700	2030

Appendix 6

CONSERVATION ESTIMATES AND WATER SAVINGS FROM CODES, STANDARDS, AND ORDINANCES

Appendix 6
CONSERVATION ESTIMATES AND WATER SAVINGS FROM CODES, STANDARDS, AND ORDINANCES

Background

Unlike traditional water supplies, which can be directly measured, conservation reduces water demand in ways that may only be indirectly quantified. Demand is reduced through changes in consumer behavior and savings from water-efficient fixtures. There are numerous approaches for estimating and projecting conservation savings, and many of them are utility-specific to meet the unique needs of different water agencies. Metropolitan estimates savings from the extensive existing conservation programs that it funds directly, as well as savings produced by plumbing codes. Metropolitan also incorporates the savings due to the impacts of price on consumers in its demand forecasts. These conservation savings estimates are incorporated into Metropolitan's long-term planning documents such as the Integrated Water Resources Plan (IRP) and its Urban Water Management Plan (UWMP).

Conservation savings are commonly estimated from a base-year water-use profile. Beginning with the 1996 IRP, Metropolitan identified 1980 as the base year for estimating conservation because it marked the effective date of a new plumbing code in California. Among other changes, the new code required toilets in new construction to be rated at 3.5 gallons per flush or less. Between 1980 and 1990, Metropolitan's service area saved an estimated 250 TAF per year as the result of this 1980 plumbing code and unrelated water rate increases. Within Metropolitan's planning framework, these savings are referred to as "pre-1990 savings." Metropolitan's conservation accounting combines pre-1990 savings and estimates of more recently achieved savings from the following sources of conservation:

- Active Conservation – Water saved directly as a result of conservation programs by water agencies. Active conservation is unlikely to occur without agency action.
- Code-Based Conservation – Water saved as a result of changes in water efficiency requirements for plumbing fixtures in plumbing codes. Sometimes referred to as "passive conservation," this form of conservation would occur as a matter of course without any additional action from water agencies.
- Price-Effect Conservation – Water saved by retail customers attributable to the effect of changes in the real (inflation-adjusted) price of water. Because water has a positive price elasticity of demand, increases in water price will decrease the quantity of water demanded.

Metropolitan's Conservation Estimate

In September 19, 2014, Governor Brown signed SB 1420 (Wolk, D-Davis), which added Section 10631(e)(4) to the Water Code. This Section provided that "water use projections may display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans" if that information is available and applicable to an urban water supplier. SB 606 (Hertzberg) amended Water Code Section 10631(e)(4), which is now Section 10631(d)(4) and applies only to retailers. This Section now requires that water use projections, where available, must "display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans identified by the urban water supplier, as applicable to the service area."

Metropolitan's conservation estimate is a comprehensive representation of Metropolitan's active conservation activities. It includes a combination of: (1) fixture/program-related savings, and (2) an estimate of code-based plumbing code conservation savings from a 1990 base year. In addition, price-effect savings are calculated using Metropolitan's MWD-EDM, a statistical model used to forecast retail water demands. Potential savings from public outreach and education programs are not included in Metropolitan's conservation estimate.

Distinguishing between active, code-based, and price-effect conservation can be complex when, for example, active programs for fixtures are implemented concurrently with conservation-related plumbing codes. Metropolitan's conservation estimate combines active, code-based, and price-effect conservation savings using methods that avoid double counting. Currently, 96 devices and programs are accounted for in estimating active conservation. These devices are spread across residential, landscape, commercial, industrial, and institutional sectors. There are eight fixtures tied to Code-based conservation estimate.

Metropolitan's conservation estimate is developed in cooperation with its 26 member agencies and falls into three general categories:

- Single-family residential (SFR),
- Multi-family residential (MFR), and
- Commercial, industrial, and institutional (CII).

Active Conservation

Estimated savings for active conservation account for programs administered by Metropolitan and its member agencies since 1990. These savings are calculated by combining counts of active program activity – numbers of devices and/or program implementations – with device-related water savings factors. These factors include:

- Savings per device/implementation
- Device life expressed in years
- Decay rate expressed as percent decay per year

Device savings estimates reflect the key assumptions outlined above. Devices may be represented more than once due to different implementation methods or savings factors. Assumptions are periodically reviewed to ensure they represent the best available savings estimates. Device-specific savings are adjusted to account for performance decay rates, or device life, but not both. For example, a residential premium high-efficiency toilet (PHET) saves about 9.4 gallons per day when replacing a 1.6 gallons per flush toilet. Lifetime savings would assume a physical life of 20 years and no performance decay.

Code-Based Conservation

Code-Based conservation accounts for water saved as a result of changes in water efficiency requirements for plumbing fixtures in plumbing codes. Plumbing code conservation is the impact of plumbing codes and other ordinances on water demand. Metropolitan's Code-Based conservation estimate represents plumbing code conservation with demographically-driven stock models. The stock models are device- or fixture- specific and are based on the same demographic data used in Metropolitan's retail demand projection. Each stock model considers the stocks and flows of conserving and non-conserving water devices, providing estimates of the impacts of plumbing codes on device saturation and overall savings.

Metropolitan's Code-based conservation estimate accounts for the following:

- New Construction: Water fixtures installed due to new construction are assumed to be in compliance with the plumbing codes in effect when the new construction occurs. For instance, a house built in 1997 would meet the efficiency standards set by California's 1992 plumbing code. Therefore, new construction is assumed to result in measurable savings from 1990, which is the baseline for conservation savings calculations. Estimates and projections of the number of fixtures added through new housing units and offices are based on growth in housing units or employment.
- Natural Replacement: Natural replacement accounts for the savings that accrue when fixtures are replaced with more efficient models due to remodeling, failure, or for other reasons. Metropolitan's savings estimate represents this effect with a "natural replacement rate" that is expressed as a percentage of existing fixtures that are replaced in a given year. Natural replacement rates vary by device and are linked to the expected life of the device. Devices with short lifespans will be replaced more frequently and thus have higher natural replacement rates. A simple percentage is used to account for this natural turn-over in non-conserving fixtures because it is difficult to back-calculate the age of the fixtures in pre-1990 construction.
- Fixtures Up for Renewal: As water-conserving fixtures reach their useful lives and become defective or inefficient, they may be replaced with water conserving fixtures due to plumbing codes. The water savings from the device is then considered "renewed" savings, which is tracked in Metropolitan's savings estimate. For example, a fixture that was installed through an active conservation program provides water savings that otherwise would not have been realized without plumbing codes. However, subsequent adoption of efficient plumbing codes means that when the fixture reaches the end of its life, it will be replaced by the same or more water-efficient model.

Stock Models

The number of efficient fixtures for each stock model is the sum of fixtures from active programs, new construction, natural replacement, and fixtures up for renewal. Table A.6-1 below shows the fixtures and devices that are assigned stock models based on existing plumbing codes.

Table A.6-1
Stock Models

Residential	CII
Toilets	Toilets
Showerheads	Urinals
Faucet Aerators	Pre-Rinse Spray Heads
Washing Machines	Washing Machines

The Stock Models generate separate annual estimates of devices and fixtures for tracking active conservation savings, while also accounting for the impacts of active programs on the overall device saturation rate. As a result, increased levels of active conservation lead to lower levels of plumbing code conservation. This helps avoid double counting in Metropolitan's conservation savings estimate.

Plumbing Code Assumptions

Plumbing code savings are determined by the device-specific assumptions used in the stock models, presented in Table A.6-2. The stock models are driven by projections of housing and employment consistent with the demand projections. Initial device counts and growth in the number of devices are determined by the combination of demographic information and the following assumptions:

- Devices per Household or Per Employee: This factor represents the average number of devices per household or per employee and is multiplied by the demographic projections to develop estimates of total number of devices or "stock." Devices per household and employee can vary by agency and change over time.
- Plumbing Code Compliance Rate: The plumbing code compliance rate is expressed as a percent and serves two purposes: (1) it indicates the presence of a plumbing code in a specific year, and (2) it determines the overall compliance rate with the plumbing code. This allows plumbing code effects to be phased in over several years.
- Natural Replacement Rate: This represents the rate at which existing non-conserving devices are converted to conserving devices due to remodeling or device failure. It has a strong impact on the saturation rate of devices that existed prior to plumbing codes, such as pre-1992 toilets.
- Device Life: The stock models also account for device life for water-efficient devices installed after 1990. This allows the stock model to track devices installed through active conservation as they reach the end of their life and are replaced due to plumbing codes. The stock models use the same device life specified in the savings assumptions.

Table A.6-2
Plumbing Code Assumptions

Stock Model	Device per Household/ Employee	Compliance Rate	Natural Replacement Rate	Plumbing Code Year
Res. Toilets	2	99%	2%	1994/2014
Res. Shower Heads	1.8	95%	10%	1994
Res. Aerators	3.5	90%	33%	1994
Res. Washing Machine	0.74	100%	6.7%	2018
CII Toilets	0.27*	100%	2%	1994/2014
CII Urinals	0.06	100%	4%	1994
CII Pre-Rinse Spray Heads	0.0055*	95%	16.7%	2006
CII Washing Machine	0.0073*	100%	5%	2007

* Varies over time and by agency (based on CUWCC BMPs savings factors)

These assumptions are derived from California Urban Water Conservation Council (CUWCC) conservation reports, American Water Works Association Research Foundation's 1999 end use study, Metropolitan's Orange County Saturation Study, and other sources. In the residential sector, devices per household combine single family and multifamily trends.

Model Water Efficient Landscape Ordinance

The California Water Commission adopted an updated Model Water Efficient Landscape Ordinance (MWELO) on July 15, 2015. The MWELO promotes efficient landscapes in new developments and retrofitted landscapes. The MWELO increases water efficiency standards for new and retrofitted landscapes through more efficient irrigation systems, greywater usage, onsite storm water capture, and by limiting the portion of landscapes that can be covered in turf. Local agencies had until December 1, 2015 to adopt the MWELO or to adopt a Local Ordinance which must be at least as effective in conserving water as MWELO. Local agencies working together to develop a Regional Ordinance had until February 1, 2016 to adopt, but they are still subject to the December 2015 reporting requirements. Local agencies were required to report on the implementation and enforcement of local ordinances by December 31, 2015.

Metropolitan's modeling of Code-based conservation includes a calculation of savings that would result from 50 percent of new households having efficient outdoor water use consistent with MWELO. The 50 percent compliance rate for new households is a conservative estimate based on an assessment of the efficacy of the current MWELO ordinance.

Price Savings Assumptions

Price-effect savings are calculated by comparing MWD-EDM demand projections with price increases to demand projections with constant 1990 water rates. The difference is the price-effect savings measured from a 1990 base. Price-effect savings increase as prices rise over time; they also increase as the household and employment base grow. A price increase applied to 1,000 households will generate more water savings than the same price increase applied to 500 households.

Un-metered Water Use Savings

A final category of savings tracked by Metropolitan is a product of other conservation efforts. MWD-EDM projects un-metered water use as a fixed percentage of total retail M&I demand. As conservation savings lowers residential and CII demands, it lowers un-metered use by the same percent. For instance, if conservation reduces M&I demands by 10 percent in 2020 (compared to demands before conservation), un-metered water use is also reduced 10 percent. This reduction is based on the assumption that un-metered use varies according to overall demand and that reducing overall use also reduces un-metered use. The reduction in un-metered water use is captured in the MWD-EDM model and included as a conservation source.

The total conservation savings are shown in Table A.6-3.

Table A. 6-3 Conservation Savings (acre-feet)

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Active Savings	0	26,000	59,000	94,000	133,000	152,000	144,000	93,000	55,000	35,000	25,000	17,000	0
Code-Based Savings	0	83,000	177,000	244,000	291,000	370,000	472,000	560,000	623,000	665,000	701,000	731,000	757,000
Price Savings	0	31,000	62,000	94,000	125,000	156,000	187,000	205,000	229,000	258,000	293,000	333,000	379,000
Un-metered Water Savings	0	9,000	18,000	26,000	35,000	44,000	52,000	53,000	54,000	55,000	56,000	57,000	58,000
Pre-1990 Savings	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Total	**250,000**	**399,000**	**566,000**	**708,000**	**834,000**	**972,000**	**1,105,000**	**1,161,000**	**1,211,000**	**1,263,000**	**1,325,000**	**1,388,000**	**1,444,000**

Note: Metropolitan's conservation savings projection includes savings from Metropolitan's Conservation Credits Program, code-based conservation, price effect conservation, and pre-1990 device retrofits. The projection does not include savings from the implementation of future active conservation programs.

Appendix 7

DISTRIBUTION SYSTEM WATER LOSSES

Appendix 7
DISTRIBUTION SYSTEM WATER LOSSES

California Water Code Section 10631(d)(3) requires urban retail suppliers to quantify distribution system water loss for each of the five years preceding the plan update, based on water system balance methodology developed by the American Water Works Association (AWWA). For the 2020 UWMP, Metropolitan is voluntarily reporting its distribution system water loss. Metropolitan followed the AWWA Water Audit methodology to track all sources of treated water and uses of treated water within its system. The AWWA Water Audit methodology quantifies real and apparent water system losses in an agency's distribution system.

For its voluntary reporting of distribution system water losses, Metropolitan included its water balance audit for calendar years 2015 through 2019. The results of Metropolitan's audit showed that the average water losses for its treated distribution system over the last five years from 2015 to 2019 is approximately 7.8 TAF. The water loss estimates are presented in Tables A.7-1 through A.7-5.

In addition to the distribution system losses described in the AWWA tables, Metropolitan estimates that 41.6 TAF was lost from reservoir evaporation occurring in Lake Mathews, Lake Skinner, and Diamond Valley Lake during calendar year 2019.

Table A.7-1
Metropolitan's Distribution System Water Loss (AF)
Calendar Year 2015

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for: Metropolitan Water District of Southern California
Reporting Year: 2015 | 1/2015 - 12/2015
Data Validity Score: 95

		Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
Own Sources (Adjusted for known errors) 791,352.381	System Input 791,352.381	Water Supplied 791,352.381	Authorized Consumption 781,504.700	Billed Authorized Consumption 780,724.000	Billed Metered Consumption (water exported is removed) 780,724.000	Revenue Water 780,724.000
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 780.700	Unbilled Metered Consumption 0.000	Non-Revenue Water (NRW) 10,628.381
					Unbilled Unmetered Consumption 780.700	
			Water Losses 9,847.681	Apparent Losses 2,001.800	Unauthorized Consumption 0.000	
					Customer Metering Inaccuracies 1,951.800	
					Systematic Data Handling Errors 50.000	
Water Imported 0.000				Real Losses 7,845.881	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

Table A.7-2
Metropolitan's Distribution System Water Loss (AF)
Calendar Year 2016

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for:	Metropolitan Water District of Southern California
Reporting Year:	2016 / 1/2016 - 12/2016
Data Validity Score:	95

Own Sources (Adjusted for known errors) 754,436.090	System Input 754,436.090	Water Exported 0.000	Billed Water Exported			Revenue Water 0.000
		Water Supplied 754,436.090	Authorized Consumption 746,636.500	Billed Authorized Consumption 745,890.600	Billed Metered Consumption (water exported is removed) 745,890.600	Revenue Water 745,890.600
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 745.900	Unbilled Metered Consumption 0.000	Non-Revenue Water (NRW) 8,545.490
					Unbilled Unmetered Consumption 745.900	
			Water Losses 7,799.590	Apparent Losses 1,914.700	Unauthorized Consumption 0.000	
					Customer Metering Inaccuracies 1,864.700	
					Systematic Data Handling Errors 50.000	
Water Imported 0.000				Real Losses 5,884.890	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

Table A.7-3
Metropolitan's Distribution System Water Loss (AF)
Calendar Year 2017

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for: Metropolitan Water District of Southern California
Reporting Year: 2017 | 1/2017 - 12/2017
Data Validity Score: 95

Own Sources (Adjusted for known errors) 850,417.043	System Input 850,417.043	Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
		Water Supplied 850,417.043	Authorized Consumption 843,331.300	Billed Authorized Consumption 842,488.800	Billed Metered Consumption (water exported is removed) 842,488.800	Revenue Water 842,488.800
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 842.500	Unbilled Metered Consumption 0.000	Non-Revenue Water (NRW) 7,928.243
					Unbilled Unmetered Consumption 842.500	
			Water Losses 7,085.743	Apparent Losses 2,156.200	Unauthorized Consumption 0.000	
					Customer Metering Inaccuracies 2,106.200	
					Systematic Data Handling Errors 50.000	
Water Imported 0.000				Real Losses 4,929.543	Leakage on Transmission and/or Distribution Mains *Not broken down*	
					Leakage and Overflows at Utility's Storage Tanks *Not broken down*	
					Leakage on Service Connections *Not broken down*	

Table A.7-4
Metropolitan's Distribution System Water Loss (AF)
Calendar Year 2018

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for: Metropolitan Water District of Southern California
Reporting Year: 2018 | 1/2018 - 12/2018
Data Validity Score: 95

Own Sources (Adjusted for known errors) 770,999.499	System Input 770,999.499	Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
		Water Supplied 770,999.499	Authorized Consumption 766,774.500	Billed Authorized Consumption 766,008.500	Billed Metered Consumption (water exported is removed) 766,008.500	Revenue Water 766,008.500
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 766.000	Unbilled Metered Consumption 0.000	Non-Revenue Water (NRW) 4,990.999
					Unbilled Unmetered Consumption 766.000	
			Water Losses 4,224.999	Apparent Losses 1,965.000	Unauthorized Consumption 0.000	
					Customer Metering Inaccuracies 1,915.000	
					Systematic Data Handling Errors 50.000	
Water Imported 0.000				Real Losses 2,259.999	Leakage on Transmission and/or Distribution Mains *Not broken down*	
					Leakage and Overflows at Utility's Storage Tanks *Not broken down*	
					Leakage on Service Connections *Not broken down*	

Table A.7-5
Metropolitan's Distribution System Water Loss (AF)
Calendar Year 2019

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for:	Metropolitan Water District of Southern California
Reporting Year:	2019 / 1/2019 - 12/2019
Data Validity Score:	95

Own Sources (Adjusted for known errors) 706,766.917	System Input 706,766.917	Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
		Water Supplied 706,766.917	Authorized Consumption 700,559.700	Billed Authorized Consumption 699,859.800	Billed Metered Consumption (water exported is removed) 699,859.800	Revenue Water 699,859.800
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 699.900	Unbilled Metered Consumption 0.000	Non-Revenue Water (NRW) 6,907.117
					Unbilled Unmetered Consumption 699.900	
			Water Losses 6,207.217	Apparent Losses 1,799.600	Unauthorized Consumption 0.000	
					Customer Metering Inaccuracies 1,749.600	
					Systematic Data Handling Errors 50.000	
Water Imported 0.000				Real Losses 4,407.617	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

Appendix 8

METROPOLITAN's EMERGENCY STORAGE OBJECTIVE

Appendix 8
METROPOLITAN'S EMERGENCY STORAGE OBJECTIVE

Metropolitan established its original criteria for determining emergency storage requirements in the October 1991 Final Environmental Impact Report for the Eastside Reservoir, which is now named Diamond Valley Lake. Emergency storage requirements are based on the potential of a major earthquake that would damage all supply aqueducts isolating Southern California from its imported water sources. The emergency storage criteria developed within the Eastside Reservoir EIR were again discussed in the 1996 Integrated Water Resources Plan. Metropolitan's Board approved both of these documents.

In 2019, Metropolitan and its member agencies completed a process to update the emergency criteria and methodology for determining the regional planning estimate of emergency storage under Metropolitan's Emergency Storage Objective. This planning estimate of emergency storage represents the amount of water that Metropolitan would store for the region to prepare for a catastrophic earthquake that would damage the aqueducts that transport imported water supplies to Southern California, including: the Colorado River Aqueduct, both the East and West branches of the California Aqueduct, and the Los Angeles Aqueduct. These emergency supplies, stored in Metropolitan and DWR existing surface reservoirs within the region, will allow Metropolitan to deliver reserve supplies to the member agencies to supplement their local production during a catastrophic earthquake or other disaster. This helps avoid severe water shortages during periods when the imported water aqueducts may be out of service.

The Emergency Storage Objective considers a six- and twelve-month outage period for the imported supply aqueducts, based on latest seismic information and estimates of repair duration for the different aqueducts. It also accounts for the operational flexibility of Metropolitan's distribution system, a retail water demand cutback ranging from 25 to 35 percent considering the level of conservation that the region achieved during the recent drought, and an aggregated loss of 10 to 20 percent of local supplies accounting for factors that could affect local production during emergency conditions.

Under this update, Metropolitan's Emergency Storage Objective was set to 750,000 acre-feet, as this level of storage would prevent severe water shortages to the region given new information on expected recovery durations. While the emergency storage would allow Metropolitan to deliver reserve supplies to the member agencies to meet their water needs during a catastrophic event, it is not intended to set a basis or a policy for allocating or apportioning storage for any individual member agency.

Included in this appendix is a copy of the Board Information Letter to Metropolitan's Water Planning and Stewardship Committee dated May 14, 2019. This Board Information Letter and the attached draft white paper review the history, policy, and criteria for evaluating a regional planning estimate for emergency storage and describe the more than year-long coordination process between Metropolitan and its member agencies in developing the region's estimate for Emergency Storage Objective.

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

INFORMATION

- **Board of Directors**
  Water Planning and Stewardship Committee

5/14/2019 Board Meeting

9-3

Subject

Update of Metropolitan's Emergency Storage Objective

Executive Summary

In February 2018, The Metropolitan Water District of Southern California (Metropolitan) and its member agencies embarked on a process to evaluate regional storage including how the storage programs performed during this post decade of drought and revisiting the size and management of Metropolitan's emergency storage reserve. This process aims to maximize the potential for optimizing performance and operations of Metropolitan's storage programs. As part of the process, a Workgroup comprised of Metropolitan staff and representatives from member agencies evaluated Metropolitan's emergency storage objective.

Metropolitan, in coordination with the Workgroup, completed the attached draft White Paper on emergency storage, which summarizes the progress to date in estimating a planning objective for the region's emergency storage.

Details

The White Paper reviews the history, policy, and criteria for evaluating a regional planning estimate for emergency storage. This evaluation prepares for major earthquake or other damage to the aqueducts that import water to Southern California. The emergency storage would allow Metropolitan to deliver reserve supplies to the member agencies to supplement local production. This would help avoid severe water shortages while one or more of the imported water aqueducts may be out of service.

The White Paper also describes the mechanisms the Workgroup employed, including: (1) updated emergency criteria, and (2) a revised methodology to evaluate emergency storage.

Updating emergency criteria involved revising the outage durations based on the latest seismic information, and revisiting retail water demands and locally available supplies within the service area. It also accounted for the member agencies' unique situations in identifying practicable ranges of reduction of retail water demands through conservation and production levels of local water supplies during an imported supply emergency outage.

The proposed emergency storage volume considers various combinations of criteria to determine an envelope of acceptable scenarios designed to prevent severe shortages during the outage. Under this approach, the Workgroup focused on a range of values from 520,000 to 830,000 acre-feet (AF). With input from the Workgroup, staff recommends increasing the emergency storage objective to 750,000 AF. This recommended volume would be distributed amongst the available capacities of in-region Department of Water Resources and Metropolitan surface reservoirs.

The recommended emergency storage volume of 750,000 AF is an increase from the current planning target of 630,000 AF. A longer outage period based on damage restoration analysis and a consideration of lower local supply production attributed to this recommended increase in emergency storage.

The emergency storage volume presented in the White Paper represents a planning estimate for the amount of water that Metropolitan would store for the region in preparation for a catastrophic earthquake or other disaster. It is not intended to set a basis or a policy for allocating or apportioning storage for any individual member agency. Staff will review and incorporate additional Board and Workgroup feedback in finalizing the White Paper. Staff will transmit the final White Paper to the Board and the member agencies.

Staff proposes to revisit the emergency storage periodically, and incorporate the analysis into the Integrated Water Resources Plan update process. In addition, a detailed review of the spatial distribution of storage and operation of the distribution system will be part of Metropolitan's continued efforts to evaluate the storage portfolio. This next phase of evaluating Metropolitan's regional storage portfolio is expected to be completed by spring of 2020.

Policy

By Minute Item 50358, dated January 12, 2016, the Board adopted the 2015 Integrated Water Resources Plan Update, as set forth in Agenda Item 8-3 board letter.

By Minute Item 50473, dated May 10, 2016, the Board adopted the 2015 Urban Water Management Plan, as set forth in Agenda Item 8-6 board letter.

Fiscal Impact

None

Bradley M. Coffey 5/1/2019

Brad Coffey *Date*

Manager, Water Resource Management

5/1/2019

Jeffrey Kightlinger *Date*

General Manager

Attachment 1 – Draft White Paper on Metropolitan's Emergency Storage Objective (May 2019)

Ref# wrm12661707

2018 Evaluation of Regional Storage Portfolio
DRAFT Evaluation of Metropolitan's Emergency Storage Objective

SUMMARY

In February 2018, the Metropolitan Water District of Southern California (Metropolitan) and its member agencies embarked on a process for the Evaluation of Regional Storage Portfolio (ERSP) to maximize potential for performance and operations of Metropolitan's storage programs. As part of the ERSP process, a Workgroup comprised of Metropolitan staff and representatives from member agencies evaluated Metropolitan's Emergency Storage Objective (Emergency Storage).

This White Paper provides a summary of the history, policy, and criteria for evaluating a regional planning estimate for the Emergency Storage. This evaluation assumes major earthquake damage to the aqueducts that transport imported water supplies to Southern California. The Emergency Storage allows Metropolitan to deliver reserve supplies to the member agencies to supplement local production. This helps avoid severe water shortages during periods when the imported water aqueducts may be out of service.

This White Paper describes: (1) updating the emergency criteria, and (2) revising the methodology for calculating the Emergency Storage.

In the review and update of emergency criteria, the Workgroup considered the 2015 Integrated Water Resources Plan (IRP) and centered on the following:

- A retail water demand cutback of 25 to 35 percent appears reasonable, based on the level of conservation that the region achieved during the recent drought; and
- A six-and 12-month aggregated loss of 10 to 20 percent of local production reported in the IRP seems reasonable. This allows a contingency for some damage to local facilities and accommodates variable durations of local repairs.

The Workgroup discussion also led to a new concept of an "envelope of solutions" to estimate an appropriate Emergency Storage for the region. The envelope concept shifts from a single equation and volume for determining emergency storage. Instead, it considers various combinations of criteria to determine a range of acceptable scenarios for Emergency Storage. The prior methodology assumed a single region-wide scenario of conservation and local production loss. This envelope concept underscores member agencies' unique situations while taking into account their inputs in identifying practicable ranges of decreases in retail water demands and local production. The Workgroup focused on an acceptable range of Emergency Storage values from 520,000 to 830,000 acre-feet (AF).

Based on input from the process, staff recommends the following:

- The Emergency Storage Objective should increase from 630,000 AF to 750,000 AF. This level of storage would prevent severe water shortages to the region given new information on expected recovery durations.
- Metropolitan should revisit the Emergency Storage Objective periodically, possibly following the completion of any new IRP with the latest information on damage scenarios, local supplies, imported water demand, and attainable conservation.

DETAILED REPORT

Background

Metropolitan's need for Emergency Storage is based on the potential for major earthquake damage to the Colorado River Aqueduct, California Aqueduct, and Los Angeles Aqueduct. Metropolitan coordinates with the member agencies in setting the emergency criteria, which forms the basis for establishing the Emergency Storage. These criteria assume that damage from such a catastrophic event could render the aqueducts that transport imported water supplies to Southern California out of service, isolating the region from its imported water supplies. Metropolitan's objective is to provide regional emergency storage that could allow Metropolitan to deliver supplies to all its member agencies during this period of outage. The Emergency Storage allows Metropolitan to continue deliveries to its member agencies to supplement local water production and release from local storage. This helps avoid severe water shortages during periods when aqueducts are out of service. In addition to Emergency Storage, Metropolitan may draw from dry-year storage during an emergency, if necessary and available.

Metropolitan's emergency planning criteria were previously established and reported in the following documents:

1. Final Environmental Impact Report for the Eastside Reservoir (now named the Diamond Valley Lake) dated October 1991, which was adopted by the Board on September 24, 1991;
2. Southern California's 1996 Integrated Water Resources Plan, which was adopted by the Board on January 9, 1996;
3. Reports on Metropolitan Water Supplies dated February 2002 and March 2003;
4. 2006 IRP Implementation Report, which was presented to the Board on September 11, 2006 and transmitted on October 9, 2006;
5. Metropolitan's Emergency Storage Requirement, a written report presented to the Board on May 11, 2010; and
6. The 2015 Urban Water Management Plan dated June 2016, which was adopted by the Board on May 10, 2016.

Metropolitan's Current Emergency Criteria

Metropolitan's current emergency criteria provide for a six-month water supply at 75 percent of member agencies' retail demand under normal hydrologic conditions. Metropolitan's emergency plan outlines that under catastrophic loss of water supply the following actions will be implemented, which serve as the criteria for determining Metropolitan's Emergency Storage:

1. any existing interruptible water deliveries would be suspended;
2. firm supplies to member agencies would be restricted by a mandatory cutback of 25 percent from normal year retail demand levels;
3. water stored in the surface reservoirs and groundwater basins under Metropolitan's interruptible program would be made available;
4. full local groundwater production, recycled water, and local surface emergency storage reserve production would be sustained; and
5. Metropolitan would draw on its emergency storage as well as other available storage.

These emergency planning criteria were the basis for the current Metropolitan's Emergency Storage planning level of 630, 000 AF.

Review and Update of Metropolitan's Emergency Criteria

The following sections detail the updated assumptions and changed conditions since the last evaluation of Emergency Storage in 2010. These include demand and supply forecasts developed for the 2015 IRP, updated studies on the potential for seismic damage and outage periods for the imported supply aqueducts, and flexibility improvements within Metropolitan's distribution system implemented as a result of recent drought and supply challenges. This new information is critical to the review and update of the emergency criteria, which forms the basis for revising the Emergency Storage.

Outage Period Criteria

The outage period pertains to the amount of time the regional aqueducts that deliver imported water to Southern California may be out of service. This outage period is derived from the estimated restoration timelines based on the nature of potential damage to the aqueduct coupled with the operational ability to deliver supplies to the area served by that specific aqueduct. During an emergency outage period, Metropolitan's member agencies will depend on previously stored imported and local supplies to supplement continued local production in meeting reduced levels of retail demands. It is acknowledged that some areas could be more impacted because they are primarily or exclusively fed by an imported aqueduct which is assumed to sustain damage. However, Metropolitan's objective is to continue building and operating its system with flexibility to respond to various potential damage scenarios.

Recent Seismic Studies

In August 2015, Metropolitan, Los Angeles Department of Water and Power (LADWP), and California Department of Water Resources (DWR) formed the Seismic Resilience Water Supply Task Force (Task Force) for the purpose of collaborating on studies and mitigation measures to improve the reliability of imported water supplies to Southern California. The specific goals of the Task Force included:

- Revisiting historical assumptions regarding potential aqueduct outages;
- Establishing a common understanding about individual agency aqueduct vulnerability assessments, projected damage scenarios, and planning assumptions; and
- Discussing ideas for improving the resilience of Southern California's imported water supplies through multi-agency cooperation.

Through exchange of information and ideas between the three agencies and experts from the industry and academia, the Task Force assessed potential aqueduct damage and restoration timeline for a M 7.8 earthquake on the San Andreas Fault. This scenario assumes severe damage to the Colorado River Aqueduct (CRA), the California Aqueduct, and the Los Angeles Aqueduct (LAA). A complete description of probable seismic damages and repair durations is presented in Metropolitan's *"Seismic Resilience Water Supply Task Force Report No. 1536"* dated June 2017 (http://www.mwdh2o.com/PDF_About_Your_Water/Report1536_Final.pdf).

Table 1 presents a summary of the estimated outage duration under the earthquake scenario based on the nature of damage for each of the aqueducts.

Table 1
Estimated Outage Duration for Imported Supply Aqueducts (M 7.8 earthquake)

Aqueduct	Estimated Outage Duration
Colorado River Aqueduct	2 to 6 months (recovery of 80% CRA capacity) 3 to 5 years (recovery of 100% CRA capacity)
California Aqueduct: East Branch	12 to 24 months
California Aqueduct: West Branch	6 to 12 months
Los Angeles Aqueduct	18 months

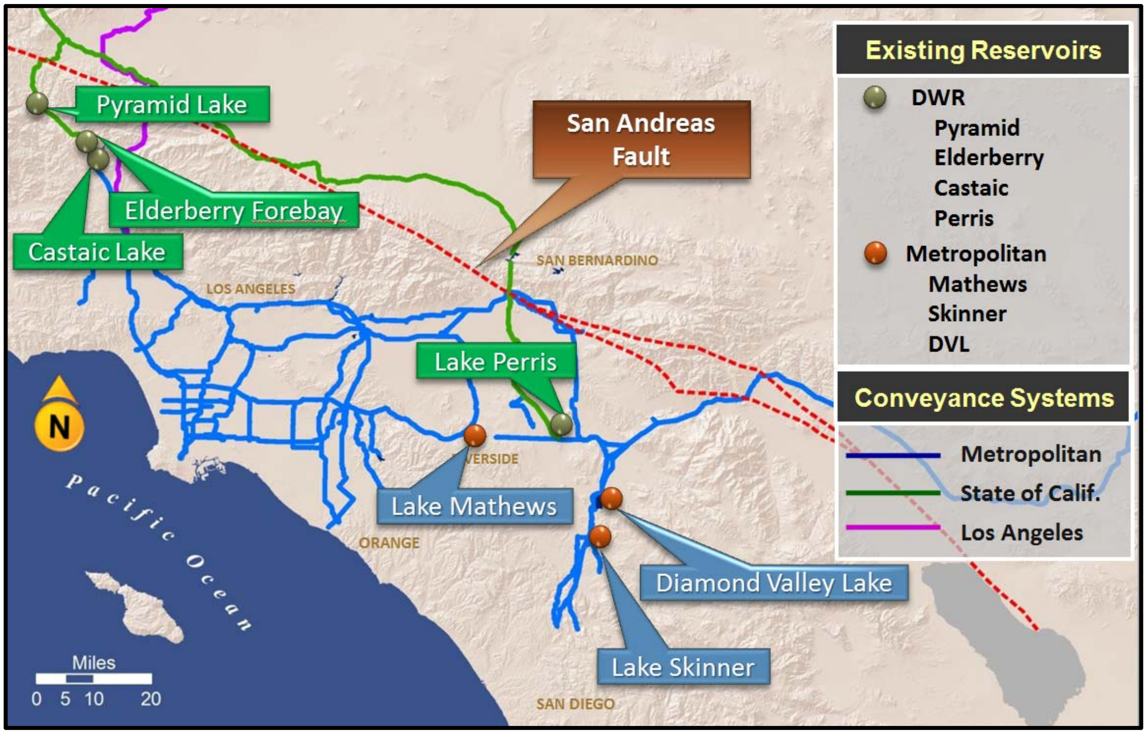
Operational Flexibility

Metropolitan's integrated system provides operational flexibility. The flexibility in Metropolitan's distribution system was demonstrated during the unprecedented drought of 2014-2016. Facing consecutive years of low SWP supplies, Metropolitan pushed CRA and Diamond Valley Lake (DVL) supplies to areas that Metropolitan normally serves only with SWP supplies or at higher blend of SWP. Figure 1 illustrates Metropolitan's operations during that period of extraordinary drought when SWP supplies were at a historic low. Metropolitan can utilize much of the same operational flexibility in its distribution system to facilitate movement of stored supplies during a prolonged outage. This flexibility combined with retail demand reduction through additional conservation and local production at appropriate levels will allow the region to meet its demands in most areas during emergency outages. Although it is not possible for Metropolitan to predict the specific damage to the system in an event of a catastrophic emergency, it seeks to ensure the most flexibility possible throughout the system to respond to different damage scenarios.

Figure 1
Metropolitan Operations during Extraordinary Drought Actions (2014-16)

During an emergency outage, previously stored imported supplies will be withdrawn to meet the region's supplemental water needs. Emergency Storage is used first and dry-year storage is then used, if necessary and available. Figure 2 shows the locations of existing DWR and Metropolitan surface reservoirs in various parts of the region.

Figure 2
Existing DWR and Metropolitan Surface Reservoirs
South of the San Andreas Fault



Metropolitan can draw from emergency supplies stored in Castaic Lake, Elderberry Forebay, and Pyramid Lake during an outage to serve the western areas that previously received SWP water. A limited quantity of CRA supplies could also be available to these areas when 80 percent of the CRA capacity is restored within six months to supplement emergency water needs in this area. Metropolitan can also supply up to 50 cfs of water from Greg Avenue Pump Station to the far western portion of its service area while repairs to the three aqueducts are being completed. This operational flexibility is also useful in the event that stored water was not adequate within the Castaic/Pyramid system.

Metropolitan can draw from emergency supplies stored in DVL, Lake Skinner, Lake Mathews, and Perris Lake during an outage to serve the eastern areas that previously received CRA and SWP water. When the CRA is restored to 80 percent of capacity within six months, it could provide up to 960,000 acre-feet per year (AFY) of imported water to the region. This volume is more than the 15-year historic average (2003 to 2017) CRA delivery of approximately 885,000 AFY and more than the 2015 IRP CRA delivery target of 900,000 AFY for a normal year. During outages, portions of the eastern area are expected to continue to receive treated CRA and/or stored emergency supplies through Weymouth. Some areas that normally receive SWP water from the East Branch may be served by delivering DVL water to Mills through the Inland Feeder/Lakeview Pipeline intertie. Metropolitan recognizes that there are currently no options to supply the Rialto Pipeline from emergency storage reservoirs during an outage of the East Branch of the California Aqueduct. However, water stored in Silverwood Lake (which is not included in Metropolitan's Emergency Storage portfolio) could be available to supply the Rialto Area as soon as repairs to damaged penstocks and pipelines downstream of Silverwood Lake are completed. This could likely require less time than repairs to the East Branch north of Silverwood Lake. In addition, other potential options to supply the Rialto region include several conceptual pump back operations and increased groundwater storage and extraction capacity for emergencies.

Metropolitan will continue to deliver treated water from stored emergency supplies during an outage and from imported supplies upon service restoration. Four of Metropolitan's five water treatment plants have redundant power feeds from the power provider. A project is currently underway to also equip the fifth plant with a redundant power feed. All five water treatment plants have backup emergency generators that support all treatment processes with the exception of ozone. Disinfection using chlorine would occur when the plants are reliant on generator power for treatment operations during a loss of utility power. Metropolitan maintains a minimum 30 day supply of chlorine in the region.

Updated Outage Criteria

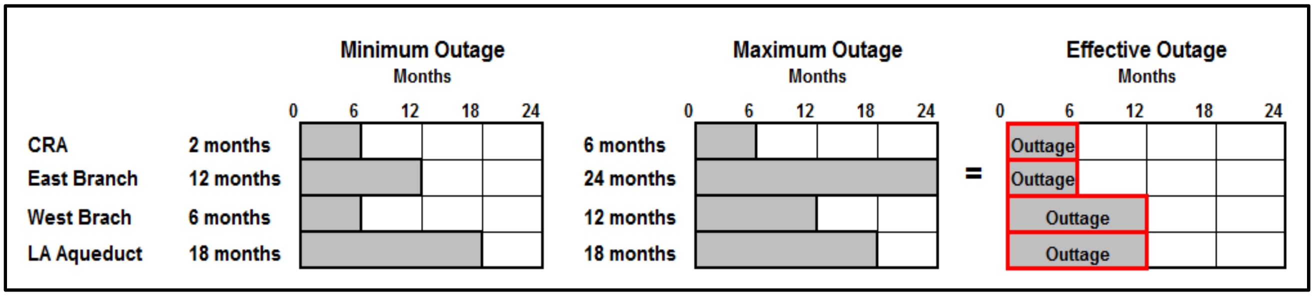
In updating the emergency outage criteria, the Workgroup considered both the duration of aqueduct repair based on the nature of potential seismic damage and recently demonstrated operational flexibilities of Metropolitan's distribution system.

Figure 3 shows the range of outage durations for the CRA, California Aqueduct East and West Branches, and the LAA. The effective outage period is then derived by accounting for the estimated durations of repair for each regional aqueduct coupled with the operational ability to deliver supplies to the area served by that specific aqueduct. In updating the outage period, the Workgroup considered the following operational assumptions:

- The estimated outage duration and repair of LAA under the earthquake scenario is 18 months. However, when the West Branch comes back in service within 12 months, it can supply water to LADWP through LA-35 while the LAA repairs continue.
  - ***Assumed outage period: 12 months for member agencies receiving supplies from West Branch and LAA.***
- The estimated outage duration and repair time of East Branch is 12 to 24 months. However, when 80 percent of the CRA capacity comes back in service within 6 months, CRA supplies would be available to many Metropolitan member agencies that normally receive SWP supplies. Thus, some areas that are normally served with water imported through the East Branch may be served with water imported through the CRA, using delivery of DVL water to Mills and several other options that should be evaluated in the Rialto area discussed above.
  - ***Assumed outage period: 6 months for member agencies receiving supplies from CRA and East Branch (with the exception of Rialto agencies).***

Using these assumptions, the effective new outage criteria presented in Figure 3 calls for storing supplemental supplies for 12 months in the West Branch and LAA areas (supplied by emergency storage in Castaic, Pyramid, and Elderberry) and 6 months in the CRA and East Branch areas (supplied by emergency storage in Perris, Skinner, Mathews, and DVL). In addition to the 12-month stored emergency supplies, West Branch areas could also be served with limited amounts of CRA supplies within 6 months to help meet demands in areas normally served with SWP supplies and higher blend areas. It is not possible to predict the specific damage to the system as a result of a catastrophic event. Therefore, system flexibility is important to ensure all supplies may be moved, if necessary and possible.

Figure 3
Updated Emergency Outage Criteria



Retail Demand Cut Back Criteria

Demand Projection

The first step in calculating the Emergency Storage is to determine the total amount of emergency retail water demand at the member agency level. The Emergency Storage is intended to reflect estimated supplemental water demands on Metropolitan during an emergency outage now updated to a period of 6 or 12 months. Thus, the aggregate of emergency retail demand is used to determine the aggregate supplemental demands on Metropolitan during such emergency, which excludes non-firm deliveries. Those deliveries are assumed to be suspended during an outage, as shown in Table 2.

Calculations of the emergency retail demand are provided for the year 2018 based on forecasts reported in the 2015 IRP. The retail demands in Table 2 were calculated at the member agency level. The numbers shown in this table represent the aggregate total retail demand (M&I and agricultural), replenishment, and seawater barrier demands over the emergency outage period considered. The total retail demands are based on forecasts from the Southern California Association of Government's (SCAG) 2012 Regional Transportation Plan/Sustainable Community Strategy and from the San Diego County Association of Government's (SANDAG) Series 13: 2050 Regional Growth Forecast (October 2013) forecast. The SCAG and SANDAG regional growth forecasts are the core assumptions in the econometric demand modeling for Metropolitan's 2015 IRP.

Table 2
Firm Retail Demands (Average Year)
(Acre-Feet)

	2018 Demands for 6-months and 12-months(1)
Total Retail Demand	2,735,617
Replenishment	(197,103)
Seawater Barrier	(52,000)
Firm Retail Demand	**2,486,514**

Note: (1) Retail demands are assessed for the 6-month outage period for member agencies receiving supplies from CRA and East Branch, and 12-months for member agencies receiving supplies from West Branch and LAA (see Attachment A).

Reduced Retail Demands during Emergency Outage

The next step in calculating the emergency storage demand on Metropolitan is to subtract a percentage reduction, or cutback, in water use from the retail demands. For illustrative purposes, Table 3 below shows the resulting reduction in retail demands during emergency outage after a cutback of 25 percent is imposed on the 2018 average condition retail demands. The retail demands in Table 3 are calculated at the member agency level. The numbers represent the aggregated total over the emergency outage period considered.

The assumption of a 25 percent retail demand cutback is a planning criterion that is consistent with previous Metropolitan studies that showed overall outdoor water use at approximately 30 percent. That cutback criterion is also consistent with the Public Policy Institute of California (PPIC) report *(Building Drought Resilience in California's Cities and Suburbs, June 2017)* based on lessons learned during drought. A higher level of austerity, public awareness, and a likely emergency declaration during an outage may support a higher cut back through additional conservation actions.

Table 3
Retail Level Emergency Demands (Average Year)
(Acre-Feet)

	2018 Demands for 6-months and 12-months(1)
Firm Retail Demand	2,486,514
25% Reduction (Cutback)	(621,629)
100% IAWP Reduction	N/A
Retail Demand during Emergency	**1,864,885**

Note: (1) Retail demands are assessed for the 6-month outage period for member agencies receiving supplies from CRA and East Branch, and 12-months for member agencies receiving supplies from West Branch and LAA (see Attachment A).

Local Production Level Criteria

The next step in calculating the Emergency Storage is to determine the amount of local supplies (local production of in-region supplies and release from local storage) available to meet retail demands at the member agency level. The local production represents the member agencies' highest potential production from the various types of supplies available within their service areas with consideration to each member agency's supply, capacity, and demand limitations. For this evaluation, the year 2018 forecast from the 2015 IRP is initially used to estimate the local production for the 6-month and 12-month emergency outage periods. In addition, Metropolitan also considered the factors that could limit each member agency's local supplies production. These include:

- Supply limitation – Considers all supplies available during an emergency outage (including additional groundwater rights, allowable over pumping in the basin, or similar mechanism if available and needed)
- Capacity limitation – Considers all available local production capacity (including extra well capacities to produce the any additional groundwater supplies if available and needed)
- Demand limitation – Considers the projected demand during the outage period (to determine the needed supplies from local and supplemental sources)

The Unused Local Production represents the aggregated production of individual member agencies above what is needed to meet their demands. In contrast, the Effective Local Production is the aggregated amount of locally available supplies that are produced to meet the reduced retail demands during an emergency outage. The Effective Local Production is derived by subtracting Unused Local Production from the aggregate total local production. For planning purposes in determining the Emergency Storage for the region, the Effective Local Production is calculated with the assumption that locally available supplies will be used only within the producing member agency's service areas and not be used or exported to meet the demands of other agencies. However, in real emergency outages, it is likely that member agencies would implement region-wide and inter-agency coordination for the most efficient operation and use of available supplies.

As part of evaluating the Effective Local Production, Metropolitan also assessed the additional local groundwater that could be theoretically produced and local surface storage that could be reasonably available during an emergency outage. This evaluation revealed that additional groundwater supplies, while theoretically available, could not be produced due to one or a combination of limiting factors. The local surface storage, on the other hand, includes all reasonably available surface water storage that the member agency could produce and use within its service area during extended shortages. The Local Surface Storage in Table 4 includes SDCWA's calculated Emergency Storage Requirement of 20,000 AF (as reported to their Water Planning Committee in July 18, 2018) and a portion of its carryover storage. Under the Carryover Storage Policy Guidelines, included in SDCWA's Water Shortage Contingency Plan Appendix A dated August 2017, SDCWA will maintain a carryover target volume of 70,000 AF and a maximum of 100,000 AF to be utilized over five consecutive dry-years. During an emergency outage, the region will most likely draw supplies from all reasonably available storage to meet demands. This evaluation reasonably assumes that in addition to its emergency storage, one-fifth of SDCWA's 70,000 AF target carryover storage, amounting to 14,000 AF, would be available for a catastrophic emergency outage based on the low likelihood that that all carryover supplies would have been withdrawn over multiple dry-years.

Table 4 shows the aggregate total for each type of locally available supplies over the emergency outage period considered. For illustrative purposes for 2018, Table 4 also presents the local production at 100 percent, 90 percent, and 80 percent. The LAA production is excluded from this calculation because the Emergency Storage assumes the loss of all imported water supplies. The member agency local production data is included as Attachment A.

Table 4
Effective Local Production
(Acre-Feet)

	2018 Local Production for 6-months and 12-months[1]		
	At 100%	At 90%	At 80%
Groundwater	832,000	748,800	665,600
Surface Water	54,935	49,442	43,948
Local Surface Storage[2]	34,000	30,600	27,200
Recycling and GW Recovery	353,797	318,417	283,038
Seawater Desalination	25,319	22,787	20,255
Los Angeles Aqueduct	0	0	0
Other	13,100	11,790	10,480
IRP Targets[3]	18,087	18,087	18,087
Subtotal Local Production	1,331,238	1,199,923	1,068,608
Unused Local Production	(152,021)	(86,449)	(31,056)
Effective Local Production	**1,179,216**	**1,113,474**	**1,037,551**

Note: (1) Local production are assessed for the 6-month outage period for member agencies receiving supplies from CRA and East Branch, and 12-months for member agencies receiving supplies from West Branch and LAA 9 (see Attachment A).
(2) Local Surface Storage is comprised of emergency storage plus reasonably available storage above emergency.
(3) Conservation and locally available supply targets from the 2015 IRP for Year 2018.

Emergency Demands on Metropolitan

The final step in calculating the Emergency Storage is to subtract the Effective Local Production from the retail demands during an emergency outage for each member agency. The resulting difference represents the supplemental water demands on Metropolitan during an outage period This is the Emergency Storage planning level for the region. Table 5 shows the aggregated totals at varying local production levels for 2018. The table below illustrates that the emergency demand on Metropolitan, and in effect the Emergency Storage, increases as Effective Local Production decreases under the 90 percent and 80 percent scenarios.

Table 5
Emergency Demands on Metropolitan
(Acre-Feet)

	Local Production		
	At 100%	**At 90%**	**At 80%**
Retail Demand during Emergency	1,864,885	1,864,885	1,864,885
Effective Local Production	(**1,179,216**)	(**1,113,474**)	(**1,037,551**)
Metropolitan Emergency Demand	**685,666**	**751,411**	**827,334**

Sensitivity Analysis

A sensitivity analysis of retail cutback and loss of local supplies were conducted. To explore the sensitivities of the Emergency Storage from these two criteria, Metropolitan evaluated various percentages of demand cut backs and levels of local production. Table 6 shows the resulting Emergency Storage at various combinations of retail demand cutback and local production levels. This matrix of emergency storage values presents retail demand cut backs of 0 percent, 25 percent, 35 percent, and 50 percent and local production levels of 100 percent, 90 percent, and 80 percent.

Table 6
Range of Potential Emergency Storage Objectives for Year 2018
(Acre-Feet)

Local Production Level	Retail Demand Cutback			
	0%	25%	35%	50%
100%	1,176,600	685,700	513,300	294,000
90%	1,286,600	751,400	570,700	332,300
80%	1,417,900	827,300	636,300	377,300

Envelope Concept for Metropolitan's Emergency Storage Objective

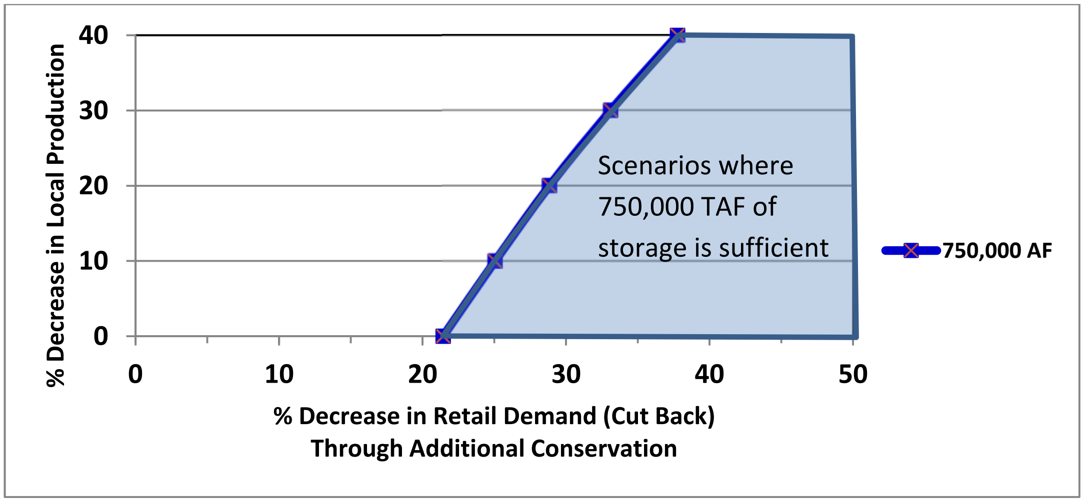
Rather than considering a specific region-wide scenario of conservation and local production loss, the Workgroup discussion led to the development of a range of emergency storage values that could provide reliability during the outage period. The concept of an envelope of solutions emerged, with the idea that an envelope of solutions will yield an appropriate Emergency Storage for the region. The Emergency Storage, in turn, could be achieved through various combinations of (1) retail demand cutback from achievable conservation and (2) local production level taking into account potential damages to local facilities. This envelope concept underscores member agencies' individual and unique situations while taking into account their inputs in identifying practicable ranges of decreases in retail demand and local production.

For the retail demand cut back, most member agencies considered the 25 to 35 percent range to be reasonable. This range is based on the level of conservation that the region was able to achieve during the recent drought. For the local production, several member agencies expected some damage to local facilities during the earthquake. In addition, Metropolitan acknowledges that retail demand cutback may also lead to reduction of non-potable recycled water use. Thus, for local production, the Workgroup focused on a range from 80 percent to 100 percent of the member agencies' reported local production in the 2015 IRP. This would allow contingency planning for uncertainties in damage to local facilities and accommodate different durations of local repairs. This is a modification from the previous assumption of full local production at the IRP level during an outage period.

As indicated in Table 6, a scenario using the criteria of 25 percent retail demand cut back and 100 percent local production level yield an estimated Emergency Storage of 686,000 AF for year 2018. However, the Workgroup focused on an envelope of alternatives for Emergency Storage that could provide reliability during the outage period. The same table matrix of values above highlights the range from 520,000 to 830,000 AF. Within this range, an Emergency Storage of 750,000 AF is recommended. This level of storage would prevent severe water shortages in the region with practicable ranges of reduced demands through conservation and plausible levels of local production during an emergency outage. Figure 4 shows that the

Emergency Storage would be sufficient to cover various combinations of practicable ranges of decreases in retail demand and local production.

Figure 4
Emergency Storage Objective derived from the Envelope Concept



Allocation of Emergency Storage in Regional Reservoirs

Once the Emergency Storage is determined, it can then be allocated to the various surface reservoirs within the region, previously illustrated in Figure 2, south of the San Andreas Fault. The total storage capacity of existing DWR and Metropolitan surface reservoirs and the allocation to emergency storage, seasonal, regulatory, and drought carryover needs are shown in Table 7 through 11. For the DWR reservoirs, the values in the tables reflect the normal maximum operating and dead pool storages indicated in the DWR report *"California State Water Project, Volume III, Storage Facilities, Bulletin 200"* dated November 1974. For this evaluation, recreational waters in DWR reservoirs are assumed to be available for emergency use during outage periods. On a short-term basis for operational purposes, storage at any specific reservoir may be below these planning levels. When this happens, the emergency storage is shifted temporarily to any of the other existing reservoirs.

Department of Water Resources Surface Reservoirs

Table 7 below shows the five major reservoirs owned and operated by DWR in or near Metropolitan's service area. Castaic Lake, Elderberry Forebay, and Pyramid Lake are located on the West Branch of the California Aqueduct. Silverwood Lake and Lake Perris are on the East Branch of the California Aqueduct. The total storage capacity of these five reservoirs is approximately 721,600 AF. When cost allocation factors from DWR Bulletin 132 Appendix B, Table B-2 are applied to the operational storage capacities, Metropolitan's share of storage in the reservoirs is equivalent to 644,400 AF.

Table 7
Allocation of Storage Capacities in DWR Reservoirs
(Acre-Feet)

Reservoir	Total Storage Capacity	Dead Storage	Storage Paid by Others	Storage Paid by Metropolitan
Pyramid Lake	169,900	4,800	7,000	158,100
Castaic Lake	323,700	18,600	12,500	292,600
Elderberry Forebay	28,200	800	1,100	26,300
Silverwood Lake	73,000	4,000	24,300	44,700
Lake Perris	126,800	4,100	0	122,700
Total	**721,600**	**32,300**	**44,900**	**644,400**

Source: California Department of Water Resources (1974). California State Water Project, Volume III, Storage Facilities, Bulletin 200, pages 294, 340, 367, 407, and 408.

From 2005 to 2017, DWR temporarily lowered the maximum storage elevation in Lake Perris because of seismic safety issues. This elevation change resulted in reduction of storage available to Metropolitan in Lake Perris, which was taken into account in past emergency storage evaluations. In 2018, the seismic retrofit of Lake Perris was completed, which restored storage to its full capacity. For purposes of the emergency storage analysis provided herein, it is assumed that 122,700 AF could be available to Metropolitan from Lake Perris. Furthermore, the Monterey Amendment, executed by the DWR and most of the State Water Contractors in 1995 and 1996, addresses the allocation of SWP water in times of shortage and deals with a number of other issues that facilitate more water management flexibility for Contractors.

Table 8 shows the distribution of Metropolitan's emergency storage in DWR reservoirs. Of the total 644,400 AF of storage in DWR Reservoirs that is for Metropolitan use, almost 381,000 AF of this amount is allocated to emergency storage and the remaining 263,600 AF is for seasonal, regulatory, and dry-year storage.

Silverwood Lake capacity does not add to the total Emergency Storage Capacity because of its location outside of major earthquake faults assumed for the emergency storage calculation methodology. However, Silverwood Lake could be available after a seismic event upon restoration of any damaged distribution system components downstream of the lake. It is expected that the portion of the distribution system downstream of the lake could be restored more expeditiously after an event due to its relatively short length, accessibility of the pipelines, and redundancies in the system.

Table 8
Allocation of Emergency Storage in DWR Reservoirs
(Acre-Feet)

Reservoir	Metropolitan Storage Capacity	Seasonal, Regulatory and Dry-Year Storage	Emergency Storage Capacity
Pyramid Lake	158,100	0	158,100
Castaic Lake	292,600	153,900	138,700
Elderberry Forebay	26,300	0	26,300
Silverwood Lake	44,700	44,700	0
Lake Perris	122,700	65,000	57,700
Total	**644,400**	**263,600**	**380,800**

Metropolitan Surface Reservoirs

Table 9 shows the allocation of storage resources in Metropolitan's three major surface reservoirs, Lake Mathews, Lake Skinner, and DVL. These three reservoirs provide approximately 1,036,000 AF of total storage capacity to Metropolitan's service area.

Lake Mathews has available storage of approximately 178,500 AF and distributes CRA water to Riverside, Orange, Los Angeles, and San Bernardino counties. Lake Skinner has approximately 43,800 AF of available storage and receives CRA and SWP water for distribution to Riverside and San Diego counties. DVL is Southern California's largest reservoir with approximately 810,000 AF of total capacity, with 798,500 AF of available capacity to meet demands and provide emergency water supplies.

Table 9
Allocation of Storage Capacities in Metropolitan Reservoirs
(Acre-Feet)

Reservoir	Total Storage Capacity	Dead Storage	Available Capacity
Lake Mathews	182,000	3,500	178,500
Lake Skinner	44,000	200	43,800
Diamond Valley Lake	810,000	11,500	798,500
Total	**1,036,000**	**15,200**	**1,020,800**

Table 10 shows the components of storage, including emergency, seasonal, regulatory, and dry-year storages, for all of Metropolitan's reservoirs. Under the recommended Emergency Storage of 750,000 AF, out of the roughly 1,021,000 AF of available Metropolitan storage capacity, approximately 369,200 AF are reserved for emergency storage, with the remaining storage capacity available for seasonal, regulatory, and dry-year storage.

Table 10
Allocation of Emergency Storage in Metropolitan Reservoirs
(Acre-Feet)

Reservoir	Available Capacity	Emergency Storage Objective at 750 TAF	
		Seasonal, Regulatory and Drought Storage	Emergency Storage
Lake Mathews	178,500	100,000	78,500
Lake Skinner	43,800	10,000	33,800
Diamond Valley Lake	798,500	541,600	256,900
Total	**1,020,800**	**651,600**	**369,200**

Emergency Storage Capacities in DWR and Metropolitan Reservoirs

The Emergency Storage presented in this white paper is evaluated based on regional aggregation of retail demands and locally available supplies within the service area. The resulting Emergency Storage is assumed to be distributed amongst the available capacities within the existing DWR and Metropolitan surface reservoirs. During an outage, Metropolitan delivers supplement water to member agencies from previously stored emergency supplies, and dry-year supplies if necessary and available, based on the most effective operation of the distribution system under emergency conditions.

Table 11 presents the storage of emergency supplies in DWR Reservoirs, Lake Mathews, and Lake Skinner to be fixed quantities, with any remaining need reflected as changes in DVL's emergency storage allocation under the recommended 750,000 AF of Emergency Storage.

Table 11
Allocation of Emergency Storage in Existing Reservoirs[1]
(Acre-Feet)

Reservoir	Emergency Storage Objective at 750 TAF
Pyramid Lake	158,100
Castaic Lake	138,700
Elderberry Forebay	26,300
Lake Perris	57,700
Lake Mathews	78,500
Lake Skinner	33,800
Diamond Valley Lake	256,900
Total	**750,000**

Note: (1) This allocation provides operational guidance but does not create a minimum emergency storage volume in any single reservoir.

Conclusion

This white paper summarizes the progress to date of the Workgroup coordination process to estimate a planning objective for the region's emergency storage, as part of Metropolitan's ERSP. Evaluating the Emergency Storage involves the regional aggregation of retail water demands and locally available supplies within the service area. It also accounts for the member agencies' unique situations in identifying practicable ranges of additional conservation actions that could yield decreases in retail demand and levels of local production that could be accomplished during emergency outage.

Under the new envelope concept, the Workgroup focused on an acceptable range of regional emergency storage values from 520,000 to 830,000 AF. **Based on feedback to date, staff recommends an Emergency Storage of 750,000 AF.** This level of storage would prevent severe water shortages for the region with practicable ranges of water demand reduction achievable conservation actions and plausible levels of local production. This recommended regional emergency storage is assumed to be distributed amongst the available capacities within the existing DWR and Metropolitan surface reservoirs, as shown in Table 11.

The Emergency Storage presented in this white paper is a regional planning objective. It is an estimate for the amount of Metropolitan water that the region targets to store in preparation for a catastrophic earthquake event. This evaluation of Emergency Storage is not intended to set a basis or a policy for allocating or apportioning storage for each individual member agency.

The Workgroup proposes that this storage objective be revisited periodically, possibly following the completion of a new IRP. Metropolitan also considers spatial distribution for the purpose of determining generally where to store its emergency water. However, specific operations during an emergency will depend on the actual conditions at that time. Since member agency demands for supplemental water will be met through deliveries of supplies from storage, evaluation of spatial distribution of storage and most effective operation of the distribution system will be accomplished as part of Metropolitan's continued efforts and coordination within the ERSP's storage portfolio evaluation or other regional planning processes.

Attachment A

2018 Member Agency Total Retail Demand and Local Production
(Source data for Tables 2, 3, and 4)

	Total Retail Demand	Groundwater	Surface Production	Recycling + GW Recovery Reclamation	Other Imports	Seawater Desal	Local Surface Storage	IRP Target	
Agencies at 6 month Outage									
Foothill MWD	9,204	3,970	200	120	0	0	0	67	
Pasadena	16,217	6,000	0	0	0	0	0	118	
San Marino	2,700	2,250	0	0	0	0	0	20	
Three Valleys MWD	63,226	21,650	3,100	4,384	0	0	0	447	
Upper San Gabriel MWD	106,945	74,163	4,500	4,354	0	0	0	625	
Anaheim	34,253	23,932	0	39	0	0	0	249	
Fullerton	14,315	10,376	0	0	0	0	0	104	
MWDOC	310,510	107,945	2,000	93,163	0	0	0	1,651	
Santa Ana	19,074	13,478	0	160	0	0	0	139	
Eastern MWD	126,051	40,400	1,550	25,112	0	0	0	890	
Western MWD	147,318	73,700	2,750	21,295	0	0	0	1,064	
IEUA	143,302	74,800	16,240	28,573	0	0	0	969	
San Diego County Water Authority	315,373	5,900	24,595	19,956	0	25,319	34,000	2,204	
Agencies at 12 month Outage									
Central Basin MWD	296,066	182,300	0	55,972	0	0	0	1,590	
Compton	7,766	6,400	0	0	0	0	0	56	
Long Beach	68,633	28,700	0	10,118	0	0	0	452	
Torrance	28,420	2,700	0	9,150	0	0	0	207	
West Basin MWD	179,750	34,600	0	33,621	0	0	0	1,173	
Santa Monica	13,732	8,200	0	145	0	0	0	100	
Burbank	27,819	300	0	13,985	0	0	0	159	
Glendale	30,319	1,500	0	8,984	0	0	0	221	
Los Angeles	566,486	77,794	0	11,681	0	0	0	4,070	
San Fernando	3,150	3,143	0	0	0	0	0	23	
Calleguas MWD	164,638	27,700	0	7,483	13,100	0	0	1,198	
Beverly Hills	11,938	0	0	700	0	0	0	87	
Las Virgenes MWD	28,413	100	0	4,804	0	0	0	207	
MWD TOTAL	**2,735,617**	**832,000**	**54,935**	**353,797**	**13,100**	**25,319**	**34,000**	**18,087**	**1,331,238**

Note: Member agency local production are approximation for year 2018 based on 2015 IRP and are estimated for the outage periods indicated.
This table shows individual member agency estimates used to develop Metropolitan's Emergency Storage Objective for the region.
For agencies along the Rialto Pipeline, see discussion on pages 5-6 related to system limitations for receiving CRA supplies.
Local surface storage includes all reasonably available surafce storage that the member agency could produce and use within its service area. Includes SDCWA's calculated ESP storage requirement reported to their Water Planning Committee in July 2018 and a portion of their target carryover storage as discussed in page 9.

Appendix 9

SEISMIC RISK ASSESSMENT AND MITIGATION PLAN

Appendix 9
SEISMIC RISK ASSESSMENT AND MITIGATION PLAN

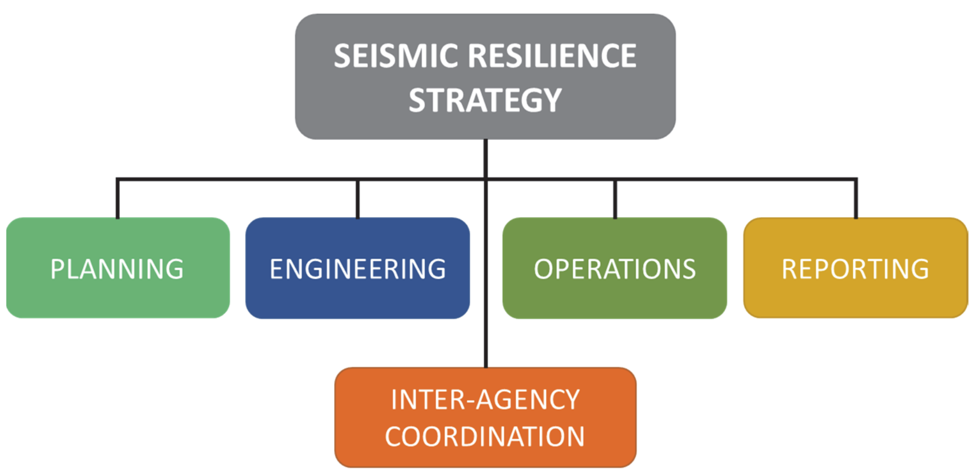
Beginning January 2020, CWC Section 10632.5 mandates UWMPs to include a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities. For Metropolitan, this required assessment and plan are accomplished as part of developing its resilience strategy and are presented in detail in Metropolitan's seismic resiliency reports attached to this appendix.

Over its nearly 90-year history, Metropolitan has been proactive in mitigating seismic risks posed to its expansive infrastructure, as well as improving its ability to maintain (or quickly restore) water deliveries following a major earthquake. This ability to mitigate seismic risks and maintain (or quickly restore) water deliveries following a seismic event is referred to as "seismic resilience." Metropolitan's holistic strategy for seismic resilience follows a "defense in depth" multi-layered approach for managing risk. Metropolitan's Seismic Resilience Strategy has three primary objectives:

1. Provide a diversified water supply portfolio, system flexibility, and emergency storage
2. Prevent damage to water delivery infrastructure in probable seismic events and limit damage in extreme events
3. Minimize water delivery interruptions through a dedicated emergency response and recovery organization

Metropolitan's Seismic Resilience Strategy is implemented through four components that encompass the various internal functions that promote the organization's seismic resilience objectives. These components are supplemented by Metropolitan's commitment to inter-agency coordination when preparing and responding to a seismic event and other emergencies. The strategy is shown below in Figure A.9-1.

Figure A.9-1
Seismic Resiliency Strategy



A brief description of the components of Metropolitan's Seismic Resilience Strategy and examples of their implementation are provided below.

Planning

The goals of the planning component are to develop and maintain a diversified water resource portfolio; provide a flexible system that allows for operational changes to handle variations in water supply, planned or unplanned system outages; and to maintain adequate emergency storage supplies. Metropolitan has developed a diverse water resource portfolio through the enactment of various exchange and water banking programs. These water supply programs are described in detail in Section 3 and Appendix 3. In addition to existing supply programs, development of the Regional Recycled Water Program would provide Metropolitan with an additional water resource and would be strategically located on the coastal side of the San Andreas Fault. Metropolitan also strives for regional seismic resilience by incentivizing local agencies to develop increased conservation, recycling, storage, and other water management programs.

As Metropolitan expanded its system over the years, it has continually improved the flexibility of the system to handle changes in water supply or pipeline or facility outages. One example of Metropolitan's system flexibility is the Common Pool service area, which can be supplied by the Jensen, Weymouth, or Diemer water treatment plants. Additionally, Metropolitan has constructed its system such that most of the service area can be supplied by either Colorado River or State Water Project supplies.

Metropolitan's imported water supplies from the CRA and SWP East and West Branches cross the San Andreas Fault (SAF) Zone prior to reaching Metropolitan's service area. A major earthquake on the SAF has the potential of damaging all three aqueducts and disrupting imported supplies for up to six months. Metropolitan constructed Diamond Valley Lake (DVL) on the coastal side of the fault to mitigate the potential impacts of a major SAF earthquake to its service area. Completion of DVL nearly doubled Metropolitan's available surface water storage in the region and, along with other local reservoirs, is used to maintain 6 to 12 months of emergency water storage supply. Water from DVL can supply four of Metropolitan's five regional water treatment plants.

Engineering

The goal of the engineering component is to assess and mitigate seismic risk to individual facilities, and the system. This is accomplished through Metropolitan's Seismic Resilience of Structures Program, the Seismic Resilience of Pipelines Program, the Dam Safety Program, and special seismic assessments.

Seismic Resilience of Structures

Metropolitan's program to increase the seismic resilience of structures is an ongoing program with the goal of protecting life safety and critical infrastructure to minimize water delivery interruptions following a seismic event. The initial program focused on evaluating the seismic risk of above ground structures (e.g., water treatment plants) constructed prior to 1990 and upgrading structures to mitigate the risk when found to be seismically deficient. The program has recently expanded to include post-1990 structures due to the progress made on the initial list of structures. Examples of seismically upgraded facilities include the Colorado River Aqueduct pump plant buildings, the Weymouth East and West Wash Water Tanks, and the Diemer and Jensen Administration Buildings.

Seismic Resilience of Pipelines

Metropolitan's conveyance and distribution system has been built in conformance with standards and practice at the time of design. In keeping with the goals of the Seismic Resilience Strategy, Metropolitan is developing seismic design criteria for new pipelines based on current state of practice, geotechnical and seismicity criteria, operating conditions, and asset management strategies. The planned design approach for new pipelines will be to establish performance criteria, identify seismicity and ground conditions along the alignment, and design the pipeline to resist damage from ground shaking and deformation. Specialized pipe joints and sections can be designed to accommodate ground deformation from fault displacement or liquefaction. For existing pipelines, seismic resilience will be incorporated as a component of pipeline rehabilitation projects. Metropolitan will evaluate each upgrade individually to balance risk, performance, and cost. Metropolitan's Casa Loma Siphon Barrel No. 1 Seismic Upgrade Project is an example of the organization incorporating seismic design in the rehabilitation of existing pipelines. The existing siphon, which crosses a segment of the San Jacinto Fault Zone and is subject to long-term subsidence, will be replaced with earthquake-resistant ductile iron pipe. The pipe joints are designed to accommodate ground displacement without failure to allow for continued service following an earthquake.

Dam Safety Program

Metropolitan has an ongoing Dam Safety Initiatives Program that has initiated several plans to improve Metropolitan's dam seismic safety and earthquake readiness. These initiatives are being coordinated with the California Division of Safety of Dams (DSOD) and Office of Emergency Services and include the following:

- Ongoing preparation of Emergency Action Plans, including inundation maps
- Performing training exercises at the dam site to test processes during a seismic event
- Providing training and guidance on overall dam safety
- Reviewing operation and maintenance methods for reservoir drawdown and operations after a seismic event
- Updating guidelines and procedures on protection against seismic risk
- Establishing a strong communications system on seismic information
- Performing structural strengthening of dams, including rehabilitation and improvement of spillways and inlet/outlet towers such as Lake Skinner Outlet Tower
- Improving dam safety instrumentation, monitoring, and reporting capabilities

Special Seismic Assessments

Metropolitan conducts special seismic assessments to increase understanding of the vulnerability of the organization's assets and operations to various seismic hazards. The studies focus on hazards specific to individual facilities or the system as a whole and identify options to mitigate the risks posed by the hazards. In addition, the studies support emergency response training and planning for future earthquake events by estimating the magnitude of damage that may occur from various seismic events. The following is a list of some of the reports that Metropolitan has completed:

- Liquefaction Susceptibility Mapping for the Metropolitan Water District of Southern California's Feeder System (Report No. 1625), Carollo Engineers, Inc., 2019.

- Colorado River Aqueduct – San Gorgonio Pass Seismic Event Vulnerability Study (Report No. 1484), GeoPentech, July 2014.
- Potential Effects of Southern California Seismic Events on Metropolitan Water Deliveries (Report No. 1335), Metropolitan Facility Planning staff, January 2009.

Operations

The goal of the operations component is to maintain effective emergency planning and response capabilities. This is accomplished through maintaining an effective Emergency Response Organization, conducting routine emergency response training exercises, and maintaining emergency construction capabilities.

Metropolitan's Emergency Response Organization (ERO) is comprised of over 200 predesignated employees who work in the Emergency Operations Center (EOC), the Incident Command Posts, or the field during emergencies. ERO staff has completed specialized training that meets State and Federal requirements. Metropolitan's emergency response structure follows the National Incident Management System (NIMS) and the State of California's Standardized Emergency Management System (SEMS).

In addition to specialized NIMS training, Metropolitan staff routinely participate in emergency response training exercises that are often based on a postulated seismic event. In 2019, Metropolitan started a new five-year emergency exercise plan that will allow all member agencies to participate in at least one of Metropolitan's annual emergency exercises. The first of these exercises was a tabletop exercise for the Orange County member agencies on August 29, 2019, which focused on a hypothetical incident at the Diemer Water Treatment Plant.

Metropolitan has conducted over 100 exercises since February 2018. This included two large functional emergency exercises for the EOC and multiple tabletop exercises, workshops, and seminars for the 12 Incident Command Posts located at the water treatment plants, conveyance and distribution facilities, and other strategic locations in Metropolitan's service area.

Metropolitan maintains the necessary staffing, materials, and equipment to respond to two simultaneous pipeline breaks. The Machine Shop and Coating Shop at La Verne are available to fabricate pipe sizes up to 12 feet in diameter, and Metropolitan's construction forces have the necessary equipment and expertise to make the repairs in-house. In addition, Metropolitan has upgraded its satellite phones to ensure communication ability following a seismic event and is in the process of installing high frequency radios at all Incident Command Posts and the Emergency Operations Center.

Reporting

Metropolitan has committed to providing annual updates to its Board of Directors on the organization's Seismic Resilience Strategy and its progress toward identified short-term and long-term goals. The organization has also committed to providing a formal report on a five-year interval summarizing accomplishments related to seismic resilience and changes in directives to the Seismic Resilience Strategy.

Inter-Agency Coordination

Improving the region's seismic resilience requires that member agencies understand the seismic risks to the imported water supplies so that they may appropriately plan on the local level. Opportunities for inter-agency coordination are provided through the Local Resources Program where Metropolitan incentivizes the development of local groundwater, recycling, and other supply resources to offset imported demands. As stated previously, Metropolitan provides member agencies the opportunity to participate in emergency response exercises. As part of a recent study, Metropolitan developed maps that define the relative liquefaction susceptibility of the region inclusive of the conveyance and distribution system and has made these maps available to member agencies. Recently, the organization updated the emergency storage goals through several workshops in coordination with member agencies.

Metropolitan is also a member of the Seismic Resilience Water Supply Task Force, along with the California Department of Water Resources (DWR) and the Los Angeles Department of Water and Power (LADWP). As the owners of the three conveyance facilities that provide imported water to the region, Metropolitan, DWR, and LADWP have recognized the importance of coordinating responses following a major seismic event that disrupts the imported water supplies. Each agency has provided an overview of the seismic risk to their respective systems and are in the process of developing a Water Mutual Assistance Agreement to formalize the coordination efforts following a major earthquake that disrupts service to the imported water supplies.

Metropolitan's Seismic Resilience Reports

The various components of Metropolitan's resilience strategy summarized above are described in detail in Metropolitan's Seismic Resilience Report First Biennial Report (February 2018) and Seismic Resilience Report 2020 Update (February 2020) presented as part of this appendix. These reports are also available on Metropolitan's website:
http://mwdh2o.com/AboutYourWater/Planning/Seismic-Resilience-Report/

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REPORT

SEISMIC RESILIENCE

FIRST BIENNIAL REPORT

The Metropolitan Water District of Southern California
700 N. Alameda Street, Los Angeles, California 90012

Report No. 1551
February 2018

SEISMIC RESILIENCE
FIRST BIENNIAL REPORT

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February 2018

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Additional copies: The Seismic Resilience Report is located on the Seismic Resilience SharePoint site. To obtain a copy of this document, please contact the Engineering Services Group.

Disclaimer

Extensive efforts have been made to ensure that the material contained in this document is accurate as of the date of publication. There are many factors, however, related to the content and applicability of this document which are beyond the control of MWD. In addition, the contents of this publication will be periodically updated, so the reader should inquire about any such changes in addition to reading this document. Finally, the reader is encouraged to seek appropriate technical and/or legal advice when specific facts or circumstances arise that raise questions concerning the applicability or interpretation of the policies and procedures discussed herein.

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TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

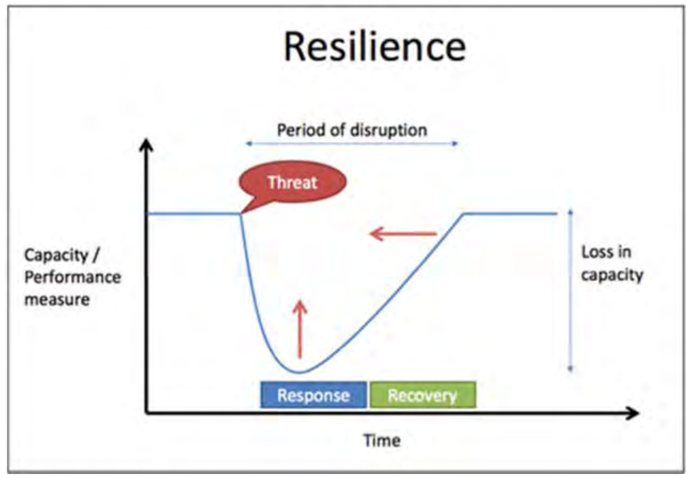
List of Appendices

EXECUTIVE SUMMARY

The ability to maintain, or quickly restore, water deliveries after a seismic event.

--Definition of "Seismic Resilience" for a water agency

An interruption in a key lifeline service such as water delivery can be devastating to a community's recovery after an earthquake. As the agency responsible for delivering imported water to over 19 million people in one of the world's most seismically active regions, The Metropolitan Water District of Southern California (Metropolitan) has made substantial efforts to minimize the impact of a major earthquake on the people and businesses within its service area. In 2017, Metropolitan refined and formalized its approach for addressing seismic resilience by fully integrating its planning, engineering, operations, and reporting functions.



This report documents Metropolitan's integrated Seismic Resilience Strategy, reports on key historic achievements, and communicates near-term goals aimed at further enhancing the seismic resilience of Metropolitan's infrastructure and water deliveries.

Seismic Resilience

"Resilience" is broadly defined as the ability of a system to absorb and rebound from shocks. The more resilient a system is, the smaller the impact will be that any given shock will have on the system, and the shorter the duration of recovery will be. Using the broad definition of resilience as a baseline, Metropolitan defines "seismic resilience" as the ability to maintain (or quickly restore) water deliveries following a seismic event. The more prepared a water agency is for earthquakes, and the more effective its emergency response capabilities are, the less impact the event will have on water deliveries to its customers.

Metropolitan's Seismic Resilience Strategy

Metropolitan's Seismic Resilience Strategy is a multi-faceted approach to prepare for and respond to seismic events. It involves close, formal coordination within the Metropolitan organization and with other owners of imported water conveyance systems that cross the Southern San Andreas Fault.

Coordination within Metropolitan and its member agencies focuses on diversifying water resources; enhancing operational flexibility; providing adequate emergency water supplies; and identifying and addressing infrastructure and system vulnerabilities. This coordination also involves development of effective emergency response capabilities.

The coordination with other owners of imported water conveyance systems is through a multi-agency task force. The members of this task force, which includes the California Department of Water Resources

(DWR) and the Los Angeles Department of Water and Power (LADWP) as well as other State and water industry organizations, work together to evaluate the unique seismic vulnerabilities of Southern California's imported water systems.

In addition to the coordination elements, Metropolitan's Seismic Resilience Strategy includes a reporting component to increase transparency and accountability. Each year, Metropolitan staff will update its Board of Directors on recent achievements and near-term goals. Every two years, a written report will be prepared to document these items.

Water is recognized as a critical resource, but having sufficient water available following an earthquake is essential. Seismic resilience has a goal that in most scenarios, water will be available for the vast majority of people and business affected by the event and for essential post-earthquake activities such as fire suppression.

Conclusion

Metropolitan's strategy for seismic resilience has evolved over time and has benefited from the lessons learned from major seismic events around the world. Because of this strategy, significant improvements in the overall seismic resilience of Metropolitan's water system have been made in each of the following key areas: water resource diversity, operational flexibility, emergency water storage capacity, resilience of existing infrastructure, and emergency response capabilities.

Metropolitan has also established a number of near-term goals within each of the planning, engineering, and operations components of seismic resilience that will further enhance this multi-layered approach.

Metropolitan's refined Seismic Resilience Strategy approach will maintain a clear and effective focus on long-term efforts, clearly communicate program achievements and goals to the Board, and provide member agencies with more clarity regarding projected seismic performance of Metropolitan's infrastructure.

SECTION 1 INTRODUCTION

Purpose

The Metropolitan Water District of Southern California (Metropolitan) owns and operates a complex conveyance, treatment, and distribution system that serves a 5,200-square-mile service area within an active seismic region. Over its nearly 90-year history, Metropolitan has been proactive in mitigating seismic risks posed to this expansive infrastructure, as well as improving its ability to maintain (or quickly restore) water deliveries following a major earthquake. This ability to mitigate seismic risks and maintain (or quickly restore) water deliveries following a seismic event is referred to as "seismic resilience." Metropolitan's strategy for seismic resilience follows a "defense in depth" multi-layered approach for managing risk: providing a diversified water resource portfolio, system flexibility, emergency water storage, robust emergency response capabilities and performing cyclical assessments of facilities and addressing identified vulnerabilities.

Over the last 20 years, Metropolitan has made significant progress in a number of key areas related to seismic resilience (see Appendix 1):

1. Increasing water supply resilience, flexibility, and emergency storage
2. Addressing the susceptibility of above-ground structures to damage from seismic events
3. Developing effective and robust emergency response capabilities

Recognizing the need for continuous improvement, Metropolitan recently re-assessed the various activities that enhance seismic resilience to refine, expand, and formalize its overall approach. The resulting Seismic Resilience Strategy is a fully integrated approach toward minimizing regional water delivery interruptions and restoring interrupted regional deliveries quickly after an earthquake.

The specific goals of the refined Seismic Resilience Strategy are to:

- Improve the integration of planning, engineering and operations activities focused on seismic resilience through regular collaborative meetings and integrated reporting
- Expand current programs to identify and address any additional seismic vulnerabilities
- Re-visit existing seismic performance objectives in light of advancements in the knowledge of earthquake hazards, earthquake engineering, and mitigation capabilities
- Document Metropolitan's seismic resilience activities to facilitate knowledge transfer and coordination
- Improve accountability by communicating seismic resilience goals and accomplishments to Metropolitan's Board of Directors and member agencies on an annual basis
- Enhance member agency planning efforts for emergency response and facility improvements by providing more clarity regarding the projected seismic performance of Metropolitan's infrastructure

This document describes Metropolitan's Seismic Resilience Strategy, summarizes key historical achievements, and communicates near-term goals that will further increase the seismic resilience of Metropolitan's system.

Seismic Resilience Strategy Structure

Metropolitan's Seismic Resilience Strategy (see **Figure 1-1**) is a multi-faceted approach that involves coordination among key functions within Metropolitan as well as formal coordination with other owners of imported water conveyance systems that cross the Southern San Andreas Fault.

Figure 1-1: Seismic Resilience Strategy Structure and High Level Goals

As shown in the figure, the coordination within Metropolitan and its member agencies focuses on the activities of planning, engineering/design, operations/emergency response, and reporting. These efforts are complemented by the efforts of the multi-agency Seismic Resilience Water Supply Task Force (Task Force). This Task Force includes the California Department of Water Resources (DWR) and the Los Angeles Department of Water and Power (LADWP) as well as other State and water industry organizations and focuses on the unique seismic vulnerabilities of Southern California's imported water supplies.

The purpose of Metropolitan's Seismic Resilience Strategy is to enable Metropolitan to restore water deliveries to its member agencies promptly after seismic events by maintaining a diversified supply portfolio, system flexibility, and emergency storage; minimizing damage to infrastructure; and supporting a robust emergency response and recovery capability. This integrated, comprehensive approach will maintain focus on effective long-term efforts, clearly communicate program achievements and goals to the Board, and provide more clarity to member agencies regarding projected regional seismic performance to enhance local facility and emergency response planning efforts.

Report Organization

This report is organized as follows:

- *Section 2 – Background.* Provides context regarding inherent seismic risks within Southern California, a definition of seismic resilience, and a summary of how Metropolitan's seismic resilience strategy developed over time.
- *Section 3 – Planning Component.* Describes planning activities that address seismic resilience through Metropolitan's diverse water supply portfolio and adaptive management approach to managing resources, including establishing emergency storage.
- *Section 4 – Engineering Component.* Describes technical programs that identify and mitigate the seismic vulnerability of Metropolitan's infrastructure and systems.
- *Section 5 – Operations Component.* Describes the emergency response organization, training exercises, and post-event capabilities that serve to minimize the disruption of water deliveries following earthquakes.
- *Section 6 – Reporting Component.* Explains the purpose and timing of the integrated reporting component.
- *Section 7 – Seismic Resilience Water Supply Task Force Component.* Describes the purpose of the collaborative task force, recent progress, and planned activities.
- *Section 8 – Seismic Resilience Performance Objectives and Near-Term Goals.* Summarizes existing objectives of the various components of seismic resilience, describes areas where new objectives are being considered, and provides high-level goals planned to be achieved by December 2019.

List of Abbreviations and Acronyms

BCP	Business Continuity Plan
CIP	Capital Investment Plan
CRA	Colorado River Aqueduct
DATs	Damage Assessment Teams
DSOD	Division of Safety of Dams
DVL	Diamond Valley Lake
DWR	California Department of Water Resources
EAP	Emergency Action Plan
EOC	Emergency Operations Center
ERO	Emergency Response Organization
FEMA	Federal Emergency Management Agency
ICCs	Incident Command Centers
IRP	Integrated Water Resources Plan

IT	Information Technology
ITP	IT Continuity Plan
LAA	Los Angeles Aqueduct
LADWP	Los Angeles Department of Water and Power
LRP	Local Resources Program
M	Magnitude
MARS	Member Agency Response System
MCE	Maximum Considered Earthquake
Metropolitan	The Metropolitan Water District of Southern California
MOU	Memorandum of Understanding
M_W	Moment Magnitude
MWD	The Metropolitan Water District of Southern California
NIAC	National Infrastructure Advisory Council
NIMs	National Incident Management System
O&M	Operation and Maintenance
OCC	Operations Control Center
PCCP	Prestressed Concrete Cylinder Pipe
PGA	Peak Ground Acceleration
SCE	Southern California Edison
SEMS	Standardized Emergency Management System
ShakeOut	Great Southern California ShakeOut Scenario
SWC	Security Water Center
SWP	State Water Project
Task Force	Seismic Resilience Water Supply Task Force
UBC	Uniform Building Code
UCERF3	Uniform California Rupture Forecast Version 3
USGS	United States Geological Survey
WSAP	Water Supply Allocation Plan
WSDM	Water Surplus Drought Management

SECTION 2 BACKGROUND

Seismic Risk

Within Southern California, there are a number of known active faults with varying levels of activity that are capable of generating significant earthquakes and causing widespread damage to infrastructure. Modern era earthquakes that occurred within or close to Metropolitan's primary service area with a magnitude above 6.3 (M6.3) are listed in Appendix 2. In 2015, the United States Geologic Survey (USGS) released the Uniform California Earthquake Rupture Forecast Version 3 (UCERF3), which provides a forecast for the likelihood of rupture for particular earthquake faults within California. UCERF3's forecast of the likelihood of a M6.7 earthquake or greater in the next 30 years on each active fault in Southern California is shown in **Figure 2-1**. As indicated in the figure, the Southern San Andreas Fault was identified as having the highest likelihood (19%) of a M6.7 earthquake or greater in the next 30 years. UCERF3 further states that the there is a 93% chance of a M6.7 or greater earthquake occurring on one of the faults within Southern California within the next 30 years, and a 36% chance of a M7.5 or greater earthquake occurring within the next 30 years.

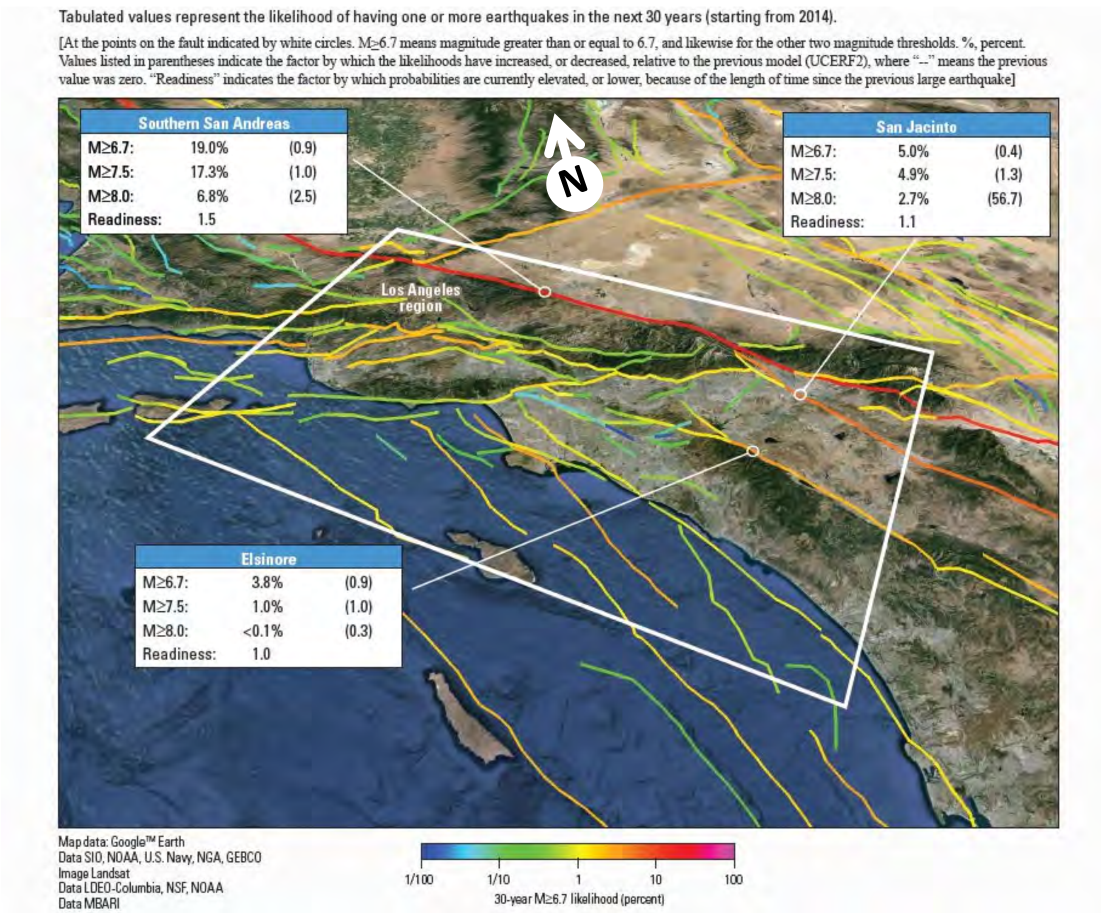


Figure 2-1: Likelihood of M6.7 or greater earthquake in the next 30 years (Source: UCERF3)

As shown in **Figure 2-2**, a significant portion of Metropolitan's infrastructure, including the Colorado River Aqueduct (CRA) and several treated water pipelines, is located near or crosses active faults.

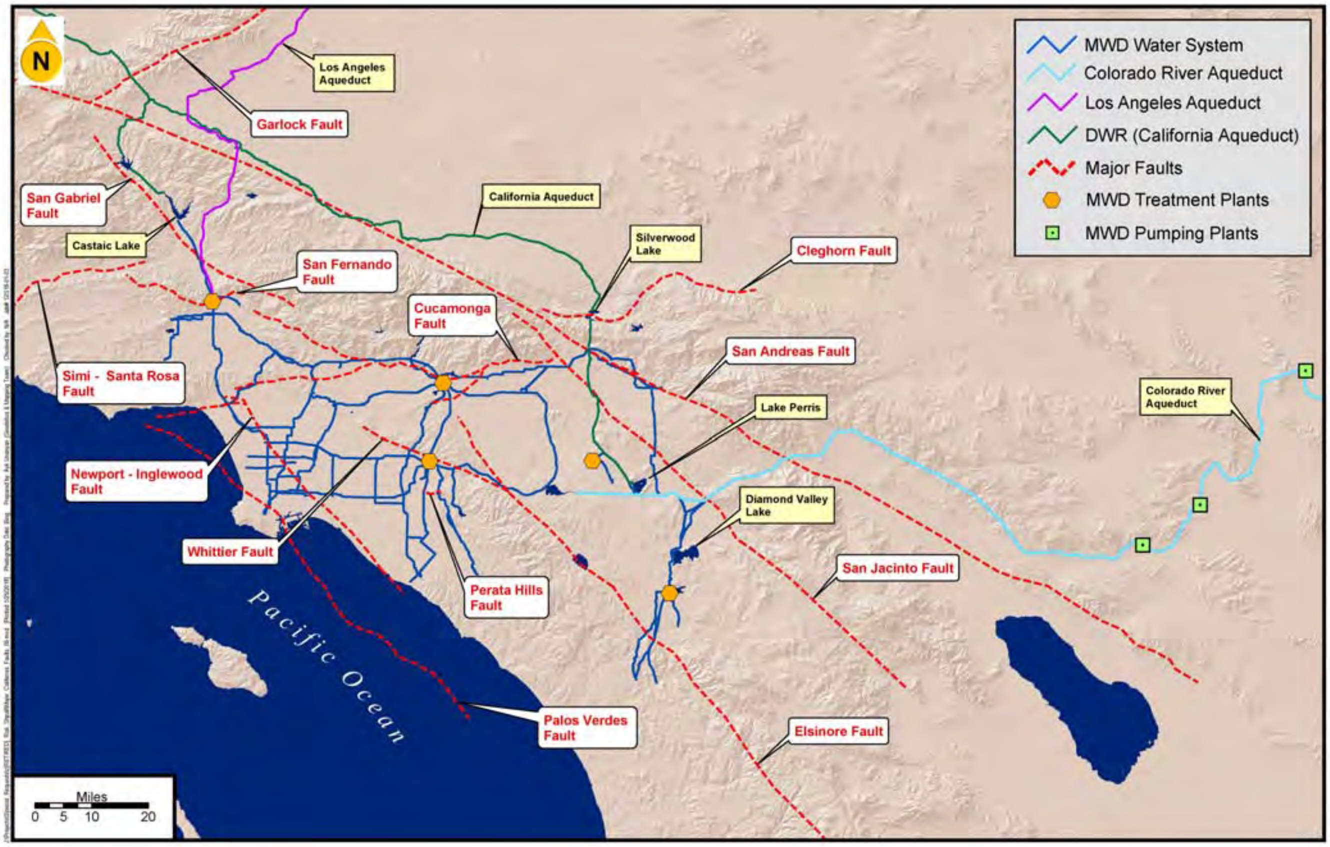


Figure 2-2: Major Earthquake Faults in Southern California

The risk of earthquake damage to Metropolitan's infrastructure from these active faults is manifested through different seismic hazards, including seismically induced ground shaking, seismically induced ground failure, and surface fault displacement.

- Seismically induced ground shaking can damage buildings, structures, aqueducts, pipelines, and tunnels. The intensity and duration of shaking at a particular location is dependent on a number of factors, including the earthquake magnitude, the distance from the earthquake epicenter, and local soil conditions.

Examples of typical effects of seismically induced ground shaking. The photograph on the left shows a damaged building from the 1994 M6.7 Northridge Earthquake. The building has essentially fallen backwards, and what was once a straight wall now appears curved. The photograph on the right shows the collapsed portion of a freeway overpass from the same earthquake.

- Seismically induced ground failure includes liquefaction, landslide, and seismic settlement. Liquefaction occurs when prolonged shaking causes saturated (water-bearing) soils to consolidate and lose their bearing capacity. This can compromise the support of structures that are constructed in these zones, including buildings and pipelines. Prolonged shaking can also lead to displacement of large areas of soil or rock, resulting in hazardous landslides and rock falls. The integrity of buildings and pipelines constructed in landslide zones can be compromised if the supporting ground experiences seismically induced failure; rockfalls can also result in structural damage due to the impacts of large boulders on structures. Seismic settlement is similar to liquefaction, except that the soil is not saturated.


Examples of seismically induced ground failures include liquefaction (left photo) and landslides (right photo) from the 2011 M6.3 Christchurch, New Zealand Earthquake and the 2016 M7.8 Kaikoura, New Zealand Earthquake, respectively.

- Surface fault displacement is usually only observed in large magnitude earthquakes but can result in devastating structural damage. The 1972 Alquist-Priolo Earthquake Fault Zoning Act prohibits construction of buildings in California within 50 feet of a known active fault trace. Therefore, surface fault displacement is generally not an issue for Metropolitan’s buildings constructed after the early 1970s. However, several components of Metropolitan’s conveyance and distribution infrastructure cross known active faults, including the CRA, various pipelines, and power transmission lines. These facilities are subject to damage from surface fault displacement.

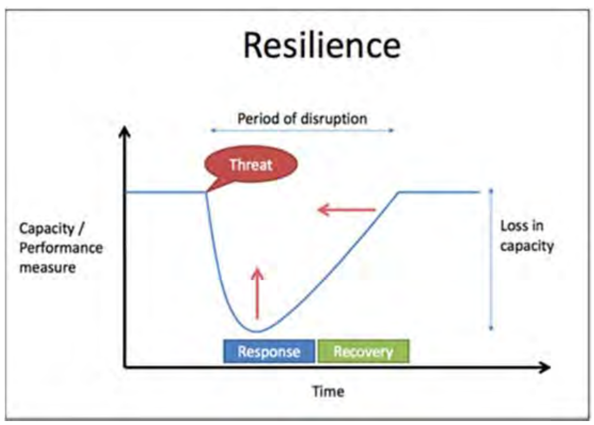

Examples of surface fault displacement. The photograph on the left shows railroad tracks displaced as a result of the 1952 M7.5 Kern County Earthquake. The photograph on the right shows a field that shifted as a result of the 2010 M7.1 earthquake in Canterbury, New Zealand.

Seismic Resilience

General

According to the National Infrastructure Advisory Council (NIAC), infrastructure resilience is "the ability to reduce the magnitude and/or duration of disruptive events." The effectiveness of a resilient infrastructure or enterprise depends upon its ability to "anticipate, absorb, adapt to, and rapidly recover from a potentially disruptive event." [ref. "*Critical Infrastructure Resilience Final Report and Recommendations*," September 8, 2009]**.** This event may be man-made, such as a cyber-attack, or a natural disaster, such as a drought, flood, or earthquake.

"Seismic resilience" (see **Figure 2-3**) narrows the focus of infrastructure resilience to only earthquakes. Using the definition of "infrastructure resilience" presented above, Metropolitan has defined seismic resilience for water agencies as the ability to reduce the magnitude and/or duration of water delivery interruptions resulting from seismic events. Rather than striving to make an entire water system "earthquake-proof," seismic resilience involves setting reasonable performance goals that provide sufficient benefits that justify the corresponding investments required by both an agency and its ratepayers. Metropolitan's seismic resilience performance objectives are summarized in Section 8 of this report.



Source: http://www.iparametrics.com/solutions/infrastructure-resilience.html

Figure 2-3: Resilience -- the ability to reduce the magnitude and/or duration of disruptive events

Applicability to Metropolitan

For over a decade, Metropolitan has had a well-defined approach to system reliability that addressed overall system resilience in five key areas: Water Supply Reliability, System Capacity, Infrastructure Reliability, System Flexibility and Emergency Response.

Seismic resilience is an essential aspect of Metropolitan's overall reliability strategy. Water deliveries are extremely crucial following earthquakes for fire suppression, for the general welfare of local residents, and for the regional economy that relies on imported water. Metropolitan's approach to seismic resilience has evolved over time to become one that is highly effective and recognized within the water industry [ref. "*Water Supply in Regard to Fire Following Earthquake*," Charles Scawthorn, Pacific Earthquake Engineering Research Center, November 2011]**.**

Metropolitan's Historical Approach to Seismic Resilience

"The aqueduct is being built for the future as well as the present, and must stand and give adequate service for an indefinitely long time."

From the "Design" Chapter of "The Great Aqueduct" book by Julian Hinds, 1938.

"It was desirable that faults be crossed at right angles, to minimize damage in the event of movement, and that some flexible type of conduit on or near the surface be used so that if repairs become necessary they will be as simple as may be…"

From "Major Problems of Aqueduct Location" by Julian Hinds, Nov. 24, 1938 Engineering News-Record.

Since its inception, and particularly during the design and construction of the CRA, Metropolitan has recognized the potential vulnerability of water infrastructure to disruptions by earthquakes. This section provides a brief overview of Metropolitan's historical approach to seismic resilience, focusing on major earthquake events in the past and lessons learned from these events.

The 1906 M7.8 San Francisco earthquake struck the coast of Northern California at 5:12 a.m. on April 18. Severe shaking was felt from Eureka on the North Coast to the Salinas Valley. Broken gas lines resulted in fires that lasted for several days due to a lack of fire supply. As a result, about 3,000 people died and over 80% of the city of San Francisco was destroyed.

The 1933 M6.7 Long Beach earthquake took place on March 10 at 5:54 P.M. Damage to buildings was widespread and between 115 and 120 people died. The earthquake highlighted the need for earthquake-resistant design for structures in California.

Post-1906 San Francisco and 1933 Long Beach Earthquakes (1930-1970)

Conveyance and Distribution System: The majority of Metropolitan's conveyance and distribution system was constructed between the 1930s and the 1970s. Historical documents regarding the planning and design of this infrastructure describe a philosophy of "permanence," which may be considered as a forerunner to "resilience." This philosophy not only took into account decades of wear and tear, routine hazards, and large storms, but also provided for seismic resilience.

Despite having no provisions within design codes, Metropolitan took proactive measures to address seismic resilience while designing the CRA. Metropolitan geologists and engineers took into account the ground shaking and deformation that had occurred along the San Andreas Fault system during the 1857 Fort Tejon earthquake and lessons learned from 1906 San Francisco earthquakes, and supplemented their understanding of regional active faults through geologic mapping and analysis of stereo aerial photographs. This led to the aqueduct being designed to cross active faults near the ground surface in inverted siphons and cross fault traces at right angles. The designers also opted for a more flexible siphon design in fault regions than the rigid monolithic concrete construction used elsewhere on the CRA, and provided extra hydraulic grade at three siphons crossing active faults (Appendix 3). These provisions were intended to minimize the adverse effects of seismically induced ground movement and to simplify access for repairs.

Metropolitan's dams are inspected on a regular basis.

Photo of the 120-inch Froriep Vertical Turning Lathe (above) and the 5-inch G&L Horizontal Boring Mill (below) in the La Verne Machine shop.

Water Treatment Plants: Metropolitan's water treatment plants were also designed with features that enhance seismic resilience, beginning with the F. E. Weymouth Water Treatment Plant in 1940, and followed by the Robert B. Diemer Water Treatment Plant in 1963. The plants are modular in design and incorporate redundancy of key components. They are also situated strategically to maximize gravity flow to a majority of the distribution system.

Dams and Reservoirs: Metropolitan began a Safety of Dams program many years before formal reporting was required by the California Division of Safety of Dams (DSOD). Staff regularly inspects Metropolitan's dams for vulnerabilities, documents their findings, and reports these findings to DSOD.

La Verne Shops and Construction Equipment: The La Verne Shops were built in the 1940s to support the construction and maintenance of Metropolitan's initial infrastructure. The shops were expanded in the 1960s as Metropolitan's system grew along with its service area. These specialized shops provide support for routine maintenance activities and are also vital for responding to emergency events impacting Metropolitan and member agency facilities. The stockpiling of key materials and the ability to roll pipe and fabricate or repair specialty equipment greatly enhances seismic resilience. Many of Metropolitan's pumps, piping, valves, and related equipment are too large to be routinely stocked by vendors.

Post-1971 San Fernando Earthquake (1971-1990)

The San Fernando earthquake struck the greater Los Angeles region in the early morning of February 9, 1971. The M6.5 earthquake caused severe property damage over $500 million and the loss of life directly attributable to the earthquake reached 58.

There were over 145 post-earthquake ignitions, typically caused by severed gas lines. Metropolitan experienced widespread damage at the Jensen plant, including a severe break to a 72" influent conduit and damage to the new finished water reservoir (shown below).

Earthquake Committee: Following the San Fernando Earthquake in 1971, Metropolitan formed an Earthquake Committee to investigate damaged structures at the Joseph Jensen Water Treatment Plant and to recommend enhanced seismic design criteria and site improvements to mitigate the seismic risk from potential future events.

The recommended modifications, such as the addition of stone columns to prevent liquefaction, are believed to have contributed to improved seismic performance of the Jensen plant in the 1994 Northridge Earthquake (see Section 4 of this report).

The Earthquake Committee also evaluated other facilities and recommended additional improvements that resulted in the upgrade of several key structures throughout Metropolitan's system. The Committee's efforts evolved over time into the current formal approach, with its emphasis on improving the seismic resilience of structures.

Emergency Response Plan: This period also saw Metropolitan adopt its Emergency Response Plan and establish a formal Emergency Response Organization (ERO). These steps led to regular emergency response training for staff, and eventually to staging formal emergency response exercises. As part of this effort, Metropolitan coordinated with its member agencies to establish the Member Agency Response System (MARS). Engineering Damage Assessment Teams (DATs) were also created to rapidly assess damage and help prioritize and initiate repair efforts.

La Verne Shops and Construction Equipment: The La Verne Shops were further expanded in the 1980s to support a major rehabilitation of the main pumps on the Colorado River Aqueduct. The additional fabrication capacity increased Metropolitan's ability to respond to emergency events.

Local Projects Program: To decrease reliance upon imported water, Metropolitan established the Local Projects Program in 1982 to provide financial incentives to member agencies for the development of recycled water projects throughout the region. A more diversified water portfolio helps the region's overall water supply reliability, which improves seismic resilience for the entire service area.

Post-1989 Loma Prieta and 1994 Northridge Earthquake (1990-2010)

During this period, Metropolitan greatly enhanced seismic resilience by performing seismic risk assessments, updating seismic design criteria, strengthening dozens of at-risk structures, encouraging development of local water resources, increasing emergency storage supplies, and enhancing emergency response capabilities.

The M6.9 Loma Prieta earthquake occurred in Northern California on October 17, 1989, at 5:04 p.m. . The shock was centered approximately 10 miles (16 km) northeast of Santa Cruz on a section of the San Andreas Fault System.

The earthquake was responsible for 63 deaths and over 3,750 injuries. The Loma Prieta segment of the San Andreas Fault System had been relatively inactive since the 1906 San Francisco earthquake until two moderate foreshocks occurred in June 1988 and again in August 1989.

As a result of this event, there were more 916 documented water system pipe breaks. This resulted in the loss of water pressure in the Marina District of San Francisco and difficulty in fighting fires.

Seismic Design Criteria: During the Inland Feeder Project, criteria were developed for new pipelines that cross seismic faults. The refined fault-crossing strategy includes using steel pipelines with welded joints; crossing fault-zones at right angles, and burying the pipes at relatively shallow depth to enable easy access for repair; and locating the pipelines where they can drain into channels or streams if damaged at fault crossings. Metropolitan also began considering the benefits of exceeding minimum code requirements for essential structures.

Seismic Upgrade Program: Dozens of pre-1990 structures were upgraded during this period. The benefit of upgrading seismically vulnerable facilities was demonstrated during the Northridge Earthquake in 1994. Structures that were upgraded at the Jensen plant, which was near the earthquake's epicenter, experienced only minor damage. The only significant damage consisted of rupture of an inlet 84-inch steel pipeline. The Jensen plant was off-line for less than 72 hours while the broken pipeline was repaired, and limited water deliveries were maintained during the repairs. Appendix 4 summarizes damage to Metropolitan infrastructure from the 1971 San Fernando and 1994 Northridge earthquakes.

Local Resources Program: In 1995, Metropolitan established the Local Resources Program (LRP). The LRP combined the Local Projects Program, which provided financial incentives for recycled water projects, with the Groundwater Recovery Program, which provided financial incentives to encourage the development of local groundwater recovery projects. The present LRP has been highly successful in reducing the region's dependence upon imported water.

Diamond Valley Lake (DVL): DVL was completed in 1999 to increase operational flexibility and reliability by providing seasonal storage, drought protection, and dedicated emergency supplies. Seismic resilience was a major factor in both the siting and design of the reservoir. DVL was specifically constructed south and west of the San Andreas Fault, and it was designed to withstand a major event on that fault in order to mitigate for the potential interruption of Southern California's imported water supplies. This 810,000 acre-foot reservoir, combined with other storage programs, provides a 6-month emergency water supply for Metropolitan's service area.

The M6.7 Northridge earthquake occurred on January 17, 1994, at 4:31 a.m. and had a duration of approximately 10-20 seconds.

The death toll was 57, with more than 8,700 injured. Property damage was estimated to be between $13 and $50 billion. LADWP reported a total of 1,405 pipe repairs and that water pressure had dropped to zero in some areas.

Metropolitan experienced damage at the Jensen Plant including a rupture of an 84" diameter pipeline. Crews worked around the clock and restored service within 72 hours. The ability to roll pipe in the La Verne shops expedited these emergency repairs.

Although Metropolitan's response was very good, a task force was formed to develop recommendations for further improvement (Ref. Report 1087, "Northridge Earthquake Assessment Report").

Special Seismic Risk Assessments: During this period, Metropolitan broadened the scope of seismic risk assessments, from focusing on isolated structures to assessing entire facilities, such as the Diemer plant, and overall systems, such as the CRA. These efforts included seismic vulnerability assessments, facility reliability assessments, and system flexibility studies. These special seismic risk assessments led to several capital projects to structurally upgrade facilities, provided input into Metropolitan's emergency response planning to reduce the time to restore service, and identified options to improve system flexibility to help maintain water deliveries during planned and unplanned outages.

Emergency Response Planning: Following the Northridge Earthquake, Metropolitan revised its Emergency Response Plan and associated programs and established a Member Agency Coordinator function. Metropolitan also began conducting training exercises in coordination with member agencies and other external agencies and three functional exercises based on postulated seismic events were conducted during this period. In addition, the EOC was relocated from the Sunset Headquarters Building to Eagle Rock, and Incident Command Centers (ICCs) were established at each of the water treatment plants. Recognizing that seismic events can impact business functions as well as infrastructure, staff developed a formal Business Resumption Plan. Over time, this evolved into the present Business Continuity Plan (BCP) and IT Continuity Plan (ITP).

Emergency Response Construction Capabilities: In 2008**,** Metropolitan enhanced its ability to respond to emergency events by initiating a long-term project to refurbish and upgrade the La Verne Shops. Metropolitan can roll pipe and conduct simultaneous repairs on two large-diameter pipelines. Retaining in-house fabrication functions is important, as there are few firms in the western U.S. with similar capabilities. In recent years, private firms with machine shop and fabrication capabilities have tended to increase the amount of work outsourced to offshore facilities, instead of retaining it locally. These firms have little ability to respond expeditiously to emergency needs.

Post-2010 Chile, 2011 Christchurch and 2011 Great East Japan Earthquakes (2010-Present)

Seismic Resilience Strategy Defined: The recent earthquakes in Chile, New Zealand, and Japan demonstrated the importance of seismic resilience, and have resulted in extensive discussions among industry experts and public agencies on strategies to achieve greater levels of seismic resilience beyond the conventional measures of prevention and protection. This was particularly true for the 2011 Christchurch, New Zealand Earthquake, although it was the smallest of the three. The reason was the widespread damage that occurred in the downtown section of Christchurch, despite the fact that the infrastructure was designed and constructed in accordance with modern building codes. While the majority of buildings did not fall, and most people were able to exit safely, many of the downtown structures were unsuitable for occupation and had to be demolished. In addition, many of the buried utilities were damaged and had to be abandoned in place. The combined loss of structures and utilities resulted in a long-term reduction to the population within the city.

A M6.3 earthquake occurred in Christchurch, New Zealand on 22 February 2011 at 12:51 p.m. The earthquake was centered 6 miles south-east of the center of Christchurch, which at the time was New Zealand's second-most populous city. The earthquake caused widespread damage across Christchurch, killing 185 people in the nation's fifth-deadliest disaster.

In December 2014, Los Angeles Mayor Eric Garcetti released Resilience by Design which provided recommendations to addresses Los Angeles' greatest earthquake vulnerabilities, including taking steps to secure imported water supplies.

Concurrent with the infrastructure industry's focus on resilience, Metropolitan re-assessed its existing programs and developed a more integrated, comprehensive approach to seismic resilience. One improvement was to incorporate the concept of performance-based design during seismic evaluations. In addition to the evaluation of structures based on design-level earthquakes to prevent damage, performance-based design evaluates the effects of more extreme events to anticipate structural damage. Another improvement was to embrace the significant technological advancements that can improve seismic resilience, including computer modeling techniques, seismic resistant products, and recent industry research. These improvements have allowed Metropolitan to develop an enhanced strategy for seismic resilience moving forward.

During this period, Metropolitan also formed a collaborative Task Force to address the unique vulnerabilities of the major aqueducts that cross the San Andreas Fault. In 2017, Metropolitan fully integrated the various seismic resilience efforts currently underway throughout the organization. The resulting Seismic Resilience Strategy is described in detail in Sections 3 through 7 of this report.

Metropolitan's Comprehensive, Integrated Seismic Resilience Strategy

The enhanced Seismic Resilience Strategy has the following objectives for Metropolitan and for the entire southern California region:

- Provide a diversified water supply portfolio, system flexibility, and emergency storage
- Prevent damage to water delivery infrastructure in probable seismic events and limit damage in extreme events
- Minimize water delivery interruptions through a dedicated emergency response and recovery organization

This strategy is built upon improved collaboration within Metropolitan and formal collaboration with LADWP and DWR, which also import water to Southern California.

Figure 2-4: Detailed Breakdown of Metropolitan's Seismic Resilience Strategy

As shown in **Figure 2-4**, Metropolitan's enhanced Seismic Resilience Strategy includes four components within Metropolitan and a fifth component that involves formal coordination between Metropolitan, LADWP, and DWR.

1. The **Planning component** develops diversified water resources, system flexibility, and emergency water storage through Metropolitan's Integrated Water Resources Plan (IRP) and System Overview Studies. The goal of Metropolitan's IRP is to develop a diverse water supply portfolio that will be able to maintain a reliable water supply under any conditions, including a major seismic event.
2. The **Engineering component** addresses design concepts, vulnerability studies, and seismic resilience projects executed under Metropolitan's Capital Investment Plan (CIP). The Engineering component includes evaluating the seismic resilience of structures, monitoring dams, special seismic assessments, and enhancing pipeline seismic resilience. These efforts are all aimed at improving the seismic resilience of the treatment plants and distribution system through facility upgrades and operational flexibility improvements.
3. The **Operations component** involves Metropolitan's emergency response organization, training exercises, and construction capabilities. Their objectives are to effectively prepare for and respond to emergency events so that impacts to water deliveries are minimized and interrupted deliveries are restored quickly.
4. The **Reporting component** involves documenting the Seismic Resilience Strategy, tracking progress of seismic resilience activities, and annual reporting of near-term goals and recent accomplishments to Metropolitan's Board. This component is aimed at facilitating knowledge transfer, increasing accountability, and improving the transparency of seismic resilience goals and achievements to the Board and member agencies. The reporting component also supports the planning efforts of member agencies by communicating potential outage durations of Metropolitan facilities during emergency events.
5. The **Seismic Resilience Water Supply Task Force component** involves Metropolitan's formal collaboration with DWR, LADWP, the State of California, and other water industry organizations to address the unique seismic vulnerabilities of Southern California's imported water supplies. The two primary objectives of this task force are to 1) enable the agencies to coordinate emergency response efforts, and 2) identify practical mitigation options for reducing the magnitude and duration of disruptions to the region's imported water supplies following a large earthquake on the San Andreas Fault.

SECTION 3 PLANNING COMPONENT

As a supplemental supplier to the Southern California water community, Metropolitan faces many challenges in meeting the region's needs for water supply reliability and quality. One of the challenges is the ability to maintain water deliveries within the region following a major seismic event. In general, Metropolitan's planning efforts focus on meeting demands during dry and critical periods. However, during the original planning for Diamond Valley Lake (DVL), Metropolitan considered a scenario and a plan to meet demands if imported supplies were interrupted due to a seismic event, including development of a significant increase in storage dedicated to meeting emergencies.

Historically, Metropolitan has provided 50 to 60 percent of the water used in its service area from the Colorado River (via the Colorado River Aqueduct) and from the Sacramento-San Joaquin River Watershed (via the State Water Project). In addition to relying on imported supplies, Metropolitan and its member agencies have developed other sources, including groundwater, surface water, recycled water, desalination of seawater, and an aggressive water conservation and water use efficiency program. These investments, and Metropolitan's ongoing efforts in several different areas, coalesce toward the goal of long-term regional water supply reliability.

Metropolitan's Integrated Water Resources Plan (IRP) is the foundation for planning and developing a diverse water supply and emergency storage. The fundamental goal of the IRP is for Southern California to develop a water supply portfolio that will be able to maintain a reliable water supply. Maintaining this reliability includes investments prior to major seismic events, when there could be extended outages of imported water conveyance systems. To meet this fundamental IRP goal of a diversified water portfolio, Metropolitan believes in investing in the reliability of imported supplies, incentivizing its member agencies to develop increased water conservation, recycling, storage, and other resource-management programs. A significant part of imported water supply reliability is preparing for recovery periods following seismic events. With the commencement of the IRP process in 1993, Metropolitan formalized this process as a long-term strategy and official policy.

Metropolitan's success in improving water supply reliability by diversifying its water resource portfolio, and by the application of adaptive resource management approaches has also increased seismic resilience. At a system level, the Planning component of seismic resilience has several facets:

- Diversified water supply portfolio
- System flexibility
- Emergency storage

Diversified Water Supply Portfolio

Metropolitan has undertaken a number of planning initiatives over the years in order to maintain a diversified water portfolio. These initiatives include the IRP, periodic IRP updates, the Water Surplus and Drought Management (WSDM) Plan, and the Water Supply Allocation Plan (WSAP). Collectively, these initiatives provide policy framework guidelines and resource targets for Metropolitan to ensure regional water supply reliability, along with additional resilience for seismic events. In addition to Metropolitan's efforts to coordinate regional supply planning through its inclusive IRP process, Metropolitan's member agencies also conduct their own planning analyses and may develop projects independently of Metropolitan.

2015 IRP Update

The 2015 IRP Update was a refinement of Southern California's water management strategy, with seismic resilience continuing to be a key component. The 2015 IRP Update called for increasing the targets for conservation and local supply development and an emphasis on the importance of protecting and maintaining existing local supplies. The more that conservation and local supplies can contribute to the baseline each year, the more imported water Metropolitan can divert into storage to prepare for droughts of unknown duration or potential seismic events. Further developing a diverse water supply portfolio also contributes to increased seismic resilience.

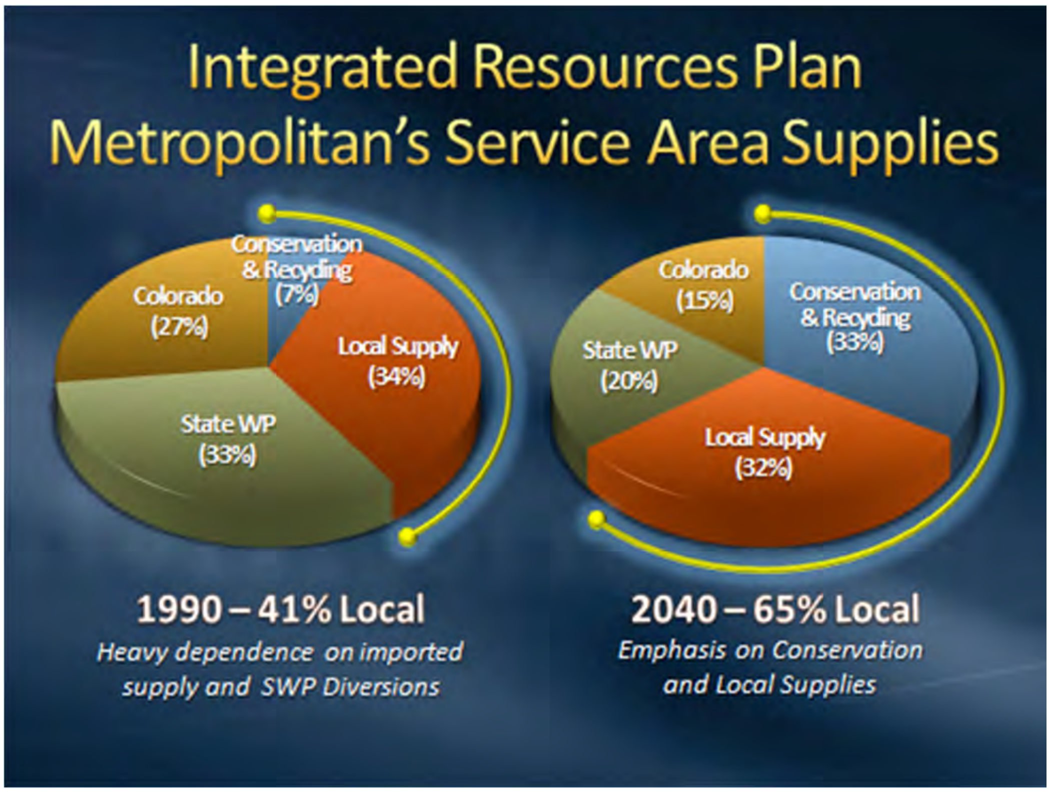


Figure 3-1: Integrated Resource Plan, Metropolitan's Service Area Supplies

Metropolitan's Service Area Supplies under the IRP

In 1990, about 41 percent of regional water demands were met with local resources and conservation. By 2040, about two-thirds will be met by local resources and increased conservation and recycling, as shown in **Figure 3-1**. Metropolitan's strategy is to maintain rather than increase traditional levels of imported supplies. The long-term portfolio approach looks to local solutions to sustain the region's continued growth. Increased flexibility to draw upon a wide range of sources from an ever more diverse water supply portfolio results in greater resilience to the potential impacts of seismic events on Southern California's water supply infrastructure.

Water Surplus and Drought Management (WSDM) Plan

Diversifying the region's water supplies and developing adequate and healthy water storage reserves have proven to be the backstop for water supply reliability. These actions have also contributed to improved seismic resilience for the region. Stored water reserves provide certainty for meeting the needs of the region's vast service area when traditional sources of supply are challenged by drought, climate change, seismic events, and other risks. It is critical that these storage resources be developed, managed and enhanced.

Metropolitan's WSDM Plan, which defines a regional water management strategy for Metropolitan and its member agencies, has focused on using storage to manage water supplies and enhance reliability since 1999. The WSDM Plan includes the following guiding principle: Metropolitan will encourage storage of water during periods of surplus and work jointly with its member agencies to minimize the impacts of water shortages on the region's retail consumers and economy during periods of shortage.

Water Supply Allocation Plan

When continued drought, earthquakes, or other natural disasters lead to shortages of supplies, Metropolitan distributes a limited amount of water through its Water Supply Allocation Plan (WSAP). First developed in 2008, Metropolitan's WSAP takes a basic premise --to fairly distribute a limited amount of water supply-- and applies it through a detailed methodology to reflect a range of local conditions and needs of the region's retail water consumers. In particular, under severe drought conditions or a potential seismic event that impacts imported conveyance systems, it may be necessary and prudent to call for greater reductions in the use of limited water supplies and to reduce reliance on storage reserves. The WSAP has 10 levels of water supply allocations, each corresponding to a five percent reduction of supply. A Level 2 allocation, for example, represents a reduction of approximately 10 percent in overall water supply available to each member agency. The level of WSAP reduction implemented would correlate to the severity of the seismic event.

System Flexibility

Metropolitan develops its facilities to meet demands; however, in the course of developing a reliable system to meet demands, some flexibility has been incorporated into the system. This flexibility helps Metropolitan accommodate changes in water supply, demands, and water quality. System flexibility also helps mitigate the impacts of planned and unplanned outages. Metropolitan's system flexibility has two key components:

- Operational flexibility: the ability to respond to changes in regional supply, water quality, or member agency demands
- Delivery flexibility: the ability to maintain partial to full deliveries during planned and unplanned single-facility outages

Metropolitan has found that for planned and unplanned outages of Metropolitan facilities, system flexibility at the regional and local levels is key to minimizing the effects of these outages. Water supply reliability and water demand-driven projects increase Metropolitan's system flexibility, which in turn can also increase seismic resilience. For example, the construction of DVL and the Inland Feeder provided significantly increased water supply reliability through the potential for dramatically increased storage of imported supplies within the service area. These projects increased water supply reliability and system flexibility, and also greatly improved seismic resilience as the storage was purposely located on the coastal side of major faults that are crossed by the SWP, CRA, and Los Angeles Aqueduct (LAA). A significant amount of storage in DVL is dedicated to emergency storage. This water is not used except in emergency conditions such as following a major seismic event. Additionally, the Diemer and Jensen plants (and associated feeders) were constructed as water demand-driven projects that also significantly improved delivery flexibility and seismic resilience within Metropolitan's distribution system.

Emergency Storage

Over the past two decades, Metropolitan has developed a large regional storage portfolio that includes both dry year and emergency storage capacity (summarized in Appendix 5). Storage generally takes two forms: surface reservoirs and groundwater basin storage. In late 2011, heading into the most recent drought cycle, Metropolitan had developed over 5.5 million acre-feet of storage capacity and had successfully stored over 2.7 million acre-feet.

Additionally, Metropolitan has long discussed and executed plans to maintain a reliable supply of water in the face of any type of water supply condition, including following major seismic events that could impact imported water conveyance systems. The development of its diverse resource mix has enhanced the flexibility of Metropolitan's conveyance and distribution system. Metropolitan established criteria for determining emergency storage requirements in the October 1991 Final Environmental Impact Report for the Eastside Reservoir, which is now DVL. These criteria were again discussed in the 1996 IRP. Both of these documents were approved by Metropolitan's Board. Additionally, Metropolitan's emergency storage requirements were summarized in a 2008 Board Report entitled "Water Surplus and Drought Management Plan on water supply and demand as of October 30, 2008."

Emergency storage requirements are based on the potential of a major earthquake causing damage to one or more of the aqueducts that convey Southern California's imported supplies (SWP, CRA, and LAA) into the region. The adopted criteria assume that damage from such an event could render the aqueducts out of service for six months. As a result, Metropolitan has based its planning on a 100 percent reduction in these imported supplies for a period of six months.

Metropolitan's WSDM Plan shortage stages guide Metropolitan's management of available supplies and resources during an emergency to minimize impacts of the catastrophe. This emergency plan outlines that under catastrophic loss of water supply the following actions will be taken:

1. Interruptible water deliveries would be suspended
2. Firm supplies to member agencies would be restricted by a mandatory cutback of 25 percent from normal year retail demand levels
3. Water stored in surface reservoirs and groundwater basins under Metropolitan's program would be made available

4. Full local groundwater production, recycled water, and local surface emergency storage reserve production would be sustained
5. Metropolitan would draw on its emergency storage as well as other available storage

Under the emergency criteria, retail demands would be met through existing surface storage, local production, and storage in surface reservoirs owned and operated by Metropolitan and by DWR. The total amount of storage available for emergency needs in Metropolitan's storage facilities, including DVL, Lake Mathews, and Lake Skinner, is currently 292,100 acre-feet (February 2018). The amount of emergency storage available to Metropolitan in DWR's reservoirs, including Lake Perris, Castaic Lake, Silverwood Lake, and Pyramid Lake, is an additional 334,300 acre-feet (February 2018).

SUMMARY

Through its IRP, Metropolitan has established a fundamental goal that Southern California will have a reliable water supply system for present and future generations, even if imported water supplies are disrupted due to a major seismic event. This reliability is achieved through Metropolitan's development of local water supplies, emphasis on water conservation, and establishment of emergency storage on the coastal side of major earthquake faults that are crossed by the SWP, CRA, and LAA. These reliability actions enable Southern California to continue water deliveries during the period when imported supply aqueducts are out of service due to damage from a major seismic event. In addition, Metropolitan's planning efforts to diversify the water supply and increase overall system flexibility over time have also contributed to providing resilience against potential in-basin earthquakes.

Metropolitan will continue to evaluate its water resource planning programs in terms of how they may further enhance seismic resilience and coordinate these efforts with the Engineering and Operations functions that are described in Sections 4 and 5 of this report.

SECTION 4 ENGINEERING COMPONENT

Metropolitan manages a number of strategies and component studies that evaluate facilities and systems against earthquake hazards. Mitigation options are then developed and executed when practical. These strategies include evaluating the seismic resilience of structures; special seismic assessments that address multiple facilities and systems; and other specialized efforts that address the seismic resilience of dams and reservoirs and the mitigation of geotechnical hazards.

Seismic Resilience of Structures

The purpose of evaluating the seismic resilience of structures is to prevent seismic damage to water delivery infrastructure from probable events and to limit damage due to extreme events in order to minimize water delivery interruptions. For occupied structures, the goal is to protect life safety and critical functions. Metropolitan applies a systematic approach to evaluate older structures that were constructed in accordance with earlier codes, and where necessary, to upgrade structures with seismic deficiencies. The criteria applied to the seismic evaluations incorporate current code provisions and up-to-date industry standards. In general, structures are upgraded to maintain seismic performance levels that are comparable to the levels of a new facility. Additional details are provided in Appendix 6, "Seismic Design Frequently Asked Questions."

Over the past two decades, this effort was primarily aimed at improving the seismic resilience of above-ground facilities and structures constructed prior to 1990. For example, the original pump houses at the five CRA pumping plants were determined to be vulnerable to significant damage in a design-level earthquake. A design-level earthquake is a probable event that is defined by the Building Code as the basis for seismic design of structures. To address this vulnerability, which could have impacted deliveries from the CRA over an extended period, new buttress walls were constructed in 1996.

Construction of new buttress walls at Hinds Pumping Plant

Procedure for Seismic Evaluation of Structures

A seismic risk-reduction program identifies seismic deficiencies of structures and quantifies the associated risks through an effective evaluation process, enabling limited resources to be allocated strategically to projects that address key vulnerabilities and to maximize improvements in seismic resilience of the water delivery system.

Metropolitan's procedure for the seismic evaluation of structures includes the following steps:

1. **Preliminary evaluation of all high-risk structures**

   The preliminary evaluation of existing structures is a high-level assessment to quickly determine if a structure is seismically deficient. Typically, this evaluation involves drawing review, visual inspection, and simplified calculations. If a potential seismic deficiency is identified, the structure is categorized as seismically deficient and the preliminary evaluation is complete.

2. **Prioritization of structures with seismic deficiencies**

   Structures identified as seismically deficient are then prioritized in preparation for a detailed evaluation. Structures built after 1990 were designed and constructed in accordance with the 1988 or later versions of the Uniform Building Code (UBC), which provides reasonable assurance of withstanding a design-level earthquake without catastrophic structural failure. Therefore, structures built before the early 1990's are given priority for the detailed evaluations, with consideration of life safety and the importance of the facility in water deliveries.

3. **Detailed evaluation to develop retrofit options**

   Structures identified with at least one potential seismic deficiency via the preliminary evaluation are thoroughly assessed to confirm any deficiencies. Feasible retrofit options are developed during this step to mitigate the identified deficiencies, and more advanced procedures such as finite element modeling and comprehensive structural calculations may also be applied. The analysis methodology, its results, findings, and recommendations are then summarized in a report that includes rough order-of-magnitude construction costs.

4. **Final retrofit design to strengthen deficient structures**

   The recommendations from the detailed evaluation form the basis for requesting approval from the Board of Directors to proceed with a seismic upgrade project. A project team consisting of design engineers and a project manager considers all feasible retrofit options developed during the detailed evaluation and recommends one option for the final retrofit design. In this process, the project team considers adequacy for seismic resistance, cost, constructability, operational impacts, and environmental impacts to select the preferred option. The selected option is then developed into bidding documents that include detailed design drawings and specifications for the retrofit work.

5. **Periodic reevaluation of strengthened structures**

   The seismic design provisions in building codes are constantly evolving, which reflects lessons learned from recent earthquakes and new findings in regional seismicity. Metropolitan periodically re-evaluates its facilities to ensure that system reliability is not compromised due to newly discovered vulnerabilities. Factors that may trigger a re-evaluation of a previously upgraded structure include:

   - Substantial increase of seismic hazard level at the site
   - New discovery of site seismicity
   - New discovery of potential seismic deficiencies in the structure
   - Significant deterioration of existing materials in the structure

Progress to date

A comprehensive inventory list of Metropolitan's above-ground structures is used to track the progress of the evaluation and seismic upgrades of structures. To date, Metropolitan has completed preliminary evaluations of all 311 pre-1990 above-ground structures (see **Figure 4-1**). Upgrades of many critical structures have also been completed, including the five pumping plants along the Colorado River Aqueduct, the Jensen Administration Building, and the Lake Mathews Outlet Tower.

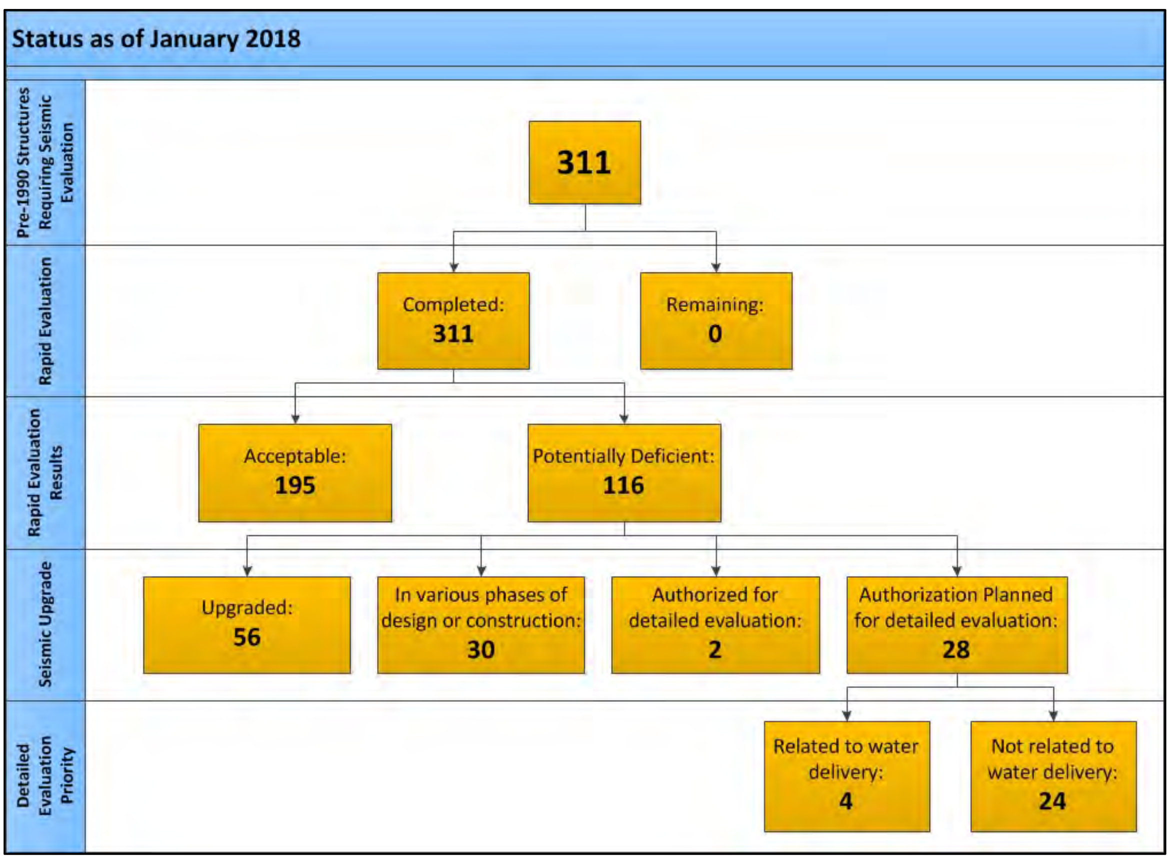


Figure 4-1: Status of Seismic Assessments and Upgrades of Pre-1990 Structures

As shown in the figure, of the 116 structures identified as potentially deficient, 56 have been upgraded and 32 are authorized for study, design or construction. The remaining 28 structures will proceed through Metropolitan's CIP evaluation process to obtain authorization for the detailed evaluations. Since 1998, Metropolitan has invested over $200M in seismic upgrades of its key structures.

Expanded Approach for Achieving Seismic Resilience of Structures

In 2017, the strategy for achieving the seismic resilience of structures was modified to further enhance the seismic resilience of the delivery system. The refined strategy moved beyond assessing only Pre-1990 above-ground structures to include the following:

- Fully and partially buried structures
- Seismic anchorage and bracing of non-structural components such as equipment, pipes, and ducts.
- Structures constructed between 1990 and 2000 (prior to the adoption of UBC1997)

For the first two items, it was recognized that fully and partially buried structures, while less vulnerable to seismic hazards than above-ground structures, are nevertheless important to maintaining system reliability. Similarly, the seismic resilience of non-structural components, such as equipment and piping, is also important for minimizing operational downtime after an earthquake.

The third item, relating to UBC1997, is included in the expanded effort since seismic design codes have been modified such that some structures designed and constructed after 1990 also warrant an assessment. Recorded ground motions in the 1994 Northridge Earthquake, for example, revealed that the design seismic force specified in building codes at the time were underestimated for sites located close to faults. This near-fault effect was incorporated into the subsequent code (UBC 1997). As a result, certain structures designed between 1990-2000 prior to the adoption of UBC 1997 may be vulnerable to a major earthquake.

Moving forward, the near-term focus is to complete the detailed evaluations and seismic retrofit projects that have been authorized to date. Long-term goals include:

- Continue assessment of seismic design criteria to incorporate updated seismic resilience strategy
- Document a systematic approach to improve seismic resilience of non-structural components
- Conduct preliminary evaluations for critical fully or partially buried structures
- Conduct preliminary evaluation of post-1990 structures.

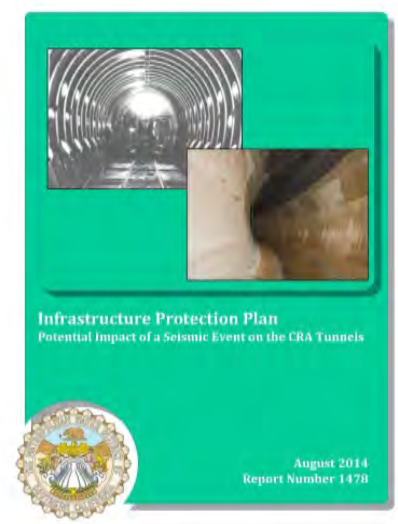
Special Seismic Assessments

Special seismic assessments are performed to complement the original seismic resilience of structures evaluations. These special assessments include seismic vulnerability evaluations, general reliability assessments, and system flexibility studies.

Seismic Vulnerability Evaluations. Seismic vulnerability evaluations identify potential impacts of credible earthquake scenarios on individual facilities and the system as a whole. For these studies, staff review current and readily available seismic hazard data from public, academic, state, and federal sources, as well as input from geotechnical consultants, to screen each facility or system (e.g., the CRA) for its level of exposure to seismic hazards (i.e., surface displacement, ground shaking, liquefaction, and landslides) during a major seismic event. Based on the potential level of exposure and the resulting damage to Metropolitan facilities, the time to restore service are estimated. These studies then evaluate the impact of the damage on Metropolitan's water delivery capability and identify areas with limited backup capability to provide water while the facility is out of service. Improvements that could reduce the loss of service, and/or reduce the time to restore service, are then identified and prioritized.

Findings from these evaluations can lead to capital improvements to strengthen facilities, improve system flexibility, and/or provide input into Metropolitan's emergency response planning to improve the seismic resilience of the distribution system.

To date, Metropolitan has completed over ten seismic vulnerability studies. A few examples are listed below, while a complete list with a brief summary of each study is included in Appendix 7.



The 2014 Potential Impact of a Seismic Event on the CRA Tunnels validated historic assumptions regarding potential outage durations for the CRA tunnels.

- *Seismic Risk Assessment of Local Water Production Facilities in the Service Area of Metropolitan Water District of Southern California,* January 14, 1991, Dames & Moore
- *Probable Maximum Loss Analysis for Metropolitan Water District of Southern California*, September 1998, EQE International
- 2009 Report No. 1335: *Effects of Southern California Seismic Events on Metropolitan Water District Deliveries*
- 2014 Report No. 1490: *Colorado River Aqueduct Seismic Vulnerability Investigations – Summary Report*
- 2017 Report No. 1533: *Seismic Risk Assessment – Conveyance and Distribution System Tunnels*

General Reliability Assessments. The vulnerability of Metropolitan's facilities to damage from major seismic events is also evaluated through general reliability assessments. The objective of these assessments is to examine the vulnerability of facilities to unplanned service interruptions from the following hazards and events:

Seismic activity	Fire
Hydraulic surge	Corrosion
Vehicle impact	Wind-blown projectiles
Equipment malfunction	Third-party construction
Erosion/Scour/Flooding	Vandalism

The assessments are based on compiling data collected from several sources and evaluating the information to identify vulnerabilities that may damage a facility and impact water deliveries. The sources of information include prior reliability studies conducted for the facility; the facility's piping and instrumentation diagrams, electrical single-line drawings and plant layout drawings; interviews with Water System Operations and Engineering Services staff; reviews of corrective maintenance reports, reviews of CIP projects; and field inspections of the facilities.

The general reliability assessments focus on the following when relating to seismic activities:

- Assessing the ability of individual equipment and piping within the facilities to withstand an earthquake
- Reviewing potential soil stability issues that might affect earthquake vulnerability with Metropolitan's geotechnical staff
- Reviewing the ability of existing critical structures (i.e., tanks, treatment basins and pump house buildings) to withstand a seismic event

After identifying potential vulnerabilities to specific hazards and events, staff categorize the vulnerabilities based on the potential service impacts and identify options to mitigate the vulnerability and improve reliability. Mitigation steps include conducting capital projects to rehabilitate, replace, or upgrade equipment and facilities; performing operation and maintenance (O&M) activities for minor equipment modifications; creating procedures for designing, operating or maintaining the facility; and refining Metropolitan's emergency response plan. These options are prioritized based on their potential impact on the operation of the facility and are considered for evaluation and action. The cost and benefit of options that involve capital projects are evaluated through the normal CIP evaluation process.

Metropolitan has completed a total of eight general reliability assessments to date, including assessments of the CRA, all five water treatment plants, the conveyance system, and portions of the distribution system. A few examples are listed below, while a complete list with a brief summary of each study is presented in Appendix 7. As the understanding of earthquake probability and seismic forces continues to increase, these studies will be periodically updated.

- 2006 Report No. 1227: *Distribution System Reliability Assessment*
- 2006 Report No. 1255: *Weymouth Water Treatment Plant Reliability Assessment*
- 2006 Report No. 1297: *Colorado River Aqueduct Reliability Assessment*

System Flexibility Studies. System flexibility studies identify:

1. The impacts of regional facility outages on water deliveries to member agencies
2. Areas with limited flexibility to serve water, which may impact deliveries during an outage
3. Options to improve system flexibility (e.g., interconnections with other agencies, local resource development, or isolation valves).

These studies postulate outages to Metropolitan and DWR facilities, assign a reasonable duration to the outage based on past experience, and then evaluate the impact of the assumed outage on water deliveries through the following steps:

1. Identify service connections affected by an outage
2. Evaluate Metropolitan options to deliver water to the affected service connections

3. Evaluate member agency backup options (e.g., wells, treatment plants, surface storage, interconnections with other agencies) to deliver water to affected service connections
4. Quantify the impact of each outage in terms of loss of retail service to affected service connections, and identify service connections and/or regions with limited or no backup capability
5. Identify options to mitigate the impact of the outage and improve system flexibility to respond to planned and unplanned outages

The results of these studies support member agencies' efforts to improve local system reliability in the event of a planned or unplanned outage of a Metropolitan facility; support joint efforts of Metropolitan and its member agencies in evaluating the reliability benefits of potential projects; and support Metropolitan's efforts to identify options to improve operational flexibility.

Two significant system flexibility studies have been completed to date:

- **System Reliability Study (2006).** This study evaluated the flexibility of Metropolitan's overall distribution system. The study examined the impact of single failures in the system to the ability to deliver water to member agencies and identified existing backup options to deliver water during the outage. Specific types of failures considered in the study included individual facility failures (e.g., the CRA, a treatment plant, a reservoir) and failures in each isolatable segment of the distribution system (e.g., pipelines). Over 250 different postulated events were considered, and the impact on delivery to each service connection was evaluated for each event. The study considered the capabilities both within Metropolitan's system as well as the member agencies' to mitigate impacts of an outage. The study did not, however, consider multiple failures that might be associated with an earthquake, due to the almost unlimited number of combinations of failures that would have to be considered. Metropolitan and member agency discussions regarding this study and local and regional obligations led to a clarification about Administrative Code 4503 "Suspension of Deliveries" that is included in Appendix 8.
- **Mills Water Supply Reliability Study (Report No. 1337).** One of the findings of the 2007 Integrated Area Study was that the supply of raw water to the Mills plant had a lesser degree of redundancy than Metropolitan's other water treatment plants. The Mills Water Supply Reliability Study was undertaken to evaluate conditions that could interrupt the normal raw water supply to the Mills plant, such as earthquakes, and develop options to improve the redundancy and flexibility of supply to the plant.

Seismic Resilience of Dams and Reservoirs

The seismic stability of Metropolitan's dams is safeguarded by a robust and proactive comprehensive dam safety strategy managed by the Safety of Dams Team. The core responsibilities of the Safety of Dams Team are to perform inspections, interpret and analyze collected surveillance and monitoring data, evaluate dam structures and appurtenant works, report the findings, and serve as Metropolitan's liaison with the California Department of Water Resources, Division of Safety of Dams (DSOD).

Metropolitan owns and operates 20 facilities that are under the jurisdiction of DSOD, as listed in Table 4-1. There are a total of 24 individual dams/reservoirs, as some of these facilities have multiple dams.

Table 4-1: Current Metropolitan Jurisdictional Dam and Reservoir Facilities

Dam/Reservoir Name	Dam Type
Cajalco Creek Detention Basin	Flood Control
Copper Basin Reservoir	Surface Water Reservoir
Diamond Valley Forebay	Hydraulic Structure
Diamond Valley Lake	Surface Water Reservoir
Diemer Mixing & Settling Basin No. 8	Hydraulic Structure
Diemer Ozone Contactor Basins	Hydraulic Structure
Diemer Treated Water Reservoir	Hydraulic Structure
Garvey Reservoir	Surface Water Reservoir
Gene Wash Reservoir	Surface Water Reservoir
Goodhart Canyon Detention Basin	Flood Control
Lake Mathews	Surface Water Reservoir
Lake Skinner	Surface Water Reservoir
Live Oak Reservoir	Surface Water Reservoir
Mills Reclamation Basin No. 14	Hydraulic Structure
Mills Treated Water Reservoir No. 1	Hydraulic Structure
Mills Treated Water Reservoir No. 2	Hydraulic Structure
Orange County Reservoir	Surface Water Reservoir
Palos Verdes Reservoir	Surface Water Reservoir
Skinner Treated Water Reservoir	Hydraulic Structure
Weymouth Treated Water Reservoir	Hydraulic Structure

Metropolitan's Comprehensive Dam Safety Management Program

Metropolitan's comprehensive dam safety strategy is comprised of six key elements:

1. Regular detailed inspections
2. Surveillance monitoring and performance reporting
3. Cyclical facility assessments
4. Emergency preparedness
5. Inundation map preparation
6. Execution of capital projects

Regular Detailed Inspections

Regular detailed inspections are essential to preserve the integrity of a dam and are necessary for early problem detection and remediation. All Metropolitan dams are regularly inspected by Metropolitan staff at specific intervals using a formal, multilayered process:

- Daily or weekly observations
- Monthly inspections of dam and reservoir facilities with the highest DSOD designated hazard classification, with at least semi-annual inspections of all other facilities
- Detailed mandatory annual inspections conducted in the presence of DSOD staff

Upon completion of the annual DSOD inspections, DSOD prepares and provides a summary inspection report that summarizes their findings and may identify recommended remedial work, which is cataloged as action items that are corrected promptly.

Surveillance Monitoring and Performance Reporting

All Metropolitan dams and reservoirs incorporate instrumentation that measures specific performance parameters such as dam or structural movement, water levels, and seepage, as well as other parameters such as shaking due to earthquakes. Collected data are retained as part of the required annual DSOD inspection report.

In terms of seismic resilience, data from surveillance monitoring and performance reporting contribute to the Cyclic Facility Assessments described below by identifying changes in specific parameters, such as dam or reservoir movement or increased seepage, that may indicate a condition that could affect the ability of the dam or reservoir to withstand an earthquake.

Cyclical Facility Assessments

Cyclic facility assessments were initiated at Metropolitan in 2004 and are generally repeated about every 10 years. These assessments use the most up-to-date data and evaluation criteria to identify potential vulnerabilities in dam embankments, dam structures, foundations, outlet facilities and spillways and develop mitigation options, if necessary. If a potential vulnerability or deficiency is identified, a rehabilitation or remediation project may be included in Metropolitan's CIP.

An example of a facility assessment that evolved into a project under Metropolitan's CIP is the Lake Mathews Outlet Tower. The outlet tower, which is critical for water deliveries to a large portion of Metropolitan's service area, was constructed in 1938 and modified in 1961 to increase its height by 30 feet. A facility assessment conducted in 1994 determined that the modified tower was vulnerable to significant damage from ground shaking. A project was authorized to evaluate and address this vulnerability, resulting in a new seismically resilient Outlet Tower being constructed in 2005.

New and Old Outlet Towers at Lake Mathews (2008)

Emergency Preparedness

Metropolitan has a comprehensive Emergency Action Plan (EAP) for each of its dam and reservoir facilities. The EAP identifies potential emergency conditions that could occur at a dam or reservoir facility and describes procedures to be implemented to minimize loss of life and property damage. EAPs serve to provide guidance to responders, local agencies, and stakeholders in evaluating potential hazards, determining the severity of the emergency, and establishing communication protocols. Required content of dam EAPs are provided in the Federal Emergency Management Agency's (FEMA) Federal Guidelines for Dam Safety, Emergency Action Planning for Dams (FEMA 64, July 2013).

Inundation Map Preparation

Inundation maps illustrate worst-case flooding that would result in the complete draining of a full reservoir. Inundation maps show lateral and longitudinal extent of flooding, flood wave arrival times, maximum flood wave depths, total flooding duration, and peak flood flow rates. Inundation maps are a required component of dam and reservoir EAPs and are used by local emergency response agencies for emergency planning purposes.

Metropolitan's current cycle of inundation mapping updates is planned to be completed by 2018 for all dam and reservoir facilities.

Execution of Capital Projects

Dam and reservoir facility vulnerabilities or deficiencies that are identified during detailed inspections or from cyclical assessments are proposed for rehabilitation or remediation through Metropolitan's CIP. Past examples of facility rehabilitation or remediation projects include the Lake Mathews Outlet Facilities, described earlier, and the Seismic Upgrade of the Diemer Finished Water Reservoir.

Currently, several dam and reservoir related capital projects are in progress, including the final design of the outlet valve replacements at Copper Basin and Gene Wash Reservoirs and the construction of the Palos Verdes Reservoir floating cover replacement and tower seismic upgrades. Planned future projects include floating cover replacements and facility upgrades for the Mills Finished Water Reservoir Nos. 1 and 2 and Garvey Reservoir.

Pipeline Seismic Resilience

Metropolitan's pipelines are exposed to a number of geohazards of varying risk, including fault zone crossings, permanent ground deformation from causes such as liquefaction or landslides, and ground shaking during seismic events. While Metropolitan's pipelines have always been constructed in conformance with standards of practice at the time of design, there haven't been code requirements to address seismic risk. In addition, until recently, there have not been mitigation options for large diameter pipelines.

The photograph on the left shows a pipe joint pullout due to liquefaction from 1995 in Kobe, Japan. (photo courtesy of D. Ballantyne, *Understanding the Seismic Vulnerability of Water Systems*, Regional Water Providers Consortium Board, October 2013)

The photograph on the right shows pipe damage at a fault crossing (photo courtesy of D. Ballantyne, *Understanding the Seismic Vulnerability of Water Systems*, Regional Water Providers Consortium Board, October 2013)

There are currently several seismic resistant pipeline options, such as earthquake resistant ductile iron pipelines with special seismic resistant joints (see **Figure 4-2**), that are becoming available in diameters suitable for use by Metropolitan.

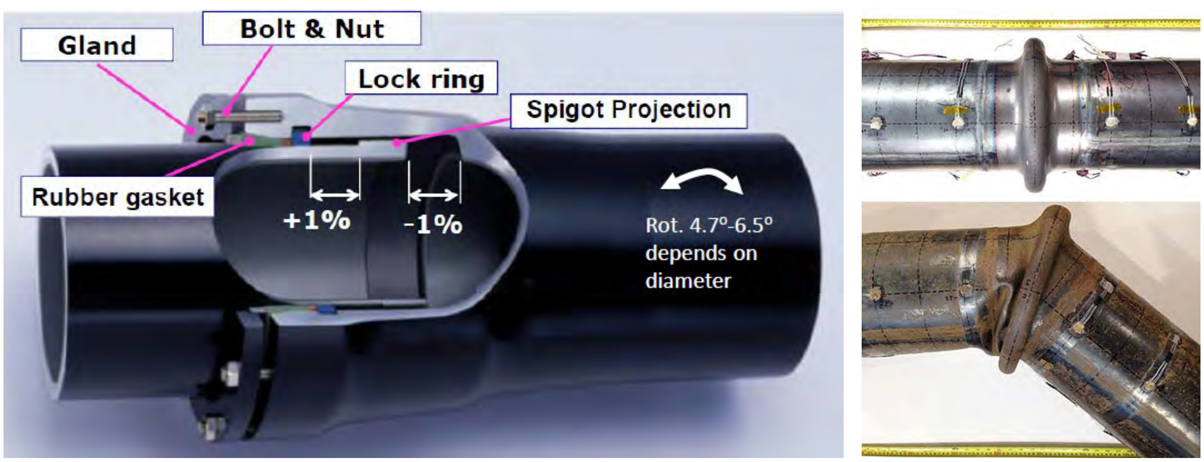


Figure 4-2: Example of Seismic Resistant Pipe (courtesy of Kubota Corp. and JFE)

As mentioned previously, Metropolitan is now formalizing a strategy to achieve significant improvements in seismic resistance of the distribution system over time. This approach takes advantage of up-to-date seismicity data, modern computer modeling techniques, recently developed seismic resistant products, extensive industry research, and updated codes.

The seismic resilience strategy for pipelines has three components:

1. Part 1 – Conducting vulnerability assessments of the existing distribution system
2. Part 2 – Identifying potential mitigation measures for existing pipelines
3. Part 3 – Establishing design and performance criteria for new pipelines and rehabilitation projects

Parts 1 and 2 are described below in more detail. Part 3 for new pipelines will be developed in conjunction with several new large-diameter pipeline projects that are planned over the next 5 to 10 years.

Part 1 –Vulnerability Assessment of Existing Pipelines: Due to the relatively good performance of large-diameter pipelines within Metropolitan's distribution system during previous earthquakes, Metropolitan is focusing on the most vulnerable existing pipelines to establish the need and priority of future mitigation work as well as integrating seismic mitigation into planned rehabilitation programs for aging pipelines. This approach is currently being followed for the PCCP Rehabilitation Program. It is anticipated that there will be relatively few cases where it would be considered cost-effective to upgrade a pipeline solely to enhance seismic resilience.

Vulnerability assessments of pipelines within the distribution system follow the same multi-step approach used for traditional risk assessments. The initial steps entail gathering available geologic, seismologic, and geodetic data, and then identifying seismic hazards along a pipeline route, such as fault zone crossings, liquefaction zones, and landslide hazards. Three simulated earthquake scenarios are considered in the evaluation: a frequent seismic event, moderate event, and a severe event. The hazard assessment provides a bounded solution that includes the expected probable and maximum probable damage for each earthquake scenario.

The resulting damage to the pipeline due to the three design seismic scenarios provides an insight into the corresponding consequences of disruption. These consequences include life-safety impacts, delivery impacts, and societal/environmental impacts.

Preliminary screening is then performed to identify the most vulnerable pipelines that warrant further analysis. Depending on the nature of the seismic hazard, Metropolitan may perform a preliminary assessment using a simplified analysis based on probable ground strain and pipeline material properties. However, in some cases, a more detailed finite element model is required to fully determine the behavior of the pipe and the surrounding support strata under seismic shaking. This comprehensive analysis includes soil-structure interaction, rupture modeling, and permanent pipeline deformation.

For any pipelines that do not meet the performance objectives, mitigation measures are considered. The order and timing of projects to mitigate risks as part of the overall rehabilitation strategy are evaluated and prioritized for inclusion in Metropolitan's CIP.

Part 2 – Mitigation Measures for Existing Pipelines: Where mitigation is recommended to minimize the consequences of service disruption, the general design goals are to design pipe segments and joints that can withstand projected vertical and horizontal movement. In most cases, a simplified analysis will provide sufficient insight into seismic performance; however, in some cases, it may be necessary to analyze the pipeline and connecting structures using a more comprehensive computer model.

Existing continuous welded steel pipe with adequate wall thickness and joint welds typically perform well under significant ground shaking. Where mitigation of existing pipelines is required to achieve acceptable seismic performance, Metropolitan may use specialized earthquake resistant joints as an option. Where these joints cannot achieve acceptable seismic performance, other options may include stiffening of the joints and pipe section; and enlarged vault sections to isolate the pipe from maximum ground deformation. Metropolitan may also evaluate alternate alignment options to relocate existing pipes, if feasible, to avoid areas of known fault crossings or expected permanent ground deformation that may result in significant disruption. Where these options are not feasible and seismic risk is not within acceptable limits, Metropolitan may consider installation of isolation valves or addition of a vault with a removable pipe spool to allow quick insertion of a bulkhead to facilitate shutdown and repair of the damaged section of pipe

Part 3 – Design Guidelines for New Pipelines: The guidelines for new pipelines will be similar in concept to existing pipelines and will be developed in conjunction with several new large-diameter pipeline projects that are planned over the next 5 to 10 years.

SECTION 5 OPERATIONS COMPONENT

Metropolitan is prepared to respond to all types of emergencies through its Emergency Management and Business Continuity Operating Policy A-06. Key elements of this policy include IT Disaster Recovery, Business Continuity and Emergency Response functions. This section focuses on the Emergency Response functions due to specific steps in this area that pertain to seismic resilience.

Emergency Response Organization

Metropolitan maintains a dedicated Emergency Operations Center (EOC) that can be activated at any time to manage Metropolitan's response to a large disaster, including seismic events. The EOC is equipped with multiple modes of communication and coordinates directly with Metropolitan's Operations Control Center (OCC) and Security Watch Center (SWC), as well as with numerous external agencies. For example, the EOC would coordinate with DWR and LADWP, as well as other related agencies, in the event of one or more aqueducts being damaged by an earthquake on the San Andreas Fault, as further explained in the next section.

Metropolitan also has Incident Command Centers (ICCs) located at various facilities. These ICCs can also be activated at any time to manage localized emergencies, and will coordinate directly with the EOC during a major disaster. Metropolitan also has Damage Assessment Teams (DATs) that that can be called upon by the ICCs to conduct investigations at incident sites. The DATs consist of engineers who can assess damage and initiate engineering responses, including recommendations for short-term repairs or work-arounds and potential designs for permanent, long-term repairs.

The Emergency Response Organization (ERO), illustrated in **Figure 5-1**, is comprised of over 200 pre-designated employees who work in the EOC, the ICCs, or in the field during emergencies. ERO staff has completed specialized training that meets State and Federal requirements.

Metropolitan's emergency response structure follows the National Incident Management System (NIMS) and the State of California's Standardized Emergency Management System (SEMS).

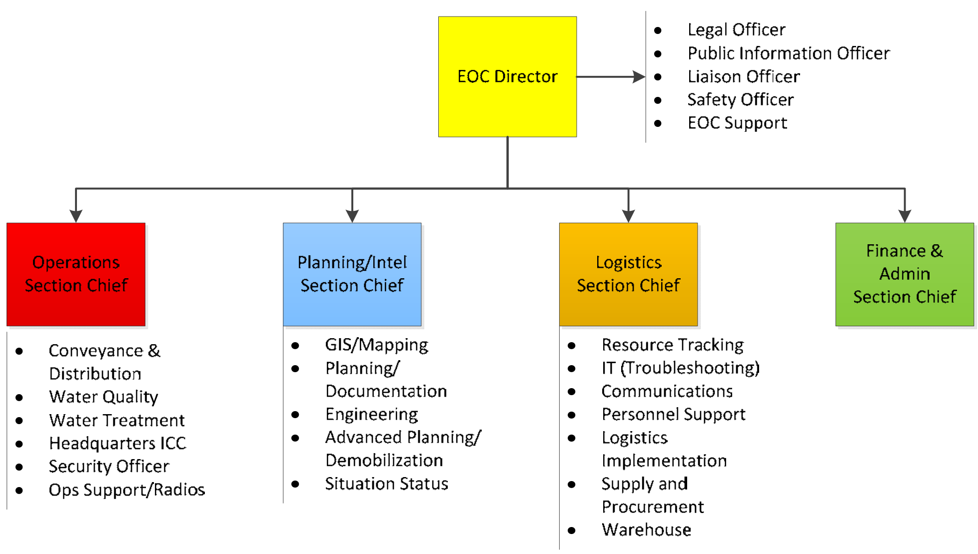


Figure 5-1: Metropolitan's Emergency Response Organization


Photographs from recent emergency exercises at the EOC

Emergency Response Training Exercises

In addition to training emergency response staff on NIMS procedures, Metropolitan regularly conducts emergency response training exercises which have often been based upon a postulated seismic event. Examples include:

- "Resilient Grid" Functional Exercise, 19 Oct 2017
- "Can you hear me now?" Full Scale Communications Exercise, 08 Apr 2017
- "Desert Shake" Functional Exercise – 04 Nov 2015 (Metropolitan and seven other agencies)
- "Oh Susana!" Functional Exercise – 05 Nov, 2013 (Metropolitan and four other agencies)
- "Golden Guardian" Functional Exercise – 20 Jun 2012
- "California Rolling" Mini Functional Exercise – 08 Oct 2008
- "Hollywood Havoc" Functional Exercise – 04 April 2007
- "Mayhem at Mathews" Tabletop Exercise – 15 Mar 2006 (Metropolitan and four other agencies)

In 2017, Metropolitan completed a five-year exercise plan that allowed all of its member agencies to participate in at least one of Metropolitan's annual emergency exercises during that period. Metropolitan also conducts approximately 50 tabletop and functional exercises each year. This includes three large-scale emergency exercises per year for the EOC and for each of the 12 ICCs. There are also monthly communication drills (includes Member Agency Response System (MARS) two-way radio, internal Metropolitan radio system, WebEOC updates, mass notification system, and satellite phones) with member agencies, ICCs, Treatment Plant Control Centers, and DWR facilities. These regular exercises, as well as monthly radio and communications tests with member agencies and other outside agencies, help Metropolitan to continually improve its readiness.

Emergency Response Construction Capabilities

Metropolitan maintains the capability to perform rapid repair of damaged facilities such as large pipelines for up to two simultaneous repairs. The machine, fabrication, coating, and valve shops at the La Verne

Shops are used extensively to support system-wide maintenance; to provide emergency services within Metropolitan, for member agencies, and for DWR; and to perform fee-for-service work that supports member agencies and the State Water Project. The fabrication shop can roll pipe on a 24-hour-per-day basis. In 2015, Metropolitan expanded the La Verne Shops to enable the fabrication of two pipe sections up to 12 feet (3.7 meters) in diameter simultaneously, and has been developing standardized pipeline repair drawings and shoring drawings to expedite repair operations.

Metropolitan also maintains stockpiles and materials on hand, and has its own construction equipment and crews ready to mobilize if necessary. Pre-selected urgent repair contractors can also provide additional construction support in case of an emergency. Maintaining these manufacturing and construction capabilities supports Metropolitan's efforts to efficiently operate and maintain its infrastructure and to quickly repair components or systems that may be damaged.

Pipe being rolled at Metropolitan's La Verne Shops

Metropolitan construction crews

42" x 30" adapter flange being drilled at Metropolitan's La Verne Shops

Stocks of steel plate allow Metropolitan to roll pipe of various diameters and wall thicknesses

SECTION 6 REPORTING COMPONENT

The reporting component of Metropolitan's seismic resilience strategy focuses on the following areas:

1. Record Keeping: Tracking progress and maintaining a record of expenditures
2. Annual Updates: Providing annual updates to Metropolitan's Board of Directors
3. Formal Reporting: Preparing a formal Seismic Resilience Biennial Report

Record Keeping

The Record Keeping component involves tracking progress on key seismic activities and maintaining a detailed record of all investments and expenditures related to seismic upgrade projects.

Key seismic resilience activities include the planning, engineering, operations, and Task Force component near-term goals identified in Section 8. Specific activities include:

- Special planning studies related to seismic resilience
- Seismic evaluations of structures, facilities, and regions
- Designs for seismically upgrading structures/systems and related construction activities
- Emergency response training exercises
- Development of new seismic performance objectives
- Joint efforts with external agencies through the Task Force

For each of these activities, progress will be tracked and reported on at regular intervals. In addition, the cumulative cost of capital investments in seismic upgrade projects will be tracked and reported on annually.

Annual Updates

Staff will update Metropolitan's Board of Directors on an annual basis. The annual update will focus on current seismic resilience issues, recent Metropolitan and Task Force accomplishments, and near-term goals.

Formal Reporting

The biennial report will summarize seismic resilience objectives, goals, and accomplishments; consolidate key reference material; and provide a high-level summary of the various activities related to seismic resilience throughout Metropolitan. Specific areas of emphasis will include:

- Knowledge Transfer: The biennial report will provide a convenient, comprehensive source for seismic resilience information. The report will contain key information for all seismic resilience efforts throughout Metropolitan, and will include a list of all formal Metropolitan reports on seismic issues. Individuals can use this information to familiarize themselves with Metropolitan's seismic resilience history, issues, and goals, which will make them more effective in supporting seismic resilience efforts.

- Accountability: Through annual reporting to the Board, seismic resilience programs will maintain a higher degree of visibility, focus and momentum on projects and studies that will help Metropolitan meet target goals.
- Transparency: The sharing of seismic resilience studies, projects, and performance objectives will benefit the facility planning efforts of member agencies. Seismic risk, mitigation, and projected duration of outages are complex issues that deserve adequate discussions between Metropolitan and member agencies to facilitate decisions and investments that best serve the public.

This summary report will be updated every two years.

SECTION 7 SEISMIC RESILIENCE WATER SUPPLY TASK FORCE

The City of Los Angeles has recently increased its focus on seismic risks and public safety. In December 2014, the city released the report, "Resilience by Design," which highlighted Los Angeles' earthquake vulnerabilities and laid out strategies to protect lives; improve the capacity of the city to respond to earthquakes; prepare the city to recover quickly from earthquakes; and protect the economy of Los Angeles and all of Southern California.

A concern noted in "Resilience by Design" is the importance of water infrastructure and the unique dependence of the region upon imported water supplies, all of which cross the San Andreas Fault. The report included a recommendation to fortify the imported water aqueducts by creating a Seismic Resilience Water Supply Task Force (Task Force) with the LADWP, Metropolitan, and DWR.

In August 2015, the three agencies formed the Task Force for the purpose of collaborating on studies and mitigation measures to improve the seismic resilience of imported water supplies to Southern California. The Task Force is comprised of managers and staff from the planning, engineering, and operations functional groups of each agency, and includes executive management on a steering committee. The Task Force also coordinates with other agencies and utilities.

The Task Force created a structure (**Figure 7-1**) that includes functional sub-teams that will focus on aqueduct assessments and mitigation, emergency response, and public relations in the near-term. The Task Force also recognized the benefit of long-term collaboration regarding 'non-aqueduct' assessments and mitigation, and agreed to discuss such issues as they arise.

The initial Task Force goals include:

- Establishing a common understanding about individual agency aqueduct seismic vulnerability assessments, projected damage scenarios, and planning assumptions
- Revisiting historical assumptions regarding potential aqueduct outages due to seismic events
- Discussing opportunities for improving the seismic resiliency of Southern California's imported water supplies through multi-agency cooperation

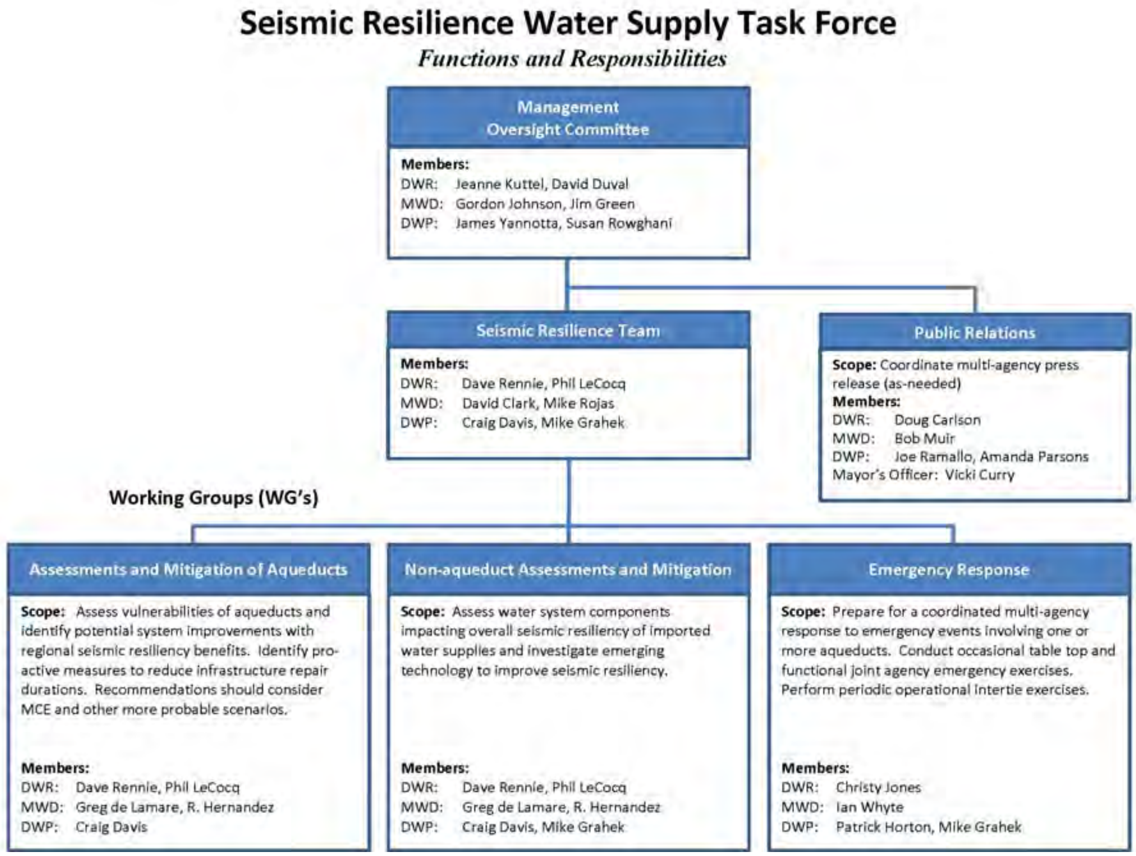


Figure 7-1: Seismic Resilience Water Supply Task Force

One of the initial activities for the Task Force was to conduct a workshop that would allow the three agencies to establish a common understanding about each agency's seismic vulnerabilities; revisit historical planning assumptions; and identify action items that would lead to increased seismic resilience moving forward. The workshop is summarized below.

2016 Aqueduct Workshop

On March 30, 2016, the Task Force held an Aqueduct Workshop at Metropolitan's Headquarters Building in Los Angeles. The purpose of this workshop was to discuss potential damage to Southern California's imported water aqueducts from a major seismic event on the San Andreas Fault. The discussion focused specifically on the Great Southern California ShakeOut Scenario (ShakeOut) of a M7.8 earthquake, developed by the U.S. Geological Survey (USGS) and many partners. The workshop format allowed for a candid exchange of information and ideas between staff from the three agencies, along with LADWP's Seismic Resilience and Sustainability Program's Expert Panel that included experts from industry and academia.

Participants were asked to consider preparations for, and response to, the ShakeOut Scenario from a regional perspective. Specifically, participants were asked, "If all aqueducts were owned and operated by a single agency, then what steps should be taken now to mitigate potential damage, and what would the priority of repairs be following a major seismic event to most rapidly restore imported water deliveries to the region?" This focus on actions that would best serve the region led to productive discussions and practical recommendations for the three agencies to improve the resilience of imported water supplies.

The assembled team concluded that for a M7.8 ShakeOut Scenario event on the southern portion of the San Andreas Fault, the recovery times would exceed historic planning assumptions:

- Restoration of full aqueduct capacities could take more than six months
- Restoration of partial aqueduct flows could take at least two months

The March 30, 2016 Task Force Workshop at Metropolitan's Headquarters Building

When considering this specific scenario from a regional perspective, the participants concluded that residents within Metropolitan's service area would be best served if the three agencies:

- Implement recently identified mitigation projects on the Colorado River Aqueduct and Los Angeles Aqueduct
- Prioritize known vulnerabilities on the Colorado River Aqueduct, Los Angeles Aqueduct, and the State Water Project
- Execute an agreement to allow for a coordinated response to emergency events
- Share resources when responding to emergency events
- Focus initial repair efforts on the State Water Project's West Branch and the Colorado River Aqueduct*

(*This is based on a ShakeOut-type event; it is recognized DWR will also have a priority to serve other customers on the East Branch)

LADWP's Seismic Resilience and Sustainability Program's Expert Panel noted the significance of the nation's largest municipal utility, largest water wholesaler, and largest state-owned water agency joining together to address a major hazard for the first time, and encouraged the Task Force to continue working together long into the future. The assembled team agreed that Southern California could become better prepared for seismic events and that the Task Force should continue to facilitate coordinated vulnerability assessments, evaluate mitigation options, and develop agreements that allow coordinated emergency responses to major seismic events. It was clear that common issues could be studied more efficiently together and there was a consensus for the Task Force to continue to maintain the momentum achieved through this workshop. Although the regional challenge of achieving a greater level of seismic resiliency is significant, the consensus was that it would be achievable through the continued, dedicated efforts of the Task Force.

Future Task Force Activities

To continue the momentum built during the collaborative workshop, the Task Force agreed to conduct conference calls every two months and to initiate a repeating 5-year cycle of planning, executing, and reporting on collaborative goals, activities and accomplishments. This approach is aimed at providing effective management of long-range actions and ensuring task force stability.

The first cycle has included preparation of a detailed report that summarized the 2016 Workshop and identified goals for the period between April 2017 and March 2022. The second cycle will report on progress achieved between 2017 and 2022, and will identify goals for the period between 2022 to 2027.

The high-level goals for 2018 to 2019 are included in Section 8 of this report.

SECTION 8 SEISMIC RESILIENCE PERFORMANCE OBJECTIVES AND NEAR-TERM GOALS

This section summarizes Metropolitan's established performance objectives for the various components of seismic resilience, along with corresponding near-term goals. The goals listed are those that are anticipated to be completed in calendar years 2018 and 2019.

Established Performance Objectives and Near-Term Goals:

- System Level
- Facility Level
- Emergency Response
- Task Force

Other Near-term Goals:

- Establish Additional Performance Objectives
- Develop a Standard Approach for Evaluating Non-Structural Elements
- Enhance Member Agency Planning Efforts
- Seek Funding for Identified Projects
- Support California WaterFix

Established Performance Objectives and Near-Term Goals

Seismic resilience performance objectives are summarized in this section along with the corresponding near-term goals.

System Level

System-level seismic resilience performance objectives and near-term goals focus on two areas: System Flexibility and Regional Supply Interruption/Emergency Storage.

System Flexibility

There are two primary components of system flexibility that contribute to seismic resilience:

1. Operational flexibility - the ability to accommodate short-term changes in regional supply, water quality, or member agency demands, and
2. Delivery flexibility - the ability to maintain deliveries to member agencies during single regional facility planned or unplanned outages.

Metropolitan will continue to develop a demand-driven, flexible regional system aimed at meeting demands, while reducing the impacts of regional infrastructure outages. Regional delivery flexibility improvements will be achieved through demand-driven projects.

System Flexibility Goal	
2019 Goal:	Conduct Rialto Pipeline Alternative Supply Needs study
This study will identify potential near-term and long-term options to meet municipal and industrial (M&I) demands supplied exclusively from the Rialto Pipeline system in the event of a disruption of supplies from the California Aqueduct, East Branch.	

Emergency Storage

Performance Objectives: Metropolitan's objectives for emergency storage include maintaining a six-month supply of water to account for interruption of imported water supplies (assuming a 25% reduction at the retail level).

Emergency Storage Goals	
2019 Goal:	Complete a re-evaluation of Metropolitan's emergency storage needs
This study will re-evaluate Metropolitan's emergency storage requirement based on updated assumptions on potential outage durations for the State Water Project and the Los Angeles Aqueduct. The latest projections for the worst case scenario are that Metropolitan's Colorado River Aqueduct can be repaired within 6 months, LADWP's Los Angeles Aqueduct within about 18 months, the West Branch of the SWP within 6-12 months and the East Branch of the SWP within 12-24 months.	
2019 Goal:	Complete a comprehensive evaluation of Metropolitan's storage programs
This comprehensive evaluation will review all existing storage programs within Metropolitan	

Facility Level

Facility-level seismic resilience performance objectives and near-term goals are categorized based on functionality of facilities: essential facilities related to water delivery; supporting facilities with permanent staff, such as administration buildings; and supporting facilities without permanent staff, such as warehouse facilities.

Essential Facilities (related to water delivery)

Performance Objectives: Performance objectives for essential facilities include maintaining operation with minimum interruption after design-level events and controlling structural damage to facilitate recovery after extreme events.

<table>
<tr><th colspan="2">Essential Facility Goals</th></tr>
<tr><td>Goal 1:</td><td>Complete construction of approved seismic upgrade projects</td></tr>
<tr><td colspan="2">• Carbon Creek Pressure Control Structure (2018)
• Ten Control Structures along the Allen McColloch Pipeline (2018)
• Diemer Administration (Control) Building (2019)
• Five CRA Pumping Plant Switch Houses (2019)</td></tr>
<tr><td>Goal 2:</td><td>Conduct studies, and complete design of approved upgrade projects</td></tr>
<tr><td colspan="2">• Define the scope and approach for assessing potential seismic-induced damage to Metropolitan’s water conveyance and distribution pipelines (2018)
- The purpose of the damage assessment is to estimate the number and severity of pipeline breaks and leaks during major earthquakes, and identify pipelines with the greatest risk for seismic damage. The results of the study will provide input into Metropolitan’s emergency response planning activities, and will help prioritize future pipeline seismic resilience enhancements.
• Design of seismic upgrade for Weymouth West Wash Water Tank (2018)
• Design of seismic upgrade for Diemer West Filter Building (2018)
• Complete evaluation of options, design, and award of construction contract to strengthen the CRA Whitewater Tunnel No. 2 (2019)
- This work will include strengthening shallow tunnel sections near the portals, improving tunnel access at the west portal, prequalifying tunnel repair contractors, stockpiling steel sets, and pre-designing tunnel repair elements.
• Investigate options to improve emergency raw water bypass capabilities at Skinner, Weymouth, Jensen and Mills Water Treatment plants (2019)
• Vulnerability study of CRA electric transmission and distribution systems (2019)
• Design of seismic upgrade for the original portion of the Water Quality Lab in La Verne and the Weymouth Administration Building (2019)</td></tr>
</table>

Supporting Facilities with Permanent Staff

Performance Objectives: Performance objectives for support facilities with permanently assigned staff include controlling structural damage to prevent casualties and severe injuries under design-level events and maintaining structural stability to prevent catastrophic collapse under extreme events.

Supporting Facilities (with permanent staff) Goals	
Goal 1:	Expedite construction of approved seismic upgrade projects
• Headquarters Building seismic upgrades (award construction contract in 2018)	
Goal 2:	Complete approved studies and seismic upgrade designs
• Seismic upgrade to Field Engineering Building at La Verne (2019)	

Supporting Facilities without Permanent Staff

Objectives: Performance objectives for support facilities without permanently assigned staff include controlling structural damage to facilitate recovery after design-level events and maintaining structural stability to prevent catastrophic collapse under extreme events.

Goals: Metropolitan's near-term goal for improving the seismic resilience of support facilities without permanently assigned staff is to continue exploring opportunities of integrating seismic upgrade work of these relatively minor structures with future capital projects at the facility. At this time, no specific goals have been identified in this area.

Emergency Response

Objectives: Metropolitan's objective is to maintain an effective emergency response organization and support facilities to ensure Metropolitan is prepared to respond to significant earthquakes. Regular training is conducted to ensure staff is prepared for actual events. Metropolitan maintains shop and construction crew capabilities to complete the repair of two simultaneous large diameter pipeline breaks within seven days. This capability is augmented by Metropolitan's ability to re-deploy its contractors and to call upon other agreements to repair four additional large diameter pipe breaks simultaneously within seven days (as well as repair other facility damages). These capabilities ensure Metropolitan is prepared to respond to significant earthquakes.

Emergency Response Goals	
Goal 1:	Prepare and conduct emergency exercises
• Conduct a joint agency workshop to prepare a draft Joint Agency Response Plan (2018) • Conduct high-level training for DWR, LADWP, and MWD staff on the Joint Agency Response Plan (2019) • Run a functional exercise on the Joint Agency Response Plan (2019)	
Goal 2:	Execute a MOU to allow for a coordinated emergency response
• Prepare draft MOU and submit for review (2018) • Secure LADWP, Metropolitan, and DWR approval for the MOU (2019)	

Task Force

Task Force Goals	
2018 Goals:	Collaborative LADWP, Metropolitan, and DWR Goals
• Discuss the applicability of lessons learned from seismic events in Japan, Chile, New Zealand, and Mexico • Compare each agency's approach to conducting seismic assessments • Meet with Southern California Edison (SCE) and Southern California Gas Co. to discuss the potential vulnerabilities of aqueduct power systems • Conduct workshop to explore potential aqueduct interties	
2019 Goals:	Collaborative LADWP, Metropolitan, and DWR Goals
• Establish a leadership structure for a coordinated response to major events • Finalize a three-agency database of available emergency response resources • Conduct a three-agency table top emergency exercise • Develop a ShakeOut Scenario Response and Restoration Plan • Conduct a second three-agency functional emergency exercise that includes energy utilities	

Other Near-Term Goals

Additional seismic resilience goals Metropolitan plans on achieving during 2018 and 2019 include:

1. **Develop a Standard Approach for Evaluating Non-Structural Elements (2019)**

   The Seismic Upgrade Program was expanded from its focus on pre-1990 above-ground structures to include post-1990 structures, partially buried structures, and non-structural components in essential facilities. The existing approach to evaluating pre-1990 structures is also applicable to the post-1990 and partially buried structures. However, a standard approach needs to be developed for evaluating the non-structural components within existing facilities, which involves equipment anchorages and bracing for piping, ducts, and cable trays.

2. **Establish Additional Performance Objectives (2019)**

   Metropolitan intends to establish seismic resilience performance objectives in the following areas:

   a) New pipelines

   b) Retrofit of existing Metropolitan pipelines, typically concurrent with rehabilitation projects

   c) New and existing tunnels

   Metropolitan is now in the process of developing a more comprehensive strategy for incorporating seismic mitigation into the design of its pipelines and tunnels. Although it is possible to clearly define performance objectives for above-ground structures, this process is more complicated for pipelines and tunnels for two reasons: 1) The performance of a pipeline or tunnel subjected to seismic forces is less well-defined than with structures, and 2) The performance needs of specific pipelines, pipeline segments, or tunnels vary widely due to Metropolitan's supply flexibility and the varied reliance on imported water by member agencies. Metropolitan will explore these issues in greater detail as it moves ahead with major capital programs, including the PCCP Rehabilitation Program. It is expected that by December 2019, Metropolitan will have established an approach for addressing seismic vulnerabilities during pipeline and tunnel rehabilitation projects, and for new pipeline and tunnel design efforts.

3. **Investigate the Potential for Developing a Model to Prioritize Pipeline Rehabilitation (2019)**

   The prioritization model will seek to optimize the sequence of pipeline repairs to achieve the greatest risk reduction for every dollar invested. The prioritization model would take into account multiple risk factors including seismic risk exposure, pipeline condition, consequence of failure in terms of damage to key facilities (e.g., hospital), difficulty of repairs, system flexibility, and cost of repairs.

4. **Enhance Member Agency Planning Efforts (2019)**

   Development of the following documents will support member agency planning efforts regarding new facilities and emergency response programs:

   a) Summary of seismic performance objectives by facility class; examples of recent seismic upgrade projects; and identification of open items

   b) Summary of projected outage durations for Metropolitan facilities under “Operational”, “Design”, and “MCE” earthquake scenarios

5. **Seek Approval for Detailed Seismic Studies (Ongoing)**

   Under the ongoing Seismic Upgrade Program, Metropolitan will assess the options for seismic upgrades to 28 structures identified as seismically deficient. These projects will be considered for inclusion in Metropolitan’s Capital Investment Plan.

6. **Support California Water Fix (Ongoing)**

   Metropolitan will continue supporting the California WaterFix to increase seismic resilience of the Bay-Delta portion of the State Water Project.

Appendix 1

Key Seismic Resilience Achievements

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Metropolitan has made significant improvements in the overall seismic resilience of its water system over the past few decades. These achievements include:

1971	Earthquake Committee formed to assess damage and recommend improvements
1976	Metropolitan's Emergency Response Plan formally adopted
1983	Member Agency Response System (MARS) established
1993	Incident Command Centers (ICCs) established at each treatment plant and a formal engineering response chart adopted for the Damage Assessment Teams (DATs)
1995	Formal Business Resumption Plan developed
1996	Seismic upgrade of CRA Pump Houses completed
1999	Construction of Diamond Valley Lake completed
2004	South slope stability improvements completed at Diemer
2005	Construction of new Lake Mathews Tower completed
2010	Jensen Administration Building seismic upgrade completed
2010	Construction of the Inland Feeder completed
2011	Seismic upgrade of Mills Electrical Buildings 1 & 2 completed
2013	Seismic upgrade of Diemer Finish Water Reservoir completed
2013	Diemer East Wash Water Tank seismic upgrade completed
2014	Seismic upgrade of Weymouth Filter Buildings 1 and 2 completed
2014	CRA seismic assessment confirmed historical assumptions for duration of worst-case outage of the CRA
2015	Seismic upgrade of Jensen Washwater Tanks 1 & 2 completed
2015	Seismic upgrade of Weymouth East Wash Water Tank completed
2015	Task Force formed to enhance seismic resilience of imported water supplies
2017	Seismic upgrade of Diemer East Filter Building completed

Note: Metropolitan has invested over $250M in seismic upgrade projects since 1998.

The California Department of Water Resources has also taken steps to improve the seismic resilience of Southern California's imported water systems, including:

1997	Construction of new Outlet Tower at Silverwood Lake completed
2018	Lake Perris Dam improvements completed

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Appendix 2

Modern Era Earthquakes over M6.3 Within or Near Metropolitan's Primary Service Area

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Southern California has experienced at least six earthquakes within or near Metropolitan's service area and with magnitudes greater than M6.3 during the past hundred years.

Date	Event Location	Fault	Magnitude
April 21, 1918	San Jacinto	San Jacinto	6.7
Mar. 10, 1933	Long Beach	Newport-Inglewood	6.4
Feb. 9, 1971	San Fernando	Sierra Madre	6.5
June 28, 1992	Landers	San Andreas	7.3
Jan. 17, 1994	Northridge	Northridge Thrust	6.7
Oct, 16, 1999	Hector Mine	Lavic Lake Fault	7.1

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Appendix 3

Provision for CRA Uplift

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MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

COLORADO RIVER AQUEDUCT

TECTONIC ALLOWANCE ORIGINAL INTENTION INVESTIGATION

1 March 2016

Purpose and Objective

Historic documents have mentioned that the designers of the Colorado River Aqueduct (CRA) incorporated "measures in their engineering designs to minimize the impacts on the flow through the CRA due to future vertical displacements across the key fault traces mapped at that time. **The measures included an additional 0.8 m (2.5 ft) of drop beyond that required by siphon losses at… three fault crossings**" (Report 1484). "In each siphon [Big Morongo and San Andreas] approximately 2.5 feet of additional grade was allowed to provide for adjustment in slope if future movement should occur" (Contract Number 149).

Figure 1 shows the location of each of the siphons in question.

Figure 1
Overview Map

The question was raised regarding the specifics of how this was accomplished. This document will describe investigation into whether this allowance was incorporated, the mechanism by which this allowance was included, summarize historical records suggesting such an allowance, and recommend field investigations which can confirm this analysis.

Observances of Tectonic Allowance

Record drawings for the Colorado River Aqueduct were explored to identify any occurrences or explanation for design Hydraulic Grade Line (HGL) at the Big Morongo Siphon, San Andreas Siphon and Casa Loma Siphon. The first observance of the allowance is found in the hydraulic profiles prepared as a part of the original record drawings of the Colorado River Aqueduct in 1935. Selected copies are included at the end of this document.

A discontinuity is observed in the HGL, dropping by a notated 2.5 feet at the beginning of the Big Morongo Siphon, San Andreas Siphon, and Casa Loma Siphon. The HGL is highlighted in red on Figure 1, with the 2.5-foot drop circled.

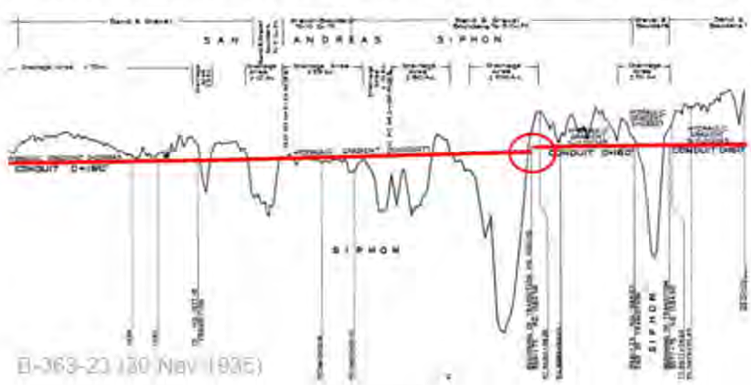

Figure 1
Original 1935 San Andreas Siphon Plan and Profile

A second observance of the allowance is found in the record drawings associated with the late 1950's construction of the second barrel for the CRA siphons (Specification Numbers 504 and 509). As before, selected copies are included at the end of this document. The plan and profiles found in the second barrel siphon record drawings show two parameters corresponding to hydraulic grade at the downstream transition structures, as follows:

- "HG. El.", assumed to be an acronym for Hydraulic Grade Elevation, and assumed to refer to the pressure head at design flow
- "WS El.", assumed to be an acronym for Water Surface Elevation, and assumed to refer to the water surface under free-surface flow conditions at design flow

In the siphon, the HGL is observed to be above the soffit of the pipeline, indicating the pipeline is designed to be under pressurized flow. Upon entering the transition structure, the HGL is below the top of the transition structure walls as free surface flow is designed for.

As shown on Figure 2, the Water Surface Elevation line in the outlet transition structure is depicted 2.5 feet below the Hydraulic Grade Elevation line, as circled in red. For other transition structures, the Hydraulic Grade Elevation line meets the Water Surface Elevation line, as shown on Figure 3 for Thousand Palms Siphon.

Figure 2
Big Morongo Siphon Second Barrel Plan and Profile

A second barrel was not constructed at Casa Loma Siphon according to the original plans, so no corresponding record drawing was identified.

Staff from the Hydraulics team confirmed via calculation that the headloss depicted by the HGL is consistent with the major and minor losses shown in the record drawings for the design flows.

A third observation of the allowance is found in the hydraulic profiles. While not called out numerically as on the previous two sources, the hydraulic profiles depict a slope offset at the Big Morongo and San Andreas Siphons of a much greater magnitude than those observed for other siphons. This is depicted in two figures on the following page.

It is understood that the design philosophy for each siphon was to size the losses across each siphon to maintain the free surface flow HGL across the siphon. This can be graphically observed in Figure 4 as shown by the red dashed line highlighting the HGL matching the canal or conduit slope upstream and downstream of the siphon.

At Big Morongo and San Andreas siphons, an offset of 2.5 feet is observed between the slope upstream of the siphon and the slope downstream of the siphon. Figure 5 highlights this in blue for Big Morongo Siphon.

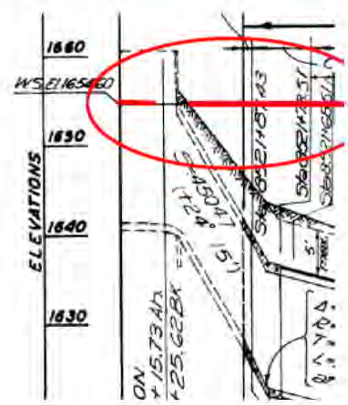

Figure 3
Thousand Palms Siphon Second Barrel Plan and Profile

CRA Tectonic Uplift Allowance 2 March 2016

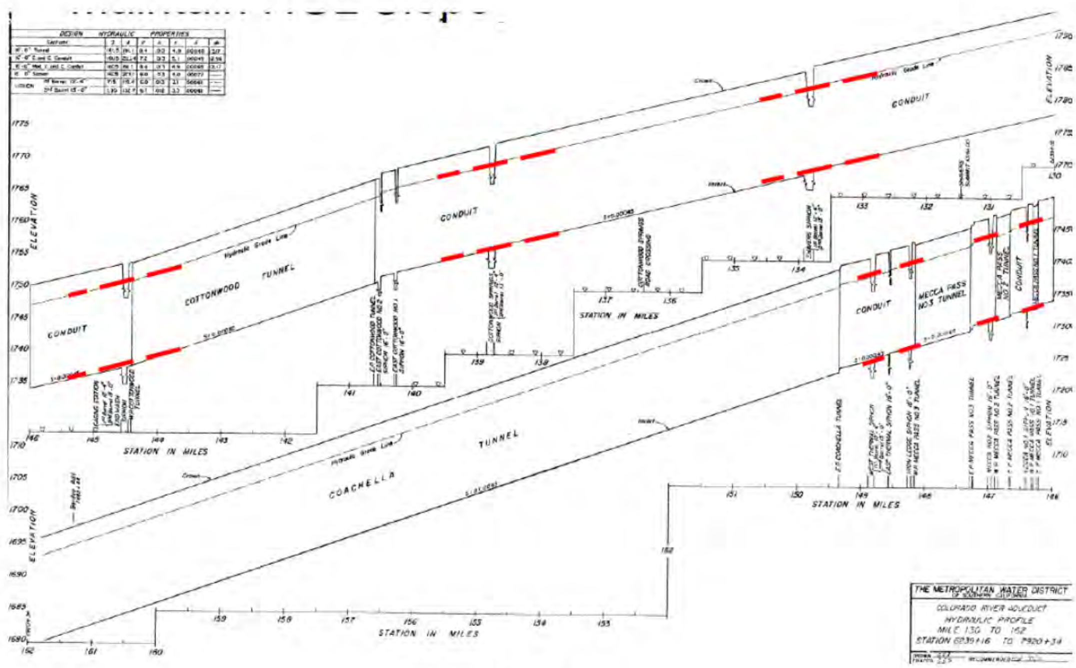

Figure 4
Siphon HGL Slope Consistent with Aqueduct Slope

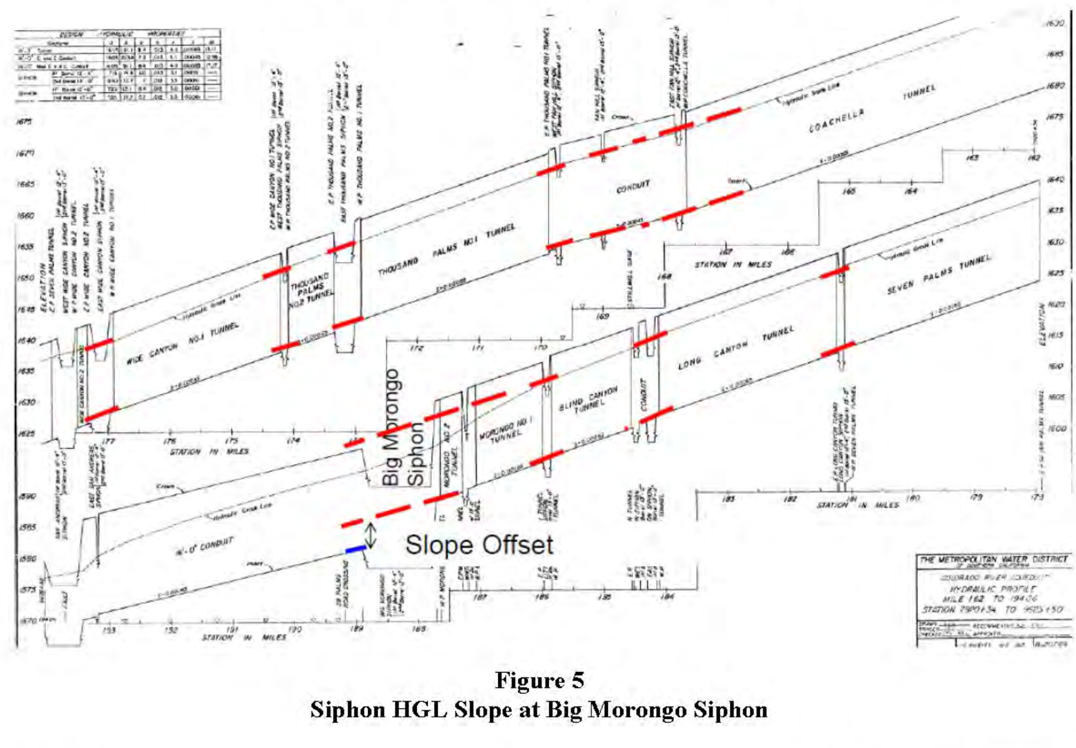

Figure 5
Siphon HGL Slope at Big Morongo Siphon

March 2016 3 CRA Tectonic Uplift Allowance

This last set of observances of the 2.5-foot allowance may provide a suggestion of the designer's thoughts on the effect of the allowance. The Hydraulic Grade Line observed on the profiles gradually drops relative to the invert elevation though the Morongo Number 1 Tunnel and the Morongo Number 2 Tunnel, and in the conduit immediately upstream of the San Andreas Siphon. While dimensions nor elevations are called out on this profile, the depth at the outlet to the Morongo Number 2 Tunnel can be measured on the drawing as 8.9 feet, and the depth at the entrance to the San Andreas Siphon can be measured on the drawing as 7.8 feet.

Previous Surveys

Based on the contract document, construction on Big Morongo Siphon and San Andreas Siphon was started on 5 Feb 1935 and concluded on 16 Sep 1936, with work activities completed by May 1936.

In February and March 1935, a construction staking survey was conducted. Included in the survey notes are an adjustment to the slopes consistent with the markups included in the contract documents (Contract 149). This timing is consistent with the start of construction.

In August 1937, after construction of the CRA, the as-built survey was conducted to set brass caps on the transition structure as permanent benchmarks. Benchmarks established include:

- a manhole at Station 9316+46
- the outlet transition structure for Big Morongo Siphon at Station 9353+15
- the outlet transition structure for East San Andreas Siphon at Station 9581+25 (referred to as "Outlet Siphon" in survey notes)
- the inlet transition structure for San Andreas Siphon at Station 9591+75
- a manhole at Station 9595+00
- the outlet transition structure for San Andreas Siphon at Station 9625+75
- the outlet transition structure for West San Andreas Siphon at Station 9651+75 (referred to as "small siphon" in survey notes)

These are recorded in Field Book 2740. No mention is made within the survey notes of any measurement of invert elevations of the pipeline or transition structure, so any inferences made to the invert elevation require the assumption that the transition structure dimensions are consistent with the planned dimensions appearing on the construction plans (19.17 feet for the Big Morongo Siphon outlet transition structure 18.96 feet for the Big Morongo Siphon inlet transition structure and both San Andreas Siphon transition structures).

In 1998, the Casa Loma Siphon first barrel was surveyed as a part of an as-built survey prepared for construction of concrete encasement between Stations 11073+45 and 11073+93 related to work on the Inland Feeder. The survey notes mention replacement of the pipeline, but do not appear to include any survey of invert elevations.

In 2008, the San Jacinto Diversion Structure, which originated as the inlet transition structure to the Casa Loma Siphon first barrel, was surveyed as a part of establishing NAVD 1988 elevations in the area. While the survey notes do not include invert elevations, they do include the weir elevation, which can be used to estimate the invert elevation based on the record drawings.

In 2014, a settlement study was conducted by Survey at San Andreas Siphon and Big Morongo Siphon to determine the difference in elevation between the inlet and outlet transition structures. The survey only measured the relative difference between the benchmarks set on the inlet and outlet transition structures of each siphon in the August 1937 survey. The difference in elevation between the inlet and outlet structure benchmarks is presented in the table below, suggesting no changes in relative ground movement in the intervening eight decades.

Table 1 1934 and 2014 Survey Comparison

Siphon	May 2014 Survey (feet)	August 1935 Survey (feet)	Difference (feet)
Big Morongo	7.90	7.90	0.00
San Andreas	6.64	6.68	-0.04

Source: Survey Field Book 2740 and Survey Note 1001-29 042

As with the previous surveys, no measurement was made of the invert elevations, so it is not possible to verify that the slope of the canal includes the 2.5-foot slope offset upstream of the siphon directly from survey measurements.

However, using the derived measurements developed as a part of IMDC (ultimately from the design drawings), the slope offset can be calculated. If the difference in elevation between the invert elevations at the inlet and outlet transition structures is 2.5 feet greater than that calculated based on the design slope for the siphon, then the survey data would confirm the tectonic allowance is included in the slope offset. Based on the notes included in the contract document and the slopes appearing on the hydraulic profiles, a slope of 0.00077 was used for design of the lengths of the CRA siphons. The table below presents the calculation, including several other siphons for comparison.

Table 2 Slope Offset Calculation

Siphon Name	Transition Structure Invert Elevation		Drop per Survey (feet)	Drop per Slope (feet)	Slope Offset (feet)
	Upstream (ft-msl '88)	Downstream (ft-msl '88)			
Cottonwood Spring Siphon	1,759.21	1,758.60	0.61	0.46	0.15
End Wash Siphon	1,740.23	1,740.12	0.11	0.45	-0.34
Iron Ledge Siphon	1,729.36	1,728.93	0.43	0.23	0.20
East Thermal Siphon	1,728.27	1,727.90	0.37	0.14	0.23
West Fan Hill Siphon	1,657.67	1,657.03	0.64	0.42	0.22
Thousand Palms Siphon	1,645.53	1,643.93	1.60	1.46	0.14
Whitehouse Canyon Siphon	1,593.82	1,593.27	0.55	0.40	0.15
Big Morongo Siphon	1,591.85	1,584.31	7.54	4.94	2.60
East San Andreas Siphon	1,574.16	1,573.69	0.47	0.27	0.20
San Andreas Siphon	1,573.22	1,566.84	6.38	2.62	3.76

Notes:
(1) Design slope of 0.00077 does not appear on most siphons on most hydraulic profiles, but was checked on the individual plan and profiles for all of the siphons listed in this table

As shown in Table 2, most of the siphons exhibit a deviation in surveyed slope from the design slope of between 0.1 and 0.2 feet. Big Morongo Siphon and San Andreas Siphon slope offsets of more than 2.5 feet each, showing that the slope across each of these siphons is greater than that required to meet the design slope for the siphon of 0.00077. It should be noted that the slope offset for San Andreas Siphon is calculated as 3.76 feet, 1.26 feet greater than the 2.5 feet suggested by the allowance. This may suggest the suggested mechanism for accomplishing the allowance is incorrect, or there may be other factors at play here.

While survey data has not explicitly measured the invert elevations at any point following the construction of these siphons, this calculation is based on the assumption that the siphon transition structures were constructed consistent with the construction plans. If the internal height of the transition structures is in doubt, survey of the invert elevations of the transition structures could be of value.

Field Observations

Given the lack of level sensors along the CRA, Water Supply Operations (WSO) staff have conducted several field investigations of depths along the CRA during periods of constant flow. These field investigations generally consist of one or two staff recording single measurements of depth at several manholes and transition structures between Hinds Pumping Plant and San Jacinto Tunnel.

Under the design flow of 1,605 cfs, the normal depth is designed as 12.96 feet in the most frequently used cut and cover conduit cross-sections, and 13.17 feet in the most frequently used tunnel sections. Figure 1 presents results from the field investigation conducted on 20 March 2013, with flow conditions near design flows.

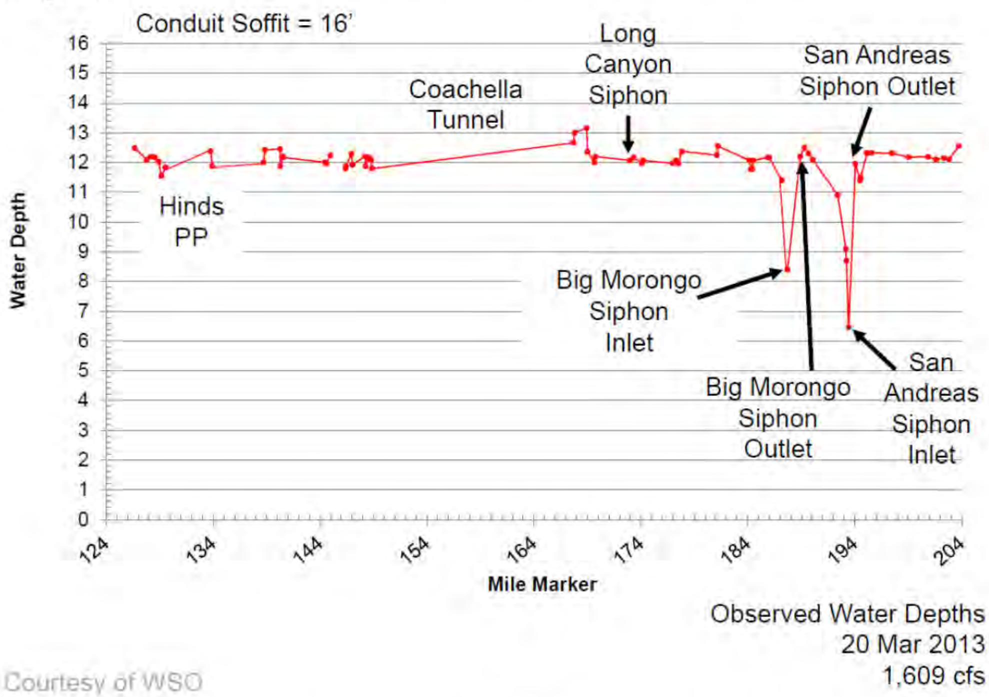

Figure 1
Observed Water Depths at Design Flow

The depth at the San Andreas Siphon and Big Morongo Siphon transition structures consistently stand out with observed water depth lower than the other siphons, dropping to less than 7 feet and less than 9 feet, respectively. These depths are fairly consistent with the depths of 7.8 feet and 8.9 feet observed in the design hydraulic profile discussed at the end of Section 0.

Mechanism

Some possible ideas that could have been incorporated include sizing the diameter of these siphons larger (reducing the headloss across the siphon) or including some type of weir structure.

It is surmised that the mechanism used for incorporating the additional head was to build the inlet transition structure 2.5 feet above the elevation at which the structure would have been constructed without the slope offset. Given that the pressurized pipeline within the siphon can change slope without impacting the hydraulics beyond minor losses, the slope of one of the stretches of pipeline could be raised to achieve a 2.5-foot elevation increase. The contract document suggests this -"The slope given in the hydraulic properties [0.00077] does not include the additional grade allowed to provide for adjustment if future earth movement should take place." (Contract 149)

An exaggerated demonstration of this mechanism is shown in Figure 1. The existing profile of the aqueduct, including the 2.5 foot allowance, is shown in black. A red line, lower at the upstream end of the siphon has been added to shown the 2.5-foot lower starting invert without the allowance. The blue line shows what the initial slope in the siphon would have been in the first pipeline segment without the allowance.

Figure 1
Surmised Design Mechanism

Further, exploring the different versions of the drawings prepared prior to construction suggests the addition of the grade as a slope change. Eight different record drawings are present in EDMS between August and December 1934 (the notice for bids was released 5 December 1934.) These partially correspond to four different construction methodologies and material choices prepared prior to the bid notice (jointed cast-in-place concrete, pre-cast concrete, above ground steel pipe, and buried steel pipe). Ultimately, jointed cast-in-place concrete was selected at the time of the bid notice. The upstream invert elevations of the transition structure in some of the drawings prepared in November 1934 have been raised by 2.5 feet from the August 1934 drawings, with differing slopes (however, each of the differing construction methodologies uses different slopes), with the height of the transition structures maintained between the different drawings. It should also be noted that the 2.5 foot allowance is observed on drawings dating back to 1933, so the allowance was likely planned for prior to 1934.

Assuming the head constraints on the design of the CRA would have been established first at the downstream end (either at the tunnels or of the elevation of Lake Mathews), this would suggest that if the allowance had not been included at each siphon, the CRA upstream of all three upstream siphons could have been designed 7.5 feet lower in elevation, with the lift at Hinds Pumping Plant reduced by 7.5 feet.

Conclusions

In review of record drawings and contract documents associated with the CRA, a tectonic allowance of 2.5 feet of HGL has been included in the design of Big Morongo Siphon, San Andreas Siphon, and the Casa Loma Siphon. Based on the above investigation into this allowance, it is believed that the mechanism for accomplishing the allowance is a slope offset in the invert elevation slope, accomplished by an increased slope in the pressurized pipeline segments within these siphons.

Based on available records, invert elevations have never been surveyed at Big Morongo Siphon, San Andreas Siphon, and the first barrel of the Casa Loma Siphon. Having invert elevation survey data will not prove the mechanism any further than currently shown on record drawings. However, if the internal height of the transition structures is in doubt, survey of the invert elevations of the transition structures could be of value.

In addition, internal inspection of the cast-in-place concrete pipeline and associated joints, as well as internal survey to determine any localized movement, may be desired for non-hydraulic reasons.

Differential survey between the inlet and outlet transition structures would likely be of little value beyond that already provided in 2014. Two additional levels of survey could be conducted—a survey of just the invert elevations of the transition structures, requiring minimal de-watering, and a survey and inspection of the entirety of the siphons, requiring full dewatering.

Estimates of effort for survey of the invert elevations in just the transition structures would be 24 staff hours plus minimal dewatering, and effort for the full siphon survey of the entire length of the two siphons would be 200 staff hours, plus staff for full dewatering.

References and List of Record Drawings

The following table lists record drawings and documents used in preparation of this analysis.

Table 3 Record Drawings and Documents Consulted

Record or ID Number	Record Drawing Type	Siphon	Revision Date
B-363-26	Plan and Profile	Big Morongo	22 Nov 1934
B-363-23	Plan and Profile	San Andreas	30 Nov 1935
B-363-12	Plan and Profile	Casa Loma Siphon	15 June 1934
B-11975	Plan and Profile	Big Morongo	30 Oct 1997
B-11979	Plan and Profile	San Andreas	1 Nov 1956
B-20749	Hydraulic Profile	Multiple, including Big Morongo and San Andreas	1 Aug 1965
B-20748	Hydraulic Profile	Multiple	1 Aug 1965
HR-149	Contract	Big Morongo and San Andreas	5 Feb 1937
FB 2740	Survey Field Book	Big Morongo and San Andreas	12 July 1938
1001 29 042	Survey Notes	Big Morongo and San Andreas	19 May 2014
2037 01 037	Survey Notes	Casa Loma Siphon Number 1	24 August 1998
2039 02 008	Survey Notes	San Jacinto Diversion Structure	5 May 2008
B-1660	Transitions & Sections	San Andreas	21 Nov 1934
B-1663	Transitions & Sections	Big Morongo	22 Nov 1934

Notes:
(1) Since the second barrel was never installed at Casa Loma Siphon, it does not have a

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Appendix 4

Summary of Damage to Metropolitan Infrastructure from Past Earthquakes

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Metropolitan experienced a significant amount of damage to its infrastructure during both the 1971 San Fernando and 1994 Northridge earthquakes. Both of these seismic events primarily impacted the Jensen Water Treatment Plant. Engineering prepared summary reports for both events. The information below represents a convenient summary of what may be found in “Report of Structural Damage to Joseph Jensen Filtration Plant, Earthquake of February 9, 1971” (Report No. 891C), “Historical Documentation of the Jensen Plant Earthquake Disaster of February 9, 1971” (Report No. 909), and “Damage and Repair Report for Joseph Jensen Filtration Plant, Northridge Earthquake of January 17, 1994 (October 1994).

1971 SAN FERNANDO EARTHQUAKE

The San Fernando earthquake struck the greater Los Angeles region in the early morning of February 9, 1971. The thrust earthquake, which had a moment magnitude between 6.5 and 6.7, caused severe damage in the northern San Fernando Valley, with extensive surface faulting to the south of the epicenter. The epicenter was approximately 6.8 miles from the Jensen Plant.

Metropolitan experienced widespread damage at the Jensen Plant. This included a severe break to a 72” Influent Conduit and damage to various structures including the Administration Building, Finished Water Reservoir, Access Tunnel, Mixing and Settling Basins, and Filters.

Following is a summary of the damage to these facilities.

INFLUENT CONDUIT

- Transverse cracks up to ½-in on concrete encasement
- Three joints in the ¼-inch thick steel cylinder separated
- Joint failed and opened up to ¾-inch at the soffit
- Fracture continued thru the top half of the joint
- Much spalling of the mortar lining about 8-inches on each side of the joint
- About 113-feet south of the 72-inch outlet, 75% of the joint failed
- Joint opened up about ¾-inch near the invert and the lining was damaged for about thirty inches each side of the joint
- Entire joint was pulled apart
- Mortar lining was damaged for about 24-inches on each side of the joint
- Considerable spalling and cracking of the lining was evident around the 72-inch outlet
- Lining suffered spalling and cracking approximately 15-feet downstream of the tunnel portal
- Several additional cracks, up to 1/16-inch wide, were observed in the lining
- Two 84-inch and 72-inch welded steel pipelines suffered only minor damage and consisted of cracking of the lining
- Minor cracking at the junction of the 72-inch pipelines and the 12-foot, 6-inch square reinforced concrete box conduit

- The 12-foot wide by 12-foot high reinforced concrete box extending northerly from the main control building had three transverse cracks in the walls and slabs located between Station 5+60 and 6+00;
- Cracks varied in width from 1/32-inch to 1/16 inch;
- 5 Transverse expansion joints in this portion of the influent conduit had separations varying from ½ -inch to 2-inches horizontally, and from ¼-inch to 1-inch vertically.

EFFLUENT CONDUIT

- Severe damage toward the southerly end;
- Differential displacement;
- Complete fracture or shearing.

MAIN CONTROL BUILDING

- Considerable horizontal and vertical displacement throughout; led to multiple non-structural damaged areas throughout building
- Building moved approximately 5-inches to the south and approximately 6-3/4-inches to the east
- There was settlement of 2-inches on the south side of the building causing a slight southeasterly tilt.

BALBOA INLET TUNNEL

- Concrete tunnel lining badly spalled and cracked at a distance approximately 100 feet near the Olive View Fault crossing;

CONNECTING CONDUITS

- Significant damage occurred at expansion joints, intersection of east-west and north-south galleries, and by punching of an embedded pipe into a wall
- Several portions of the structure between expansion joints moved as separated structures, on the three axes of movement, and also moved with twisting (torsional) action on each of the three planes
- In some cases, the joint filler and sealant was compressed and squeezed out of the joint
- Individual working of the structurally separated portions of the structure caused them to pound against each other, thereby resulting in spalling of concrete adjacent to the edges of the expansion joints
- Considerable cracking and some spalling occurred at the intersection of the east-west and north-south 25-foot wide influent conduit and pipe gallery, all were repairable
- Cracks in slabs and walls occurred at the intersection of pipe galleries Nos. 1 and 2 in the north-south influent conduit and pipe gallery, but all were repairable

- The southern end of the east-west pipe that was cast into the west wall of the north-south influent conduit pipe gallery pounded and caused the wall to shatter
- Large amount of movement took place in the overhead piping at the intersection of the east-west and north-south influent conduit pipe galleries
- Movement was in several directions, with pipe having been displaced.

MIXING AND SETTLING BASINS

- Significant damage occurred at expansion joints, and the intersection of the east-west and north-south galleries
- Several portions of the structure between expansion joints moved as separate structures on the three axes of movement
- Some cases, the joint filler and sealant was compressed and squeezed out of the joint;
- The individual working of the structurally separated portions of the structure caused them to pound against each other, thereby resulting in spalling of concrete adjacent to the edges of the expansion joint
- Cracking and some spalling occurred at the intersection of the east-west and north-south influent conduit and pipe gallery
- Cracks in slabs and walls occurred at the intersection of pipe galleries Nos. 1 and 2 in the north-south influent conduit and pipe gallery

FILTERS

- Some vertical and lateral displacement occurred between adjacent beds at some expansion joint locations
- Compressive loads forced expansion joint material out of some joints
- Minor spalling occurred adjacent to some expansion joints
- An apparent lateral thrust from the west caused the wash troughs to pull partly out of the insets
- Wash troughs acting as struts transferred the thrust to the gullet wall, which had not been completely poured, causing the wall to split at the east line of reinforcing bars
- Cracking and spalling in other filter beds occurred at the wash troughs but were minor in nature
- Minor spalling occurred where 16-inch spray header line passes through the wall filter beds
- The west end of the conduit was damaged
- Connection between the used washwater conduit and the 48-inch diameter conduit pulled apart
- Top walkway grid slab cracked diagonally across the northeast corner of filter bed
- Filter control building No. 2 separated from the walkway at the top of the filter beds expansion joint
- Separation varied from ½-inch to 1 ¼-inch at the expansion joint between Filter Control Building No. 2 and the valve and meter structure

- Valve and meter structure settled 1” lower than Filter Control Building No. 2
- Lining on north side of the return washwater line had a spalled area.

CHEMICAL BUILDING

- Severe lateral and vertical motion
- Column anchor bolts either stretched or pulled out of the footing concrete at all six columns
- Column in south wall buckled
- Column at northeast corner bowed out of line
- Diagonal bracing system in exterior walls failed
- Diagonals failed in tension or damaged in compression
- Upper concrete floors and roof were pierced by the diagonal bracing and columns
- Considerable cracking or spalling of slab concrete
- Building frame racked out of plumb, being tilted toward the east
- Metal door and window frames in north wall were racked out of square
- Several siding panels on the north wall broke loose from the framing
- Siding fasteners snapped off or pulled out
- All anchor bolts for the four chemical tanks failed by being sheared, bent or pulled out
- Tanks were not damaged by second floor slab; although marks on tank indicate that 6 to 8 inches of vertical movement took place
- Columns supporting exterior stairway were bent.

BRIDGE AND BOX CULVERT FOR RAILROAD SPUR TRACK

- Vertical crack at the juncture between the north abutment and the wing wall on the west side
- Wall and abutment became offset.

WASHWATER TANK

- Vertical movement of the tank
- Movement caused anchor bolts to either pull out or fail in tension
- Tank slammed down upon the ring wall, resulting in buckling in the upper courses of the tank skin
- Damage to stairway.

FINISHED WATER RESERVOIR

- North Wall:
  - Did not rupture but had 3 continuous horizontal cracks
  - Cracks varied in width from hairline to 1/32 inch and were spaced
  - There were many random vertical and diagonal hairline or large cracks.

- South Wall:
  - Easterly half of the south wall had several vertical and diagonal random cracks
  - Wall between column lines ‘B’ and ‘C’ was severely shattered
  - Some earth backfill entered the reservoir thru the wall and roof rupture
  - Random vertical and diagonal wall cracks occurred in the westerly half of the south wall
  - Fracturing and spalling occurred at other locations along the south wall on both the interior and exterior surfaces
  - Lateral offset at crack, particularly where it crossed the wall corbels.
- East Wall:
  - Portion of east wall, north of outlet received extensive damage
  - Bowed inward between the floor and roof slabs
  - Series of continuous horizontal cracks
  - Extensive lengths of spalls and cracks with some fractures occurred at the base of the wall
  - Large vertical crack occurred in the east wall
  - Overflow weir wall was also damaged and laterally offset at a vertical construction joint in the same area
  - East wall, south of the outlet structure, showed some offset and spalling at the floor line
  - Random and vertical cracks occurred at about mid-height
  - East wall of the finished water reservoir was severely fractured and spalled.
- West Wall:
  - Fractured and shattered above the floor slab line;
  - Horizontal displacement of the bottom of this wall occurred at the fracture;
  - Wall shattered for its full height between column 24 and 25.
- Roof
  - Failure plane occurred in the roof slab between column lines B and C
  - Extensive damage to the roof slab occurred adjacent to the drop panel connections;
  - Fracture at the drop panel line was apparent only in the north half of the reservoir
  - Continuous east-west failure occurred in line with the south edge of the roof slab drop panels
  - Roof slab south of this line had a vertical offset approximately 12 inches lower than the roof slab on the north side
  - From column line “0”, east to column line “V”, spalling was evident only at the west faces of the drop panels
  - Roof slab fractured between column lines “B” and “C”
  - Continuous east-west lines of failure occurred between column lines 3 and 4, 7 and 8, and 24 and 25. These breaks or spalls exposed the reinforcement for the full length of the reservoir roof slab.

- The width of spalling at the construction joint between column lines 24 and 25 varied between 4 feet and 6 feet. During the quake, this joint opened up, allowing for considerable quantities of gravel backfill to fall through from above.
- The roof slab was also severely spalled, shattered and offset vertically at the west edge of the drop panel line adjacent to the east wall
- Spalling also occurred at the west face of the drop panels at line “B” from column line 22, to a point midway between column lines 24 and 25.

RESERVOIR FLOOR

- While floor slab damage was general throughout the structure it was most apparent in the southeast quadrant
- Spalled strip running east-west between column 2 and 3, from a point midway between lines B and C to the east wall
- Spalled strip at the center of the structure, between lines 13 and 14. These spalled strips averaged about 2 feet wide and many of them had vertical offsets upward from the general floor level.
- There were additional spalled construction joints in the north-south direction; however, none of these were as long as the two east-west spalls previously described
- Spalling occurred at the drainage gutters for almost the entire length in both the north-south and east-west directions
- Continuous spalls occurred throughout and between various lines
- Floor cracking occurred midway between lines 14 and 15 in the east-west direction; the south exterior wall drop panels at M-1, N-1 and U-1 spalled in the east-west direction;
- Floor slab cracks located were located as follows:
  - North-south between lines Y and Z; from midway between lines 5 and 6 to a point midway between lines 17 and 18
  - North-south between lines between Z and AA, from a point midway between lines 2 and 3 to a point midway between lines 19 and 20; diagonally across the southeast corner of drop panel W-18
  - North-south between lines P and Q; from a point midway between lines 13 and 14; to column line 15
  - East-west between lines 14 and 15, from a point midway between lines D and E, to a point midway between lines E and F.

BAFFLE WALLS AND COLUMNS

- Damage to the baffle walls consisted of two principal types; cracking or fracturing of the vertical beams and dislodgement and fracturing of the corrugated asbestos cement panels, only one vertical concrete beam collapsed
- The other beams remained standing but were tilted out of plumb
- Many of the other vertical beams were fractured or cracked near the base or in the region slightly above the base
- There were a number of spalls in the cast-in-place concrete projections forming the panel slots on the sides of the circular roof columns
- A large number of the corrugated asbestos cement panels were damaged or completely destroyed. Some of them fell to the floor and were shattered, while others that remained in place were damaged less severely.
- Approximately 73 baffle walls vertical beams sustained cracks, fractures, spilling, etc.
- Damage to the reservoir roof columns varied widely, from hairline cracks to complete fractures
- The damage to any individual column appeared generally to be the same at the top as at the bottom
- The majority of columns were spalled, or otherwise damaged on the east and west sides
- There were two notable exceptions: The first row of columns south of the north wall and the first row of columns north of the south. In these two rows, major damage occurred on the north and south sides
- In all cases, damage to the circular columns appeared to be primarily due to flexure and not to vertical load
- A number of the columns, notably those in the first row east of the west wall, were visibly out of plumb
- The tops of these columns were displaced east. Damage to drop panels and column capitals were generally limited to minor spalls and some cracks, except for several bottom capitals located in the northeasterly quadrant of the reservoir that were fractured or shattered.

RESERVOIR OUTLET STRUCTURE

- Severe and extensive damage;
- Fractures throughout the entire structure.

RESERVOIR INLET STRUCTURE

- Moderate damage;
- Spalled concrete exposing reinforcement.

1994 NORTHRIDGE EARTHQUAKE

In 1994, the Northridge earthquake occurred on January 17, at 4:30 a.m. It had a duration of approximately 10–20 seconds. The blind thrust earthquake had a moment magnitude (M_w) of 6.7. The death toll was 57, with more than 8,700 injured. In addition, property damage was estimated to be between $13 and $50 billion, making it one of the costliest natural disasters in U.S. history. LADWP reported a total of 1,405 pipe repairs and that water pressure had dropped to zero in some areas. The epicenter was approximately 7.3 miles from the Jensen Plant.

Metropolitan had damage at the Jensen Plant and adjacent facilities. Following is a summary of the damage to these facilities:

MAJOR DAMAGE

- Jensen Plant Balboa Influent Conduit
  - 84-in influent pipeline severed approximately 3-in horizontally and 1-in vertically near venturi structure
- East Valley Feeder
  - Pipeline breaks occurred between Odessa and Rinaldi Streets (976+86.70) and Woodley Avenue and Rinaldi Street (957+66.50)
  - Sectionalizing valve damage caused damage to all electrical equipment
  - Street asphalt damage as result of pipe breaks/leaks
- West Valley Feeder No. 1
  - Crack at cut-off wall at Station 1219+10
  - Sectionalizing valve structure damaged, causing damage to all electrical equipment
- Main Electrical Center
- Service Connection CLWA-1T
  - Service connection structure settled and drifted laterally
  - Misalignment of valve assemblies
- Service Connection LA-25
  - Extensive damage at ten pipe joints in the 97-in diameter pipeline and 60-in diameter overflow pipeline; pipe joints spread 1/8” to 3/4”
  - Reinforced box conduit suffered a break and 2” separation; a 6-1/2” separation occurred at the joint where the double box conduit meets the discharge structure
  - Turnout structure moved 6 to 8 inches east
  - Double box conduit moved 3 inches to the east

- Service Connection LA-35T
  - Damage to valve structure and pipe bridge due to differential displacement
- Newhall Tunnel
  - Buckling of steel liner
  - Concrete construction joints opened and closed resulting in sand and water infiltration
  - Bulge on steel liner split at circumferential joint resulting in oil and water infiltration

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Appendix 5

Metropolitan Water Storage Capacity

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Over the past two decades, Metropolitan has developed a large regional storage portfolio that includes both dry year and emergency storage capacity. Storage generally takes two forms: surface reservoirs and groundwater basin storage. Heading into the most recent drought cycle, Metropolitan had developed over 5.5 million acre-feet of storage capacity and had successfully stored over 2.7 million acre-feet. This is a more than 13 times the storage capacity compared to the 1980s, with record quantities of water in reserve. This increase in storage capacity is shown in Figure 5-1.

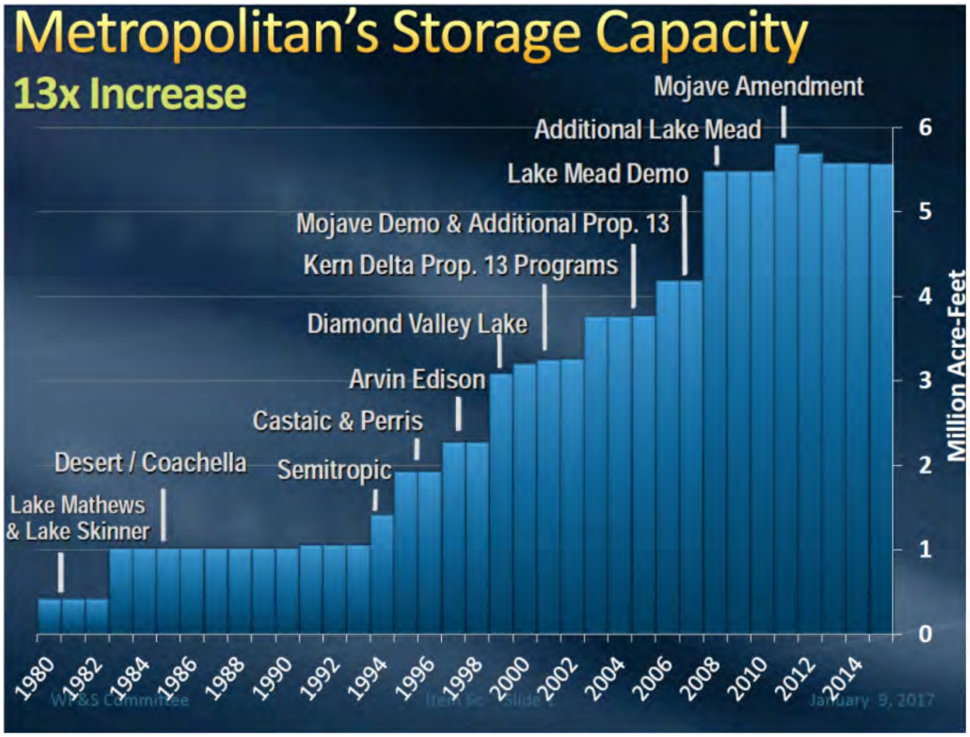

Figure 5-1. Summary of Metropolitan's Storage Capacity Over Time

Some examples of storage resources that have been developed since 1990 include:

- Surface Water Reservoirs:
  - Diamond Valley Lake (810,000 acre-feet)
  - SWP Article 56 Carryover Storage (up to 200,000 acre-feet)
  - Flexible Storage in Castaic Lake and Lake Perris (219,000 acre-feet)
  - Intentionally Created Surplus in Lake Mead (1.5 million acre-feet)
- Groundwater Storage:
  - Member Agency Conjunctive Use Programs (210,000 acre-feet)
  - Semitropic Storage Program (350,000 acre-feet)
  - Arvin-Edison Storage Program (350,000 acre-feet)
  - San Bernardino Municipal Water District Storage Program (50,000 acre-feet)
  - Kern Delta Water District Storage Program (250,000 acre-feet)
  - Mojave Storage Program (390,000 acre-feet)

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Appendix 6

Seismic Design Frequently Asked Questions

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Seismic Design FAQs

September 2017

What are the effects of earthquakes?

- Ground shaking
- Ground rupture
- Liquefaction
- Landslides and avalanches
- Tsunamis

What causes earthquakes?

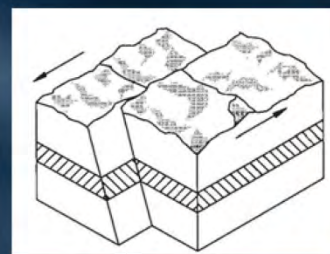
- Slips or rupture of faults
- Movements of tectonic plates
- Volcanic or magmatic activity
- Sudden changes in earth's crust

What is a fault?

- Faults are fractures or discontinuities in large masses of rock, where the rocks on either side have undergone relative displacement
- Faults are planar surfaces, not lines
- Faults can be vertical, horizontal, or at some angle in between
- Faults can be divided into three basic types
  - Strike-slip
  - Thrust
  - Normal
- Strike-slip and thrust most common in So. Cal.

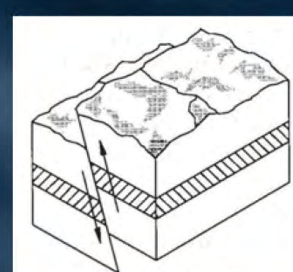
Strike-Slip Faults

- Faults are primarily vertical or near-vertical
- Movement occurs primarily laterally - one side slides by the other
- Primary examples are the San Andreas and San Jacinto Faults

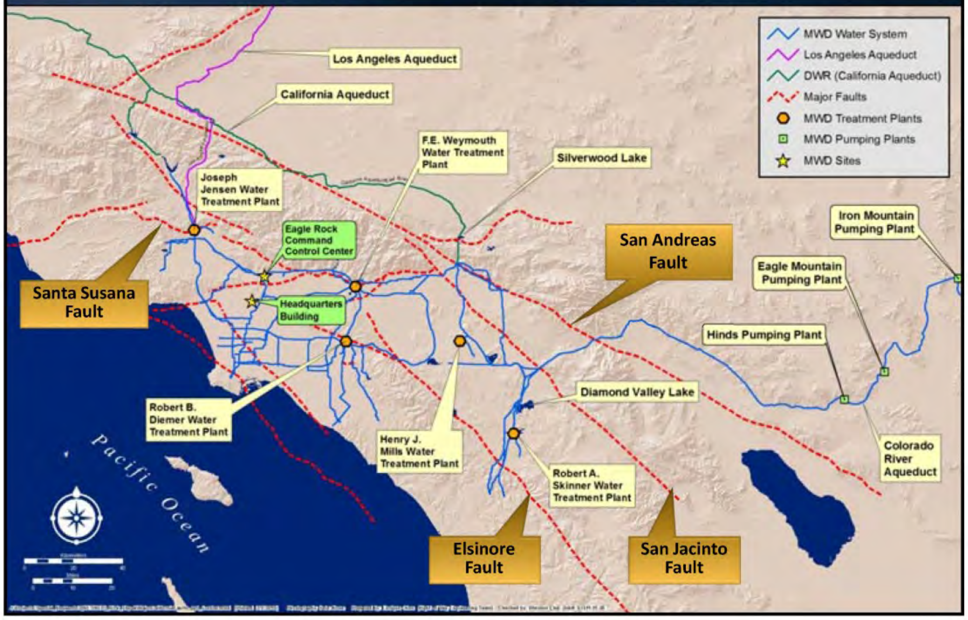


Thrust Faults

- Faults occur at an angle to the surface
- Movement occurs primarily vertically - one side slides up over the other
- Primary examples are the Santa Susana and Bunker Hill Faults



Major Earthquake Faults in So. Cal.



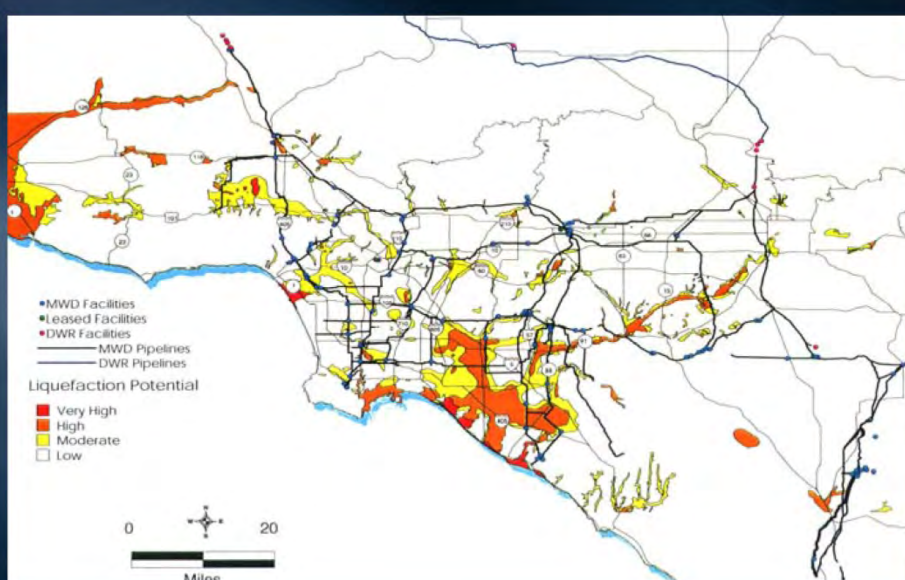
San Andreas Fault

- Fault with the highest probability of generating a major earthquake in So. Cal.
- Potential impact on MWD operation
  - CRA
  - Hinds and Eagle Mountain Pumping Plants
  - Rialto and Inland Feeders
  - East Branch of State Water Project
  - DWR's Santa Ana Pipeline

Liquefaction

- What is liquefaction?
  - A process by which water-saturated soils temporarily lose strength and act like liquid
- Factors needed for liquefaction
  - Loose or low density sandy soils
  - Shallow ground water
  - Strong ground shaking

Liquefaction Susceptible Zones in So. Cal.



How to measure earthquakes?

- Earthquake Magnitude
  - Describes size of earthquake
  - Unique value for each earthquake
  - Quantitative value based upon amount of released energy
- Earthquake Intensity
  - Describes effect of earthquake
  - Multiple number of values for every earthquake
  - Qualitative description or quantitative measurement of ground or structural response to earthquake

Definitions

- Maximum Credible Earthquake
  - Largest earthquake that is physically capable of occurring on a fault
- Peak Ground Acceleration (PGA)
  - Maximum acceleration measured at ground surface during the course of earthquake motion
- %g
  - Acceleration expressed as a percentage of the force of gravity
- Maximum Considered Earthquake Ground Motion
  - Smaller of the probabilistic ground motion (2% probability of exceedance in 50 years), and the deterministic ground motion (Maximum Credible Earthquake occurring on the controlling fault)

Earthquake Magnitude

- One unique value for each earthquake depending upon amount of energy released
- Earlier version – Richter or Local Magnitude
- Current version – Moment Magnitude
- Logarithmic-based measurement scale
- A magnitude 6 earthquake releases 32 times more energy than a magnitude 5 and 1,024 times more energy than a magnitude 4 earthquake (based on Moment Magnitude)
- Reported to the nearest 0.1, e.g., M7.1

What affects earthquake magnitude?

- Fault rupture length - Longer rupture length releases more energy
- Length of fault – Longer faults have the potential to release more energy than shorter faults
- San Andreas is longest fault in So. Cal. and has the largest potential to generate a Magnitude 8+ earthquake.

Earthquake Intensity

- Multiple values for each earthquake depending on location relative to earthquake epicenter
- Described qualitatively using a system such as the Modified Mercalli Scale (roman numerals between I: not felt and XII: total damage) based upon visual perception of earthquake severity in terms of effects on humans and structures
- Reported quantitatively using seismographs to measure ground motion

What affects earthquake intensity?

- Magnitude of earthquake - increased magnitudes tend to increase intensity
- Distance from earthquake – increased distance from an earthquake tends to lessen intensity
- Fault type – thrust faults tend to increase intensity of vertical ground motions
- Site soil conditions – rock sites tend to lessen intensity compared to soil sites
- All factors interact to yield unique site-specific intensity

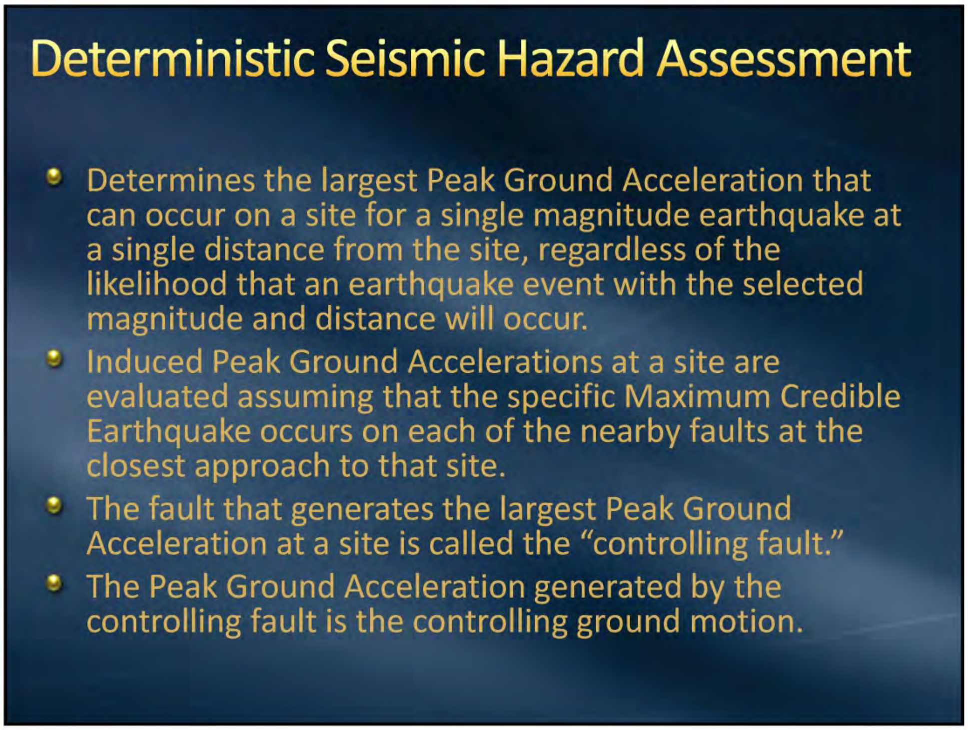
Comparison of Magnitude Scale and Intensity Scale

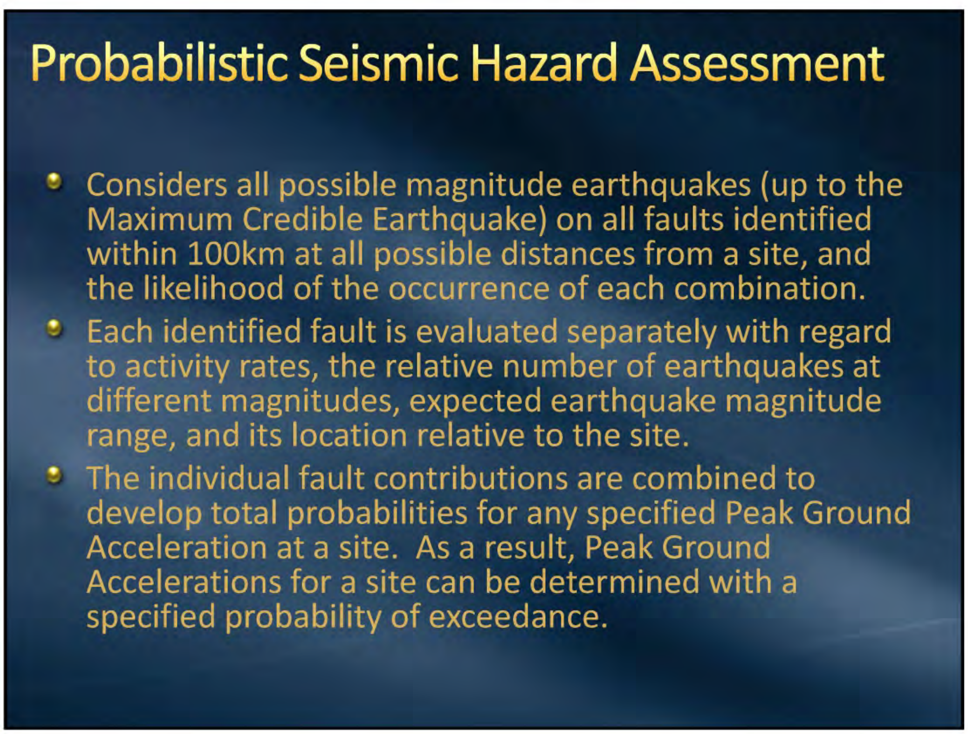
Richter Scale	Modified Mercalli Intensity Scale	Perception of Earthquake Intensity*
2	I-II	Detected only by instruments
3	III	Felt indoors
4	IV-V	Felt by most people; slight damage
5	VI-VII	Felt by all; damage minor to moderate
6	VII-VIII	Everyone runs outdoors; damage moderate to major
7	IX-X	Major damage
8+	X-XII	Major to total damage

***Measured at epicenter**

How are earthquake magnitude and intensity used in design?

- Earthquake magnitudes are not specifically used in design
- Designs are based upon resisting predicted earthquake intensities (quantified by peak ground accelerations stated to nearest 0.01 or %g)
- Earthquake magnitudes and several other factors are used to estimate earthquake intensities for design


Deterministic Seismic Hazard Assessment
Determines the largest Peak Ground Acceleration that can occur on a site for a single magnitude earthquake at a single distance from the site, regardless of the likelihood that an earthquake event with the selected magnitude and distance will occur.
Induced Peak Ground Accelerations at a site are evaluated assuming that the specific Maximum Credible Earthquake occurs on each of the nearby faults at the closest approach to that site.
The fault that generates the largest Peak Ground Acceleration at a site is called the "controlling fault."
The Peak Ground Acceleration generated by the controlling fault is the controlling ground motion.


Probabilistic Seismic Hazard Assessment
Considers all possible magnitude earthquakes (up to the Maximum Credible Earthquake) on all faults identified within 100km at all possible distances from a site, and the likelihood of the occurrence of each combination.
Each identified fault is evaluated separately with regard to activity rates, the relative number of earthquakes at different magnitudes, expected earthquake magnitude range, and its location relative to the site.
The individual fault contributions are combined to develop total probabilities for any specified Peak Ground Acceleration at a site. As a result, Peak Ground Accelerations for a site can be determined with a specified probability of exceedance.

Current Building Code Seismic Design Requirements

- Maximum Considered Earthquake (MCE) Ground Motion
  - Probabilistic: Ground motion with 2% probability of exceedance in 50 years
  - Deterministic: Ground motion generated by Maximum Credible Earthquake occurring on the controlling fault(s)
  - Smaller ground motion determined by these two methods governs design
  - Deterministic approach usually governs in So. Cal.
- A Regular Facility is designed for 2/3 of MCE Ground Motion to achieve Life Safety performance
- An Essential Facility is design for a higher performance
  - Building codes establish the minimum seismic design criteria, and building owners can choose to design for a higher performance
- Building codes do not apply to facilities under Cal. Division of Safety of Dams (DSOD) jurisdiction

Examples of Regular and Essential Facilities

Facilities	Description	Examples
Regular	Normal occupancy	•Commercial buildings •Residential buildings •Manufacturing facilities
Essential	High occupancy/Special occupancy	•Schools •Hospitals •Jails, detention facilities •Public utility facilities •Hazardous material storage facilities • Fire and police stations • Emergency shelters • Aviation facilities

Based on IBC 2009, ASCE 7-05

Examples of Design Peak Ground Acceleration in Recent Codes

Codes	Year in Effect in Cal.	Design Peak Ground Acceleration (PGA)+		
		Weymouth	USHQ	Skinner
UBC 1994	1995	0.4g	0.4g	0.4g
1994 Northridge Earthquake - Resulted in codification of the near-source effect*				
UBC 1997	1998	0.52g	0.4g	0.4g
Seismic hazard map updated to reflect the adoption of Maximum Considered Earthquake Ground Motion as the basis of structural design				
IBC 2009	2010	0.71g	0.59g	0.4g

+The listed PGA values are based on generic seismic hazard maps included in the codes. A site-specific analysis may result in different values.
*Other factors such as frequency contents and shaking duration will result in adverse effect on structures that cannot be captured by PGA along. The effect is more pronounced when the site is close to earthquake epicenter, and accounted for by amplifying PGA.

How to define seismic performance of structures?

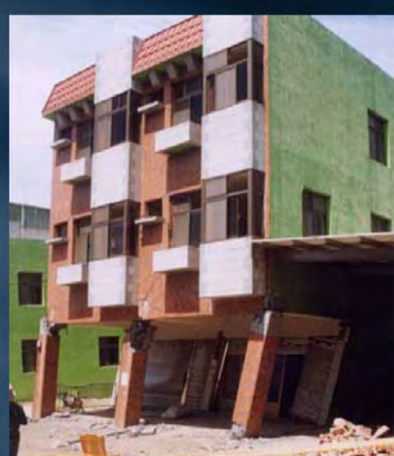
Structural Performance Level*	Expected Performance	Post-Earthquake Assessment
Immediate Occupancy	• Limited structural damage • Safe to occupy immediately after earthquake with minor repair	Green
Life Safety	• Significant structural damage; no imminent risk of collapse • Occupants would safely evacuate from the building • Not safe to occupy w/o major repair. Repair may be economically impractical.	Yellow or Red
Collapse Prevention	• Extensive structural damage and on verge of partial or total collapse • Building is likely damaged beyond repair both technically and economically	Red

*As defined in ASCE 41-06 Seismic Rehabilitation of Existing Buildings

Example of life safety performance

1999 Chi-Chi (Taiwan) Earthquake

Example of collapse prevention performance



1999 Chi-Chi (Taiwan) Earthquake

What's the expected seismic performance of a structure meeting current code requirements?

- Regular Facilities
  - The objective is to allow safe evacuation of occupants (Life Safety), instead of focusing on prevention of structural damage
- Essential Facilities
  - The objective is to allow continuous operation of the building (Immediate Occupancy) with limited structural damage
- The expected performances are for the design earthquake (2/3 of MCE Ground Motion)

Does the building code require existing structures to be upgraded to the current code requirements?

- No, but there are a few exceptions
- Exceptions
  - Type of structural system known to have significant inherent deficiencies: unreinforced masonry or block wall structures
  - Structures required for post-earthquake disaster response: hospitals and emergency response centers
  - Extensive addition/alternation
- Owners can reduce seismic risk with voluntary upgrades

What's the acceptable seismic performance level for an existing structure, as it may not meet the current code requirements?

- Depending on post-earthquake functions of the building, the owner may choose the desired performance level
  - Immediate Occupancy
  - Life Safety
  - Collapse Prevention
- Non-building structures (reservoirs, tanks…) are designed based on consensus standards and guidelines (e.g. ASCE, ASME, AWWA…)
  - Operational
  - Prevention of uncontrolled release of contents

What seismic performance are specified in MWD's seismic design criteria?

Building Type Structures				
Importance Designation	**Essential Facilities**		**Regular Facilities**	
	New	**Existing**	**New**	**Existing**
Building Code and Industry Standards	CBC ASCE 7	CBC ASCE 41	CBC ASCE 7	CBC ASCE 41
Design Intent Per Code/ Standard Language	Provide a larger margin against collapse in MCE and remain operational in Design Earthquake (2/3 MCE)	Enhanced performance against life safety in Design Earthquake	Collapse prevention in MCE and prevent life threatening damage in Design Earthquake	To achieve life safety in Design Earthquake
Metropolitan Seismic Design Objective	To remain operational following a major seismic event	Intended to maintain occupancy immediately following a major seismic event	May experience significant damage, but would prevent life threatening injury or casualty following a major seismic event	May experience significant damage, but would prevent life threatening injury or casualty following a major seismic event

What seismic performance are specified in MWD's seismic design criteria? (Cont.)

Water Containing Structures				
Importance Designation	Essential Facilities (Related to Water Delivery)		Regular Facilities (Not Related to Water Delivery)	
	New	Existing	New	Existing
Building Code and Industry Standards	CBC ASCE 7 ACI350 AWWA D100 API 650	CBC ASCE 41 ACI350 AWWA D100 API 650	CBC ASCE 7 ACI350 AWWA D100 API 650	CBC ASCE 41 ACI350 AWWA D100 API 650
Design Intent Per Code/ Standard Language	Provide a larger margin against failure in MCE and require a higher level of liquid tightness to maintain serviceability in Design Earthquake (2/3 MCE)	Not differentiated.	Prevent catastrophic failure in MCE and prevent uncontrolled release of liquid in Design Earthquake	Not differentiated.
Metropolitan Seismic Design Objective	To remain operational following a major seismic event	To remain operational or can be restored quickly following a major seismic event	May experience significant leak and require dewatering to repair, but would prevent uncontrolled release of liquid following a major seismic event	May experience significant leak and require dewatering to repair, but would prevent uncontrolled release of liquid following a major seismic event

Appendix 7

Summary of Previous Metropolitan Seismically Induced Damage Studies

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The impact of earthquakes on Southern California and on Metropolitan's system has been the subject of several previous internal and external assessments:

Seismic Risk Assessment of Local Water Production Facilities in the Service Area of Metropolitan Water District of Southern California, **January 14, 1991, Dames & Moore.** This is a comprehensive report on the effects of a major earthquake on the Southern San Andreas Fault. The report has various models for estimating damage and concludes that there could be hundreds of local water pipelines damaged, loss of power, etc. Metropolitan feeders that are vulnerable to damage were identified, and the report estimates that Metropolitan service will be lost for 6 months or less. The report also predicts significant damage to ground water wells.

***Probable Maximum Loss Analysis for Metropolitan Water District of Southern California*. September 1998, EQE International.** This report was prepared to assess the potential monetary loss associated with several earthquake scenarios. This report highlighted the potential for widespread damage resulting from an earthquake. The study did not address the impact on deliveries or system recovery.

Assessment of Frequency of Recovery Plan and Extreme Events within the Metropolitan Water District Service Area, **December 2001, Geomatrix Consultants.** This report was prepared to aid in the evaluation of hazards under the System Reliability Plan (see next report). This report evaluated the probability of earthquakes of two levels of severity within Metropolitan's service area. The first was a moderate (strong) earthquake similar to the Northridge earthquake (M6.7) and the second was an extreme event, on the order of M7.5. The report provided information on the probability of these earthquakes both within each of Metropolitan's operating regions and within the service area as a whole. The scope of the report did not include evaluating the impact on service or time for recovery.

Distribution System Reliability Assessment, (Report No. 1227), **December 2006, Metropolitan Facility Planning staff.** This report evaluated the reliability of the distribution system. In addition, a separate section of the report dealt with the vulnerability of Metropolitan's facilities to various initiating events. The report addressed the probability of failures in the system due to various random causes including earthquakes. It utilized information from the Geomatrix study to estimate the probability of seismically induced failures. Estimates for the recovery time from the various events were provided.

Facility Reliability Assessments, **2006, Metropolitan Facility Planning staff.** Reliability assessments were conducted by Metropolitan of the five treatment plants and the Colorado River Aqueduct. These assessments evaluated the susceptibility of individual facilities to a series of hazards such as fire, flooding, and earthquakes. Earthquakes were identified as one of the highest risk hazards because of the potential to cause numerous simultaneous failures. The reliability assessments identified structures that had not been updated to the latest seismic criteria. As part of the Seismic Upgrade Program, these structures have been evaluated. Where necessary, capital projects were initiated to upgrade the facilities to the most recent building codes. Completed Facility Reliability Assessments are listed below:

- *Diemer Water Treatment Plant Reliability Assessment, (Report No. 1225),* 2006
- *Skinner Water Treatment Plant Reliability Assessment, (Report No. 1246),* 2006
- *Weymouth Water Treatment Plant Reliability Assessment, (Report No. 1255),* 2006

- *Mills Water Treatment Plant Reliability Assessment, Report No. 1269,* 2006
- *Jensen Water Treatment Plant Reliability Assessment, Report No. 1280,* 2006
- *Colorado River Aqueduct Reliability Assessment, Report No. 1297,* 2006

***System Reliability Study,* 2007, Metropolitan Facility Planning staff.** This study evaluated the reliability of the entire system. This study examined the impact of single failures within the system on the ability to deliver water to member agencies and identified existing backup options. The failures considered included individual facilities as a unit (e.g., a treatment plant or a reservoir). For pipelines, the study considered a failure in each isolatable segment of the line. The impact on deliveries to each service connection was identified and over 250 different events were studied. The study considered capabilities within Metropolitan's system, as well as the member agencies', to mitigate the failures. This study did not consider multiple failures that might be associated with an earthquake due to the almost unlimited number of combinations of failures that would have to be considered.

Golden Guardian 2008. In November 2008, under the auspices of the USGS, Caltech and Earthquake Research Associates, a major disaster drill was conducted in Southern California. The drill was based on a magnitude 7.8 earthquake on the San Andreas Fault (Golden Guardian Exercise). The preliminary studies conducted as part of the exercise indicated that major damage is expected. The impact on water systems was one of the areas of focus for the drill and the related studies. The studies concluded that in areas impacted heavily, water service could be lost for six months.

***Potential Effects of Southern California Seismic Events on Metropolitan Water Deliveries (Report No. 1335)*, January 2009, Metropolitan Facility Planning staff.** This report provided a perspective on the magnitude of damage that could result from moderate and extreme earthquakes, the corresponding potential impacts on Metropolitan water deliveries, and estimated time frames for restoring service. The report also offered recommendations for reducing the potential impacts of certain significant seismic events.

***Mills Water Supply Reliability Study (Report No. 1337),* Metropolitan Facility Planning staff.** The Mills study was prepared in response to findings of the Integrated Area Study, which identified risks to the raw water supply to the Mills plant. The study evaluated alternatives to improve the reliability and redundancy of the raw water supply to Mills. A capital project has been initiated to implement one of the options.

***Potential Impact of a Seismic Event on the CRA Tunnels (Report No.* 1478), August 2014, Metropolitan Facility Planning staff.** This is the first report of a comprehensive study of the seismic vulnerability of the CRA. Five companion reports (Metropolitan Report Numbers 1470, 1484, 1485, 1490 1558) are described below. This study evaluated the vulnerability of CRA tunnels to damage from a major seismic event, provided a perspective of the level, extent and type of seismic damage that could be imposed on CRA tunnels, and estimated the time frame to restore service. The results of the study showed that most of the CRA tunnels are expected to perform well following a large seismic event. Of all the CRA tunnels, only the area near the west portal of the San Jacinto tunnel would be subject to liquefaction, but this area would be easily accessible. The area above the west portal of the San Jacinto tunnel could also be subject to seismically induced landslides, but a project was completed in 1998 to mitigate the potential damage from a landslide at the portal. For the remainder of the tunnels, the potential to experience heavy damage from landslide or rockfalls is negligible. Despite traversing a highly seismic area, there are only three instances of the CRA tunnels crossing a known active fault: Whitewater Tunnel No. 2, Thousand Palms Tunnel No. 2, and Wide Canyon Tunnel No. 2. Of these three tunnels, Whitewater Tunnel No. 2 would likely experience the most significant displacement from a fault rupture.

For ground shaking, while a number of the tunnels could experience high levels of shaking based on estimated Peak Ground Acceleration (PGA), most of these tunnels are deep and constructed in hard rock, which is beneficial for their performance during an earthquake. However, approximately 4.2 miles of tunnel were identified as having a high potential of experiencing heavy damage from the Maximum Considered Earthquake (MCE). These are areas that have shallow cover (e.g. near portals) and experience high PGA values. It should be noted that the entire 4.2 miles would not be expected to be damaged from a single earthquake, but rather there would be isolated areas of damage with those identified tunnel sections. A CIP has been submitted to further investigate the vulnerability of these tunnel sections and to identify options to mitigate the risk.

The Whitewater Tunnel No. 2 was identified as having the greatest cumulative seismic risk. The tunnel is crossed by the Garnett Hills segment of the San Andreas Fault which, from the San Gorgonio Pass Seismic Event Vulnerability Study (Report No. 1484; 2014), could experience up to a 12 foot horizontal and 3 foot vertical offset from a rupture of the San Andreas Fault approximating the MCE. The tunnel could also experience very high levels of shaking from the MCE, and was constructed in compacted sands and gravels, which could negatively impact the performance against the shaking.

For the purpose of estimating repair times, a worst-case damage scenario was developed for the Whitewater Tunnel No. 2, and a tunnel repair workshop was conducted to get a realistic understanding of repair methods and repair times (reference Report No. 1485).

***Colorado River Aqueduct – San Gorgonio Pass Seismic Event Vulnerability Study (Report No. 1484),* July 2014, GeoPentech.** This study evaluated the potential for horizontal and vertical deformation following a large seismic event within the San Gorgonio Pass area. To assist in the study, a team of geoscientists experienced in assessing the potential for fault displacements along the southern San Andreas Fault System in the area of the San Gorgonio Pass was assembled under GeoPentech, Inc. The study incorporated the most recent information available regarding the seismicity of the area including: geology, geodesy, seismicity, paleoseismology, and tectonics.

The information gathered during the course of the study was used to develop a 3-dimensional deformation model of the San Gorgonio Pass area using Coulomb 3.3 (San Gorgonio Pass Model). The model was developed to estimate the surface fault displacement and deformation that would occur along and near the CRA within the San Gorgonio Pass as a result of future seismic events. The results of the San Gorgonio Pass Model were compared to current geologic and geomorphic data, which showed a reasonable reflection of the natural conditions of the area, validating the results of the model.

The MCE for the southern San Andreas Fault would be a rupture originating near the Salton Sea around Bombay Beach and extending through the San Gorgonio Pass up to between Wrightwood and Three

Points. Based on available geologic data, the most likely event on the San Andreas Fault to rupture in on the Garnett Hills Fault, which is a strand of the San Andreas Fault system located in the San Gorgonio Pass. Results from the San Gorgonio Pass Model indicate that an earthquake approximating the MCE for the Southern San Andreas Fault System could result in a horizontal offset of approximately 12 feet and a vertical deformation of approximately 3 feet at the Garnett Hills Fault crossing of the CRA. The vertical deformation would extend over the CRA for approximately 60 miles.

The seismic event would result in uplift along the longitudinal profile of the CRA with three separate peaks, with the last peak occurring at or near the Whitewater Tunnel No. 2 and resulting in a cumulative upward deformation of approximately 3 feet. This upward deformation of the CRA would reduce the flow carrying capacity of the aqueduct. An accompanying probabilistic rupture hazard analysis of the San Gorgonio Pass (Report No. 1470) showed that the above deformation occurring at the CRA crossing has a return period of approximately 750 years.

***The Colorado River Aqueduct San Gorgonio Pass Seismic Event Vulnerability Study – Hydraulic Analysis, (Report No. 1558),* September 2014, Metropolitan Facility Planning and Hydraulics staff.** This study documents a detailed hydraulics analysis that evaluated the impact of a seismically induced vertical uplift of the CRA alignment over a length of approximately 60 miles, based on the uplift profile from the San Gorgonio Pass Seismic Event Vulnerability Study (Report No. 1484). The analysis showed that despite the uplift, Metropolitan would be able to continue flowing approximately 1300 cubic feet per second, approximately 80 percent of design flow, through the aqueduct after initial rapid repairs are completed. The analysis assumed free surface flow with a 3-foot minimum freeboard, the same as the current aqueduct design. Minor pressurization of the system could allow for some additional flow if required. The analysis also assumed that repairs to the CRA following the earthquake maintained the design cross sections and friction of the non-damaged CRA sections, and that no repairs were done to reestablish the grade.

***Probabilistic Rupture Hazard Analysis of CRA at San Gorgonio Pass (Report No. 1470),* October 2014, Metropolitan staff.** This report is a supplemental report to Report No. 1484, “Colorado River Aqueduct – San Gorgonio Pass Seismic Event Vulnerability Study.” The report documents the results of a probabilistic rupture hazard analysis of the CRA where it crosses the Garnett Hills segment of the Southern San Andreas Fault in the San Gorgonio Pass. The analysis showed that the projected 3-foot vertical and 12-foot horizontal surface deformation at the CRA crossing in the San Gorgonio Pass has a return period of approximately 750 years.

***Colorado River Aqueduct Seismic Vulnerability Investigations – Summary Report (Report No. 1490)*, December 2014, Metropolitan Facility Planning staff.** This report briefly summarizes the results of the CRA seismic vulnerability studies (Reports 1478, 1484, 1485 and 1558).

***Seismic Risk Assessment – Conveyance and Distribution System Tunnels (Report No. 1533),* March 2016, GeoPentech and Metropolitan Facility Planning staff.** This study evaluated the seismic risk of the 41 tunnels within Metropolitan’s Conveyance and Distribution System to heavy damage during a future maximum considered earthquake (MCE) event that would adversely impact water deliveries to member agencies while the tunnel is out of service for repairs. The study was completed through a two part process. Part 1 screened each of the 41 tunnels and identified tunnels that were vulnerable to one or more seismic hazard, and could result in a loss of service to the member agencies (i.e., no backup capability) if flow through the tunnel is disrupted. Tunnels that met both criteria in Part 1 were deemed a potential seismic risk to Metropolitan's water delivery reliability and were pushed through to Part 2 of the process. Part 2 further evaluated each of the potential high-risk tunnels identified in Part 1 and numerically ranked each tunnels degree of seismic risk in order to identify which tunnel(s) may pose the greatest risk to Metropolitan's water delivery capability.

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Appendix 8

Administrative Code Section 4503 "Suspension of Deliveries" and 9/21/06 IAS Clarification

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§ 4503. Suspension of Deliveries.

(a) Whenever repairs or maintenance of the District's system, in the opinion of the Chief Executive Officer of the District, shall require suspension of delivery of water at any point or points, such delivery may be suspended without liability on the part of the District; provided, that except in cases of emergency, as determined by the Chief Executive Officer, notice of such suspension of service shall be given to the affected member public agency in advance of such suspension. Metropolitan will make a concerted effort to notify and work with member public agencies regarding all scheduled interruptions. The District will schedule non-emergency interruptions for the low demand months of the year, typically October through April, in coordination with the member public agencies.

(b) Each member agency shall have sufficient resources such as local reservoir storage, groundwater production capacity, system interconnections or alternate supply source to sustain a seven-day interruption in Metropolitan deliveries based on annual average demands. If a member public agency has been provided with a sixty (60) day notice of when an interruption in service is to occur, the member public agency shall be responsible for and reimburse direct costs, excluding labor costs, incurred by Metropolitan in the event that a scheduled non-emergency interruption of up to seven days is postponed or cancelled at the request of the member public agency as a result of insufficient local resources, and the District agrees to such cancellation or postponement. Direct costs shall be determined by Metropolitan's Chief Executive Officer, in consultation with the affected member agency. These direct costs shall be applied to the member public agency's water invoice following cancellation or postponement of the shutdown.

(c) Except in cases of emergency, the District, working with the member agencies, will produce a shutdown schedule each September for the annual shutdown season from October through April. The District will also develop a three-year shutdown schedule, which will give notice of the proposed shutdowns greater than seven days at least one-year in advance.

(d) Replenishment Service certifications will be adjusted for the reduction of credits that are accrued due to shutdowns that are greater than seven days. No adjustments will be made for shutdowns seven days or less unless the member agency provides a service to the District by serving another member agency in-lieu of District deliveries during a shutdown even if the shutdown is seven days or less.

Section 322.4 based on Res. 7260 – May 12, 1970, amending Res. 3896 – August 18, 1950; amended by M.I. 33642 – March 10, 1981. Section 322.4 repealed and Section 4503 adopted by M.I. 36464 – January 13, 1987, effective April 1, 1987; amended by M.I. 42278 - February 11, 1997; paragraph amended by M. I. 44812 - March 12, 2002; paragraph amended by M. I. 45943 – October 12, 2004; paragraphs assigned (a), (b), (c), & (d) designations and amended by M. I. 45988 – November 9, 2004.

2007 Integrated Area Study (IAS) Clarification

1. Original intent
    a. Communicated that MWD's system is interruptible
    b. Protected MWD from liability claims for required shutdowns
    c. Illustrated commitment to minimizing impacts
        i. Advanced notice & coordination
        ii. Non-emergency outages only during low flow months
    d. Required member agencies to make provisions for outages
        i. 7-day supply of average annual demands
        ii. No enforcement – no penalty

2. Updated text & interpretation
    a. Recognized changing conditions
        i. Increased member agency dependence upon MWD
        ii. Many agencies in non-compliance
        iii. Increased difficulty in storing treated water
    b. Revised requirement for member agency outage provisions
        i. Capability to sustain 7-day interruption (not limited to supply)
        ii. Penalty added for cancellation or postponement of outage

3. IAS clarification
    a. MWD planned outages are required to maintain long-term reliability
    b. Unplanned MWD outages may also occur
    c. Intent of 4503 was to encourage agency provisions for planned and unplanned outages
    d. Compliance not enforced (beyond interference with planned outages)
    e. Member agencies responsible for decisions regarding provisions for unplanned outages
    f. Regional flexibility improvements achieved through demand-driven LRP & IAS projects

REPORT

SEISMIC RESILIENCE REPORT

2020 UPDATE

The Metropolitan Water District of Southern California

700 N. Alameda Street, Los Angeles, California 90012

Report No. 1551-1

February 2020

Seismic Resilience Report 2020 Update

Prepared By:

The Metropolitan Water District of Southern California
700 North Alameda Street
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Report Number 1551-1
February 2020

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Additional copies: The Seismic Resilience Report is located on the Seismic Resilience SharePoint site. To obtain a copy of this document, please contact the Engineering Services Group.

Disclaimer

Extensive efforts have been made to ensure that the material contained in this document is accurate as of the date of publication. There are many factors, however, related to the content and applicability of this document which are beyond the control of MWD. In addition, the contents of this publication will be periodically updated, so the reader should inquire about any such changes in addition to reading this document. Finally, the reader is encouraged to seek appropriate technical and/or legal advice when specific facts or circumstances arise that raise questions concerning the applicability or interpretation of the policies and procedures discussed herein.

PUBLICATION HISTORY:

Initial Release (First Biennial Report No. 1551)	*February 2018*
2020 Update (Report No. 1551-1)	*February 2020*

Cover Photo: Test setup for large diameter seismic-resilient ductile-iron pipe to be used on Metropolitan’s Casa Loma Siphon

CONTENTS

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EXECUTIVE SUMMARY

In February 2018, the Metropolitan Water District of Southern California (Metropolitan) published *Report No. 1551, Seismic Resilience First Biennial Report*, which defined Metropolitan's Seismic Resilience Strategy and identified a number of near-term goals to improve Metropolitan's seismic resilience. The *2020 Seismic Resilience Report Update* is a supplement to the *Seismic Resilience First Biennial Report* (2018 Report). The purpose of the update is to document revisions to Metropolitan's Seismic Resilience Strategy, document seismic-resilience-related studies completed since publication of the 2018 Report, list the achievements related to the seismic performance objectives and near-term goals identified in the 2018 Report, and communicate new performance objectives and goals that will further increase the seismic resilience of Metropolitan's system.

Since the publication of the 2018 Report, Metropolitan has initiated multiple studies that will improve planning for earthquake response. Completed studies include an evaluation of Metropolitan's emergency storage requirements and an evaluation of the susceptibility of the conveyance and distribution pipelines to liquefaction. Staff is also nearing completion of an assessment of the potential damage to the conveyance and distribution pipelines from different earthquake events.

In the last two years, Metropolitan has also completed construction for seismic upgrades to 17 structures. Additionally, Metropolitan substantially completed the initial round of seismic evaluations for above-ground structures constructed pre-1990, which in general pose an elevated seismic risk. Evaluation of above-ground structures built post-1990 has been initiated as well as evaluation of hydraulic structures (e.g., reservoir outlet towers) to assess their seismic risk when compared to current design practices.

Finally, Metropolitan conducted over 100 emergency response exercises, workshops, and seminars since February 2018, including two large functional exercises. These exercises help to ensure that Metropolitan staff is prepared for when an eventual earthquake occurs. Metropolitan also started a new five-year exercise plan in 2019 that will allow all of its member agencies to participate in at least one of Metropolitan's annual emergency exercises during the next five years.

Overall, Metropolitan has achieved many of the near-term goals that were proposed in the 2018 Report and is continuing the efforts to complete the few items that are still outstanding. The strategy outlined in the 2018 Report to develop the seismic resilience of the system is an ongoing process that will continue to evolve and adapt as new information becomes available.

Staff recommends changing the frequency of written update reports from its current two-year cycle to a frequency of a written report every five years, with the next written report to the Board in 2025. Staff will continue to provide annual oral updates on Metropolitan's Seismic Resiliency Strategy to the Board.

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SECTION 1 PURPOSE

The Metropolitan Water District of Southern California (Metropolitan) owns and operates a complex conveyance, storage, treatment, and distribution system that serves a 5,200-square-mile service area within an active seismic region. Over its approximate 90-year history, Metropolitan has been proactive in mitigating seismic risk posed to the system, as well as improving its ability to maintain or quickly restore water deliveries following a major earthquake.

In February 2018, Metropolitan published *Report No. 1551, Seismic Resilience First Biennial Report* (2018 Report), which summarized Metropolitan's historical approach to mitigating seismic risk and defined the organization's current Seismic Resilience Strategy and the core components of that strategy. The report also identified performance objectives and near-term goals of the Seismic Resiliency Strategy. The 2018 Report is available on Metropolitan's website using the link below:

http://mwdh2o.com/PDF_About_Your_Water/SRS%20Report%201551_Final_030518A_Submit_Reduced.pdf

The *2020 Seismic Resilience Report Update* is a supplement to the 2018 *Seismic Resilience First Biennial Report*. The purpose of the update is to document recent revisions to Metropolitan's Seismic Resilience Strategy regarding emergency storage requirements, document seismic-resilience-related studies completed since publication of the 2018 Report, and list the achievements related to Metropolitan's Seismic Resilience of Structures Program, emergency response planning, and the seismic performance objectives and near-term goals identified in the 2018 Report. The report also identifies new performance objectives and goals that will further increase the seismic resilience of Metropolitan's system.

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SECTION 2 BACKGROUND

Seismic Risk

Southern California is crossed by numerous faults of varying levels of activity that are capable of generating large earthquakes and causing widespread damage. The 2018 Report listed six earthquakes that occurred within or near Metropolitan's service area in southern California since 1900 - four strong earthquake events (M6.0 – 6.9) and two major earthquake events (M7.0 to M7.9).

In 2019, two significant earthquakes events occurred in the region. On July 4, 2019, a M6.4 earthquake occurred near Ridgecrest, approximately 122 miles north/northeast of Los Angeles. Then on July 5th, a M7.1 earthquake occurred in the same vicinity. While the earthquakes caused major damage to Ridgecrest and the surrounding communities, the earthquakes only caused mild shaking in the Los Angeles region due to the distance from the epicenter. However, these earthquakes are a reminder that earthquake risk is always present and that the region must take steps to prepare and respond.

A map showing significant (M6.3 and greater) earthquakes that have occurred in the southern California region since 1900 is provided in Appendix A.

Seismic Resilience Strategy

Metropolitan's Seismic Resilience Strategy is comprised of four components that encompass the various functions that promote the organization's seismic resilience objectives.

Planning – Developing and maintaining a diversified water portfolio, system flexibility, and emergency storage supplies

Engineering – Evaluation and mitigation of seismic risks of infrastructure and the water system as a whole

Operations – Maintain effective emergency planning and response capabilities

Reporting – Increase accountability and transparency of seismic resilience programs

Metropolitan's Seismic Resilience Strategy was described in detail in the 2018 Report, and the overall structure of the strategy is unchanged. A detailed breakdown of Metropolitan's Seismic Resilience Strategy is provided in Figure 2-1. The figure provides an overview of the comprehensive actions taken to mitigate impacts from large earthquakes, to quickly respond following an earthquake event, and to provide transparency regarding seismic risk and preparedness.

As shown in Figure 2-1, in addition to the activities conducted under the Planning, Engineering, Operations, and Reporting components of the Seismic Resilience Strategy, Metropolitan has continued its involvement with the Seismic Resilient Water Supply Task Force. The Seismic Resilient Water Supply Task Force is a collaboration between Metropolitan, the Department of Water Resources (DWR), and the Los Angeles Department of Water and Power (LADWP) to improve the seismic resilience of the imported water supply aqueducts.

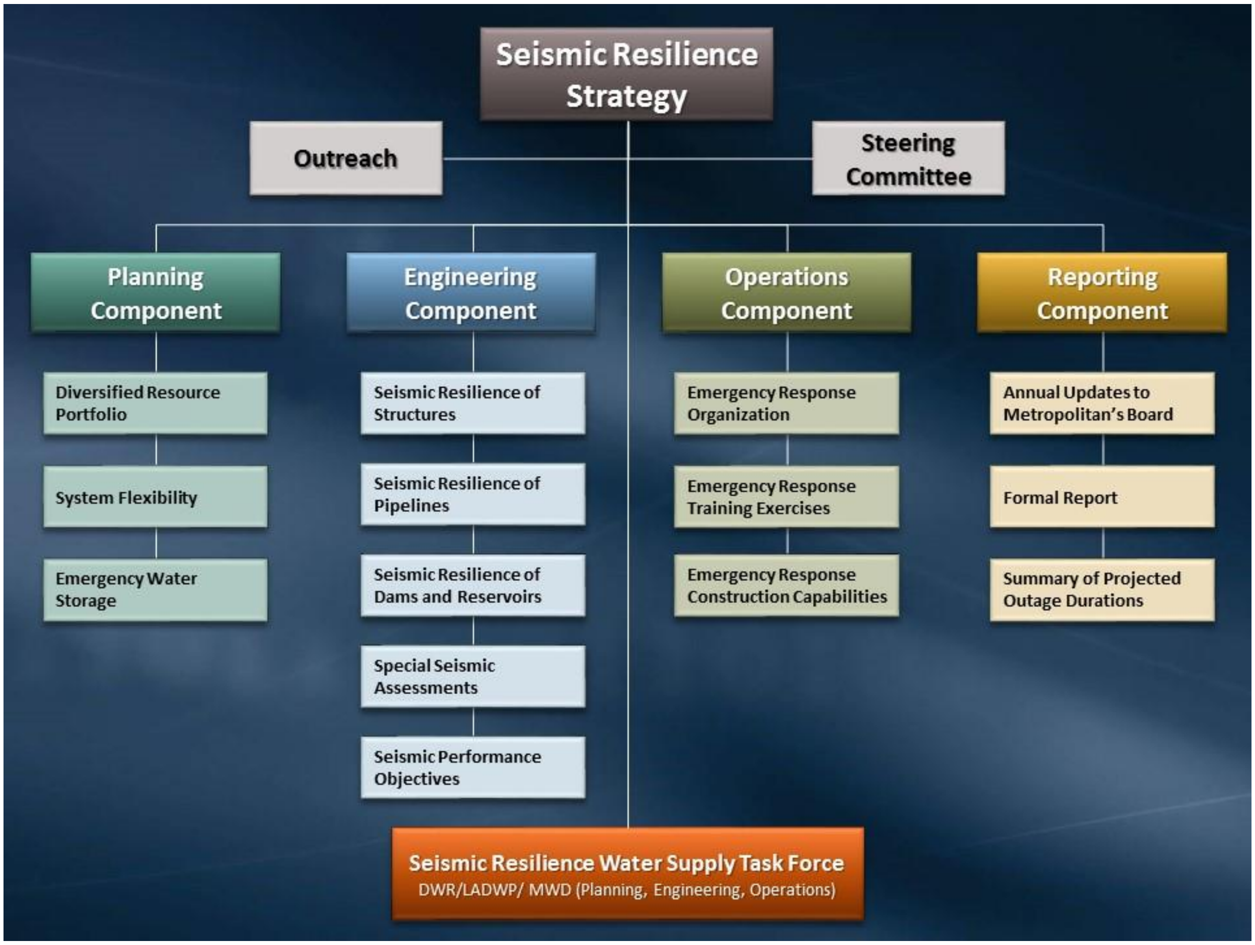

Figure 2-1: Detailed Breakdown of Metropolitan's Seismic Resilience Strategy

SECTION 3 SEISMIC RESILIENCE STRATEGY UPDATES/REVISIONS

Planning Component

Emergency Storage

Beginning in February 2018, Metropolitan and its member agencies convened a workgroup to evaluate regional storage, including the size and management of Metropolitan's emergency storage program. The goal of the emergency storage program evaluation was to update the emergency criteria and develop a revised methodology to determine emergency storage needs. The methodology and recommendation of the workgroup were described in a draft white paper, "2018 Evaluation of Regional Storage Portfolio: Draft Evaluation of Metropolitan's Emergency Storage Objective," and presented to Metropolitan's Board in May 2019[1].

The update of the emergency criteria was based on 1) newly revised potential outage durations for the region's imported water supplies – the Colorado River Aqueduct (CRA), the Los Angeles Aqueduct, and the State Water Project east and west branches – following a seismic event, and 2) a revisit of retail water demand and locally available supplies within the service area. The revised outages were developed as part of the Seismic Resilience Water Supply Task Force. The workgroup took into account the capabilities of member agencies when identifying reduction of retail water demand and local production during an emergency outage of imported supplies. This is a critical change in that the previous storage calculation assumed 100 percent local production during the outage period.

Diamond Valley Lake

The new emergency storage criteria considered various combinations of local demand reduction and supply production to develop an envelope of scenarios designed to prevent a shortage during an outage. Based on the range of potential scenarios, the workgroup recommended 750,000 acre-feet for the emergency storage program target, an increase from the previous planning target of 630,000 acre-feet.

The emergency storage is assumed to be distributed among the available capacities of existing Department of Water Resources and Metropolitan surface reservoirs located on the coastal side of the San Andreas Fault. Since member agency demands for supplemental water will be met through deliveries of supplies from storage, evaluation of spatial distribution of storage and most effective operation of the

[1] The Metropolitan Water District of Southern California, Water Planning and Stewardship Committee, Board Item 9-3, "Update of Metropolitan's Emergency Storage Objective," May 2019. http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Board%20Archives/2019/05-May/Letters/064883968.pdf

distribution system will be accomplished as part of Metropolitan's continued efforts and coordination within Metropolitan's storage portfolio evaluation or other regional planning processes.

System Flexibility

In July 2019, Metropolitan's Board of Directors authorized an amendment to the Administrative Code to enable delivery of member agency water supplies in Metropolitan's system in an emergency subject to the General Manager's approval[2]. The amendment is an effort to enhance water delivery reliability after a serious emergency in which 1) Metropolitan is unable to make deliveries to a member agency due to physical damage to Metropolitan's system resulting from a natural disaster or other emergency and 2) there are no alternate means for Metropolitan or the member agency to provide service to an area without the use of a portion of Metropolitan's system. The Administrative Code change clarifies the conditions of these emergency deliveries in a proactive way, instead of a reactive way in response to damaged infrastructure following a natural disaster or serious emergency.

Engineering Component

Seismic Resilience of Structures

Metropolitan has developed an ongoing program for evaluating and upgrading its above-ground facilities with the goal of protecting life safety and critical infrastructure to minimize water delivery interruptions following a seismic event. The initial round of evaluations focused on structures that were deemed likely to be more susceptible to damage from earthquakes – buildings constructed prior to 1990. Structures built after 1990 were constructed in accordance with the 1988 or later versions of the Uniform Building Code, which provides reasonable assurance of withstanding a design-level earthquake without catastrophic failure. The program procedure for the seismic resilience of Metropolitan's above-ground structures was described in the *Seismic Resilience First Biennial Report* and the program status as of January 2018 was provided. Since publication of that report, an additional 17 seismic upgrades have been completed. Figure 3-1 provides the overall status for the pre-1990 structures as of November 2019. Of the 311 pre-1990 structures identified, 63 percent were found to be acceptable and 37 percent (116 structures) potentially deficient following the rapid evaluation process. Of the 116 structures, 85 have either been seismically upgraded or are in design or construction. The remaining are largely structures that are not related to water delivery.

The program for seismically upgrading the above-ground structures is meant to be a continuous program, with the intent of reevaluating structures periodically. Structures found to be acceptable during the initial evaluation round may undergo a reevaluation, if warranted by new information such as a significant increase in seismic design force or displacement due to code revisions or newly discovered ground conditions, damage of structural components, severe material deterioration, and/or changes of occupancy.

[2] The Metropolitan Water District of Southern California, Engineering and Operations Committee, Board Item 8-4 "Authorize Amendments to the Administrative Code Regarding Deliveries of Member Agency Supplies in Metropolitan's System in an Emergency; the General Manager has determined that the Proposed Action is Exempt or Otherwise Not Subject to CEQA", July 2019. http://www.mwdh2o.com/WhoWeAre/Board/Board-Meeting/Board%20Archives/2019/07-July/Letters/07092019%20BOD%208-4%20B-L.pdf

As shown in Figure 3-1, evaluation of the pre-1990 structures related to water delivery has been substantially complete and the deficient structures are being addressed. Following the 1994 Northridge earthquake, and subsequent earthquakes in Taiwan, Japan, and New Zealand, substantial research in seismic design and code revisions has taken place. Post-1990 structures may or may not meet the current seismic performance standards, which has prompted Metropolitan to expand the seismic evaluation to post-1990 structures, a process which was initiated in early 2019 to further improve its seismic resilience. Twenty-six structures have been identified as part of the post-1990 structure list. Rapid evaluations have been completed on six structures, and none have been identified as seismically deficient.

As Metropolitan begins its evaluation of the post-1990 above-grade structures, staff is also initiating a process to identify and systematically evaluate below-ground structures such as vaults and manholes. Similar to the evaluation of above-ground structures, the prioritization of these facilities will consider potential impacts to water delivery and potential for loss of life.

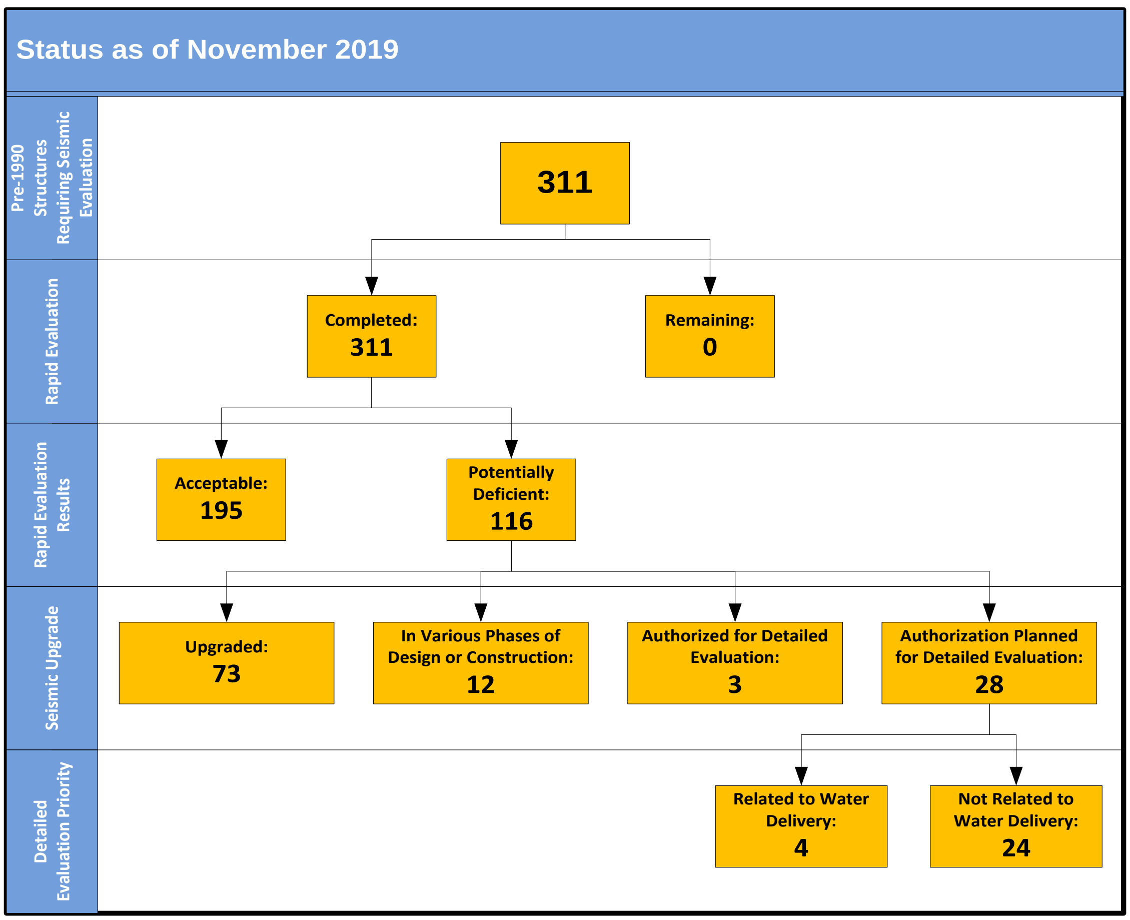

Figure 3-1: Status of Seismic Assessment and Upgrades of Pre-1990 Structures

Seismic Resilience of Pipelines

Metropolitan's pipelines have been constructed in conformance with standards of practice at the time of design. Historically, there have been very few prescriptive code requirements for seismic design of pipelines. Only recently have there been developments in mitigation options for large diameter pipelines, including improved techniques to analyze the response of structures and pipelines within the ground from shaking, increased post-earthquake data collection of ground motions and damage observations, and demonstrated performance of earthquake-resistant pipeline products.

In keeping with the goals of the Seismic Resilience Strategy, Metropolitan is developing seismic design criteria for new pipelines based on current state of practice, geotechnical and seismicity criteria, operating conditions, and asset management strategies. The planned design approach for new pipelines will be to establish performance criteria, identify seismicity and ground conditions along the alignment, and design the pipeline to resist damage from ground shaking and deformation. Specialized pipe joints and sections can be designed to accommodate ground deformation from fault displacement or liquefaction. For existing pipelines, seismic resilience will be incorporated as a component of pipeline rehabilitation projects. Metropolitan will evaluate each upgrade individually to balance risk, performance, and cost. See the Seismic Performance Objectives in this section for more information on the pipeline seismic design.

Metropolitan is in the early years of a 20-year program to rehabilitate its prestressed concrete cylinder pipelines (PCCP), which, at 163 miles, makes up approximately 20 percent of Metropolitan’s conveyance and distribution system. The initial phase of the program will focus on the Second Lower Feeder, which will be upgraded with an interior steel liner. The new steel lining and the welded joints are designed to improve the seismic performance of the pipeline. For Reach 9 of the Second Lower Feeder, Metropolitan is investigating alternatives for realigning the portion of the pipeline that crosses the Newport-Inglewood Fault. One alternative being evaluated is to use specialized large-diameter earthquake-resistant steel pipe to accommodate fault displacement while maintaining structural integrity of the pipe for water conveyance.

Following this strategy, Metropolitan is completing the final design for rehabilitation of the Casa Loma Siphon Barrel No. 1 on the CRA in 2020. The Casa Loma Siphon Barrel No. 1 crosses the San Jacinto Fault Zone and is subject to long-term subsidence-induced deformation from groundwater pumping. The project will replace 800 feet of the existing 148-inch diameter concrete pipeline with two parallel barrels of 104-inch diameter earthquake resistant ductile iron pipe (ERDIP). The ERDIP joints are designed to accommodate ground displacements without failure, which will allow for uninterrupted service following a major earthquake.

Earthquake-Resistant Pipe

Seismic Resilience of Dams and Reservoirs

Metropolitan's ongoing strategy for managing the safety of its 24 dams includes five major components: (1) Detailed Inspections; (2) Monitoring & Reporting; (3) Facility Assessments; (4) Emergency Action Plans, including Inundation Maps; and (5) Capital Projects for dam improvements and upgrades.

Consistent with the goals of the Seismic Resilience Strategy, Metropolitan performs cyclical assessments of its facilities that include: 1) developing dam seismic performance criteria based on current state of practice, geotechnical and seismicity criteria, and operating conditions, 2) selecting design or safety evaluation earthquakes, 3) characterizing ground motions, 4) analyzing seismic performance of the dams and foundations, and 5) evaluating structural adequacy of dam appurtenant structures for earthquake loading.

Finally, Metropolitan has an ongoing Dam Safety Initiatives Program that has initiated several plans to improve Metropolitan's dam seismic safety and earthquake readiness. These initiatives are being coordinated with the California Division of Safety of Dams (DSOD) and Office of Emergency Services and include the following:

- Ongoing preparation of Emergency Action Plans, including inundation maps
- Performing training exercises at the dam site to test processes during a seismic event
- Providing training and guidance on overall dam safety
- Reviewing operation and maintenance methods for reservoir drawdown and operations after a seismic event
- Updating guidelines and procedures on protection against seismic risk
- Establishing a strong communications system on seismic information
- Performing structural strengthening of dams, including rehabilitation and improvement of spillways and inlet/outlet towers such as Lake Skinner Outlet Tower
- Improving dam safety instrumentation, monitoring, and reporting capabilities

Special Seismic Assessments

Metropolitan conducts studies to further the organization's understanding of the vulnerability of the system to seismic hazards. The studies support emergency response training and planning for future earthquake events by estimating the magnitude of damage that may occur from various seismic events. Recently completed and ongoing studies are described below.

Completed Study:

Report 1625 - Liquefaction Susceptibility Mapping for the Metropolitan Water District of Southern California's Feeder System **(Carollo Engineers, Inc., 2019)**. The liquefaction susceptibility mapping study provides a relative scale of liquefaction susceptibility of deposits along Metropolitan's conveyance and distribution system, given sufficient earthquake ground motions. Existing liquefaction maps available from the California Geological Survey provide a conservative overview of potentially liquefiable areas without any delineation for relative susceptibility. Areas are marked as either liquefiable or not liquefiable. The study utilized available geologic mapping data as well as publicly available groundwater data to map the relative liquefaction susceptibility of Metropolitan's conveyance and distribution pipelines for historical high and modern (1999 to 2019) groundwater depths providing five levels of relative scaling of susceptibility from very high to very low. The results of the study will be used to identify specific locations that may be targeted for future site-specific detailed liquefaction analyses, help prioritize pipeline replacement projects, and assess alternative pipeline alignments.

Studies currently underway:

> ***Earthquake Damage Assessment of Metropolitan Water District Conveyance and Distribution Feeder System*** **(ABS Consulting, Inc.).** The study utilizes proprietary modeling software to estimate the potential number of pipeline breaks that may occur from various extreme earthquakes such as a Magnitude 7.8 earthquake on the South San Andreas Fault. The damage assessment model takes into account pipeline material and joint type, distance from earthquake source, and regional geologic conditions when developing the damage estimate. The results of the study will provide input into Metropolitan's earthquake emergency response planning and training activities, and help prioritize future pipeline seismic resilience enhancements. Anticipated completion is March 2020.

Seminars and Workshops

Metropolitan has recognized the importance of providing awareness of the seismic hazards and risks to Metropolitan, its member agencies, and sub-agencies and encouraging a transfer of knowledge of assessment and mitigation strategies to reduce seismic risk. Metropolitan ensures that risk awareness and knowledge transfer are promoted through active participation at various workshops.

In October 2019, Metropolitan co-hosted with LADWP the 11th Water System Seismic Conference. The conference is a bi-annual event that brings together utility, consulting, and academic professionals from the United States, Japan, and Taiwan to share knowledge in research, design practices, and construction technologies to prepare for and respond to seismic events. Conference topics included emerging design techniques, innovative construction practices, seismic damage assessments, seismic mitigation measures, and emergency response and recovery. In addition to co-hosting the conference, Metropolitan staff delivered four presentations on the organization's seismic resilience efforts. The papers and authors are listed in Appendix B.

Metropolitan Chief Engineer Providing Opening Remarks at 11th Water System Seismic Conference

In December 2019, Metropolitan co-sponsored the Earthquake Resilience Workshop for Water and Wastewater Utilities in Southern California. The workshop was a partnership with the United States Environmental Protection Agency and local utility and emergency management organizations to provide guidance and information to drinking water and waste water utilities to enhance their ability to enhance their resilience approach.

Staff also presented Metropolitan's seismic strategy and goals at the Member Agency Managers Meeting in August 2019. Staff described the various activities that Metropolitan conducts to understand the seismic risk and improve the overall resilience of the system. They also used the opportunity to promote the defense-in-depth approach to seismic resilience for the member agencies. This approach is a layered strategy of system hardening, emergency water supply diversification, and increased system flexibility, including potential interties between member agencies.

Seismic Performance Objectives

Structures

Metropolitan's facilities are categorized as either an essential facility or regular facility, depending on performance requirements of the structure in accordance with code requirements. The structures are then designed or rehabilitated to meet the design criteria specified in the applicable seismic codes.

Essential facilities are those that are required for Metropolitan's core business-water delivery. All structures that are directly or indirectly related to water conveyance, storage, treatment and distribution are considered essential. Additionally, structures that contribute to Metropolitan's business continuity are also considered essential. The performance objective for an essential facility is to allow for continuous operation of the structure with limited damage after a maximum considered seismic event. These essential facilities are designed or improved to allow for immediate occupancy or continuous operation after a major seismic event. As an owner/operator of essential lifeline facilities, Metropolitan's water-related facilities will remain functional for disaster relief and fire suppression following a seismic event.

For regular facilities, the objective is to allow safe evacuation of occupants with possible structural and non-structural damage. The performance objective is to ensure life safety and prevent collapse of the structure. A facility designed as a regular facility may require significant repair following a major seismic event.

Pipelines

Metropolitan's conveyance and distribution pipelines are considered essential pipelines that are required for post-earthquake response and recovery. The pipelines are intended to remain functional and operational during and following a maximum considered earthquake. No uncontrolled release of a substantial amount of water is permitted under this design scenario.

Metropolitan continuously improves its techniques to analyze the response of pipelines to a seismic event to improve its assessment and prediction of earthquake damage to these facilities. Post-earthquake data of ground motion and damage information are used to improve earthquake resilience design methodologies. The data collected is used in advanced seismic pipeline analysis that relies on finite element techniques for soil-structure 3d modeling. Innovation in the development of earthquake-resistant pipeline products contributes to better seismic performance.

For new pipeline seismic design, the performance objective is to ensure the pipeline, pipe joints, and pipe-to-structure connections are capable of resisting the seismic shaking resulting from earthquake wave propagation without permanent damage. As the pipeline crosses known earthquake faults, the system will be designed to accommodate the maximum anticipated ground movement from fault displacement using specialized joints or pipe sections. Automatic shutoff valves may be added on either side of the fault to increase system flexibility.

For existing pipeline seismic design, a comprehensive risk assessment of the system using the latest seismicity and pipeline fragility data will be performed. The vulnerabilities of each pipeline segment will be used to determine the priority and schedule of seismic rehabilitation. Seismic resilient design to resist shaking and accommodate fault displacement will be incorporated as components of the rehabilitation program. Each upgrade will be evaluated individually to balance risk, consequence, performance, and cost to define an economical long-term approach.

Operations Component

Emergency Response Training Exercises

In addition to training emergency response staff on National Incident Management System procedures, Metropolitan regularly conducts emergency response training exercises which have often been based upon a postulated seismic event.

Recent examples include:

- "ShakeOut" Full-Scale Emergency Operations Center (EOC)/Incident Command Post (ICP) Exercise, October 17, 2019
- "Joint Infrastructure Security Exercise"- Tabletop Exercise with various Federal, State, and Local emergency management partner agencies- April 10, 2019
- "Operation Nomad"- Functional EOC/ICP and member agencies, November 14, 2018

In 2019, Metropolitan started a new five-year emergency exercise plan that will allow all of its member agencies to participate in at least one of Metropolitan's annual emergency exercises. The first of these exercises was a tabletop exercise for the Orange County member agencies on August 29, 2019, which focused on a hypothetical incident at the Diemer Water Treatment Plant.

Metropolitan has conducted over 100 exercises since February 2018. This included two large functional emergency exercises for the EOC and multiple tabletop exercises, workshops, and seminars for the 12 Incident Command Posts located at the water treatment plants, conveyance and distribution facilities, and other strategic locations in Metropolitan's service area.

The Metropolitan EOC also conducts monthly communication tests, which include Metropolitan's emergency two-way radio system, on-line WebEOC system, Met-Alert mass notification system, and satellite phones. These monthly tests reach out to the member agencies, Treatment Plant Control Centers, ICPs, Metropolitan management, and the Department of Water Resources. These regular exercises help prepare Metropolitan and its member agencies to respond to future emergencies.

Emergency Response Capability

Metropolitan continues to maintain the necessary staffing, materials, and equipment to respond to two simultaneous pipeline breaks. The Machine Shop and Coating Shop at La Verne are available to fabricate pipe sizes up to 12 feet in diameter, and Metropolitan's construction forces have the necessary equipment and expertise to make the repairs in-house. In addition, Metropolitan has upgraded its satellite phones to ensure communication ability following a seismic event and is in the process of installing high frequency radios at all Incident Command Posts (formerly Incident Command Centers) and the Emergency Operations Center.

Reporting Component

Formal Report

The interval for development of a formal report will be changed to every five years from the original two-year interval. Increasing the time interval between report updates will allow for a full Capital Investment Plan cycle to complete and for projects to move through concept, design, and construction.

Seismic Resilience Water Supply Task Force

The Seismic Resilience Water Supply Task Force (Task Force) is a collaborative effort involving Metropolitan, DWR, and LADWP to improve the seismic resilience of the imported water supplies to southern California. Following a major earthquake that disrupts the imported water supplies, the agencies would coordinate resources to repair the imported water supply aqueducts to ensure that deliveries are restored as quickly and to as many people as possible.

In March 2018, Metropolitan, DWR, and LADWP convened an aqueduct workshop to discuss lessons learned from recent large earthquakes in New Zealand, Japan, and Mexico; share each agency's approach to conducting seismic assessments; and discuss potential interties that may assist with recovery of water supply to the region. The group also had initial discussions on development of an emergency response plan specific to the Task Force.

Seismic Resilience Water Supply Task Force Aqueduct Workshop – March 2018

The Task Force also conducted two tabletop emergency exercises in 2018 and 2019. These exercises were used to give substance to some of the ideas in the Joint Agency Emergency Response Plan (ERP).

Metropolitan, DWR, and LADWP are developing a Water Mutual Assistance Agreement (WMUA), which will formalize the Task Force and define the reporting and accounting requirements for mutual assistance following a major seismic event that impacts imported water supplies. A draft of the Joint Agency ERP has also been completed. The Joint Agency ERP will be finalized along with the WMUA. The plan defines the scenarios that would trigger the deployment of the Multi-Agency Coordination Group, which enhances the collaboration in operation, reporting, and plan maintenance.

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SECTION 4 SEISMIC RESILIENCE NEAR-TERM GOALS

Status of 2018 Listed Goals

The 2018 Seismic Resilience First Biennial Report identified near-term goals to further Metropolitan's seismic resilience objectives. The near-term goals are listed below along with an update of the work done to date.

System Level Goals

Goal	Conduct Rialto Pipeline Alternative Supply Needs Study
Status: Metropolitan completed an initial study to identify the near-term and long-term emergency supply needs for member agency demand from the Rialto Pipeline. The Rialto Pipeline is exclusively supplied from the California Aqueduct East Branch and is susceptible to extended disruption from an earthquake on the San Andreas Fault. The study also identified options to meet emergency supply needs. Metropolitan is currently working with member agencies to expand on the emergency supply options.	

Goal	Complete a Re-evaluation of Metropolitan's Emergency Storage Needs
Status: Metropolitan, in coordination with member agencies, completed a re-evaluation of Metropolitan's emergency storage needs and presented the recommendations to increase storage from 630,000 acre-feet to 750,000 acre-feet to Metropolitan's Board in May 2019. A description of the emergency storage re-evaluation is provided in Section 3.	

Goal	Complete a Comprehensive Evaluation of Metropolitan's Storage Programs
Status: Metropolitan, in coordination with member agencies, will complete the 2020 Integrated Water Resources Plan (IRP). Metropolitan will use newly developed demand and supply forecasts to analyze its entire supply portfolio, including all storage programs, in assessing regional reliability.	

Facility Level Goals

Goal	Complete Construction of Approved Seismic Upgrade Projects
Status: Construction has been completed for the listed projects. • Carbon Creek Pressure Control Structure • Ten Control Structures along the Allen-McColloch Pipeline • Diemer Administration Building • CRA Pump Plants Switch Houses (Five Buildings) • Weymouth West Wash Water Tank	

Goal	Conduct Studies, and Complete Design of Approved Upgrade Projects

Status:

- Assessment of potential seismic-induced damage to Metropolitan's water conveyance and distribution pipelines

  Studies to estimate damage from shaking and at fault crossings from large earthquakes and liquefaction susceptibility of pipelines are in progress with an estimated completion date of March 2020. See Special Seismic Assessments under Section 3.

- Seismic upgrade for Diemer West Filter Building

  Completed design and construction of seismic upgrades is ongoing with an estimated completion date of December 2020.

- Complete evaluation of options, design, and construction contract to strengthen CRA Whitewater Tunnel No. 2

  Preliminary design is underway.

- Investigate options to improve emergency raw water bypass capabilities at treatment plants

  Study is ongoing.

- Vulnerability Study of CRA electric transmission and distribution systems

  Completed CRA Electric Transmission System Towers Reliability Study, which considered seismic vulnerability in addition to other hazards.

- Seismic Upgrade of Water Quality Lab in La Verne

  Project is currently in design.

- Seismic Upgrade of Weymouth Administration Building

  Project is currently in design.

- Seismic Study of Lake Skinner Outlet Tower

  Completed voluntary seismic assessment of the tower which considered current dam safety criteria

<u>Emergency Response Goals</u>

Goal 1:	Prepare and Conduct Emergency Exercises
Status: • Conduct a joint agency workshop to prepare a draft Joint Agency Response Plan • Conduct high-level training for DWR, LADWP, and Metropolitan staff on the Joint Agency Emergency Response Plan • Run a functional exercise on the Joint Agency Emergency Response Plan *Metropolitan conducted joint agency tabletop exercises to develop the Joint Agency Emergency Response Plan in 2018 and 2019. The functional exercise will be conducted following finalization of the Joint Agency Emergency Response Plan.*	
Goal 2:	**Execute MOU to Allow for Coordinated Emergency Response**
Status: • Prepare draft Memorandum of Understanding (MOU) and submit for review • Secure LADWP, Metropolitan, and DWR approval for the MOU *The Joint Agency Mutual Assistance Agreement is in the final stages of review and is expected to be signed off by all three parties in the near future.*	

Seismic Task Force Goals

2018 Goals:	**Collaborative LADWP, Metropolitan, and DWR Goals**
Status: • Discuss the applicability of lessons learned from seismic events in Japan, Chile, New Zealand, and Mexico *The organizations continue to incorporate lessons-learned from seismic events, including the July 4, 2019, M 6.4 and July 5, 2019, M 7.1 events in Ridgecrest, California* • Compare each agency's approach to conducting seismic assessments *In development of the Joint Agency Emergency Response Plan, the organizations provided detailed presentations of their seismic assessments and the underlying assumptions to their anticipated damage and outage durations.* • Meet with Southern California Edison (SCE) and Southern California Gas Co. to discuss the potential vulnerabilities of aqueduct power systems *Metropolitan held discussions with staff from SCE and shared information on the respective systems and seismic vulnerabilities.* • Conduct workshops to explore potential aqueduct interties *DWR and LADWP continue to investigate the potential for constructing an intertie between the State Water Project East Branch and the Los Angeles Aqueduct.*	

2019 Goals:	**Collaborative LADWP, Metropolitan, and DWR Goals**
Status: • Establish a leadership structure for a coordinated response to major events *The leadership structure for a coordinated response is described in the Joint Agency Emergency Response Plan* • Finalize a three-agency database of available emergency response resources *Updating list of emergency response resources for 2020*	

2019 Goals:	**Collaborative LADWP, Metropolitan, and DWR Goals (cont'd)**

Status:

- Conduct a three-agency tabletop exercise

  Metropolitan hosted a tabletop exercise in October 2019.

- Develop a ShakeOut Scenario Response and Restoration Plan

  The ShakeOut Scenario is identified as one of the triggers that would initiate the Joint Agency Emergency Response Plan.

- Conduct a second three-agency functional exercise that includes energy utilities

  Conducted a functional emergency exercise at the Robert B. Diemer Water Treatment Plant with local Sheriff and Fire Departments, SCE, City of Yorba Linda Emergency Services, Yorba Linda Water District, Orange County Emergency Management, and the Water Emergency Response of Orange County.

Other Near-Term Goals

1. Develop a Standard Approach for Evaluating Non-Structural Elements:

   Metropolitan is in the process of studying industry standards applicable to Metropolitan and collecting approaches taken by other agencies.

2. Establish Additional Performance Objectives for new pipelines, retrofit of pipelines, and new and existing tunnels:

   Metropolitan is now designing new pipelines and tunnels and retrofitting existing pipelines and tunnels in accordance with current standards and incorporating additional seismic mitigation measures wherever practicable.

3. Investigate the Potential for Developing a Model to Prioritize Pipeline Rehabilitation:

   This is being addressed through the Asset Management efforts, with input from recent seismic studies on risk from potential damage from shaking, fault rupture, and liquefaction.

4. Enhance Member Agency Planning Efforts Regarding New Facilities and Emergency Response Programs:

   The Member Agency Managers Workshop was used to present the Seismic Resilience Strategy and objectives and Seismic Task Force findings.

5. Seek Approval for Detailed Seismic Studies

   This is an ongoing effort. As Metropolitan completes the rapid evaluations of the Post-1990 structures, detailed studies will be recommended for those structures found to be potentially deficient.

6. Support the Delta Conveyance Project (part of the former proposed California WaterFix Project)

Metropolitan will continue to support the Delta Conveyance Project to increase the seismic resiliency of the Bay-Delta portion of the State Water Project.

2020 Update Near-Term Goals

The following section lists new near-term goals that will further Metropolitan's objective of seismic resilience. These goals are anticipated to be completed before the next update in 2025.

System Level Goals

Goal	Conduct Special Seismic Studies
• Update 2006 System Reliability Study, which analyzed the impacts of various single outage scenarios on Metropolitan's ability to meet member agency demand	

Goal	Conduct Planning Studies
• Complete the 2020 IRP and comprehensive distribution system study under collaborative regional process. Update the emergency storage objective based on new IRP goals and forecasts.	

Facility Level Goals

Goal	Complete Construction of Approved Projects
• Weymouth West Wash Water Tank Seismic Upgrade • Union Station Headquarters Building Seismic Upgrade • Diemer West Filter Seismic Upgrade • CRA Casa Loma Siphon Barrel No. 1 Replacement	

Goal	Complete Design of Approved Seismic Upgrade Projects
• Weymouth Administration Building Seismic Upgrade and Building Improvements • La Verne Water Quality Lab and Field Engineering Building Seismic Upgrades and Building Improvements • CRA Whitewater Tunnel No. 2 Seismic Upgrades • Lake Mathews Disaster Recovery Facility Seismic Upgrades • Upper Feeder San Gabriel Tower Seismic Upgrade • Weymouth Inlet Channel Structural Upgrades	

Goal	Seismic Upgrade of Below Ground Structures
• Initiate evaluation of below-ground structures. Identify and list all structures. Develop a prioritization system for evaluation.	

Task Force Goals

Goal	Emergency Response Plan and Exercises
• Conduct annual exercises to ensure familiarity with Joint Agency Emergency Response Plan • Semi-annual verification of emergency contact list for DWR, Metropolitan, and LADWP	

Other Near-Term Goals

- Promote to member agencies the Defense-in-Depth approach to seismic resilience as recommended in *Report 1335 – Potential Effects of Southern California Seismic Events on Metropolitan Deliveries* (January 2009).
- Continue to gain and share knowledge about seismic resilience through participation in workshops and conferences.
- Complete rapid evaluations for post-1990 above-grade structures.

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Appendix A – M6.3 or Greater Earthquakes in Southern California Region - 1900 to Present

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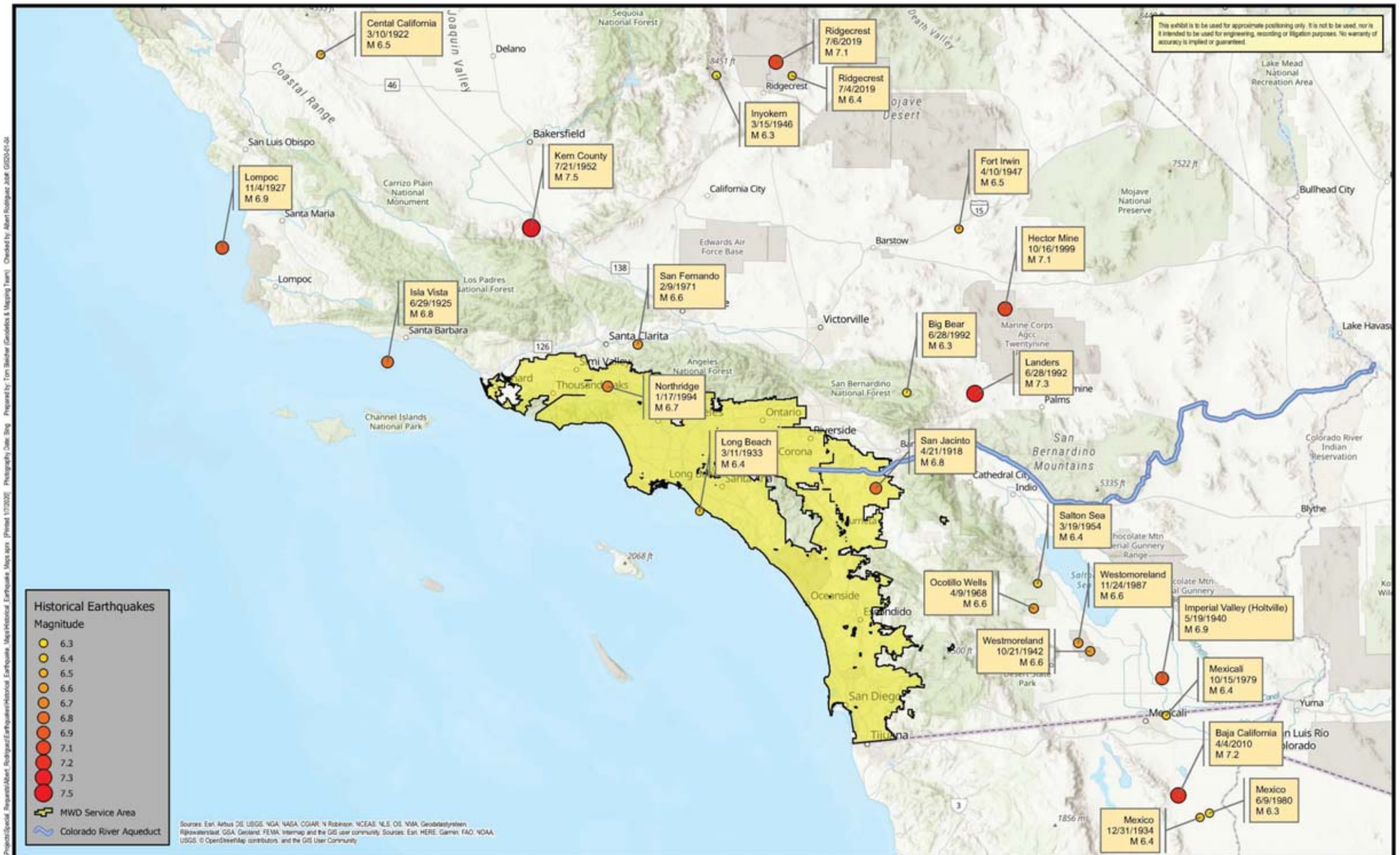

Historical Earthquakes M6.3 and Greater - 1900 to Present

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Appendix B – List of Metropolitan Staff Seismic Conference Papers

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Metropolitan Staff Papers Presented at the 11th JWWA/WRF/CTWWA Water Seismic Conference

Brainard, Andrew (2019), “Evaluation of Welded Joints in Steel Pipelines by Finite Element Modeling”, P*roceedings of the 11th JWWA/WRF/CTWWA Water Seismic Conference*, October 9-11 2019, pp. 42-53.

Beikae, Mohsen (2019), “Monte Carlo Simulation of Probabilistic Rupture Hazard Analysis for Lifelines Crossing Active Faults”, *Proceedings of the 11th JWWA/WRF/CTWWA Water Seismic Conference*, October 9-11 2019, pp. 107-119.

Chai, Winston (2019), “Seismic Rehabilitation of Upper Feeder Pipeline Santa Ana River Crossing – An Example of Metropolitan’s Seismic Upgrade Program”, *Proceedings of the 11th JWWA/WRF/CTWWA Water Seismic Conference*, October 9-11 2019, pp. 1-12.

Peng, Tao (2019), “Mitigation of Fault Displacement and Ground Subsidence for Large Diameter Pipeline”, *Proceedings of the 11th JWWA/WRF/CTWWA Water Seismic Conference*, October 9-11 2019, pp. 217-228.

Appendix 10

METROPOLITAN’S ENERGY INTENSITY INFORMATION, INCLUDING CONVEYANCE AND DISTRIBUTION GENERATION

Appendix 10
METROPOLITAN'S ENERGY INTENSITY INFORMATION

Introduction

The Metropolitan Water District of Southern California is a wholesale water agency that distributes water to its 26 member agencies. These agencies receive treated and untreated water through Metropolitan's 830 miles of interconnected pipelines. There are over 400 service connections to the 26 member agencies located throughout Metropolitan's 5,200 square mile service area.

Metropolitan has always recognized the relationship between water and energy. In addition to being one of the original contractors for power from Hoover Dam in 1937, Metropolitan also paid for half of the cost of the Parker Dam power plant. The energy Metropolitan receives from these facilities provides greenhouse gas (GHG)-free electricity for pumping along the Colorado River Aqueduct. Metropolitan's conveyance and distribution system is also designed to minimize pumping. Imported supplies flow by gravity through Metropolitan's treatment plants and distribution system to the member agencies.

Water-Related Energy Use in California

The Water-Energy Nexus (W-E Nexus) recognizes that water supplies and energy supplies are interrelated. Water supplies require energy for heating and cooling, but also for transporting, treating and disposing. Likewise, energy supplies require water for cooling, fuel extraction and processing and hydropower production.

State agencies, water districts, and other stakeholders began to study the important link between energy and water in the 2000s. Since then, it has been widely reported that California's "Water Sector" uses 19 percent of the state's electricity and 32 percent of the state's natural gas not used for power generation.

The original source for these facts is the California Energy Commission's 2005 "California's Water – Energy Relationship" report (CEC-700-2005-011-SF, Nov. 2005[1]). In the report, the CEC analyzed energy use data for 2001 and disaggregated the 19 percent into urban water supply, wastewater treatment, customer end uses, and agriculture. Based on the CEC's analysis, approximately 3 percent of California's electrical use in 2001 was associated with urban water agency conveyance, treatment, and distribution. Customer end-uses such as the heating and cooling of water represented 11.1 percent. Another 0.8 percent was attributed to wastewater treatment and 4.2 percent was associated with agricultural uses. Table A.10-1 presents the water related energy use in California adapted from the 2005 CEC report.

The 3.8 percent of electricity associated with urban water supply and wastewater treatment represent the "embedded energy" in water.

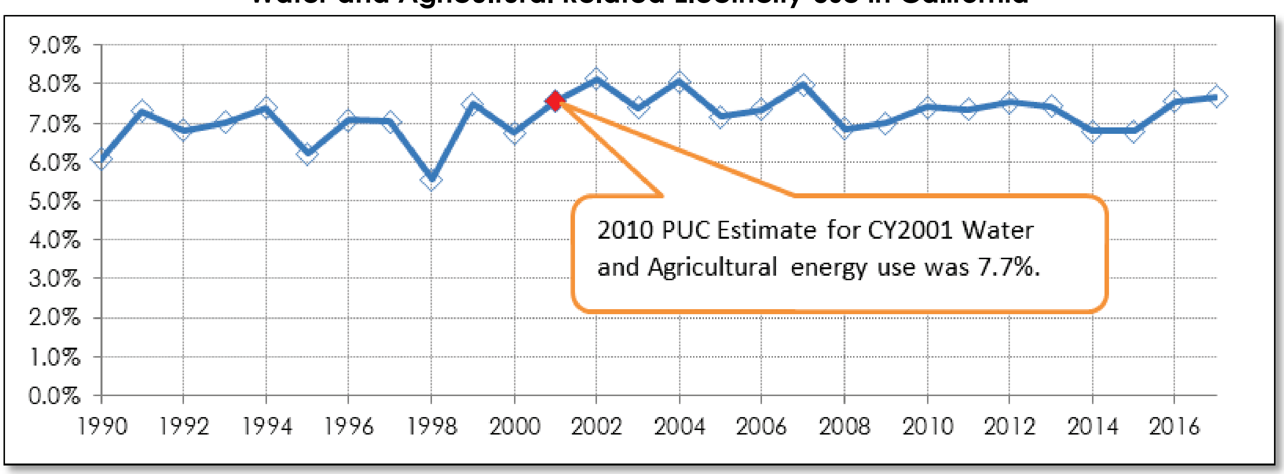
[1] https://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011.PDF

Table A.10-1
Water Related Energy Use in California[2]

	Electricity (Gigawatt-hour)	Natural Gas (Million Therms)
Urban Water Supply	**7,554**	**19**
Wastewater Treatment	2,012	27
Urban End Users	27,887	4,220
Agricultural Total	10,560	18
Total Water Sector Use	**48,013**	**4,284**
Total California Use	**250,494**	**13,571**
Urban Water Supply	**3.0%**	**0.1%**
Wastewater Treatment	0.8%	0.2%
Urban End Users	11.1%	31.1%
Agricultural Total	4.2%	0.1%
Total Water Sector Use	**19.2%**	**31.6%**

In 2010, the California Public Utilities Commission (PUC) reevaluated water-related energy use and estimated that 7.7 percent of the State's electricity was used for urban water supply, wastewater treatment, and agricultural-related pumping and treatment.[3] This is close to the CEC report estimate for those three sectors. While water-related electricity use varies from year to year, it has fluctuated between 6 percent and 8 percent over the past 30 years, as shown in Figure A.10-1.

Figure A.10-1
Water and Agricultural Related Electricity Use in California[4]



[2] "California's Water – Energy Relationship" report (CEC-700-2005-011-SF, 2005)
[3] Embedded Energy in Water Studies Study 1: Statewide and Regional Water-Energy Relationship (Public Utilities Commission, 2010, page 58)
[4] CEC: California Energy Consumption Data Base: http://ecdms.energy.ca.gov/

In response to California's GHG emission goals, Metropolitan and many other water utilities are taking steps to reduce water-related energy use and emissions. This includes increasing energy recovery in conveyance and distribution systems, developing renewable energy projects, performing energy studies, auditing facility energy usage, and other related actions. Additionally, the conservation programs administered by Metropolitan and the member agencies save embedded energy along with the energy associated with customer end uses. Section 3.8 contains a description of Metropolitan's energy sustainability initiatives and proposed Climate Action Plan.

Metropolitan's Energy Intensity

Under CWC 10631.2(a), urban water management plans "Shall include any of the following information that the urban water supplier can readily obtain:"

1. An estimate of the amount of energy used to extract or divert water supplies.
2. An estimate of the amount of energy used to convey water supplies to the water treatment plants or distribution systems.
3. An estimate of the amount of energy used to treat water supplies.
4. An estimate of the amount of energy used to distribute water supplies through its distribution systems.
5. An estimate of the amount of energy used for treated water supplies in comparison to the amount used for nontreated water supplies.
6. An estimate of the amount of energy used to place water into or withdraw from storage.
7. Any other energy-related information the urban water supplier deems appropriate.

This section provides Metropolitan's energy intensity information according to these guidelines. Due to the mixing of water supplies before and after treatment, Metropolitan's complex distribution system, and the large number of service connections, Metropolitan provides system-wide energy intensity values. As operational conditions change from month to month and year to year, Metropolitan's energy use and energy intensity also vary.

Metropolitan's operational control includes the Colorado River Aqueduct (CRA) but does not include the State Water Project (SWP). However, excluding upstream embedded energy from the SWP would not represent an accurate estimate of the energy embedded in Metropolitan's water supplies. To avoid potential misinterpretation of the data provided, this Appendix reports Metropolitan's energy intensity information <u>with</u> upstream SWP embedded energy.

Metropolitan's energy intensity for the water it provides to its member agencies is broken down into the following functions and described below:

- Source
- Conveyance
- Treatment
- Distribution
- Storage

Source

The water Metropolitan receives comes from two sources: (1) the California Department of Water Resources' (DWR) State Water Project, and (2) the Colorado River. The energy required to extract or divert water from these sources is reported in conveyance.

Conveyance

The energy requirements from the two conveyance systems supplying Metropolitan's water have been combined, along with the volume of water delivered, into a single weighted energy intensity value. This method provides an energy intensity estimate which can then be used by other water agencies and stakeholders. As the blend of water from the SWP and the Colorado River changes each year, the total energy consumption for conveyance also varies.

Metropolitan's energy intensity for conveyance also accounts for consequential and non-consequential hydropower. Consequential hydropower is hydropower produced as the sole result of a water demand or use. Non-consequential hydropower is hydropower produced as the result of some combination of water demand deliveries and releases for other purposes such as flood control. The non-consequential hydropower from Hoover Dam and the SWP's Hyatt-Thermalito Complex are discussed in the following sections.

Colorado River

Metropolitan conveys water from the Colorado River through its Colorado River Aqueduct (CRA). The water is pumped through five pumping plants to reach Metropolitan's service area. The nominal energy intensity of water conveyed through the CRA is 2,000 kWh/AF.

There are no recovery generating plants along the CRA. However, the water that Metropolitan pumps from the Colorado River has been released from Lake Mead through the Hoover Dam generators. Metropolitan receives 27.1 percent of the energy produced at Hoover. This energy is used to power the CRA pumps. The production rate (kWh/AF) at Hoover depends on several factors, including the elevation of Lake Mead. The USBR updates this value monthly. Metropolitan incorporates its share of the energy produced at Hoover in the calculation of the CRA conveyance energy requirement.

State Water Project

Metropolitan is a contractor for water from DWR's SWP. The SWP uses a combination of natural and man-made systems to move water from Lake Oroville on the Feather River in northern California, through the Sacramento/San Joaquin River Delta (Delta), and into the California Aqueduct for delivery to Southern California and other regions. DWR conveys water through the California Aqueduct using a series of pumps and hydroelectric generators. Metropolitan receives water from DWR through the West Branch of the California Aqueduct at Castaic Lake and from the East Branch of the California Aqueduct at several locations in San Bernardino and Riverside Counties.

The California Aqueduct's net energy intensity for the water received from the West Branch is 2,580 kWh/AF and for the East Branch it is 3,236 kWh/AF. These values are the nominal pumping requirements of the SWP pumps (Banks, Dos Amigos, Buena Vista, Teerink, Chrisman, Edmonston, Oso, and Pearblossom) less the nominal generation values from the West and East Branch recovery generating plants (Warne, Castaic, Alamo, Mojave, and Devil Canyon). These values exclude pumping and generating at the San Luis Gianelli Plant.

The SWP also produces power at its Hyatt-Thermalito complex (HTC) near Lake Oroville and the Feather River in northern California. DWR releases water from Lake Oroville which flows through the HTC hydro generators and produces power for the SWP. State Water Project Contractors, including Metropolitan, pay for the HTC based on their share of the SWP's Variable Operation, Maintenance, Power and Replacement (OMP&R) Component of the Transportation Charge. To determine the benefit Metropolitan receives from the HTC generation in calculating the Energy Intensity of SWP conveyance, this same OMP&R share (percentage) is used with the total generation from the HTC. From 2004 through 2018, Metropolitan's share of the HTC costs has ranged from 60.2 percent to 74.3 percent. A multi-year average percentage has been used to reduce the year-to-year volatility of this factor and calculate the non-consequential energy included in Metropolitan's conveyance energy intensity. Table A.10-2 presents the 2018 conveyance energy intensity with upstream SWP embedded energy.

The SWP contract has specific provisions on how and when to account for various water deliveries and the associated costs. This will result in differences between the SWP billing values and the amount of water delivered to Metropolitan from the SWP.

Table A.10-2
2018 Conveyance Energy Intensity with Upstream SWP Embedded Energy

	With SWP Embedded Energy
Net Energy Use (kWh)*	3,050,621,000
Water Conveyed (AF)	1,588,958
Energy Intensity (kWh/AF)	1,919.9

* Accounts for non-consequential hydropower generation of 94,161,800 kWh from Hoover Dam on the Colorado River and 861,900,000 kWh from the Hyatt-Thermalito Complex on the State Water Project.

Treatment

Metropolitan operates five treatment plants to provide potable water to its Member Agencies. The estimated amount of energy used to treat water supplies has been calculated by dividing the annual amount of energy consumed at the plant sites by the amount of water treated. In order to meet water quality regulations, Metropolitan has retrofitted its treatment plants to use ozone, rather than chlorine, as the primary disinfectant during treatment (chlorine and ammonia are added after filtration for a disinfection residual in the distribution system). Metropolitan generates ozone on-site at each treatment plant. The ozone generation process has increased the energy required for treating Metropolitan's supplies. Table A.10-3 presents the treatment energy intensity for 2018.

Table A.10-3
2018 Treatment Energy Intensity

	2018
Energy Use (kWh)	53,608,000
Water Treated (AF)	769,398
Energy Intensity (kWh/AF)	69.7

Metropolitan has also installed solar energy at three of its treatment plants with a combined capacity of five megawatts. The electricity generated by these facilities meets between 15 percent and 20 percent of the energy demands of those plants. Solar energy is added to the grid power used at each plant to estimate a total energy intensity value. In 2018, Metropolitan generated 10,409,000 kWh of solar energy from these facilities, reducing the electricity purchased from the grid and its associated GHG emissions.

Distribution

Due to the high elevations at which Metropolitan receives water from the SWP and CRA conveyance facilities, minimal pumping (and electricity use) is needed to distribute treated and untreated water to its Member Agencies. Gravity, not electricity, drives water supply deliveries through most of Metropolitan's distribution system.

In addition, Metropolitan has 16 recovery hydroelectric generating plants located throughout its distribution system. The generators produce electricity from the water flowing through the pipelines. These plants generate more power than is consumed from distribution pumping. Without the hydroelectric generators, embedded energy in the water would be reduced at facilities called pressure control structures and the potential for energy production would be lost. The energy used in the pumping plants and produced by the generators has been netted, with the result divided by water deliveries to calculate the distribution energy intensity.

Weather variation has a significant impact on distribution system energy intensity. In dry years with low SWP deliveries, Metropolitan generates less distribution system hydropower and may need to increase pumping to deliver CRA supplies throughout the region. Table A.10-4 presents the distribution system net energy intensity for 2018.

Table A.10-4
2018 Distribution System Net Energy Intensity

	2018
Pumping (kWh)	4,753,000
Hydropower Generation (kWh)	-239,699,000
Net Distribution Energy Use (kWh)	-234,946,000
Water Delivered (AF)	1,540,022
Energy Intensity (kWh/AF)	-152.6

Storage

Metropolitan maintains significant storage facilities and programs both inside and outside its service area. However, Metropolitan does not use any energy for storage programs under its "span of control." Water is delivered by gravity flow. External water storage and recovery are managed by other parties and are often transacted through exchange arrangements. Water delivered to Metropolitan from these storage programs is accounted for in conveyance energy intensity.

Metropolitan's Annual Energy and Energy Intensity

Energy and energy intensity information is provided for each of the non-zero processes listed above: Conveyance; Treatment; and Distribution. As noted previously, these values vary from year to year due to operational changes and differences in water supply availability. An estimated overall energy intensity is provided for untreated and treated water deliveries for 2018 and for a six-year average in the tables below. Both estimates account for non-consequential hydropower. Table A.10-5 presents the treated and untreated water energy intensity for year 2018. Table A.10-6 presents the average treated and untreated water energy intensity for 2013 through 2018. Figure A.10-2 shows Metropolitan's energy use for 2013 through 2018 and highlights the impacts of hydrological conditions on Metropolitan's energy use.

Table A.10-5
2018 Treated and Untreated Water Energy Intensity

	With SWP (kWh/AF)
Conveyance*	1,919.9
Treatment	69.7
Distribution	-152.6
Total Treated	1,837.0
Total Untreated	1,767.3

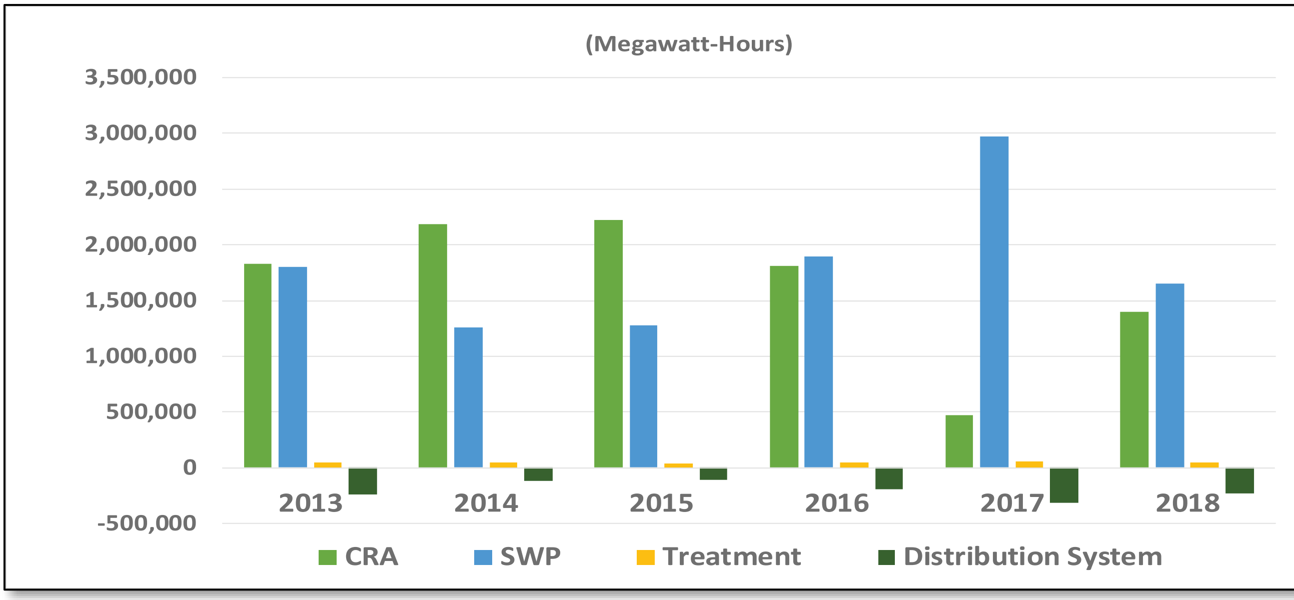
*Accounts for hydropower generation from Hoover and Hyatt/Thermalito

Table A.10-6
Average Treated and Untreated Water Energy Intensity (2013 – 2018)

	With SWP (kWh/AF)
Conveyance*	1,928.0
Treatment	57.0
Distribution	-121.9
Total Treated	1,863.0
Total Untreated	1,806.0

*Accounts for hydropower generation from Hoover and Hyatt/Thermalito

Figure A.10-2
Variations in Metropolitan Energy Use (2013-2018)



Greenhouse Gas Emissions

Metropolitan voluntarily reports its GHG emissions from all sources to The Climate Registry (TCR). TCR implements a GHG registry for California entities and develops protocols for GHG reporting. The data provided in TCR's registry is publicly accessible and transparent. Metropolitan's annual GHG data and those for many other water agencies are available through TCR's CRIS website[5]. To guarantee data quality, TCR requires published GHG information to be audited by a certified verification expert. Metropolitan has been auditing and reporting its annual GHG emissions to TCR since 2005.

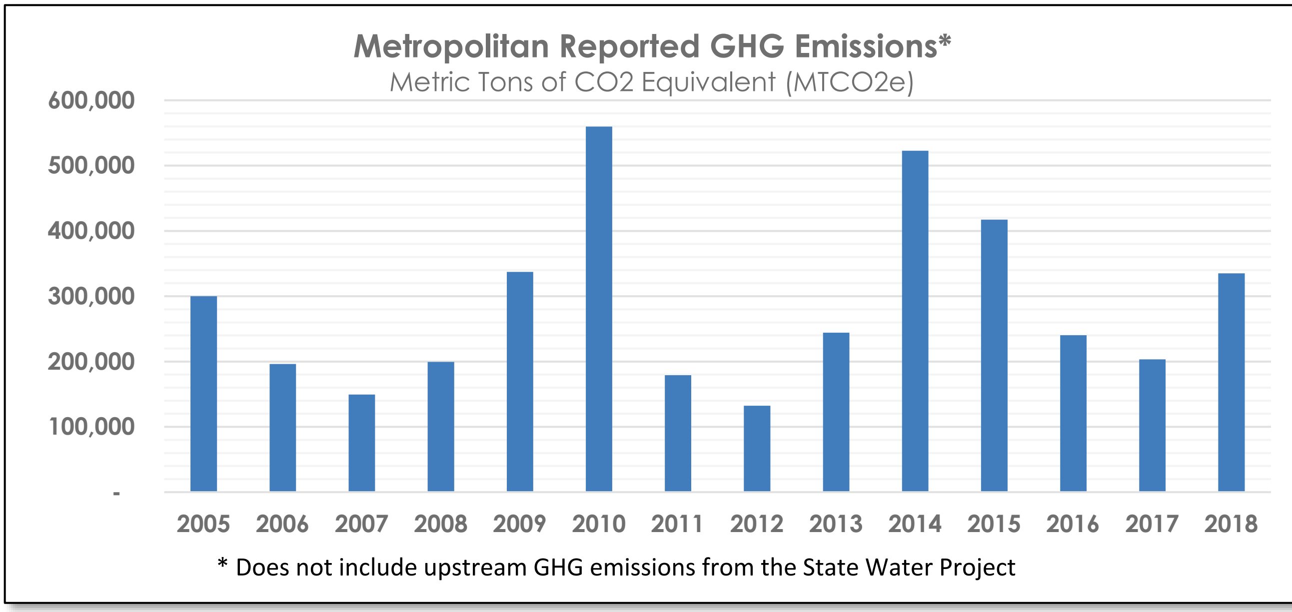
As with energy intensity, Metropolitan's GHG emissions vary due to hydrology. Over 95 percent of Metropolitan's GHG emissions are derived from electricity use, primarily from the CRA. In dry years, Metropolitan purchases additional grid electricity to accommodate higher CRA deliveries and uses more energy for distribution system pumping. The combination of higher electricity use coupled with higher GHG emission factors for purchased electricity cause Metropolitan's GHG emissions to spike in dry years. The opposite is true in wet years. Lower CRA deliveries are met with zero-carbon electricity from Hoover and Parker dams. In recent years, Metropolitan's GHG emissions have swung from 522,600 tons of CO2e emitted during the record low SWP allocation year in 2014 to 203,400 tons of CO2e emitted during the record wet year in 2017. Metropolitan's 10-year average of 317,100 tons of CO2e includes two dry-year/wet-year cycles.

[5] The Climate Registry CRIS GHG Database: https://www.theclimateregistry.org/tools-resources/reporting-toolkit/cris-resources/

Unlike Metropolitan's embedded energy described above, Metropolitan's reported GHG emissions do not include upstream SWP emissions. Metropolitan is participating in TCR's new Water-Energy Nexus GHG Registry and will be able to provide additional GHG metrics in the future.

The California Air Resources Board (CARB) tracks state-wide GHG emissions from all sources on an annual basis[6]. Compared to CARB's GHG inventory, Metropolitan's CO2e emissions represented 0.12 percent of the state's total emissions in 2014 and 0.05 percent in 2017. Additional information on Metropolitan's GHG emissions and Climate Action Plan are contained Section 3.8. Figure A.10-3 presents Metropolitan GHG emissions for 2005 through 2018.

Figure A.10-3
Metropolitan GHG emissions



DWR Required Water-Energy Nexus Table: Process Approach

Table A.10-7 contains Metropolitan's required Water-Energy Table for CY2018 using the Water Supply Process Approach in Table O-1A.

The table shows Metropolitan's energy intensity with upstream SWP embedded energy and non-consequential generation included.

Note that Metropolitan uses an alternative approach for calculating total or system-wide kWh/AF. Metropolitan's approach adds the energy intensity of the individual components to derive a system-wide total, where the required table divides the total net energy use by total deliveries. As a result, the system-wide kWh/AF total described in Table A.10-6 varies slightly from DWR's required Table A.10-7. Metropolitan also incorporates non-consequential hydropower production in its energy intensity calculations.

[6] https://ww2.arb.ca.gov/ghg-inventory-data; California's GHG emissions were 444.7 million tons of CO2e in 2014 and 424.1 million tons of CO2e in 2017, the latest year available.

Table A.10-7 (Table O-1A for Year 2018): Water Supply Process Approach Including Upstream State Water Project Energy Use

Urban Water Supplier: ***Metropolitan Water District of Southern California***

Water Delivery Product (If delivering more than one type of product use Table O-1C)

Wholesale Potable Deliveries

Table O-1A: Recommended Energy Intensity - Water Supply Process Approach

Enter Start Date for Reporting Period: 1/1/18

End Date: 12/31/18

☑ Is upstream embedded in the values reported?

	Water Volume Units Used	Extract and Divert	Place into Storage	Conveyance	Treatment	Distribution	Total Utility	Hydropower	Net Utility
		Urban Water Supplier Operational Control							
		Water Management Process						**Non-Consequential Hydropower (if applicable)** See Narrative Below	
Volume of Water Entering Process	acre feet	0	0	1,588,958	769,398	1,540,022	1,540,022	0	1,540,022
Energy Consumed (kWh)	N/A	0	0	3,050,621,051	53,607,943	-234,945,839	2,869,283,155		2,869,283,155
Energy Intensity (kWh/vol.)	N/A	**0.0**	**0.0**	**1919.9**	**69.7**	**-152.6**	**1863.1**	**0.0**	**1863.1**
				MWD method: process additive			**1837.0**		

Quantity of Self-Generated Renewable Energy

10,409,000 kWh

Data Quality *(Estimate, Metered Data, Combination of Estimates and Metered Data)*

Combination of Estimates and Metered Data

Data Quality Narrative:

Assumes Colorado river energy intensity at 2,000 kWh/AF; SWP East Branch at 3,236, and SWP West Branch at 2,580.
Energy use for the treatment and distribution processes are metered. Non-consequential hyrdopower is calculated from metered data.
Detailed descriptions of the methodology are contained in the appendix.

Narrative:

This table incorporates upstream State Water Project conveyance deliveries, energy use, consequential and non-consequential energy generation from Hoover Dam and the SWP Hyatt-Thermalito Complex.
Including upstream SWP imbedded energy represents the applicable energy intensity of Metropolitan's water supplies as delivered to its Member Agencies.

Metropolitan uses an alternative method for calculating overall energy intensity by adding the processes to derive a total utility value as described above.
Using Metropolitan's additive methodology, the total utility energy intensity for treated water would be 1,837 kWh / AF instead of 1,863 kWh / AF in the table above

Total non-consequential hydropower included in 2018 conveyance: 956,021,000 kWh
- Hoover Dam non-consequential hydropower: 94,162,000 kWh
- Hyatt-Thermalito non-consequential hydropower: 861,859,000 kWh

Metropolitan delivers both treated and untreated water to its member agencies.

Glossary

Water-Energy Nexus: The recognition of the link between water supplies and energy supplies

Energy Intensity: A measure of the energy required to deliver, or process water expressed in kilowatt hours per acre-foot (kWh/AF)

Embedded Energy: The amount of energy required to deliver water supplies from a source to a delivery point. Also expressed in kilowatt hours per acre-foot (kWh/AF).

Greenhouse Gas Intensity: a measure of the overall greenhouse gasses required to deliver or process water, expressed in GHG/AF.

Hydropower: Renewable energy produced by water powering a turbine to produce electricity.

Water Sector: The water sector in the W-E Nexus is broadly defined to include customer end-uses of water such as heating or cooling; pumping and treating urban and agricultural water supplies; and wastewater disposal.

Consequential Hydropower: Hydropower produced as the sole result of a water demand or use. An example would be a hydropower recovery plant on an aqueduct that generates power as demands dictate flows in the aqueduct.

Non-consequential Hydropower: Hydropower produced as the result of some combination of water demand and other requirements such as flood releases or environmental flows.

The Climate Registry: A California non-profit organization tasked with managing a voluntary GHG registry for the State as well as implementing a voluntary GHG registry specifically for water-related GHG emissions.

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Appendix 11

QUANTIFYING REGIONAL SELF-RELIANCE AND REDUCED RELIANCE ON WATER SUPPLIES FROM THE DELTA WATERSHED

Appendix 11
METROPOLITAN'S
REDUCED DELTA RELIANCE REPORTING

A.11.1 Background

Under the Sacramento-San Joaquin Delta Reform Act of 2009, state and local public agencies proposing a covered action in the Delta,[1] prior to initiating the implementation of that action, must prepare a written certification of consistency with detailed findings as to whether the covered action is consistent with applicable Delta Plan policies and submit that certification to the Delta Stewardship Council.[2] Anyone may appeal a certification of consistency, and if the Delta Stewardship Council grants the appeal, the covered action may not be implemented until the agency proposing the covered action submits a revised certification of consistency, and either no appeal is filed, or the Delta Stewardship Council denies the subsequent appeal.[3]

An urban water supplier that anticipates participating in or receiving water from a proposed covered action such as a multi-year water transfer, conveyance facility, or new diversion that involves transferring water through, exporting water from, or using water in the Delta should provide information in their 2015 and 2020 Urban Water Management Plans (UWMPs) that can then be used in the covered action process to demonstrate consistency with Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (WR P1).[4]

WR P1 details what is needed for a covered action to demonstrate consistency with reduced reliance on the Delta and improved regional self-reliance. WR P1 subsection (a) states that:

(a) Water shall not be exported from, transferred through, or used in the Delta if all of the following apply:

> *(1) One or more water suppliers that would receive water as a result of the export, transfer, or use have failed to adequately contribute to reduced reliance on the Delta and improved regional self-reliance consistent with all of the requirements listed in paragraph (1) of subsection (c);*
>
> *(2) That failure has significantly caused the need for the export, transfer, or use; and*
>
> *(3) The export, transfer, or use would have a significant adverse environmental impact in the Delta.*

WR P1 subsection (c)(1) further defines what adequately contributing to reduced reliance on the Delta means in terms of (a)(1) above.

(c)(1) Water suppliers that have done all the following are contributing to reduced reliance on the Delta and improved regional self-reliance and are therefore consistent with this policy:

> *(A) Completed a current Urban or Agricultural Water Management Plan (Plan) which has been reviewed by the California Department of Water Resources for compliance with the applicable requirements of Water Code Division 6, Parts 2.55, 2.6, and 2.8;*

---

[1] Water Code, § 85057.5; Cal. Code Regs. tit. 23, § 5001.
[2] Water Code, § 85225; Delta Plan, App. D.
[3] Water Code, §§ 85225.10-85225.25; Delta Plan, App. D.
[4] Cal. Code Regs., tit. 23, § 5003.

(B) Identified, evaluated, and commenced implementation, consistent with the implementation schedule set forth in the Plan, of all programs and projects included in the Plan that are locally cost effective and technically feasible which reduce reliance on the Delta; and

(C) Included in the Plan, commencing in 2015, the expected outcome for measurable reduction in Delta reliance and improvement in regional self-reliance. The expected outcome for measurable reduction in Delta reliance and improvement in regional self-reliance shall be reported in the Plan as the reduction in the amount of water used, or in the percentage of water used, from the Delta watershed. For the purposes of reporting, water efficiency is considered a new source of water supply, consistent with Water Code Section 1011(a).

The analysis and documentation provided below include all of the elements described in WR P1(c)(1) that need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action.

A.11.2 Summary of Expected Outcomes for Reduced Reliance on the Delta

As stated in WR P1(c)(1)(C), the policy requires that, commencing in 2015, UWMPs include expected outcomes for measurable reduction in Delta reliance and improved regional self-reliance. WR P1 further states that those outcomes shall be reported in the UWMP as the reduction in the amount of water used, or in the percentage of water used, from the Delta.

The expected outcomes for Metropolitan's Delta reliance and regional self-reliance were developed using the approach and guidance described in Appendix C of DWR's Urban Water Management Plan Guidebook 2020 (Guidebook Appendix C) issued in March 2021.

The data used in this analysis represent the total regional efforts of Metropolitan and its member agencies and their customers (many of them, retail agencies) and were developed in conjunction with Metropolitan's member agencies as part of the UWMP coordination process as described in Section 5 of Metropolitan's UWMP. In accordance with UMWP requirements, Metropolitan's member agencies and their customers (many of them, retail agencies) also report demands and supplies for their service areas in their respective UWMPs. The data reported by those agencies are not additive to the regional totals shown in Metropolitan's UWMP; rather, their reporting represents subtotals of the regional total and should be considered as such for the purposes of determining reduced reliance on the Delta.

While the demands that Metropolitan's member agencies and their customers report in their UWMPs are a good reflection of the demands in their respective service areas, they do not adequately represent each water supplier's contributions to reduced reliance on the Delta. In order to calculate and report their reliance on water supplies from the Delta watershed, water suppliers that receive water from the Delta through other regional or wholesale water suppliers would need to determine the amount of Delta water that they receive from the regional or wholesale supplier. Two specific pieces of information are needed to accomplish this: first is the quantity of demands on the regional or wholesale water supplier that accurately reflect a supplier's contributions to reduced reliance on the Delta, and second is the quantity of a supplier's demands on the regional or wholesale water supplier that are met by supplies from the Delta watershed.

For water suppliers that make investments in regional projects or programs it may be infeasible to quantify their demands on the regional or wholesale water supplier in a way that accurately reflects their individual contributions to reduced reliance on the Delta. Due to the extensive, long-standing and successful implementation of regional demand management and local resource incentive programs in Metropolitan's service area, this infeasibility holds true for Metropolitan's members as well their customers. For Metropolitan's service area, reduced reliance on supplies from the Delta watershed can only be accurately accounted at the regional level, as is demonstrated in this analysis.

The following provides a summary of the near-term (2025) and long-term (2045) expected outcomes for Metropolitan's Delta reliance and regional self-reliance. The results show that as a region, Metropolitan and its members as well as their customers are measurably reducing reliance on the Delta and improving regional self-reliance, both as an amount of water used and as a percentage of water used.

Expected Outcomes for Regional Self-Reliance

- Near-term (2025) – Normal water year regional self-reliance is expected to increase by 813 TAF from the 2010 baseline; this represents an increase of almost 25 percent of 2025 normal water year retail demands (Table A.11-2).
- Long-term (2045) – Normal water year regional self-reliance is expected to increase by more than 1.28 MAF from the 2010 baseline, this represents an increase of more than 25 percent of 2045 normal water year retail demands (Table A.11-2).

Expected Outcomes for Reduced Reliance on Supplies from the Delta Watershed

- Near-term (2025) – Normal water year reliance on supplies from the Delta watershed decreased by 301 TAF from the 2010 baseline, this represents a decrease of 3 percent of 2025 normal water year retail demands (Table A.11-3).
- Long-term (2045) – Normal water year reliance on supplies from the Delta watershed decreased by 314 TAF from the 2010 baseline, this represents a decrease of just over 5 percent of 2045 normal water year retail demands (Table A.11-3).

A11.3 Demonstration of Reduced Reliance on the Delta

The methodology used to determine Metropolitan's reduced Delta reliance and improved regional self-reliance is consistent with the approach detailed in DWR's UWMP Guidebook Appendix C, including the use of narrative justifications for the accounting of supplies and the documentation of specific data sources. Some of the key assumptions underlying Metropolitan's demonstration of reduced reliance include:

- All data were obtained from the current 2020 UWMP or previously adopted UWMPs and represent average or normal water year conditions.
- All analyses were conducted at the service area level, and all data reflect the total contributions of Metropolitan and its members as well as their customers.
- No projects or programs that are described in the UWMPs as "Projects Under Development" were included in the accounting of supplies.

Baseline and Expected Outcomes

In order to calculate the expected outcomes for measurable reduction in Delta reliance and improved regional self-reliance, a baseline is needed to compare against. This analysis uses a normal water year representation of 2010 as the baseline, which is consistent with the approach described in the Guidebook Appendix C. Data for the 2010 baseline were taken from Metropolitan's 2005 UWMP as the UWMPs generally do not provide normal water year data for the year that they are adopted (i.e., 2005 UWMP forecasts begin in 2010, 2010 UWMP forecasts begin in 2015, and so on).

Consistent with the 2010 baseline data approach, the expected outcomes for reduced Delta reliance and improved regional self-reliance for 2015 and 2020 were taken from Metropolitan's 2010 and 2015 UWMPs respectively. Expected outcomes for 2025-2045 are from the current 2020 UWMP. Documentation of the specific data sources and assumptions are included in the discussions below.

Service Area Demands without Water Use Efficiency

In alignment with the Guidebook Appendix C, this analysis uses normal water year demands, rather than normal water year supplies to calculate expected outcomes in terms of the percentage of water used. Using normal water year demands serves as a proxy for the amount of supplies that would be used in a normal water year, which helps alleviate issues associated with how supply capability is presented to fulfill requirements of the Act versus how supplies might be accounted for to demonstrate consistency with WR P1.

Because WR P1 considers water use efficiency savings a source of water supply, water suppliers such as Metropolitan that explicitly calculate and report water use efficiency savings in their UWMP will need to make an adjustment to properly reflect normal water year demands in the calculation of reduced reliance. As explained in the Guidebook Appendix C, water use efficiency savings must be added back to the normal year demands to represent demands without water use efficiency savings accounted for; otherwise the effect of water use efficiency savings on regional self-reliance would be overestimated. Table A.11-1 shows the results of this adjustment for Metropolitan. Supporting narratives and documentation for all of the data shown in Table A.11-1 are provided below.

Table A.11-1
Demands without Water Use Efficiency Accounted For

Total Service Area Water Demands (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Service Area Demands with Water Use Efficiency Accounted For	4,628,000	4,563,000	4,163,000	3,763,000	3,821,000	3,893,000	3,936,000	3,985,000
Reported Water Use Efficiency	865,000	936,000	1,056,000	1,162,000	1,211,000	1,263,000	1,325,000	1,389,000
Service Area Demands without Water Use Efficiency Accounted For	**5,493,000**	**5,499,000**	**5,219,000**	**4,925,000**	**5,032,000**	**5,156,000**	**5,261,000**	**5,374,000**

Service Area Demands without Water Use Efficiency

The service area demands shown in Table A.11-1 represent the total retail water demands for Metropolitan's service area and include municipal and industrial demands, agricultural demands, seawater barrier demands, and storage replenishment demands. These demand types and the modeling methodologies used to calculate them are described in Section 2.2 and Appendix 1 of Metropolitan's UWMP.

Water Use Efficiency

The water use efficiency numbers shown in Table A.11-1 represent the total water use efficiency savings (conservation) for Metropolitan's region, including savings from active, code-based, price-effect and pre-1990 sources. These sources of water use efficiency and the methodologies used to calculate them are described in Section 2.2, Section 3.4, Section 3.7 and Appendix 1 of Metropolitan's UWMP.

The demand and water use efficiency data shown in Table A.11-1 were collected from the following sources:

- Baseline (2010) values – Metropolitan's 2005 UWMP, Table 2-6: Metropolitan Regional Water Demand Average Year
- 2015 values – Metropolitan's 2010 UWMP, Table 2-8: Metropolitan Regional Water Demands Average Year
- 2020 values – Metropolitan's 2015 UWMP, Table 2-3: Metropolitan Regional Water Demands Average Year
- 2025-2045 values – Metropolitan's 2020 UWMP, Table 2-3: Metropolitan Regional Water Demands Normal Water Year

Supplies Contributing to Regional Self-Reliance

For a covered action to demonstrate consistency with the Delta Plan, WR P1 subsection (c)(1)(C) states that water suppliers must report the expected outcomes for measurable improvement in regional self-reliance. Table A.11-2 shows expected outcomes for supplies contributing to regional self-reliance both in amount and as a percentage. The numbers shown in Table A.11-2 represent efforts to improve regional self-reliance for Metropolitan's entire service area and include the total contributions of Metropolitan and its members as well as their customers. Supporting narratives and documentation for the all of the data shown in Table A.11-2 are provided below.

The results shown in Table A.11-2 demonstrate that Metropolitan's service area is measurably improving its regional self-reliance. In the near-term (2025), the expected outcome for normal water year regional self-reliance increases by 747 TAF from the 2010 baseline; this represents an increase of about 23 percent of 2025 normal water year retail demands. In the long-term (2045), normal water year regional self-reliance is expected to increase by more than 1.2 MAF from the 2010 baseline; this represents an increase of 25 percent of 2045 normal water year retail demands.

Table A.11-2
Supplies Contributing to Regional Self-Reliance

Water Supplies Contributing to Regional Self-Reliance (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Water Use Efficiency	865,000	936,000	1,056,000	1,162,000	1,211,000	1,263,000	1,325,000	1,389,000
Water Recycling	316,000	348,000	436,000	550,000	613,000	687,000	698,000	706,000
Stormwater Capture and Use	100,000	103,000	110,000	80,000	82,000	82,000	82,000	82,000
Advanced Water Technologies	111,000	101,000	194,000	194,000	208,000	209,000	209,000	210,000
Conjunctive Use Projects	1,416,000	1,429,000	1,303,000	1,255,000	1,273,000	1,296,000	1,311,000	1,326,000
Local and Regional Water Supply and Storage Projects	252,000	224,000	261,000	257,000	257,000	258,000	258,000	258,000
Other Programs and Projects that Contribute to Regional Self-Reliance	875,000	1,250,000	1,200,000	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Water Supplies Contributing to Regional Self-Reliance	**3,935,000**	**4,391,000**	**4,560,000**	**4,748,000**	**4,894,000**	**5,045,000**	**5,133,000**	**5,221,000**

Service Area Demands without Water Use Efficiency (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Service Area Demands without Water Use Efficiency Accounted For	5,493,000	5,499,000	5,219,000	4,925,000	5,032,000	5,156,000	5,261,000	5,374,000

Change in Regional Self Reliance (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Water Supplies Contributing to Regional Self-Reliance	3,935,000	4,391,000	4,560,000	4,748,000	4,894,000	5,045,000	5,133,000	5,221,000
Change in Supplies Contributing to Regional Self-Reliance	**NA**	**456,000**	**625,000**	**813,000**	**959,000**	**1,110,000**	**1,198,000**	**1,286,000**

Percent Change in Regional Self Reliance (As Percent of Demand w/out WUE)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Percent of Supplies Contributing to Regional Self-Reliance	71.6%	79.9%	87.4%	96.4%	97.3%	97.8%	97.6%	97.2%
Change in Percent of Supplies Contributing to Regional Self-Reliance	**NA**	**8.2%**	**15.7%**	**24.8%**	**25.6%**	**26.2%**	**25.9%**	**25.5%**

Water Use Efficiency

The water use efficiency information shown in Table A.11-2 is taken directly from Table A.11-1 above.

Water Recycling

The water recycling values shown in Table A.11-2 reflect the total recycled water production in Metropolitan's service area as described in Section 3.5 and Appendix 2 of Metropolitan's UWMP.

Stormwater Capture and Use

The stormwater capture and use data shown in Table A.11-2 include supplies from local surface water production as described in Section 1.4 and Appendix 2 of Metropolitan's UWMP.

These values do not include production from regional storage reservoirs; storage in these reservoirs is comprised of previously stored water from sources already reflected in Tables A.11-2 and A.11-3. These regional storage resources are generally used to provide additional regional self-reliance in dry years, which is not reflected in this normal water year analysis. The regional storage reservoirs and their yields are described in Section 3.6, Appendix 2 and Appendix 3 of Metropolitan's UWMP.

The stormwater capture and use values shown in Table A.11-2 also do not include stormwater capture that is used to recharge local groundwater basins. Stormwater capture for groundwater recharge supports production of groundwater in the region, and for the purposes of this analysis that production is already captured in Table A.11-2 under conjunctive use projects.

Advanced Water Technologies

The advanced water technologies data shown in Table A.11-2 include total groundwater recovery and seawater desalination production in Metropolitan's service area as described in Section 3.5 and Appendix 2 of Metropolitan's UWMP.

Conjunctive Use Projects

The values for conjunctive use projects shown in Table A.11-2 represent total groundwater production in the region as described in Section 1.4 and Appendix 2 of Metropolitan's UWMP.

The conjunctive use projects numbers shown in Table A.11-2 do not include production from regional groundwater conjunctive use programs. As described in the stormwater capture and use discussion above, these regional storage programs rely on previously stored water from sources already reflected in Tables A.11-2 and A.11-3 and are generally used to provide additional regional self-reliance in dry-years. The regional groundwater conjunctive use programs and their yields are described in Section 3.6 and Appendix 3.

Local and Regional Water Supply and Storage Programs

The data for local and regional water supply and storage programs shown in Table A.11-2 include supplies from the Los Angeles Aqueduct. This supply is described in Section 1.4 and Appendix 2 of Metropolitan's UWMP.

The local and regional supply numbers shown in Table A.11-2, except for "Other Programs and Projects that Contribute to Regional Self-Reliance" which is discussed below, were obtained from the following sources:

- Baseline (2010) values – Metropolitan's 2005 UWMP, Table 2-6: Metropolitan Regional Water Demand Average Year

- 2015 values – Metropolitan's 2010 UWMP, Table 2-8: Metropolitan Regional Water Demands Average Year
- 2020 values – Metropolitan's 2015 UWMP, Table 2-3: Metropolitan Regional Water Demands Average Year
- 2025-2045 values – Metropolitan's 2020 UWMP, Table 2-3: Metropolitan Regional Water Demands Normal Water Year

Other Programs and Projects that Contribute to Regional Self-Reliance

Other programs and projects that contribute to regional self-reliance shown in Table A.11-2 include current programs from the Colorado River Aqueduct. Colorado River supplies include Metropolitan's basic Colorado River apportionment, as well as supplies that result from existing and committed programs, including those from the IID-MWD Conservation Program, the implementation of the Quantification Settlement Agreement (QSA), related agreements, and the exchange agreement with SDCWA. Colorado River Aqueduct supplies and programs are described in Section 3.1 and Appendix 3 of Metropolitan's UWMP.

The values shown in Table A.11-2 for other programs and projects that contribute to regional self-reliance come from the following sources:

- Baseline (2010) values – Metropolitan's 2005 UWMP, Table A.3-7: Maximum Expected Colorado River Aqueduct Deliveries Year 2010 (Average Year)
- 2015 values – Metropolitan's 2010 UWMP, Table A.3-7: Maximum Expected Colorado River Aqueduct Deliveries Year 2015 (Average Year)
- 2020 values – Metropolitan's 2015 UWMP, Table A.3-7: Maximum Expected Colorado River Aqueduct Deliveries Year 2020 (Average Year)
- 2025-2045 values – Metropolitan's 2020 UWMP, Table A.3-7: Maximum Expected Colorado River Aqueduct Deliveries Years 2025, 2030, 2035, 2040, 2045 (Normal Water Year)

Reliance on Water Supplies from the Delta Watershed

In order for a covered action to demonstrate consistency with the Delta Plan, WR P1 subsection (c)(1)(C) requires that water suppliers report the expected outcomes for measurable reductions in supplies from the Delta watershed either as an amount or as a percentage. This analysis provides both calculations. Based on the methodology described in Guidebook Appendix C, and consistent with the approach of this analysis in not including projects under development, this accounting does not include any supplies from potential future covered actions. Table A.11-3 shows the expected outcomes for reliance on supplies from the Delta watershed for Metropolitan's service area. Supporting narratives and documentation for the all of the data shown in Table A.11-3 are provided below.

The results shown in Table A.11-3 demonstrate that Metropolitan's service area is measurably reducing its Delta reliance. In the near-term (2025), the expected outcome for normal water year reliance on supplies from the Delta watershed decreased by 301 TAF from the 2010 baseline; this represents a decrease of 3 percent of 2025 normal water year retail demands. In the long-term (2045), normal water year reliance on supplies from the Delta watershed decreased by 314 TAF from the 2010 baseline; this represents a decrease of just over 5 percent of 2045 normal water year retail demands.

Table A.11-3
Reliance on Water Supplies from the Delta Watershed

Water Supplies from the Delta Watershed (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
CVP/SWP Contract Supplies	1,472,000	1,029,000	984,000	1,133,000	1,130,000	1,128,000	1,126,000	1,126,000
Delta/Delta Tributary Diversions	-	-	-	-	-	-	-	-
Transfers and Exchanges of Supplies from the Delta Watershed	20,000	44,000	91,000	58,000	52,000	52,000	52,000	52,000
Other Water Supplies from the Delta Watershed	-	-	-	-	-	-	-	-
Total Water Supplies from the Delta Watershed	**1,492,000**	**1,073,000**	**1,075,000**	**1,191,000**	**1,182,000**	**1,180,000**	**1,178,000**	**1,178,000**

Service Area Demands without Water Use Efficiency (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Service Area Demands without Water Use Efficiency Accounted For	5,493,000	5,499,000	5,219,000	4,925,000	5,032,000	5,156,000	5,261,000	5,374,000

Change in Supplies from the Delta Watershed (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Water Supplies from the Delta Watershed	1,492,000	1,073,000	1,075,000	1,191,000	1,182,000	1,180,000	1,178,000	1,178,000
Change in Supplies from the Delta Watershed	**NA**	**(419,000)**	**(417,000)**	**(301,000)**	**(310,000)**	**(312,000)**	**(314,000)**	**(314,000)**

Percent Change in Supplies from the Delta Watershed (As a Percent of Demand w/out WUE)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045
Percent of Supplies from the Delta Watershed	27.2%	19.5%	20.6%	24.2%	23.5%	22.9%	22.4%	21.9%
Change in Percent of Supplies from the Delta Watershed	**NA**	**-7.6%**	**-6.6%**	**-3.0%**	**-3.7%**	**-4.3%**	**-4.8%**	**-5.2%**

CVP/SWP Contract Supplies

The CVP/SWP contract supplies shown in Table A.11-3 include Metropolitan's SWP Table A and Article 21 supplies. These supplies are described in Section 3.2 and Appendix 3 of Metropolitan's UWMP.

The values shown in Table A.11-3 do not include Desert Water Agency/Coachella Valley Water District SWP contract supplies. These supplies are exchanged with Desert Water Agency and Coachella Valley Water District for an equal amount of Colorado River water, which is reflected in the Colorado River Aqueduct supplies shown in Table A.11-2. In addition, Desert Water Agency and Coachella Valley Water District should include their SWP contract supplies in their own accountings of reduced reliance. Additional information on these exchange agreements can be found in Section 3.2 and Appendix 3 of Metropolitan's UWMP.

These values also do not include supplies from San Luis Carryover storage or Central Valley storage programs because storage in these programs comprises previously stored water from sources already reflected in Table A.11-3. These storage programs are generally used to provide additional regional self-reliance in dry years, which is not reflected in this normal water year analysis. The Central Valley storage projects and their yields are described in Section 3.3, and Appendix 3. San Luis Carryover storage is described in Section 3.2 and Appendix 3.

Transfers and Exchanges of Supplies from the Delta Watershed

The transfers and exchanges of supplies from the Delta watershed shown in Table A.11-3 include supplies from the San Bernardino Valley MWD Program, Yuba River Accord Purchase Program, the San Gabriel Valley MWD Program, Irvine Ranch Water District Storage and Exchange Program, and other generic SWP and Central Valley transfers and exchanges. These programs are described in Section 3.2 and Appendix 3 of Metropolitan's UWMP.

Supplies from the Delta Watershed shown in Table A.11-3 are from the following sources:

- Baseline (2010) values – Metropolitan's 2005 UWMP, Table A.3-7: California Aqueduct Program Capabilities Year 2010 (Average Year)

- 2015 values – Metropolitan's 2010 UWMP, Table A.3-7: California Aqueduct Program Capabilities Year 2015 (Average Year)
- 2020 values – Metropolitan's 2015 UWMP, Table A.3-7: California Aqueduct Program Capabilities Year 2020 (Average Year)
- 2025-2045 values – Metropolitan's 2020 UWMP, Table A.3-7: California Aqueduct Program Capabilities Years 2025, 2030, 2035, 2040, 2045 (Normal Water Year)

A.11.4 UWMP Implementation

In addition to the analysis and documentation described above, WR P1 subsection (c)(1)(B) requires that all programs and projects included in the UWMP that are locally cost-effective and technically feasible, which reduce reliance on the Delta, are identified, evaluated, and implemented consistent with the implementation schedule. WR P1 (c)(1)(B) states that:

> *(B) Identified, evaluated, and commenced implementation, consistent with the implementation schedule set forth in the Plan, of all programs and projects included in the Plan that are locally cost effective and technically feasible which reduce reliance on the Delta*[.]

In accordance with Water Code Section 10631(f), water suppliers must already include in their UWMP a detailed description of expected future projects and programs that they may implement to increase the amount of water supply available to them in normal and single-dry water years and for a period of drought lasting five consecutive years. The UWMP description must also identify specific projects, include a description of the increase in water supply that is expected to be available from each project, and include an estimate regarding the implementation timeline for each project or program.

Section 3 of Metropolitan's UWMP summarizes the implementation plan and continued progress in developing a diversified water portfolio to meet the region's water needs.

Water Use Efficiency

The water use efficiency numbers used in this analysis include the total water use efficiency savings (conservation) for the service area, including savings from active, code-based, price-effect and pre-1990 savings. The specific water use efficiency programs and their implementation are described in Section 3.4 of Metropolitan's UWMP.

Water Recycling

The water recycling values used in this analysis reflect the total recycled water production in Metropolitan's service area. Water recycling programs and implementation are discussed in Section 3.5 of Metropolitan's UWMP. In addition, individual project-level details are provided in Appendix 5.

Stormwater Capture and Use

The stormwater capture and use data used in this analysis include supplies from local surface water production. Local surface water production and its implementation are discussed in Appendix 2 of Metropolitan's UWMP.

Advanced Water Technologies

The advanced water technologies data used in this analysis include total groundwater recovery and seawater desalination production in Metropolitan's service. Groundwater recovery and seawater desalination programs and implementation are described in Section 3.5 of Metropolitan's UWMP. In addition, individual project-level details are provided in Appendix 5.

Conjunctive Use Projects

The values for conjunctive use projects used in this analysis represent total groundwater production in the region. Groundwater production and its implementation are discussed in Appendix 2 of Metropolitan's UWMP.

Local and Regional Water Supply and Storage Programs

The data for local and regional water supply and storage programs shown this analysis include supplies from the Los Angeles Aqueduct. This program and its implementation are described in Appendix 2 of Metropolitan's UWMP.

Other Programs and Projects that Contribute to Regional Self-Reliance

Other programs and projects that contribute to regional self-reliance used in this analysis include current programs from the Colorado River Aqueduct. Colorado River supplies include Metropolitan's basic Colorado River apportionment, as well as supplies that result from existing and committed programs, including those from the IID-MWD Conservation Program, the implementation of the Quantification Settlement Agreement (QSA), related agreements, and the exchange agreement with SDCWA. Colorado River Aqueduct programs and their implementation are described in Section 3.1 and Appendix 3 of Metropolitan's UWMP.

CVP/SWP Contract Supplies

The CVP/SWP contract supplies shown in this analysis include Metropolitan's SWP Table A and Article 21 supplies. These supplies and their implementation are described in Section 3.2 and Appendix 3 of Metropolitan's UWMP.

Transfers and Exchanges of Supplies from the Delta Watershed

The transfers and exchanges of supplies from the Delta watershed shown in this analysis include supplies from the San Bernardino Valley MWD Program, Yuba River Accord Purchase Program, the San Gabriel Valley MWD Program, Irvine Ranch Water District Storage and Exchange Program, and other generic SWP and Central Valley transfers and exchanges. These programs and their implementation are described in Section 3.2 and Appendix 3 of Metropolitan's UWMP.

A.11.5 2015 UWMP Appendix 11

The information contained in this Appendix 11 is also intended to be a new Appendix 11 attached to Metropolitan's 2015 UWMP consistent with WR P1 subsection (c)(1)(C) (Cal. Code Regs. tit. 23, § 5003). Metropolitan provided notice of the availability of the draft 2020 UWMP (including this Appendix 11 which will also be a new Appendix 11 to its 2015 UWMP) and WSCP and the public hearing to consider adoption of both plans and Appendix 11 to the 2015 UWMP in accordance with CWC Sections 10621(b) and 10642, and Government Code Section 6066, and Chapter 17.5 (starting with Section 7290) of Division 7 of Title 1 of the Government Code. The public review drafts of the 2020 UWMP, Appendix 11 to the 2015 UWMP, and the WSCP were posted prominently on Metropolitan's website, mwdh2o.com, starting February 1, 2021, more than 60 days in advance of the public hearing on April 12, 2021. The notice of availability of the documents was sent to Metropolitan's member agencies, as well as cities and counties in Metropolitan's service area. In addition, a public notice advertising the public hearing in English and Spanish was published in 12 Southern California newspapers. The notification in English language newspapers was published on February 1 and 8, 2021. The notification was published on January 28-30, 2021 and February 1, 4-6, and 8, 2021 in Spanish language newspapers, satisfying the requirement for non-English language notification. Copies of: (1) the notification letter sent to the member agencies, cities and counties in Metropolitan's service area, and (2) the notice published in the newspapers are included in the 2020 UWMP Section 5. Thus, this Appendix 11 to Metropolitan's 2020 UWMP, which was adopted with Metropolitan's 2020 UWMP, will also be recognized and treated as Appendix 11 to Metropolitan's 2015 UWMP.

Metropolitan held the public hearing for the draft 2020 UWMP, draft Appendix 11 to the 2015 UWMP, and draft WSCP on April 12, 2021, at the Board's Water Planning and Stewardship Committee meeting, held online due to COVID-19 concerns. On May 11, 2021, Metropolitan's Board determined that the 2020 UWMP and the WSCP are consistent with the MWD Act and accurately represent the water resources plan for Metropolitan's service area. In addition, Metropolitan's Board determined that Appendix 11 to both the 2015 UWMP and the 2020 UWMP includes all of the elements described in Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs. tit. 23, § 5003), which need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action. As stated in Resolutions 9279, 9280, and 9281, the Board adopted the 2020 UWMP, Appendix 11 to the 2015 UWMP, and the WSCP and authorized their submittal to the State of California. Copies of Resolutions 9279, 9280, and 9281 are included in the 2020 UWMP Section 5, and Resolution 9281 for the WSCP is attached to the WSCP as Attachment C.

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Appendix 12

DWR 2020 UWMP SUBMITTAL TABLES

Appendix 12
DWR 2020 UWMP SUBMITTAL TABLES

In fulfillment of California Water Code Sections, 10621(d) and 10644(a) and (b), Metropolitan's Final 2020 Urban Water Management Plan, Water Shortage Contingency Plan, and Appendix 11 Addendum to the 2015 Urban Water Management Plan were electronically submitted to the State of California through DWR's WUE Data Portal (https://wuedata.water.ca.gov/) in June 2021. This appendix contains the mandatory DWR 2020 UWMP Submittal Tables that were uploaded to the WUE data website.

Submittal Table 2-2: Plan Identification			
Select Only One	**Type of Plan**		**Name of RUWMP or Regional Alliance** *if applicable* (select from drop down list)
☑	**Individual UWMP**		
	☐	Water Supplier is also a member of a RUWMP	
	☐	Water Supplier is also a member of a Regional Alliance	
☐	**Regional Urban Water Management Plan (RUWMP)**		
NOTES:			

Submittal Table 2-3: Supplier Identification	
Type of Supplier (select one or both)	
☑	Supplier is a wholesaler
☐	Supplier is a retailer
Fiscal or Calendar Year (select one)	
☑	UWMP Tables are in calendar years
☐	UWMP Tables are in fiscal years
If using fiscal years provide month and date that the fiscal year begins (mm/dd)	
Units of measure used in UWMP * (select from drop down)	
Unit	AF
***Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*	
NOTES:	

Submittal Table 2-4 Wholesale: Water Supplier Information Exchange (select one)	
☑	Supplier has informed more than 10 other water suppliers of water supplies available in accordance with Water Code Section 10631. Completion of the table below is optional. If not completed, include a list of the water suppliers that were informed.
Section 5 pp. 5-8 to 5-9	**Provide page number for location of the list.**
☐	Supplier has informed 10 or fewer other water suppliers of water supplies available in accordance with Water Code Section 10631. **Complete the table below.**
Water Supplier Name	
Add additional rows as needed	
NOTES: NOTES: See 2020 UWMP Sections 2 and 5 for discussion of Metropolitan's planning coordination, outreach, and notification (list provided in Section 5 Table 5-3 pp. 5-8 and 5-9).	

Submittal Table 3-1 Wholesale: Population - Current and Projected						
Population Served	2020	2025	2030	2035	2040	2045*(opt)*
	19,035,000	**20,089,000**	**20,634,000**	**21,145,000**	**21,610,000**	**22,026,000**
NOTES: See 2020 UWMP Appendix 1 Tabel A.1-2.						

Submittal Table 4-1 Wholesale: Demands for Potable and Non-Potable[1] Water - Actual			
Use Type	2020 Actual		
Drop down list May select each use multiple times These are the only use types that will be recognized by the WUE data online submittal tool	Additional Description (as needed)	Level of Treatment When Delivered Drop down list	Volume[2]
Add additional rows as needed			
Sales to other agencies		Drinking Water	789,218
Sales to other agencies		Raw Water	605,043
Losses			48,520
		TOTAL	1,442,781
[1] *Recycled water demands are NOT reported in this table. Recycled water demands are reported in Table 6-4.*			
[2] *Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Table 2-3.*			
NOTES: Sales to other agencies include Metropolitan deliveries to member and non-member agencies and deliveries from conjunctive use programs. Some of these deliveries are not revenue producing nor sales. Losses include evaporation losses from storage reservoirs and distribution system (2019 estimate). Water losses are both drinking and raw water.			

Submittal Table 4-2 Wholesale: Use for Potable and Raw Water [1] - Projected						
Use Type	Additional Description (as needed)	Projected Water Use [2] Report To the Extent that Records are Available				
Drop down list May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool.		2025	2030	2035	2040	2045 (opt)
Add additional rows as needed						
Other		1,149,000	1,110,000	1,084,000	1,100,000	1,125,000
Exchanges to other agencies		278,000	278,000	278,000	278,000	278,000
	TOTAL	1,427,000	1,388,000	1,362,000	1,378,000	1,403,000

[1] *Recycled water demands are NOT reported in this table. Recycled water demands are reported in Table 6-4.*

[2] *Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: See 2020 UWMP detailed discussion in Section 2, Metropolitan's Regional Water Demands Table 2-3 for Normal Water Year, and Supply Capability and Projected Demands Table 2-6 for Normal Water Year (average of 1922 to 2017 historic hydrologies).

Submittal Table 4-3 Wholesale: Total Water Use (Potable and Non-Potable)						
	2020	2025	2030	2035	2040	2045 (opt)
Potable and Raw Water From Tables 4-1W and 4-2W	1,442,781	1,427,000	1,388,000	1,362,000	1,378,000	1,403,000
Recycled Water Demand* From Table 6-4W	0	0	0	0	0	0
TOTAL WATER DEMAND	1,442,781	1,427,000	1,388,000	1,362,000	1,378,000	1,403,000

**Recycled water demand fields will be blank until Table 6-4 is complete.*

NOTES:

OPTIONAL Table 4-4 Wholesale: Last Five Years of Water Loss Audit Reporting	
Reporting Period Start Date (mm/yyyy)	Volume of Water Loss [1,2]
01/2015	10,628
01/2016	8,545
01/2017	7,928
01/2018	4,991
01/2019	6,907

[1] *Taken from the field "Water Losses" (a combination of apparent losses and real losses) from the AWWA worksheet.*

[2] ***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: See 2020 UWMP discussions in Section 2.6 and Appendix 7, and estimate of distribution system water losses in Tables A.7-1, A.7-2, A.7-3, A.7-4, and A.7-5.

Submittal Table 6-1 Wholesale: Groundwater Volume Pumped

✓	Supplier does not pump groundwater. The supplier will not complete the table below.					
☐	All or part of the groundwater described below is desalinated.					
Groundwater Type	Location or Basin Name	2016*	2017*	2018*	2019*	2020*
Add additional rows as needed						
	TOTAL	0	0	0	0	0

**** Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:

Submittal Table 6-3 Wholesale: Wastewater Treatment and Discharge Within Service Area in 2020

✓	Wholesale Supplier neither distributes nor provides supplemental treatment to recycled water. The Supplier will not complete the table below.										
							2020 volumes [1]				
Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID Number *(optional)* [2]	Method of Disposal ***Drop down list***	Does This Plant Treat Wastewater Generated Outside the Service Area? ***Drop down list***	Treatment Level ***Drop down list***	Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area	Instream Flow Permit Requirement
Add additional rows as needed											
						Total	0	0	0	0	0

[1] **Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.
[2] If the **Wastewater Discharge ID Number** is not available to the UWMP preparer, access the SWRCB CIWQS regulated facility website at https://ciwqs.waterboards.ca.gov/ciwqs/readOnly/CiwqsReportServlet?inCommand=reset&reportName=RegulatedFacility

NOTES:

Submittal Table 6-4 Wholesale: Current and Projected Retailers Provided Recycled Water Within Service Area

✓	Recycled water is not directly treated or distributed by the Supplier. The Supplier will not complete the table below.						
Name of Receiving Supplier or Direct Use by Wholesaler	Level of Treatment *Drop down list*	2020*	2025*	2030*	2035*	2040*	2045* *(opt)*
Add additional rows as needed							
	Total	0	0	0	0	0	0

*** Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.

NOTES:

Submittal Table 6-5 Wholesale: 2015 UWMP Recycled Water Use Projection Compared to 2020 Actual		
☑	Recycled water was not used or distributed by the supplier in 2015, nor projected for use or distribution in 2020. The wholesale supplier will not complete the table below.	
Name of Receiving Supplier or Direct Use by Wholesaler	2015 Projection for 2020*	2020 Actual Use*
Add additional rows as needed		
Total	0	0
***Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*		
NOTES: The 2015 UWMP Table 2-3 included projection for recycled water use in 2020 of 436 TAF under average hydrology. In 2020, the actual recycled water use (regional total within Metropolitan service area) is estimated at 441 TAF (excluding Santa Ana River baseflow), as discussed in this 2020 UWMP Section 3.5 on Table 3-14 p. 3-78 and Appendix 2 p. A.2-8. Regional total represents the projected production of projects by Metropolitan member agencies. Metropolitan's Regional Recycled Water Program is still a pilot project, with recent Board approval to proceed with environmental planning.		

Submittal Table 6-7 Wholesale: Expected Future Water Supply Projects or Programs						
☐	No expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Supplier will not complete the table below.					
☑	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.					
2020 UWMP Section 3 and Appendix 3	Provide page location of narrative in the UWMP					
Name of Future Projects or Programs	Joint Project with other suppliers?		Description *(if needed)*	Planned Implementation Year	Planned for Use in Year Type *Drop Down list*	Expected Increase in Water Supply to Supplier*
	Drop Down Menu	*If Yes, Supplier Name*				
Add additional rows as needed						
***Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*						
NOTES: See 2020 UWMP Section 3 description of resources and program development for CRA, SWP, Central Valley/SWP storage and transfers programs, conservation, LRP (groundwater recovery, recycling, desalination), and groundwater. Also, see Appendix 3 detailed discussion of all supply programs and justification for supply projections.						

Submittal Table 6-8 Wholesale: Water Supplies — Actual				
Water Supply	Additional Detail on Water Supply	2020		
Drop down list May use each category multiple times.These are the only water supply categories that will be recognized by the WUEdata online submittal tool		Actual Volume*	Water Quality Drop Down List	Total Right or Safe Yield* (optional)
Add additional rows as needed				
Purchased or Imported Water		1,069,648	Other Non-Potable Water	
Supply from Storage		367,069	Other Non-Potable Water	
Transfers		6,064	Other Non-Potable Water	
	Total	1,442,781		0
***Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*				
NOTES: Actual volume of water reported in this table are raw water. The "Other Non-Potable Water" from the Water Quality column drop down list is the closest description to raw water.				

Submittal Table 6-9 Wholesale: Water Supplies — Projected											
Water Supply	Additional Detail on Water Supply	Projected Water Supply* Report To the Extent Practicable									
		2025		2030		2035		2040		2045 (opt)	
Drop down list May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool		Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)
Add additional rows as needed											
Other		3,912,000		3,906,000		3,903,000		3,901,000		3,898,000	
	Total	3,912,000	0	3,906,000	0	3,903,000	0	3,901,000	0	3,898,000	0
***Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*											
NOTES: See 2020 UWMP detailed discussion in Section 2 and Supply Capability and Projected Demands Table 2-6 for Normal Water Year (average of 1922-2017 hydrologies). Projected water supply includes capability of current and proposed programs.											

Submittal Table 7-1 Wholesale: Basis of Water Year Data (Reliability Assessment)			
Year Type	**Base Year** If not using a calendar year, type in the last year of the fiscal, water year, or range of years, for example, water year 1999-2000, use 2000	**Available Supplies if Year Type Repeats**	
		☑ Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP. Location: 2020 UWMP Section 2 Tables 2-4, 2-5, 2-6, and Appendix 3.	
		☐ Quantification of available supplies is provided in this table as either volume only, percent only, or both.	
		Volume Available *	**% of Average Supply**
Average Year	1922-2017		100%
Single-Dry Year	1977		
Consecutive Dry Years 1st Year	1988		
Consecutive Dry Years 2nd Year	1989		
Consecutive Dry Years 3rd Year	1990		
Consecutive Dry Years 4th Year	1991		
Consecutive Dry Years 5th Year	1992		

Supplier may use multiple versions of Table 7-1 if different water sources have different base years and the supplier chooses to report the base years for each water source separately. If a supplier uses multiple versions of Table 7-1, in the "Note" section of each table, state that multiple versions of Table 7-1 are being used and identify the particular water source that is being reported in each table. Suppliers may create an additional worksheet for the additional tables.

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: See 2020 UWMP Section 2.3 discussion of sources of supply and water reliability assessment under normal water year, single dry year, and five consecutive drought years (summarized in Tables 2-4, 2-5, and 2-6). See Section 3 and Appendix 3 for a detailed discussion of all supply programs and justifications for supply projections. See Section 2 p. 2-7 for description, assumption, and basis of the three year types.

Submittal Table 7-2 Wholesale: Normal Year Supply and Demand Comparison					
	2025	2030	2035	2040	2045 *(Opt)*
Supply totals *(autofill from Table 6-9)*	3,912,000	3,906,000	3,903,000	3,901,000	3,898,000
Demand totals *(autofill fm Table 4-3)*	1,427,000	1,388,000	1,362,000	1,378,000	1,403,000
Difference	2,485,000	2,518,000	2,541,000	2,523,000	2,495,000

NOTES: See 2020 UWMP detailed discussion in Section 2, and Supply Capabilities and reliability assessment in Table 2-6 for Normal Water Year condition (average of 1922-2017 historic hydrology).

Submittal Table 7-3 Wholesale: Single Dry Year Supply and Demand Comparison					
	2025	2030	2035	2040	2045 (Opt)
Supply totals*	2,772,000	2,761,000	2,760,000	2,760,000	2,757,000
Demand totals*	1,544,000	1,500,000	1,473,000	1,496,000	1,525,000
Difference	1,228,000	1,261,000	1,287,000	1,264,000	1,232,000

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: See 2020 UWMP detailed discussion in Section 2, and Supply Capabilities and reliability assessment in Table 2-4 for Single Dry Year condition (repeat of 1977 hydrology).

Submittal Table 7-4 Wholesale: Multiple Dry Years Supply and Demand Comparison						
		2025*	2030*	2035*	2040*	2045* (Opt)
First year	Supply totals	2,178,800	2,219,000	2,241,000	2,263,000	2,239,000
	Demand totals	1,592,000	1,570,000	1,537,000	1,539,000	1,564,000
	Difference	586,800	649,000	704,000	724,000	675,000
Second year	Supply totals	2,178,800	2,219,000	2,241,000	2,263,000	2,239,000
	Demand totals	1,592,000	1,570,000	1,537,000	1,539,000	1,564,000
	Difference	586,800	649,000	704,000	724,000	675,000
Third year	Supply totals	2,178,800	2,219,000	2,241,000	2,263,000	2,239,000
	Demand totals	1,592,000	1,570,000	1,537,000	1,539,000	1,564,000
	Difference	586,800	649,000	704,000	724,000	675,000
Fourth year	Supply totals	2,178,800	2,219,000	2,241,000	2,263,000	2,239,000
	Demand totals	1,592,000	1,570,000	1,537,000	1,539,000	1,564,000
	Difference	586,800	649,000	704,000	724,000	675,000
Fifth year	Supply totals	2,178,800	2,219,000	2,241,000	2,263,000	2,239,000
	Demand totals	1,592,000	1,570,000	1,537,000	1,539,000	1,564,000
	Difference	586,800	649,000	704,000	724,000	675,000
Sixth year *(optional)*	Supply totals					
	Demand totals					
	Difference	0	0	0	0	0
***Units of measure (AF, CCF, MG) m** ust remain consistent throughout the UWMP as reported in Table 2-3.*						
NOTES: See 2020 UWMP detailed discussion in Section 2, and Supply Capabilities and reliability assessment in Table 2-5 for Five Consecutive Drought Year condition (repeat of 1988-1992 hydrology). Similar to the multiple dry-year reporting in past UWMPs, Metropolitan's reliability assessment for the five consecutive year drought is developed by simulating the five-year driest sequence leading to each of the fifth year reporting. This allows impacts of multiple consecutive years of droughts to be captured within the sequential accounting of Metropolitan's various supply program storage balance. The five consecutive years of supply and demand are then averaged and presented every five years rather than a year by-year display. Over the years, Metropolitan has developed numerous programs to increase its water supply capabilities, dry year supplies, and regional storage. These programs may be exercised in conjunction with effective demand management measures during drought years. Under this reliability planning, if a five consecutive year drought sequence was to repeat, Metropolitan could exercise similar supply augmentation and demand management options for each of the five drought years at the appropriate level to meet demands. This methodology best captures Metropolitan's complex demand and supply planning with appropriate flexibility.						

Submittal Table 7-5: Five-Year Drought Risk Assessment Tables to address Water Code Section 10635(b)

2021	Total
Total Water Use	1,596,000
Total Supplies	1,164,000
Surplus/Shortfall w/o WSCP Action	(432,000)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	432,000
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

2022	Total
Total Water Use	1,669,000
Total Supplies	1,903,000
Surplus/Shortfall w/o WSCP Action	234,000
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	0
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	234,000
Resulting % Use Reduction from WSCP action	0%

2023	Total
Total Water Use	1,688,000
Total Supplies	1,300,000
Surplus/Shortfall w/o WSCP Action	(388,000)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	388,000
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

2024	Total
Total Water Use	1,491,000
Total Supplies	1,468,000
Surplus/Shortfall w/o WSCP Action	(23,000)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	23,000
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

2025	Total
Total Water Use	1,592,000
Total Supplies	1,369,000
Surplus/Shortfall w/o WSCP Action	(223,000)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	223,000
WSCP - use reduction savings benefit	0
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	0%

Note: See 2020 UWMP discussion in Section 2.4 Drought Risk Assessment and the supply augmentation actions that may be exercised to meet demands through 2025.

Submittal Table 8-1 Water Shortage Contingency Plan Levels		
Shortage Level	**Percent Shortage Range**	**Shortage Response Actions** *(Narrative description)*
1	Up to 10%	Shortage response actions will be customized to meet the circumstances for the particular shortage. Response actions may include a combination of supply augmentation from flexible supplies and dry year storage, demand response actions, and operational measures.
2	Up to 20%	Shortage response actions will be customized to meet the circumstances for the particular shortage. Response actions may include a combination of supply augmentation from flexible supplies and dry year storage, demand response actions, and operational measures.
3	Up to 30%	Shortage response actions will be customized to meet the circumstances for the particular shortage. Response actions may include a combination of supply augmentation from flexible supplies and dry year storage, demand response actions, and operational measures.
4	Up to 40%	Shortage response actions will be customized to meet the circumstances for the particular shortage. Response actions may include a combination of supply augmentation from flexible supplies and dry year storage, demand response actions, and operational measures.
5	Up to 50%	Shortage response actions will be customized to meet the circumstances for the particular shortage. Response actions may include a combination of supply augmentation from flexible supplies and dry year storage, demand response actions, and operational measures.
6	>50%	Shortage response actions will be customized to meet the circumstances for the particular shortage. Response actions may include a combination of supply augmentation from flexible supplies and dry year storage, demand response actions, operational measures, and emergency storage if needed.
NOTES: Actions taken will be based on resource and operational conditions throughout the year. To determine specific actions that would be taken at each level, Metropolitan will evaluate circumstances including cost, timing, distribution needs and capabilities, and other variables that include SWP allocation, Colorado River conditions, take capacities, and storage balances. See Table A.4-5 Shortage Stages and Response Actions from Appendix 4: Water Shortage Contingency Plan.		

Submittal Table 8-2: Demand Reduction Actions				
Shortage Level	Demand Reduction Actions ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool. Select those that apply.*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*	Penalty, Charge, or Other Enforcement? ***For Retail Suppliers Only*** *Drop Down List*
Add additional rows as needed				
1 to 6	Expand Public Information Campaign	Range between 160,000 to 320,000 acre-feet	Assumed range of between 5% and 10% effectiveness in demand reduction realized at the wholesale level, using a hypothetical single dry year assessment of wholesale demand within the 2020 Urban Water Management Plan (2025 single-dry year). Based on assumptions of service area retail M&I demand of 4.379 MAF and up to 20 percent of retail demands could be reduced if a successful media campaign reached and influenced the entire service area population (source: American Water Works Association. 2019. Manual of Water Supply Practices – M60, Second Edition: Drought Preparedness and Response. p. 35)	
1 to 6	Other	Up to 900,000 acre-feet	Water Supply Allocation Plan (WSAP) allocates Metropolitan's wholesale water supplies among its member agencies. The WSAP is designed to reduce demands by up to approximately 50 percent of the WSAP's calculated base demand. Up to 900,000 AF of savings is based on a hypothetical WSAP base demand of 1.8 MAF. Actual reductions and base demands are based on a formula that includes various factors such as actual local supply production, population growth, and conservation.	
NOTES: Total estimated savings potential from differerent Demand Reducation Actions are nonadditive. Savings potential from voluntary actions overlaps with savings from supply allocations.				

Submittal Table 8-3: Supply Augmentation and Other Actions			
Shortage Level	Supply Augmentation Methods and Other Actions by Water Supplier ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*
Add additional rows as needed			
1 to 6	Transfers	Up to 64,000 acre-feet	Based on a hypothetical 2025 single dry year assessment within the 2020 Urban Water Management Plan. See Table 2-1 in the 2020 UWMP.
1 to 6	Other Actions (describe)	Up to 1,714,000 acre-feet	Dry year storage. Based on a hypothetical 2025 single dry year assessment within the 2020 Urban Water Management Plan.
6	Stored Emergency Supply	Up to 750,000 acre-feet	Based on Metropolitan's Emergency Storage Objective, set at 750,000 AF. Emergency storage represents water Metropolitan reservees for the region for use in the event of supply interruptions from earthquakes or similar emergencies.
NOTES:			

Submittal Table 10-1 Wholesale: Notification to Cities and Counties (select one)		
☑	Supplier has notified more than 10 cities or counties in accordance with Water Code Sections 10621 (b) and 10642. **Completion of the table below is not required. Provide a separate list of the cities and counties that were notified.**	
2020 UWMP Section 5 Table 5-3	Provide the page or location of this list in the UWMP.	
☐	Supplier has notified 10 or fewer cities or counties. **Complete the table below.**	
City Name	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
County Name *Drop Down List*	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
NOTES: See 2020 UWMP Section 5 discussion on Metropolitan's notification to cities and counties (list provided in Table 5-3). Metropolitan sent a total of 195 notification letters to cities, counties, and member agencies within its service area.		

WATER TOMORROW

Planning for the Future

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA