THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

# Climate Action Plan

**May**
2022

The Metropolitan Water District of Southern California

*Prepared by:*

**THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA**

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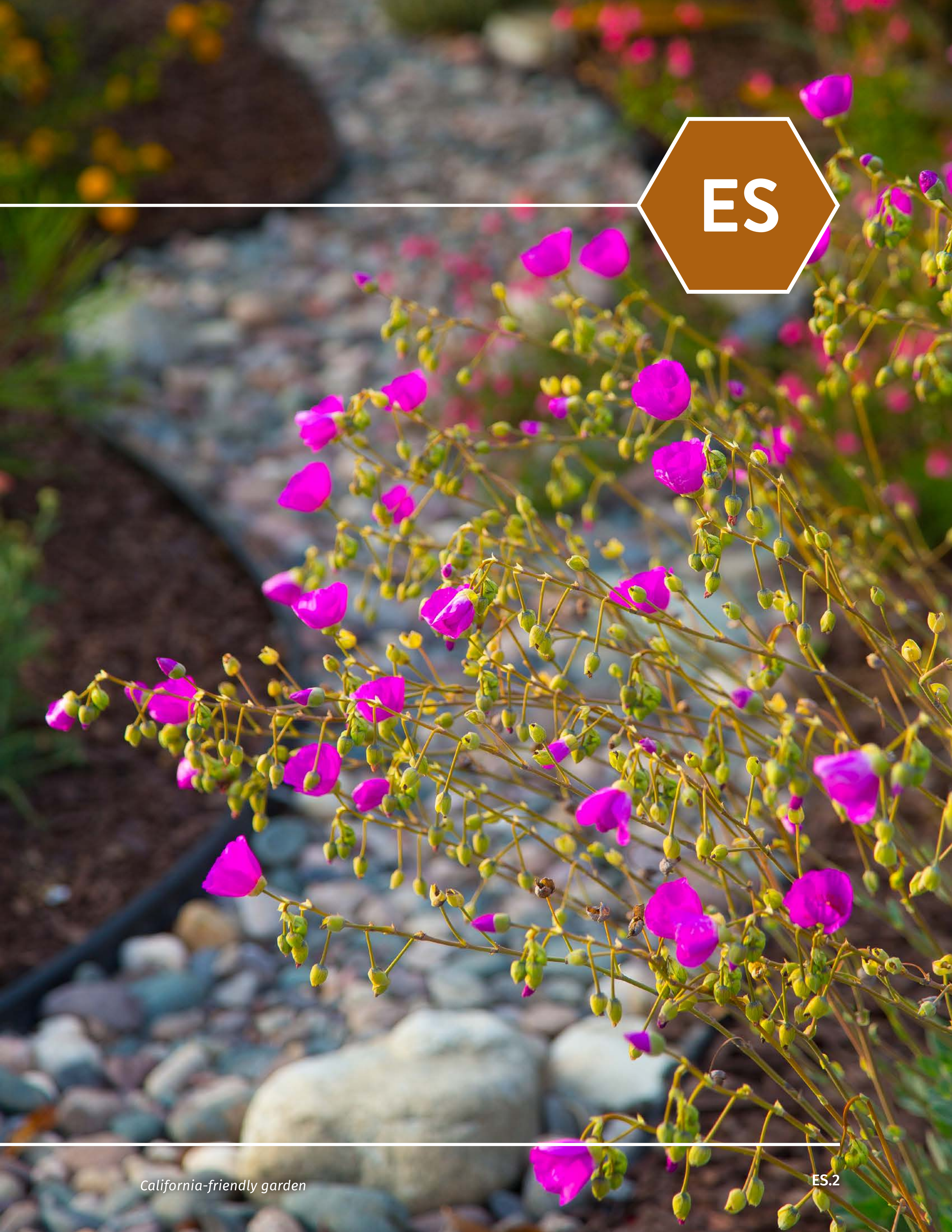
# EXECUTIVE SUMMARY

**The Metropolitan Water District of Southern California's (Metropolitan) core mission is to provide a clean, reliable water supply to Southern California. Changing climatic conditions, variable precipitation patterns, availability of water supplies, changes in consumer demands, and sea level rise will change the way Metropolitan provides its services and how it operates its regional water system. Metropolitan recognizes the potential impact of climate change to water availability and is committed to environmental stewardship to protect this valuable resource. Reducing greenhouse gas (GHG) emissions is an important step in protecting California and the region from the effects of climate change. Reducing GHG emissions from Metropolitan's operations supports California's overall GHG reduction goals. This Climate Action Plan (CAP) sets targets for reducing GHG emissions from Metropolitan's operations, including conveyance, storage, treatment, and delivery of water to its 26 member water agencies. Additionally, this CAP complements Metropolitan's existing long-range planning efforts, including the Integrated Water Resources Plan, Energy Sustainability Plan, and Capital Investment Plan. Through the implementation of this CAP, Metropolitan will strengthen its commitment to environmental sustainability, increase the resiliency of its operations, and strategically achieve GHG reduction goals. For additional details on the purpose of this CAP and Metropolitan's history and existing operations, refer to Section 1.0, Purpose, Overview, and Environmental History and Leadership.**



# ES

California-friendly garden

*Diamond Valley Lake, West Dam*

# PURPOSE OF THE CAP

## CALIFORNIA AND INTERNATIONAL GHG REDUCTION GOALS

California passed the California Global Warming Solutions Act of 2006 (Assembly Bill 32 or AB 32), creating a comprehensive strategy to reduce greenhouse gas (GHG) emissions in California. AB 32 required the California Air Resources Board (CARB) to develop a Scoping Plan that details the strategy and GHG reduction goals for the State. On the international stage, the Paris Agreement, a legally binding, international global climate agreement, establishes a roadmap for nations to remain under 2 degrees Celsius of warming by the end of the century with a goal of limiting the temperature increase to 1.5 degrees Celsius. Based on the scientific research supporting the Paris Agreement goals, the 2017 Scoping Plan outlines California's strategic vision for achieving at least a 40 percent reduction in GHG emissions from 1990 levels by 2030.

**In its Fifth Assessment Report (AR5), the Intergovernmental Panel on Climate Change (IPCC), concluded there's a more than**

**95%**

**likelihood that human activities are a principal cause of our warming planet over the past 50 years.**[1]

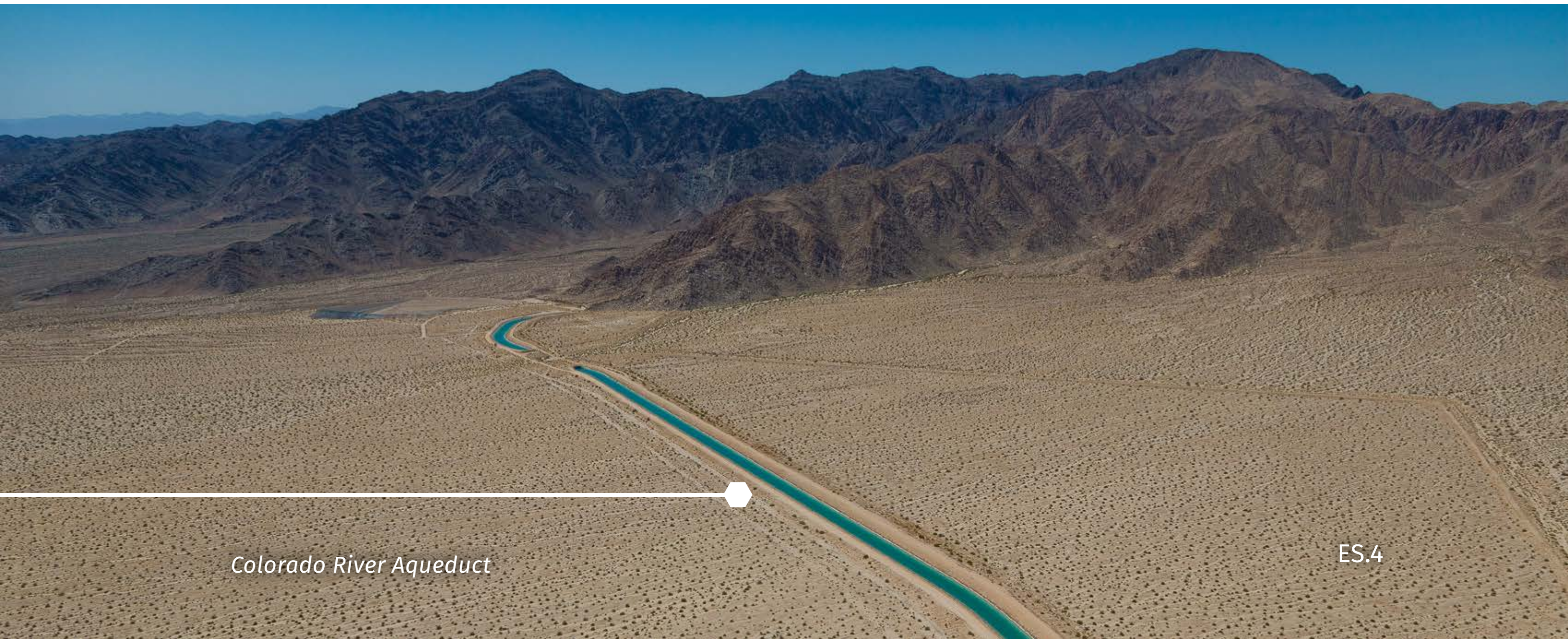
1. *https://archive.ipcc.ch/report/ar5/syr/*

This Climate Action Plan (CAP) is consistent with all California GHG reduction legislation, including Senate Bill (SB) 32 and Executive Order (EO) B-55-18, which expands upon AB 32. The CAP also meets the requirements of Section 15183.5(b)(1) of the State CEQA Guidelines for a "Qualified GHG Reduction Plan" (CAP or Plan). A qualified CAP allows Metropolitan to tier future project-level GHG emissions analyses if projects demonstrate consistency with the CAP goals. Section 4.2, California Regulations and GHG Emissions Targets, of this CAP, California Regulations and GHG Emissions Targets, can be referenced for more information on the regulatory context of the CAP.

## SCIENTIFIC CONTEXT

The gases that make up Earth's atmosphere act like a blanket that allows high-energy light from the Sun to pass through to Earth, while reflecting and absorbing lower-energy heat radiating back from Earth. The trapping of this heat is known as the greenhouse effect because atmospheric gases function similar to the windows of a greenhouse, which trap the Sun's rays and create a much warmer space inside as compared to the outside air.

The greenhouse effect regulates the Earth's climate, maintaining conditions suitable for life on Earth. However, a rapid increase of GHGs can cause excess heat to be trapped, affecting global temperatures and climate. Human activities such as burning fossil fuels, deforestation, and land development release GHGs that contribute to global warming. For more detailed information, please refer to Section 2.0, Scientific Context and Climate Change Impacts.



*Colorado River Aqueduct*

*Weymouth Water Treatment Plant*

# METROPOLITAN'S GREENHOUSE GAS EMISSIONS

## METROPOLITAN'S GHG EMISSIONS INVENTORY

Metropolitan imports its water supply from two sources - Northern California via the State Water Project (SWP), which is owned and operated by the California Department of Water Resources (DWR), and the Colorado River via the Colorado River Aqueduct (CRA). Metropolitan's GHG emissions are calculated based on sources within its operational control, thus water from the Colorado River pumped from Lake Havasu in San Bernardino County and water from the SWP where Metropolitan takes delivery of its SWP supplies. Metropolitan takes delivery of the SWP at several locations including the Foothill Feeder immediately downstream of Castaic Lake in Los Angeles County, through the Rialto Pipeline and Inland Feeder which connect to the Devil Canyon Powerplant after-bays in San Bernardino County, through the Box Springs Feeder, and through the Perris Pressure Control Structure at Lake Perris in Riverside County. See Appendix B for more information on emissions associated with the DWR's SWP.

Metropolitan's GHG emissions are primarily generated from the purchase and consumption of electricity used for conveyance, treatment, and delivery of water throughout Metropolitan's Southern California service area. Metropolitan's GHG emissions vary due to the amount of water pumped from the Colorado River to meet the demands of Southern California. Higher Colorado River pumping generally correlates to dry years with low SWP allocations. Through the implementation of energy and water efficiency projects, as well as state legislation, overall emissions from Metropolitan operations have decreased since 1990, even during extreme drought events that resulted in increased pumping on the CRA.

The GHG inventory was calculated using the protocol from the International Council for Local Environmental Initiatives (ICLEI) and The Climate Registry (TCR). The data is organized into three source categories, or scopes, related to the level of operational control the organization or reporting entity has over the emission source. Figure ES-1 shows Metropolitan's GHG emissions by scope as well as the sources of emissions within each scope.

**FIGURE ES-1: GHG Emissions by Scope**

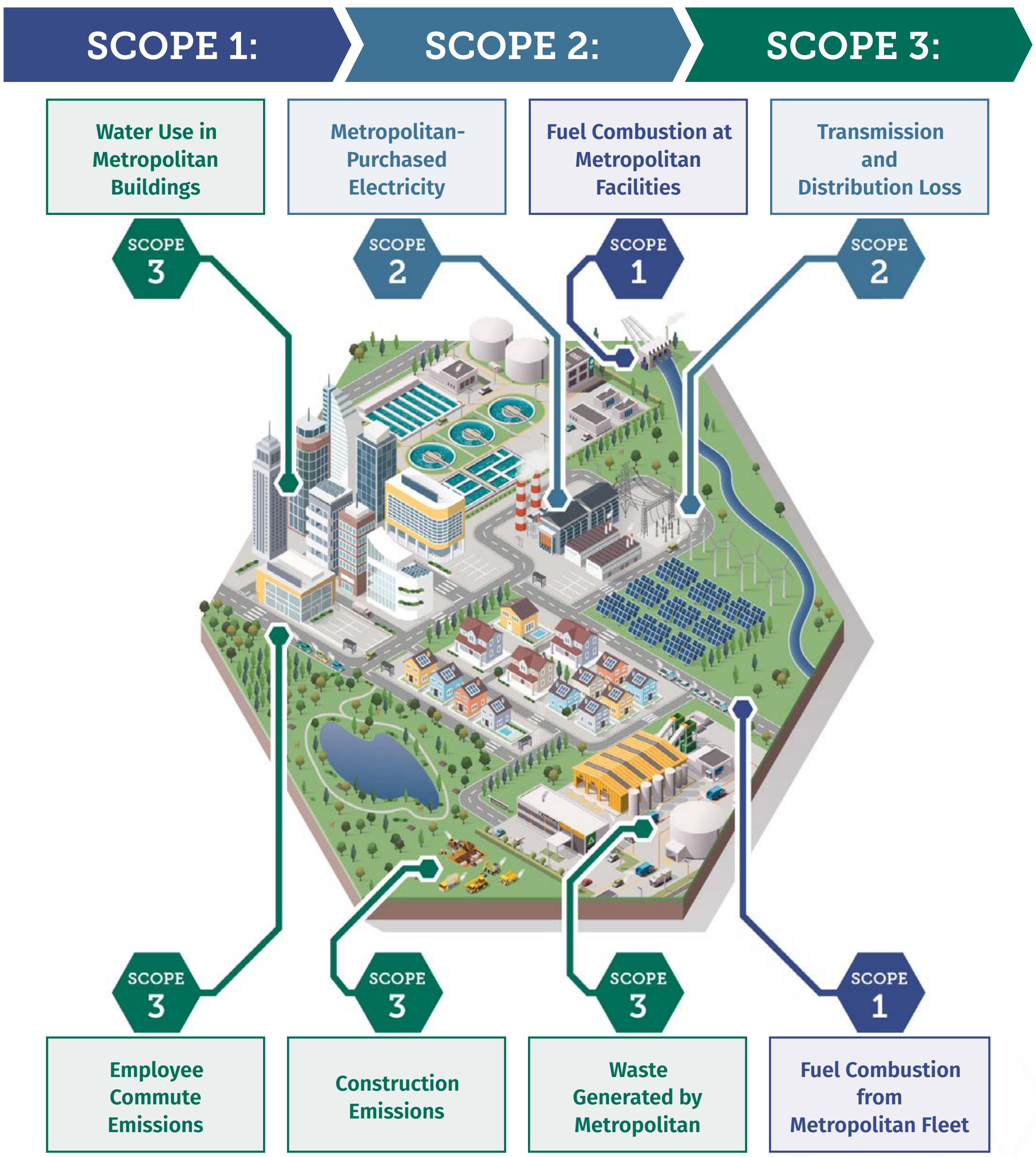
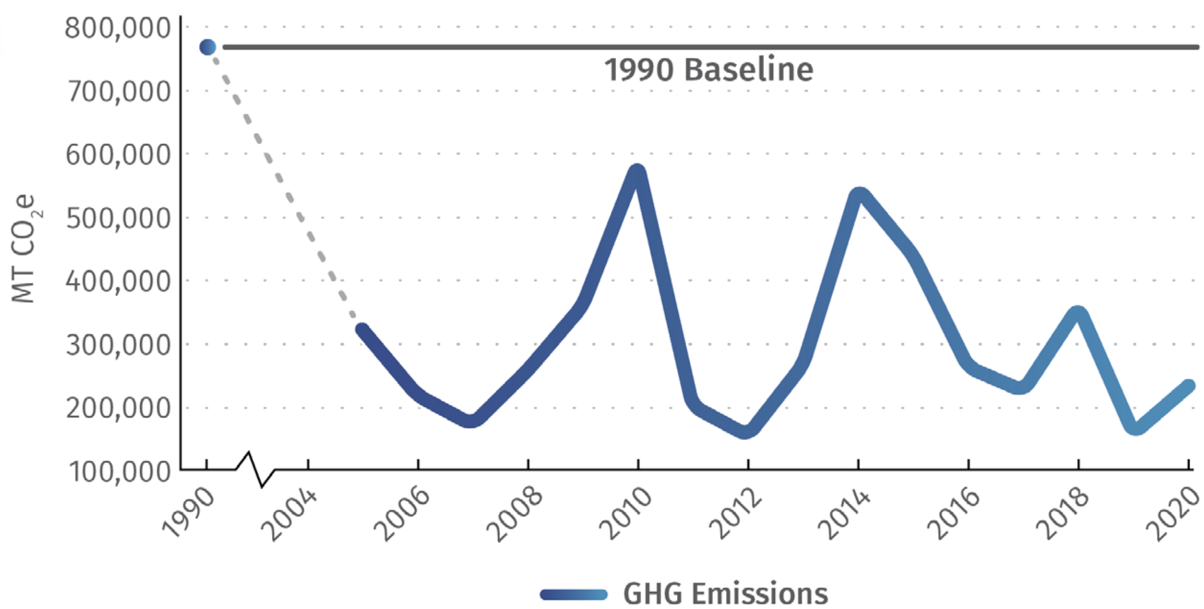


Figure ES-2 illustrates Metropolitan's historical GHG emissions in metric tons of carbon dioxide equivalent (MT $CO_2e$).[2] For more information on historic emissions please see Section 3.2, Historical Metropolitan GHG Emissions. Metropolitan's emissions are highly variable depending on the amount of CRA pumping during each calendar year.

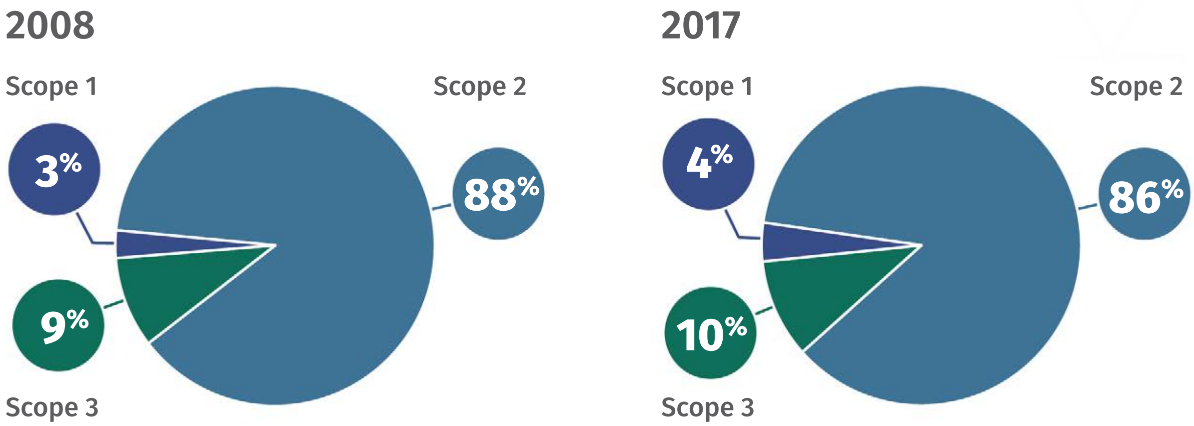
**FIGURE ES-2: Metropolitan GHG Emissions Over Time**

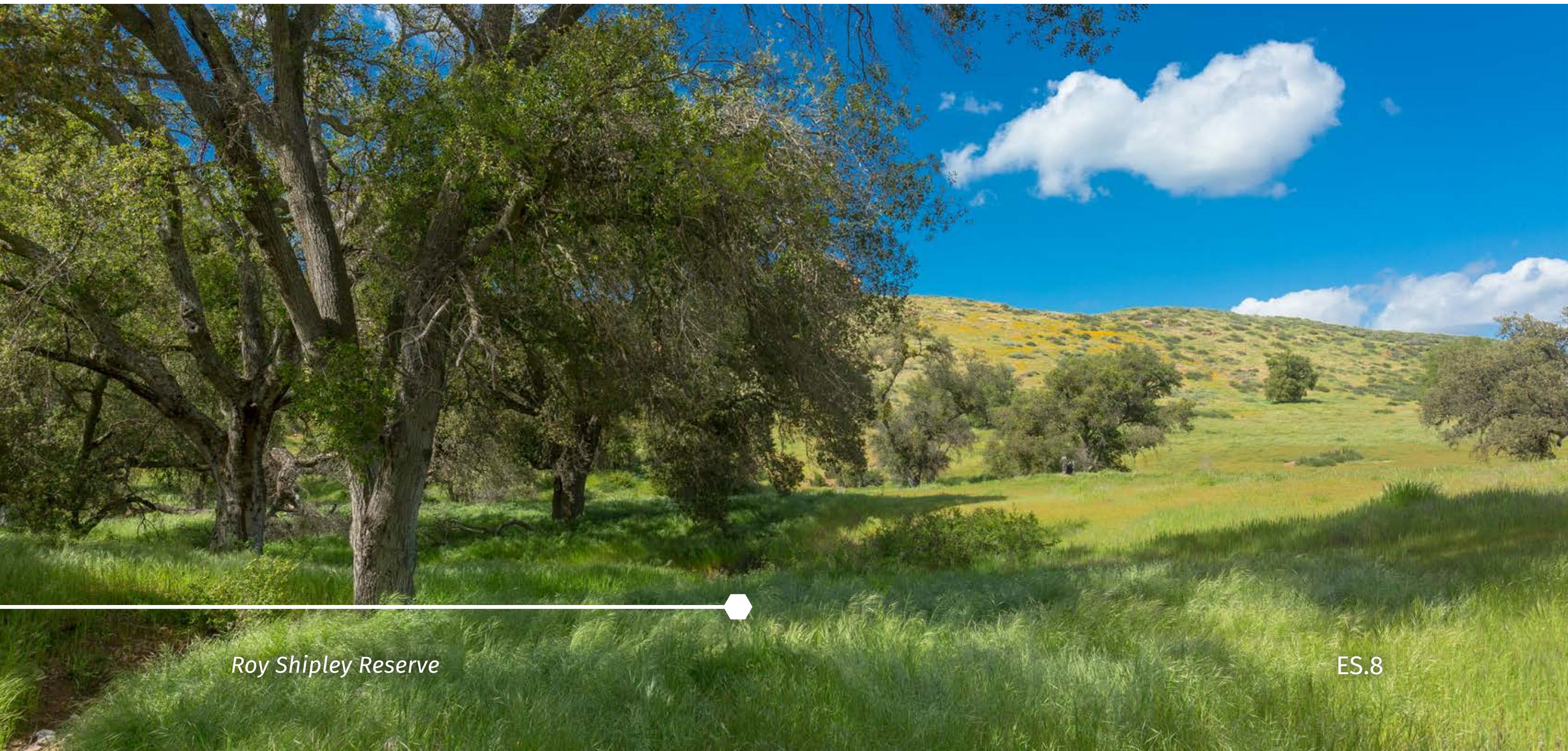



Emissions are categorized into three scopes. Scope 1 emissions are associated with fuel use associated with combustion in equipment or vehicles, propane and natural gas use at Metropolitan facilities, and fugitive emissions. Scope 2 emissions are indirect emissions associated with the purchase and consumption of electricity, and Scope 3 emissions are from other indirect emissions, such as those associated with employee commutes, waste generation, water consumption, and emissions associated with construction projects. Metropolitan's emissions are largely dominated by Scope 2 emissions (electricity). Figure ES-3 shows the breakdown of Metropolitan's emissions in 2008 and 2017 by scope. For more detailed information on Metropolitan's GHG inventory, please refer to Section 3.1, Metropolitan Operational Boundary and Emissions Sources and Section 3.2, Historical Metropolitan GHG Emissions.

2. *MT $CO_2e$ – Metric tons of carbon dioxide equivalent. This is a measure of all greenhouse gases (carbon dioxide, methane, nitrogen dioxide, and others) converted into tons of carbon dioxide using the global warming potential. For more information, see Section 2, Scientific Context and Climate Change Impacts.*

**FIGURE ES-3: Metropolitan Emissions By Scope**



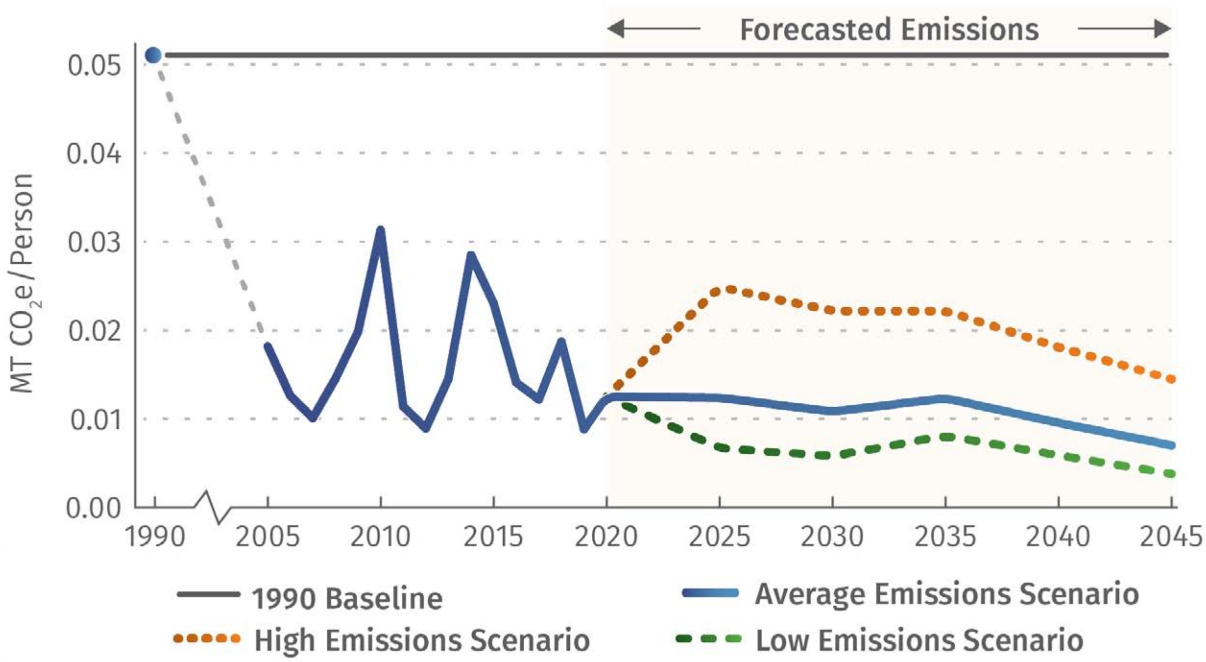



*Roy Shipley Reserve*

# METROPOLITAN'S GHG EMISSIONS FORECAST

To better estimate future emissions, Metropolitan prepared an emissions forecast through 2045 under high-, average-, and low-emissions scenarios, which are based on projections for water demand in its 2020 Urban Water Management Plan. Section 3.3, Metropolitan GHG Emissions Forecast details Metropolitan's forecast results. Figure ES-4 illustrates Metropolitan's GHG emissions forecasts through 2045.

**FIGURE ES-4: GHG Emissions Forecast and Potential Range (Per Capita)**



*Joshua Tree area desert landscape*

# EMISSIONS REDUCTION TARGETS

The emissions inventory and forecast provide a basis for Metropolitan to establish targets for future GHG reductions. Metropolitan established a 2030 target of 40% below 1990 levels by 2030 for GHG emissions reduction to achieve consistency with SB 32 and a 2045 target of carbon neutrality consistent with EO B-55-18. By defining specific reduction targets, Metropolitan can track its progress towards meeting its goals and measure the success of its CAP. CEQA Guidelines Section 15183.5(b)(1) requires that plans establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable. Metropolitan will utilize a per capita emissions calculation to track progress towards meeting its GHG reduction goals. The per-capita GHG emissions forecast provides a metric to measure each person's GHG emissions generated from water use. This approach can clearly illustrate the positive effect an individual's lower water use can have on GHG emissions. Metropolitan will pursue a linear per capita GHG emission reduction pathway, as demonstrated in Figure ES-5, to exceed the State's target of 40 percent below 1990 levels by 2030 (0.0309 MT $CO_2e$ per person) and make significant progress towards ultimately achieving carbon neutrality by 2045 (0.0 MT $CO_2e$ per person). Table ES-1 provides more detail on Metropolitan's adopted GHG reduction targets and how they compare to the state reduction targets. For more information on the emissions reductions targets, please refer to section 4.3, Metropolitan's GHG Emissions Reduction Targets.

**FIGURE ES-5: Metropolitan's Per Capita GHG Emissions Targets**

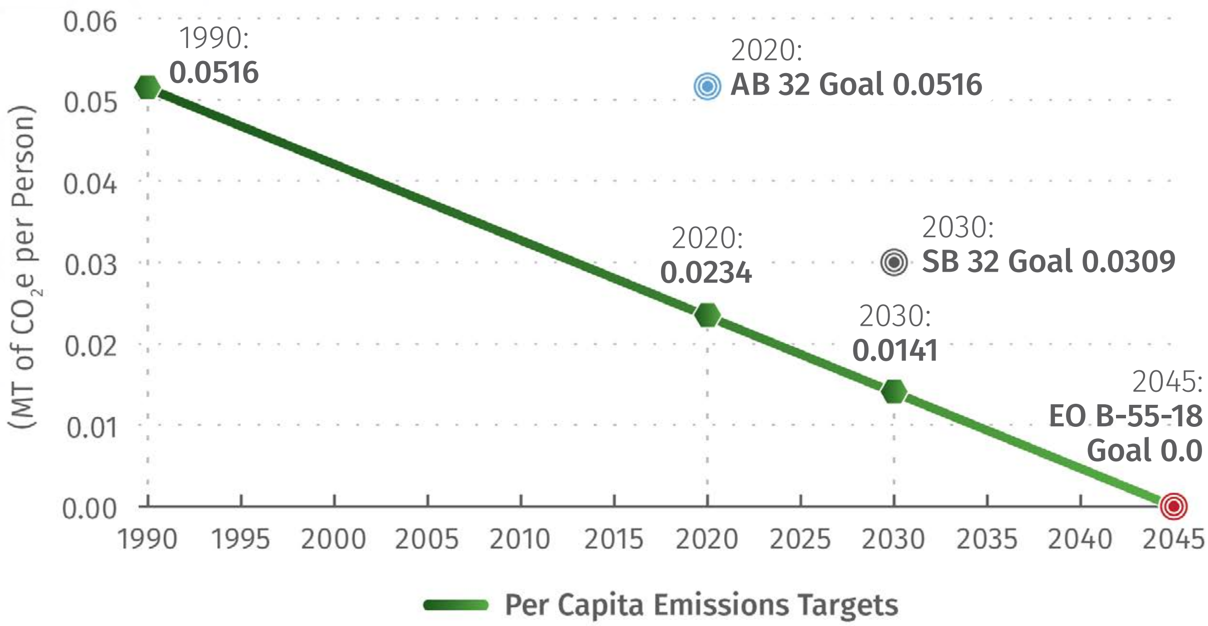



**TABLE ES-1: Comparison of Metropolitan and California GHG Reduction Targets**

| Target | Per Capita Emissions (MT $CO_2e$) | Associated Mass Emissions* (MT $CO_2e$) | Percent Reduction (Below 1990) |
|---|---|---|---|
| Metropolitan's 1990 Per Capita Emissions (AB32 Target) | 0.0516 | 771,514 | N/A |
| Minimum Per Capita Reduction Target for SB 32 Consistency | 0.0309 | 638,423 | 40% |
| Metropolitan's Per Capita 2030 GHG Emissions Target+ | 0.0141 | 290,192 | 73% |
| Metropolitan's 2045 Per Capita Goal | 0 | 0 | 100% |
| California's EO B-55-18 Per Capita Goal | 0 | 0 | 100% |

*+Pending final population numbers*

**Associated Mass Emissions are calculated by multiplying the per capita emissions target by the projected population in that year. Final mass emission values will be updated based on actual population data.*



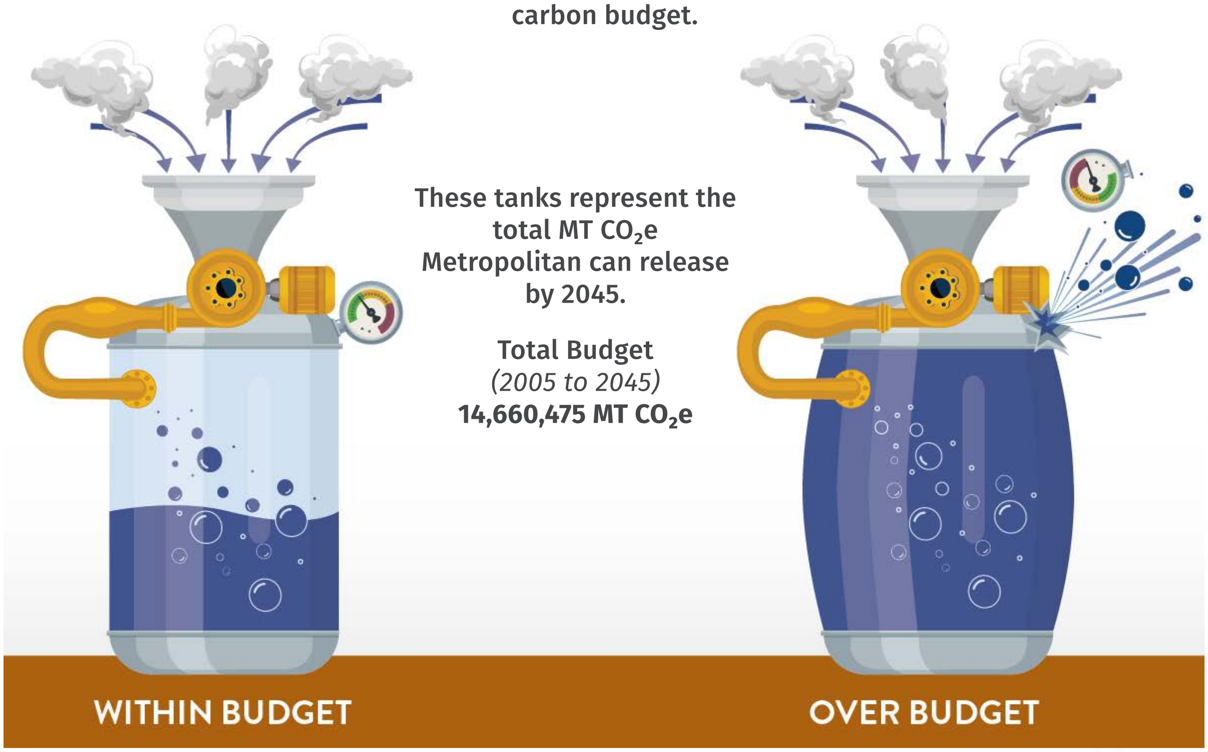
# METROPOLITAN'S CARBON BUDGET

Metropolitan's GHG emissions fluctuate from year to year depending on the amount of water pumped from the Colorado River. Consequently, GHG emissions recorded in any one particular year are not necessarily representative of Metropolitan's overall progress towards meeting its GHG emissions reduction targets. To account for this factor, Metropolitan will track its emissions annually using a carbon budget approach. Figure ES-6 illustrates the carbon budget approach as applied to Metropolitan's operations.

**FIGURE ES-6: How a Carbon Budget Works**

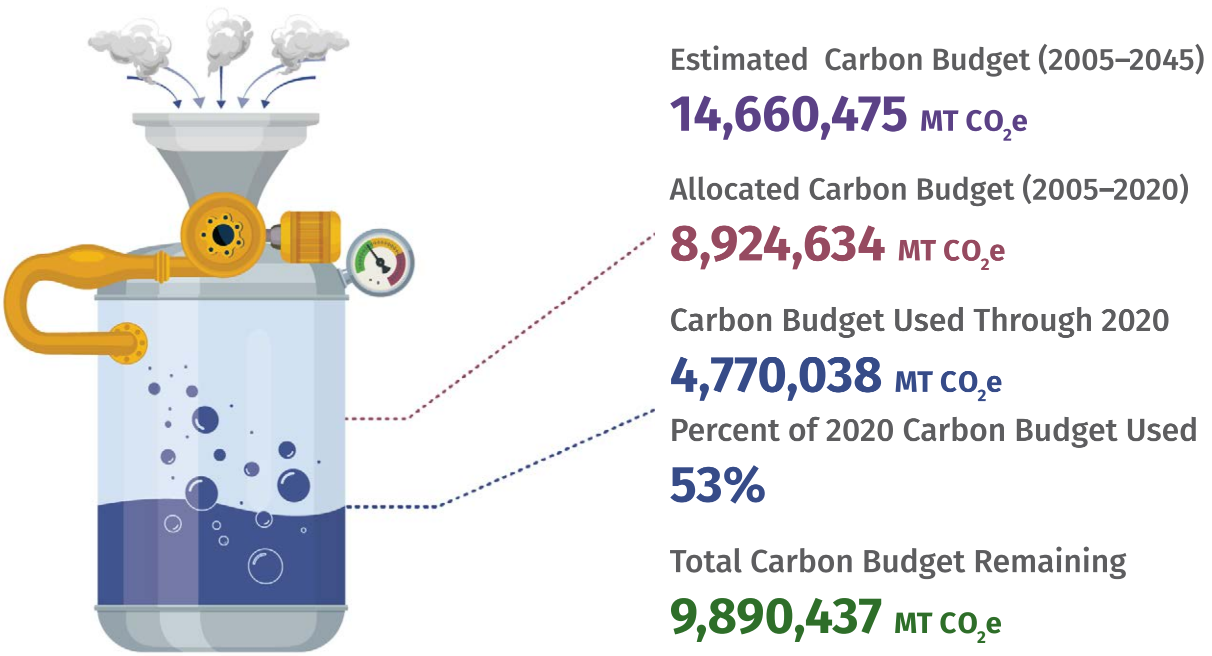
**GHG EMISSIONS FROM METROPOLITAN'S OPERATIONS**

**As Metropolitan releases GHG emissions during its operations, those emissions deplete the carbon budget.**



Between 2005 and 2020, Metropolitan used approximately 4,770,038 MT $CO_2e$ of its total carbon budget of 14,660,475 MT $CO_2e$. This accounts for only 53 percent of the total budget allocated for this timeframe. As shown in Figure ES-7, Metropolitan has approximately 9.9 million MT GHG emissions (as $CO_2e$) remaining until 2045

**FIGURE ES-7: Metropolitan's Remaining Carbon Budget as of 2020**




As shown in Table ES-2, under current projections, Metropolitan is expected to stay within the carbon budget through 2030 in all three scenarios. However, achieving carbon neutrality will require additional reductions regardless of the water demand scenario modeled. In order to stay within its established carbon budget, Metropolitan developed a suite of GHG reduction strategies outlined in Section 5.0, Metropolitan's GHG Emissions Reduction Strategy.

**TABLE ES-2: Metropolitan's Forecasted Carbon Budget Outcomes**

| Emissions Levels | Remaining Budget 2030 (MT $CO_2e$) | Remaining Budget 2045 (MT$CO_2e$) |
|---|---|---|
| **Low Emissions** | 6,405,936 | 6,704,456 |
| **Average Emissions** | 5,465,774 | 4,413,932 |
| **High Emissions** | 3,384,248 | (718,236) |

*( ) denotes a negative value*

*Lake Havasu*


*Inland Feeder*

# METROPOLITAN'S GHG EMISSIONS REDUCTION STRATEGY

This CAP includes specific strategies that will help Metropolitan achieve carbon neutrality while providing co-benefits such as improved infrastructure reliability, increased energy resiliency, and decreased costs associated with energy procurement and maintenance. The following section presents the nine GHG reduction strategies included in the CAP. For more detailed information on the strategies, refer to section 5.0, Metropolitan's GHG Emissions Reduction Strategy.

## SCOPE 1:

## DIRECT EMISSIONS

### Strategy 1: Phase Out Natural Gas Combustion at Facilities

Combustion of fossil fuels at Metropolitan facilities emits over 1,000 MT $CO_2e$ annually. Natural gas-powered equipment can be electrified over time as the equipment reaches the end of its useful life. Carbon-free electricity can then be used to power equipment, further reducing emissions.

### Strategy 2: Zero Emissions Vehicle Fleet

Metropolitan's vehicle fleet emits an average of 7,000 MT $CO_2e$ per year. Decarbonizing Metropolitan's fleet and powering it with carbon-free electricity or other zero-emission technology would allow for this emission source to achieve carbon neutrality.

### Strategy 3: Use Alternative Fuels to Bridge the Technology Gap to Zero Emission Vehicles and Equipment

While zero-emission vehicles are being developed, using low-carbon intensity fuels like renewable diesel in older vehicles can help reduce GHG emissions in the near-term.

## SCOPE 2:

## INDIRECT EMISSIONS FROM ELECTRICITY

### Strategy 4: Utilize Low-Carbon and Carbon-Free Electricity

Electricity consumption is Metropolitan's single largest and most variable emissions source. While the California Renewables Portfolio Standard Program (SB 100) mandates that emissions from retail electricity will be reduced over time, additional steps are necessary to generate and procure carbon-free electricity to reach Metropolitan's carbon neutrality goal. This strategy includes purchasing low-carbon and carbon-free electricity, implementing time-of-use strategies, and developing additional carbon-free energy generation like wind, solar, and hydropower.

### Strategy 5: Improve Energy Efficiency

Increasing the efficiency of electric-powered equipment can substantially reduce GHG emissions. Improving pump efficiency, installing light emitting diode (LED) lighting and energy recovery systems can reduce total demand for electricity from Metropolitan operations, saving money and decreasing emissions.

SCOPE 3:

# OTHER INDIRECT EMISSIONS

## Strategy 6: Incentivize More Sustainable Commutes

While Metropolitan does not have direct control over the manner in which its employees travel to and from their jobs, Metropolitan can facilitate alternative commute strategies, including use of active and shared/subsidized transportation, remote work, and charging equipment for electric vehicles.

## Strategy 7: Increase Waste Diversion to Achieve Zero Waste

Though waste generated by Metropolitan operations results in only a small fraction of overall annual GHG emissions, Metropolitan will implement specific measures designed to reduce the waste generated at its offices and facilities.

## Strategy 8: Increase Water Conservation and Local Water Supply

Metropolitan will continue incentivizing conservation and investing in local projects that increase local water supplies such as groundwater, recycled water, and stormwater.

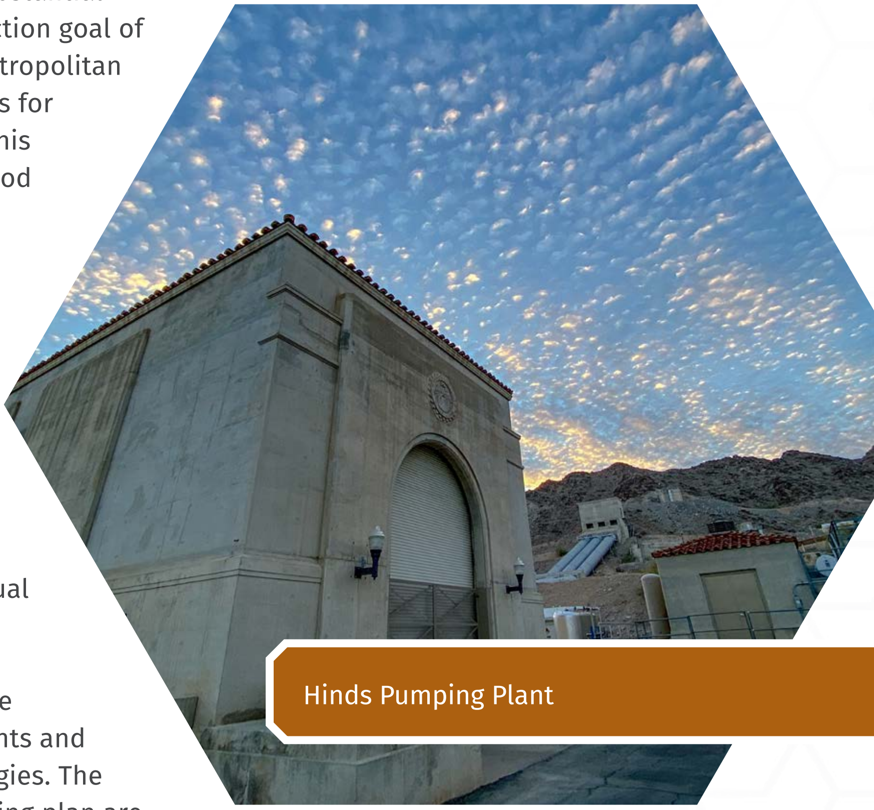
## Strategy 9: Investigate and Implement Carbon Capture and Sequestration Opportunities

Carbon sequestration and carbon capture and storage projects could provide Metropolitan a source of "negative" GHG emissions that will support its efforts to achieve carbon neutrality. Metropolitan will continue to track these opportunities as they progress. While GHG reduction through electrification, carbon-free electricity, and efficiency will drive a significant portion of Metropolitan's GHG reduction needs, sequestering and storing carbon will likely play a critical role in achieving and maintaining carbon neutrality for both Metropolitan and California.

Lake Mead

# IMPLEMENTATION STRATEGY AND MONITORING

This CAP will guide Metropolitan to achieve the 2030 GHG reduction target and demonstrate substantial progress toward the long-term state reduction goal of carbon neutrality by 2045. At this time, Metropolitan has developed two implementation phases for the GHG reduction measures included in this CAP. Phase 1 will implement well-understood measures over the next 10 years based on cost, available technology, and certainty of future conditions. Phase 2 will follow with measures that show promise, but require additional research, new or emerging technology, or different market conditions before implementation. To maintain accuracy and adapt to changing conditions, Metropolitan will conduct annual updates of the carbon budget and develop an annual progress report to demonstrate successes and areas for continued improvement. Metropolitan will update the CAP every five years to capture new research developments and identify new, adapted, or expanded strategies. The CAP implementation strategy and monitoring plan are detailed in Section 6.0, Implementation and Monitoring.



Hinds Pumping Plant

# SECTION 1.0
# PURPOSE, OVERVIEW, AND ENVIRONMENTAL HISTORY AND LEADERSHIP

The Metropolitan Water District of Southern California (Metropolitan) recognizes the potential impact of climate change to its core mission of providing a reliable water supply for Southern California. Variable precipitation patterns, timing and availability of water supplies, changes in consumer demands, and sea level rise will all change the way Metropolitan plans to provide its services and how it operates its regional water system. Reducing greenhouse gas (GHG) emissions from water operations supports California's overall strategy to achieve statewide GHG reduction goals. This Climate Action Plan (CAP) sets targets and goals for reducing GHG emissions from Metropolitan's operations, including conveyance, storage, treatment and delivery of water to its 26 member public agencies. The CAP also will have an important role in the environmental review of projects subject to the California Environmental Quality Act (CEQA) that were included in the GHG emissions forecast, as it provides a pathway to tier GHG emissions analysis for projects. In addition, it complements Metropolitan's other long-range planning efforts, including the Integrated Water Resources Plan, Energy Sustainability Plan and Capital Investment Plan.

This section establishes the purpose of the CAP, provides an overview of Metropolitan, and describes Metropolitan's efforts to date in reducing GHG emissions.

# 1.0

*Diamond Valley Lake*

# 1.1 PURPOSE OF THE CAP

The CAP is a long-range planning document that will inform policy and planning decisions on operations, water resources, capital investments, and conservation and local resource programs. It also can be used by member agencies when considering local policies and programs. Additionally, as mentioned previously, the CAP will allow Metropolitan to streamline the environmental review process for future projects under CEQA. The CAP creates a roadmap that will provide Metropolitan with a broad range of feasible and implementable strategies and measures to mitigate or reduce GHG emissions in line with State goals. The CAP also will help Metropolitan reduce overall GHG emissions from its operations and improve cost effectiveness, while avoiding negative impacts to Metropolitan's core mission. Beyond establishing a feasible and implementable pathway to its emissions reduction target of carbon neutrality by 2045, the CAP will:

- Incorporate legislation and guidance from state, federal, and international sources
- Identify cost-effective energy efficient measures
- Provide co-benefits, such as improved operational resilience and air quality
- Streamline CEQA review for future projects in accordance with CEQA Guidelines Section 15183.5(b)(1)
- Integrate actions to achieve California's transportation strategies to transition away from fossil fuels.

**Metropolitan is adopting a long-term goal of achieving carbon neutrality by 2045, consistent with California's Executive Order B-55-18.**

# METROPOLITAN CAP INTENT AND USE

## CEQA GHG Emissions Analyses Streamlining

This CAP is consistent with all state legislation, including Senate Bill (SB) 32 and Executive Order (EO) B-55-18, and meets the requirements of Section 15183.5(b)(1) of the CEQA Guidelines for a "Qualified GHG Reduction Plan" (CAP or Plan).

To meet the requirements of CEQA Guidelines Section 15183.5(b)(1), a qualified CAP must:

1. Quantify existing and projected GHG emissions within the Plan area (see Section 3.0)
2. Establish a reduction target based on local, regional or state targets (see Section 4.0)
3. Identify and analyze sector specific GHG emissions from Plan activities (see Section 3.0)
4. Specify policies and actions (measures) that, if implemented, would achieve the specified reduction target (see Section 5.0)
5. Establish a mechanism to monitor progress and amend the CAP (see Section 6.0)
6. Adopt the document in a public process following environmental review (see CAP Program Environmental Impact Report).

Using a qualified CAP will allow Metropolitan to tier future project-level GHG emissions analyses from the CAP, if those projects demonstrate consistency with the CAP. Consistency will be determined by conducting annual GHG emissions inventories to ensure Metropolitan is meeting its adopted GHG reduction goals.

## CAP Implementation Tracking

Metropolitan is committed to tracking the implementation of this CAP using a specialized tracking tool as well as through annual, third-party verified GHG emissions inventories submitted to The Climate Registry (TCR).[1] Metropolitan will use this information to monitor its consistency with its GHG reduction goals (Section 4.0) and ensure the effectiveness of the CAP at reducing GHG emissions. The CAP measures and actions in Section 5.0, Metropolitan's GHG Emissions Reduction Strategy, are summarized by responsible entity, timing, and monitoring approach. Section 6.0, Implementation and Monitoring, details how GHG emissions will be measured on an annual basis, and how and when the CAP will be updated. At a minimum, the CAP will be updated every five years, or sooner if needed to ensure progress towards meeting Metropolitan's GHG reduction goals. Metropolitan will be responsible for tracking the implementation of the CAP measures and actions as well as staying within the GHG emissions established by the carbon budget defined in Section 4.0.

1. *The Climate Registry was formed to continue the work of the California Climate Action Registry. Created by the State of California in 2001, the California Climate Action Registry promoted and protected businesses' early actions to manage and reduce their GHG emissions. Source:* **https://www.theclimateregistry.org/who-we-are/about-us/**

*Colorado River Aqueduct*

# 1.2 OVERVIEW OF METROPOLITAN

Formed in 1928 by an act of the California Legislature, Metropolitan is a regional wholesaler providing water for its 26 member public agencies – to deliver either directly or through their sub-agencies – to 19 million people living in Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties. Metropolitan's mission is to provide its 5,200-square-mile service area with adequate and reliable supplies of high-quality water to meet present and future needs in an environmentally and economically responsible way.

To fulfill its mission, Metropolitan imports water from the Colorado River and Northern California to supplement local supplies and helps its members develop increased water conservation, recycling, storage, and other resource management projects. Metropolitan's service area is shown in Figure 1-1.

**The mission of the Metropolitan Water District of Southern California is 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.**

**FIGURE 1-1: Metropolitan's Service Area**


# METROPOLITAN'S WATER SOURCES

Metropolitan imports water from two sources:

- The Colorado River via the Colorado River Aqueduct (CRA), which is owned and operated by Metropolitan. The headwaters of the Colorado River originate in the Rocky Mountains. The system is governed by water rights and agreements among the seven Colorado River Basin states[2] and is managed by the United States Bureau of Reclamation.
- Northern California via the State Water Project (SWP),[3] which delivers water through the California Aqueduct to 29 state contractors. The California Department of Water Resources (DWR) owns and operates the system. Metropolitan is the largest SWP contractor.

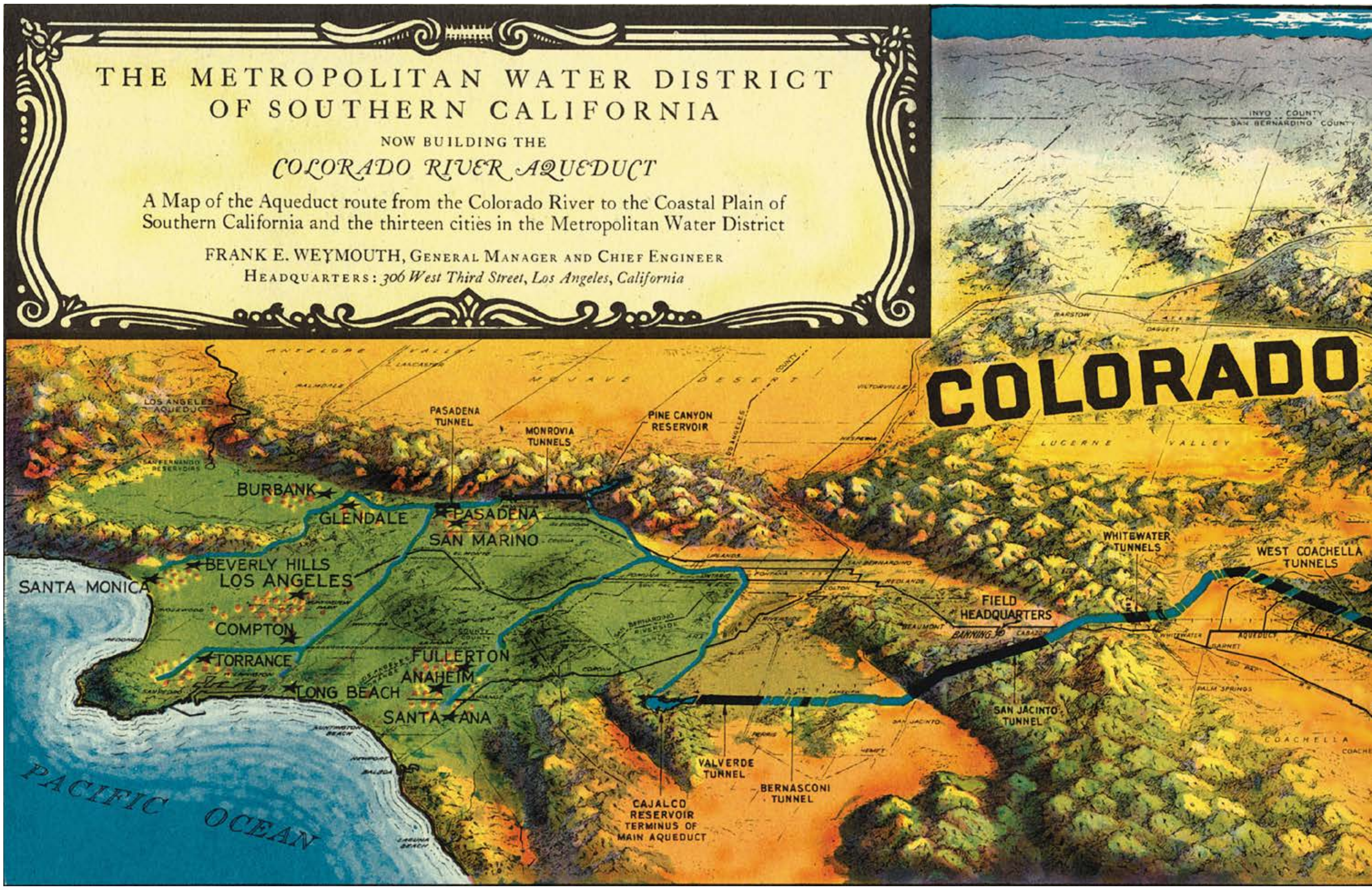
2. *The Colorado River Basin states include Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. Source:* ***https://www.usbr.gov/lc/hooverdam/faqs/riverfaq.html.***

3. *The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants and pumping plants extending throughout California for more than 700 miles (or approximately two-thirds the length of California).*

An increasing percentage of Southern California's water supply comes from water conservation, water recycling, and other local resources. Metropolitan supports these programs with funding to support additional development.

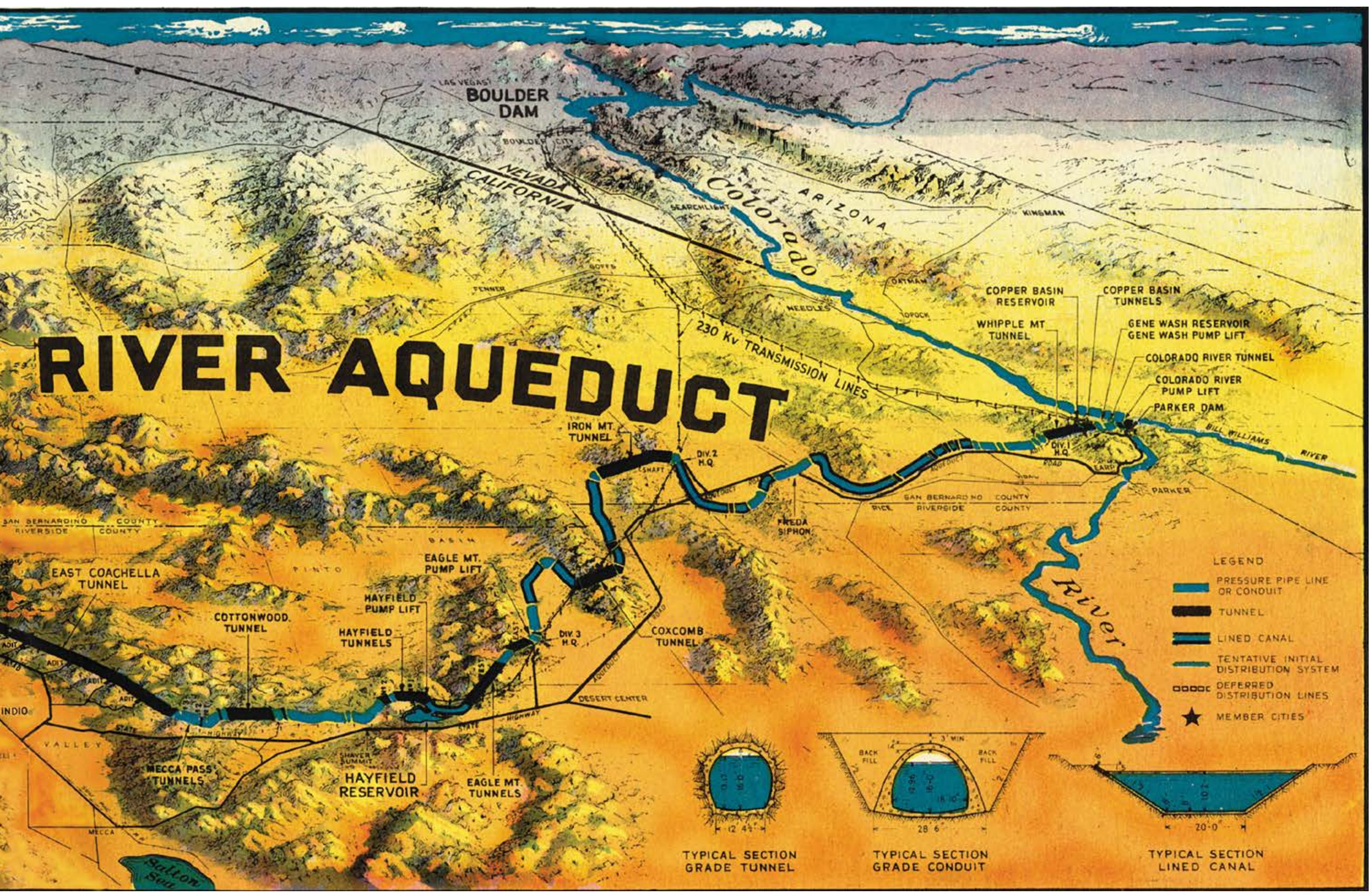
Metropolitan owns and operates the 242-mile CRA (see Figure 1-2), a system of reservoirs, pump plants, canals, tunnels, and pipelines that convey water from Lake Havasu on the California-Arizona border across the Mojave Desert and southern edge of the San Bernardino Mountains, to Lake Mathews on the east side of the Santa Ana Mountains in western Riverside County.

**FIGURE 1-2: Colorado River Aqueduct System**

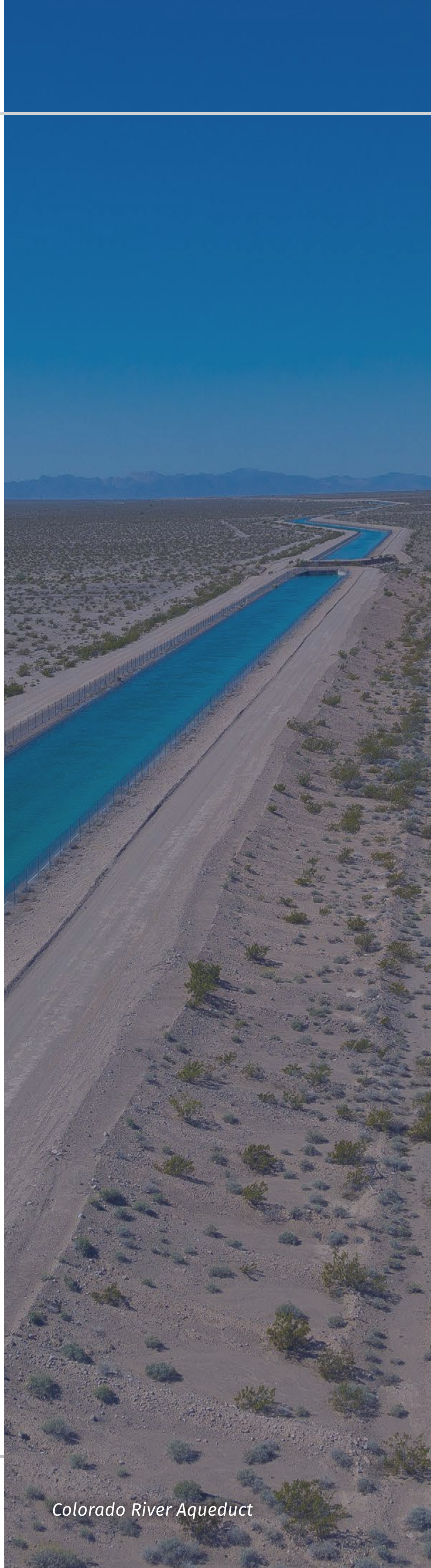


Metropolitan takes delivery of its SWP supplies through the Foothill Feeder immediately downstream of Castaic Lake in Los Angeles County, through the Rialto Pipeline and Inland Feeder which connect to the Devil Canyon Powerplant after-bays in San Bernardino County, through the Box Springs Feeder in Riverside County, and through the Perris Pressure Control Structure at Lake Perris in Riverside County (see Figure 1-3). The operations of the SWP and associated GHG emissions are addressed in the DWR Climate Action Plan and are not included in this CAP.[4]

4. ***https://water.ca.gov/Programs/All-Programs/Climate-Change-Program***



## FIGURE 1-3: California Water Map

Colorado River Aqueduct

## METROPOLITAN SNAPSHOT

**Member agencies**
**26**

**Serve area population**
(including parts of Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties)
**19 Million**

**Miles of water pipelines and tunnels**
**830**

**Reservoir storage capacity**
(including a six-month emergency supply)
**1,072,000 Acre-feet**

**Hydroelectric generation via 16 plants**
**131 Megawatts**

**Water treatment plants**
**5**

# METROPOLITAN STATISTICS[5]

Metropolitan supplies water for 19 million people across Southern California (see Figure 1-4) and maintains hundreds of miles of pipelines, several water treatment facilities, and countless pumps and other infrastructure. Water delivered per year (acre-feet) by Metropolitan is shown in Figure 1-5.

**FIGURE 1-4: Metropolitan Service Area Population by Year (Millions)**

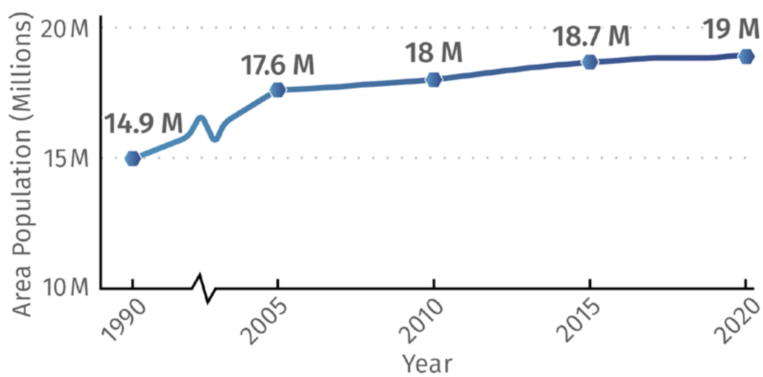
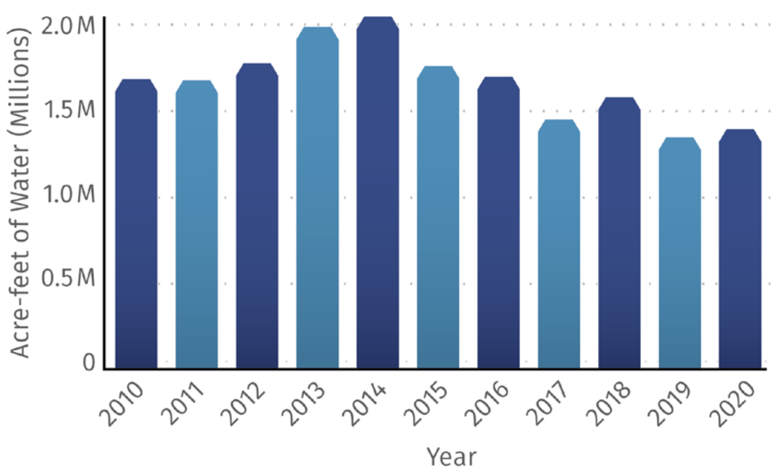



**FIGURE 1-5: Water Delivered per Year (Acre-feet) by Metropolitan**



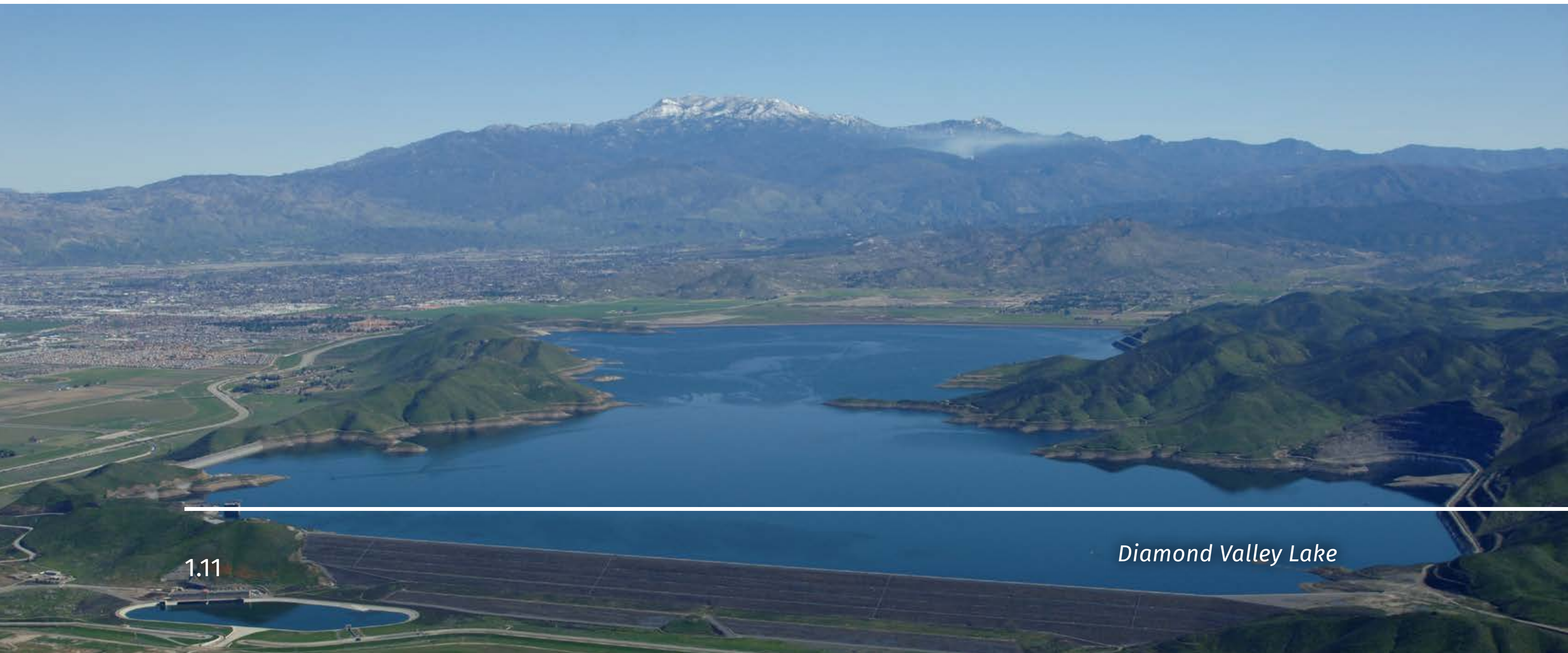

5. **https://www.mwdh2o.com/who-we-are/our-story/** *Accessed April 15, 2020.*

# ENVIRONMENTAL COMMITMENT AND GHG REDUCTION GOALS

## Commitment to Environmental Responsibility

Although Metropolitan was formed in 1928 to build a system to import water from the Colorado River, its mission has evolved to ensure the water reliability of Southern California by incorporating a diverse portfolio of water sources and initiatives to help meet the needs of the region.[6] Early on, Metropolitan's planners and engineers recognized the need for efficiency and energy reliability. The CRA, Metropolitan's first and primary source of water conveyance, was designed to deliver water 242 miles across the arid desert to Southern California, primarily through gravity. Five pump plants along the aqueduct lift the water to cross mountains and allow gravity to continue the work. In 1960, Metropolitan was instrumental in securing a new supply from Northern California, with California voters approving construction of SWP.[7] In 2000, Metropolitan completed construction of Diamond Valley Lake (DVL), the region's largest drinking water reservoir, which helps protect the region from droughts and ensures a reliable supply of water in emergencies. In 2009, Metropolitan completed the Inland Feeder, a 44-mile-long conveyance system that connects the SWP to DVL and the CRA, increasing the operational flexibility necessary to store water in wet years.

6. ***http://www.mwdh2o.com/DocSvcsPubs/mwd_newsletter/aug2011/article4.html***
7. ***https://www.mwdh2o.com/who-we-are/our-story/***



*Diamond Valley Lake*

Today, Metropolitan continues to adapt to the region's ever-changing needs and challenges by investing in its imported supplies while also making significant investments in conservation, water recycling, groundwater storage, and innovative water transfer and storage projects. Metropolitan also works with its partners on the co-equal goals of restoring the environmental health of the Sacramento-San Joaquin Delta and protecting its water resources to ensure a reliable source of imported water. The CAP represents the next step of Metropolitan's long-standing commitment to environmental stewardship.

Water use efficiency, which includes both short-term conservation efforts and longer-term demand management actions play a key role in water reliability for the region. All water savings actions in Metropolitan's service area and the greater Southern California region will continue to play a priority role in the reduction of GHG emissions. While all of Metropolitan's actions to reduce its GHG emissions will benefit the region, its conservation programs allow Metropolitan to target more specific sectors, communities, and technologies. Underserved (Disadvantaged Communities/DACs) communities represent a significant portion of Metropolitan's Southern California service area. Residents in these areas may lack the resources to take advantage of rebates or incentives for high-efficiency appliances or equipment that can require large, up-front purchases. They also may live in apartments and other multi-family buildings without yards, limiting their participation in outdoor programs such as Metropolitan's landscape transformation program or rebates for smart irrigation controllers.

Metropolitan continually reviews and updates its conservation programs to improve water savings and benefits to communities throughout its service area. For example, in FY 2021-22 Metropolitan is continuing a pilot program to penetrate underserved communities that are traditionally "hard to reach" to increase access to incentives and help ensure equitable distribution of water savings devices. The program targets older multi-family housing (built prior to 1994) and allows contractors to directly install high-efficiency toilets in the housing units. Metropolitan also provides funding to its Member Agencies that helps subsidize their local programs for underserved communities. These local programs are also aimed at generating water savings in underserved communities, and may include replacement of older, high water-using toilets, shower heads, aerators, and other water-saving devices in multi-family housing within Member Agencies' service areas. Other programs include providing leak detection equipment that monitor flows and identifies leaky devices and providing technical assistance for educational programs. Lastly, Metropolitan continues to partner with local utility companies like Southern California Gas Company (SoCalGas) to pursue joint Water-Energy efficiency programs. One of the longer-running programs allows Metropolitan to provide incentives to SoCalGas to help offset the cost of high-efficiency clothes washers that use less water and gas and expand installations directly into income-qualified, single-family residences.

Metropolitan also includes outreach and messaging campaigns over a variety of media and in multiple languages to ensure that the broader community is aware of the conservation opportunities available to them. Conservation and water use efficiency play a key role in water reliability for the region and water savings actions in local communities will continue to play a priority role in the reduction of GHG emissions. All of these efforts help to ensure a more equitable distribution of conservation funds and that the broader community is educated about water conservation and its contribution to the region's ability to provide a safe and reliable water supply for all.


*Partnership with California Native Plant Society*

*Skinner Water Treatment Plant solar panels*

# 1.3 METROPOLITAN'S GHG EMISSIONS REDUCTION HISTORY AND LEADERSHIP

Metropolitan's GHG emissions are primarily from the purchase and consumption of electricity used for conveyance, treatment, and delivery of water throughout Metropolitan's service area. Since 1990, Metropolitan has continued to take significant steps to reduce GHG emissions by improving its operational efficiency and by supporting the development of local water supplies and water use efficiency for homes, businesses and industries. These actions among others contribute to an overall decrease in Metropolitan's GHG emissions. Some of the GHG emissions reduction projects implemented by Metropolitan to date are summarized below. More information about Metropolitan's Energy Sustainability Plan can be found at ***https://www.mwdh2o.com/planning-for-tomorrow/addressing-climate-change/***.

## METROPOLITAN GHG REDUCTION STRATEGIES

### Infrastructure Energy Efficiency and Renewable Energy

Through its Capital Investment Plan, Metropolitan helps make significant investments to ensure energy reliability by upgrading its infrastructure with the most efficient technology. Metropolitan also is committed to the development of new innovations through programs like the Technology Feedback Forum, a program that offers innovators and entrepreneurs an opportunity to pitch their new technologies or services to Metropolitan, its member agencies, and their partners. Metropolitan also invests in carbon-free energy resources, including procuring a significant portion of its electricity from hydroelectric power and installing 5.5 megawatt (MW) total capacity of photovoltaic solar power at its facilities. Planning and adoption of new energy technologies is managed through the Energy Sustainability Plan that positions Metropolitan as a leader in energy efficiency and forward-thinking energy management. The development of new initiatives considers the evolving regulatory landscape, economic factors, water supply reliability, and development of new technologies or improvements to existing technologies.

## Vehicle Fleet and Facilities

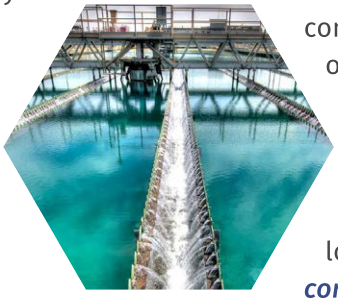
Metropolitan has reduced GHG emissions through its fleet management and facilities design and management. Metropolitan was an early adopter of high-fuel-efficiency and hybrid-electric vehicles for its fleet. Offices and facilities also are strategically located near public transportation. Employees have access to electric vehicle charging stations and the Metropolitan Rideshare Program. This commitment to GHG emissions reduction is further demonstrated through the design of its facilities, with Metropolitan achieving Leadership in Energy and Environmental Design (LEED) Platinum certification at the DVL Visitors Center and LEED Silver certification at the Union Station Headquarters in Los Angeles.

## Conservation of Natural Lands

Metropolitan directly contributes to the safeguarding of over 30,000 acres of multi-species preserves within California and more than 8,100 acres of native habitat along the Colorado River through participation in the Lower Colorado River Multi-Species Habitat Conservation Plan. By preserving natural lands, Metropolitan helps ensure that critical habitats and valuable natural carbon stockpiles are protected from future release, contributing to the removal and storage of carbon from the atmosphere.

## Water Conservation Efforts

Metropolitan's investment of more than $1 billion in water conservation, recycling, and groundwater recovery has funded projects responsible for the conservation of over 7 million acre-feet of water since 1990. These efforts, coupled with behavior changes by Southern Californians, reduced per capita water use in the region by a third since the 1990 baseline. Metropolitan provides funding, education, and engagement on multiple water conservation programs, including incentives for turf replacement, high efficiency appliances, smart irrigation controllers, and through the funding of water conservation innovation programs. A detailed description of Metropolitan's conservation efforts can be found in the Annual Regional Progress Report located at ***http://www.mwdh2o.com/inthecommunity/conservation-programs/Pages/default.aspx***.



# METROPOLITAN HISTORICAL GHG EMISSIONS TIMELINE

Metropolitan's GHG emissions are extremely variable and are tied directly to the amount of water pumped from the Colorado River to help meet the needs of Southern California. Depending on the carbon content of the energy used to pump the water, increased CRA pumping can result in higher GHG emissions. The amount of water Metropolitan pumps from the Colorado River is driven by availability of water on both the Colorado River and SWP systems, available storage, demand, and other factors. Higher Colorado River pumping generally correlates to dry years with low SWP allocations. Through the implementation of energy and water efficiency projects as well as state legislation, overall emissions from Metropolitan operations have decreased since 1990, even during extreme drought events that resulted in increased pumping on the CRA. Although Metropolitan's emissions spike in drought years, the level of GHG emissions associated with these spikes is decreasing over time.

The following graph summarizes Metropolitan's annual GHG emissions since 1990. The major events, reduction actions, and state legislation that have driven Metropolitan's unique GHG emission profile are also included to generate a timeline of emissions from Metropolitan's operations. For more detailed information about legislative drivers of GHG emissions reduction, see Section 4.0, and for more information on Metropolitan's GHG emissions see Section 3.0.

*Hinds Pumping Plant*

## 1990

### Conservation Credits Program

Metropolitan launches the Conservation Credits Program, providing incentives for water savings and reducing water use by an average of 158,000 acre-feet per year and GHG emissions by an average of 27,000 metric tons (MT) of carbon dioxide equivalent ($CO_2e$) per year from 1990 to 2018.[8]

## 1991

### No More Coal

Metropolitan stops purchasing electricity from coal-fired power plants, significantly reducing GHG emissions over time.

### Groundwater Recovery Program

Metropolitan initiates its Groundwater Recovery Program to encourage treatment and use of degraded groundwater for municipal purposes.[9]

## 1987–1992

### DROUGHT

During these years California experienced one of the longest droughts in its history, resulting in increased Colorado River pumping. The drought was eventually broken by a strong El Niño known as the “March Miracle.”

## 2002

### Senate Bill 1078

SB 1078, establishes the California Renewables Portfolio Standards (RPS) Program requiring 20 percent of electricity retail sales be served by renewable energy sources by 2017. Passage of SB 107 in 2006 accelerates this goal to a 2010 deadline.

## 2005

### First GHG Emissions Inventory

Metropolitan completes its first annual GHG emissions inventory reported to the California Climate Action Registry, including Scope 1 and Scope 2 emissions.

### Executive Order S-3-05

EO S-3-05 is signed, establishing statewide GHG emissions reduction targets for the years 2020 and 2050. The order calls for the reduction of GHG emissions in California to 1990 levels by 2020 and 80 percent below 1990 levels by 2050.

## 2006

### Solar at DVL Visitors Center

Metropolitan installs 0.5 MW of roof-mounted solar panels at the DVL Visitors Center, offsetting GHG emissions by approximately 80 MT $CO_2e$ per year.

8. *Water Tomorrow Annual Report to the California State Legislature. February 2019. Pg. 4. Average between 1990 and 2018 was multiplied by emission factors from Metropolitan Conservation Efforts Summary, and then averaged.*

9. *Water Tomorrow Annual Report to the California State Legislature. February 2019. Pg. 5*

### Assembly Bill 32

With the passage of Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006, California becomes the first state in the nation to mandate GHG emissions reductions across all industries. This landmark legislation requires the state to reduce GHG emissions to 1990 levels by 2020. It also directs the California Air Resources Board (CARB) to develop and implement a scoping plan and regulations to meet the 2020 target.

## 2007

### High-Fuel-Efficient Fleet

Metropolitan purchases 11 additional hybrid vehicles, making 30 percent of its passenger car fleet high-fuel-efficient vehicles.

### Senate Bill 97

The signing of SB 97 acknowledges that climate change is an environmental issue that requires analysis in CEQA documents. In 2010, CARB adopts guidelines that give lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHG emissions and climate change impacts. It also allows lead agencies to streamline the analysis of GHG emissions on a project level using a programmatic GHG emissions reduction plan that meets certain criteria.

## 2008

### SoCal Water$mart

Metropolitan launches a program to provide rebates to residential and commercial customers for water-efficiency upgrades.[10]

### Senate Bill 375

SB 375, the Sustainable Communities and Climate Protection Act, is signed, establishing regional GHG emission reduction targets for passenger vehicles. Under SB 375, CARB establishes targets for 2020 and 2035 for each region covered by one of the metropolitan planning organizations. Each major metropolitan planning organization must prepare a sustainable communities strategy (SCS) as an integral part of its regional transportation plan.

## 2009

### Solar at Skinner Water Treatment Plant (WTP)

Metropolitan installs a 1 MW photovoltaic power facility at the Skinner Water Treatment Plant, replacing 17 percent of the facility's grid electricity and reducing GHG emissions by approximately 550 MT $CO_2e$ per year.

### Senate Bill X7-7

SB X7-7, the Water Conservation Act, is signed, requiring all water suppliers to increase water use efficiency. This legislation sets an overall goal of reducing per capita urban water use by 20 percent by 2020.

10. 2015 IWRP

# 2007–2009

## DROUGHT

These three years of drought were the 12th worst in California's history and the first drought that resulted in the issuance of a statewide emergency. This drought limited water diversions from the SWP resulting in higher CRA pumping and corresponding high emissions that carried over into 2010.

# 2010

## GHG Reduction Strategy

Metropolitan completes an Energy Management and Reliability Study, which established policies and strategies for reducing GHG emissions, increasing revenue and mitigating price volatility.

# 2011

## Senate Bill 2X

SB 2X is signed, requiring California energy providers to buy (or generate) 33 percent of their electricity from renewable energy sources by 2020.

# 2012

## GHG Emissions Reach All-time Low

An 2012 GHG emissions inventory shows GHG emissions from Metropolitan operations at an all-time low due to almost all of Metropolitan's electric energy use being provided by hydro-electric power at the Parker and Hoover Dams in this year.

## Assembly Bill 341

AB 341 is signed, directing the California Department of Resources Recycling and Recovery (CalRecycle) to develop and adopt regulations for mandatory commercial recycling. As of July 2012, businesses are required to recycle and jurisdictions must implement a program that includes education, outreach, and monitoring. AB 341 also set a statewide goal of 75 percent waste diversion by the year 2020.

# 2011–2014

## DROUGHT

This period includes the hottest and driest period in California history, leading to increased CRA pumping and GHG emissions. In 2015 Governor Jerry Brown instituted a mandatory 25 percent water restriction. By 2016, California experienced the wettest year on record, replenishing water supplies, but causing widespread damage.

# 2014

## HECW Program

In partnership with SoCal Gas, Metropolitan implements a High Efficiency Clothes Washer (HECW) direct installation program for low income customers.

## California Water Action Plan

The California Water Action Plan is issued at the direction of Governor Brown in January, establishing 10 priority actions that guide the state's effort to create more resilient, reliable water systems and to restore critical ecosystems. The plan is established as California feels the effects of a record-breaking drought. An update to the plan is adopted in 2016 as drought continues.

## 2015

### Metropolitan Headquarters Energy Star Certification

Metropolitan's commitment to sustainability is recognized when the Metropolitan's Headquarters building at Union Station again receives ENERGY STAR certification, this time with a score of 97 out of 100.

## 2016

### Solar at Weymouth WTP

Metropolitan installs a 3 MW photovoltaic power facility at the Weymouth Water Treatment Plant, replacing 45 percent of the facility's grid electricity and reducing GHG emissions by approximately 1,500 MT $CO_2e$ per year.

### Senate Bill 32

SB 32 is signed, requiring CARB to develop technologically feasible and cost-effective regulations to achieve the target of 40 percent below 1990 GHG emission levels by 2030.

## 2017

### Solar at Jensen WTP

Metropolitan installs a 1 MW photovoltaic power facility at the Jensen Water Treatment Plant, offsetting 20 percent of the facility's energy demand and reducing GHG emissions by approximately 550 MT $CO_2e$ per year.

## 2018

### Save Water 365 campaign

Metropolitan launches the Save Water 365 campaign through multiple platforms, encouraging Southern Californians to save water everyday and take advantage of Metropolitan's water efficiency rebate programs.

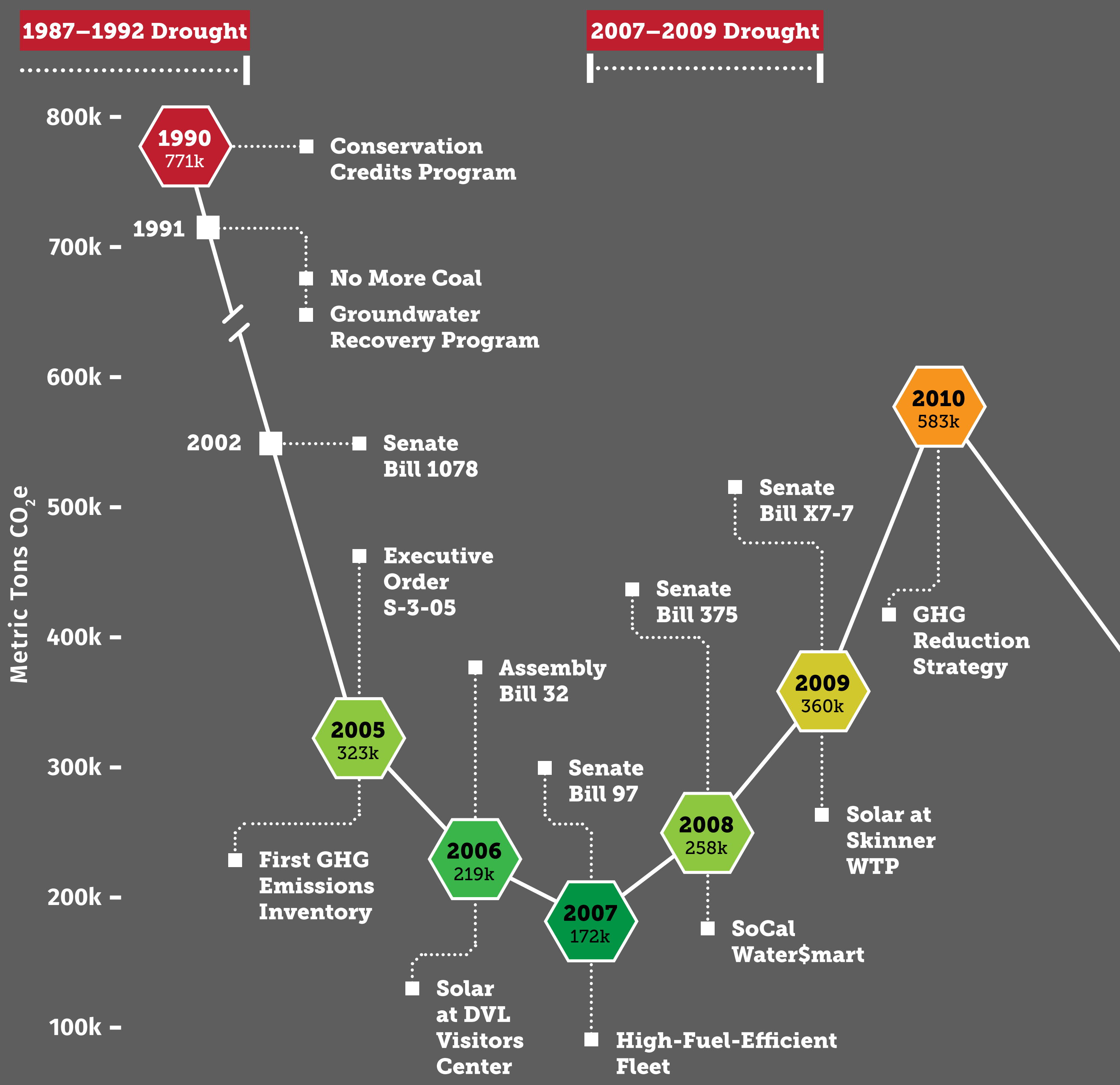
### Executive Order B-55-18

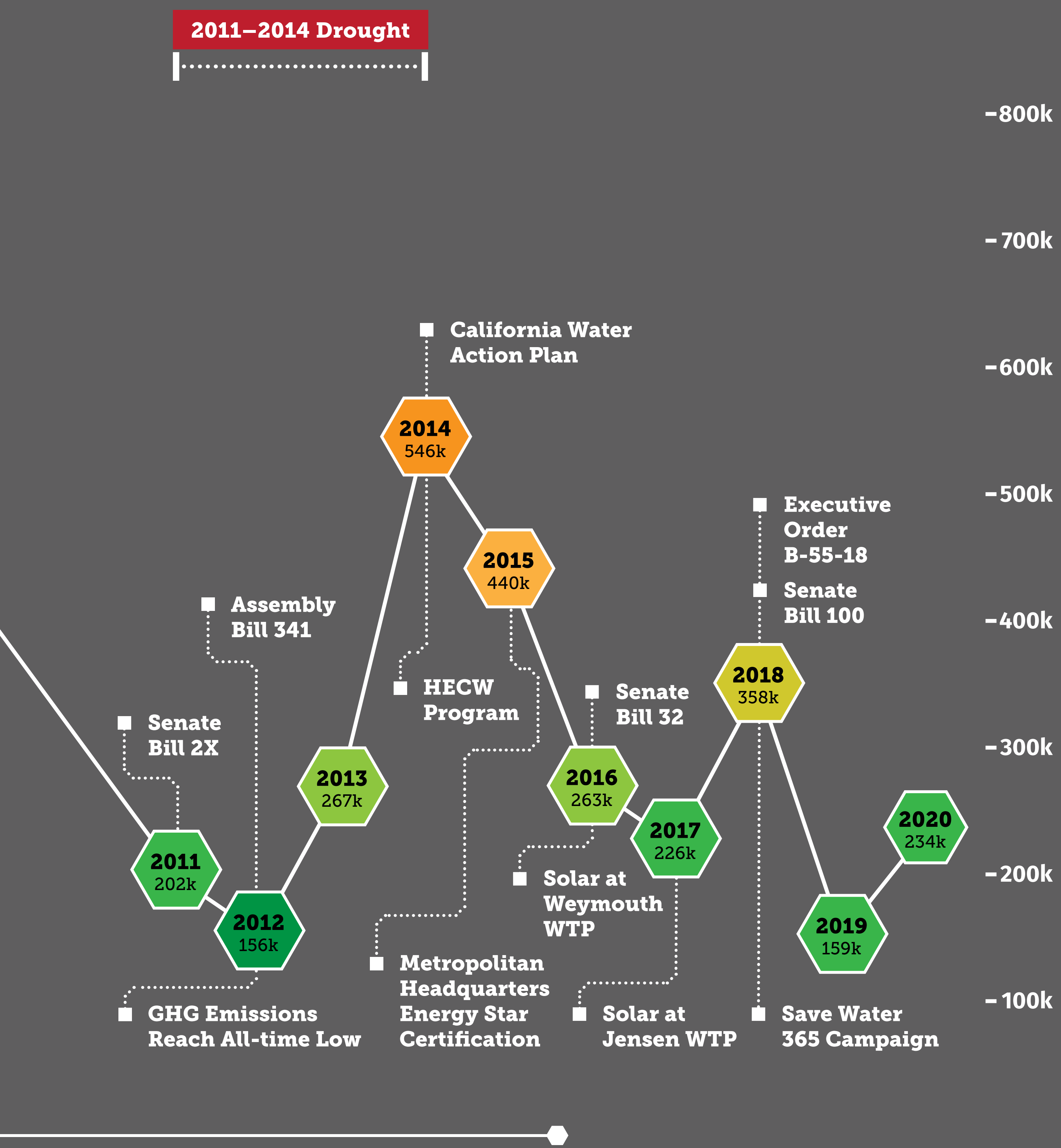
EO B-55-18 is signed, establishing the goal for state agencies to reach carbon neutrality by 2045 and to achieve and maintain net negative emissions thereafter.

### Senate Bill 100

SB 100 requires 100 percent of retail electricity sales to be zero carbon by 2045.

# Historical GHG Emissions Timeline




2011–2014 Drought
800k
700k
600k
500k
400k
300k
200k
100k
California Water Action Plan
2014 546k
2015 440k
Executive Order B-55-18
Senate Bill 100
2018 358k
Assembly Bill 341
HECW Program
Senate Bill 32
Senate Bill 2X
2013 267k
2016 263k
2017 226k
2020 234k
2011 202k
2012 156k
Solar at Weymouth WTP
2019 159k
Metropolitan Headquarters Energy Star Certification
GHG Emissions Reach All-time Low
Solar at Jensen WTP
Save Water 365 Campaign

# SECTION 2.0
# SCIENTIFIC CONTEXT AND CLIMATE CHANGE IMPACTS

**While the scientific understanding of climate change continues to improve and develop, the mechanism driving climate change has been well understood since the middle of the twentieth century. This section provides an overview of the scientific context and forecasted impacts of climate change and how these impacts could affect Metropolitan's operations.**

**Climate change:**
**A change in the average conditions — such as temperature and rainfall — in a region over a long period of time.**

# 2.0


*Farming in the Sacramento-San Joaquin Delta*

# 2.1 SCIENTIFIC CONTEXT

## GREENHOUSE EFFECT AND GLOBAL WARMING

### Greenhouse Effect

Gases in the Earth's atmosphere act like a blanket that allows high-energy light from the Sun to pass through to Earth, while reflecting and absorbing lower-energy heat that has been radiated back from Earth. The trapping of this heat is known as the greenhouse effect because atmospheric gases function similar to the windows in a greenhouse, which trap the Sun's rays and create a much warmer space inside as compared to the outside air. The greenhouse effect regulates the Earth's climate, maintaining conditions suitable for life on Earth. However, a rapid increase of GHGs can cause excess heat to be trapped, affecting global temperatures and climate. This process is depicted in Figure 2-1.

**In its Fifth Assessment Report (AR5), the Intergovernmental Panel on Climate Change (IPPC), concluded there's a more than**

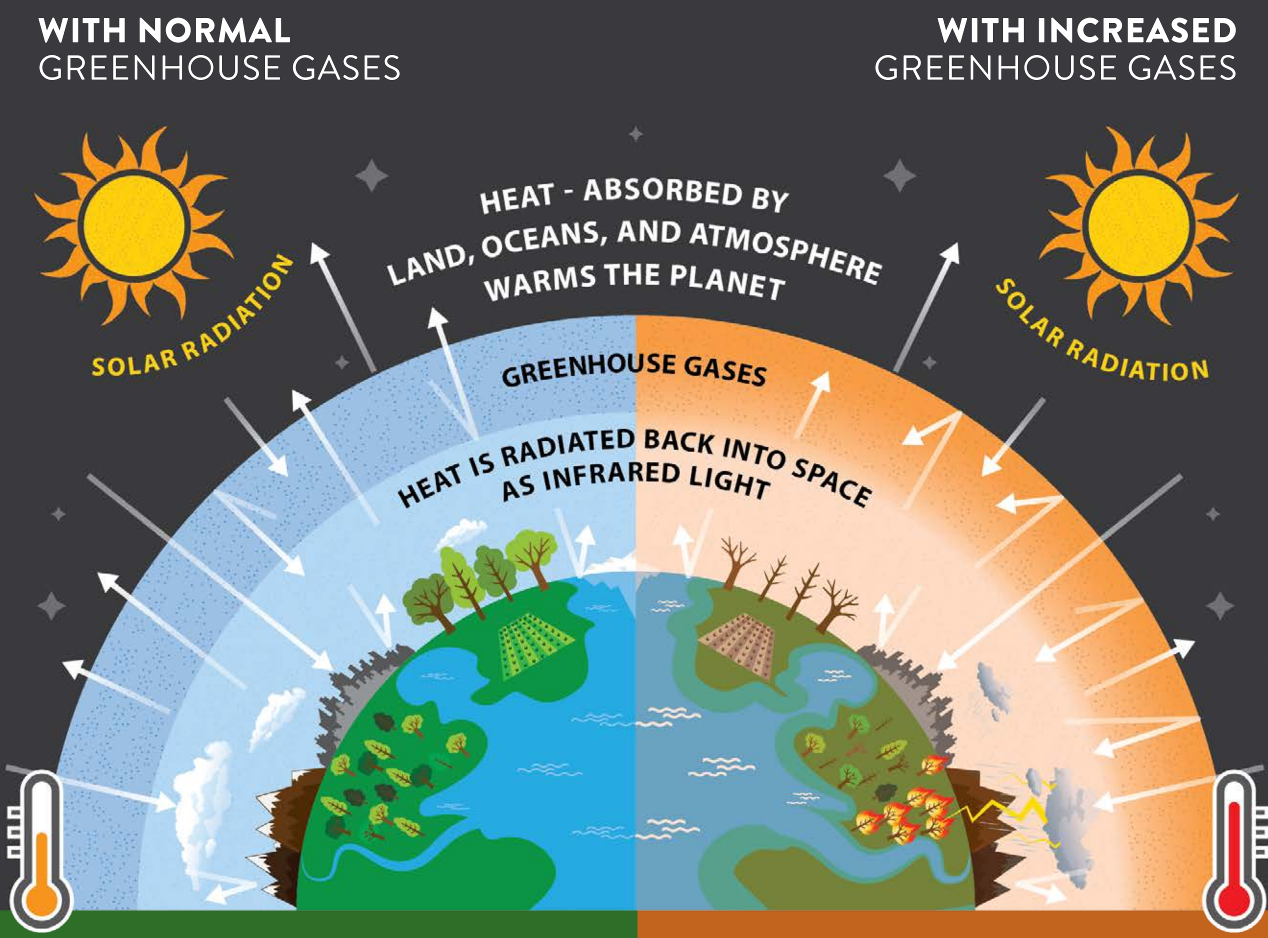
**95%**

**likelihood that human activities are a principal cause of our warming planet over the past 50 years.[1]**

1. *https://archive.ipcc.ch/report/ar5/syr/*

**FIGURE 2-1: Greenhouse Gas Effect and Associated Climate Impacts**

## Greenhouse Gas Effect




Some heat continues into space while the rest, trapped by GHGs, help maintain the planet's relatively comfortable temperatures.

**LESS GAS =**
**LESS HEAT TRAPPED IN THE ATMOSPHERE**

**Retain more reliable:**

- Weather
- Rainfall
- Temperature
- Sea Level

Increased GHGs means less heat escapes to space. Between preindustrial times and now, the earth's average temperature has risen by 1.8°F (1.0°C).

**MORE GAS =**
**MORE HEAT TRAPPED IN THE ATMOSPHERE**

**Results in more intense:**

- Storms
- Drought
- Heat
- Sea Level Rise

## GLOBAL GHG CONTRIBUTIONS

Carbon dioxide ($CO_2$) and other GHGs including methane ($CH_4$) and nitrous oxide ($N_2O$) are responsible for the radiative greenhouse effect on Earth. Each GHG has its own global warming potential (GHG), or the extent to which it traps energy in the atmosphere. GHGs utilize $CO_2$ as a reference point to compare the potential impact of different GHGs. As such, $CO_2$ has a GHG of one. Methane has a GHG of 21, meaning that each unit of methane causes 21 times more global warming potential than one unit of $CO_2$, while $N_2O$ has a GHG of 310. Other GHGs include the fluorinated gases, which can have a GHG of up to 22,000 (see Figure 2-4); however, in comparison, fluorinated gases are released in such small quantities that they only contribute about two percent of overall global warming (see Figure 2-2).

When individual GHGs are normalized based on their GHGs, we refer to them as $CO_2e$. Generally, GHG emissions are quantified in terms of MT $CO_2e$ emitted per year.

As shown in Figure 2-3, the total annual emissions generated anthropogenically have increased continuously since 1970, with an increase of approximately 1.3 percent annually between 1970 and 2000 and an increase of 2.2 percent annually between 2000 and 2010. Globally, economic and population growth were the most direct drivers of increases in $CO_2$ emissions from fossil fuel combustion, with population growth generally plateauing globally over the three decade period, while economic growth continued to increase rapidly over that same time.

**FIGURE 2-2: Overall GHG Contribution**

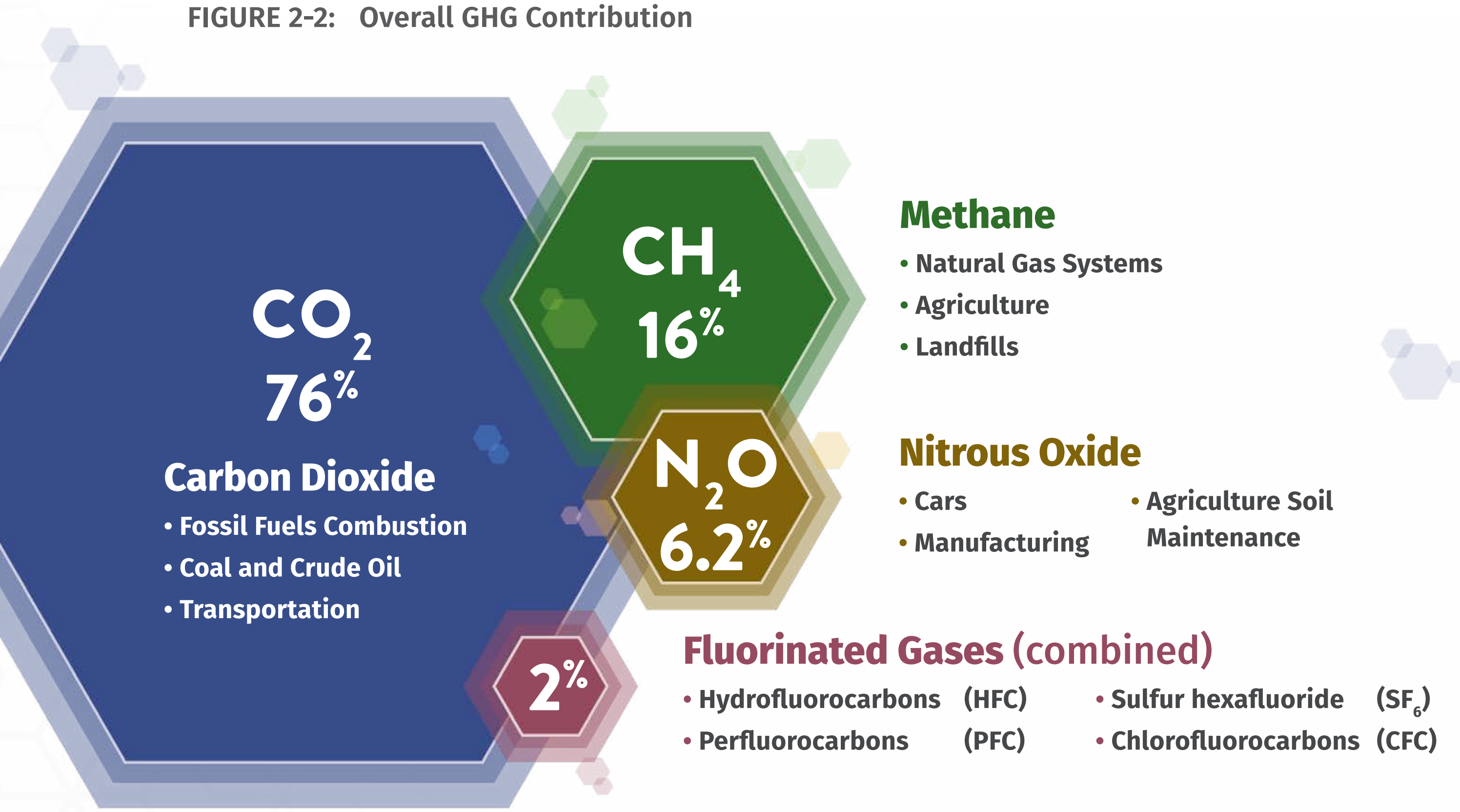
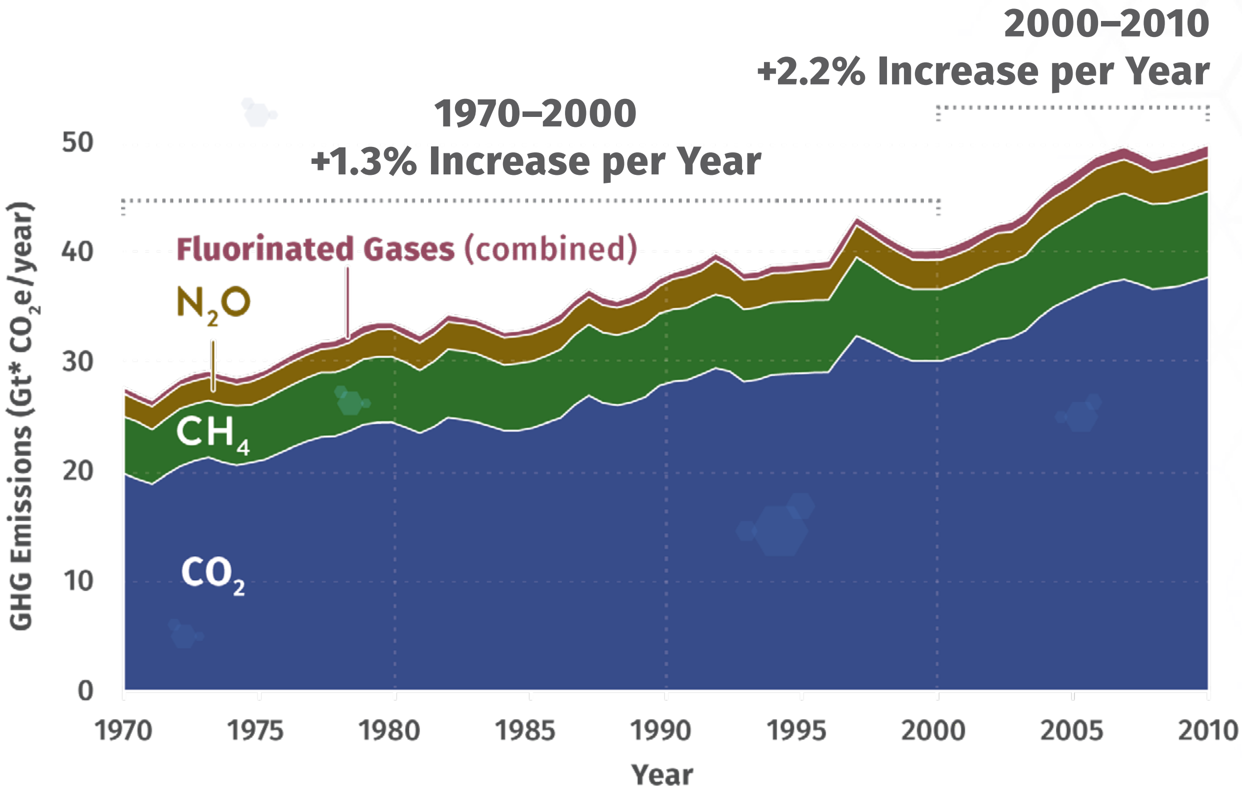
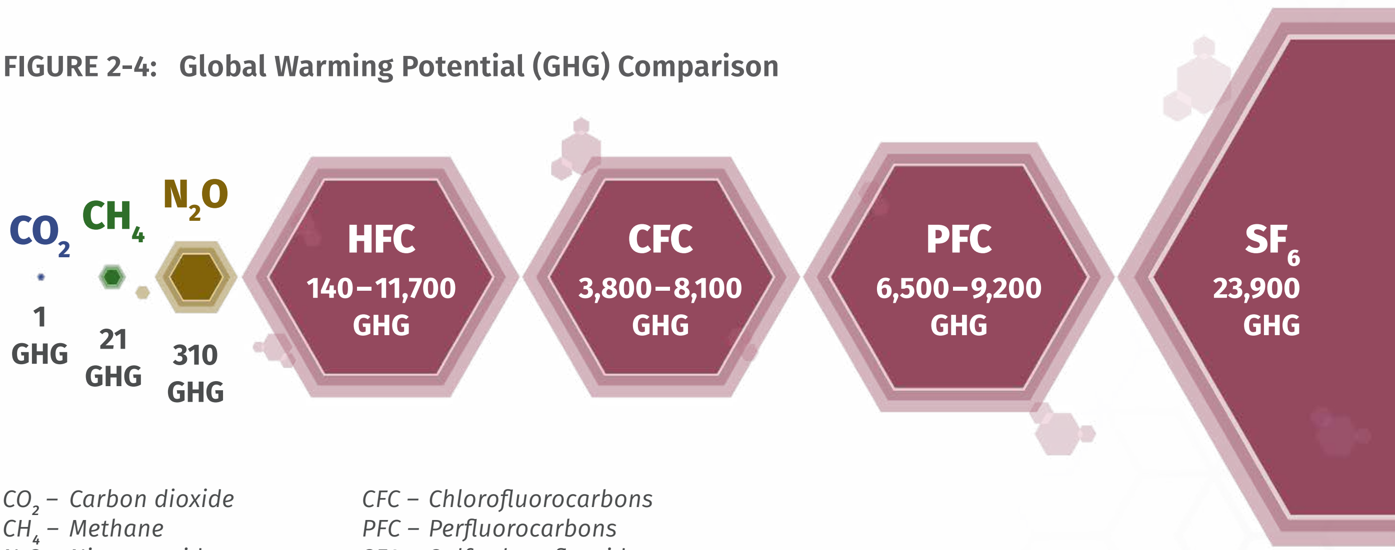


**FIGURE 2-3: GHG Contribution Over Time**




** Gt = gigaton or one million metric tons*
*Source: IPCC–**https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf***

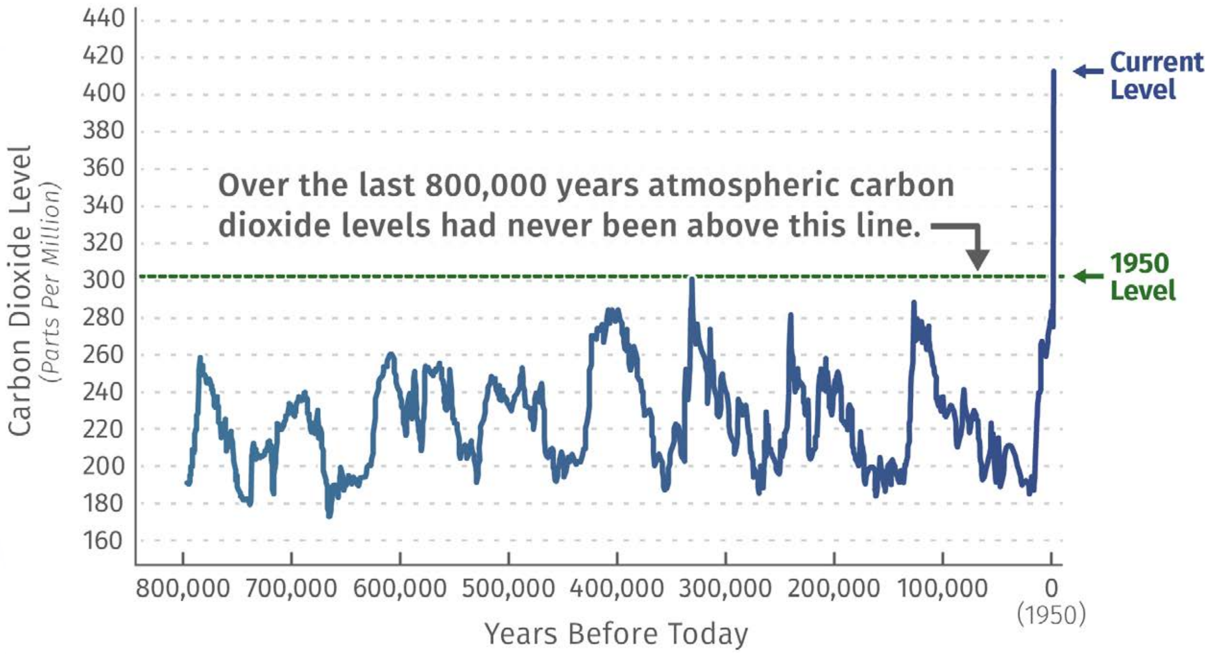
**FIGURE 2-4: Global Warming Potential (GHG) Comparison**




*$CO_2$ – Carbon dioxide*
*$CH_4$ – Methane*
*$N_2O$ – Nitrous oxide*
*HFC – Hydrofluorocarbons*
*CFC – Chlorofluorocarbons*
*PFC – Perfluorocarbons*
*SF6 – Sulfur hexafluoride*

While $CO_2$ has the lowest GHG of the GHGs, it is by far the largest contributor due to the total mass of anthropogenic GHG emissions released annually. Since the dawn of the industrial revolution in the mid-nineteenth century, human activities have been emitting large quantities of GHGs into the atmosphere, enough to nearly double the amount of $CO_2$ from 280 parts per million to over 400 parts per million, which is 100 parts per million higher than any time in the last 800,000 years. The atmospheric concentration of $CO_2$ over time, based on measuring the composition of air trapped in ice cores from Antarctica,[2] is shown in Figure 2-5.

**FIGURE 2-5: Atmospheric Carbon Dioxide Levels**




*Source:* ***https://climate.nasa.gov/evidence/***

The more $CO_2$ and other GHGs in the atmosphere, the greater the amount of heat trapped on Earth. The mechanisms surrounding anthropogenic (human-caused or based on human activity) global warming are well-understood and widely accepted by the scientific community, with over 97 percent of climate scientists agreeing that the planet is warming at an accelerated rate and that human activities are the root cause.[3]

2. ***https://www.researchgate.net/publication/5370384_High-resolution_carbon_dioxide_concentration_record_650000-800000_years_before_present***

3. *J. Cook, et al, "Consensus on consensus: a synthesis of consensus estimates on human-caused global warming," Environmental Research Letters Vol. 11 No. 4, (13 April 2016); DOI:10.1088/1748-9326/11/4/048002*

# GREENHOUSE GAS EMISSIONS

## GHG Emission Sources

Anthropogenic processes that release GHGs include the burning of fossil fuels for transportation, heating, and electricity generation; agricultural practices that release methane, such as livestock grazing and crop residue decomposition; and industrial processes that release smaller amounts of high-GHG gases. Deforestation and land cover conversion also contribute to global warming by reducing the Earth's capacity to remove $CO_2$ from the air and altering the Earth's albedo,[4] or surface reflectance, allowing for absorption of additional solar radiation.

## Metropolitan GHG Emission Sources

Metropolitan's sources of GHG emissions include, but are not limited to:

- Energy (water pumping and treatment, facilities operation and construction activities);
- Transportation (fleet vehicle fuel and employee commutes);
- Water (consumption by Metropolitan facilities);
- Waste (generation, diversion, and decomposition); and
- Fugitive emissions (which are small amounts of high GHG gases, from refrigerants and fire suppression equipment).

For a complete description of Metropolitan's emissions and associated GHG emissions see Section 3.0, GHG Emissions Inventory and Forecast.

Whitsett Intake Pumping Plant

4. *Albedo refers to the amount of diffuse radiation of energy out of the total that is reflected by a surface, ranging from 0 (a black body that absorbs all radiation) to 1 where no energy/radiation is absorbed. Source: National Snow & Ice Data Center (NSIDC). 2020.* ***https://nsidc.org/cryosphere/seaice/processes/albedo.html***

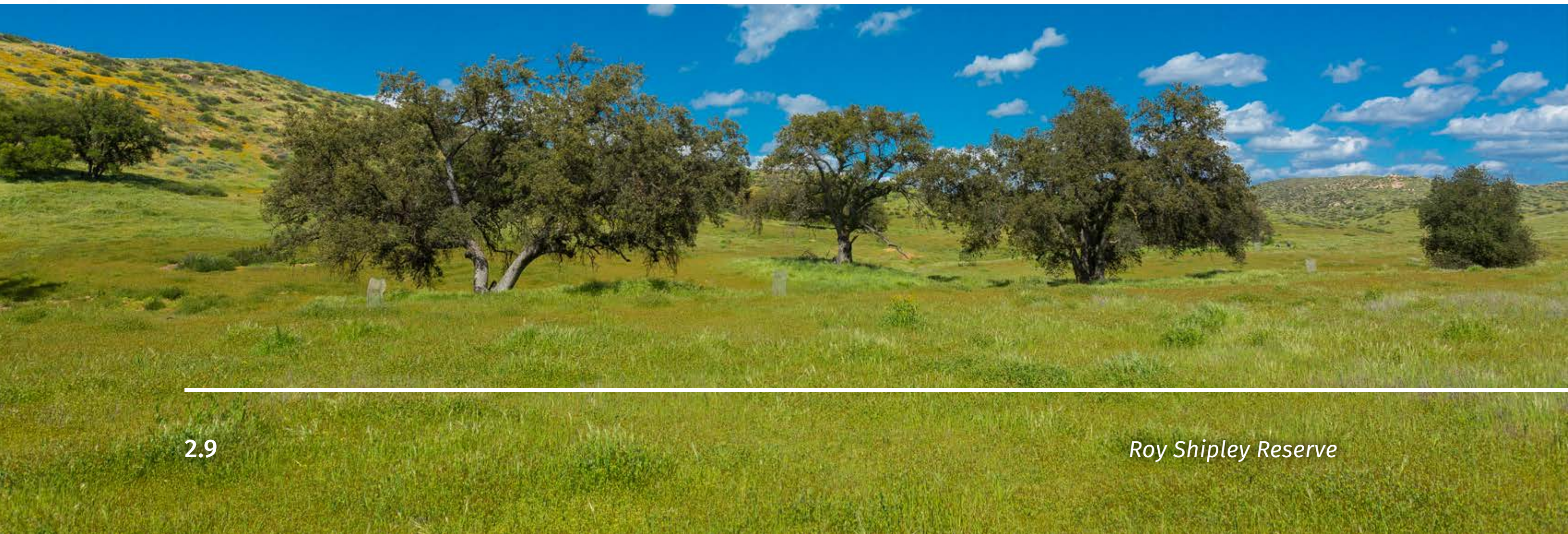
## AIR QUALITY

According to the United States Environmental Protection Agency (EPA), changes in climate can result in impacts to local air quality.[5] Specifically, atmospheric warming associated with climate change has the potential to increase ground-level ozone emissions. The federal and State Clean Air Acts mandate the control and reduction of certain air pollutants, including ozone ($O_3$). Under these laws, the EPA and CARB established the National Ambient Air Quality Standards and the California Ambient Air Quality Standards for "criteria pollutants" and other pollutants. Primary criteria pollutants are emitted directly from a source (e.g., vehicle tailpipe, an exhaust stack of a factory, etc.) into the atmosphere and include carbon monoxide, volatile organic compounds (VOC)/reactive organic gases (ROG),[6] nitrogen oxides ($NO_X$), fine particulate matter ($PM_{10}$ and $PM_{2.5}$), sulfur dioxide, and lead. Secondary criteria pollutants, such as oxidants, $O_3$, and sulfate and nitrate particulates (smog), are created by atmospheric chemical and photochemical reactions primarily between VOCs and $NO_X$.

A photochemical reaction (triggered by sunlight) between $NO_X$ and VOCs produces $O_3$. VOCs are composed of non-methane hydrocarbons (with some specific exclusions), and $NO_X$ is composed of different chemical combinations of nitrogen and oxygen, mainly nitric oxide and nitrogen dioxide. $NO_X$ is formed during the combustion of fuels, while VOCs are formed during combustion and evaporation of organic solvents. As a highly reactive molecule, $O_3$ readily combines with many different components of the atmosphere.

5. *https://www.epa.gov/air-research/air-quality-and-climate-change-research*

6. *The California Air Resources Board defines VOC and ROG similarly as, "any compound of carbon excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate," with the exception that VOC are compounds that participate in atmospheric photochemical reactions*



*Sacramento-San Joaquin Delta*

# 2.2 CLIMATE CHANGE IMPACTS

## CALIFORNIA CLIMATE CHANGE IMPACTS

California has undertaken extensive research at the state and local levels in order to support State and local agencies on long-range planning and adaptation strategies to protect infrastructure and resources. The impacts of climate change from potential sea level rise, changing weather patterns, extended drought, increased fire danger, and more severe storms have the potential to affect Metropolitan's infrastructure and water supply. By leveraging these studies as part of the climate action planning process, Metropolitan can identify potential climate vulnerabilities that may occur even while striving to reduce GHG emissions. Potential vulnerabilities are presented here to highlight possible impacts to its operations and infrastructure.

The most apparent effects of climate change in the southwestern United States, including the Metropolitan service area, will likely be in the form of more days of extreme heat, an increase in periods of drought, resulting in a reduction in water supply, as well as increased fire danger from hot, dry conditions, which could threaten critical infrastructure.[7,8] Air quality impacts from heat and wildfires may also continue to be an issue. Due to the size and scope of Metropolitan's operational area, which includes the Sierra Nevada and Colorado River watersheds, the potential climate change impacts to Metropolitan are diverse. The changes expected to impact Metropolitan specifically include: reduced quality and availability of water from the Sierra Nevada and Rocky Mountains snowpacks, sea level rise and coastal displacement affecting local coastal groundwater basins and water quality and levee stability in the Sacramento-San Joaquin Delta, increased risk of large wildfires, increased temperatures and extreme heat events, and exacerbation of air quality problems, each of which are described in more detail below.

7. ***https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-southwest_.html***
8. ***https://www.nationalgeographic.com/science/article/climate-change-increases-risk-fires-western-us#close***

*Sierra Nevada Mountains snowpack*

## Reduced Quality and Supply of Water from the Sierra Nevada and Rocky Mountains Snowpacks

If heat-trapping emissions continue unabated, more precipitation will fall as rain instead of snow, and the snow that does fall will melt earlier, reducing the Sierra Nevada and Rocky Mountains spring snowpacks by as much as 65 percent by the end of the century (see Figure 2-6).[9] Figure 2-6 shows the historical (1961–1990) and projected (2070–2099) Sierra Nevada snowpack measured in "Snow Water Content in inches"[10] on April 1 based on two warming scenarios or ranges. The effect of different estimates of the sensitivity of the climate system to emissions is generally understood by comparing the temperature projections from different global climate models.[11] As outlined by the California Climate Change Center (2015), the models each contain unique variables and projections that result in different levels of climate sensitivity. In total, there are three climate scenarios or ranges – lower emissions scenario, medium-high emissions scenario, and higher emissions scenario. The lower and higher emissions scenarios characterize a world with similar population growth, but the lower emission scenario anticipates rapid changes in clean technologies and a shift toward a service and information economy (Cayan et al. 2005).

Without the natural storage provided by a deep snowpack, less water will be available through California's dry summer months. This can limit the availability of water traditionally produced from local snowpack. As snow melts sooner and faster, less water can be captured and stored in reservoirs like Oroville, which could reduce the potential to generate hydropower used to power Metropolitan's pumps along the SWP. Further, as outlined in Metropolitan's 2015 Urban Water Management Plan (UWMP) (June 2016),[12] the amount of contractual supplies that the 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 Mountains, reservoir storage, operational constraints, and demands of other water users. As such, reduced quality and supply of water from the Sierra Nevada and Rocky Mountains snowpacks may further result in decreased accessibility to water in the Metropolitan service area.

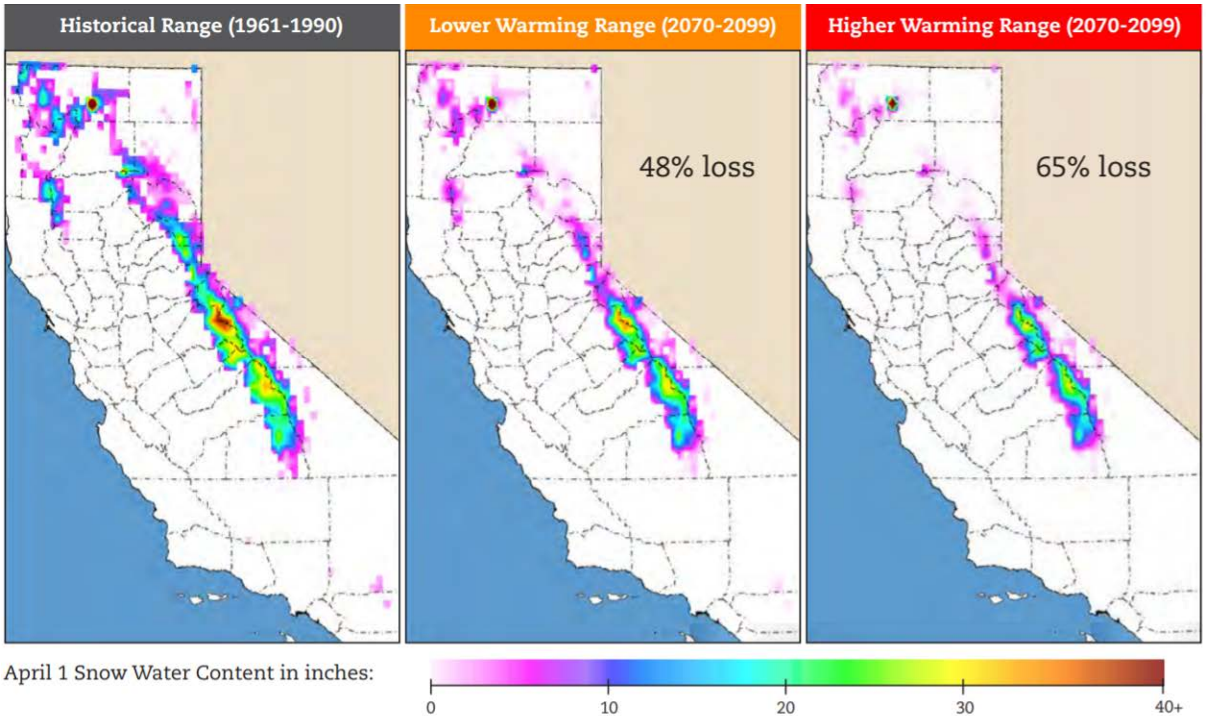
9. ***https://water.ca.gov/Programs/All-Programs/Climate-Change-Program/Climate-Change-and-Water***

10. *Snow Water Content is synonymous with Snow Water Equivalent (SWE), a commonly used measurement used by hydrologists and water managers to gauge the amount of liquid water contained within the snowpack.*

11. ***https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.169.4744&rep=rep1&type=pdf***

12. ***http://www.mwdh2o.com/PDF_About_Your_Water/2.4.2_Regional_Urban_Water_Management_Plan.pdf***

**FIGURE 2-6: Historical and Projected Snowpack in the Sierra Nevada Mountains**




*Source: "California Climate Science and Data for Water Resources Management" published by DWR in 2015*

## Sea Level Rise and Coastal Displacement

Along with temperature increases and shifting weather patterns associated with climate change, sea level is expected to rise an additional one to nine feet by the end of the century depending on the magnitude of global emissions[13] modeled (Figure 2-7).[14] While sea level rise is most often talked about as a threat to coastal communities and infrastructure, a rising sea will also push more salt water into the Sacramento-San Joaquin Delta, which supplies water to the SWP. To keep saltwater out of critical water supplies, more fresh water will need to be flushed through the Delta, decreasing the amount available for Californians.[15]

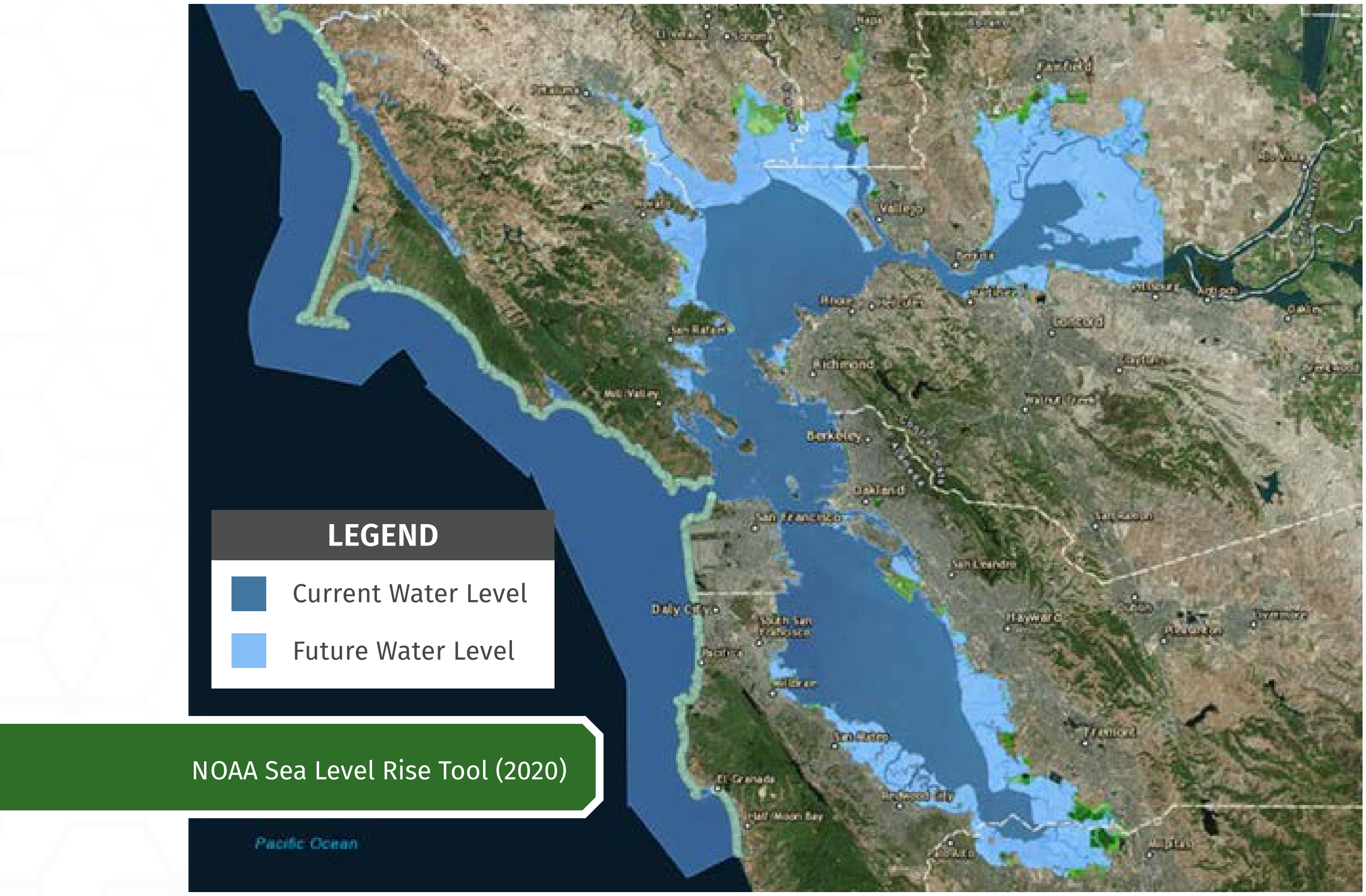
13. *Emissions scenarios refer to a set of six global sea level rise scenarios that reflect different assumptions about the degree to which ocean warming and ice sheet loss will affect the rate and magnitude of global sea level rise that were developed by oceanographers and climatologists. Source: U.S. Climate Resilience Toolkit. September 19, 2019. Sea Level Rise.* ***https://toolkit.climate.gov/topics/coastal/sea level-rise***

14. ***http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea level-rise-science.pdf***

15. ***https://water.ca.gov/Programs/All-Programs/Climate-Change-Program/Climate-Change-and-Water***

As demonstrated in Figure 2-7, sea level rise of one meter (3.3 feet) would push salt water farther into the Sacramento-San Joaquin Delta. As sea levels rise, and salt water intrusion takes place, additional water would be required to be pumped through the Delta to ensure salt does not reach potable water supplies. This means less water available for SWP allocations. The Delta system relies on levees that are vulnerable to earthquakes, floods, and rising sea levels. When these levees fail, water rushes into the lower-than-sea-level islands behind them, pulling in salt water from the bay and diminishing water quality before it can be delivered to Southern California, the Bay Area, and Central Valley farmland. However, the proposed Delta Conveyance Facilities could potentially provide salinity protection of water supplies without additional Delta outflow.[16]

**FIGURE 2-7: Impacts to the Sacramento-San Joaquin Delta from 1 Meter (3.3 feet) of Sea Level Rise**




*Source: NOAA. 2020. Sea Level Rise Tool.* ***https://coast.noaa.gov/digitalcoast/tools/slr.html***

16. ***http://www.mwdh2o.com/DocSvcsPubs/DeltaConveyance/index.html***



## Increased Risk of Large Wildfires

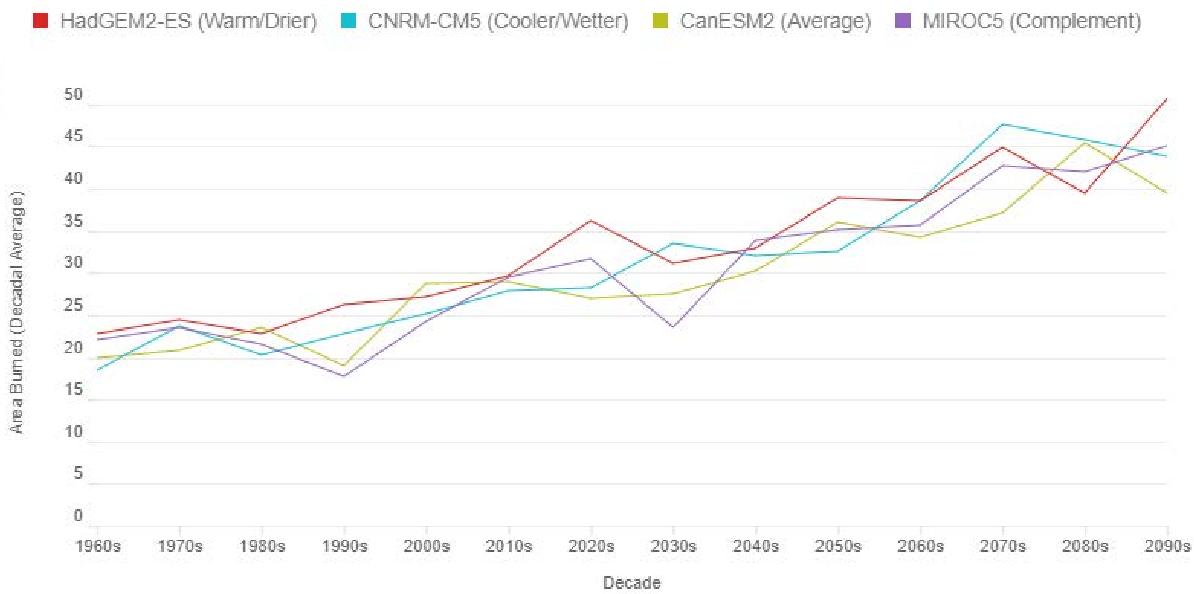
Wildfires in the grasslands and chaparral ecosystems of Southern California are estimated to increase by approximately 30 percent toward the end of the twenty-first century because increases in winter rain will stimulate the growth of more vegetation that will act as fuel in the summer and autumn months. Metropolitan infrastructure within vegetated areas could be impacted by the increased number of fires and hinder potential carbon sequestration projects. For example, the area around Diamond Valley Lake is projected to see an increase in annual acreage burned throughout the rest of the century, potentially impacting infrastructure and water quality (Figure 2-8).[17]

In order to better understand the potential impacts of climate change, scientists use several "scenarios" to help put bounds on the uncertainty associated with modeling complex systems. These scenarios show what California would look like under different climate conditions based on the level of emissions reductions moving forward and the impact of those emissions on precipitation and temperature. The lines in Figure 2-8 show the change between historical and projected burn area for the DVL area under four global emissions scenarios including: warm/drier, cooler/wetter, average, and complement, which is the scenario that is most unlike the other three models and is chosen to give better coverage of the full spread of 10 California GCM model results.[18]

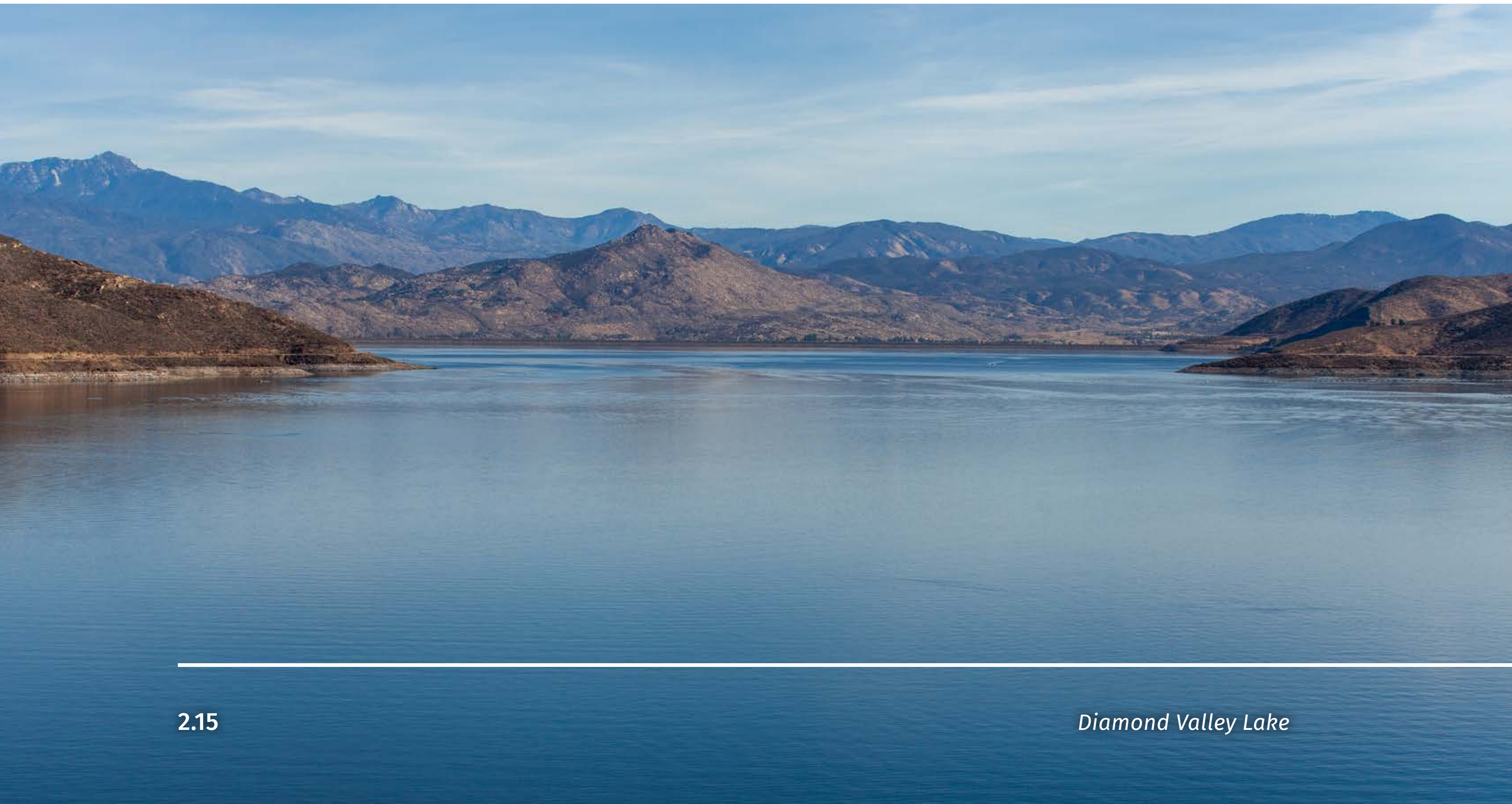
Under each of the scenarios shown, the burned area is projected to increase. This may seem counterintuitive because it may be anticipated that the cooler/wetter scenario may show a significant difference between the warm/drier scenario. However, the timing of rainfall during the year determines growth patterns which, when followed by the higher anticipated temperatures in the warm summer months, could exacerbate fire risk. Likewise, there may also be an impact from larger wildfires on upper watershed areas for the SWP and CRA. For example, during active wildfires, there is a risk of increased contaminants, such as ash, in water, and vegetation that holds soil in place and retains water may be destroyed. In the rainstorms following wildfires, ash, sediment, nutrients, and other contaminants may also be transported into the waterways.[19]

17. *https://cal-adapt.org/tools/wildfire/*
18. *https://www.energy.ca.gov/sites/default/files/2019-11/Projections_CCCA4-CEC-2018-006_ADA.pdf*
19. *https://www.epa.gov/sciencematters/wildfires-how-do-they-affect-our-water-supplies*

**FIGURE 2-8: Historical and Projected Area Burned for Diamond Valley Lake Area (Hectares of Land per Year)**



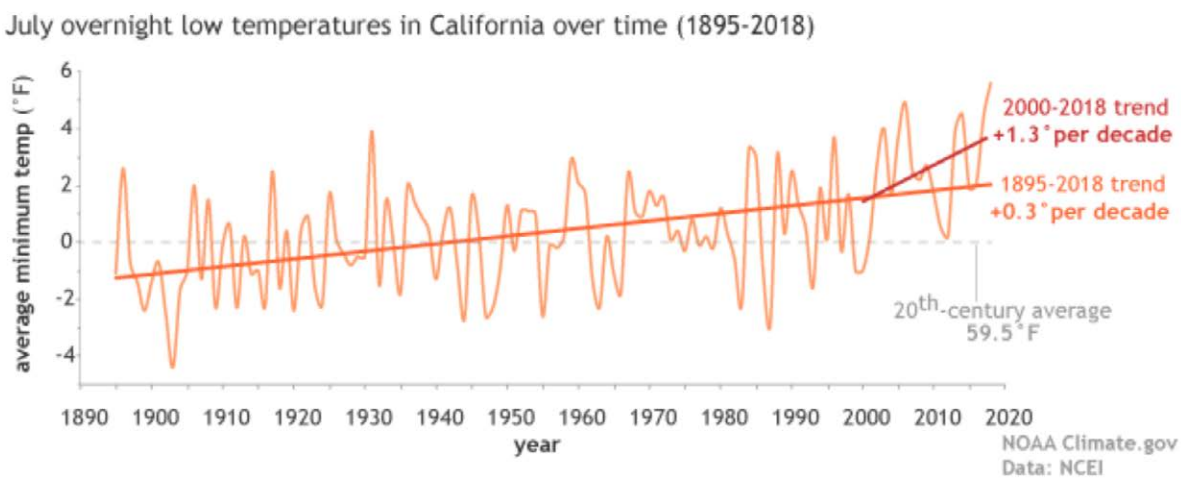

*Source:* ***https://cal-adapt.org/***



## Increased Temperatures and Extreme Heat Events

California is expected to see an average annual temperature increase of 2.5°F by 2030 and 2.7°F by 2050,[20] with inland areas expected to see the most extreme changes.[21] Evidence of increasing annual temperatures has already been documented, as shown in Figure 2-9.[22] Furthermore, according to current climate prediction models, California's average annual temperature increases could range from approximately 3.5°F to 11°F by the end of the century, relative to the annual average temperature for the 1961–1990 time period. In addition, the number of extreme heat days, defined as days with temperatures above the 98th percentile of computed maximum temperature by 2050, in Southern California are expected to increase from approximately four annually on average up to approximately 53 in 2050 and up to approximately 99 in 2100.[23]

**FIGURE 2-9: Average Minimum Temperature for July in California 1890 to 2020**




*Source:* ***https://www.climate.gov/news-features/event-tracker/extreme-overnight-heat-california-and-great-basin-july-2018***

20. ***https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf***
21. ***https://cal-adapt.org/tools/annual-averages/***
22. ***https://www.climate.gov/news-features/event-tracker/extreme-overnight-heat-california-and-great-basin-july-2018***
23. ***https://www.opr.ca.gov/facts/climate-change-and-public-health.html***

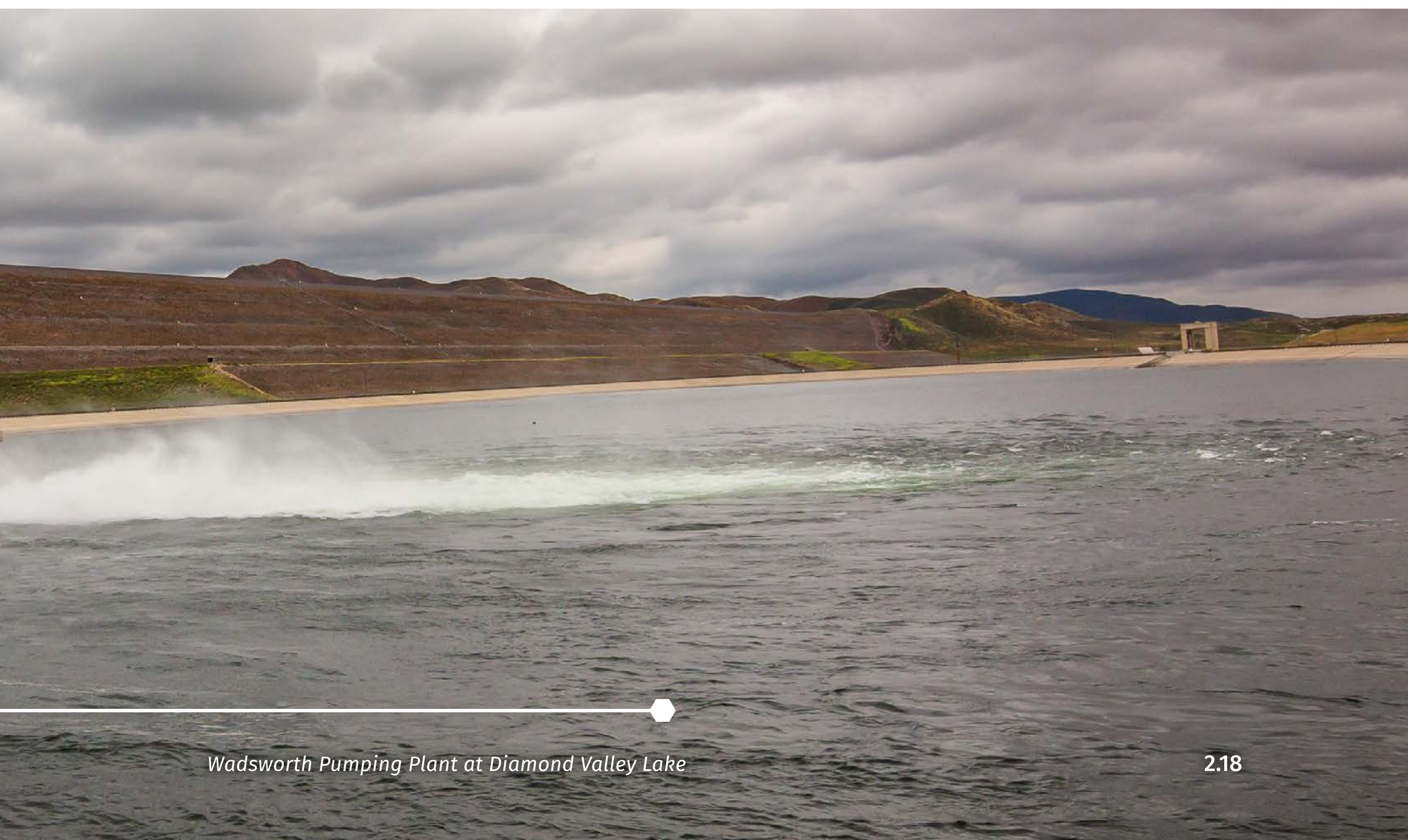
## Exacerbation of Air Quality Problems

If temperatures rise to the medium warming range,[24] there could be 75 to 85 percent more days with weather conducive to $O_3$ formation, relative to current conditions. This is more than twice the increase expected if rising temperatures remain in the lower warming range. This increase in air quality problems could result in an increase in asthma and other health-related problems. Increased wildfire events also create poor air quality that impacts human health. For example, researchers at Harvard University linked short-term exposure to $PM_{2.5}$ pollution from events such as wildfires to hospitalizations among older adults for septicemia, fluid and electrolyte disorders, renal failure, urinary tract infections, and skin and tissue disorders. Additionally, there are clear links between $PM_{2.5}$ pollution and cognitive disease, such as dementia.[25]

24. *A medium warming scenario reflects a projected temperature rise between 5.5 and 8°F.*

25. ***https://www.sierraclub.org/sierra/particle-pollution-wildfires-big-problem-for-california***

For Metropolitan, climate change will bring many challenges. Increases in the frequency, duration, and severity of drought and rising temperatures are but a few of the resulting impacts that threaten the reliability of Metropolitan's regional water supply. Metropolitan has long made ensuring a reliable supply of water a planning priority and will need to anticipate and adapt to changing climactic conditions to continue to do so. The 2020 Integrated Water Resources Plan uses scenario analysis to look at a range of futures affected by varying impacts of climate change. The measures identified in this CAP complement Metropolitan's efforts to prepare for these future changes.



*Wadsworth Pumping Plant at Diamond Valley Lake*

# SECTION 3.0
# GHG EMISSIONS INVENTORY AND FORECAST

**Metropolitan prepared a GHG emissions inventory for activities under its control for each year from 2005–2017 to provide an understanding of emissions over time. The inventory was prepared in accordance with standard accounting protocols from TCR[1] and the International Council for Local Environmental Initiatives (ICLEI).[2] This section defines the boundary of Metropolitan operations, reflects the GHG emissions inventory and sources within that boundary, and provides a summary of the methods and data sources used to inventory Metropolitan's GHG emissions. A full description of the data, methodology, and emissions factors for each inventory year are included in Appendix A. Metropolitan's inventory includes its operational GHG emissions for the baseline year of 1990, as well as each year from 2005 through 2017. Historical GHG emissions were calculated using consistent methodologies to allow accurate comparison between years.**

1. *The Climate Registry.* ***https://www.theclimateregistry.org/tools-resources/reporting-protocols/general-reporting-protocol/***.
2. *ICLEI. 2010. Local Government Operations Protocol.* ***http://icleiusa.org/GHG-protocols/***.

# 3.0


*Lake Mathews Outlet Structure*


*Whitsett Intake Pumping Plant*

# 3.1 METROPOLITAN OPERATIONAL BOUNDARY AND EMISSIONS SOURCES

GHG reporting protocols generally require a clear delineation of an organization's operational boundaries to account for sources of GHG emissions in an inventory. The organizational boundary includes all facilities, equipment, and operations over which the reporting entity (i.e., Metropolitan) has management control. Management control can be defined in either financial or operational terms, but the chosen definition of control must be applied consistently across the organization.

Metropolitan's primary operational infrastructure includes five CRA pumping stations and two smaller pumping stations, 15 hydroelectric facilities, multiple pressure control systems, nine reservoirs, and five water treatment plants. Emissions from supporting infrastructure are also included, such as those from the Union Station Headquarters and various control facilities, fleet vehicles, aircraft owned and operated by Metropolitan, stationary equipment like generators, and waste generation and water use associated with these facilities. In addition, Metropolitan includes employee commutes within its operational boundary. Although Metropolitan does not have complete control over this specific emission source, it can provide programs and infrastructure to influence employee behaviors. Finally, Metropolitan's operational boundary includes construction-related emissions associated with maintenance of existing facilities and new construction undertaken by contractors of Metropolitan. While these emissions are not directly under Metropolitan's control, Metropolitan can make decisions to decrease these emissions over time; therefore, these emissions sources have been included in the overall emissions inventory.

**METROPOLITAN'S PRIMARY OPERATIONAL INFRASTRUCTURE:**
**five CRA pumping stations and two smaller pumping stations, 15 hydroelectric facilities, multiple pressure control systems, nine reservoirs, and five water treatment plants.**

# GHG EMISSIONS SCOPES

As mentioned above, the ICLEI and TCR reporting protocols were used to analyze the emissions generated by Metropolitan. Both ICLEI and TCR's protocols provide authoritative guidance to account for GHG emissions accurately and consistently.[3,4] Specifically, ICLEI's protocols, including the Local Government Operations Protocol, serve as the national standards for local-scale accounting of emissions that contribute to climate change. These were developed through robust stakeholder consultation and partnerships with leading GHG emission experts. This inventory protocol provides detailed guidance on accounting for emissions from the buildings, facilities, and vehicles operated by a local government or agency, such as Metropolitan. TCR's program aligns with international standards and provides a nexus between business, government, and non-governmental organizations to share policy information and exchange best practices.[5] The protocol used in this analysis was established for TCR's voluntary emission reporting program, which is called the Carbon Footprint Registry. Per the ICLEI and TCR reporting protocols, the data is organized into three source categories, or scopes, related to the level of operational control the organization or reporting entity has over the emission source. It is important to recognize that Metropolitan is a water distributor, and although the ICLEI and TCR protocols were used to analyze the data, only applicable emission sources were included in this inventory.

3. **https://icleiusa.org/GHG-protocols/**
4. **https://www.theclimateregistry.org/tools-resources/reporting-protocols/general-reporting-protocol/**
5. **https://www.theclimateregistry.org/wp-content/uploads/2014/11/General-Reporting-Protocol-Version-2.1.pdf**

*Gene Pumping Plant*

## SCOPE 1: DIRECT EMISSIONS

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.[6]

## SCOPE 2: INDIRECT EMISSIONS FROM ELECTRICITY

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 (T&D) losses. T&D losses arise from three primary causes: short- and long-distance transmission losses from the electricity generation station to the step-down transformer substation, distribution losses between the step-down substation and the end user, and transformer losses.[7]

## SCOPE 3: OTHER INDIRECT EMISSIONS

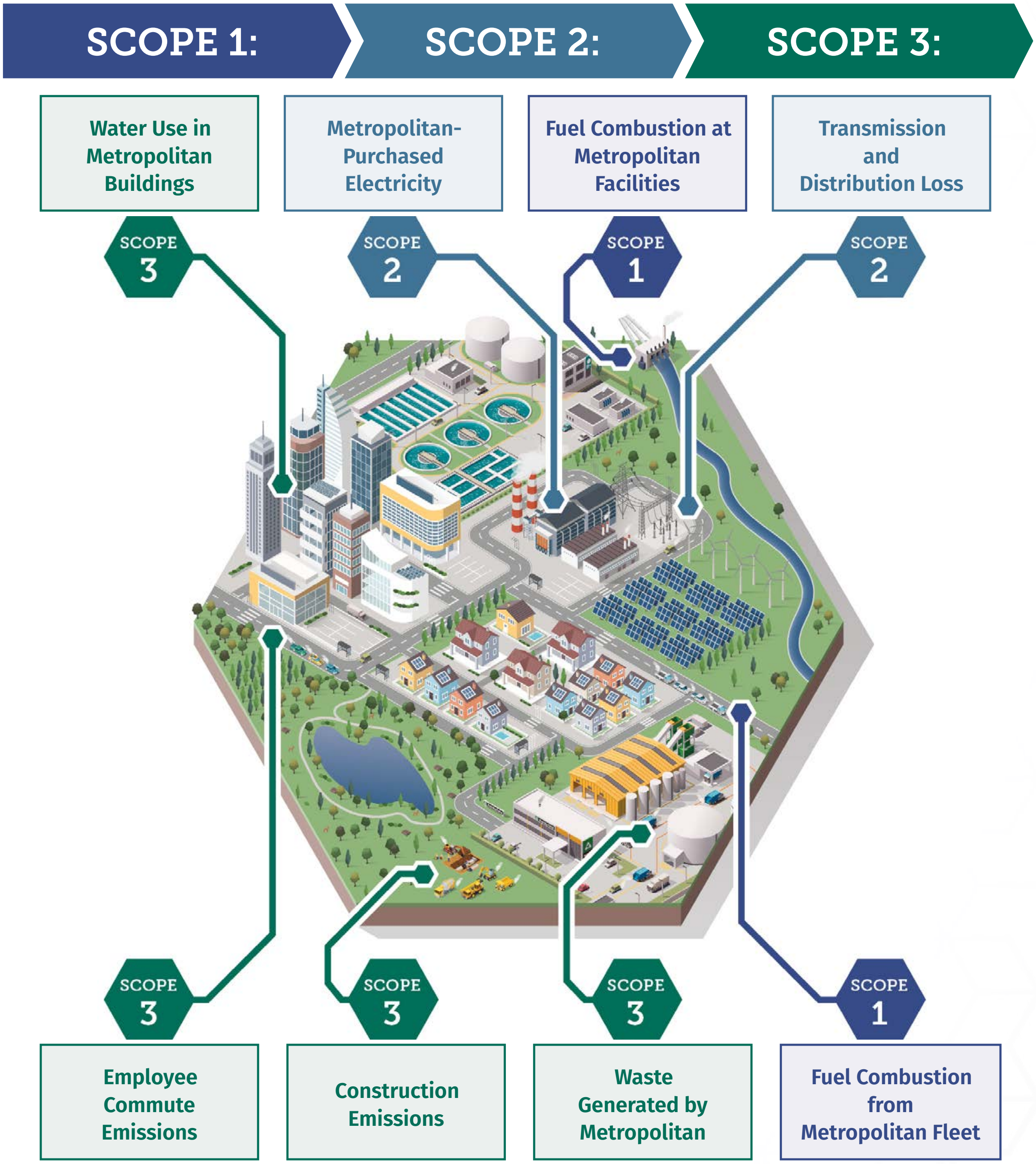
Scope 3 emissions consist of other indirect GHG emissions not captured in Scopes 1 or 2, such as those associated with employee commutes, waste generation, water consumption occurring at Metropolitan facilities, and emissions associated with construction projects.

6. *Fugitive emissions are emissions of gases or vapors from industrial equipment due to leaks or other unintended releases.*

7. ***https://web.stanford.edu/group/efmh/jacobson/Articles/I/TransmisDistrib.pdf***

Section 3.2 provides greater details and examples of each scope. Figure 3-1 illustrates the three types of emissions scopes and the Metropolitan-specific emissions that fall within each scope.

**FIGURE 3-1: GHG Emissions by Scope**



Copper Basin Reservoir

# 3.2 HISTORICAL METROPOLITAN GHG EMISSIONS

Metropolitan has reported its Scope 1 and Scope 2 GHG emissions data to TCR since 2005. In addition, Metropolitan conducted an analysis of Scope 3 emissions for the years 2008 and 2017. These years were chosen as the most recent (2017) and oldest (2008) years for which complete data were available.[8] Unlike Scope 2 electricity use, which changes as a result of pumping, Scope 3 emissions remain relatively constant from year to year. Therefore, the average of the 2008 and 2017 Scope 3 emissions were applied to all inventory years. Metropolitan also calculated a baseline GHG emissions inventory using data records from 1990, to be consistent with the State's long-term emission reduction goals. For a complete description of GHG calculation methodologies and data sources, please refer to Appendix A.

## 1990 GHG EMISSIONS BASELINE YEAR

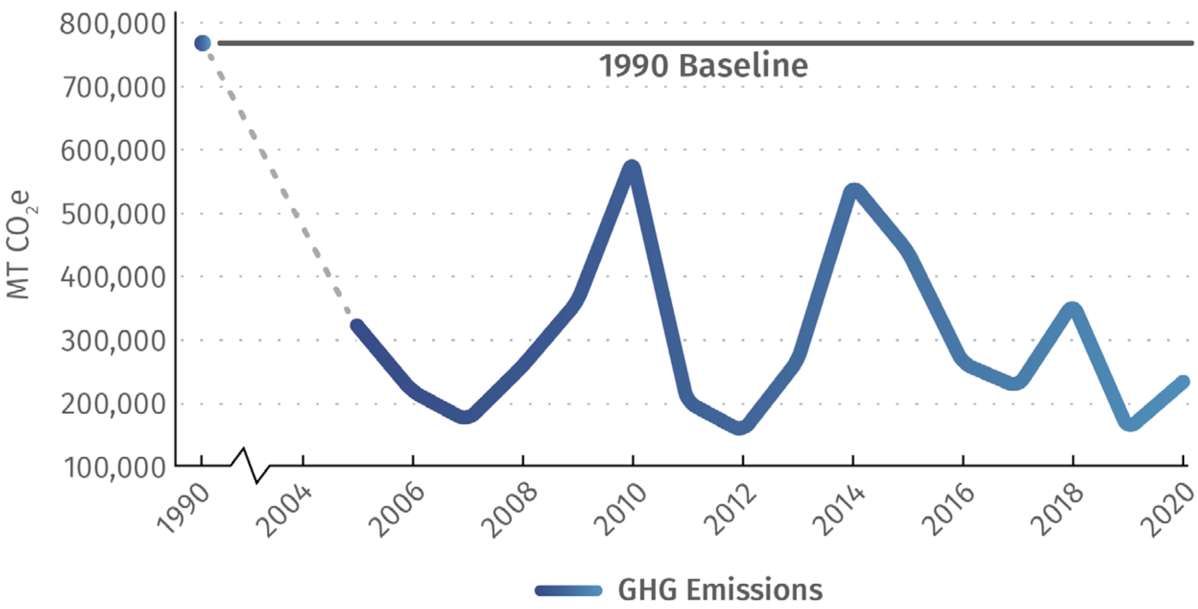
As described in Section 4.0, Regulatory Context and GHG Reduction Targets, AB 32 and SB 32 established the 1990 statewide emissions level as the baseline against which GHG emissions reduction targets are measured. Although Metropolitan did not begin reporting annual GHG emissions until 2005, historical operational data records, including electricity and fuel consumption exist. Using this data, Metropolitan was able to calculate a 1990 emissions inventory that is consistent with California's established baseline date. The 1990 emissions estimate of 771,000 MT $CO_2e$ provides an accurate representation of Metropolitan's operational emissions in 1990 from which future reduction targets can be established.

8. *Complete data refers to Scope 3 data including waste, water, and employee commute which are collected via invoices. Scope 1 and 2 data was available for all inventory years.*

# ANNUAL GHG EMISSIONS: 1990 THROUGH 2017

Based on a review of the available data (2005–2017), Metropolitan's annual GHG emissions are highly variable, ranging from a high of 583,000 MT $CO_2e$[9] in 2010 to a low of 156,000 MT $CO_2e$ in 2012. These fluctuations tie directly to the volume of water pumped from the CRA. Transporting water from the CRA is energy-intensive as a lot of energy is needed to move it long distances. This results in increased GHG emissions. Annual GHG emissions have declined since 1990, even with the periodic energy use spikes related to increased pumping from the CRA in 2010 and 2013. The GHG emission trend has generally decreased from approximately 771,000 MT $CO_2e$ in 1990 to approximately 234,000 MT $CO_2e$ in 2020, a decrease of approximately 70 percent over this time period, although intervening years have been highly variable. Much of the decrease in emissions from 1990 is attributable, in part, to the removal of carbon from electricity required by California's Renewable Portfolio Standard and the Cap-and-Trade Program.[10] In addition, water conservation efforts by Metropolitan and the community have helped keep emissions low even as population increased. Figure 3-2 shows Metropolitan's annual emissions from 1990 through 2020.

**FIGURE 3-2: Metropolitan GHG Emissions Over Time**



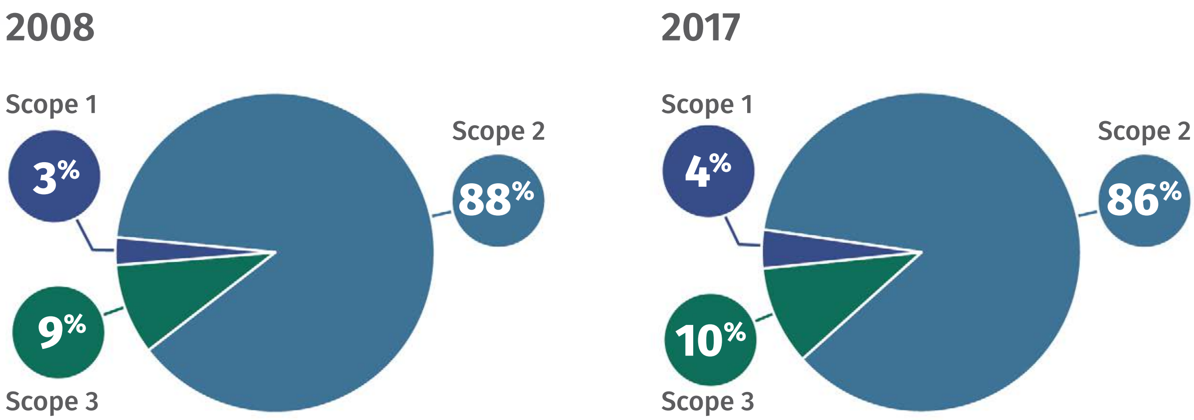

9. *According to the United States Environmental Protection Agency (USEPA), "the unit "$CO_2e$" represents an amount of a GHG whose atmospheric impact has been standardized to that of one-unit mass of carbon dioxide ($CO_2$), based on the global warming potential (GWP) of the gas." USEPA. October 2014. Pollution Prevention Greenhouse Gas (GHG) Calculator Guidance.* ***https://www.epa.gov/sites/production/files/2014-12/documents/GHGcalculatorhelp.pdf***

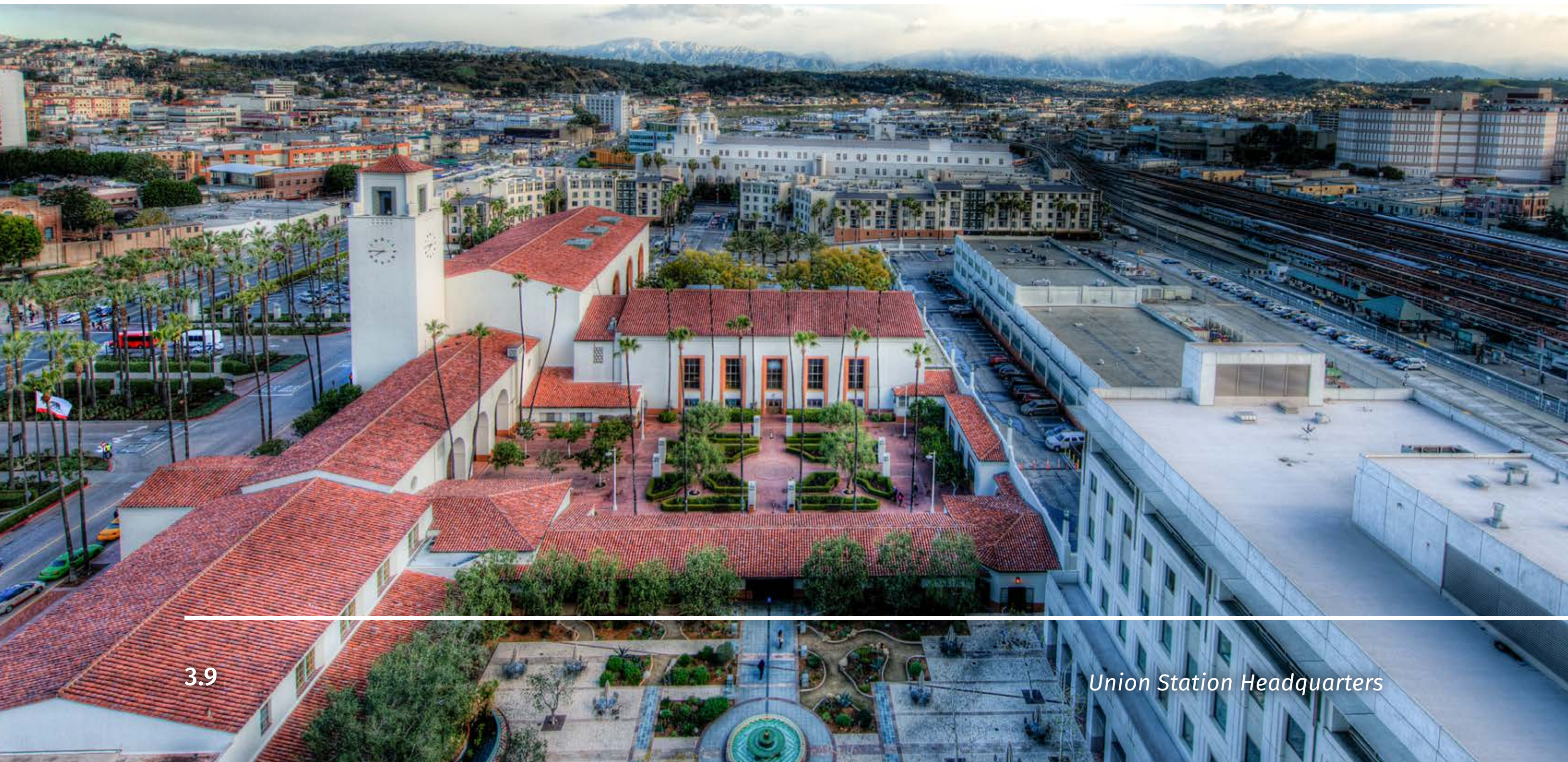
10. ***https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2016/GHG_inventory_trends_00-16.pdf***

## GHG EMISSIONS BY SCOPE: 2008 AND 2017

Metropolitan's organization-wide GHG emissions in 2008 and 2017 were estimated at 258,419 MT $CO_2e$ and 226,036 MT $CO_2e$, respectively. Figure 3-3 details the breakdown of Metropolitan's GHG emissions in both years by scope. The figures clearly show that emissions associated with electricity dominate Metropolitan's GHG emissions (Scope 2). In comparison, Scope 1 and Scope 3 sources contribute a small percentage overall each year.

**FIGURE 3-3: Metropolitan GHG Emissions by Scope**





*Union Station Headquarters*

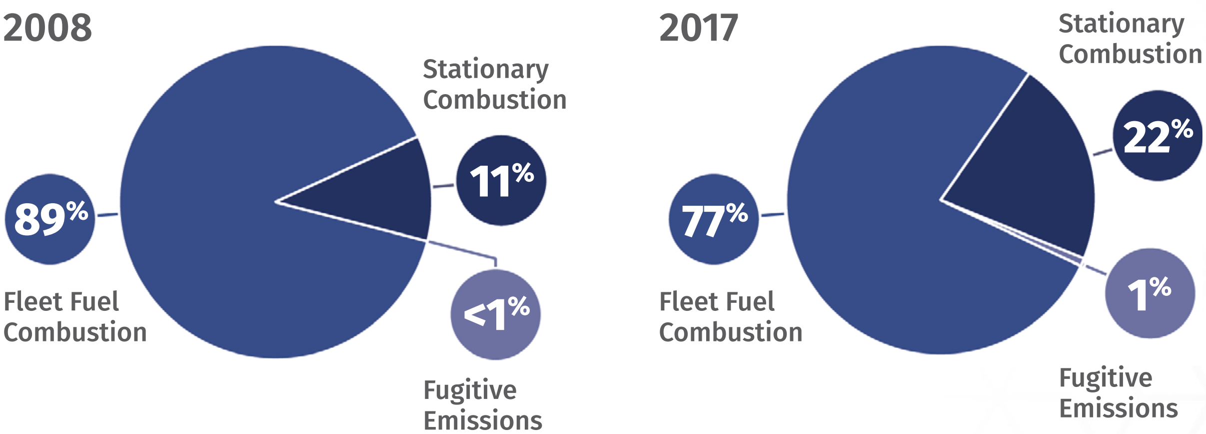
*Colorado River Aqueduct shutdown*

## SCOPE 1:

### Metropolitan Scope 1 Emissions

Metropolitan's Scope 1 GHG emissions comprise approximately three percent of total emissions in 2008 and four percent of total emissions in 2017. Figure 3-4 details the breakdown of Metropolitan's Scope 1 GHG emissions in both years by source. The largest source of Scope 1 GHG emissions is mobile combustion of fuel by Metropolitan's vehicle fleet, accounting for approximately 89 percent of total Scope 1 emissions in 2008. This decreased to 77 percent in 2017, largely due to increased vehicle efficiency. Stationary combustion of fuel in Metropolitan buildings is the second largest source of Scope 1 emissions, which accounted for approximately 11 percent of total Scope 1 emissions in 2008. Fugitive emissions make up a small percentage of Scope 1 emissions and include sulfur hexafluoride emissions leakage from electrical equipment, hydrofluorocarbon emissions from refrigerants, and fugitive emissions from use of welding gas.

**FIGURE 3-4: Scope 1 Emissions by Source**

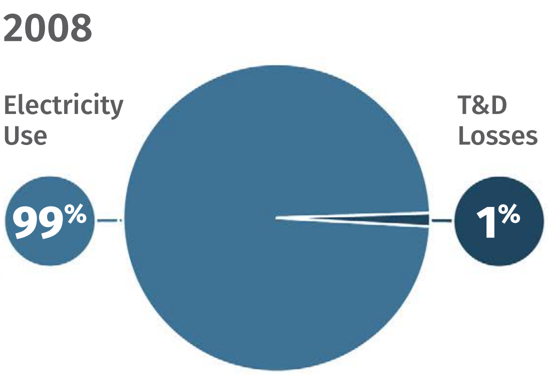


# SCOPE 2:

## Metropolitan Scope 2 Emissions

The majority of Metropolitan's GHG emissions are Scope 2, with 88 percent and 86 percent of total emissions coming from Scope 2 emissions in 2008 and 2017, respectively. The small decrease in Scope 2 emissions is attributed to pumping variability on the CRA, availability of water from other sources (SWP), and variable rainfall and pumping requirements as well as decreased emission factors for electricity that are attributable to the increased use of carbon-free electricity. Direct electricity consumption makes up 99 percent of Scope 2 emissions, and T&D losses consistently comprise the remainder. Figure 3-5 details the breakdown of Metropolitan's Scope 2 GHG emissions in both years by source. Pumping associated with the conveyance and distribution of water from the CRA is the primary driver of Metropolitan's electricity demand and overall GHG emissions, representing 75 percent of total emissions in 2008 and 78 percent in 2017. Availability of hydropower from Hoover Dam and Parker Dam also contributes to GHG emissions variability. Because these dams generally produce carbon neutral electricity, the more electricity they generate, the less carbon intensive electricity Metropolitan is required to source from the utilities and wholesale electricity market.

**FIGURE 3-5: Scope 2 Emissions by Source**



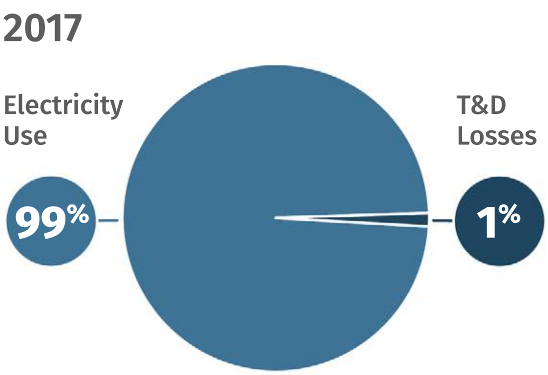
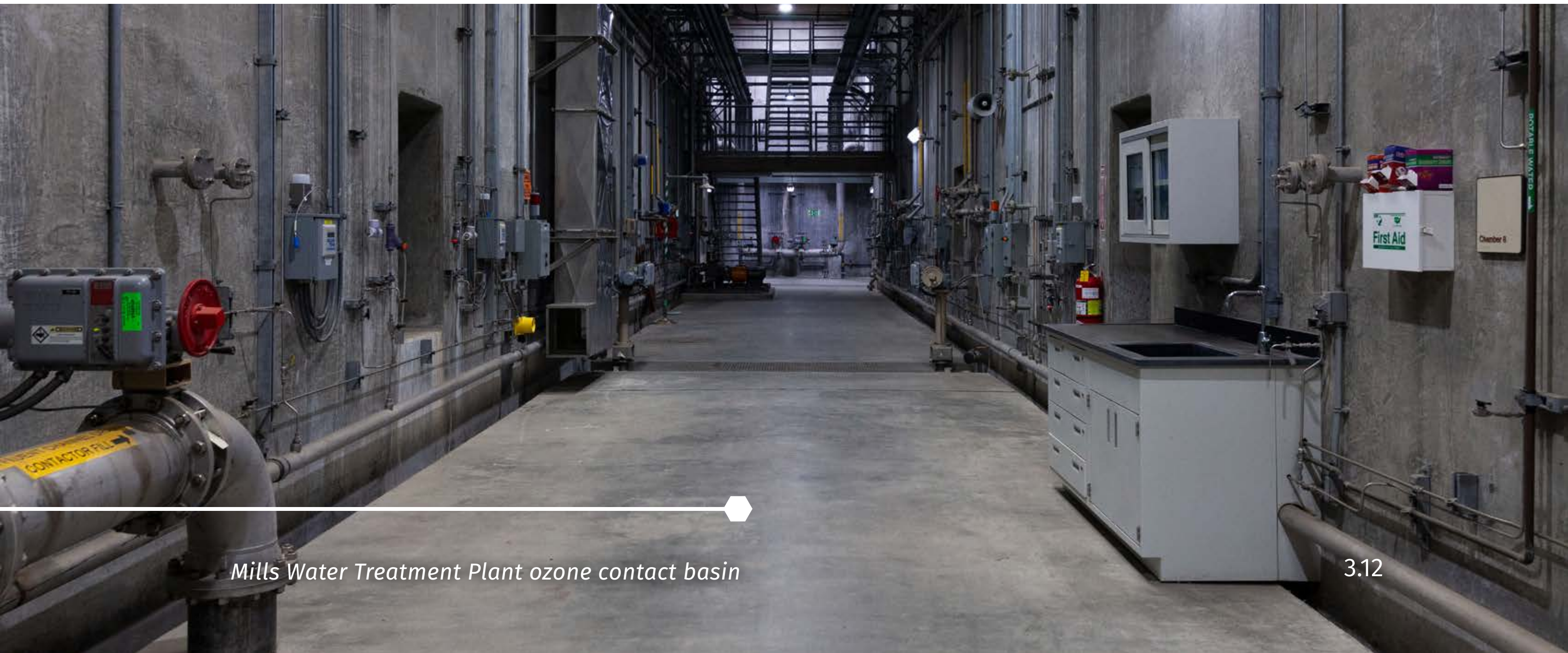



Table 3-1 depicts how much electricity is used throughout Metropolitans various operations. A majority of electricity consumption is due to pumping on the CRA using wholesale power. Other electricity consumption is due to water treatment, reservoir operations, transmission losses, and other facilities including Metropolitan’s offices.

**TABLE 3-1: Scope 2 Electricity Consumption by End Use (kWh)**

| Consumption Source | 2008 | 2017 |
|---|---|---|
| **Treatment Plants** | 42,907,728 | 48,788,848 |
| **Pumping Plants - Wholesale Power** | 1,762,803,183 | 1,313,240,090 |
| **Pumping Plants - Retail Power** | 11,420,786 | 4,875,221 |
| **Reservoirs** | 2,597,860 | 2,538,876 |
| **Power Plants & PCS** | 2,385,665 | 2,124,924 |
| **Other Facilities** | 10,203,709 | 8,073,807 |
| **MISC Energy Usage** | 3,261,236 | 1,960,488 |
| **T&D Losses** | 26,593,474 | 14,687,361 |




*Mills Water Treatment Plant ozone contact basin*

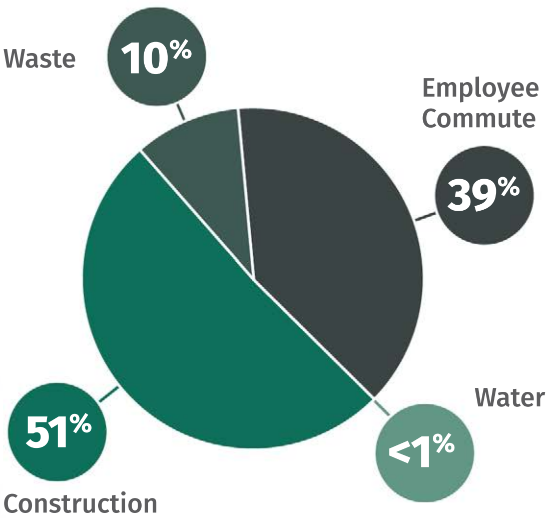
## SCOPE 3:

### Metropolitan Scope 3 Emissions

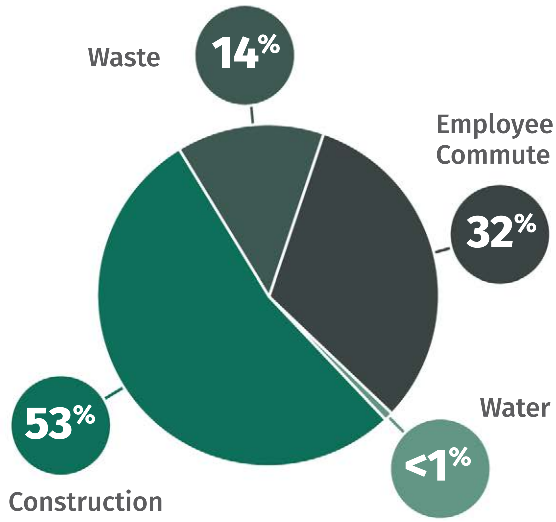
Metropolitan's Scope 3 GHG emissions comprised approximately nine percent of annual emissions in 2008 and 10 percent of annual emissions in 2017. As detailed in Figure 3-6, construction activities represent the largest percentage of Scope 3 emissions, contributing 51 percent in 2008 and 53 percent in 2017. Employee commutes generated 39 percent of inventoried Scope 3 emissions in 2008 but decreased to 32 percent by 2017. Solid waste-associated emissions contributed 9 percent of Scope 3 emissions in 2008 and 14 percent in 2017. In both years, water-related emissions contributed about one percent.

**FIGURE 3-6: Scope 3 Emissions by Source**

**2008**




**2017**



# GHG EMISSIONS INVENTORY SUMMARY

Table 3-2 provides a summary of Metropolitan's GHG emissions by sector for both the 2008 and 2017 calendar years. Additional information and details on methodologies and other calendar years can be found in Appendix B.

**TABLE 3-2: GHG Emissions Inventory Summary (MT $CO_2$e)**

| Scope | Emissions | 2008 | 2017 |
|---|---|---|---|
| Scope 1 | Mobile Emissions | 7,180 | 6,886 |
| | Stationary Emissions | 893 | 1,918 |
| | $SF_6$/HFC Emissions | N/A | 71 |
| Scope 2 | Treatment Plants | 18,167 | 11,727 |
| | Pumping Plants–Wholesale Power | 193,731 | 176,080 |
| | T&D Losses | 2,546 | 1,969 |
| | Pumping Plants–Retail Power | 3,595 | 1,172 |
| | Power Plants & PCS | 780 | 511 |
| | Reservoirs | 818 | 610 |
| | Other Facilities | 5,923 | 1,941 |
| | MISC Energy Usage | 1,092 | 471 |
| Scope 3 | Water and Wastewater Services | 13 | 184 |
| | Solid Waste | 2,363 | 3,157 |
| | Employee Commute | 9,237 | 7,257 |
| | Construction | 12,081 | 12,081 |
| **Total** | | **258,419** | **226,036** |

*Sacramento-San Joaquin Delta*

# 3.3 METROPOLITAN GHG EMISSIONS FORECAST

The annual GHG emissions inventories presented in this CAP provide accurate reference points for GHG emissions in past years. To estimate the level of GHG emissions reductions necessary for Metropolitan to achieve its GHG reduction target and be consistent with the requirements for a qualified GHG emissions reduction plan, an emissions forecast must be prepared.[11] Forecasts of future scope 1, 2, and 3 emissions are based on Metropolitan's 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.

GHG emissions associated with Metropolitan's operations are tied closely to the location where water is sourced. Metropolitan imports water to the Southern California region from two sources: the Colorado River through the CRA and via the California Aqueduct through the SWP.

Water from the CRA requires substantially more electricity usage, as it requires additional pumping across an extended distance from the Colorado River before it enters Metropolitan's distribution system. In contrast, water from the SWP does not require substantial, additional pumping due to the use of gravity to transport the water once it enters Metropolitan's operational control.[12] To account for this variability in electricity use and, therefore, GHG emissions, three forecast scenarios were modeled.

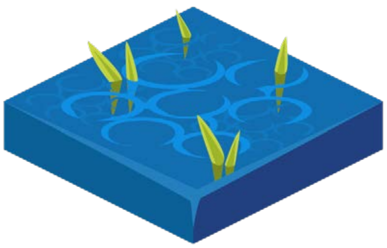
Figure 3-7 provides a description of the three modeled GHG emissions scenarios used to forecast Metropolitan's GHG emissions in 2030 and 2045. To calculate the three GHG emissions scenarios (high, average, and low), the expected water demand forecasts from the 2020 UWMP were combined with Metropolitan-specific per acre-foot emissions factors.

11. ***https://govt.westlaw.com/calregs/Document/I872A68805F7511DFBF66AC2936A1B85A?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=%28sc.Default%29***

12. *However, water from the SWP does have associated emissions not captured by Metropolitan. These emissions are detailed in the DWR CAP found here:* ***https://water.ca.gov/Programs/All-Programs/Climate-Change-Program/Climate-Action-Plan***

**FIGURE 3-7: Future GHG Emissions Scenarios**

### LOW EMISSIONS SCENARIO



The low GHG emissions scenario utilizes the assumed water delivery demands for the average rainfall year as defined in the Metropolitan 2015 UWMP. The GHG emissions factor for this scenario is derived by calculating the activity data per acre-foot of delivered water from calendar year 2012, which is the lowest emissions year between 2008 and 2017.[13]

### AVERAGE EMISSIONS SCENARIO

The average GHG emissions scenario utilizes the assumed water delivery demands of a single dry year with below-average rainfall as defined in the Metropolitan 2015 UWMP. However, the single dry year forecast assumes a single dry year level of water availability each year through 2045. The average GHG emissions factor for this scenario is calculated by averaging the activity data per acre-foot delivered from 2008-2017.

### HIGH EMISSIONS SCENARIO

The high GHG emissions scenario utilizes the assumed water delivery demands for consecutive dry years with below-average rainfall as defined in the Metropolitan 2015 UWMP. The GHG emissions factor for this scenario was derived by using the activity data associated with the year 2010, which is the highest emissions year between 2008 and 2017.

*13. This scenario provides the lowest emissions scenario for Metropolitan. Although this scenario considers multiple "average" rainfall years, due to the expected impacts of climate change (see Section 2.0), the Low Emission Scenario is considered a conservative estimate of the lower bound of future Metropolitan emissions.*

To calculate emissions factors used in forecasting, emissions in previous years (2005 through 2020) were divided by the total deliveries in each year. In years with high CRA pumping, emissions factors are much higher due to the increased electricity consumption required to pump CRA water to Metropolitan's service area. To ensure the most conservative estimates for each scenario were used to forecast the worst-case future emissions scenario, the highest resulting emissions factor (2010) was applied to the multiple dry year scenario for water deliveries from the 2020 UWMP. The average emissions scenario utilized the average emissions factor and the single dry year water delivery forecast from the 2020 UWMP. Finally, the low emissions scenario utilized the lowest emissions factor (2012) and applied the average year forecast from the 2020 UWMP. Table 3-3 provides a summary of the 2020 UWMP factors used in the GHG emissions forecasting.

**TABLE 3-3: 2020 Urban Water Management Plan Factors**

| Inventory Year | Emissions (MT $CO_2e$) | Deliveries (Acre-feet) | Emissions Factor (MT $CO_2e$/ Acre-foot) | Scenario Applied |
|---|---|---|---|---|
| **2010** | 582,952 | 1,642,000 | 0.355 | High |
| **Average of all years (2005-2020)** | 298,127 | 1,794,625 | 0.170 | Average |
| **2012** | 155,637 | 1,756,000 | 0.089 | Low |

**Numbers may not sum due to rounding.*

# ADDITIONAL GHG EMISSIONS FORECAST CONSIDERATIONS

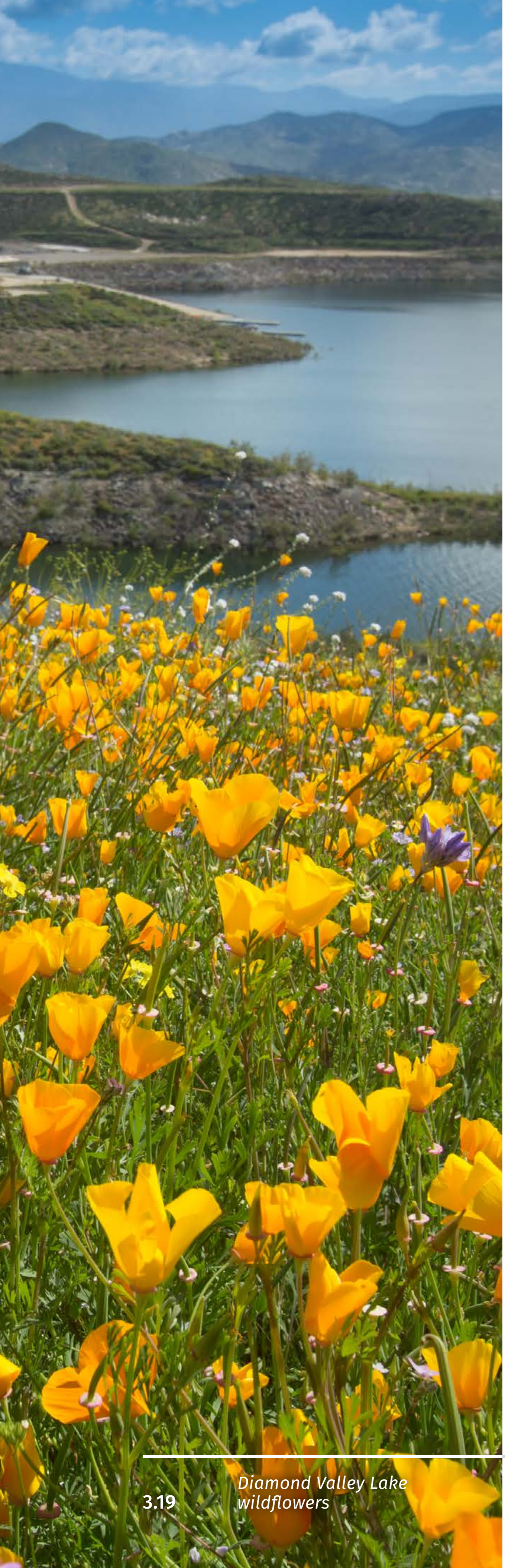
## Regional Recycled Water Program Construction and Operation

In addition to forecasting the GHG emissions from existing Metropolitan operations under the high-, average-, and low-emissions scenarios, the planned construction and operational GHG emissions from the proposed Regional Recycled Water Program (RRWP) were also modeled and included in the forecast. The program-specific information was used to estimate the future emissions from the RRWP, including construction and operation of an Advanced Water Treatment Plant, approximately 40 miles of pipelines, three pumping stations, and groundwater injection sites. To approximate annual construction GHG emissions, total construction emissions were divided by an assumed five-year construction schedule from 2025 through 2030. Operational GHG emissions are assumed to begin in 2031. Additional information about the RRWP emissions calculations and assumptions can be found in Appendix B.

## State GHG Emissions Reduction Regulations

California has enacted several regulations to reduce GHG emissions generated by energy consumption, water use, and transportation that will assist in reducing Metropolitan's emissions over time. SB 100 (2018) is the primary driver of emissions reductions in the forecast, and it accelerates the State's Renewables Portfolio Standard Program.[14] SB 100 requires electricity providers to increase procurement from eligible renewable energy resources to 33 percent of total retail sales by 2020, 60 percent by 2030, and 100 percent by 2045. Since Metropolitan also receives electricity from other states, the renewable portfolio standards of each state in the Western Electricity Coordinating Council was included in the forecast. California has several other regulations intended to reduce GHG emissions, examples of which include Title 24 and the Advanced Clean Cars Program. Each of these regulations was reviewed and found to have limited impact on Metropolitan operations as they are designed to primarily impact community-level emissions. Furthermore, leaving these expected reductions from State regulations out of the Metropolitan forecast provides a conservative estimate of future emissions.

14. *SB 100 and other regulations are covered in depth in Appendix A.*



*Diamond Valley Lake wildflowers*

# GHG EMISSIONS FORECAST RESULTS

The GHG emissions forecast projects Metropolitan's future GHG emissions through 2045 under high-, average-, and low-emissions scenarios. Both a mass emissions and a per-capita scenario are included below. The mass emissions forecast shows the total GHG emissions generated by Metropolitan's operations. The mass emissions forecast also serves as the basis for the per-capita forecast, which normalizes for population growth within Metropolitan's service area by dividing mass GHG emissions by Metropolitan's service population. As shown in Figure 3-8 and Figure 3-9, both mass and per-capita GHG emissions are expected to decline in future years due to the implementation of SB 100. SB 100 requires all retail electricity be carbon-free by the year 2045. Table 3-4 and Table 3-5 provide a comparison of the projected mass GHG emissions and per-capita GHG emissions for each emissions scenario in 2030 and 2045 relative to the 1990 emissions baseline.

**CARBON-FREE ELECTRICITY: Electricity produced by a resource that generates no carbon emissions, such as renewable energy, nuclear or large hydroelectric sources.**

**FIGURE 3-8: GHG Emissions Forecast and Potential Range of Emissions**

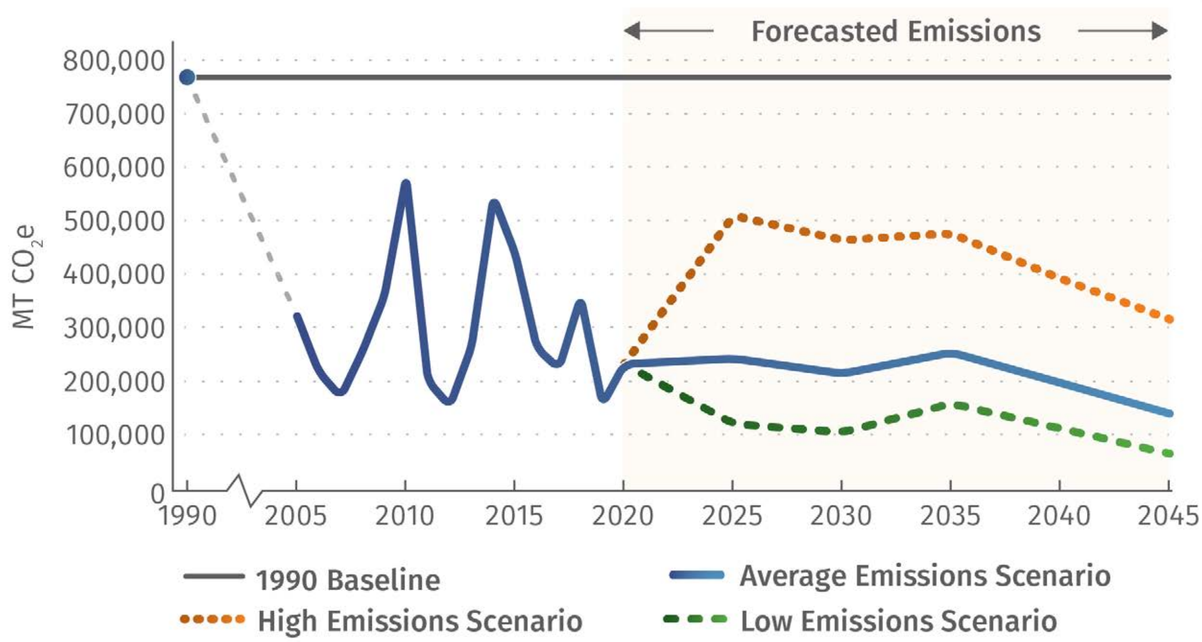



**TABLE 3-4: Anticipated Changes to Mass GHG Emissions Between 1990 and 2045 (MT $CO_2e$)**

| Emissions Scenario | 1990 Emissions (Baseline) | 2030 Forecast Emissions | Percent Reduction | 2045 Forecast | Percent Reduction |
|---|---|---|---|---|---|
| **High** | 771,514 | 465,664 | 40% | 317,441 | 59% |
| **Average** | 771,514 | 216,460 | 72% | 142,059 | 82% |
| **Low** | 771,514 | 106,615 | 86% | 66,812 | 91% |

**FIGURE 3-9: GHG Emissions Forecast and Potential Range (Per Capita)**

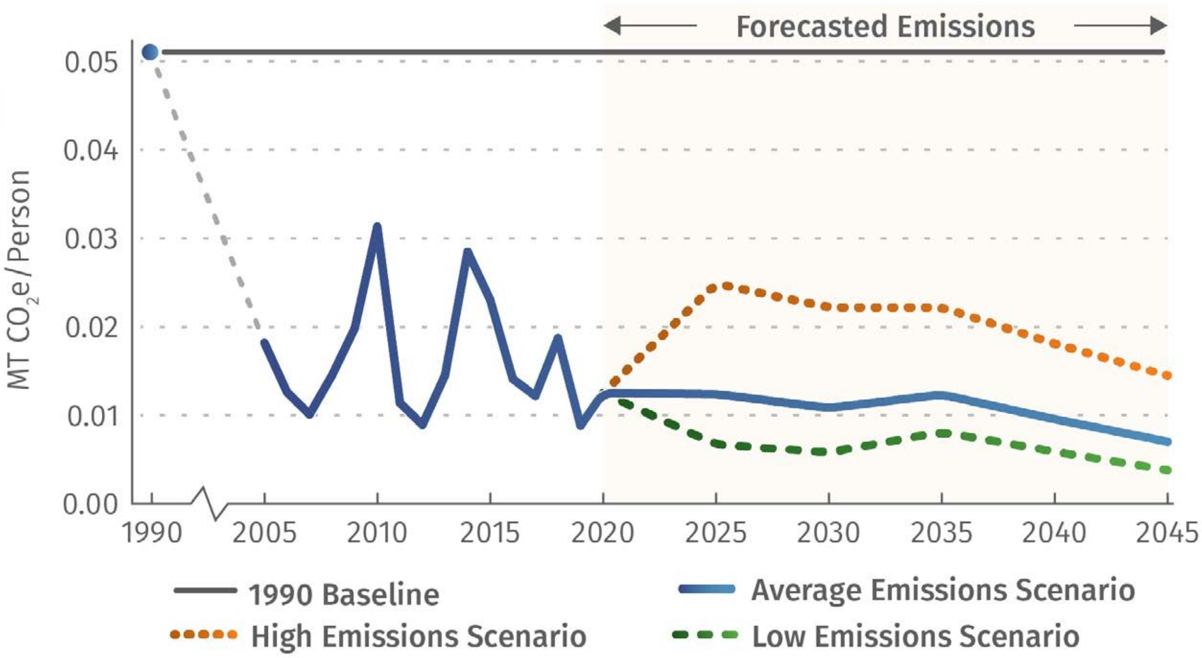



**TABLE 3-5: Forecasted Per-Capita GHG Emissions Between 1990 and 2045 (MT $CO_2e$)**

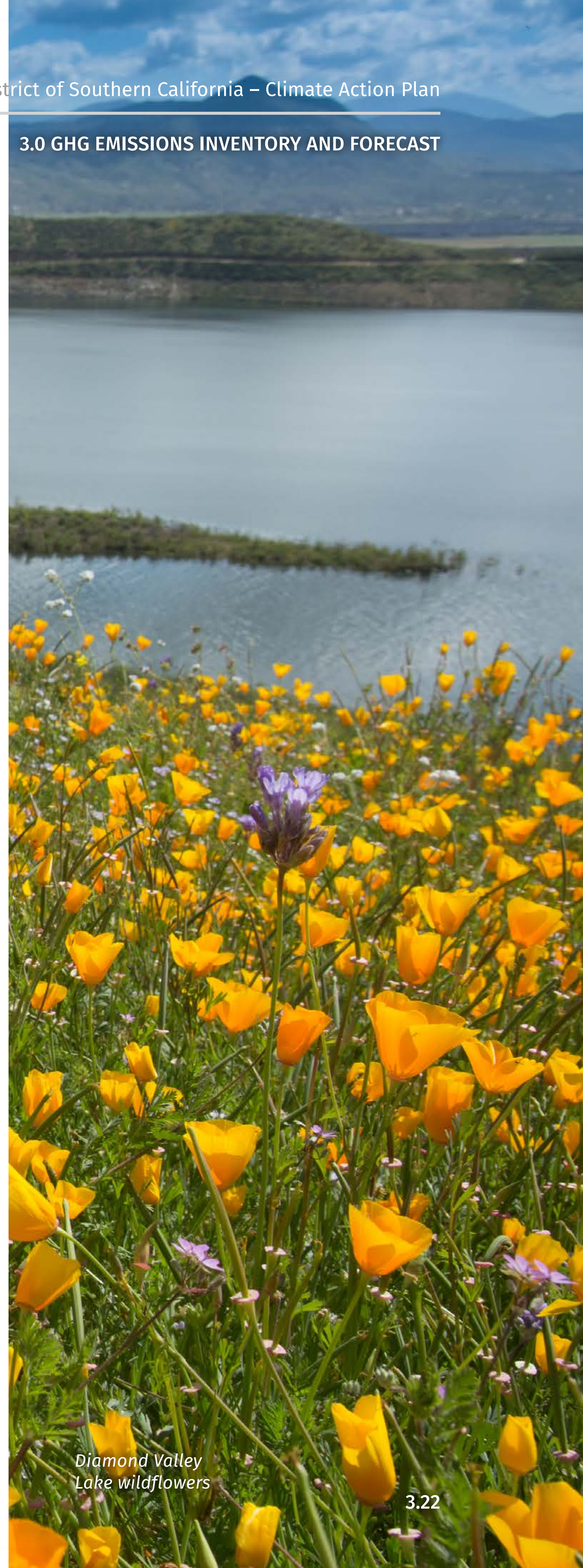
| Emissions Scenario | 1990 Emissions Baseline (MT/Person/Year) | 2030 Forecast (MT/Person/Year) | Percent Reduction | 2045 Forecast (MT/Person/Year) | Percent Reduction |
|---|---|---|---|---|---|
| **High** | 0.0516 | 0.0226 | 56% | 0.0144 | 72% |
| **Average** | 0.0516 | 0.0105 | 80% | 0.0064 | 87% |
| **Low** | 0.0516 | 0.0052 | 90% | 0.0030 | 94% |

*Population assumptions for the Metropolitan service area are as follows: 1990 population = 14,961,310; 2030 population = 20,634,000; 2045 population = 22,026,000. Population numbers are consistent with the 2020 UWMP and SCAG projections. More information on Metropolitan's per capita water use over time can be found in the 2020 UWMP.*

Pursuant to guidance provided in the State's Global Warming Solutions Act of 2006 (AB 32) and the 2017 Scoping Plan, Metropolitan utilized the per capita emissions calculation to track progress and set targets for future GHG reductions (Section 4.0).[15] The per-capita GHG emissions forecast provides a metric detailing each person's GHG emissions generated from water use and can clearly illustrate the effect of water conservation on the basis of an individual's actions. For example, under the average GHG emissions scenario, mass emissions are expected to decrease by 72 percent by 2030 when compared to 1990 levels. However, using the per-capita approach, 2030 GHG emissions are 80 percent lower when compared to 1990 levels, capturing the decrease in water use of an average individual due to Metropolitan's substantial investments in water conservation efforts.

As shown in Table 3-5, Metropolitan's per-capita GHG emissions reductions are expected to range between 56 percent and 90 percent, relative to 1990 emissions by 2030, and between 72 and 94 percent, relative to 1990 emissions by 2045. Due to the variable nature of annual emission rates and the large projected range of future emissions, Metropolitan will use a carbon budget approach to measure progress towards meeting its GHG reduction goals. The carbon budget methodology is outlined in Section 4.0.

15. *See Appendix A for a full discussion of relevant legislation as well as the 2017 Scoping Plan.*



*Diamond Valley Lake wildflowers*

# SECTION 4.0
# REGULATORY CONTEXT AND GHG REDUCTION TARGETS

**Metropolitan prepared this CAP to ensure that its operations and future projects are implemented in alignment with the State of California's SB 32, which builds on AB 32: The California Global Warming Solutions Act of 2006.[1] In support of AB 32, California established regulatory GHG emissions reduction mechanisms, such as the California Cap-and-Trade Program,[2] and thresholds on future GHG emissions levels. As part of this CAP, Metropolitan established GHG reduction targets consistent with the State's climate goals which would result in Metropolitan's "fair share" of emissions reductions in support of the overall statewide reductions.[3] Fair share emission reductions are determined by assessing whether an entity supports substantial progress toward the statewide reduction targets over time, not whether the entity is meeting a milestone target many years in the future. This section addresses applicable regulations related to GHG emissions and describes Metropolitan's approach to align with these GHG reduction targets and demonstrate progress over time.**

1. *In 2016 statewide GHG emissions fell below 1990 levels, generally achieving the goals of AB 32.* ***https://ww2.arb.ca.gov/news/climate-pollutants-fall-below-1990-levels-first-time***
2. *An in-depth description of California's GHG reduction legislation can be found in Appendix A.*
3. *Association of Environmental Professionals, Final White Paper, Beyond 2020 and Newhall, October 18, 2016*

# 4.0

4.0

# 4.1 INTERNATIONAL REGULATIONS

## INTERNATIONAL REGULATIONS

As a global intergovernmental organization, the United Nations (UN) leads and coordinates climate change response at the global level. The United Nations Framework Convention on Climate Change (UNFCCC) and Paris Agreement are central to the UN's action on climate change. Additional UN policies and programs related to climate change are discussed in Appendix A.

### The Paris Agreement

The Paris Agreement (Agreement) is the first international, legally binding, global climate agreement. The Agreement was adopted in 2015 and has been ratified by 189 countries worldwide.[4] The Agreement establishes a roadmap to keep the world under 2°C of warming by the end of the century with a goal of limiting an increase of global temperature to 1.5°C. The Agreement does not dictate one specific reduction target; instead, it relies on individual countries to set nationally determined contributions or reduction targets based on gross domestic product and other factors. According to the Intergovernmental Panel on Climate Change (IPPC), achieving a global warming limit of 1.5°C requires global emissions reductions of at least 49 percent below 2017 emissions[5] through 2030 and carbon neutrality by mid-century,[6] with carbon neutrality being defined as a balance between reducing carbon and GHG emissions emitted into the atmosphere and absorbing carbon from the atmosphere through carbon sequestration and other techniques.

4. *https://unfccc.int/process/the-paris-agreement/status-of-ratification*
5. *https://www.nature.com/articles/d41586-018-06876-2*
6. *https://www.ipcc.ch/sr15/*

*Transmission towers near Colorado River Aqueduct*

# 4.2 CALIFORNIA REGULATIONS AND GHG EMISSIONS TARGETS

## CALIFORNIA REGULATIONS AND GHG EMISSIONS TARGETS

California is a leader in the development of GHG policy and the mitigation of GHG emissions. Legislation and policy related to climate change mitigation have been in place since 2002. Some of these regulations establish statewide reduction goals, while others establish specific mechanisms to achieve California's goals. California became the first state to establish levels for statewide GHG reduction with the passage of AB 32 in 2006. California has since enacted additional legislation, regulations, and EOs to promote robust GHG emissions reductions across many economic sectors[7]. Although these regulations drive climate policy in California, they do not include requirements for water agencies like Metropolitan. The following is a summary of the most relevant executive and legislative emissions reduction goals established at the state level. Additional relevant policies related to climate change and GHG emissions are discussed in Appendix A.

### Executive Order S-3-05 (2005)

EO S-3-05 was signed in 2005, establishing statewide GHG emissions reduction targets for the years 2020 and 2050. The EO calls for the reduction of GHG emissions in California to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below 1990 levels by 2050. The 2050 emissions reduction target would put the State's emissions in line with the worldwide reductions needed to reach long-term climate stabilization as concluded by the IPPC 2007 Fourth Assessment Report.

7. *Scoping Plan Sectors include; Industrial, Electricity, Agriculture, Commercial and Residential, High GWP, Recycling and Waste, and Transportation.*

## Assembly Bill 32 (2006)

AB 32, the California Global Warming Solutions Act of 2006, is at the core of California policy related to GHG emissions reductions. By enacting AB 32, California became the first state to mandate GHG emissions reduction across all industries and economic sectors. The landmark legislation converted the 2020 GHG emissions reduction goal set by EO S-3-05 into statewide requirements, mandating the reduction of GHG emissions to 1990 levels by 2020. It also directed CARB to develop and implement a Scoping Plan and other regulations to ensure California would meet the 2020 goal.[8] The Scoping Plan includes the State's GHG inventory and 1990 baseline emission rate.[9]

## Senate Bill 32 (2016)

SB 32 extends the provisions of AB 32 by requiring the State to reduce GHG emissions to 40 percent below 1990 levels by 2030 (the other provisions of AB 32 remain unchanged). In 2017, the CARB adopted the 2017 Scoping Plan, which provides a framework for achieving the 2030 goal. The 2017 Scoping Plan relies on the continuation and expansion of existing policies and regulations, such as the Cap-and-Trade Program, along with implementation of recently adopted policies, such as SB 350 (renewable electricity), which was signed in 2020, and SB 1383 (organic waste diversion), which was signed in 2016, both discussed in Appendix B.

## Executive Order B-55-18 (2018)

EO B-55-18 establishes a statewide carbon neutrality goal for GHG emissions in all sectors by 2045. The EO states, "Achievement of carbon neutrality will require both significant reduction in carbon pollution and removal of carbon dioxide from the atmosphere, including sequestration in forests, soils, and other natural landscapes."[10] It further directs the CARB to update the Scoping Plan to reflect this goal.

8. *The SB32 scoping plan does not include specific goals or requirements for water agencies.*
9. ***https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan***
10. ***https://www.gov.ca.gov/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf***

*Whitsett Intake Pumping Plant*

# 4.3 METROPOLITAN'S GHG EMISSIONS REDUCTION TARGETS

The emissions inventory and forecast presented in Section 3.0 provide a basis for Metropolitan to establish targets for future GHG reductions. Metropolitan established a 2030 target for GHG emissions reduction to achieve consistency with SB 32 and a 2045 target consistent with EO B-55-18. By defining specific reduction targets, Metropolitan can track its progress towards meeting its goals and measure the success of its CAP. CEQA Guidelines Section 15183.5(b)(1) requires that plans establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable.[11] Metropolitan has chosen to adopt GHG emissions reduction targets that align with State goals as well as international consensus on the GHG reductions needed to avoid the most serious climate change impacts. Consistency with statewide GHG reduction goals has been established through case law as an appropriate methodology for establishing significance under CEQA.[12]

## ESTABLISHING AND TRACKING GHG REDUCTION TARGETS

With the release of the 2017 Scoping Plan,[13] the CARB recognized the need to balance population growth with emissions reductions, and in doing so, provided a new methodology for proving consistency with State GHG reduction goals through the use of per capita efficiency targets. These targets are calculated by dividing a jurisdiction's GHG emissions for each horizon year by the jurisdiction's total population for that target year. Metropolitan will pursue a linear per capita GHG emission reduction pathway to exceed the State's target of 40 percent

11. 14 CCR § 15183.5

12. CENTER FOR BIOLOGICAL DIVERSITY v. The Newhall Land and Farming Company. Decided: November, 30 2015.

13. **https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf**

below 1990 levels by 2030 (0.0309 MT $CO_2e$ per person) and make significant progress towards the ultimate goal of achieving carbon neutrality by 2045 (0.0 MT $CO_2e$ per person). Measuring progress towards meeting the established target using a per capita emissions approach is achieved by using Metropolitan's 1990 GHG emissions and then dividing by the population of Metropolitan's service area in that year to calculate a baseline per capita emissions rate of 0.0516 MT $CO_2e$ per person in 1990. Using Metropolitan's long-term goal of carbon neutrality, a per capita emissions rate of 0.0 MT $CO_2e$ per person was established for the year 2045, and interim targets (between 1990 and 2045) were established by drawing a straight line between these two points. The straight line approach results in a per capita target that is 73 percent below 1990 levels by 2030, as shown in Table 4-1, which exceeds the State's 40 percent reduction goal.

While the GHG reduction targets have been determined using a per capita approach, Metropolitan will measure progress towards these goals by calculating its total operational GHG emissions in MT $CO_2e$. In order to better understand the total emissions allowable in each year, the per capita target in MT $CO_2e$ per person is multiplied by the expected service area population in each year. This generates a total MT $CO_2e$ value for that year as shown in Table 4-1 in the "Associated Mass Emissions" column.

**TABLE 4-1: Comparison of Metropolitan and California GHG Reduction Targets**

| Target | Per Capita Emissions (MT $CO_2e$) | Associated Mass Emissions* (MT $CO_2e$) | Percent Reduction (Below 1990) |
|---|---|---|---|
| **Metropolitan's 1990 Per Capita Emissions (AB32 Target)** | 0.0516 | 771,514 | N/A |
| **Minimum Per Capita Reduction Target for SB 32 Consistency** | 0.0309 | 638,423 | 40% |
| **Metropolitan's Per Capita 2030 GHG Emissions Target** | 0.0141 | 290,192 | 73% |
| **Metropolitan's 2045 Per Capita Goal** | 0 | 0 | 100% |
| **California's EO B-55-18 Per Capita Goal** | 0 | 0 | 100% |

*+Pending final population numbers*
**Associated Mass Emissions are calculated by multiplying the per capita emissions target by the projected population in that year. Final mass emission values will be updated based on actual population data.*

**FIGURE 4-1: Metropolitan's Per Capita GHG Emissions Targets (MT $CO_2e$ per Person)**

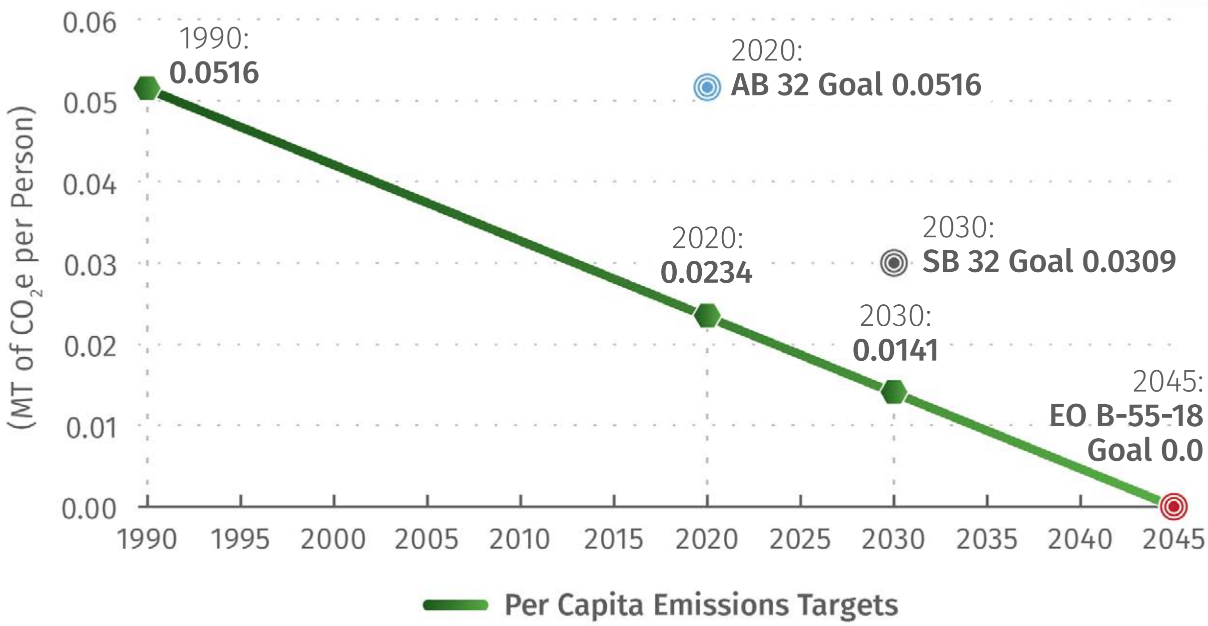
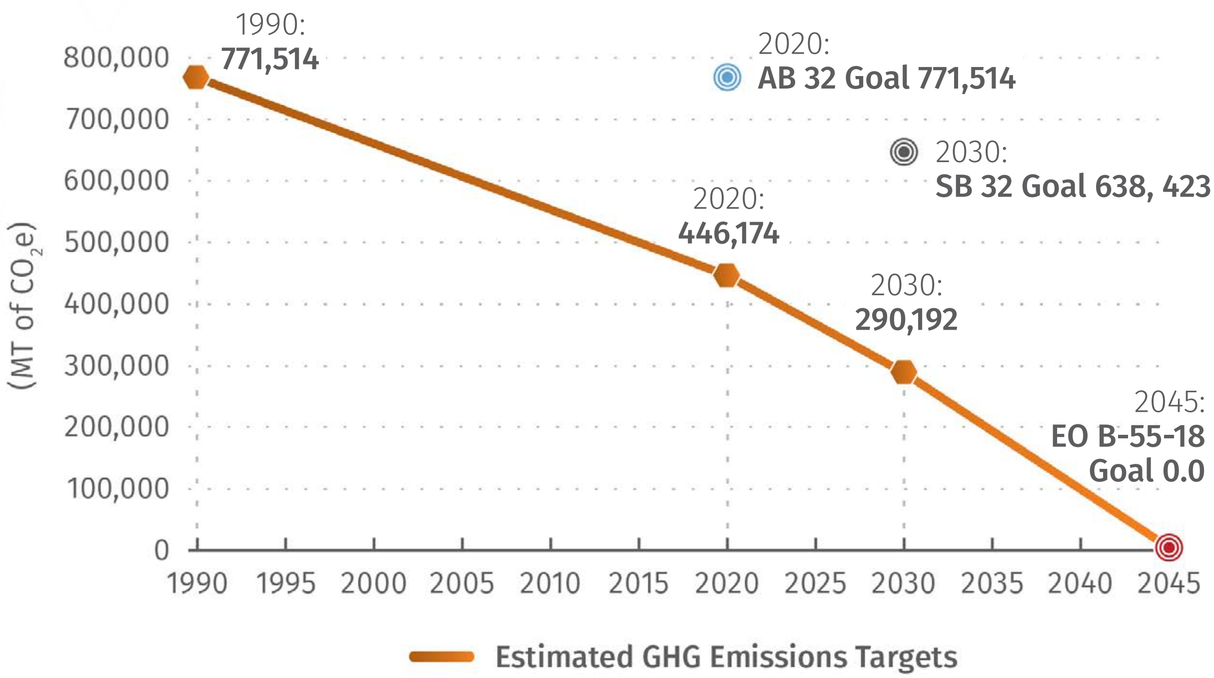



Figure 4-1 describes the complete per capita reduction pathway. The figure shows Metropolitan will meet or exceed the per capita emissions target for all three California goals described by AB 32, SB 32, and EO B-55-18. The use of per capita reduction targets to show progress towards GHG reduction goals was established and promoted by the State in the 2017 Scoping Plan Update.[14] Figure 4-2 illustrates the per capita reduction pathway translated into mass emissions. Per capita emissions are translated to mass emissions by multiplying by the population in each year. As shown in Figure 4-2, Metropolitan's target pathway exceeds the State's emissions reduction goals in 2020 and 2030 before ultimately reaching carbon neutrality in line with the State's long-term goal in 2045. The current population values are projected and will need to be updated over time as actual population numbers are established. This will change the allowable emissions (MT $CO_2e$) in each year by effectively including a variable that considers the actual service population in determining the emission reductions. Normalizing the emissions by dividing the total emissions by population removes population growth as a variable and allows Metropolitan to focus on deep decarbonization over time. Furthermore, achieving the 2045 target of carbon neutrality may be an iterative process and require revisions between now and 2045, with changes to State policy or new statewide GHG emissions targets established by the California legislature.

14. *https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf*

**FIGURE 4-2: Metropolitan's Per Capita GHG Emissions Targets Translated to Mass Emissions (MT $CO_2e$)**




Metropolitan's estimated emissions in 2030 are well below the State's 2030 target. However, due to the variability associated with Metropolitan's GHG emissions (as discussed in Section 3.0), using any individual year to gain an understanding of Metropolitan's GHG emissions reduction progress would not provide a clear picture of overall emissions reduction trends. Therefore, Metropolitan intends to implement a carbon budget approach to determine GHG emissions reduction progress.

*Native plant garden at Weymouth Water Treatment Plant*

# METROPOLITAN'S CARBON BUDGET AND LINEAR EMISSIONS

Due to the nature of its operations, Metropolitan's GHG emissions fluctuate from year to year depending on water pumped from the Colorado River (see Figure 3-2). Consequently, GHG emissions recorded in any one particular year are not necessarily representative of Metropolitan's overall progress towards meeting its GHG emissions reduction targets. To account for this factor, Metropolitan will track its emissions annually using a carbon budget approach.

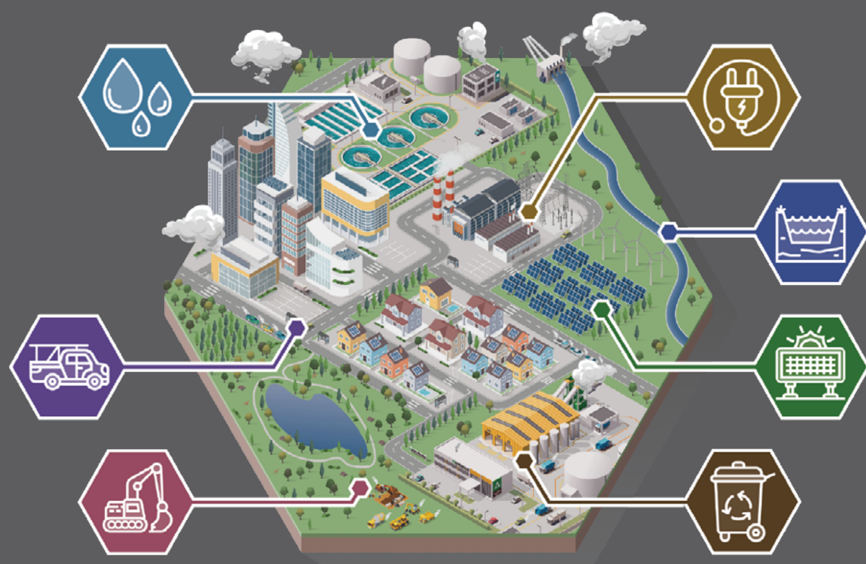
The carbon budget is analogous to a tank with a set capacity or a total mass emission cap between 2005 and carbon neutrality in 2045. All of the emissions from Metropolitan's operations go into this tank each year. The total capacity of the tank is Metropolitan's total emissions budget, and over time that tank fills up. As long as Metropolitan produces fewer GHG emissions than can fit in the tank, the target will be achieved regardless of emissions produced during any particular year. This process is illustrated in Figure 4-3. Carbon budgets are widely used in the context of international climate policy and development of global-scale GHG emissions targets.[15,16,17] The importance of staying within the carbon budget has also been established by CARB.[18] As outlined in the 2017 Scoping Plan, California's strategic vision for achieving at least a 40 percent reduction in GHG emissions below 1990 levels by 2030 is based on the level of reductions scientists say is necessary to meet the Paris Agreement goals (CARB 2017). To track progress in achieving the GHG emissions reduction goals, Metropolitan will utilize the per capita target methodology in combination with an established carbon budget.

As described above, Metropolitan will pursue carbon neutrality by 2045 via a linear per capita emissions reduction methodology. To calculate the total carbon budget that corresponds to Metropolitan's GHG emissions reduction targets, the area beneath the reduction curve shown in Figure 4-2 is calculated. The sum of this area represents the carbon budget. Data is not available for the years 1990 through 2004; therefore, the carbon budget begins in 2005, the year in which Metropolitan began submitting data to The Climate Registry. Using this methodology allows Metropolitan to capture its significant progress toward reducing emissions to well below the AB 32 goal of returning to 1990 emissions levels by 2020. According to this methodology, between 2005 and 2045 Metropolitan's total carbon budget is 14,660,475 MT $CO_2$e.

15. *https://www.earth-syst-sci-data.net/11/1783/2019/*
16. *https://www.wri.org/resources/data-visualizations/infographic-global-carbon-budget*
17. *https://www.carbonbrief.org/analysis-why-the-ipcc-1-5c-report-expanded-the-carbon-budget*
18. *https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/meetings/012319/cneutrality_ca.pdf*

**FIGURE 4-3: How a Carbon Budget Works**

## THE CARBON BUDGET



### GHG EMISSIONS FROM METROPOLITAN'S OPERATIONS

As Metropolitan releases GHG emissions during its operations, those emissions deplete the carbon budget.

These tanks represent the total MT $CO_2e$ Metropolitan can release by 2045.

Total Budget
*(2005 to 2045)*
**14,660,475 MT $CO_2e$**

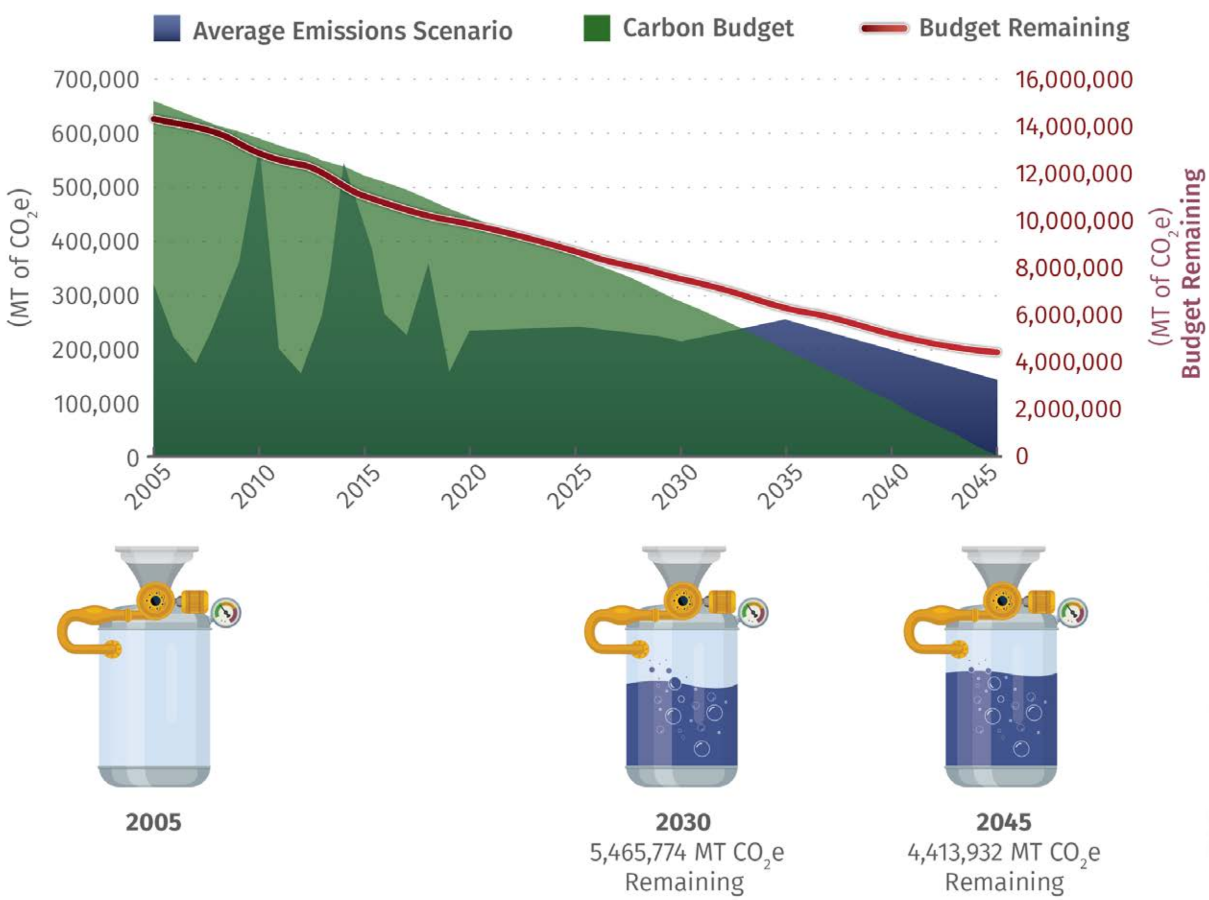
**WITHIN BUDGET**

**OVER BUDGET**

## GHG EMISSIONS REDUCTION GAP

In order to better illustrate how the carbon budget will be applied to Metropolitan's operations, each of the emissions scenarios defined in Section 3.0 can be analyzed under the carbon budget approach. Figure 4-4 illustrates Metropolitan's carbon budget contextualized with the average GHG emissions scenario in dark blue with the carbon budget overlaid in green. The tanks below the graph in Figure 4-4 show the remaining budget in each year. Under this scenario, Metropolitan stays within its carbon budget through 2045 (red line) but would still need additional GHG reductions to achieve carbon neutrality by 2045.[19]

**FIGURE 4-4: Metropolitan's Projected Carbon Budget Under the Average Emissions Scenario**




19. *Based on Metropolitan's historical emissions, it is expected that actual future emissions will continue to be highly variable and Metropolitan will continue to monitor its carbon budget on an annual basis.*

The average GHG emissions scenario is only one of the potential GHG emissions scenarios Metropolitan is including in its planning process. Table 4-2 and Figure 4-5 show the impact of each of the three forecasted GHG emissions scenarios on the projected carbon budget. In every GHG emissions forecast scenario, Metropolitan is expected to remain within its carbon budget through 2030. Both the average and low emissions scenarios show Metropolitan maintaining a positive budget through 2045. However, under the high emissions scenario, without additional GHG emissions reductions, Metropolitan will deplete its carbon budget by 2043, as shown in Table 4-2. In all scenarios, additional reductions will be needed to achieve carbon neutrality in 2045. This CAP establishes the foundation for achieving these reductions over time and will allow Metropolitan to stay within its allotted carbon budget. Metropolitan will continue to update the CAP with new and additional GHG emissions reduction measures as necessary to remain under the carbon budget regardless of how actual future scenarios play out.

**FIGURE 4-5: Metropolitan's Forecasted Carbon Budget Outcomes**

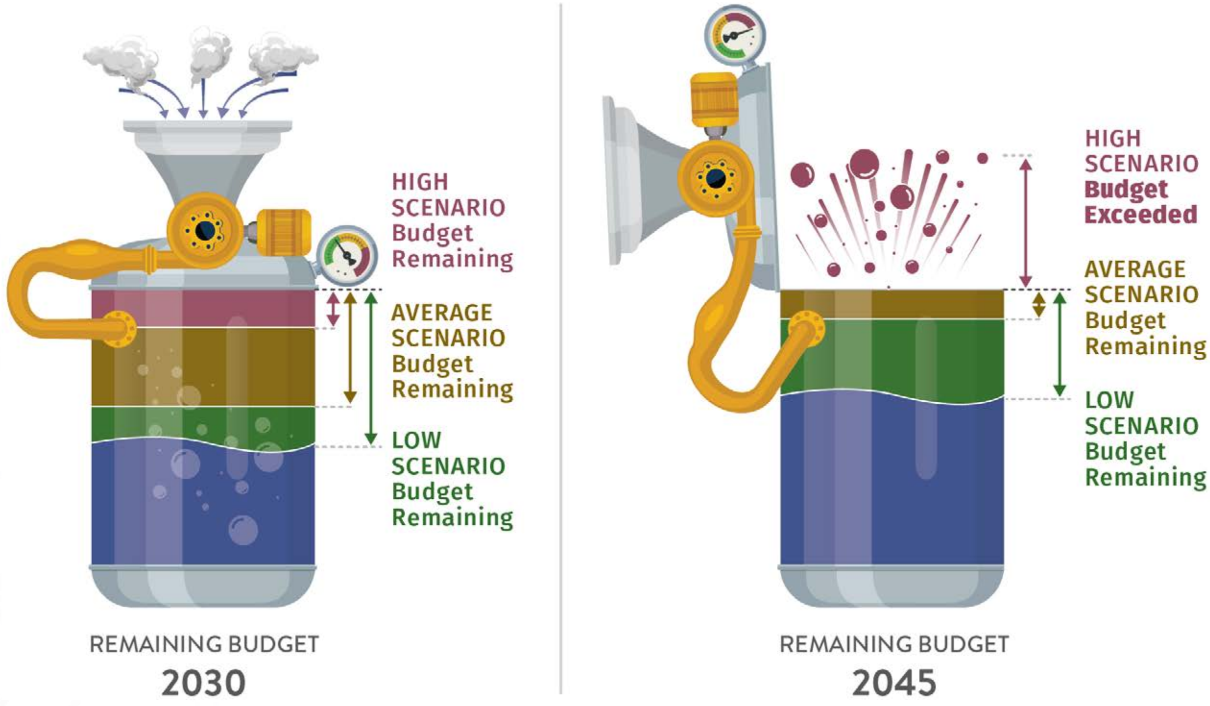


**TABLE 4-2: Metropolitan's Forecasted Carbon Budget Outcomes**

| Emissions Levels | Remaining Budget 2030 (MT $CO_2e$) | Remaining Budget 2045 (MT $CO_2e$) |
|---|---|---|
| **Low Emissions** | 6,405,936 | 6,704,456 |
| **Average Emissions** | 5,465,774 | 4,413,932 |
| **High Emissions** | 3,384,248 | *(718,236)* |

*( ) denotes a negative value*

## METROPOLITAN'S CURRENT BALANCE

Between 2005 and 2020, Metropolitan used approximately 4,770,038 MT $CO_2e$ of its total carbon budget of 14,660,475 MT $CO_2e$. This accounts for only 53 percent of the total budget allocated for this timeframe. As shown in Figure 4-6, Metropolitan has approximately 9.9 million MT GHG emissions (as $CO_2e$) remaining until 2045. In order to stay within its established carbon budget, Metropolitan developed a suite of GHG reduction strategies outlined in Section 5.0.

**FIGURE 4-6: Metropolitan's Remaining Carbon Budget as of 2020**

Estimated Carbon Budget (2005 to 2045)
**14,660,475** MT $CO_2e$

Allocated Carbon Budget (2005 to 2020)
**8,924,634** MT $CO_2e$

Carbon Budget Used Through 2020
**4,770,038** MT $CO_2e$

Percent of 2020 Carbon Budget Used
**53%**

Total Carbon Budget Remaining
**9,890,437** MT $CO_2e$

# SECTION 5.0
# METROPOLITAN’S GHG EMISSIONS REDUCTION STRATEGY

While Metropolitan has made significant progress towards reducing its GHG emissions (especially over 1990 baseline levels), achieving carbon neutrality by 2045 requires additional focused actions. This CAP includes specific strategies that, when implemented, can achieve carbon neutrality and provide co-benefits, such as improved infrastructure reliability, increased energy reliability, and decreased costs associated with energy procurement and maintenance. This section focuses on GHG emission reduction strategies over which Metropolitan has direct operational control (e.g., emissions from construction equipment or fleet vehicle replacement). These strategies or action items can have either quantifiable (i.e., with clear GHG tracking metrics and performance standards) or non-quantifiable (i.e., “supportive”) goals associated with them. While “supportive” measures may not be quantifiable, they can provide opportunities to study technologies and strategies that can ensure Metropolitan reaches its GHG reduction goals. An example of a quantifiable measure would be purchasing a specific amount of carbon-free electricity, whereas a supportive measure would be implementing a sustainable purchasing policy. The first example has a quantifiable GHG reduction. The second may reduce emissions somewhere, but that reduction is not quantifiable for Metropolitan. Together, these measures establish a pathway to achieve carbon neutrality and satisfy the requirements of CEQA Guidelines Section 15183.5(b)(1)(D) for a qualified GHG reduction plan. It is important to note that none of the projects listed in Section 5.0 have been approved and are subject to the approval of Metropolitan’s Board of Directors or General Manager before implementation.

# 5.0

*Weymouth Water Treatment Plant solar panels*


*Sacramento-San Joaquin Delta*

# 5.1 STRATEGY OVERVIEW

Metropolitan serves a critical function within its service area by providing safe and reliable water to its member agencies who then serve homes and businesses throughout Southern California. The transport and delivery of water will always be needed to meet the needs of Southern California's growing population and dynamic economy. While increasing water efficiency can decrease per capita water demand and thus reduce some of Metropolitan's GHG emissions, these actions alone will not be sufficient to meet the goal of carbon neutrality. This comprehensive CAP identifies strategies to reduce GHG emissions, ensures implementation of future technological advances, and incorporates State regulations related to climate change.

Metropolitan has organized its GHG reduction measures into three emission categories or scopes–direct combustion (Scope 1), indirect electrical consumption (Scope 2), and indirect emissions and sequestration (Scope 3)–as well as nine core strategies to systematically reduce overall GHG emissions.[1] These strategies and measures are summarized below. Sections 5.2 through 5.4 detail the specific actions required to reduce emissions and provide a high-level course of action to achieve Metropolitan's goal of carbon neutrality. Through these measures, Metropolitan will be well-positioned to meet its carbon neutrality goal by 2045. By utilizing a carbon budget to track its emissions reductions, Metropolitan can leverage this data to accelerate GHG reduction strategies and identify and implement new technologies, as needed. As outlined in Section 6.0, Metropolitan will evaluate and update the CAP every five years and adjust its implementation measures (such as the amount of carbon-free electricity to purchase) to balance the carbon budget, all the while balancing the cost of the water Metropolitan provides to its customers.

1. *The GHG Protocol, which is discussed in detail in Section 3.0, GHG Emissions Inventory and Forecast, segregates GHG emission sources into 3 scopes based on varying levels of control: Scope 1 –Direct Emissions from the activities that are directly under an organization's control, such as on-site fuel combustion including boilers, fleet vehicles and air-conditioning leaks; Scope 2 – Indirect Emissions from purchased electricity–emissions are created during the production of the electricity that is eventually used by the organization; and Scope 3 – All Other Indirect Emissions from activities of the organization, occurring from sources that it does not own or control, including emissions associated with business travel, procurement, waste and water usage.*

SCOPE 1:

# DIRECT EMISSIONS

## STRATEGY 1: Phase Out Natural Gas Combustion at Facilities

Natural gas and other fossil fuels combusted in Metropolitan facilities emit approximately 1,000 MT $CO_2e$ per year. While natural gas and other fossil fuels are not the most substantial source of emissions, natural gas-powered equipment can be electrified over time as the equipment reaches the end of its useful life. Once equipment is electrified, carbon-free electricity can be used to power it, further reducing GHG emissions.

## STRATEGY 2: Zero Emission Vehicle Fleet

Metropolitan's fleet emits on average 7,000 MT $CO_2e$ per year. Fully electrifying or otherwise decarbonizing Metropolitan's fleet and powering it with carbon-free electricity or other zero emission technology would allow for this emission source to achieve carbon neutrality. However, not all vehicles in Metropolitan's fleet currently have a zero-emission option. While passenger vehicles can take advantage of commercially available zero-emission vehicle technologies (ZEV), such as electric vehicles (EVs), replacement of heavy-duty vehicles will occur at a slower pace as new technologies are introduced.

## STRATEGY 3: Use Alternative Fuels to Bridge the Technology Gap to Zero Emission Vehicles and Equipment

Metropolitan currently uses a combination of gasoline, diesel, and compressed natural gas to fuel its fleet. While zero-emission heavy-duty vehicles are being developed, using low-carbon intensity fuels like renewable diesel in its older vehicles can help reduce GHG emissions over the short-term. The use of alternative fuels allows for additional time to fully vet the new zero-emission technology before significant infrastructure investments are made, which could help prevent stranded assets through the proper selection of the most cost-effective alternatives.

**While zero-emission heavy-duty vehicles are being developed, using low-carbon intensity fuels like renewable diesel can help reduce GHG emissions over the short term.**

## SCOPE 2:

## INDIRECT EMISSIONS FROM ELECTRICITY

### **STRATEGY 4:** Utilize Low-Carbon and Carbon-Free Electricity

Electricity consumption is Metropolitan's single largest and most variable emission source. While SB100 ensures that emissions from retail electricity will be reduced over time, additional steps will be needed to generate or procure carbon-free electricity to reach Metropolitan's carbon neutrality goal. Purchasing low-carbon and carbon-free electricity, implementing pump time-of-use strategies, and developing additional carbon-free energy generation are all covered under this strategy.

### **STRATEGY 5:** Improve Energy Efficiency

Increased efficiency of electric-powered equipment can substantially reduce GHG emissions. Improving pump efficiency, installing light emitting diode (LED) lighting, and installing energy recovery systems could all reduce the total demand for electricity from Metropolitan systems, saving money and emissions.

## SCOPE 3:

## OTHER INDIRECT EMISSIONS

### **STRATEGY 6:** Incentivize More Sustainable Commutes

Based on its experiences with the COVID-19 global pandemic, Metropolitan is re-evaluating its remote working options and alternative work schedules. These changes alone may affect when and how employees commute to work, and thus, may reduce Metropolitan's carbon footprint. In addition, Metropolitan tracks employee commuting methods and provides education on alternative commute options as well as discounts on transit passes and EV charging stations at select facilities (e.g., Union Station Headquarters and the Weymouth Water Treatment Plant). Providing EV charging infrastructure encourages employees to drive personal EVs by providing workplace charging options. Collectively, these incentives help Metropolitan lower its carbon footprint.

## STRATEGY 7: Increase Waste Diversion to Achieve Zero Waste

To reduce emissions in a variety of sectors, Metropolitan will develop and implement a Net-Zero Waste Plan to eliminate waste generated at offices and other facilities, which would involve diverting 100 percent of organic and inorganic waste streams from the landfill, as well as develop policies to eliminate the use of single-use plastics.

## STRATEGY 8: Increase Water Conservation and Local Water Supply

Metropolitan has a long history of incentivizing water conservation, which has had a measurable effect on overall water conservation (and GHG emissions). This can be clearly seen through the decrease in per capita water consumption over time from 0.14 acre-feet per person in 1990 to 0.09 acre-feet per person in 2017, a 36 percent reduction in per capita water use. Metropolitan plans to continue and expand its water conservation efforts into the future. Reduced per capita water consumption allows Metropolitan to meet the water demands of a growing population and reduce operational emissions.

## STRATEGY 9: Investigate and Implement Carbon Capture and Sequestration Opportunities

While Strategies 1 through 8 actively reduce GHG emissions from Metropolitan's operations, Strategy 9 looks at opportunities for negative emissions through carbon capture and storage and/or carbon sequestration on natural and working lands (e.g., rangeland, forests, woodlands, wetlands and coastal areas, grasslands, shrubland, farmland, riparian areas, and urban green space). Carbon capture and storage refers to the process of capturing $CO_2$ emissions from the atmosphere or an industrial process, transporting it, and storing it in deep geological formations, the ocean, or minerals.[2] Carbon sequestration programs will be an important tool to mitigate some of Metropolitan's emissions. It is important to plan and implement sequestration programs that can be used as mitigation. Although no reductions were quantified for this strategy, future CAP updates and projects may utilize carbon sequestration to help Metropolitan achieve carbon neutrality.

Table 5-1 summarizes how each of the strategies established by Metropolitan in this CAP align with the emission sources outlined in ICLEI's[3] Local Government Operations Protocol by scope to provide a transparent outline of how Metropolitan plants to reduce its emissions over the next decade.

2. ***https://www.ipcc.ch/site/assets/uploads/2018/03/srccs_wholereport-1.pdf***

3. *ICLEI is an international non-governmental organization that promotes sustainable development. ICLEI provides technical consulting to local governments to meet sustainability objectives.*

TABLE 5-1: Scope, Strategy, and Measure Summary

| Scope | Emissions Source | Strategy |
|---|---|---|
| 1 | Stationary Combustion | Strategies 1, 3 |
| 1 | Mobile Combustion | Strategies 2, 3 |
| 1 | Fugitive Emissions | Strategy 9 |
| 2 | Purchased Electricity | Strategies 4, 5, 8 |
| 3 | Waste Generation | Strategy 7 |
| 3 | Employee Commute | Strategy 6 |
| 3 | Employee Business Travel | Strategies 6, 9 |

## IMPLEMENTATION PHASES AND GHG REDUCTION

The intent of the CAP is to achieve the 2030 GHG reduction target and demonstrate substantial progress toward the long-term State reduction goal of carbon neutrality by 2045. New opportunities are anticipated to emerge that could yield additional reductions beyond those identified in this CAP. Furthermore, it is recognized that climate action planning is an iterative process, and additional phases may be needed to continue and expand the actions in the CAP and to explore new opportunities to meet carbon neutrality. At this time, Metropolitan has developed two implementation phases for the GHG reduction measures considered in the CAP, Phase 1 and Phase 2.

Phase 1 measures are ready for implementation over the next ten years based on their cost, available technology, and certainty about future conditions. Phase 2 measures show promise, but need more research, new technologies, or different financial conditions before they can be implemented. While Metropolitan will work to stay under its carbon budget through 2030 and 2045 through implementation of the identified measures, the high degree of variability in annual emissions could require increased or adapted implementation of the measures outlined in this section.

As discussed in Section 4.0 Regulatory Context and Targets, Table 5-2 shows the carbon budget compared to Metropolitan's expected emissions between 2005 and 2030 under the low average and high emission scenarios. As seen in the table Metropolitan is expected to stay within the carbon budget in all of the emission forecasts. However due to the uncertainty of future demand potential climate impacts and the long term goal of carbon neutrality Metropolitan will implement the GHG reduction measures outlined in Sections 5.2 through 5.4. The modeled forecasts represent the likely best, worst, and average case for any particular year. The most likely scenario is an oscillation around the mean with some high emission years and some low emission years. However, the measures listed in Table 5-3 (see Section 5.3, Measure Quantification and Summary Table) allow Metropolitan to achieve its GHG reduction goal regardless of actual future conditions.

**TABLE 5-2: Carbon Budget and Projected Reduction Gap Through 2030**

| Scenario | Total Allowable Budget (2005–2030) | Estimated Metropolitan Emissions (2005–2030) | 2030 Gap* |
|---|---|---|---|
| **Low Emissions Scenario** | 12,577,075 | 6,171,139 | *(6,405,936)* |
| **Average Emissions Scenario** | 12,577,075 | 7,111,301 | *(5,465,774)* |
| **High Emissions Scenario** | 12,577,075 | 9,192,827 | (3,384,248) |

Additional GHG reductions will be needed to achieve carbon neutrality in 2045. While the strategies listed above provide a high-level pathway for Metropolitan to achieve carbon neutrality and the measures outlined in this CAP provide a framework to achieve that goal, utilization of new technologies and the implementation of existing and future state policies will ensure that Metropolitan will ultimately reach its goal.

Execution of the established strategies and implementation of the supporting measures are detailed in Section 6.0, Implementation and Monitoring. Following the implementation strategy outlined in Section 6.0 will be critical to meeting the GHG emissions reduction targets established by Metropolitan.

**The measures in Table 5-3 allow Metropolitan to achieve its GHG reduction goal regardless of actual future conditions.**


*Great Blue Heron forages for food, Yolo Bypass*

# 5.2 GHG REDUCTION MEASURES CO-BENEFIT SUMMARY

Reducing emissions and mitigating the potential impacts of climate change have a range of additional co-benefits that result in a positive impact or benefit to Metropolitan and its service area. For example, eliminating direct emissions would also reduce the amount of carbon monoxide and other pollutants released into the atmosphere, thereby incrementally improving regional air quality and community health. Likewise, as discussed in Section 5.6, Measure WC-2 will identify and expand on the current water reduction programs with the highest adoption rates and highest water reduction impacts. Expanding those programs will increase water conservation while also reducing GHG emissions. A co-benefit analysis has been conducted for each strategy and is outlined in the following section. Although there are myriad co-benefits related to reducing emissions, this analysis focuses on five primary co-benefits.

## COMMUNITY HEALTH

One of the primary co-benefits of reducing GHG emissions is directly improving community health. For example, replacing natural gas and propane-consuming equipment with electrically-powered equivalents, as outlined in Measure DC-2, would result in cleaner air because burning natural gas and propane results in the release of carbon monoxide, nitrogen dioxide, and particulate matter (PM).[4] According to a California Energy Commission study of public health and electrification would significantly reduce air pollutant emissions, resulting in improved air quality and a reduction in mortality rates from pollution.[5] The analysis specifically notes that the monetized health benefits for combined changes in $O_3$ and $PM_{2.5}$[6] from electrification would result in $108 billion per year in cost-savings

4. **https://www.epa.gov/indoor-air-quality-iaq/sources-combustion-products-introduction-indoor-air-quality**
5. **https://ww2.energy.ca.gov/2019publications/CEC-500-2019-049/CEC-500-2019-049.pdf**
6. *$PM_{2.5}$ stands for particulate matter below 2.5 micrometers or below (a unit of measurement). $PM_{2.5}$ is small particulates found in the air that can enter lungs and cause health issues.* **https://www.cdc.gov/air/particulate_matter.html**

by 2050 for California, including $56 billion in benefits for the South Coast Air Basin.[7] Similarly, electrifying the fleet (Strategy 2) would result in a reduction of gasoline and diesel fuel combustion, which similarly provides incremental benefits to air quality and human health.

## COST SAVINGS

Although implementation of the GHG emissions reduction measures generally requires an investment of either time or money, many measures have longer-term cost savings that are attributable to reduced utility and transportation costs or avoided waste. These cost savings co-benefits can range in timeframe and monetary returns, and do not account for the potentially significant economic benefits of avoiding impacts associated with climate change, such as increased drought and sea level rise. Examples of cost saving measures to be implemented by Metropolitan are the energy efficiency measures outlined in Strategy 5. These measures will result in long-term cost-savings from reducing the amount of energy required to operate.

Additionally, establishing a zero emission fleet, as outlined in Strategy 2, would be completed as vehicles are replaced at the end of their natural life. Replacing gasoline powered vehicles with electric vehicles may result in a higher up-front cost. However, recent studies including one by Massachusetts Institute of Technology found that, over the course of the vehicle's useful life, the cost savings associated with fuel savings and decreased maintenance costs result in lower lifecycle costs compared to both hybrid and internal combustion vehicles.[8] Maintenance costs on an electric car are much lower because they have fewer moving parts and fewer fluids to be replaced and are easier on brake systems. Furthermore, the study found that EV lifecycle costs are fairly insensitive to electricity costs and that even a doubling of electricity costs does not change the relative cost comparison between battery electric vehicles and internal combustion vehicles.[9]

7. *The South Coast Air Basin is one of several regional air basin areas designated by the State to manage air quality. The South Coast Air Basin covers an area of 6,745 square miles and encompasses much of Metropolitan's service area.*
8. ***https://www.carboncounter.com/***
9. ***https://pubs.acs.org/doi/suppl/10.1021/acs.est.6b00177/suppl_file/es6b00177_si_001.pdf***

## ECOSYSTEM HEALTH

It is estimated that plastics make up approximately 90 percent of the floating marine debris[10] and, based on a study of beach debris at sites along the Orange County coast, expanded polystyrene foam was the second most abundant form of beach debris.[11] Debris is released into the world's oceans at a rate of 13 million MT of plastic annually, which is equivalent to dumping one standard garbage truck of waste into the ocean every minute.[12] Globally, over 800 species are affected by marine debris, including fish, seabirds, sea turtles, and marine mammals, which can become entangled in or ingest plastic debris, causing suffocation, starvation, and drowning. As of 2018, it is estimated that half of sea turtles worldwide have ingested plastic and plastic waste kills up to a million seabirds a year. Integrating a plan to replace single-use plastics, polystyrene, and other non-biodegradable items with biodegradable or multi-use materials would thereby improve ecosystem health while helping to drive down Metropolitan's GHG emissions. The health of an ecosystem is directly correlated to the health of the humans living in it because humans ultimately depend upon ecosystem products and services (such as availability of fresh water, food, and air).[13] Measure WA-1, discussed in detail in Section 5.4, aims to implement procurement policies that eliminate the use of single-use plastics, polystyrene, and other non-biodegradable items at Metropolitan and reduce the waste stream to the surrounding ecosystems.

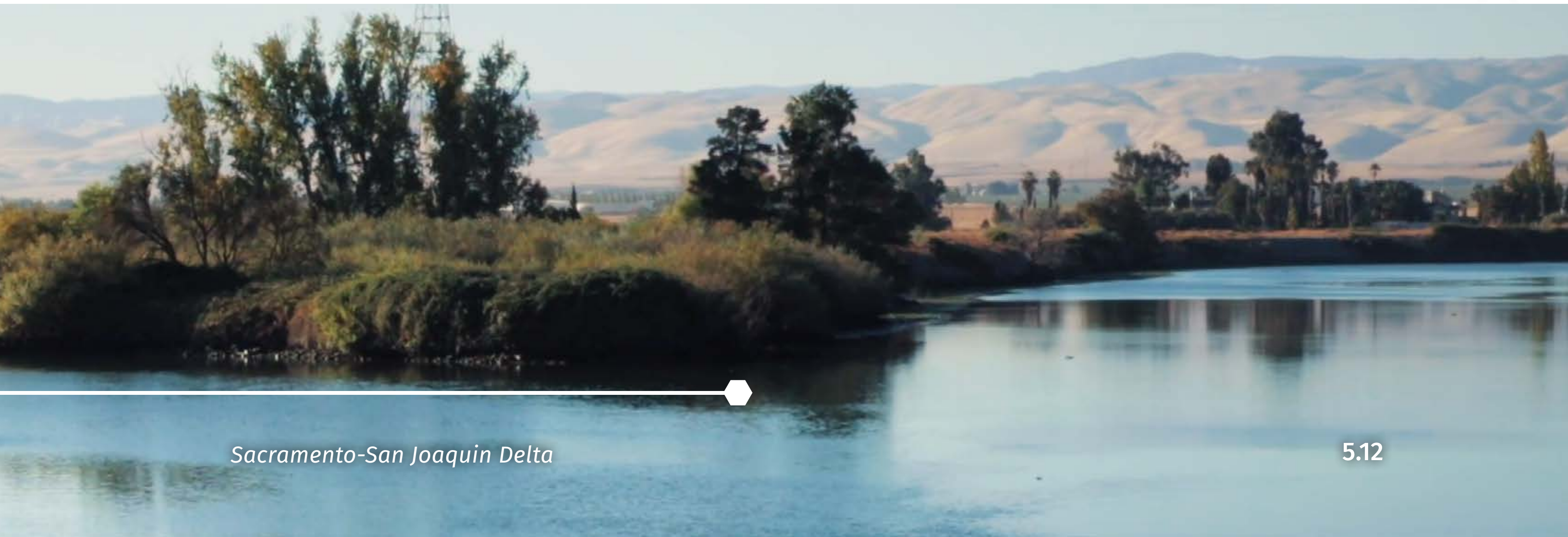
10. *United States Department of Commerce, National Oceanic and Atmospheric Administration, Office of Public and Constituent Affairs (1999). Turning to the Sea: America's Ocean Future; United Nations Environment Programme (1995). Global Programme of Action for the Protection of the Marine Environment from Land-based Activities. Note by the Secretariat. UNEP (OCA) /LBA/IG.2/7.*
11. *S. Moore et al. (2001). Composition and Distribution of Beach Debris in Orange County, California. Marine Pollution Bulletin 42.3: 241-245. Plastic pellets used to manufacture plastic products was the most abundant type of debris.*
12. ***https://www.pewtrusts.org/en/research-and-analysis/articles/2018/09/24/plastic-pollution-affects-sea-life-throughout-the-ocean***
13. ***https://www.who.int/globalchange/ecosystems/en/***

## OPERATIONAL RESILIENCE

Metropolitan's core mission is to provide adequate and reliable supplies of high-quality water to its service area in an environmentally and economically responsible way. Operation and maintenance of its infrastructure is essential to Metropolitan's core mission. Operational resilience requires preparation and planning to ensure functioning equipment, operational flexibility, and a robust water supply in spite of changing environmental conditions, including those related to climate change. Many of the CAP strategies and measures increase Metropolitan's operational resilience, adding benefits beyond GHG emissions reduction. Measure E-5, for example, includes the installation of 3.5 MW battery storage systems at treatment plants, which would ensure that these facilities would have on-site power for some period after a major catastrophic event, such as a large earthquake, if the electricity grid is impacted.

## WATER CONSERVATION

Retaining a diverse, robust, and sustainable water supply is at the heart of Metropolitan's mission and is woven into various strategies to reduce long-term emissions. As Metropolitan moves forward and faces more extreme impacts of climate change and population growth, water conservation will become even more essential. Water conservation combined with operational resilience results in water supply reliability and ultimately an ability to adapt to more frequent droughts and extreme weather events. This co-benefit is specifically demonstrated through the measures included in Strategy 8.



*Sacramento-San Joaquin Delta*

*Bald Eagle near the Colorado River Aqueduct*



# 5.3 MEASURE QUANTIFICATION AND SUMMARY TABLE

Table 5-3 summarizes the Phase 1 measures, the co-benefits associated with each measure, and the cumulative emissions reduction potential between 2020 and 2030.[14] In some instances, measures do not directly result in quantitative GHG emission reductions, although they support the overall goals of the CAP; these measures are considered "supportive." The Phase 1 measures have been developed to ensure Metropolitan can stay within its carbon budget even under the high emissions scenario. This approach allows Metropolitan the flexibility to respond to unforeseen circumstances yet stay within the established carbon budget. As mentioned previously, Phase 1 measures are expected to be implemented between 2020 and 2030. Before implementation, each measure will need to be approved by the Metropolitan Board of Directors.

Due to the high degree of uncertainty around Metropolitan's long-term emissions, GHG reduction measures were not quantified through 2045. Each measure is quantified based on the noted implementation timeline and the estimated cumulative emissions reductions through 2030. Cumulative savings provide an estimate on how the carbon budget will be impacted over time. However, based on Metropolitan's emission scenario, GHG savings may vary, and actual GHG emissions reductions will be tracked through the carbon budget and an annual GHG inventory as outlined in Section 6.0.

*14. The anticipated reductions by 2030 are shown because 2030 represents California's next major emissions reduction target year.*

**TABLE 5-3: Phase One Emission Reduction Measure Co-Benefit and Reduction Summary (Implement Between 2020 to 2030)**

| Phase | # | Measure | Co-Benefits | Cumulative Emissions Reduction 2020–2030 |
|---|---|---|---|---|
| **Scope 1: Direct Combustion** | | | | |
| **Strategy 1–Phase Out Natural Gas Combustion at Facilities** | | | | |
| 1 | DC-1 | Conduct a survey of all natural gas consuming devices in offices, control buildings, and residential structures and establish a schedule to replace natural gas equipment with electric by 2025. | • Operational Resilience | Supportive |
| 1-2 | DC-2 | Reduce natural gas emissions by 50 percent by 2030 and 100 percent by 2045 through electrification. | • Community Health<br>• Cost Savings<br>• Operational Resilience | 2,830 MT $CO_2e$ |
| 1 | DC-3 | Update Metropolitan building standards to require all-electric construction for new buildings and retrofits. | • Community Health<br>• Cost Savings<br>• Operational Resilience | Supportive |
| **Strategy 2–Zero Emission Vehicle Fleet** | | | | |
| 1 | FL-1 | Conduct a ZEV/EV Feasibility Study to determine which fleet vehicles can be converted, what chargers/fueling stations are required, and where they should be located by the end of 2022. | • Operational Resilience | Supportive |
| 1 | FL-2 | Adopt an ZEV/EV first policy for fleet vehicles to obtain ZEVs when technological, operational, or cost effectiveness parameters are met. | • Operational Resilience | Supportive |
| 1 | FL-3 | Replace fossil fuel passenger fleet vehicles as identified in the ZEV/EV Feasibility Study (FL-1). | • Community Health<br>• Cost Savings<br>• Operational Resilience | Supportive |
| 1 | FL-4 | Install EV charging and/or ZEV infrastructure at facilities pursuant to the findings of the ZEV/EV Feasibility Study (FL-1). | • Community Health<br>• Operational Resilience | Supportive |

**TABLE 5-3: Phase One Emission Reduction Measure Co-Benefit and Reduction Summary (Implement Between 2020 to 2030)** *(continued)*

| Phase | # | Measure | Co-Benefits | Cumulative Emissions Reduction 2020–2030 |
|---|---|---|---|---|
| **Strategy 3–Use Alternative Fuels to Bridge the Technology Gap to Zero Emission Vehicles and Equipment** | | | | |
| 1 | AF-1 | Complete a pilot project on the use of renewable diesel rather than conventional diesel for all stationary equipment by 2025. | • Community Health<br>• Cost Savings<br>• Operational Resilience | Supportive |
| 1 | AF-2 | Complete a pilot project of renewable diesel use in on-road and off-road vehicles by providing at least one renewable diesel tank at Metropolitan-owned fueling depots in 2021. | • Community Health<br>• Cost Savings<br>• Operational Resilience | Supportive |
| 1 | AF-3 | Based on the results of the study in AF-2, Metropolitan will begin using renewable diesel fuel in 100 percent of Metropolitan's diesel-consuming on-road and off-road vehicles by 2025. | • Community Health<br>• Cost Savings<br>• Operational Resilience | 998 MT $CO_2e$ |
| **Scope 2: Electricity** | | | | |
| **Strategy 4 – Utilize Low-Carbon and Carbon-Free Electricity** | | | | |
| 1 | E-1 | Analyze marginal emissions rates and evaluate the feasibility of shifting energy use to lower emission periods. | • Operational Resilience | Supportive |
| 1 | E-2 | Connect the Yorba Linda Hydroelectric Power Plant (YLHEP) behind Metropolitan's Southern California Edison (SCE) electricity meter to directly utilize carbon-free electricity at Metropolitan's Diemer facility by 2025. | • Community Health<br>• Cost Savings<br>• Operational Resilience | 6,301 MT $CO_2e$ |

**TABLE 5-3: Phase One Emission Reduction Measure Co-Benefit and Reduction Summary (Implement Between 2020 to 2030)** *(continued)*

| Phase | # | Measure | Co-Benefits | Cumulative Emissions Reduction 2020–2030 |
|---|---|---|---|---|
| 1 | E-3 | In markets where available, Metropolitan will switch its retail accounts to green tariff options offered by power providers by 2025 to reduce the Scope 2 GHG emissions associated with retail electricity use. | • Community Health<br>• Operational Resilience | 18,048 MT $CO_2e$ |
| 1 | E-4 | Install 3.5 MW battery storage systems at the Jensen, Skinner, and Weymouth treatment plants. Investigate the use of a software system to track and optimize GHG emissions reduction due to time-of-use strategies by 2025. | • Community Health<br>• Cost Savings<br>• Operational Resilience | 219 MT $CO_2e$ |
| 1 | E-5 | Manage Metropolitan's energy purchases to ensure cost-effective energy supply while achieving the required GHG emissions objective. | | 1,961,822 MT $CO_2e$<br><br>(high emissions scenario) |
| **Strategy 5 – Improve Energy Efficiency** | | | | |
| 1 | EE-1 | Convert all interior and exterior lighting at 50 percent of Metropolitan facilities to LED technologies by 2030 and 100 percent by 2045. | • Cost Savings<br>• Operational Resilience | 1,220 MT $CO_2e$ |
| 1 | EE-2 | Continue programs to analyze CRA pump efficiency and replace or refurbish pumps when cost effective. | • Cost Savings<br>• Operational Resilience | Supportive |

**TABLE 5-3: Phase One Emission Reduction Measure Co-Benefit and Reduction Summary (Implement Between 2020 to 2030)** *(continued)*

| Phase | # | Measure | Co-Benefits | Cumulative Emissions Reduction 2020–2030 |
|---|---|---|---|---|
| **Scope 3: Other Indirect Emissions** | | | | |
| **Strategy 6 – Incentivize More Sustainable Commutes** | | | | |
| 1 | EC-1 | Expand subsidized transit commute program to reduce employee commute miles. | • Community Health<br>• Operational Resilience | Supportive |
| 1 | EC-2 | Expand employee use of carbon-free and low carbon transportation by providing education programs on the benefits of commute options including public transportation, EV/ZEV options, and vanpools. | • Community Health<br>• Operational Resilience | Supportive |
| 1 | EC-3 | Install ZEV and/or EV infrastructure as directed by the ZEV/EV Feasibility Study to support at least a 15 percent transition of employee-owned vehicles to ZEVs/EVs by 2025. | • Community Health<br>• Operational Resilience | 3,427 MT $CO_2e$ |
| 1 | EC-4 | Continue to offer benefits to employees who use alternative modes of transportation (e.g. public transportation, bikes). | • Community Health<br>• Operational Resilience | Supportive |
| 1 | EC-5 | Allow 50 percent of employees located at Metropolitan's headquarters to telecommute or utilize flexible schedules through 2030 to reduce travel time, vehicle miles traveled (VMT), and GHG emissions. | • Community Health<br>• Cost Savings<br>• Operational Resilience | 3,345 MT $CO_2e$ |

**TABLE 5-3: Phase One Emission Reduction Measure Co-Benefit and Reduction Summary (Implement Between 2020 to 2030)** *(continued)*

| Phase | # | Measure | Co-Benefits | Cumulative Emissions Reduction 2020–2030 |
|---|---|---|---|---|
| **Strategy 7 – Increase Waste Diversion to Achieve Zero Waste** | | | | |
| 1 | WA-1 | Develop and implement net zero waste policies and programs at all facilities to reduce landfilled waste by 30 percent by 2030 and achieve zero landfilled waste by 2045. | • Community Health<br>• Ecosystem Health<br>• Operational Resilience | 4,517 MT $CO_2e$ |
| 1 | WA-2 | Implement a program to reduce organic waste at Metropolitan's Union Station building. Contract or team with local organizations and waste disposal companies to route organic waste to anaerobic digestion or composting facilities and edible food-to-food recovery centers. | • Ecosystem Health<br>• Operational Resilience | Supportive |
| 1 | WA-3 | Develop and implement a sustainable procurement policy. | • Community Health<br>• Ecosystem Health | Supportive |
| **Strategy 8 – Increase Water Conservation and Local Water Supply** | | | | |
| 1 | WC-1 | Expand programs that educate customers on water conservation initiatives through workshops and speaking engagements. | • Cost Savings<br>• Water Conservation | Supportive |
| 1 | WC-2 | Continue to implement innovative water use efficiency programs. | • Cost Savings<br>• Operational Resilience<br>• Water Conservation | Supportive |
| 1 | WC-3 | Continue Turf Removal Program to install an average of 1,500,000 square feet (sq. ft.) of water efficient landscapes per year through 2030 through the use of a rebate program. | • Operational Resilience<br>• Water Conservation | 968 MT $CO_2e$ |

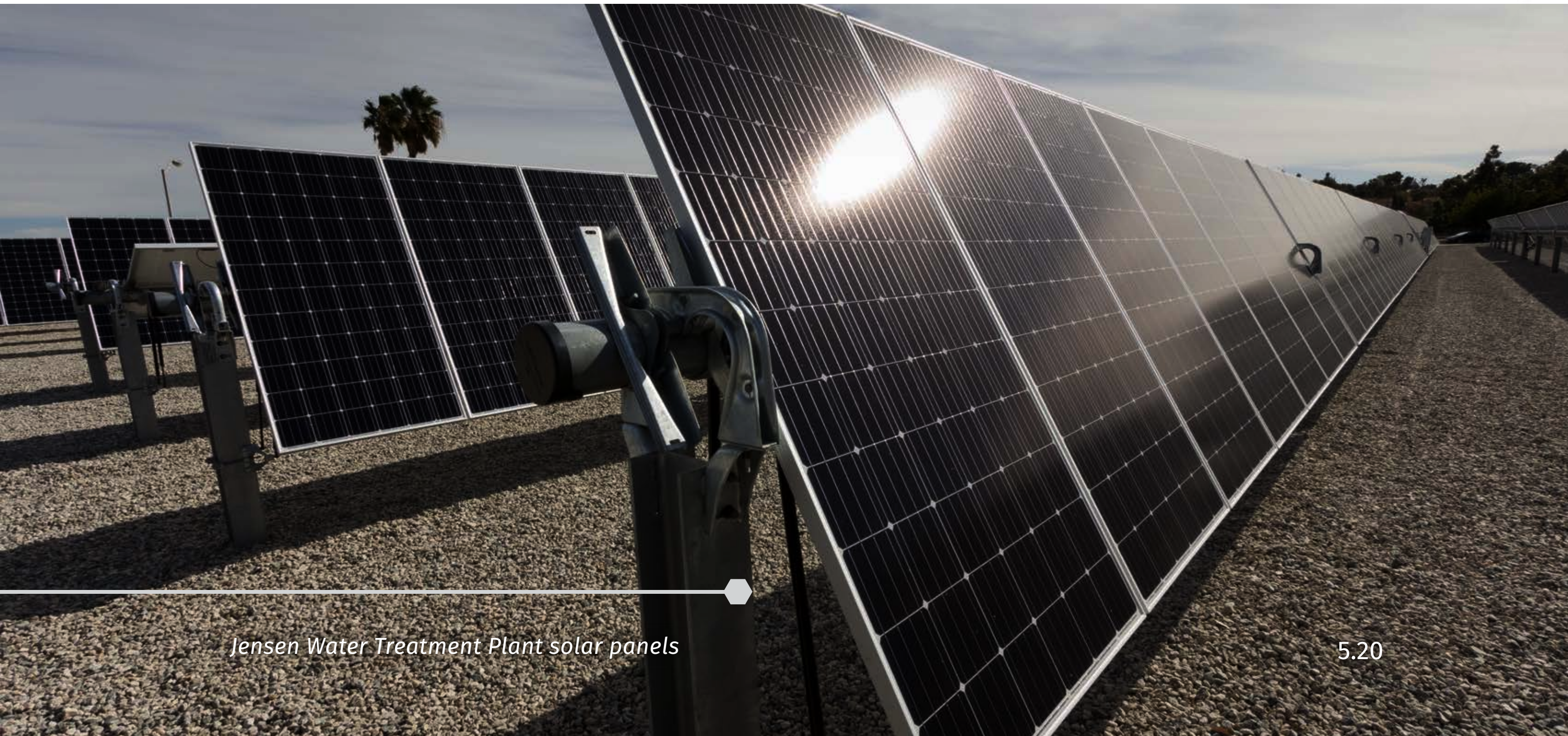
**TABLE 5-3: Phase One Emission Reduction Measure Co-Benefit and Reduction Summary (Implement Between 2020 to 2030)** *(continued)*

| Phase | # | Measure | Co-Benefits | Cumulative Emissions Reduction 2020–2030 |
|---|---|---|---|---|
| 1 | WC-4 | Provide funding for the development and monitoring of local stormwater recharge and use projects to evaluate the water supply benefit of stormwater. | • Ecosystem Health<br>• Operational Resilience<br>• Water Conservation | Supportive |
| 1 | WC-5 | Continue to promote water efficiency technologies and innovative practices that can be adopted into future water conservation program updates. | • Ecosystem Health<br>• Operational Resilience<br>• Water Conservation | Supportive |
| **Strategy 9 – Investigate and Implement Carbon Capture and Sequestration Opportunities** | | | | |
| 1 | CS-1 | Study carbon capture protocols in the Sacramento-San Joaquin River Delta. | • Community Health<br>• Cost Savings<br>• Ecosystem Health<br>• Operational Resilience | Supportive |
| 1 | CS-2 | Conduct a five-year research program to increase Metropolitan's knowledge of regenerative agriculture and carbon sequestration opportunities on Metropolitan properties in the Palo Verde Valley. | • Community Health<br>• Cost Savings<br>• Ecosystem Health<br>• Operational Resilience | Supportive |
| **Total Phase 1 Reduction Under High Emission Scenario** | | | | **2,003,695** |
| **Remaining Carbon Budget Under High Emission Scenario** | | | | **3,384,248** |
| **Remaining Carbon Budget After Measure Implementation** | | | | **5,387,943[15]** |

15. *Parentheses denotes a negative number. In this case, Metropolitan would have 5,387,943 MT $CO_2e$ remaining in its carbon budget through 2030 under the High Emissions Scenario. Metropolitan would have even larger remaining budgets under the Low and Average Emissions Scenarios.*

Using the Phase 1 measures identified in Table 5-3, Metropolitan can reduce the estimated 725,909 MT $CO_2e$ needed to offset the projected emissions under the high emissions scenario with budget remaining. The actual implementation schedule and the quantified GHG emissions over time will determine the actual emissions reductions necessary for Metropolitan to meet its GHG reduction goals. While purchasing carbon-free electricity from the wholesale market under Measure E-5 may increase costs, it provides Metropolitan the flexibility to ensure that it will meet its GHG reduction goals. However, other Phase 1 and 2 measures, which provide co-benefits such as cost savings, operational resiliency, and water conservation, will be implemented first.

In addition to the Phase I measures, Metropolitan has also identified a suite of Phase 2 measures that have high potential for reducing GHG emissions and providing significant co-benefits. These measures are included in Table 5-4. Phase 2 measures have been quantified by the expected average annual GHG reduction since the timeline for implementation is not yet known. The earlier these measures can be implemented the more reductions Metropolitan will realize. However, more information or the development of new technologies are required before the Phase 2 measures can be deployed. Phase 2 measures also have a longer-term implementation time frame between 2025 and 2045.



*Jensen Water Treatment Plant solar panels*

**TABLE 5-4: Phase Two Emission Reduction Measure Co-Benefit and Reduction Summary**

| Phase | # | Measure | Co-Benefits | Cumulative Emissions Reduction 2020–2030 |
|---|---|---|---|---|
| **Scope 2: Electricity** | | | | |
| **Strategy 4 – Utilize Low-Carbon and Carbon-Free Electricity** | | | | |
| 2 | EE-3 | Investigate feasibility of a large-scale (100 MW) battery storage system for the CRA. | • Operational Resilience | Supportive |
| **Strategy 5 – Improve Energy Efficiency** | | | | |
| 2 | EE-4a | Replace pump impellers at the Iron Mountain pumping plant if directed by findings of the pump assessment (Measure EE-2). | • Cost Savings<br>• Operational Resilience | Supportive |
| 2 | EE-4b | Replace pump impellers at Eagle Mountain or Hinds pumping plants if directed by findings of the pump assessment (Measure EE-2). | • Cost Savings<br>• Operational Resilience | Supportive |
| 2 | EE-4c | Refurbish motors at Iron Mountain if applicable based on the findings of the pump assessment (Measure EE-2). | • Cost Savings<br>• Operational Resilience | Supportive |
| 2 | EE-4d | Refurbish motors at Eagle Mountain or Hinds pumping plants if directed by findings of the pump assessment (Measure EE-2). | • Cost Savings<br>• Operational Resilience | Supportive |
| 2 | EE-5 | If the proposed RRWP is ultimately constructed, install an inter-stage pumping system on the reverse osmosis brine stream to reduce energy use. | • Cost Savings<br>• Operational Resilience | Supportive |

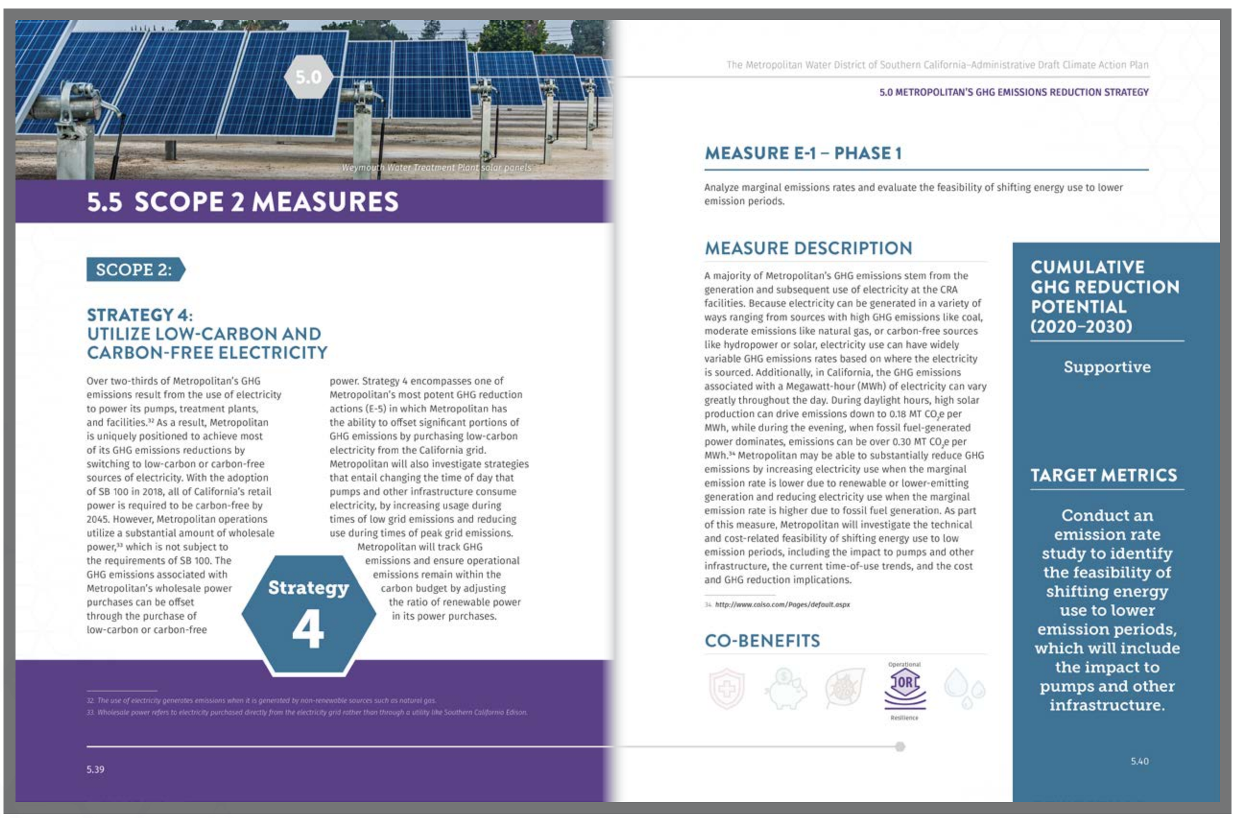
**TABLE 5-4: Phase Two Emission Reduction Measure Co-Benefit and Reduction Summary (continued)**

| Phase | # | Measure | Co-Benefits | Cumulative Emissions Reduction 2020–2030 |
|---|---|---|---|---|
| **Scope 3: Other Indirect Emissions** | | | | |
| **Strategy 6 – Incentivize More Sustainable Commutes** | | | | |
| 2 | EC-6 | Replace all Metropolitan vanpool vehicles with ZEVs. Start with a pilot study (Measure FL-1) to evaluate the best approach. | • Community Health<br>• Cost Savings<br>• Operational Resilience | Supportive |
| **Strategy 7 – Increase Waste Diversion to Achieve Zero Waste** | | | | |
| 2 | WA-4 | Partner with municipal agencies, like the City of Los Angeles, to create programs that will allow Metropolitan to provide its fair share of diversion and help local jurisdictions meet the goals of SB 1383 for organics diversion, including food waste and composting. | • Ecosystem Health<br>• Water Conservation | Supportive |
| **Strategy 8 – Increase Water Conservation and Local Water Supply** | | | | |
| 2 | WC-6 | Implement advanced technology systems to increase Metropolitan-owned recycled and groundwater recovery systems to maintain local water supply (e.g., proposed RRWP). | • Ecosystem Health<br>• Operational Resilience<br>• Water Conservation | Supportive |
| 2 | CS-3 | Establish baseline soil carbon quantities through science-based approaches then develop pilot projects to enhance carbon sequestration and implement larger scale carbon sequestration projects as deemed feasible. | • Community Health<br>• Cost Savings<br>• Ecosystem Health<br>• Operational Resilience | Supportive |

# HOW TO READ THE MEASURE SECTIONS

Sections 5.4 through 5.6 include robust details on each of the measures summarized by scope and strategy. Section 5.4 covers Scope 1 strategies and measures, Section 5.5 covers Scope 2 strategies and measures, and Section 5.6 covers Scope 3 strategies and measures.

Details on what is included in each page layout is provided on the following pages. Figures 5-1 and 5-2 provide a visual example of how to review and interpret the information found in these sections. Figure 5-1 shows a typical strategy and identifies the main components of a strategy summary page, while Figure 5-2 shows a specific measure that supports the execution of the strategy.


5.0

Weymouth Water Treatment Plant solar panels

5.5 SCOPE 2 MEASURES

SCOPE 2:

STRATEGY 4:
UTILIZE LOW-CARBON AND CARBON-FREE ELECTRICITY

Over two-thirds of Metropolitan's GHG emissions result from the use of electricity to power its pumps, treatment plants, and facilities.[32] As a result, Metropolitan is uniquely positioned to achieve most of its GHG emissions reductions by switching to low-carbon or carbon-free sources of electricity. With the adoption of SB 100 in 2018, all of California's retail power is required to be carbon-free by 2045. However, Metropolitan operations utilize a substantial amount of wholesale power,[33] which is not subject to the requirements of SB 100. The GHG emissions associated with Metropolitan's wholesale power purchases can be offset through the purchase of low-carbon or carbon-free power. Strategy 4 encompasses one of Metropolitan's most potent GHG reduction actions (E-5) in which Metropolitan has the ability to offset significant portions of GHG emissions by purchasing low-carbon electricity from the California grid. Metropolitan will also investigate strategies that entail changing the time of day that pumps and other infrastructure consume electricity, by increasing usage during times of low grid emissions and reducing use during times of peak grid emissions. Metropolitan will track GHG emissions and ensure operational emissions remain within the carbon budget by adjusting the ratio of renewable power in its power purchases.

Strategy 4

32. The use of electricity generates emissions when it is generated by non-renewable sources such as natural gas.
33. Wholesale power refers to electricity purchased directly from the electricity grid rather than through a utility like Southern California Edison.

5.39

The Metropolitan Water District of Southern California–Administrative Draft Climate Action Plan

5.0 METROPOLITAN'S GHG EMISSIONS REDUCTION STRATEGY

MEASURE E-1 – PHASE 1

Analyze marginal emissions rates and evaluate the feasibility of shifting energy use to lower emission periods.

MEASURE DESCRIPTION

A majority of Metropolitan's GHG emissions stem from the generation and subsequent use of electricity at the CRA facilities. Because electricity can be generated in a variety of ways ranging from sources with high GHG emissions like coal, moderate emissions like natural gas, or carbon-free sources like hydropower or solar, electricity use can have widely variable GHG emissions rates based on where the electricity is sourced. Additionally, in California, the GHG emissions associated with a Megawatt-hour (MWh) of electricity can vary greatly throughout the day. During daylight hours, high solar production can drive emissions down to 0.18 MT $CO_2e$ per MWh, while during the evening, when fossil fuel-generated power dominates, emissions can be over 0.30 MT $CO_2e$ per MWh.[34] Metropolitan may be able to substantially reduce GHG emissions by increasing electricity use when the marginal emission rate is lower due to renewable or lower-emitting generation and reducing electricity use when the marginal emission rate is higher due to fossil fuel generation. As part of this measure, Metropolitan will investigate the technical and cost-related feasibility of shifting energy use to low emission periods, including the impact to pumps and other infrastructure, the current time-of-use trends, and the cost and GHG reduction implications.

34. http://www.caiso.com/Pages/default.aspx

CO-BENEFITS

Operational Resilience

CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

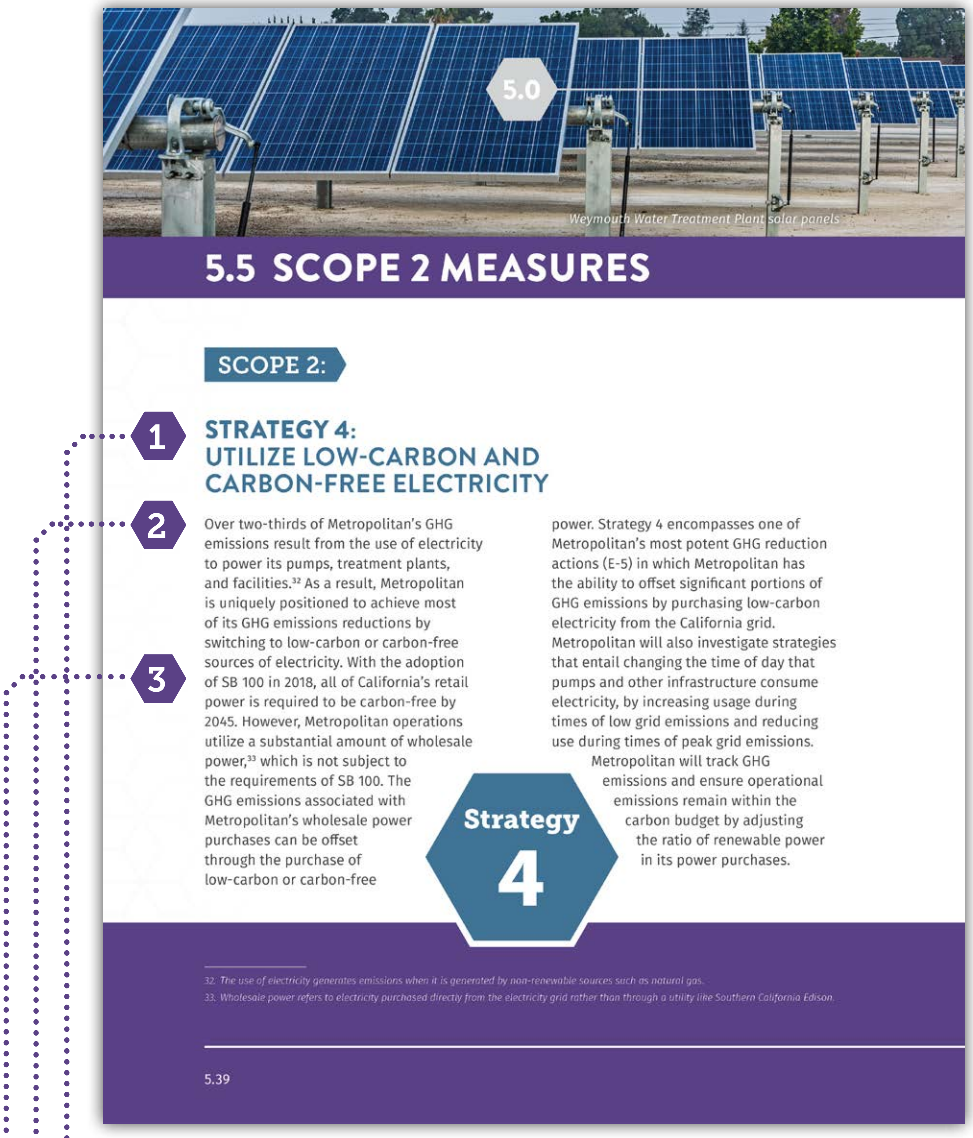
Supportive

TARGET METRICS

Conduct an emission rate study to identify the feasibility of shifting energy use to lower emission periods, which will include the impact to pumps and other infrastructure.

5.40

**FIGURE 5-1: How to Read Strategy Summary Layout Page**


5.0

*Weymouth Water Treatment Plant solar panels*

5.5 SCOPE 2 MEASURES

SCOPE 2:

STRATEGY 4:
UTILIZE LOW-CARBON AND CARBON-FREE ELECTRICITY

Over two-thirds of Metropolitan's GHG emissions result from the use of electricity to power its pumps, treatment plants, and facilities.[32] As a result, Metropolitan is uniquely positioned to achieve most of its GHG emissions reductions by switching to low-carbon or carbon-free sources of electricity. With the adoption of SB 100 in 2018, all of California's retail power is required to be carbon-free by 2045. However, Metropolitan operations utilize a substantial amount of wholesale power,[33] which is not subject to the requirements of SB 100. The GHG emissions associated with Metropolitan's wholesale power purchases can be offset through the purchase of low-carbon or carbon-free power. Strategy 4 encompasses one of Metropolitan's most potent GHG reduction actions (E-5) in which Metropolitan has the ability to offset significant portions of GHG emissions by purchasing low-carbon electricity from the California grid. Metropolitan will also investigate strategies that entail changing the time of day that pumps and other infrastructure consume electricity, by increasing usage during times of low grid emissions and reducing use during times of peak grid emissions. Metropolitan will track GHG emissions and ensure operational emissions remain within the carbon budget by adjusting the ratio of renewable power in its power purchases.

Strategy 4

32. The use of electricity generates emissions when it is generated by non-renewable sources such as natural gas.
33. Wholesale power refers to electricity purchased directly from the electricity grid rather than through a utility like Southern California Edison.

5.39



1. **Scope:** Categories (1–3) established by the Greenhouse Gas Protocol to better understand the source of emissions
2. **Strategy Number and Name:** Number and name of the specific high-level course of action complemented by the emission reduction measures (Figure 5-2)
3. **Strategy Description:** Detailed summary of the strategy and how it will contribute to Metropolitan's long-term goals

**FIGURE 5-2: How to Read Measure Summary Layout Page**


The Metropolitan Water District of Southern California–Administrative Draft Climate Action Plan

5.0 METROPOLITAN'S GHG EMISSIONS REDUCTION STRATEGY

## MEASURE E-1 – PHASE 1

Analyze marginal emissions rates and evaluate the feasibility of shifting energy use to lower emission periods.

### MEASURE DESCRIPTION

A majority of Metropolitan's GHG emissions stem from the generation and subsequent use of electricity at the CRA facilities. Because electricity can be generated in a variety of ways ranging from sources with high GHG emissions like coal, moderate emissions like natural gas, or carbon-free sources like hydropower or solar, electricity use can have widely variable GHG emissions rates based on where the electricity is sourced. Additionally, in California, the GHG emissions associated with a Megawatt-hour (MWh) of electricity can vary greatly throughout the day. During daylight hours, high solar production can drive emissions down to 0.18 MT $CO_2e$ per MWh, while during the evening, when fossil fuel-generated power dominates, emissions can be over 0.30 MT $CO_2e$ per MWh.[34] Metropolitan may be able to substantially reduce GHG emissions by increasing electricity use when the marginal emission rate is lower due to renewable or lower-emitting generation and reducing electricity use when the marginal emission rate is higher due to fossil fuel generation. As part of this measure, Metropolitan will investigate the technical and cost-related feasibility of shifting energy use to low emission periods, including the impact to pumps and other infrastructure, the current time-of-use trends, and the cost and GHG reduction implications.

34. http://www.caiso.com/Pages/default.aspx

### CO-BENEFITS



**CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)**

Supportive

**TARGET METRICS**

Conduct an emission rate study to identify the feasibility of shifting energy use to lower emission periods, which will include the impact to pumps and other infrastructure.

5.40



1. **Measure Name and Text:** Action established to reduce GHG emissions in Metropolitan's operations and service areas
2. **Annual GHG Reduction Potential:** Emissions reduced annually by implementation of the measure – supportive measures do not directly result in quantitative GHG emission reductions, although they support the overall goals of the CAP
3. **Measure Description:** Detailed explanation of why the measure is important, how it will be implemented, and general background information
4. **Target Metrics:** Specific goal of the reduction measure
5. **Co-benefits:** Additional benefits/advantages of a specific measure

*Jensen Water Treatment Plant*

# 5.4 SCOPE 1 MEASURES

**SCOPE 1:**

## STRATEGY 1: PHASE OUT NATURAL GAS COMBUSTION AT FACILITIES

California adopted SB 100 in 2018, making electrification an important strategy for reducing GHG emissions. SB 100 requires that all retail energy sold in California be 100 percent carbon-free by 2045; therefore, electrifying a fossil fuel source like a natural gas hot water heater means that piece of equipment will also be carbon-free by 2045. In addition to GHG reductions, removing natural gas from facilities would also improve indoor and local outdoor air quality by reducing atmospheric $PM_{2.5}$.[16]

16. **https://www.nrdc.org/experts/pierre-delforge/gas-appliances-pollute-indoor-and-outdoor-air-study-shows**

**Strategy**

**1**

## MEASURE DC-1 – PHASE 1

Conduct a survey of all natural gas consuming devices in offices, control buildings, and residential structures and establish a schedule to replace natural gas equipment with electric by 2025.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive Measure Description

## MEASURE DESCRIPTION

Completing a survey of all natural gas and propane-consuming equipment in Metropolitan-owned buildings is a critical first step to identifying cost-effective and efficient replacement options, developing a budget, and establishing a replacement schedule. The first step of this measure will include establishing an updated list of Metropolitan-owned facilities and creating a matrix, which outlines the various pieces of equipment and appliances (e.g., water heaters, HVAC, and stoves) at each facility. This matrix may include the facility name, types and number of pieces of equipment, location of equipment, estimated age, and potential cost to replace it. An added benefit of this measure will be an up-to-date inventory of equipment, their condition, and expected replacement schedule, thereby increasing operational resiliency.

## TARGET METRICS

Complete a natural gas equipment consumption survey.

## CO-BENEFITS

OR

Operational Resilience

# MEASURE DC-2 – PHASE 1

Reduce natural gas emissions by 50 percent by 2030 and 100 percent by 2045 through electrification.

## MEASURES DESCRIPTION

Upon completion of the survey and replacement schedule matrix (Measure DC-1), Metropolitan will begin replacing natural gas and propane-consuming equipment with electrically-powered equivalents in line with the established timeframes. As part of this measure, the original survey results should be updated and reviewed annually as equipment and appliances are replaced to provide a tracking mechanism. It is anticipated that most equipment would be replaced near the end of its useful life or in an order that replaces the oldest and most antiquated pieces of equipment first. Electrification of natural gas equipment will likely save money over time due to decreased operating costs even when upfront costs may be higher.[17]

17. *https://rmi.org/insight/the-economics-of-electrifying-buildings/*

## CO-BENEFITS


## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**2,830**

MT $CO_2e$

## TARGET METRICS

Replace all natural gas consuming equipment with electrically-powered equivalents and measure quantity in therms of natural gas reduced.

## MEASURE DC-3 – PHASE 1

Update Metropolitan building standards to require all-electric construction for new buildings and retrofits.

### CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

### TARGET METRICS

Adopt an operating policy that updates Metropolitan's building standards to require all-electric new construction and retrofits.

### MEASURE DESCRIPTION

Adopt an operating policy requiring new construction to be all-electric. Electrification ensures new buildings can achieve carbon neutrality once electricity is carbon-free. All-electric buildings are often less expensive to build and operate.[18] Switching to electricity also helps avoid potential natural gas cost increases, which are expected to greatly outpace electricity increases.[19] This measure also applies to building retrofits (upgrades and rehabilitation). While electric equipment for residential and commercial applications are readily available and cost-effective today, technologies for some industrial applications may either not be readily available or are cost prohibitive. Industrial applications will be electrified as cost effective technologies become available. An added benefit of all-electric building design and construction is that battery storage or generators can power the whole building in an emergency or outage.

18. ***https://explorer.localenergycodes.com/***
19. ***https://gridworks.org/initiatives/cagas-system-transition/***

### CO-BENEFITS

Community Health

Cost Savings

Operational Resilience

# SCOPE 1:

## STRATEGY 2: ZERO EMISSION VEHICLE FLEET

Transportation is the largest source of GHG emissions in California. While Metropolitan's vehicle fleet represents only two to three percent of Metropolitan's total annual emissions, electrifying the fleet is a key step towards achieving carbon neutrality.[20] Electric passenger vehicles are quickly reaching cost parity with internal combustion vehicles and can even provide cost savings over the lifetime of the vehicle.[21] While heavy duty electric vehicles are not currently available for all commercial requirements, new technology that will advance heavy duty vehicle choices will become available in the near future.[22] Furthermore, the advancement of ZEVs, such as EVs, adoption will be driven at the State level in part by EO N-79-20, which directs CARB to develop regulations to achieve 100 percent zero-emission car sales in California by 2035 and zero-emission medium- or heavy-duty vehicles by 2045. Currently, the most promising ZEVs are electric. However, Metropolitan will continue to consider new technologies as they become available and will consider other alternative ZEVs in the future, if feasible. At this phase, beginning to prepare for an emission-free future will ensure Metropolitan can continue to operate without disruption and leverage grants and financing for EV/ZEV infrastructure while they are available.

20. *Fleet refers to the vehicles that are owned and operated by Metropolitan including all passenger vehicles, work trucks, and other mobile equipment.*

21. ***https://rosap.ntl.bts.gov/view/dot/31875/dot_31875_DS1.pdf***

22. ***https://www.atlasevhub.com/resource/race-to-zero-how-manufacturers-are-positioned-for-zero-emission-commercial-trucks-and-buses-in-north-america/***


*Metropolitan's vehicle fleet*

## MEASURE FL-1 – PHASE 1

Conduct a ZEV/EV Feasibility Study to determine which fleet vehicles can be converted, what chargers/fueling stations are required, and where they should be located by the end of 2022.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Complete a ZEV/EV Feasibility Study on fleet vehicles.

## MEASURE DESCRIPTION

Completing a ZEV/EV Feasibility Study will provide Metropolitan with a clear understanding of the existing fleet and establish a path forward to replace fossil fuel-powered vehicles with ZEVs/EVs. In analyzing the existing fleet, the uses of the various fleet vehicles will be considered in order to establish an efficient replacement vehicle schedule and budget. A large component of this study will review and address where new ZEV/EV infrastructure may be required and establish an outline of where it should be installed. The assessment will include all of Metropolitan's facilities and will provide detailed recommendations on vehicle replacement, charging infrastructure, and scheduling. In addition to fleet vehicles, the study will also investigate needs and opportunities relating to vanpool vehicles and employee owned vehicles. This measure will be used as a blueprint for transitioning Metropolitan's fleet to zero emissions.

## CO-BENEFITS

Operational Resilience

# MEASURE FL-2 – PHASE 1

Adopt an ZEV/EV first policy for fleet vehicles to obtain ZEVs when technological, operational, or cost effectiveness parameters are met.

## MEASURE DESCRIPTION

Based on the results of the analysis completed as part of Measure FL-1, Metropolitan will adopt an ZEV/EV first policy for fleet vehicles when vehicles are purchased unless technological, operational, or cost effectiveness issues are identified. The policy will establish a framework for Metropolitan to purchase ZEVs/EVs or the cleanest available bridge technology per South Coast Air Quality Management District (SCAQMD) Rule 1196 for Clean On-Road Heavy-Duty Public Fleet Vehicles and CARB public fleet rules. It is anticipated that new technology will be developed to establish a pathway forward for medium- or heavy-duty vehicles to become powered by electricity or other alternative fuels as time progresses. Switching to EVs may decrease maintenance costs, result in less downtime for vehicle repairs, decrease emissions, and improve air quality.[23] Cost savings from the decreased operations and maintenance of ZEVs/EVs can then be used to offset vehicle purchase costs for future ZEV/EV purchases. In the event that ZEVs/EVs are not available (due to technological constraints or cost effectiveness), fuel efficiency should be prioritized to help decrease overall fossil fuel consumption as described in Measure AF-2.

23. ***https://www.government-fleet.com/327215/nyc-compares-maintenance-costs-for-ev-and-gasoline-vehicles***

## CO-BENEFITS

Operational Resilience

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Adopt an ZEV/EV first policy for fleet vehicles.

# MEASURE FL-3 – PHASE 1

Replace fossil fuel passenger fleet vehicles as identified in the ZEV/EV Feasibility Study (FL-1).

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## MEASURE DESCRIPTION

Metropolitan will replace its fossil fuel-powered passenger vehicles with ZEV/EVs at the time of vehicle replacement with a goal of replacing its fossil-fuel fleet with a ZEV/EV passenger fleet, as feasible. While the ZEV/EV Feasibility Study will include all ZEV types, EVs currently appear to be the leading technology. While the upfront price of passenger EVs is continuing to drop, they may still be more expensive than purchasing traditional passenger vehicles. However, when the total lifetime cost of the passenger EVs (which includes vehicle acquisition costs, maintenance, fuel and electricity, ZEV incentives, reduced tolls for EVs or low-emission vehicles on freeways, and insurance) is compared, passenger EVs can result in a significant cost savings on fuel and maintenance, all of which often make up the difference in initial cost.[24] As the state transitions to carbon-free electricity, the benefits of transitioning to EVs become even greater. Even without carbon-free electricity, passenger EVs result in far fewer GHG emissions, improved air quality, energy security, and increased fuel economy. It is anticipated that each of the fossil fuel-powered passenger vehicles that are currently in Metropolitan's fleet would be replaced at the end of their useful life with an ZEV/EV, as feasible.

24. ***https://www.geotab.com/white-paper/going-electric/***

## TARGET METRICS

Number of passenger ZEVs purchased.

## CO-BENEFITS

Community Health

Cost Savings

Operational Resilience

# MEASURE FL-4 – PHASE 1

Install EV charging and/or ZEV infrastructure at facilities pursuant to the findings of the ZEV/EV Feasibility Study (FL-1).

## MEASURE DESCRIPTION

A core component of establishing a network of EVs/ZEVs is creating a robust charging/refueling infrastructure network that is available, accessible, and reliable. One of the greatest hurdles with EV/ZEV adoption is a lack of available infrastructure.[25] While all ZEV options will be included in the feasibility study, EVs currently appear to be the leading technology. Expanding EV charger availability will be an essential aspect of creating a reliable EV fleet. The analysis completed as part of Measure FL-1 will outline which facilities would benefit from installing EV infrastructure and at what scale. Installation of EV charging stations would include chargers, grid equipment, software, and communication networks. EV charging stations will be used by Metropolitan's fleet, employees, and visitors to Metropolitan facilities. EV chargers will likely be needed at Metropolitan offices like Union Station Headquarters, the five treatment plants, pumping stations, and Metropolitan-owned housing and other facilities.

25. *https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/charging-ahead-electric-vehicle-infrastructure-demand*

## CO-BENEFITS

Community Health

Operational Resilience

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Install ZEV/EV charging infrastructure detailed in the ZEV/EV Feasibility Study.

SCOPE 1:

## STRATEGY 3: USE ALTERNATIVE FUELS TO BRIDGE THE TECHNOLOGY GAP TO ZERO EMISSION VEHICLES AND EQUIPMENT

Because of the limited availability of electric medium- and heavy-duty vehicles, the use of alternative fuels like renewable diesel or biogas can serve as a temporary solution to help reduce GHG emissions in the near-term. Although there are opportunities for near-term advances in this area, care will be taken to assure that the measures included in this CAP work towards carbon neutrality without promoting build-out of significant infrastructure for transition fuels that will leave stranded assets. Instead, the measures focus on long-term decarbonization of the fleet as technology becomes available.

Strategy 3

# MEASURE AF-1 – PHASE 1

Complete a pilot project on the use of renewable diesel rather than conventional diesel for all stationary equipment by 2025.

## MEASURE DESCRIPTION

Metropolitan operates a variety of stationary equipment currently powered by diesel fuel. Replacing the existing diesel fuel with renewable diesel as a short-term measure would reduce emissions with no change in existing infrastructure. Renewable diesel can be used interchangeably in a traditional diesel-powered engine and does not result in any negative operational impacts.[26] According to a study completed by the United States Department of Energy, renewable diesel is also currently cost-competitive with traditional petroleum diesel and sometimes less expensive than conventional petroleum-based diesel in California.[27] In addition, a 2015 study by the California Environmental Protection Agency concluded that renewable diesel has approximately 30 percent less PM emissions, five percent less total hydrocarbon emissions, and 10 percent less $NO_x$ emissions than conventional diesel.[28] Currently, renewable diesel is utilized at a large scale by the United States military and is also used by a variety of city, state, and private fleets.[29] Replacing petroleum diesel with renewable diesel in stationary combustion sources would reduce up to 760 MT $CO_2e$ per year based on the 2017 GHG inventory.

26. *https://www.government-fleet.com/156621/what-you-need-to-know-about-renewable-diesel*
27. *https://afdc.energy.gov/files/u/publication/alternative_fuel_price_report_july_2020.pdf*
28. *https://ww2.arb.ca.gov/sites/default/files/2018-08/Renewable_Diesel_Multimedia_Evaluation_5-21-15.pdf*
29. *https://www.caranddriver.com/research/a31883731/biodiesel-vs-diesel/*

## CO-BENEFITS

Community Health

Cost Savings

Operational Resilience

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Complete pilot project on the use of renewable diesel in stationary diesel equipment.

## MEASURE AF-2 – PHASE 1

Complete a pilot project of renewable diesel use in on-road and off-road vehicles by providing at least one renewable diesel tank at Metropolitan-owned fueling depots in 2021.

### CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

### TARGET METRICS

Install one renewable diesel tank at a Metropolitan-owned fuel depot and complete pilot project.

### MEASURE DESCRIPTION

Metropolitan vehicles generally fuel at Metropolitan-owned fueling depots. By contracting with fuel suppliers to replace petroleum diesel with renewable diesel at these facilities, Metropolitan can reduce GHG emissions and easily track the amount of low carbon fuels being utilized in the fleet. In California, renewable diesel fuel costs mirror the cost of petroleum-based diesel fuel.[30] This measure will be implemented through new contracts for renewable fuels and a change in Metropolitan's policy to use only renewable diesel fuel following the results of the pilot project.

30. *https://www.government-fleet.com/348069/is-renewable-diesel-still-a-miracle-fuel*

### CO-BENEFITS

Community Health

Cost Savings

Operational Resilience

# MEASURE AF-3 – PHASE 1

Based on the results of the study in AF-2, Metropolitan will begin using renewable diesel fuel in 100 percent of Metropolitan's diesel-consuming on-road and off-road vehicles by 2025.

## MEASURE DESCRIPTION

Implementation of this measure is in addition to Measure AF-1, which covers stationary equipment. Similar to stationary equipment, diesel-powered on-road equipment could utilize renewable diesel fuel, which is a domestically-produced, clean-burning, renewable substitute for petroleum diesel fuel, without any modifications to the internal combustion engines. Because the $CO_2$ emissions associated with renewable diesel fuels are biogenic, those emissions do not contribute to climate change.[31] Only the $N_2O$ and $CH_4$ emissions increase net GHG emissions in the atmosphere, leading to a significantly lower GHG emission factor for those fuels. The use of these fuels is considered a bridge to reduce emissions in the short term before electric technologies are available for heavy duty and medium duty on-road vehicles. As stated in Measure AF-1, renewable diesel fuel also burns cleaner, resulting in lower air quality emissions. This measure will be implemented by updating contracts with fuel suppliers for renewable diesel fuel and tracking the total volume of diesel fuel consumed.

31. *https://climatechange.ucdavis.edu/climate-change-definitions/biogenic-carbon/*

## CO-BENEFITS

Community Health

Cost Savings

Operational Resilience

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**998**

MT $CO_2e$

## TARGET METRICS

Gallons of Petroleum Diesel Fuel replaced with Renewable Diesel Fuel.


Weymouth Water Treatment Plant solar panels

# 5.5 SCOPE 2 MEASURES

## SCOPE 2:

## STRATEGY 4: UTILIZE LOW-CARBON AND CARBON-FREE ELECTRICITY

Over two-thirds of Metropolitan's GHG emissions result from the use of electricity to power its pumps, treatment plants, and facilities.[32] As a result, Metropolitan is uniquely positioned to achieve most of its GHG emissions reductions by switching to low-carbon or carbon-free sources of electricity. With the adoption of SB 100 in 2018, all of California's retail power is required to be carbon-free by 2045. However, Metropolitan operations utilize a substantial amount of wholesale power,[33] which is not subject to the requirements of SB 100. The GHG emissions associated with Metropolitan's wholesale power purchases can be offset through the purchase of low-carbon or carbon-free power. Strategy 4 encompasses one of Metropolitan's most potent GHG reduction actions (E-5) in which Metropolitan has the ability to offset significant portions of GHG emissions by purchasing low-carbon electricity from the California grid. Metropolitan will also investigate strategies that entail changing the time of day that pumps and other infrastructure consume electricity, by increasing usage during times of low grid emissions and reducing use during times of peak grid emissions.

Strategy 4

Metropolitan will track GHG emissions and ensure operational emissions remain within the carbon budget by adjusting the ratio of renewable power in its power purchases.

32. The use of electricity generates emissions when it is generated by non-renewable sources such as natural gas.

33. Wholesale power refers to electricity purchased directly from the electricity grid rather than through a utility like Southern California Edison.

# MEASURE E-1 – PHASE 1

Analyze marginal emissions rates and evaluate the feasibility of shifting energy use to lower emission periods.

## MEASURE DESCRIPTION

A majority of Metropolitan's GHG emissions stem from the generation and subsequent use of electricity at the CRA facilities. Because electricity can be generated in a variety of ways ranging from sources with high GHG emissions like coal, moderate emissions like natural gas, or carbon-free sources like hydropower or solar, electricity use can have widely variable GHG emissions rates based on where the electricity is sourced. Additionally, in California, the GHG emissions associated with a Megawatt-hour (MWh) of electricity can vary greatly throughout the day. During daylight hours, high solar production can drive emissions down to 0.18 MT $CO_2e$ per MWh, while during the evening, when fossil fuel-generated power dominates, emissions can be over 0.30 MT $CO_2e$ per MWh.[34] Metropolitan may be able to substantially reduce GHG emissions by increasing electricity use when the marginal emission rate is lower due to renewable or lower-emitting generation and reducing electricity use when the marginal emission rate is higher due to fossil fuel generation. As part of this measure, Metropolitan will investigate the technical and cost-related feasibility of shifting energy use to low emission periods, including the impact to pumps and other infrastructure, the current time-of-use trends, and the cost and GHG reduction implications.

34. ***http://www.caiso.com/Pages/default.aspx***

## CO-BENEFITS


## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Conduct an emission rate study to identify the feasibility of shifting energy use to lower emission periods, which will include the impact to pumps and other infrastructure.

# MEASURE E-2 – PHASE 1

Connect the Yorba Linda Hydroelectric Power Plant (YLHEP) behind Metropolitan's Southern California Edison (SCE) electricity meter to directly utilize carbon-free electricity at Metropolitan's Diemer facility by 2025.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**6,301**

MT $CO_2e$

## TARGET METRICS

Connect YLHEP lines behind the SCE meter to utilize carbon-free electricity at the Diemer Plant.

## MEASURE DESCRIPTION

The YLHEP currently generates carbon-free electricity by harnessing the power of water as it flows through turbines on its way to the Robert B. Diemer Water Treatment Plant (Diemer Plant). This electricity is currently sold by Metropolitan to the wholesale market and released to the state's electricity grid. In its existing configuration, the Diemer Plant uses retail electricity that has a GHG emission factor greater than zero. By reconfiguring the YLHEP power source behind the meter, the electricity it generates would become directly available to the Diemer Plant, offsetting the need for retail power. This reconfiguration would allow Metropolitan to power the Diemer Plant with carbon-free electricity and generate cost savings for Metropolitan by eliminating external electricity purchases. Excess electricity generated at the YLHEP not utilized by the Diemer Plant would continue to be sold by Metropolitan to SCE.

## CO-BENEFITS

Community Health

Cost Savings

Operational Resilience

# MEASURE E-3 – PHASE 1

In markets where available, Metropolitan will switch its retail accounts to green tariff options offered by power providers by 2025 to reduce the Scope 2 GHG emissions associated with retail electricity use.

## MEASURE DESCRIPTION

Metropolitan can reduce its retail electricity emissions by purchasing low-carbon electricity through green tariff options and potentially reduce the cost of electricity simultaneously. Most retail providers offer a portfolio of green energy options, each with a guaranteed percentage of green energy. The price per kilowatt-hour (kWh) varies depending on the mix of energy. For example, a provider in Los Angeles County currently has three options for both commercial and residential customers:

- 36 percent renewable energy content
- 50 percent renewable energy content
- 100 percent renewable energy content

By implementing this measure, Metropolitan will switch to a mix that offers a middle-of-the-road renewable and carbon -free energy mix. Additional reductions could be achieved by switching to a ”greener” option, like a 100 percent renewable electricity program.

## CO-BENEFITS

Community Health

Operational Resilience

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**18,048**

MT $CO_2e$

## TARGET METRICS

Percent of retail electricity purchased as no or low-carbon.

## MEASURE E-4 – PHASE 1

Install 3.5 MW battery storage systems at the Jensen, Skinner, and Weymouth treatment plants. Investigate the use of a software system to track and optimize GHG emissions reduction due to time-of-use strategies by 2025.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**219**

MT $CO_2e$

## MEASURE DESCRIPTION

Although utilizing renewable energy is an excellent option to reduce Scope 2 GHG emissions, many renewable sources are limited to the time of day when there is sun or wind. Therefore, energy storage systems are an essential component to store energy produced during peak renewable power generation periods in order to power systems during periods when renewable power is not produced. By storing renewable energy, Metropolitan will reduce GHG emissions by charging the battery system during periods of low grid emissions and discharging them during periods of high emission electricity. Battery storage systems will also add increased operational resilience by allowing facilities to operate for short periods of time without power from the grid. The batteries can also be used to conduct rate arbitrage by charging during times when electricity is cheapest and offsetting the peak (most expensive) power periods through use of stored energy.

## TARGET METRICS

MW of energy storage installed.

## CO-BENEFITS

Community Health

Cost Savings

Operational Resilience

# MEASURE E-5 – PHASE 1

Manage Metropolitan's energy purchases to ensure cost-effective energy supply while achieving the required GHG emissions objective.

## MEASURE DESCRIPTION

The single largest source of GHG emissions associated with Metropolitan's operations relates to electricity consumption. Most of Metropolitan's Scope 2 GHG emissions are tied to the consumption of electricity needed for pumping water along the CRA, which is directly tied to water demands. Metropolitan's water demands are met through its imported water supplies, which vary year-to-year. When Metropolitan is required to meet these demands through increased pumping on the CRA, higher GHG emissions may result. Electricity used to power the pumps along the CRA comes from three distinct sources: Hoover and Parker Dam hydroelectric power, which has an emission factor of zero, energy purchased from the California Independent System Operator (CAISO's) centralized markets, which had an emission factor of approximately 0.239 MT $CO_2e$ per MWh in 2017, and out-of-state electricity, which is delivered through the Arizona, southern Nevada, New Mexico (AZNM) regional grid, which receives power from multiple states outside California and had an emission factor of 0.480 MT $CO_2e$ in 2017.[35] Metropolitan relies on zero-emission large hydro pumping from Hoover and Parker Dams during low pumping periods. The amount of additional electricity purchased from each source during high pumping years varies year-to-year depending on multiple factors. In general, power purchased from the CAISO or AZNM regional grid makes up a higher percentage of Metropolitan's electricity in high pumping years and adds to the higher GHG emissions in those years.

This measure would change electricity procurement policies to reduce reliance on AZNM electricity and increase the use of energy from the CAISO grid or specific lower GHG emission generating resources. Not only will this action reduce a significant amount of GHG emissions in the short term, but emissions will also likely continue to decrease over time due to SB 100. Energy sales in both markets will also likely continue to transition to carbon-free sources, further reducing GHG emissions. However, it is difficult to predict the future market energy mix or the cost of lower emission energy. Since the emissions reduction associated with this measure will change depending on the actual amount of electricity purchased and the source of purchased energy, Metropolitan will meet any shortfall in its carbon budget through

35. https://www.epa.gov/sites/production/files/2020-01/documents/egrid2018_summary_tables.pdf

low or no carbon energy purchases and other measures that most cost-effectively achieve the carbon budget objective. The GHG emission reductions below show the potential reduction associated with purchasing CAISO electricity instead of AZNM electricity from 2021 through 2030.

## CO-BENEFITS

## ESTIMATED CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)[36]

**High Emissions Scenario**

**1,961,822** MT $CO_2e$

**Average Emissions Scenario**

**610,245** MT $CO_2e$

**Low Emissions Scenario**

**258,371** MT $CO_2e$

## TARGET METRICS

GHG emissions reductions realized to meet the GHG target.

*36. Assumes current CAISO emission factor compared to current and forecasted AZNM emission factor.*

# MEASURE EE-3 – PHASE 2

Investigate feasibility of a large-scale (100 MW) battery storage system for the CRA.

## MEASURE DESCRIPTION

Metropolitan will complete a feasibility study to analyze the feasibility of large-scale battery storage for the CRA. As renewable electricity becomes more available, establishing a mechanism to store the energy for times when renewable power may not be available will become essential. This will increase resilience in the water conveyance system in the event of a power outage or during an emergency scenario. The system would also be available to use for rate and GHG emissions arbitrage, allowing Metropolitan to reduce GHG emissions and potentially save money over time. The true costs and savings associated with a storage system of this size would be further defined by the feasibility study. The GHG emissions reduction potential for a 100 MW battery storage array is estimated at 20,000 MT $CO_2e$ annually, on average. However, this measure is supportive because more data is needed before a project of this magnitude is implemented.

## CO-BENEFITS

Operational Resilience

## AVERAGE ANNUAL GHG REDUCTION POTENTIAL

Supportive

## TARGET METRICS

Complete a feasibility study of large-scale battery storage system for the CRA.

SCOPE 2:

## STRATEGY 5: IMPROVE ENERGY EFFICIENCY

In addition to reducing the Scope 2 carbon intensity of electricity usage, Metropolitan can reduce GHG emissions associated with electricity use by reducing demand through improvements in energy efficiency. Metropolitan's major electrical demand is associated with the pumping of water, and these pumps are already maintained to a high degree of energy efficiency. However, due to their size and amount of electricity used, even marginal improvements in pump efficiency can lead to substantial cost savings and GHG emissions reductions. Additional opportunities include more efficient lighting systems and more energy-efficient buildings (predominantly covered under Strategy 1). Improvements in electrical efficiency will reduce the total demand for electricity from Metropolitan systems, saving money and reducing GHG emissions over the long term.

Strategy 5

# MEASURE EE-1 – PHASE 1

Convert all interior and exterior lighting at 50 percent of Metropolitan facilities to light emitting diode (LED) technologies by 2030 and 100 percent by 2045.

## MEASURE DESCRIPTION

Metropolitan's facilities include extensive lighting systems. According to the United States Department of Energy, ENERGY STAR-qualified LEDs use only 20 to 25 percent of the energy and last 15 to 25 times longer than the traditional incandescent bulbs they replace. Likewise, LEDs use 25 to 30 percent of the energy and last eight to 25 times longer than halogen incandescent bulbs. Studies show that LEDs not only reduce energy consumption, but they also provide cost savings over traditional bulbs.[37] Implementation of this measure is estimated to save Metropolitan an estimated 1,700 MWh per year by 2030 and 3,400 MWh per year by 2045.

37. *https://www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/led-lighting*

## CO-BENEFITS


## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**1,220**

MT $CO_2e$

## TARGET METRICS

Convert

**50%**

of facilities to LED by 2030 and 100% facilities by 2045.

# MEASURE EE-2 – PHASE 1

Continue programs to analyze CRA pump efficiency and replace or refurbish pumps when cost effective.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## MEASURE DESCRIPTION

To ensure the CRA pumps operate at maximum efficiency, Metropolitan is currently implementing a review of the CRA pumping facilities for operational dependability and efficiency. Based on the results of these studies, pumps will be refurbished or replaced as needed to ensure cost effectiveness and operational resilience. Metropolitan has five pumping plants along the CRA in the California Mojave Desert that transport water 242 miles to its terminus at Lake Mathews.[38] Each pumping plant has nine pumps with a total lift of 1,617 feet. Ensuring that these units are operating at the highest efficiency level will maximize cost savings and enhance operational resilience.

38. *http://www.mwdh2o.com/AboutYourWater/Storage-And-Delivery/Pumping-Plants#:~:text=These%20pumping%20plants%20move%20water,225%20cubic%20feet%20per%20second*.

## TARGET METRICS

Complete the CRA pump efficiency study, and replace/refurbish pumps, as needed.

## CO-BENEFITS

Cost Savings

Operational Resilience

# MEASURE EE-4A-D – PHASE 2

Implement findings of the CRA pump assessment (from Measure EE-2) to either refurbish or replace pumps at Eagle Mountain, Iron Mountain or Hinds pumping plants.

## MEASURE DESCRIPTION

Based on the findings of the pump plant assessment, Metropolitan will refurbish or replace some or all of the pumps at Eagle Mountain, Iron Mountain, and Hinds Pumping Plants. The actual efficiency gain for refurbishment/replacement of these pumps will be identified by the pump assessment. However, for this analysis, an efficiency gain of two percent was assumed for replacements and 0.5 percent for repairs based on feedback from Metropolitan engineers and industry standards. Even with these marginal efficiency improvements, Metropolitan could substantially reduce GHG emissions over time. However, because the actual efficiency gain will be based on the pump assessment and the implementation would not occur until Phase 2 of the CAP, emission reduction estimates for this measure are not yet considered quantifiable and are not quantified in this report.

- **EE-4a** – Replace impellers at Iron Mountain
- **EE-4b** – Replace impellers at Eagle Mountain or Hinds
- **EE-4c** – Refurbish motors at Iron Mountain
- **EE-4d** – Refurbish motors at Eagle Mountain or Hinds

## CO-BENEFITS

Cost Savings

Operational Resilience

## AVERAGE ANNUAL GHG REDUCTION POTENTIAL

Supportive

## TARGET METRICS

Number of pumps refurbished/replaced.

# MEASURE EE-5 – PHASE 2

If the proposed RRWP is ultimately constructed, install an inter-stage pumping system on the reverse osmosis brine stream to reduce energy use.

## AVERAGE ANNUAL GHG REDUCTION POTENTIAL

Supportive

## TARGET METRICS

Install an energy recovery system if the Regional Recycled Water Program is approved.

## MEASURE DESCRIPTION

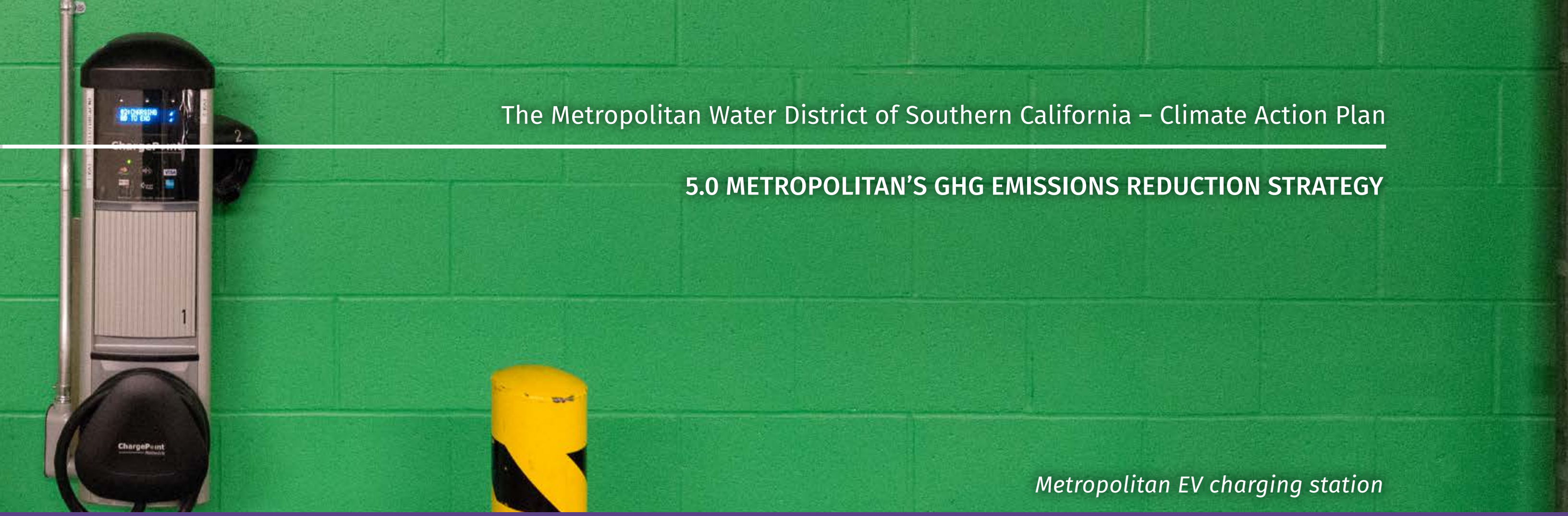
Inter-stage pumping systems help improve balance throughout the reverse osmosis (RO) system, decreasing energy demand by approximately 6 percent.[39] Since the RO system would be the largest consumer of electricity at the proposed RRWP, this measure would help decrease electricity demand and therefore lower GHG emissions associated with electricity use at the proposed facility. If the RRWP is ultimately constructed, Metropolitan will include an inter-stage pumping system to improve overall system efficiency while keeping operating costs and GHG emissions at a minimum.

39. *https://membranes.com/wp-content/uploads/Documents/Technical-Papers/Application/Waste/Operational-Performance-and-Optimization-of-RO-Wastewater-Treatment-Plants-1.pdf*

## CO-BENEFITS

Cost Savings

Operational Resilience



*Metropolitan EV charging station*

# 5.6 SCOPE 3 MEASURES

## SCOPE 3:

### STRATEGY 6: INCENTIVIZE MORE SUSTAINABLE COMMUTES

While Metropolitan does not have direct control over the manner in which its employees travel to and from their jobs, Metropolitan can facilitate alternative commute strategies, including use of active and shared/subsidized transportation as well as EVs. By providing EV charging infrastructure, Metropolitan can encourage employees to drive personal EVs and shift how some individuals travel in both their work and non-work time. Reducing the potential hurdles of charging during work can encourage Metropolitan staff to purchase EVs. Metropolitan will continue its transit programs to further encourage staff to commute through shared transit. In addition, working remotely during the COVID-19 pandemic has substantially reduced commuter vehicle miles traveled. Metropolitan will develop a policy allowing for remote work in some capacity moving forward, which will both reduce GHG emissions and commuter vehicle miles traveled for employees.

Strategy 6

## MEASURE EC-1 – PHASE 1

Expand subsidized transit commute program to reduce employee commute miles.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## MEASURE DESCRIPTION

The transit commute program is designed to incentivize employees to use mass transit for their commutes to and from work. Metropolitan will evaluate the current success of the subsidized transit commute program and identify avenues to expand the program to reach new employees or provide additional incentives to current employees to increase the rate of alternative commutes by 2025. One potential subsidy is to add incentives for employees to carpool. The role of transit in Metropolitan's commute portfolio will need to be tracked closely over time due to the impacts of COVID-19. More employees working from home and hesitation to take public transit during the pandemic may shift Metropolitan's approach to reducing emissions from employee commutes.

## TARGET METRICS

Miles commuted by alternative transportation.

## CO-BENEFITS

Community Health

Operational Resilience

# MEASURE EC-2 – PHASE 1

Expand employee use of carbon-free and low carbon transportation by providing education programs on the benefits of commute options including public transportation, EV/ZEV options, and vanpools.

## MEASURE DESCRIPTION

Providing education to staff on the use of new programs and policies is a fundamental component of achieving significant and impactful change. Metropolitan has established an employee commute education program that provides clear information on the various commute options available to Metropolitan employees, including public transportation, EV charging options, and vanpools. A portion of the education focuses on how Metropolitan employees can integrate diverse commute options and provides a clear list of benefits, including incentive programs and maps outlining where services are available. Metropolitan will track employee participation. One avenue of sharing information may be through Metropolitan's "Water Talk" newsletter and Rideshare's quarterly e-newsletter "Met's On the Go," which provides highlights of Metropolitan's Rideshare programs and announcements for commuters.

## CO-BENEFITS

Community Health

Operational Resilience

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Miles commuted by low/no carbon vehicles.

# MEASURE EC-3 – PHASE 1

Install ZEV and/or EV infrastructure as directed by the ZEV/EV Feasibility Study to support at least a 15 percent transition of employee-owned vehicles to ZEVs/EVs by 2025.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**3,427**

MT $CO_2e$

## TARGET METRICS

Install ZEV/EV infrastructure to support at least

**15%**

ZEV/EV total adoption by Metropolitan employees.

## MEASURE DESCRIPTION

Metropolitan recognizes that current estimates indicate that approximately 90 percent of EV owners charge at home or work with up to 40 percent of charging happening at work.[40] Given this fact, Metropolitan will install additional EV charging stations at its facilities for employees and visitors. Implementation of this measure may encourage Metropolitan employees and visitors to its sites to purchase or lease personal EVs/ZEVs with reduced range anxiety, one of the leading reasons for not moving to EVs/ZEVs. This measure would also allow employees who live further away to commute via personal EVs without worrying about completing round-trip commutes on a single charge. The most appropriate installation locations and charger technologies will be specified in the EV study outlined in Measure FL-1.

40. *https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf*

## CO-BENEFITS

Community Health

Operational Resilience

# MEASURE EC-4 – PHASE 1

Continue to offer benefits to employees who use alternative modes of transportation (e.g., public transportation, bikes).

## MEASURE DESCRIPTION

Measure EC-4 supports the implementation of Measure EC-1 by further expanding the benefits Metropolitan will provide to employees who utilize alternative forms of transportation for their commute. Parking cash outs, pre-tax benefits, and other solutions like gift cards or commute competitions will be implemented over time in support of the goal of achieving a reduction in employee commutes.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Miles commuted by alternative transportation.

## CO-BENEFITS

Community Health

Operational Resilience

# MEASURE EC-5 – PHASE 1

Allow 50 percent of employees located at Metropolitan's headquarters to telecommute or utilize flexible schedules through 2030 to reduce travel time, vehicle miles traveled (VMT), and GHG emissions.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**3,345**

MT $CO_2e$

## TARGET METRICS

Reduce employee commute VMT by

**11%.**

## MEASURE DESCRIPTION

As a result of the COVID-19 pandemic, many organizations have allowed their staff to work remotely. This remote work has substantially reduced employee commute times, travel costs, and associated GHG emissions during 2020. This measure would implement a policy to allow Metropolitan staff to continue working from home through the end of 2030. The GHG reduction benefit calculated below conservatively assumes 50 percent of all staff would telecommute on average 1.5 times per week. However, as demonstrated during the COVID-19 pandemic, the number of employees who can feasibly work from home at one time is substantially higher than the conservative numbers assumed here.

## CO-BENEFITS

# MEASURE EC-6 – PHASE 2

Replace all Metropolitan vanpool vehicles with ZEVs. Start with a pilot study (Measure FL-1) to evaluate the best approach.

## MEASURE DESCRIPTION

Metropolitan currently has a rideshare vanpool program in which more than 40 percent of employees participate. Metropolitan's current rideshare program uses approximately 48 conventional vans to allow staff to carpool together instead of driving individually. Based on the EV study described in Measure FL-1, Metropolitan would replace the conventional fossil fuel-operated vans with electric vans. New technologies for passenger vans are already being developed, and some electric options for commercial vans are already available.[41,42] This measure is considered to be part of Phase 2, because no passenger EV vans are currently available to suit this need.[43] Once those technologies are prevalent and cost effective, Metropolitan will move to replace the current Rideshare vanpool fleet with EVs.

41. *https://www.ford.com/commercial-trucks/e-transit/2022/*

42. *https://www.vans.mercedes-benz.com/vans/en/mercedes-benz-vans/insights/mercedes-benz-esprinter-emission-free*

43. *While commercial vans are currently available, passenger vans (with seats) are not. They will likely become available in the next several years.*

## CO-BENEFITS

Community Health

Cost Savings

Operational Resilience

## AVERAGE ANNUAL GHG REDUCTION POTENTIAL

Supportive

## TARGET METRICS

Replace all vanpool vehicles with ZEVs.

## SCOPE 3:

# STRATEGY 7: INCREASE WASTE DIVERSION TO ACHIEVE ZERO WASTE

Though waste generated by Metropolitan operations results in only a small fraction of overall annual GHG emissions, Metropolitan will implement specific measures designed to reduce the waste generated at its offices and other facilities. A majority of the GHG emissions resulting from Metropolitan-generated waste are caused by decomposition of organic material under anaerobic conditions. The remainder of the emissions come from inorganic wastes, such as plastic, which have both upstream and downstream emissions. Therefore, increasing the diversion of organic and inorganic waste streams is a primary measure to reduce waste-related GHG emissions. Waste reduction programs will prioritize organic waste streams, like food waste, first as they contribute the most to overall waste emissions when sent to the landfill.[44] By composting and diverting these items from the landfill, Metropolitan can not only reduce its GHG emissions, but also generate valuable compost, which can be used to sequester carbon and keep it from entering the atmosphere. Organics diversion is a major driver of State regulations including SB 1383.[45]

44. ***https://www.usda.gov/foodlossandwaste/why***
45. ***https://www.calrecycle.ca.gov/climate/slcp***

**Strategy 7**

# MEASURE WA-1 – PHASE 1

Develop and implement net zero waste policies and programs at all facilities to reduce landfilled waste by 30 percent by 2030 and achieve zero landfilled waste by 2045.

## MEASURE DESCRIPTION

Achieving zero landfilled waste is an attainable goal for Metropolitan. While Metropolitan does have control over the items it purchases, without substantial changes to how products are designed and the materials used, zero waste will remain a challenge. However, Metropolitan will continue its efforts to lower its waste generation by implementing procurement policies, updating food service requirements, and adhering to State and local regulations, like SB 1383 that will increase waste diversion as it works towards the ultimate goal of achieving carbon neutrality. This measure assumes a linear reduction of waste starting in 2022 (3.3 percent) and achieving a 30 percent reduction by 2030.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**4,517**

MT $CO_2e$

## TARGET METRICS

Reduce waste generation by

**30%.**

## CO-BENEFITS

# MEASURE WA-2 – PHASE 1

Implement a program to reduce organic waste at Metropolitan's Union Station building. Contract or team with local organizations and waste disposal companies to route organic waste to anaerobic digestion or composting facilities and edible food-to-food recovery centers.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Separate organic waste from other materials at Metropolitan's Union Station building and route organics to local facilities.

## MEASURE DESCRIPTION

To reduce organics in the waste stream, Metropolitan will implement composting at the Union Station building food service areas. Composting diverts organic waste from the landfill where it decomposes and generates methane, which is a potent GHG. Organic waste pickup is available through Los Angeles Sanitation & Environment and other waste haulers. Edible organics (food left over from food service, but not provided to Metropolitan staff) can also be diverted and beneficially reused because many local organizations focus on edible food diversion to those in need.[46, 47] As part of this measure, composting with signage will be included in all eating areas and in the kitchen of the food service areas.

46. *https://www.lacitysan.org/san/faces/home?_adf.ctrl-state=po85gh5ho_5*

47. *https://furtherwithfood.org/resources/los-angeles-area-food-recovery-guide-la-food-policy-council/*

## CO-BENEFITS

Ecosystem Health

Operational Resilience

# MEASURE WA-3 – PHASE 1

Develop and implement a sustainable procurement policy.

## MEASURE DESCRIPTION

In order to reduce waste and improve overall sustainability, Metropolitan will develop, adopt, and implement a sustainable procurement policy (SPP). The SPP will set guidelines on the materials Metropolitan will purchase for its operations, including office supplies, cleaning products, building materials, electronics, and durable goods. SPP guidelines and examples for developing and implementing an SPP are available from the EPA, CalRecycle, and StopWaste.[48, 49, 50]

48. *https://www.epa.gov/greenerproducts/about-environmentally-preferable-purchasing-program*
49. *https://www.calrecycle.ca.gov/epp*
50. *https://www.stopwaste.org/at-work/green-purchasing/fact-sheets-guides-and-model-policy/environmentally-preferable-purchasing*

## CO-BENEFITS

Community Health

Ecosystem Health

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Develop and implement an environmentally-preferred purchasing policy.

# MEASURE WA-4 – PHASE 2

Partner with municipal agencies, like the City of Los Angeles, to create programs that will allow Metropolitan to provide its fair share of diversion and help local jurisdictions meet the goals of SB 1383 for organics diversion, including food waste and composting.

## AVERAGE ANNUAL GHG REDUCTION POTENTIAL

Supportive

## TARGET METRICS

Partner with local jurisdictions to help meet the goals of SB 1383.

Tons of compost utilized.

Tons of organics diverted.

## MEASURE DESCRIPTION

SB 1383 calls for the diversion of 75 percent of organics from the waste stream by 2025. In order to achieve this goal, jurisdictions throughout California will need to collect organics, create compost through organics processing, and utilize compost as a soil amendment to sequester carbon and avoid methane emissions. Metropolitan can support this process not only by providing composting at Metropolitan facilities, but also by investigating opportunities to utilize compost application techniques on Metropolitan-owned lands. Compost application to range lands and agricultural fields offers several benefits, including healthier soils, more plant growth, and carbon sequestration.[51] Compost application can also enhance water retention in some soil types, reducing the need for watering.[52] By working to both reduce its own organic waste and find a place for compost application, Metropolitan can support the overall goals of S B 1383 and reduce its own GHG emissions.

51. *https://www.ioes.ucla.edu/project/carbon-sequestration-through-compost/*

52. *https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=16800#:~:text=In%20sandy%20soils%20with%20poor,structure%20ie.%2C%20aggregate%20stability.&text=Adding%20compost%20as%20a%20thin,garden%20and%20farm%20raised%20plants*

## CO-BENEFITS

Ecosystem Health

Water Conservation

## SCOPE 3:

# STRATEGY 8: INCREASE WATER CONSERVATION AND LOCAL WATER SUPPLY

Through the implementation of water conservation programs, per capita water consumption in the Metropolitan service area has decreased from 0.14 acre-feet of deliveries per person in 1990 to 0.09 acre-feet of deliveries per person in 2017, an approximate reduction of 36 percent in per capita water use. This increase in water efficiency has come from a variety of actions by the State, Metropolitan, and the community. Metropolitan has invested millions of dollars to support these actions, including educational programs and incentives for water efficient appliances and turf removal. Reducing water consumption provides many benefits in addition to the potential reduction in GHG emissions. Lower per capita demand means the same amount of water can meet the demand of a growing region while leaving enough water in the ecosystem to support critical habitats. Metropolitan will continue and potentially expand its water conservation efforts into the future through incentivizing conservation and through the proposed Regional Recycled Water Program which, if completed, will provide a substantial source of local water to the Los Angeles Basin.

Strategy
8

*Regional Recycled Water Program Advanced Purification Center*

## MEASURE WC-1 – PHASE 1

Expand programs that educate customers on water conservation initiatives through workshops and speaking engagements.

### CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

### TARGET METRICS

Expand water conservation education initiatives.

### MEASURE DESCRIPTION

Metropolitan already provides educational programs about the benefits of water conservation throughout its service area. Implementation of this measure will ensure that Metropolitan continues to provide these services and expand the message to include the benefits of GHG reduction and resiliency achieved through water conservation.

### CO-BENEFITS

Cost Savings

Water Conservation

# MEASURE WC-2 – PHASE 1

Continue to implement innovative water use efficiency programs.

## MEASURE DESCRIPTION

Metropolitan completed a study of its water use efficiency programs. Metropolitan will commit to continue to review current and past water conservation programs with the goal of identifying the most successful programs on a water reduction per dollar spent basis.

## CO-BENEFITS


## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Complete a review of current water reduction programs, expand successful programs and identify new opportunities for program expansion.

## MEASURE WC-3 – PHASE 1

Continue Turf Removal Program to install an average of 1,500,000 square feet (sq. ft.) of water efficient landscapes per year through 2030 through the use of a rebate program.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

**968**

MT $CO_2e$

## TARGET METRICS

Continue water conservation by removing turf and installing an additional

**1,500,000**

SQ. FT.

of water efficient landscapes per year.

## MEASURE DESCRIPTION

Metropolitan already implements landscape water reduction programs for residents and businesses by offering rebates through its BeWaterWise program.[53] However, there is still an abundance of high-water use landscapes in Metropolitan's service area that could be converted to a drought tolerant landscape to better conserve water. Implementation of this measure will ensure Metropolitan continues to provide the education and incentives necessary to continue retrofitting 1,500,000 sq. ft. of conventional landscapes to water efficient landscapes per year through 2030.

53. *http://www.bewaterwise.com/*

## CO-BENEFITS

# MEASURE WC-4 – PHASE 1

Provide funding for the development and monitoring of local stormwater recharge and use projects to evaluate the water supply benefit of stormwater.

## MEASURE DESCRIPTION

Metropolitan's Stormwater Pilot Programs provide up to $12.5 million for the development and monitoring of stormwater recharge and direct use projects. The purpose of the Stormwater Pilot Programs is to gain a better understanding of the actual costs and potential water supply benefits associated with stormwater recharge and use by increasing monitoring data collection for new and existing stormwater projects in the region. Funding is open to public and private (non-residential) locations within Metropolitan's service area. Ultimately, these studies will provide a basis for potential future funding approaches for stormwater.

The Recharge Pilot Program is open to new and existing projects that capture stormwater for groundwater recharge. Examples of stormwater recharge projects include capture and recharge through spreading basins, dry wells, or subsurface infiltration galleries. These projects increase groundwater levels and storage in the groundwater basin. The stormwater recharge projects included in this study are designed to benefit the regional water supply by increasing local groundwater production or reducing Metropolitan replenishment demands.

The Direct Use Pilot Program focuses on projects that capture and directly use stormwater on-site, often through an underground cistern. These direct use projects will be used to offset non-potable demands.

## CO-BENEFITS

Ecosystem Health

Operational Resilience

Water Conservation

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Provide funding for the development and monitoring of local stormwater recharge and use projects to evaluate the water supply benefit of stormwater.

# MEASURE WC-5 – PHASE 1

Continue to promote water efficiency technologies and innovative practices that can be adopted into future water conservation program updates.

## MEASURE DESCRIPTION

1. Metropolitan's Innovative Conservation Program provides funding in cooperation with other entities (currently Southern California Gas Company) for research that will document water savings and reliability of innovative water savings devices. A call for proposals is released approximately every two years, and applicants selected for grant funding are given one to two years to implement their test protocols and deliver a final report to Metropolitan staff. The objective is to evaluate the water savings potential and reliability of innovative water saving devices, technologies, and strategies. **EXAMPLE:** One study evaluates the use of drone imagery to improve irrigation management in golf courses. (http://www.bewaterwise.com/icp-projects.html)

2. Metropolitan's Water Savings Incentive Program provides financial incentives for customized water efficiency projects, including installation of commercial or industrial high-efficiency equipment; industrial process improvements; agricultural and landscape water efficiency improvements; and water management services. New technologies or custom strategies to save water can be tested in real-world settings; if a project or application is repeatedly successful, the technology or strategy may be incorporated into Metropolitan's standard programs.

   **EXAMPLE:** Fire-fighting training devices allow for recycling of hose water during training cycles. Metropolitan has funded about six of these projects and has seen a high success rate; the device may be considered for a standard incentive.

3. Metropolitan's Conservation Credits Program has a standing committee – the Program Advisory Committee (PAC) – that is comprised of Metropolitan and member and retail agency staff and meets on a regular basis to provide recommendations to Metropolitan's management on all the water efficiency incentive programs. The PAC has the ability to investigate new devices and technologies to determine potential applicability to Metropolitan incentive programs.

# MEASURE WC-5 – PHASE 1 (CONTINUED)

## MEASURE DESCRIPTION

**EXAMPLE:** The Municipal Water District of Orange County (MWDOC) has provided information on average water savings associated with conversion of overhead/spray irrigation to drip irrigation in its service area. The MWDOC provided this information to the PAC; the PAC felt it was representative for all member agencies and recommended adoption of the water savings value for other agency projects.

4. Metropolitan's existing program, MWD Innovates, provides developers of new technologies a venue to pitch their ideas and receive feedback from Metropolitan staff.[54] This measure will extend this program through 2030. This measure will realize GHG emissions reduction as a result of implementation of projects approved under this program, and Metropolitan will conduct additional outreach about the program's goals and its benefits. Metropolitan will also increase support of these projects with the potential for funding or pilot projects.

54. *http://mwdinnovates.com/*

## CO-BENEFITS

Ecosystem Health

Operational Resilience

Water Conservation

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Number of new technologies/ ideas reviewed.

# MEASURE WC-6 – PHASE 2

Implement advanced technology systems to increase Metropolitan-owned recycled and groundwater recovery systems to maintain local water supply (e.g., proposed RRWP).

## AVERAGE ANNUAL GHG REDUCTION POTENTIAL

Supportive

## TARGET METRICS

Acre-feet of water generated by the RRWP that replaces water pumped from the CRA.

## MEASURE DESCRIPTION

Metropolitan is in the process of investigating the feasibility of a regional recycled water program that would treat wastewater to potable water quality and send treated water to groundwater injection wells within the Los Angeles area. The development and operation of this facility would substantially increase the amount of local water available and potentially reduce the amount of imported water needed to meet increasing demand, reducing operational GHG emissions. The increased GHG emissions associated with the RRWP have already been included in the GHG emissions forecast, and the savings estimated below are associated with estimates of reduced imported water pumping. Actual GHG emissions savings would depend on changes observed after RRWP implementation.

## CO-BENEFITS

Ecosystem Health

Operational Resilience

Water Conservation

## SCOPE 3:

# STRATEGY 9: INVESTIGATE AND IMPLEMENT CARBON CAPTURE AND SEQUESTRATION OPPORTUNITIES

Carbon sequestration and carbon capture and storage projects could provide Metropolitan a source of "negative" GHG emissions that will support its ability to achieve carbon neutrality. Carbon sequestration generally refers to natural processes such as plant growth or avoided soil carbon loss, while carbon capture and storage refers to technologies that take $CO_2$ or other GHG emissions out of the atmosphere and store them in deep underground geologic formations. Several carbon sequestration/carbon capture and storage opportunities are being investigated, researched and evaluated. Metropolitan will continue to track these opportunities as they progress. While GHG reduction through electrification, carbon-free electricity, and efficiency will drive a significant portion of the GHG reductions Metropolitan needs, sequestering and storing carbon from the atmosphere will likely play a critical role in achieving and maintaining carbon neutrality for both Metropolitan and California.[55]

Carbon capture will be based on the CARB protocol adopted in 2018 under "Carbon Capture and Sequestration Protocol". Other carbon sequestration opportunities will be vetted through the "Restoration of California Deltaic and Coastal Wetlands" protocol adopted in 2017 by the American Carbon Registry, which operates in the voluntary and regulated carbon markets until the time CARB adopts the protocol into the compliance market.

55. *https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf*

Strategy 9

# MEASURE CS-1–PHASE 1

Study carbon capture protocols in the Sacramento-San Joaquin River Delta.

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Conduct a carbon capture reconnaissance and general assessment that evaluates technological, scientific, economic, and regulatory dimensions relevant to potential carbon capture and storage on Metropolitan properties.

## MEASURE DESCRIPTION

Prepare an assessment that will investigate potential opportunities within Metropolitan's Delta property boundaries. The carbon capture protocols will be aligned with CARB's approved "Carbon Capture and Sequestration Protocol" under the Low Carbon Fuel Standard adopted in 2018.

## CO-BENEFITS

Community Health

Cost Savings

Ecosystem Health

Operational Resilience

# MEASURE CS-2–PHASE 1

Conduct a five-year research program to increase Metropolitan's knowledge of regenerative agriculture and carbon sequestration opportunities on Metropolitan properties in the Palo Verde Valley.

## MEASURE DESCRIPTION

Metropolitan will partner with the California State University, Chico Center for Regenerative Agriculture and Resilient Systems to conduct a five-year research program designed to increase Metropolitan's knowledge of regenerative agriculture and carbon sequestration opportunities. The project will compare regenerative land management methods to the current conventional practices used by Metropolitan and contrast cash crop (alfalfa) productivity between the two systems. The program will look at the impacts of traditional fallowing practices, which involve significant inputs of fuel, time, and labor and can also damage soil and increase soil loss. In an effort to reduce or eliminate these impacts, the pilot program will investigate the effects of various cover crops and no-till practices. The benefits of these practices may include improved carbon capture and storage, less soil erosion, and reduced emissions from fuel consumption. The results of the study will be reviewed, and changes to a larger area of agricultural land would follow based on the results.[56]

56. *https://www.csuchico.edu/regenerativeagriculture/research/metro-district-water-soil-carbon.shtml*

## CO-BENEFITS

Community Health

Cost Savings

Ecosystem Health

Operational Resilience

## CUMULATIVE GHG REDUCTION POTENTIAL (2020–2030)

Supportive

## TARGET METRICS

Complete a regenerative agriculture and carbon sequestration study on Metropolitan properties in the Palo Verde Valley.

## MEASURE CS-3 – PHASE 2

Establish baseline soil carbon quantities through science-based approaches then develop pilot projects to enhance carbon sequestration and implement larger scale carbon sequestration projects as deemed feasible.

## AVERAGE ANNUAL GHG REDUCTION POTENTIAL

Supportive

## TARGET METRICS

Conduct a Carbon Sequestration Feasibility Study on Metropolitan-owned lands.

Carbon Sequestered in MT $CO_2e$.

## MEASURE DESCRIPTION

Metropolitan owns several separate islands/tracts in the Sacramento-San Joaquin River Delta (California Delta). These properties have significant soil acreages rich in organics, making them potentially strong candidates for carbon sequestration projects. This measure directs Metropolitan to fully research the feasibility of conducing carbon sequestration projects on the islands to reduce GHG emissions. Significant research on current property conditions and the impacts of alternative land use strategies would be required before these programs are implemented and quantified.

## CO-BENEFITS

Community Health

Cost Savings

Ecosystem Health

Operational Resilience

Lake Skinner

# SECTION 6.0 IMPLEMENTATION AND MONITORING

**Through this CAP, Metropolitan is committed to achieving long-term carbon neutrality. The CAP outlines specific strategies and measures to achieve demonstrative GHG emissions reductions in Metropolitan's day-to-day operations (see Section 5.0 for more details). The CAP will be implemented in two phases: Phase 1 from 2020 to 2030 and Phase 2 from 2031 to 2045. Throughout the process, strategies and measures included in the CAP may evolve over time. Implementation of this plan is grounded in science and current best practices in climate action planning. This section details Metropolitan's commitment to continually implement the CAP, monitor progress, and prepare the CAP updates required to achieve its ambitious goals.**

# 6.0

*California-friendly rock garden*

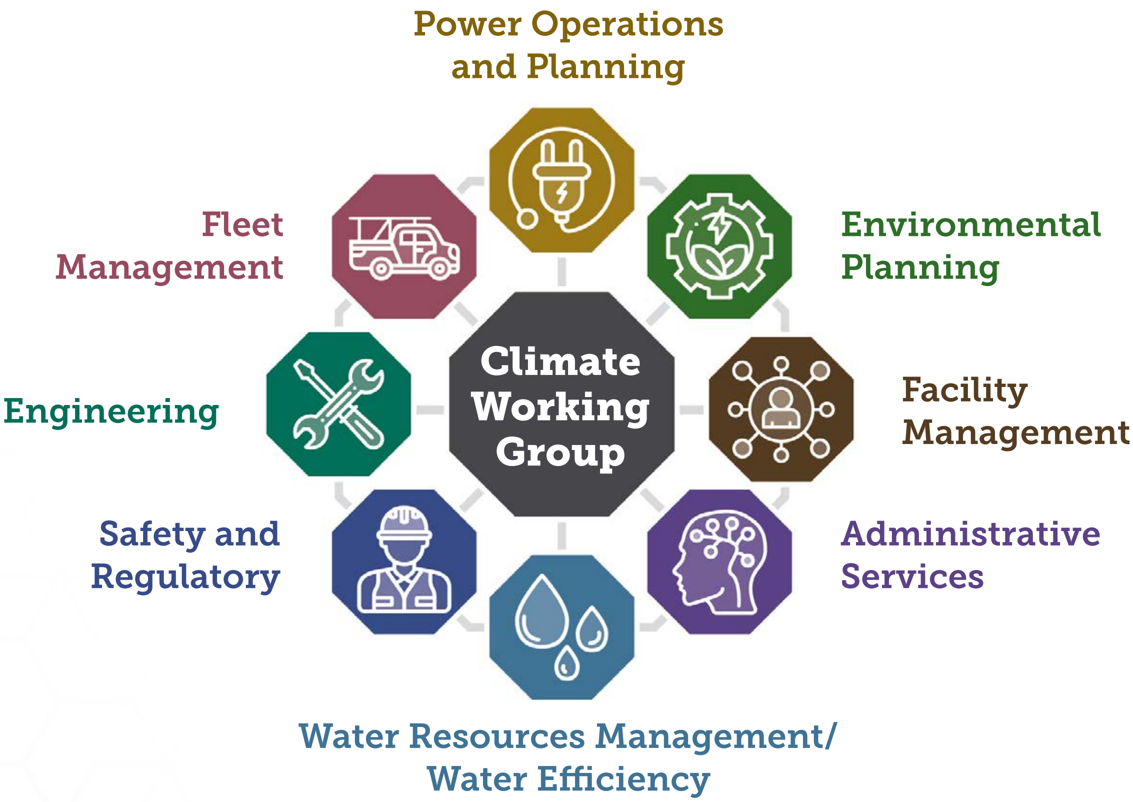

*Colorado River Aqueduct shutdown work*

# 6.1 CAP IMPLEMENTATION

To ensure that the CAP is being implemented, Metropolitan established the Climate Working Group and developed an internal pathway to prioritize and implement the strategies and measures discussed in Sections 5.4 through 5.6.

The Climate Working Group is comprised of a key group of Metropolitan team members specifically selected from each of the internal responsible departments, as shown in Figure 6-1.

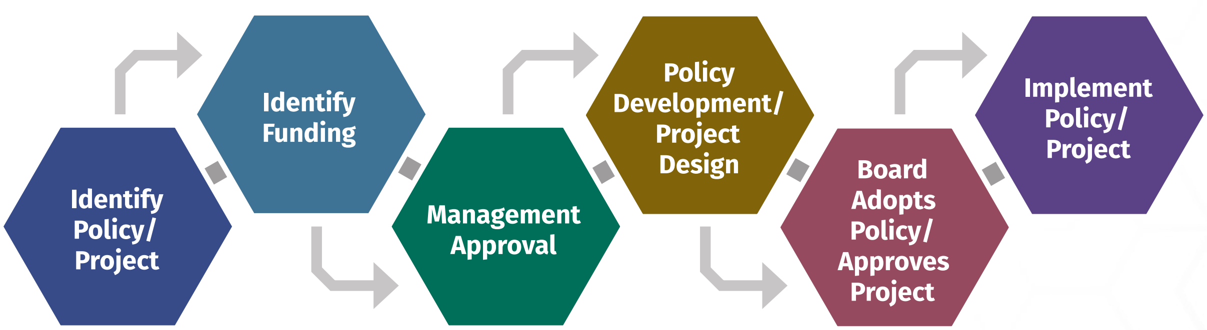
**FIGURE 6-1: Metropolitan Responsible Departments**



The Climate Working Group will identify policies and projects for implementation, work with relevant departments to draft and review required projects or policies, present the items to Metropolitan management to identify funding and obtain approval, and track implementation metrics. The Climate Working Group also will work with all relevant departments to develop policies/project design, as appropriate. Plans, programs and relevant projects will be submitted to the Metropolitan Board of Directors to fund and adopt the new plan, program, policy, or project. Figure 6-2 provides a visual demonstration of the CAP implementation phases, which requires the Climate Working Group to manage the implementation process.

Metropolitan's Environmental Planning Section, along with the Climate Working Group, will track GHG emission reductions realized from implementation of the measures to ensure Metropolitan stays within its carbon budget. The Environmental Planning Section will also be responsible for future updates to the CAP, which are anticipated every five years. Tracking will occur through an annual GHG inventory, which will be used to adjust the remaining carbon budget. Metropolitan is committed to staying within the carbon budget and will implement the monitoring and reporting protocol, update the GHG inventory, and provide an update to the Board of Directors on progress every year starting in the summer of 2022. Table 6-1 includes a complete list of the Phase 1 GHG reduction strategies and measures, the estimated year of implementation for each strategy and measure, and the departments responsible for implementation. Phase 1 measures are those that will be implemented through 2030 and contribute to Metropolitan's plan to stay within its carbon budget even under the high emissions scenario. Table 6-2 includes Phase 2 measures which are focused on long-term GHG emission reduction that will require further development and may be adjusted based on the findings of specified feasibility studies.

**FIGURE 6-2: Metropolitan CAP Implementation Process**



# RESPONSIBLE METROPOLITAN DEPARTMENTS AND GROUPS

Several departments within Metropolitan will play key roles in the CAP implementation. Each of the departments responsible for CAP implementation are listed below as well as the climate working group that is made up of members from each of these departments as well as additional departments within Metropolitan as outlined in Figure 6-1.

## Climate Working Group

The Climate Working Group will be the primary entity responsible for CAP implementation and will be made up of staff from key departments. The Climate Working Group convened at the start of the CAP process, has developed and reviewed each section of the CAP, and will ensure the CAP is implemented over time. The Climate Working Group meets monthly and will take the lead on educating and engaging other departments on the implementation of measures identified in the CAP.

## Administrative Services

Administrative Services manages Metropolitan's purchasing processes and rideshare programs and will lead implementation of the employee commute measures, including distribution of subsidized transit passes and education campaigns.

## Environmental Planning

Environmental Planning will be responsible for implementation of the CAP, tracking the carbon budget on an annual basis with data validated by TCR, updating the CAPDash tool that tracks progress towards meeting the targets, producing annual progress reports, and developing the five-year CAP updates. CAPDash is a customizable, web-based dashboard developed by Rincon Consultants, Inc. that allows Metropolitan to track the implementation of each measure and meet the requirements of State CEQA Guidelines Section 15183.5(b)(1). Environmental Planning will also work with the Climate Working Group to spearhead the work with other departments and present annual progress reports to Metropolitan's Board of Directors.

## Facility Management

Facility Management is tasked with maintaining Metropolitan's building operations and will be critical in implementing waste, energy, and other reduction measures that focus on facility operations.

## Fleet

Fleet is responsible for purchasing and maintaining Metropolitan's on-road, off-road, and stationary equipment. The Fleet Department will be responsible for implementing many of the vehicle- and fuel-related measures in the CAP, including Metropolitan's transition to ZEVs and biofuels.

## Engineering Department

Engineering, along with Facility Management, discussed above, will lead the implementation of Metropolitan's building and energy efficiency related projects, including the development of electric building policies, existing building electrification projects, and infrastructure changes, such as water pump retrofits.

## Water Resources Management/ Water Efficiency

Water Resources Management and its Water Efficiency division are tasked with planning, securing, and managing Metropolitan's water resources. This department will take the lead on many of the water conservation measures such as continuation of the turf removal program (WC-3).

## Bay Delta Initiatives

Bay Delta Initiatives is responsible for overseeing efforts to secure a reliable water supply from the SWP through environmental and water supply improvements in the Sacramento-San Joaquin River Delta. Bay Delta Initiatives will be responsible for implementing many of the carbon sequestration measures.

## Power Operations and Planning

Power Operations and Planning manages the wholesale power requirements of the CRA pumping operation and the power supplies from Metropolitan's entitlements to the output from Hoover and Parker Dams.  Power Operations and Planning also manages power sales from Metropolitan's hydroelectric plant fleet and power issues related to Metropolitan's retail treatment and pumping energy needs.

# THE PHASE 1 IMPLEMENTATION PLAN

The Implementation Plan (Table 6-1) includes the strategies and measures included in Section 5.0 of the CAP, their implementation timeframe, the responsible departments, and the implementation performance metrics. The strategies are intended to identify the general focus areas for GHG emissions reductions, while measures show the specific and quantifiable actions that will be taken to achieve Metropolitan's GHG emission reduction targets and stay within the carbon budget under all emissions scenarios. Each Phase I measure includes specific actions that are known to be feasible and implementable. Based on substantial evidence, including Metropolitan-specific data, these measures are found to be capable of reducing a specific quantity of GHG emissions within a reasonable period of time, considering economic, environmental, legal, social, and technological factors.

**TABLE 6-1: Phase 1 Measure Implementation Plan**

| Phase | # | Measure | Implementation Year | Responsible Department(s) and Group(s) | Implementation Metric |
|---|---|---|---|---|---|
| **Scope 1: Direct Combustion** | | | | | |
| **Strategy 1 – Phase Out Natural Gas Combustion at Facilities** | | | | | |
| 1 | DC-1 | Conduct a survey of all natural gas consuming devices in offices, control buildings, and residential structures and establish a schedule to replace natural gas equipment with electric by 2025. | 2025 | • Facility Management<br>• Engineering | Complete Study |
| 1-2 | DC-2 | Reduce natural gas emissions by 50 percent by 2030 and 100 percent by 2045 through electrification. | 2021 | • Facility Management<br>• Engineering | Therms Reduced |
| 1 | DC-3 | Update Metropolitan building standards to require all-electric construction for new buildings and retrofits. | 2022 | • Facility Management<br>• Engineering | Update Building Standards |

**TABLE 6-1: Phase 1 Measure Implementation Plan** *(continued)*

| Phase | # | Measure | Implementation Year | Responsible Department(s) and Group(s) | Implementation Metric |
|---|---|---|---|---|---|
| **Strategy 2 - Zero Emission Vehicle Fleet** | | | | | |
| 1 | FL-1 | Conduct a ZEV/EV Feasibility Study to determine which fleet vehicles can be converted, what chargers/fueling stations are required, and where they should be located by the end of 2022. | 2022 | • Fleet Management<br>• Engineering<br>• Environmental Planning | Complete Study |
| 1 | FL-2 | Adopt an ZEV/EV first policy for fleet vehicles to obtain ZEVs when technological, operational, or cost effectiveness parameters are met. | 2022 | • Fleet Management | Update Policy |
| 1-2 | FL-3 | Replace fossil fuel passenger fleet vehicles as identified in the ZEV/EV Feasibility Study. | 2025 | • Fleet Management | Percent ZEVs/EVs in Fleet |
| 1 | FL-4 | Install EV charging and/or ZEV infrastructure at facilities pursuant to the findings of the ZEV/EV Feasibility Study (FL-1). | 2023 | • Fleet Management<br>• Facility Management<br>• Engineering | ZEV/EV Infrastructure Installed |
| **Strategy 3 - Use Alternative Fuels to Bridge the Technology Gap to Zero Emission Vehicles** | | | | | |
| 1 | AF-1 | Complete a pilot project on the use of renewable diesel rather than conventional diesel for all stationary equipment by 2025. | 2022 | • Fleet Management | Complete Study |
| 1 | AF-2 | Complete a pilot project of renewable diesel use in on-road and off-road vehicles by providing at least one renewable diesel tank at Metropolitan-owned fueling depots in 2021. | 2021 | • Fleet Management | Complete Pilot |
| 1 | AF-3 | Based on the results of the study in AF-2, Metropolitan will begin using renewable diesel fuel in 100 percent of Metropolitan's diesel-consuming on-road and off-road vehicles by 2025. | 2022 | • Fleet Management | Gallons of Renewable Diesel Fuel Used |

TABLE 6-1: **Phase 1 Measure Implementation Plan** *(continued)*

| Phase | # | Measure | Implementation Year | Responsible Department(s) and Group(s) | Implementation Metric |
|---|---|---|---|---|---|
| **Scope 2: Electricity** | | | | | |
| **Strategy 4 – Utilize Low-Carbon and Carbon-Free Electricity** | | | | | |
| 1 | E-1 | Analyze marginal emissions rates and evaluate the feasibility of shifting energy use to lower emission periods. | 2023 | • Power Operations and Planning | Complete Study |
| 1 | E-2 | Connect the YLHPP behind SCE electricity meter to directly utilize carbon-free electricity at Metropolitan's Diemer facility by 2025. | 2025 | • Facility Management<br>• Engineering | Complete Project |
| 1 | E-3 | In markets where available, Metropolitan will switch its retail accounts to green tariff options offered by power providers by 2025 to reduce the Scope 2 GHG emissions associated with retail electricity use. | 2025 | • Power Operations and Planning | Percent Low-Carbon or Carbon-Free Electricity |
| 1 | E-4 | Install 3.5 MW battery storage systems at the Jensen, Skinner, and Weymouth treatment plants. Investigate the use of a software system to track and optimize GHG emissions reduction due to time-of-use strategies by 2025. | 2023 | • Power Operations and Planning<br>• Facility Management<br>• Engineering | Complete Project |
| 1 | E-5 | Manage Metropolitan's energy purchases to ensure cost-effective energy supply while achieving the required GHG emissions objective. | 2021 | • Power Operations and Planning | GHG Emissions Reductions |

**TABLE 6-1: Phase 1 Measure Implementation Plan** *(continued)*

| Phase | # | Measure | Implementation Year | Responsible Department(s) and Group(s) | Implementation Metric |
|---|---|---|---|---|---|
| **Strategy 5 – Improve Energy Efficiency** | | | | | |
| 1 | EE-1 | Convert all interior and exterior lighting at 50 percent of Metropolitan facilities to LED technologies by 2030 and 100 percent by 2045. | 2025 | • Facility Management | Percent of Facilities Upgraded |
| 1 | EE-2 | Continue programs to analyze CRA pump efficiency and replace or refurbish pumps when cost effective. | 2023 | • Facility Management<br>• Engineering | Complete Study |
| **Scope 3: Indirect Emissions and Sequestration** | | | | | |
| **Strategy 6 – Incentivize More Sustainable Commutes** | | | | | |
| 1 | EC-1 | Expand subsidized transit commute program to reduce employee commute miles. | 2022 | • Administrative Services | Expand Subsidized Transit Commute Program |
| 1 | EC-2 | Expand employee use of carbon-free and low carbon transportation by providing education programs on the benefits of commute options including public transportation, ZEV options, and vanpools. | 2021 | • Administrative Services | Continue Education Program |
| 1 | EC-3 | Install ZEV and/or EV infrastructure as directed by the ZEV/EV Feasibility Study to support at least a 15 percent transition of employee-owned vehicles to ZEVs/EVs by 2025. | 2030 | • Facility Management<br>• Engineering | Number of ZEV/EV Infrastructure Installed |
| 1 | EC-4 | Continue to offer benefits to employees who use alternative modes of transportation (e.g. public transportation, bikes). | 2021 | • Administrative Services | Maintain Program |

**TABLE 6-1: Phase 1 Measure Implementation Plan** *(continued)*

| Phase | # | Measure | Implementation Year | Responsible Department(s) and Group(s) | Implementation Metric |
|---|---|---|---|---|---|
| 1 | EC-5 | Allow 50 percent of employees located at Metropolitan's headquarters to telecommute or utilize flexible schedules through 2030 to reduce travel time, VMT, and GHG emissions. | 2021 | • Administrative Services | Update Policy |
| **Strategy 7 – Increase Waste Diversion to Achieve Zero Waste** | | | | | |
| 1 | WA-1 | Develop and implement net zero waste policies and programs at all facilities to reduce landfilled waste by 30 percent by 2030 and achieve zero landfilled waste by 2045. | 2023 | • Facility Management | Percent Waste Reduction |
| 1 | WA-2 | Implement a program to reduce organic waste at Metropolitan's Union Station building. Contract or team with local organizations and waste disposal companies to route organic waste to anaerobic digestion or composting facilities and edible food-to-food recovery centers. | 2023 | • Facility Management | Percent Waste Reduction |
| 1 | WA-3 | Develop and implement a sustainable procurement policy. | 2022 | • Administrative Services | Develop and Adopt Policy |
| **Strategy 8 – Increase Water Conservation and Local Water Supply** | | | | | |
| 1 | WC-1 | Expand programs that educate customers on water conservation initiatives through workshops and speaking engagements. | 2023 | ◦ Water Resources Management/ Water Efficiency | Expand Program |
| 1 | WC-2 | Continue to implement innovative water use efficiency programs. | 2022 | • Water Resources Management/ Water Efficiency | Maintain Program |

**TABLE 6-1: Phase 1 Measure Implementation Plan** *(continued)*

| Phase | # | Measure | Implementation Year | Responsible Department(s) and Group(s) | Implementation Metric |
|---|---|---|---|---|---|
| 1 | WC-3 | Continue Turf Removal Program to install an average of 1,500,000 square feet (sq. ft.) of water efficient landscapes per year through 2030 through the use of a rebate program. | 2021 | • Water Resources Management/ Water Efficiency | Maintain Program |
| 1 | WC-4 | Provide funding for the development and monitoring of local stormwater recharge and use projects to evaluate the water supply benefit of stormwater. | 2025 | • Water Resources Management/ Water Efficiency | Acre-feet of Stormwater Capacity Installed |
| 1 | WC-5 | Continue to promote water efficiency technologies and innovative practices that can be adopted into future water conservation program updates. | 2025 | • Water Resources Management/ Water Efficiency | New Technologies Reviewed |
| **Strategy 9 – Investigate and Implement Carbon Capture and Sequestration Opportunities** | | | | | |
| 1 | CS-1 | Study carbon capture protocols in the Sacramento-San Joaquin River Delta. | 2025 | • Facility Management<br>• Engineering<br>• Bay Delta Initiatives<br>• Water Resources Management | Complete Study |
| 1 | CS-2 | Conduct a five-year research program to increase Metropolitan's knowledge of regenerative agriculture and carbon sequestration opportunities on Metropolitan properties in the Palo Verde Valley. | 2020 | • Water Resources Management | Complete Study |

Table 6-2 includes the implementation plan for Phase 2 measures. Because Phase 2 measures still require additional information or new technologies before they can be implemented, the implementation year is not listed. Furthermore, the short-term implementation metric for each of these measures is to complete a feasibility study, with the potential long-term implementation metrics shown in Table 6-1. More detailed implementation metrics and dates will be included in future updates of the CAP. However, the party responsible for research and future implementation are listed as well as the implementation tracking metrics.

**TABLE 6-2: Phase 2 Measure Implementation Plan**

| Phase | # | Measure | Responsible Department(s) and Group(s) | Implementation Metric |
|---|---|---|---|---|
| **Strategy 4 – Utilize Low-Carbon and Carbon-Free Electricity** | | | | |
| 2 | EE-3 | Investigate feasibility of a large-scale (100 MW) battery storage system for the CRA. | • Facility Management<br>• Engineering<br>• Power Operations and Planning | Complete Feasibility Study |
| **Strategy 5 – Improve Energy Efficiency** | | | | |
| 2 | EE-4a | Replace pump impellers at the Iron Mountain pumping plant if directed by findings of the pump assessment (Measure EE-2). | • Facility Management<br>• Engineering | Replace Impellers |
| 2 | EE-4b | Replace pump impellers at Eagle Mountain or Hinds pumping plants if directed by findings of the pump assessment (Measure EE-2). | • Facility Management<br>• Engineering | Replace Impellers |
| 2 | EE-4c | Refurbish motors at Iron Mountain if applicable based on the findings of the pump assessment (Measure EE-2). | • Facility Management<br>• Engineering | Refurbish Motors |
| 2 | EE-4d | Refurbish motors at Eagle Mountain or Hinds pumping plants if directed by findings of the pump assessment (Measure EE-2). | • Facility Management<br>• Engineering | Refurbish Motors |

**TABLE 6-2: Phase 2 Measure Implementation Plan** *(continued)*

| Phase | # | Measure | Responsible Department(s) and Group(s) | Implementation Metric |
|---|---|---|---|---|
| 2 | EE-5 | If the proposed RRWP is ultimately constructed, install an inter-stage pumping system on the reverse osmosis brine stream to reduce energy use. | • Facility Management<br>• Engineering | Install Energy Recovery System |
| **Strategy 6 – Incentivize More Sustainable Commutes** | | | | |
| 2 | EC-6 | Replace all Metropolitan vanpool vehicles with ZEVs. Start with a pilot study (Measure FL-1) to evaluate the best approach. | • Administrative Services/ Rideshare | Replace All Vanpool Vehicles with EVs |
| **Strategy 7 – Increase Waste Diversion to Achieve Zero Waste** | | | | |
| 2 | WA-4 | Partner with municipal agencies, like the City of Los Angeles, to create programs that will allow Metropolitan to provide its fair share of diversion and help local jurisdictions meet the goals of SB 1383 for organics diversion, including food waste and composting. | • Facility Management | Complete Feasibility Study |
| **Strategy 8 – Increase Water Conservation and Local Water Supply** | | | | |
| 2 | WC-6 | Implement advanced technology systems to increase Metropolitan-owned recycled and groundwater recovery systems to maintain local water supply (e.g., RRWP). | • Facility Management<br>• Engineering | Acre-feet of Water Generated |
| **Strategy 9 – Investigate and Implement Carbon Capture and Sequestration Opportunities** | | | | |
| 2 | CS-3 | Establish baseline soil carbon quantities through science-based approaches then develop pilot projects to enhance carbon sequestration and implement larger scale carbon sequestration projects as deemed feasible. | • Facility Management<br>• Engineering<br>• Bay Delta Initiatives<br>• Water Resources Management | Complete Feasibility Study |

*Newport Back Bay restoration project*

# 6.2 CAP MONITORING

One requirement of a successful CAP is routine monitoring of progress towards the established GHG reduction goals. For Metropolitan, this will include the monitoring of and reporting on the CAP implementation metrics defined in Sections 5.4 through 5.6 and summarized in the implementation plan. CAP monitoring will also include the preparation of annual GHG inventories. These annual inventories will be used to track carbon budget progress and provide the detail needed to make implementation decisions. Specifically, Metropolitan may need to make adjustments to renewable power purchases to ensure progress towards carbon neutrality by 2045. The Climate Working Group will provide updates on CAP implementation progress and status of the carbon budget to the Board of Directors on an annual basis.

## CARBON BUDGET UPDATES

The key step in maintaining the accuracy of the carbon budget is an annual GHG inventory of Metropolitan operations. To ensure the carbon budget is an accurate representation of Metropolitan's GHG emissions and progress towards its targets, Metropolitan will conduct annual updates of the carbon budget. On an annual basis, Metropolitan will record Scopes 1 and 2 GHG emission sources, including fuel consumption and electricity use. Due to the small contribution of Scope 3 emissions to Metropolitan's overall emissions and the relatively difficult data collection process, Metropolitan will conduct a complete inventory, which will also calculate all Scope 3 emissions, every five years. In interim years between major inventories, a Scope 3 estimate will be included. Carbon budget updates will be done every spring, once the prior year's energy data is available. This ensures that the carbon budget results can be tied into decision making across Metropolitan's planning efforts.

## ANNUAL MONITORING AND REPORTING OF METROPOLITAN GHG REDUCTION MEASURES

Metropolitan will monitor implementation of the GHG emissions reduction measures and develop an annual progress report, which will include both the most recent carbon budget update and updates on the implementation status of each GHG reduction measure. The process for monitoring and quantifying measure implementation status requires tracking the key target metrics identified in each of the GHG reduction measures in Sections 5.4 through 5.6. In order to provide a transparent mechanism of tracking, Table 6-1 and Table 6-2 identify specific actions, expected implementation timing, and which Metropolitan department(s) will monitor the ongoing implementation of the CAP measures. This process will also include updates to Metropolitan's CAPDash and monitoring software, which will be used to provide transparent and regular updates to stakeholders.

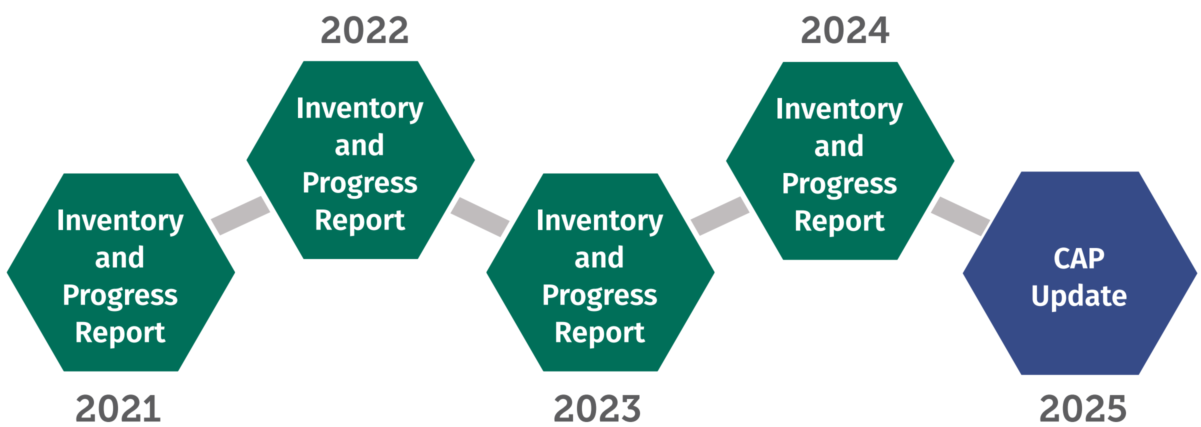
*Dennis Underwood Conservation Area*

Natural desert landscape

# 6.3 CAP UPDATE SCHEDULE

Metropolitan's CAP has been designed to provide substantial progress towards achieving carbon neutrality by 2045. As part of this plan, Metropolitan has established a carbon budget with interim targets that exceed the State GHG reduction goals. To support these goals, strategies and measures have been developed that will form the foundation of carbon-neutral operations at Metropolitan. Some of these strategies include transitioning buildings to all-electric power, procuring carbon-free electricity, and transitioning the vehicle fleet to ZEVs. These strategies have been identified to ensure Metropolitan will achieve carbon neutrality over time. However, new technologies, new State regulations, and new incentives as well as Metropolitan's operational conditions will all change over time. Therefore, Metropolitan is committed to conducting comprehensive updates of the CAP every five years. These updates will revisit the strategies in the plan, update actions based on progress to date, and evaluate new technologies and the legislative landscape. The five-year update will also include a comprehensive GHG inventory, identify new opportunities to reduce emissions, revise emissions forecasts to ensure an accurate analysis of Metropolitan's operations, and adjust the implementation schedule accordingly to ensure Metropolitan stays within its carbon budget.

**FIGURE 6-3: CAP Update Timeline**



Lake Havasu

# APPENDICES

# APP.

*Diamond Valley Lake*

# APPENDIX A:
# REGULATORY CONTEXT

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# Regulatory Context

As the impacts of climate change are becoming clearer, strategies to address climate change are emerging at all levels of government. This section provides an overview of the regulatory context at the international, state, and local levels relative to Metropolitan's actions toward reducing greenhouse gas (GHG) emissions.

## International Climate Action Guidance

### 1992 United Nations Framework Convention on Climate Change

The primary international regulatory framework for GHG reduction is the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC is an international treaty adopted in 1992 with the objective of stabilizing atmospheric GHG concentrations to prevent disruptive anthropogenic climate change. The framework established non-binding limits on global GHG emissions and specified a process for negotiating future international climate-related agreements.[1]

### 1997 Kyoto Protocol

The Kyoto Protocol is an international treaty that was adopted in 1997 to extend and operationalize the UNFCCC. The protocol commits industrialized nations to reduce GHG emissions per country-specific targets, recognizing that they hold responsibility for existing atmospheric GHG levels. The Kyoto Protocol involves two commitment periods during which emissions reductions are to occur, the first of which took place between 2008-2012. The second commitment period set new targets and other changes but has not been entered into force (meaning it has not gone into effect).[2]

### 2015 The Paris Agreement

The Paris Agreement is the first universal, legally binding global climate agreement that was adopted in 2015 and has been ratified by 191 countries worldwide.[3] The Paris Agreement establishes a roadmap to keep the world under 2 degrees Celsius (°C) of warming with a goal of limiting an increase of temperature to 1.5°C. The Paris Agreement does not dictate one specific reduction target, instead relying on individual countries to set nationally determined contributions (NDCs) or reductions based on gross domestic product and other factors. According to the International Panel on Climate Change (IPCC), limiting global warming to 1.5°C will require global emissions to reduce through 2030 and hit carbon neutrality by mid-century.[4]

## California Regulations and State GHG Targets

California remains a global leader in the effort to reduce GHG emissions and combat climate change through its mitigation and adaptation strategies. By the early 2000's, California was passing climate change bills including Senate Bill (SB) 1078 and Executive Order (EO) S-3-05 which began to require

[1] United Nations Framework Convention on Climate Change (UNFCCC). United Nations Framework Convention on Climate Change. https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf
[2] UNFCCC. What is the Kyoto Protocol? https://unfccc.int/kyoto_protocol
[3] UNFCCC. Paris Agreement - Status of Ratification. https://unfccc.int/process/the-paris-agreement/status-of-ratification
[4] IPCC. Global Warming of 1.5 C. https://www.ipcc.ch/sr15/

state agencies and utilities to address climate change. With the passage of Assembly Bill (AB) 32 in 2006, California became the first state in the nation to mandate GHG emission reductions across its entire economy. To support AB 32, California has enacted legislation, regulations, and executive orders (EO) that put it on course to achieve robust emission reductions and address the impacts of a changing climate. The following is a summary of executive and legislative actions most relevant to the Climate Action Plan.

## 2002 Senate Bill 1078

In 2002, Senate Bill (SB) 1078 established the California Renewables Portfolio Standards (RPS) Program which requires that 20 percent of retail electricity sales be composed of renewable energy sources by 2017 and was accelerated in 2006 by SB 107,[5] which requires that 20 percent of retail electricity sales be composed of renewable energy sources by 2010, instead of 2017. EO S-14-08 was signed in 2008 to further streamline California's renewable energy project approval process and increase the state's RPS to the most aggressive in the nation requiring 33 percent renewable power by 2020.[6] SB 350, discussed further below, further accelerated the program which mandated a 50% RPS by 2030.

## 2002 Assembly Bill 1493

In 2002, AB 1493, also known as the Pavley Regulations, directed the California Air Resources Board (CARB) to establish regulations to reduce GHG emissions from passenger vehicles to the maximum and most cost-effective extent feasible. CARB approved the first set of regulations to reduce GHG emissions from passenger vehicles in 2004, with the regulations initially taking effect with the 2009 model year.

## 2005 Executive Order S-3-05

EO S-3-05 was signed in 2005, establishing statewide GHG emissions reduction targets for the years 2020 and 2050. The EO calls for the reduction of GHG emissions in California to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below 1990 levels by 2050. The 2050 emission reductions target would put the state's emissions in line with the worldwide reductions needed to reach long-term climate stabilization as concluded by the IPCC *2007 Fourth Assessment Report*.

## 2006 Assembly Bill 32

California's major initiative for reducing GHG emissions is outlined in AB 32, the "California Global Warming Solutions Act of 2006," which was signed into law in 2006. AB 32 codifies the statewide goal of reducing GHG emissions to 1990 levels by 2020 and requires CARB to prepare a Scoping Plan that outlines the main state strategies for reducing GHG emissions to meet the 2020 deadline. In addition, AB 32 requires CARB to adopt regulations to require reporting and verification of statewide GHG emissions.

Based on this guidance, CARB approved a 1990 statewide GHG baseline and 2020 emissions limit of 427 million metric tons of $CO_2$ equivalent (MMT $CO_2e$). The Scoping Plan was approved by CARB on December 11, 2008 and included measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures. Many of the

[5] California Public Utilities Commission.2021. Renewables Portfolio Standard (RPS) Program. https://www.cpuc.ca.gov/General.aspx?id=6442463710
[6] Executive Order S-14-08. http://www.climatestrategies.us/library/library/view/292

GHG reduction measures included in the Scoping Plan (e.g., Low Carbon Fuel Standard, Advanced Clean Car standards,[7] and Cap-and-Trade) have been adopted since approval of the Scoping Plan.

In May 2014, CARB approved the first update to the AB 32 Scoping Plan. The 2014 Scoping Plan update defined CARB's climate change priorities for the next five years and set the groundwork to reach post-2020 statewide goals. The update highlighted California's progress toward meeting the "near-term" 2020 GHG emission reduction goals defined in the original Scoping Plan. It also evaluated how to align the state's longer-term GHG reduction strategies with other state policy priorities, including those for water, waste, natural resources, clean energy, transportation, and land use (CARB 2014).

## 2007 Executive Order S-1-07

Also known as the Low Carbon Fuel Standard, EO S-1-07, issued in 2007, established a statewide goal that requires transportation fuel providers to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020. EO S-1-07 was readopted and amended in 2015 to require a 20 percent reduction in carbon intensity by 2030, the most stringent requirement in the nation. The new requirement aligns with California's overall 2030 target of reducing climate changing emissions 40 percent below 1990 levels by 2030, which was set by SB 32 and signed by the governor in 2016.

## 2007 Senate Bill 97

Signed in August 2007, SB 97 acknowledges that climate change is an environmental issue that requires analysis in California Environmental Quality Act (CEQA) documents. In March 2010, the California Natural Resources Agency adopted amendments to the State CEQA Guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions. The adopted guidelines give lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHG and climate change impacts.

## 2008 Senate Bill 375

SB 375, signed in August 2008, enhances the state's ability to reach AB 32 goals by directing CARB to develop regional GHG emission reduction targets to be achieved from passenger vehicles by 2020 and 2035. In addition, SB 375 directs each of the state's 18 major Metropolitan Planning Organizations (MPOs), to prepare a Sustainable Communities Strategy" that contains a growth strategy to meet these emission targets for inclusion in the MPO's Regional Transportation Plan.

In March 2018, CARB adopted updated regional targets for reducing GHG emissions from 2005 levels by 2020 and 2035. Each region was assigned a target for 2020 and 2035.[8] Metropolitan's operations span several of these regions.

## 2009 California Green Building Code

The California Green Building Standards Code (CALGreen) is Part 11 of the California Building Standards Code or Title 24 and is the first statewide "green" building code in the nation. The

[7] On September 19, 2019, the National Highway Traffic Safety Agency and the U.S. Environmental Protection Agency issued a final action entitled the One National Program on Federal Preemption of State Fuel Economy Standards Rule. This action finalizes Part I of the Safer, Affordable, Fuel-Efficient (SAFE) Vehicles Rule. This rule states that federal law preempts State and local tailpipe GHG emissions standards as well as zero emission vehicle (ZEV) mandates. The SAFE Rule withdraws the Clean Air Act waiver it granted to California in January 2013 as it relates to California's GHG and zero emission vehicle programs.

8 https://ww2.arb.ca.gov/sites/default/files/2020-06/SB375_Final_Targets_2018.pdf

purpose of CALGreen is to improve public health, safety, and general welfare by enhancing the design and construction of buildings. Enhancements include higher energy efficiency, better air quality, and improved daylighting. The first CALGreen Code was adopted in 2009 and has been updated in 2013, 2016, and 2019. The CALGreen Code will have subsequent, and continually more stringent, updates every three years.

## 2009 Senate Bill X7-7

In 2009, SB X7-7, also known as the Water Conservation Act, was signed, requiring all water suppliers to increase water use efficiency. This legislation sets an overall goal of reducing per capita urban water use by 20 percent by2020.

## 2011 Senate Bill 2X

In 2011, SB 2X was signed, requiring California energy providers to buy (or generate) 33 percent of their electricity from renewable energy sources by 2020.

## 2012 Assembly Bill 341

AB 341 directed the California Department of Resources Recycling and Recovery (CalRecycle) to develop and adopt regulations for mandatory commercial recycling. As of July 2012, businesses are required to recycle, and jurisdictions must implement a program that includes education, outreach, and monitoring. AB 341 also set a statewide goal of 75 percent waste diversion from landfill by the year 2020.

## 2014 Assembly Bill 32 Scoping Plan Update

In 2014, CARB approved the first update to the Scoping Plan. This update defines CARB’s climate change priorities and sets the groundwork to reach the post-2020 targets set forth in EO S-3-05. The update highlights California’s progress toward meeting the near-term 2020 GHG emissions reduction target, defined in the original Scoping Plan. It also evaluates how to align California’s longer-term GHG reduction strategies with other statewide policy priorities, such as water, waste, natural resources, clean energy, transportation, and land use.

## 2014 Assembly Bill 1826

AB 1826 was signed in 2014 to increase the recycling of organic material. GHG emissions produced by the decomposition of these materials in landfills were identified as a significant source of emissions contributing to climate change. Therefore, reducing organic waste and increasing composting and mulching are goals set out by the AB 32 Scoping Plan. AB 1826 specifically requires jurisdictions to establish organic waste recycling programs by 2016, and phases in mandatory commercial organic waste recycling over time.

## 2015 Senate Bill 350

SB 350, the Clean Energy and Pollution Reduction Act of 2015, has two objectives: to increase the procurement of electricity from renewable sources from 33 percent to 50 percent by 2030 and to double the energy efficiency of electricity and natural gas end users through energy efficiency and conservation.

## 2015 Executive Order B-30-15

EO B-30-15 was signed in 2015, establishing an interim GHG emissions reduction target to reduce emissions to 40 percent below 1990 levels by 2030. The EO also calls for another update to the CARB Scoping Plan to provide a pathway to achieve this goal.

## 2016 Senate Bill 32

In September 2016, the governor signed SB 32 into law, extending AB 32 by requiring the state to further reduce GHGs to 40 percent below 1990 levels by 2030 (the other provisions of AB 32 remain unchanged).

## 2016 Senate Bill 1383

Adopted in September 2016, SB 1383 requires CARB to approve and begin implementing a comprehensive strategy to reduce emissions of short-lived climate pollutants. SB 1383 requires achievement of the following reduction targets by 2030:

- Methane – 40 percent below 2013 levels
- Hydrofluorocarbons – 40 percent below 2013 levels
- Anthropogenic black carbon – 50 percent below 2013 levels

SB 1383 also requires CalRecycle, in consultation with CARB, to adopt regulations that achieve specified targets for reducing organic waste in landfills. SB 1383 further requires 20% of edible food disposed of at the time to be recovered by 2025.

## 2017 Scoping Plan Update

In December 2017, CARB adopted the 2017 Scoping Plan, which provides a framework for achieving the 2030 goal set by SB 32. The 2017 Scoping Plan relies on the continuation and expansion of existing policies and regulations, such as the Cap-and-Trade Program, as well as implementation of recently approved legislation, such as SB 350 and SB 1383.

The 2017 Scoping Plan also puts an increased emphasis on innovation, adoption of existing technology, and strategic investment to support its strategies. As with the 2014 Scoping Plan Update, the 2017 Scoping Plan does not provide project-level thresholds for land use development. Instead, it recommends that local governments adopt policies and locally appropriate quantitative thresholds consistent with statewide per capita goals of six metric tons (MT) $CO_2e$ by 2030 and two MT $CO_2e$ by 2050 (CARB 2017). As stated in the 2017 Scoping Plan, these goals may be appropriate for plan-level analyses (i.e., city, county, subregional, or regional level), but not for specific individual projects because they include all emissions sectors in the state (CARB 2017).

## 2018 Senate Bill 100

Adopted in September 2018, SB 100 supports the reduction of GHG emissions from the electricity sector by accelerating the state's RPS Program, which was last updated by SB 350 in 2015. SB 100 requires electricity providers to increase procurement from eligible renewable energy resources to 33 percent of total retail sales by 2020, 60 percent by 2030, and 100 percent by 2045.

## 2018 Executive Order B-55-18

In September 2018, the governor issued Executive Order B-55-18, which established a new statewide goal of achieving carbon neutrality by 2045 and maintaining net negative emissions thereafter. This goal is in addition to the existing statewide GHG reduction targets established by SB 375, SB 32, SB 1383, and SB 100.

# APPENDIX B:
# GHG INVENTORY AND FORECAST METHODOLOGY

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## Tables

## Figures

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# 1 Introduction

California considers the impact of climate change to be a serious threat to the public health, the environment, and the economic well-being of the State. California has taken an aggressive stance to mitigate the impact on climate change at the State-level through the adoption of legislation and policies to protect natural resources and reduce greenhouse gas (GHG) emissions. The three major State GHG-related goals are established by Assembly Bill (AB) 32 and Senate Bill (SB) 32, and most recently, Executive Order (EO) B-55-18, which has not yet been codified. AB 32 required State Air Resources Board to adopt rules and regulations that would reduce the State's GHG emissions to 1990 levels by 2020; whereas SB 32 requires a 40 percent reduction below 1990 levels by 2030. EO B-55-18 sets a long-term goal of achieving carbon neutrality as soon as possible, but no later than 2045. The goals set by AB 32 were achieved by the State in 2016[1]and many jurisdictions have completed GHG inventories to quantify compliance with their own 2020 goals as well as develop targets to align with the requirements of SB 32 and show progress towards carbon neutrality. The Metropolitan Water District of Southern California (Metropolitan) has chosen to develop a Climate Action Plan (CAP) for its operations and align GHG reduction goals to correspond with State emissions reduction targets.

Estimating GHG emissions enables entities to establish an emissions baseline, track emissions trends, identify the greatest sources of GHG emissions within their jurisdictions, and set targets for future reductions. This inventory is compliant with the Local Governments for Sustainability (ICLEI) *Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories*[2] (Local Government Protocol) and meets the requirements of the California Environmental Quality Act (CEQA) Guidelines Section 15183.5(b) for a 'qualified' GHG emissions reduction plan or CAP. Methodology used in some sections (water/wastewater) has been updated to conform with the industry standard as recommended in the Association of Environmental Professionals (AEP) *California Supplement to the United States Community-Wide GHG Emissions Protocol*[3] (California Supplement). Emissions inventories are an iterative process and must be reviewed annually to ensure consistency with current emissions inventory methodologies and factors.

Emissions contained within this inventory include activities under the jurisdictional control or significant influence of Metropolitan, as recommended by AEP in preparing CEQA-compliant inventories.[3]

[1] California Air Resources Board. California Greenhouse Gas Emissions Inventory. Accessed at: https://ww3.arb.ca.gov/cc/inventory/inventory.htm. Accessed on July 2019

[2] ICLEI. 2010. *Local Government Operations Protocol For the quantification and reporting of greenhouse gas emissions inventories*, Version 1.1

[3] Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol.

# 1.1 Executive Summary

## GHG Emissions Inventories

Metropolitan has reported operational GHG emissions to The Climate Registry (TCR) annually since 2005. For each year from 2005 to 2020, Scope 1 and 2 emissions are calculated using operational activity data. Scope 3 emissions were calculated for the year 2008, the first year with complete data, and 2017, the final complete year of data available for the inventory. At the time of developing the CAP the complete scope 3 datasets for 2018, 2019 and 2020 were not available. Scope 3 emissions were found to contribute a relatively small amount of overall emissions, as shown below in Figure 1 and Table 1. Scope 3 emissions from 2008 and 2017 were averaged and the average was then applied to all interim years for consistency. Construction emissions were estimated based on annual construction forecasts for the years 2019 through 2024. An analysis of Metropolitan's Annual Capital Expenditures since 1990 showed construction activities during the period 2019-2024 represents an average or less than average level of construction activity when compared to historical annual capital expenditures adjusted to current dollars. Therefore, the GHG inventory provides a conservative estimate of past emissions (by not inflating historical emissions and thereby making future reduction targets easier to meet). Both Figure 1 and Table 1 summarize the emissions inventory. For an in-depth data analysis of the years 2008 and 2017, including detailed inventory methodologies, please see Section 4 of this appendix.

**Figure 1 Metropolitan Emissions by Scope**

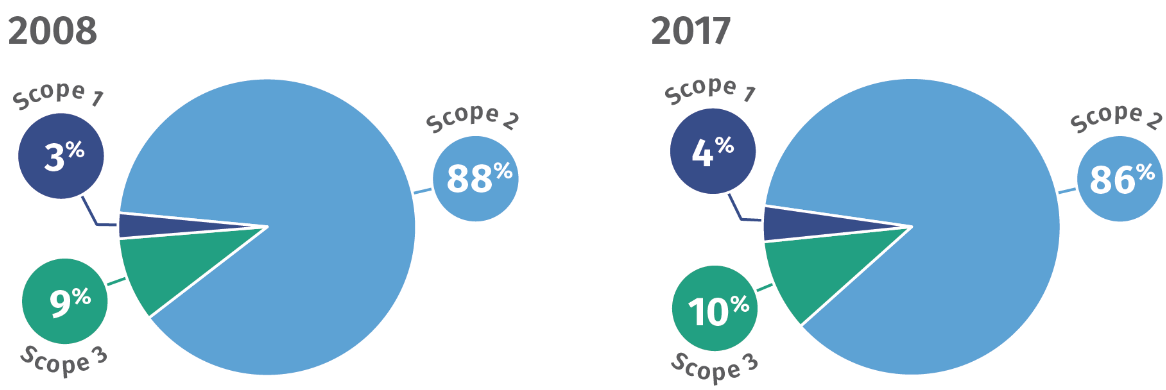


**Table 1 2008 and 2017 Emissions by Scope and Sector**

| Scope | 2008 GHG Emissions (MT of $CO_2e$) | 2008 Percent of Total Emissions | 2017 GHG Emissions (MT of $CO_2e$) | 2017 Percent of Total Emissions |
|---|---|---|---|---|
| **Scope 1** | **8,073** | **3%** | **8,875** | **4%** |
| Stationary Combustion | 893 | <1% | 1,918 | 1% |
| Fugitive Emissions | 0 | 0% | 71 | <1% |
| Mobile Combustion | 7,180 | 3% | 6,886 | 3% |
| **Scope 2** | **226,651** | **88%** | **194,480** | **86%** |
| Electricity Consumption | 224,105 | 87% | 192,511 | 85% |
| T&D Losses | 2,546 | 1% | 1,969 | 1% |
| **Scope 3** | **11,613** | **4%** | **10,598** | **5%** |
| Water and Wastewater | 13 | <1% | 184 | <1% |
| Waste Generation | 2,363 | 1% | 3,157 | 1% |
| Employee Commute | 9,237 | 4% | 7,257 | 3% |
| **Scope 3 Construction** | **12,081** | **5%** | **12,081** | **5%** |
| Construction Emissions | 12,081 | 5% | 12,081 | 5% |
| **Total Emissions** | **258,419** | **100%** | **226,036** | **100%** |

Numbers may not sum due to rounding

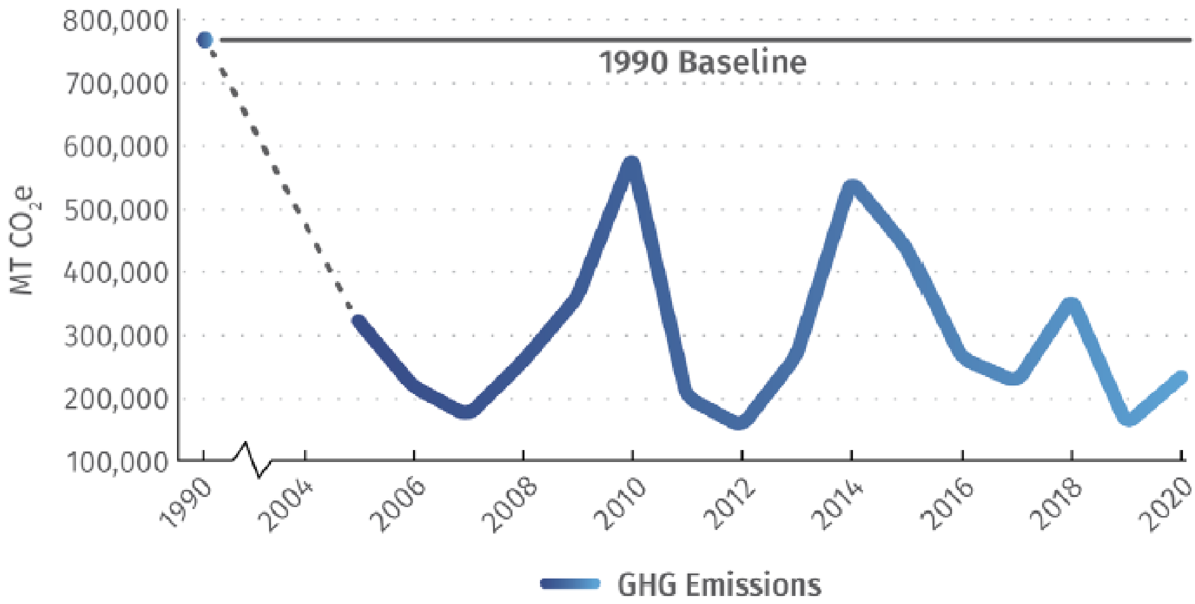
MT = metric tons

$CO_2e$ = carbon dioxide equivalent

T&D = transmission and distribution

Metropolitan's GHG emissions have steadily decreased compared to 1990 levels even during periods of GHG emissions spikes caused by increased pumping along the Colorado River Aqueduct (CRA) between 2010 and 2014. Emissions in 2017 were 71 percent lower than 1990 emission levels. Figure 2 presents the annual operational emissions for every year Metropolitan has reported emissions to TCR as well as estimated emissions for 1990. Emissions are reported as metric tons (MT) of carbon dioxide equivalents ($CO_2e$) per standard practice and using the global warming potential (GWP) presented in the Intergovernmental Panel on Climate Change (1995) Second Assessment Report to maintain consistency with State regulations. Future inventories may update these GWPs to maintain consistency with State methodologies. Inventory results highlighted in Figure 2 and Table 2 shows Metropolitan emissions have decreased from approximately 772,000 MT of $CO_2e$ in 1990 to approximately 226,000 MT of $CO_2e$ in 2017.

### Figure 2 GHG Emissions 1990 through 2020




### Table 2 Inventory Results 1990 and 2005 Through 2017

| Year | Scope 1 & 2 (MT $CO_2e$) | Scope 3 (MT $CO_2e$) | Scope 3 Construction (MT $CO_2e$) | Total Emissions (MT $CO_2e$) |
|---|---|---|---|---|
| 1990 | 748,326 | 11,106 | 12,081 | 771,514 |
| 2005 | 300,036 | 11,106 | 12,081 | 323,224 |
| 2006 | 196,167 | 11,106 | 12,081 | 219,355 |
| 2007 | 149,580 | 11,106 | 12,081 | 172,768 |
| 2008 | 234,724 | 11,614 | 12,081 | 258,419 |
| 2009 | 337,269 | 11,106 | 12,081 | 360,457 |
| 2010 | 559,764 | 11,106 | 12,081 | 582,952 |
| 2011 | 179,187 | 11,106 | 12,081 | 202,374 |
| 2012 | 132,449 | 11,106 | 12,081 | 155,637 |
| 2013 | 244,164 | 11,106 | 12,081 | 267,352 |
| 2014 | 522,643 | 11,106 | 12,081 | 545,830 |
| 2015 | 417,213 | 11,106 | 12,081 | 440,400 |
| 2016 | 240,233 | 11,106 | 12,081 | 263,420 |
| 2017 | 203,356 | 10,599 | 12,081 | 226,036 |
| 2018 | 335,099 | 11,106 | 12,081 | 358,287 |
| 2019 | 136,012 | 11,106 | 12,081 | 159,200 |
| 2020 | 211,141 | 11,106 | 12,081 | 234,329 |

Numbers may not sum due to rounding

MT = metric tons

$CO_2e$ = carbon dioxide equivalent

## GHG Emissions Forecast

The GHG inventories provide an accurate depiction of Metropolitan emission trends over time. Because annual emissions change over time due to external factors such as hydrology, climate, population growth, operational changes, and construction projects, Metropolitan also developed an emissions forecast that estimates GHG emissions between 2017 and 2045.[4] The forecast is used to assist Metropolitan in setting targets that are consistent with State-level goals by means of a gap analysis between the forecasted emissions and the reductions targets. Because GHG emissions associated with Metropolitan operations are heavily impacted by water demand and water source, three scenarios were modeled for Metropolitan's forecast. Each of the three scenarios are based on Metropolitan's 2020 Urban Water Management Plan water demand forecast. The three scenarios are intended to capture the full range of possible future emissions. The scenarios account for a high emission scenario where there are multiple-dry years and high operational emissions; an average emission scenario which assumes a single dry year demand level and average operational emissions; and a low emission scenario associated with an average demand year and low operational emissions.

The forecast presented here has been further adjusted to incorporate State and federal programs which are currently codified and are expected to continue being implemented through 2045. However, to be conservative only SB 100 (100% carbon free electricity by 2045) was applied to the forecast. Other State and federal programs may support Metropolitan's GHG emission reductions in the future, but they were not quantified as part of this forecast. In addition, emissions resulting from the construction and operation of the proposed Regional Recycled Water Plant (RRWP) were also included in each of the GHG emission forecasts. Calculating the difference between the adjusted GHG emissions forecast and the reduction targets set by Metropolitan determines the gap to be closed through Metropolitan's CAP policies. Figure 3 presents the projected emissions for Metropolitan through 2045 associated with the three different forecast scenarios (high, average, low). Table 3 includes a comparison of the projected emissions for each scenario in each target year (2030 and 2045) compared to the 1990 emissions baseline. The full methodology used to derive these results are provided in Section 4 of this appendix.

[4] 2018, 2019, and 2020 emissions inventories were received after completion of the forecast and therefore, not used to develop Metropolitan's GHG emissions forecast. However, they have been accounted for in the carbon budget. However, the forecasts are based on the 2020 UWMP which was updated in 2021.

**Figure 3 Adjusted Emissions Forecast 1990-2045**

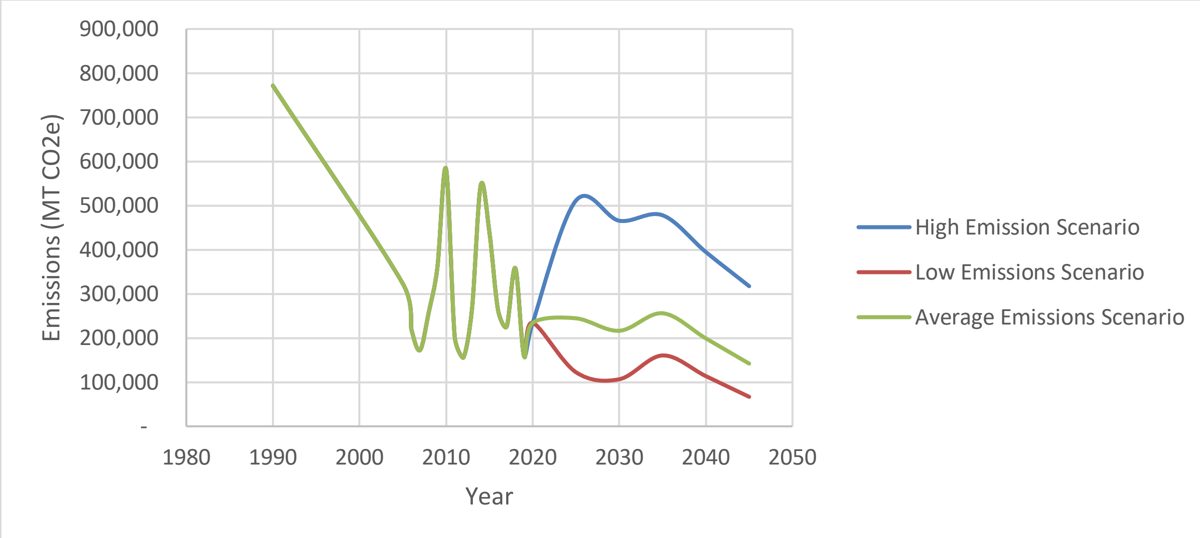



**Table 3 Expected Percent Reduction from 1990 by 2030 and 2045**

| Emissions Scenario | 1990 Emissions | 2030 Forecast Emissions | Percent Reduction | 2045 Forecast Emissions | Percent Reduction |
|---|---|---|---|---|---|
| High | 771,514 | 465,664 | 40% | 317,441 | 59% |
| Average | 771,514 | 216,460 | 72% | 142,059 | 82% |
| Low | 771,514 | 106,615 | 86% | 66,812 | 91% |

## 1.2 Background

In response to climate change the State of California has enacted several cornerstone GHG reduction legislations. The primary legislative drivers for climate action in California are included below and a full list is included in Appendix A.

- **Executive Order S-3-05,** signed by former Governor Schwarzenegger in 2005, establishes statewide GHG emissions reduction goals to achieve long-term climate stabilization as follows: by 2020, reduce GHG emissions to 1990 levels and by 2050, reduce GHG emissions to 80 percent below 1990 levels. The 2050 goal was accelerated by the 2045 carbon neutral goal established by EO B-55-18, as discussed below.[5]
- **Assembly Bill 32,** known as the Global Warming Solutions Act of 2006, requires California's GHG emissions be reduced to 1990 levels by the year 2020 (approximately a 15 percent reduction from 2005 to 2008 levels). The AB 32 Climate Change Scoping Plan, published in 2008, identifies mandatory and voluntary measures to achieve the statewide 2020 emissions limit, and encourages local governments to reduce municipal and community GHG emissions proportionate with State goals.[6]

[5] Executive Orders are binding only unto State agencies. Accordingly, EO S-03-05 will guide State agencies' efforts to control and regulate GHG emissions but will have no direct binding effect on local government or private actions.

[6] Specifically, the AB 32 Climate Change Scoping Plan states CARB, "encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State commitment to reduce GHG emissions by approximately 15 percent from current levels by 2020" (p. 27). "Current" as it pertains to the AB 32 Climate Change Scoping Plan is commonly understood as between 2005 and 2008.

- **Senate Bill 32,** signed by former Governor Brown in 2016, establishes a statewide mid-term GHG reduction goal of 40 percent below 1990 levels by 2030. California Air Resources Board (CARB) formally adopted an updated Climate Change Scoping Plan in December 2017, laying the roadmap to achieve 2030 goals and giving guidance to achieve substantial progress toward 2050 State goals.
- **Executive Order B-55-18,** signed by former Governor Brown in 2018, expanded upon EO S-3-05 by creating a statewide GHG goal of carbon neutrality by 2045. EO S-55-18 identifies CARB as the lead agency to develop a framework for implementation and progress tracking toward this goal in the next Climate Change Scoping Plan Update.

The State of California, via CARB, has issued several guidance documents establishing GHG emissions reduction targets in order for local climate action plans to comply with legislated GHG emissions reductions goals and CEQA Guidelines Section 15183.5(b). In the first *Climate Change Scoping Plan,*[7] CARB encouraged local governments to adopt a reduction target for community emissions paralleling the State commitment to reduce GHG emissions. In 2016, the State adopted SB 32 mandating a reduction of GHG emissions by 40 percent from 1990 levels by 2030 and in 2017 CARB published *California's 2017 Climate Change Scoping Plan* (hereafter referred to as the Scoping Plan Update) outlining the strategies the State will employ to reach these targets.[8] With the release of the Scoping Plan Update, CARB recognized the need to balance population growth with emissions reductions and in doing so, provided a new methodology for proving consistency with State GHG reduction goals through the use of per capita efficiency targets. These targets are generated by dividing a jurisdiction's GHG emissions for each horizon year by the jurisdiction's total population for that target year and are discussed further in the Forecast Section.

## 1.3 Greenhouse Gases

Scope 1 emissions are defined as direct anthropogenic GHG emissions generated from sources that are owned or directly controlled by the reporting organization. Scope 2 refers to GHG emissions that are indirectly generated due to the consumption of purchased electricity, steam, heating, or cooling. Scope 3 refers to all other indirect emissions not covered under Scope 2 that are associated with sources that are not directly owned or controlled by the reporting organization but are fundamental to the organization's operation. A visualization of each Scope category is provided in Figure 4, *Example Emissions by Scope*.

Metropolitan has reported operational GHG emissions to TCR annually since 2005. For each year, Scope 1 and 2 emissions are calculated using operational activity data. Additionally, Rincon completed a Scope 3 analysis for data years 2008 and 2017 using methodologies described in the Local Government Protocol.[9] These two years were chosen for an in-depth analysis due to guidance from the AB 32 Scoping Plan which suggests using GHG emissions from 2005-2008 to back cast to 1990 since most jurisdictions do not have a GHG inventory for 1990.

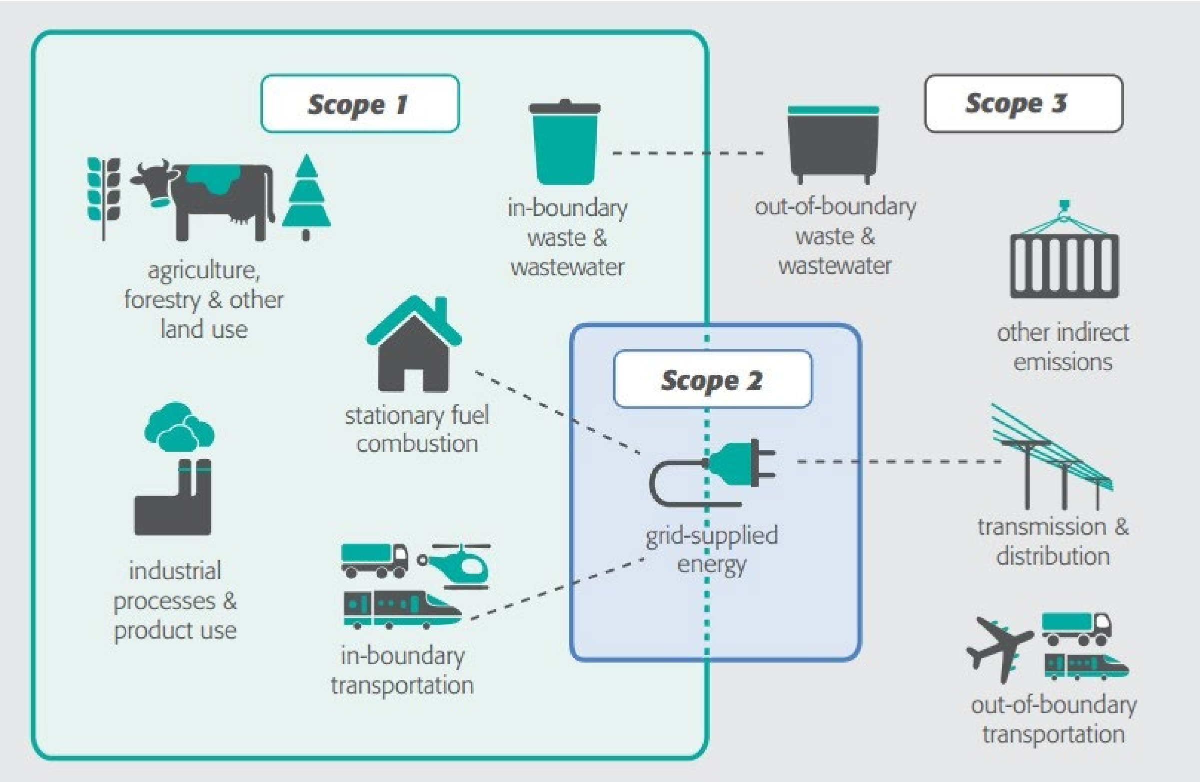
[7] California Air Resources Board. 2008. Climate Change Scoping Plan. Accessed at: https://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. Accessed on: June 20, 2019

[8] California Air Resources Board. California's 2017 Climate Change Scoping Plan. Accessed at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf. Accessed on: June 20, 2019

[9] ICLEI. 2010. Local Government Operations Protocol *For the quantification and reporting of greenhouse gas emissions inventories*, Version 1.1

Emissions were calculated using the principles and methods from the Local Government Protocol[10] and 2017 Scoping Plan Update.[11] Emissions from nitrous oxide ($N_2O$), methane ($CH_4$), and carbon dioxide ($CO_2$) are included in this assessment. Each GHG has a different capability of trapping heat in the atmosphere, known as its GWP, which is normalized relative to $CO_2$ and expressed as carbon dioxide equivalent, or $CO_2e$. The $CO_2e$ values for these gases are derived from the Second Assessment of the Intergovernmental Panel on Climate Change GWP values for consistency with the yearly GHG inventory reported to TCR by Metropolitan, as shown in Figure 4.[12]

**Figure 4 Example Emissions by Scope[13]**




10 ICLEI. 2010. Local Government Operations Protocol *For the quantification and reporting of greenhouse gas emissions inventories*, Version 1.1

11 California Air Resources Board. 2017. California's Climate Change Scoping Plan.

12 Intergovernmental Panel on Climate Change. 1995. Second Assessment Report: Climate Change. Direct Global Warming Potentials.

13 Figure obtained from the Cambridge Community Development Department website: https://www.cambridgema.gov/CDD/climateandenergy/greenhousegasemissions. This figure is provided for illustrative purposes only and may not directly correspond to operations at Metropolitan.

**Table 4 Global Warming Potentials of Greenhouse Gases**

| Greenhouse Gas | Molecular Formula | Global Warming Potential ($CO_2e$) |
|---|---|---|
| Carbon Dioxide | $CO_2$ | 1 |
| Methane | $CH_4$ | 21 |
| Nitrous Oxide | $N_2O$ | 310 |
| Sulfuric hexafluoride | $SF_6$ | 23,900 |
| Hydrofluorocarbons (HFCs) | R-134a | 1,300 |
| Hydrofluorocarbons (HFCs) | R-1410a | 1,725 |

$CO_2e$: carbon dioxide equivalent

# 1.4 Excluded Emissions

The following emissions are excluded from the inventory and emissions forecast.

## Consumption-based Emissions

Currently, no widely accepted standard methodology for reporting consumption-based inventories exists. Therefore, GHG emissions from consumed goods used by Metropolitan facilities are excluded from the inventory and forecast of Metropolitan emissions.

## Natural and Working Lands

GHG emissions from carbon sinks and sources in natural and working lands are not included in this inventory and forecast due to the lack of granular data and standardized methodology. Forestry and other land emissions potentially associated with Metropolitan's properties were also excluded, due to limited availability of appropriate data and lack of standardized methods for quantifying such emissions. The sequestration potential of Metropolitan lands may be evaluated during the GHG reduction measure development process.

## Agricultural Emissions

Emissions from agricultural activities are not relevant to Metropolitan operations and therefore, are not included in the inventory.

## State Water Project Emissions

The State Water Project (SWP) is a water storage and delivery system that extends more than 705 miles from northern to southern California. This system is owned and operated by the Department of Water Resources (DWR) and provides water to urban and industrial water users In the San Francisco Bay Area and Southern California, and agricultural users in the Central Valley. As a State Water Contractor, Metropolitan has a set maximum allocation of this water that can be distributed to its member agencies. However actual annual deliveries could be reduced based on a number of factors including regulatory restrictions, water supply imbalances, monthly snowpack and runoff, water quality, and health and safety issues. Metropolitan has no control or direct influence over DWR operations or the SWP.

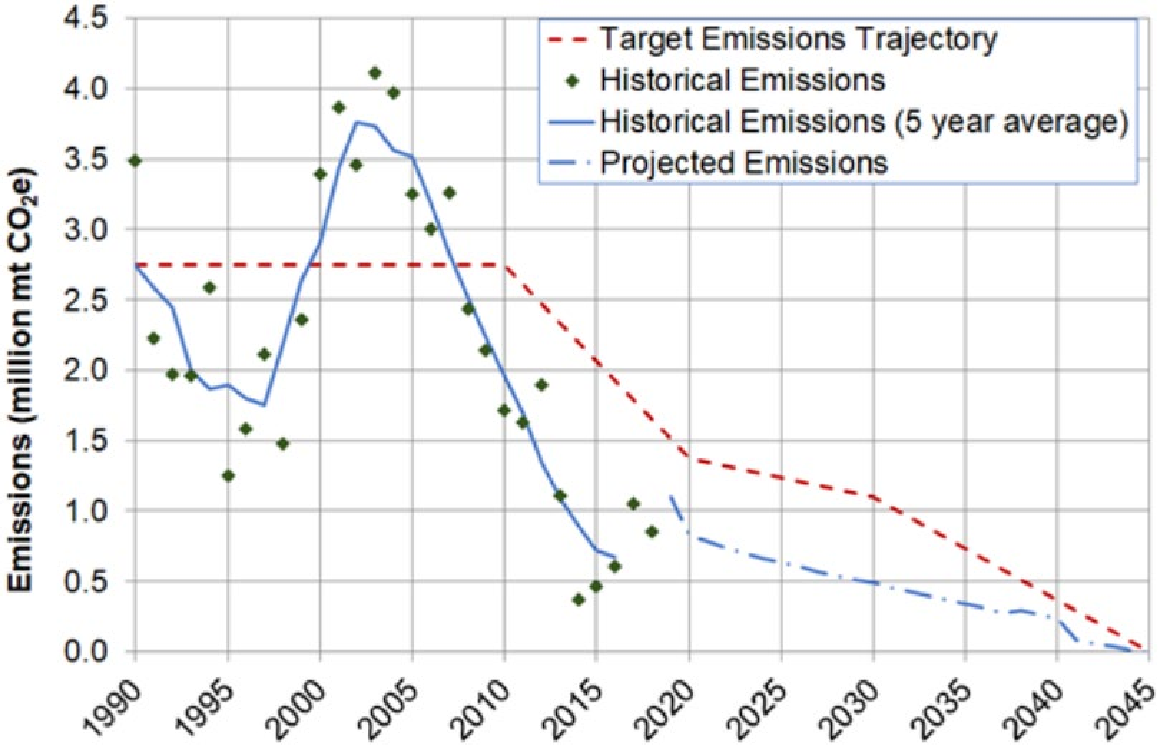
Pursuant to the Climate Registry General Reporting Protocol (2019), Metropolitan used Operational Control to define the boundaries of the GHG Inventory. TCR defines Operational Control as:

**Operational Control**: Reflects the activities where the organization or its subsidiaries has the full authority to introduce and implement operating policies. The organization that holds the operating license for an activity typically has operational control.[14]

Metropolitan's GHG inventory includes sources within each sector that are under its operational control, in accordance with established GHG accounting protocols and state guidance. SWP water, and its associated emissions, were assumed to remain outside of Metropolitan's operational boundary until the water enters Metropolitan-controlled facilities. Thus, upstream emissions associated with the SWP are not included in the Metropolitan CAP.

Upstream emissions associated with the SWP are covered in the DWR's own CAP. Since 2005 the SWP emissions have decreased significantly, exceeding the GHG emissions reduction targets set by DWR as shown in Figure 5. The DWR CAP GHG reduction targets align with Metropolitan's CAP and both seek to achieve carbon neutrality by 2045. Therefore, while not addressed in Metropolitan's CAP, SWP emissions are actively being managed and reduced in accordance with State targets. Through continued collaboration, Metropolitan and DWR will work to decarbonize a significant portion of California's water infrastructure.

**Figure 5 State Water Project Historic Emissions and Targets**




[14] General Reporting Protocol V3, The Climate Registry, May 2019.

## 1.5 Target Years

The emissions forecast is based upon the latest available operational data from Metropolitan including Scope 1 and 2 emissions reported annual to TCR and the average annual Scope 3 emissions estimated as described in this appendix. This forecast uses benchmark years of 2025, 2030, 2035, 2040, and 2045, consistent with currently codified GHG reduction targets or executive orders which are expected to be codified in future, and a target of carbon neutrality on or before 2045.

The forecast years align with the following targets:

- 2030 (SB 32)
- 2045 (EO B-55-18)

The 2030 target is required for consistency with SB 32, while the remainder of the targets (i.e., 2025, 2035, 2040) identify a clear path and milestones of progress toward the long-term State reduction goals.

# 2 Previous GHG Inventories

Metropolitan has reported operational GHG emissions to TCR annually for the years 2005-2017. Emissions reported to the TCR were calculated by Metropolitan using operational activity data and only include Scope 1 and Scope 2 emissions.[15] Scope 1 emissions include direct fuel combustion within Metropolitan's operational control including emissions from propane, natural gas, and welding gasses. Mobile combustion of gasoline and diesel from Metropolitan fleet vehicles and fugitive emissions were also included in Scope 1. Scope 2 emissions include the indirect GHG emissions associated with the purchase and consumption of electricity as well as transmission and distribution (T&D) losses associated with transmission lines.

Metropolitan provided Rincon with operational data and the internal emission calculations that were reported to TCR for all years between 2005 and 2020. Additionally, Metropolitan provided estimations for 1990 emissions. A summary of previous GHG emissions inventories reported to TCR for these years can be found in Table 5. Metropolitan methodologies used to calculate Scope 1 and Scope 2 emissions are summarized in the following sections.

**Table 5 Metropolitan GHG Inventories Summary**

| Year | Scope 1 & 2 (MT $CO_2e$) | Scope 3 (MT $CO_2e$) | Scope 3 Construction (MT $CO_2e$) | Total Emissions (MT $CO_2e$) |
|---|---|---|---|---|
| 1990 | 748,326 | 11,106 | 12,081 | 771,514 |
| 2005 | 300,036 | 11,106 | 12,081 | 323,224 |
| 2006 | 196,167 | 11,106 | 12,081 | 219,355 |
| 2007 | 149,580 | 11,106 | 12,081 | 172,768 |
| 2008 | 234,724 | 11,614 | 12,081 | 258,419 |
| 2009 | 337,269 | 11,106 | 12,081 | 360,457 |
| 2010 | 559,764 | 11,106 | 12,081 | 582,952 |
| 2011 | 179,187 | 11,106 | 12,081 | 202,374 |
| 2012 | 132,449 | 11,106 | 12,081 | 155,637 |
| 2013 | 244,164 | 11,106 | 12,081 | 267,352 |
| 2014 | 522,643 | 11,106 | 12,081 | 545,830 |
| 2015 | 417,213 | 11,106 | 12,081 | 440,400 |
| 2016 | 240,233 | 11,106 | 12,081 | 263,420 |
| 2017 | 203,356 | 10,599 | 12,081 | 226,036 |
| 2018 | 335,099 | 11,106 | 12,081 | 358,287 |
| 2019 | 136,012 | 11,106 | 12,081 | 159,200 |
| 2020 | 211,141 | 11,106 | 12,081 | 234,329 |

Numbers may not sum due to rounding

MT = metric tons

$CO_2e$ = carbon dioxide equivalent

[15] 2017 was the most recent GHG inventory available at time of this report.

## 2.1 1990 Baseline

The State of California uses 1990 as a reference year to remain consistent with AB 32 and SB 32, which codified the State's 2020 and 2030 GHG emissions targets by directing CARB to reduce statewide emissions to 1990 levels by 2020 and 40 percent below 1990 levels by 2030.

Metropolitan has reported estimated emissions for 1990 to TCR that include Scope 1 and Scope 2 emissions. The 1990 emissions were calculated using available 1990 activity data; when 1990 activity data was not available, activity data from 2006 was used as a proxy for operational activity in 1990. Energy consumption data, including electricity, natural gas and propane usage from 1990 was only available for the Treatment and Pumping plant facilities which represent over 90% of annual electricity consumption. Energy consumption data for all other facilities from 2006 was used as a proxy for 1990 energy related emissions.

Electricity emissions account for a vast majority of Metropolitan's overall emissions. Electricity emission factors from 2004 were used to estimate 1990 emission levels due to 1990 emission factors for electricity not being available. This is assumed to be a conservative estimate since estimated emission factors for 1990 have been calculated to be higher than the emission factors used in this study. For example, *Estimating Carbon Dioxide Emissions Factors for the California Electric Power Sector* (August 2002) conducted by Lawrence Berkeley Labs calculated an emission factor of 0.488 MT $CO_2$e per megawatt hour (MWh) for Southern California Edison power[16] while the 2004 emission factor used for the 1990 baseline is 0.333 MT $CO_2$e per MWh. Using a lower emission factor in 1990 is considered more conservative since it increases the reduction required to be consistent with State targets in 2030. A portion of Metropolitan's GHG emissions were also due to direct purchases from the Salt River Project Navajo Generating Station[17], a coal fired power plant. Metropolitan utilized an estimated emission factor of 1.04 MT $CO_2$e per MWh for electricity from this source. The remaining electricity was hydro power generated by Hoover and Parker Dams, which is assumed to be carbon free.

Mobile emissions were estimated based on mobile fuel consumption in 2006. Emission factors for gasoline use in vehicles of model year 1994-1999 was applied to mobile fuel consumption of gasoline to estimate 1990 mobile emissions. Metropolitan estimated emissions from Scope 1 and Scope 2 sources in 1990 to total 748,326 MT $CO_2$e.

In order to improve consistency and allow for comparison between 1990 and current inventories, historical Scope 3 emissions from waste, water use at Metropolitan facilities, and employee commute were estimated based on the average Scope 3 emissions for 2008 and 2017. Construction emissions for 1990 were assumed to be 12,081 MT $CO_2$e (annual average applied to all inventory years). This is assumed to be a conservative estimate of actual construction activities based on CIP budgets analyzed as part of the project. For more information see Section 3.2.

[16] This emission factor was calculated based on data in Table 25 of *Estimating carbon dioxide emissions factors for the California electric power sector*. SCE emissions were calculated as 0.132 kg C/kWh. To convert between kg C and kg $CO_2$e the following equation was used. 0.133 kg C/kWh * (44.0g CO2 / 12.0g C) = 0.488 kg CO2/kWh = 0.488 metric tons $CO_2$e/MWh.

[17] https://www.srpnet.com/about/stations/ngs/default.aspx

**Table 6 1990 Emissions Summary**

| Source | Total Emissions (MT of $CO_2e$) |
|---|---|
| **Scope 1** | **8,482** |
| Mobile Emissions | 7,400 |
| Stationary Emissions | 1,082 |
| **Scope 2** | **739,845** |
| Electricity | 739,845 |
| **Scope 3** | **23,187** |
| Water Use | 99 |
| Waste | 2,760 |
| Employee Commute | 8,247 |
| Construction | 12,081 |
| **Total** | **771,514** |

*Numbers may not sum due to rounding

## 2.2 2005-2017 Inventory Methodology

Metropolitan is a regional water district that operates an aqueduct, pumping plants, treatment plants, a 230kV transmission line system, and a distribution system that includes reservoirs, hydroelectric power plants, pressure control structures, and valve structures. Metropolitan reports GHG emissions data to the CARB under the Mandatory Reporting of Greenhouse Gas Emissions as an Electric Power Entity-Marketer. The data used by the Cap-and-Trade Program is included in California's Greenhouse Gas Inventory.

In addition to reporting GHG emissions for the Cap-and-Trade Program, Metropolitan has voluntarily reported GHG emissions through the California Climate Action Registry starting in 2007 (which included 2005 and 2006 calendar year data) and then through TCR starting in 2010.[18] Metropolitan reports annual emissions of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluorides. Data is obtained from a mix of sources including utilities and applicable Metropolitan organizational units. Emission factors obtained from TCR, CARB or the United States Environmental Protection Agency (EPA) are applied to operational activity data to calculated annual GHG emissions in a Metropolitan Excel workbook. Data from the workbooks are reviewed and verified prior to entry into the CARB and TCR online reporting tools. Reports are verified by approved third-party verification bodies. The following sections summarize activity data sources and methodology used by Metropolitan for emission calculations. It should be noted that GHG emissions reported to TCR and discussed below do not include Scope 3 emissions, which were calculated for the first time as part of this project.

### Electricity

Metropolitan electricity use includes both wholesale power purchases and retail energy. Wholesale power used for pumping requirements of the CRA are mainly provided by the Hoover and Parker Hydroelectric Power Plants, though this is often supplemented by grid mix from the CAMX or AZNM

[18] California Climate Action Registry transitioned all emissions reporting to the TCR in 2010.

electricity grids[19]. Monthly transaction data from wholesale power sources is compiled into monthly reports by an internal working group (Power Resources Unit). Metropolitan calculates its own blended emission factor for wholesale electricity based on all the power sources acquired for the CRA. Retail electricity is based on actual consumption data provided by individual utilities and utilities bills. Emission factors for retail electricity is obtained from TCR public reports or eGRID data and is based on the specific entity's power mix.

### Fuel Use

Metropolitan uses propane, welding gas, natural gas and various transportation fuels for its fleet. Annual consumption of propane is provided by individual facilities and is tracked by the Metropolitan Fleet Unit. Welding gas is purchased by the Metropolitan Manufacturing Services Unit. Natural gas usage at facilities is obtained through utility billing from Southern California Gas company. Metropolitan's fleet uses gasoline, diesel, compressed natural gas, and aviation fuel. Fuel use is recorded internally by the Fleet Unit and reported quarterly using the WARD System. TCR's "Default Emission Factors" published each year are used to calculate emission for each fuel type.

### Non-$CO_2$ Emissions

Sulfur hexafluoride (SF6) usage is tracked and accounted for through Maximo and is based on changes in inventory, purchases, disbursements, and changes in nameplate capacity of equipment. The EPA mass balance method is used to estimate sulfur hexafluoride emissions from circuit breakers.

Hydrofluorocarbons (HFCs) used in Metropolitan's cooling system are accounted for using TCR's recommended methodology for estimating emissions from refrigeration and air conditioning equipment.

## 2.3 Inventory GHG Data Sources

The data used to complete this inventory and forecast came from multiple sources, as summarized in Table 7. As previously discussed, Scope 1 and 2 data and calculations were provided by Metropolitan and reported to TCR. Scope 3 emissions were calculated using data supplied by Metropolitan.

[19] CAMX and AZNM are subregions of the electricity grid that cover California and Arizona/New Mexico respectively (with some overlap). https://www.epa.gov/sites/production/files/2015-10/documents/egrid2012_summarytables_0.pdf

## Table 7 Inventory and Forecast Data Sources

| Sector | Activity Data | Unit | Source |
|---|---|---|---|
| **Scope 1 and Scope 2** | | | |
| Energy | Electricity Usage | MWh | Metropolitan TCR Reports |
| | T&D Losses | MWh | Metropolitan TCR Reports |
| | Stationary Combustion (fuel) | MMBtu | Metropolitan TCR Reports |
| Mobile Combustion | Annual fuel consumption (gasoline, diesel, jet fuel, aviation gasoline, CNG) | gallons | Metropolitan TCR Reports |
| Fugitive Emissions | SF6 use<br>HFCs use | pounds | Metropolitan TCR Reports |
| **Scope 3** | | | |
| Employee Commute | VMT by Transport Mode | VMT | Metropolitan Employee Commute Survey/VanPool Ridership |
| Water/Wastewater | Water Usage | HCF | Utility invoices |
| Solid Waste | Waste Generated | Cubic Yards | Utility invoices |
| Construction | Construction | N/A | CEQA documentation/CalEEMod/CIP |
| **Forecast Growth Indicators** | | | |
| Operational Growth | Water Deliveries | Acre Feet | 2015 Urban Water Management Plan |
| Electricity Emissions | Renewable Portfolio Standard | Percent | Renewable Portfolio Standard; Senate Bill 100 |

Numbers may not sum due to rounding

MWh: megawatt hours; T&D: transmission and distribution; MMBtu: one million British thermal unit; VMT: vehicle miles traveled; HCF: hundred cubic feet; CIP: Capital Investment Plan; CEQA: California Environmental Quality Act

# 3 Inventory

Metropolitan used operational activity data to calculate Scope 1 and Scope 2 emissions for years 2005 through 2017, as summarized in Section 2. However, no Scope 3 data was collected for these reports. Therefore, to bring Metropolitan's GHG inventories into consistency with applicable CAP guidelines, Scope 3 data for 2008 and 2017 was calculated and used to estimate Scope 3 emissions in all other interim years including 1990. The average of the Scope 3 emissions from 2008 and 2017 was then applied to all interim years for consistency. Though Scope 1 and 2 data was available for 2005, 2008 was used because it was the earliest year for which complete Scope 3 emissions data was available. Each of the in-depth inventory years were chosen for specific reasons. The 2008 data year was chosen due to the availability of Scope 3 data as well as its consistency with state protocols for baseline years which can be backcast. The 2017 data year was chosen because, at the time of the inventory preparation, it was the most recent year for which all data was available while also providing a clear picture of current Metropolitan emissions.

## 3.1 Scope 1 and 2

The methodologies, data sources, calculations, and results associated with the 2008 and 2017 GHG inventory update are included in this section. Information regarding data sources used by Metropolitan to calculate Scope 1 and Scope 2 emissions for the 2008 and 2017 inventories are located in Section 2.2 of this technical appendix. The following sections summarize the activity data, emission factors, and absolute emissions reported by Metropolitan for 2008 and 2017. This includes emissions from direct fuel combustion at Metropolitan facilities, mobile combustion of gasoline and diesel from Metropolitan fleet vehicles, non-$CO_2$ fugitive emissions, and indirect GHG emissions associated with the purchase and consumption of electricity. Table 8 and Table 9 summarize the activity data, emission factors and total emissions reported by Metropolitan for Scope 1 and 2 emissions in 2008 and 2017, respectively.

**Table 8 Scope 1 and 2 Emissions by Category for Year 2008**

| Source | Activity Data | Emission Factor | Total Emissions (MT of $CO_2e$) |
|---|---|---|---|
| **Energy** | | | **227,544** |
| Electricity | 1,835,580 MWh | 0.1221 MT $CO_2e$/MWh | 224,105 |
| Electricity T&D Loss | 26,593 MWh | 0.0957 MT $CO_2e$/MWh | 2,546 |
| Natural Gas | 16,308 MMBtu | 0.0532 MT $CO_2e$/MMBtu | 868 |
| Propane | 401 MMBtu | 0.0631 MT $CO_2e$/MMBtu | 25 |
| **Mobile** | | | **7,180** |
| Gasoline (unleaded) | 663,738 gallons | 0.0092 MT $CO_2e$/gallon | 6,076 |
| Diesel | 108,644 gallons | 0.0017 MT $CO_2e$/gallon | 1,104 |
| **Non-$CO_2$ Fugitive Emissions** | | | **0** |
| SF6 | 0 lbs | N/A | 0 |
| **Total** | | | **234,724** |

MWh: megawatt hours; MMBtu: one million British Thermal Units; MT $CO_2e$: metric tons of carbon dioxide equivalent; SF6: sulfur hexafluoride; lbs: pounds; N/A: not applicable

Numbers may not sum due to rounding

**Table 9 Scope 1 and 2 Emissions by Category for Year 2017**

| Source | Activity Data | Emission Factor | Total Emissions (MT of $CO_2e$) |
|---|---|---|---|
| **Energy** | | | **196,398** |
| Electricity | 1,381,602 MWh | 0.1393 MT $CO_2e$/MWh[2] | 192,511 |
| Electricity T&D Loss | 14,687 MWh | 0.1341 MT $CO_2e$/MWh | 1,969 |
| Natural Gas | 21,360 MMBtu | 0.0532 MT $CO_2e$/MMBtu | 1,136 |
| Propane | 317 MMBtu | 0.0621 MT $CO_2e$/MMBtu | 20 |
| Diesel | 10,244 MMBtu | 0.0744 MT $CO_2e$/MMBtu | 762 |
| **Mobile** | | | **6,886** |
| Gasoline (unleaded) | 637,079 gallons | 0.0089 MT $CO_2e$/gallon | 5,673 |
| Diesel | 89,866 gallons | 0.0104 MT $CO_2e$/gallon | 931 |
| Aviation Gasoline | 10,237 gallons | 0.0085 MT $CO_2e$/gallon | 87 |
| Jet Fuel | 16,171 gallons | 0.0098 MT $CO_2e$/gallon | 159 |
| CNG | 5,525 gallons | 0.0066 MT $CO_2e$/gallon | 36 |
| **Non-$CO_2$ Fugitive Emissions[1]** | | | **72** |
| SF6 | 2 pounds | N/A | 24 |
| HFC | 66 pounds | N/A | 47 |
| **Total** | | | **203,356** |

Numbers may not sum due to rounding

MWh: megawatt hours; MMBtu: one million British Thermal Units; MT $CO_2e$: metric tons of carbon dioxide equivalent; CNG: compressed natural gas; SF6: sulfur hexafluoride; HFC: Hydrofluorocarbons; N/A: not applicable

[1] Fugitive emissions are estimated using a mass balance approach and are directly converted from the mass of gaseous emissions to $CO_2e$ using the appropriate GWP factor.

[2] This emission factor represents a weighted average of multiple emission factors specific to each source of electricity used by Metropolitan including but not limited to SCE, LADWP, CAMX, AZNM, and Hoover and Parker Hydroelectric Plants

## Energy

The energy sector includes GHG emissions resulting from the consumption of electricity, natural gas, propane, and welding gases at Metropolitan facilities. The following subsections describe the data sources, emission factors and calculation methodologies associated with energy sources.

### *Electricity*

Emissions resulting from electricity consumption were estimated by multiplying annual electricity consumption by an electricity emission factor representing the average emissions associated with generation of 1 MWh of electricity. Metropolitan receives wholesale and retail electricity from numerous providers. In 2008, Metropolitan used electricity provider specific emission factors obtained from TCR public reports or 2007 eGRID data when provider specific emission factors were not available. Metropolitan developed a blended emission factor that is weighted based on the amount of electricity received by the power source for wholesale electricity used for CRA pumping. In 2017 Metropolitan applied the WECC California average emission factor from the EPA's 2016 eGRid data for electricity purchased from retail providers. To calculate emissions from electricity, the total electricity use reported by Metropolitan was multiplied by the carbon intensity factor to determine MT $CO_2e$. Metropolitan reports and calculates emissions for electricity use at Metropolitan facilities and for T&D losses associated with Metropolitan transmission lines.

Electricity associated with water use and wastewater generation by employees at Metropolitan facilities is not included under this section and is discussed in the water and wastewater section. As shown in Table 8 and Table 9, a total of 226,652 MT $CO_2$eand 194,481 MT $CO_2$e were generated due to electricity use, including T&D losses by Metropolitan facilities in 2008 and 2017, respectively.

### *Stationary Fuel Combustion*

In order to calculate emissions from stationary sources at Metropolitan facilities, the total fuel consumption in MMBtus was multiplied by the fuel specific default emission factors provided by TCR. Fuel consumption reported by Metropolitan for 2008 and 2017 is provided in Table 8 and Table 9 along with the associated fuel specific emission factors. A total of 893 MT $CO_2$e and 1,918 MT $CO_2$e were generated due to combustion of fuel by stationary sources at Metropolitan facilities in 2008 and 2017, respectively.

## Mobile Sources

Transportation emissions are generated by Metropolitan through on-road transportation, including passenger, commercial, and heavy machinery, and through aviation. Metropolitan records fleet fuel use by gallon by fuel type including unleaded gasoline, diesel, compressed natural gas, aviation gasoline, and jet fuel. Metropolitan applies TCR default emission factors for mobile fuel combustion to the annual fuel use. As shown in Table 8 and Table 9, a total of 7,180 MT $CO_2$e and 6,886 MT $CO_2$e were generated due to combustion of fuel by mobile sources at Metropolitan facilities in 2008 and 2017, respectively.

## Non-$CO_2$ Fugitive Emissions

Metropolitan tracks sulfur hexafluoride (SF6) usage based on changes in inventory, purchases, disbursements, and changes in nameplate capacity of equipment. The EPA mass balance method is used to estimated sulfur hexafluoride emissions from circuit breakers and other equipment used by utilities. Sulfur hexafluoride in pounds is converted to metric tons then multiplied by the GWP for sulfur hexafluoride to estimate $CO_2$e emissions. There were no sulfur hexafluoride emissions reported for 2008, however 24 MT $CO_2$e was generated from sulfur hexafluoride use in 2017 (Table 9)

Hydrofluorocarbons (HFCs) used in Metropolitan's cooling system are accounted for using TCR's recommended methodology for estimating emissions from refrigeration and air conditioning equipment. Metropolitan tracks various hydrofluorocarbons (e.g., R-410a, R-134a) through HVAC team field reports. Quantity per year of hydrofluorocarbons is estimated using the simplified mass balance approach as described by the EPA and TCR.[20] Each hydrofluorocarbon (e.g., R-410a, R-134a) is converted from pounds to metric tons and multiplied by the appropriate GWP from the IPCC's Second Assessment[12]. Hydrofluorocarbons were not tracked in 2008, however 47 MT $CO_2$e was generated due to use of 39 pounds of R-134a for fleet AC and 8 pounds of R-404a for HVAC systems.

[20] https://www.theclimateregistry.org/protocols/GRP-V3-Quantification-Methods.pdf

## 3.2 Scope 3

Scope 3 includes all other indirect GHG emissions including those resulting from employee commute, waste generation, water consumption (in Metropolitan-owned buildings), and construction related emissions. Scope 3 data collection and emissions calculations followed the methodologies outlined in the ICLEI-Local Government Operations Protocol.[21] Because Scope 3 data requires significant data collection efforts, Scope 3 emissions for employee commute, waste disposal, and water service were calculated for 2008 and 2017 only. These years represent the most recent and most historical years for which complete data was available. Scope 3 emissions were then averaged and applied to all other years to allow for a comparable estimate and accurate tracking via the carbon budget approach. The following sections summarize activity data sources and methodology used for emission calculations for each of the identified Scope 3 emission sources.

### Employee Commute

Emissions associated with employees commuting to work by their own personal vehicles, local transit, or company owned vehicles are classified as Scope 3 emissions. Based on an employee list provided by Metropolitan, there were 1,975 employees in 2008 and 1,796 employees in 2017. Rincon used a geographic information system (GIS) mapping exercise to estimate vehicle miles traveled for each employee based on the zip code and regular office location of each employee. It was assumed that all employees listed were full-time. Employee commute data was derived from the existing Metropolitan Employee Commute Survey and employee VanPool ridership data. The survey included the employee's mode of transport and the number of miles traveled one way to work. The commute survey results were used to scale the total VMT calculated using the zip code of each employee. Annual employee vehicle miles traveled (VMT) was calculated using the number of employees, workdays, and round-trip mileage traveled per day per employee. The number of workdays, 250, was estimated assuming full-time employees did not work on federal holidays and that full-time employees would take two weeks of vacation. Emissions factors from personal vehicle commutes, including those that drive alone and carpool, were derived from the EMFAC2017 model for Los Angeles County and were weighted based on the percent of fuel type used per class of vehicle. The Los Angeles County Metropolitan Transportation Authority emission factors were used to calculate emissions from alternative trips including bus and rail. [22,23] Emission factors are shown by passenger mile which take into account the shared emissions on mass transit or carpool and vanpooling scenarios.

Table 10 and Table 11 include the activity data, derived annual VMT, emission factors by passenger mile, and total emissions from employee commutes in 2008 and 2017, respectively. Employee commutes resulted in emissions of 9,237 MT $CO_2e$ and 7,257 MT $CO_2e$ in 2008 and 2017, respectively.

[21] ICLEI. 2010. ICELI- Local Government Operations Protocol. http://icleiusa.org/ghg-protocols/

[22] California Air Resources Board, https://www.arb.ca.gov/emfac/

[23] Metro's 2016 Energy and Resource Report, Metro (https://media.metro.net/projects_studies/sustainability/images/report_sustainability_energyandresource_2016.pdf)

### Table 10 Employee Commute Emissions for Year 2008

| Source | Number of Employees | Activity Data (annual VMT)[1] | Emission Factor (MT $CO_2e$/passenger mile) | Total Emissions (MT $CO_2e$) |
|---|---|---|---|---|
| Bike | 1 | 11,500 | 0 | 0 |
| Bus | 46 | 477,300 | 1.81E-3 | 87 |
| Carpool | 8 | 109,200 | 2.01E-3 | 22 |
| Drive Alone | 1,435 | 20,579,700 | 4.02E-3 | 8,264 |
| Train | 300 | 4,565,150 | 1.18E-3 | 538 |
| Vanpool | 185 | 3,126,950 | 1.04E-3 | 326 |
| **Total** | **1,975** | **28,869,800** | **3.20E-3** | **9,237** |

VMT: vehicle miles traveled; MT: metric tons; $CO_2e$: carbon dioxide equivalent

[1] Annual VMT calculated by scaling total VMT by the survey results

Numbers may not sum due to rounding

### Table 11 Employee Commute Emissions for Year 2017

| Source | Number of Employees | Activity Data (annual VMT) | Emission Factor (MT $CO_2e$/passenger mile) | Total Emissions (MT $CO_2e$) |
|---|---|---|---|---|
| Bike | 1 | 4,800 | 0 | 0 |
| Bus | 58 | 604,250 | 1.81E-3 | 110 |
| Carpool | 4 | 48,200 | 1.70E-3 | 8 |
| Drive Alone | 1,143 | 17,681,750 | 3.40E-3 | 6,018 |
| Train | 332 | 5,418,300 | 1.18E-3 | 639 |
| Vanpool | 258 | 4,621,360 | 1.04E-3 | 482 |
| **Total** | **1,796** | **28,378,660** | **2.56E-3** | **7,257** |

VMT: vehicle miles traveled; MT: metric tons; $CO_2e$: carbon dioxide equivalent

Numbers may not sum due to rounding

## Water and Wastewater Service

Metropolitan received water from 14 water providers in 2008 and 2017. Water usage data by facility was provided by Metropolitan and was derived from utility provider invoices. Water supplied to Metropolitan facilities contributes emissions through the use of energy to extract, convey, treat, and deliver water. The amount of energy required for facility water usage was calculated following Community Protocol Method WW.14[24], where the total emissions are equal to the energy used in each of the four phases above.

The wastewater generated by Metropolitan facilities also creates GHG emissions during the treatment processes, including process, stationary, and fugitive emissions. The sources and magnitude of emissions depend on the type of wastewater treatment plant and the treatment processes utilized. Wastewater generated by Metropolitan facilities is collected in local sewer lines and discharged to various regional wastewater treatment plants. Because Metropolitan does not have operational control over the wastewater treatment plants and the wastewater generated at Metropolitan facilities is distributed to numerous treatments plants, fugitive emissions were not

[24] U.S Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1, July 2013, https://static1.squarespace.com/static/5d1e51dd2a98da000183bc20/t/5db5c0f84f74010ee4dac41a/1572192509182/Appendix+F+-+Wastewater+and+Water+Emission+Activities+and+Sources+-+U.S.+Community+Protocol.pdf

calculated. In the absence of wastewater generated at Metropolitan facilities it was assumed wastewater volume was equivalent to water use volume. This is a conservative estimate because it assumes all water used in the building was then treated at the wastewater treatment facility, when any outdoor/irrigation water would not be treated.

The energy required for each segment of the water cycle, including wastewater treatment, was calculated using standardized energy intensity factors (kWh/million gallons) for a typical urban system in Southern California.[25] For recycled water use, the statewide average energy intensity factor was applied.[26] As previously described in Section 2.2 of this technical appendix, Metropolitan receives electricity from a number of retail and wholesale providers. Therefore, a blended electricity emission factor from Metropolitan's annual operations was used to calculate emissions associated with electricity embedded in water consumption. Metropolitan's energy emission factor of 269.16 pounds $CO_2e$/MWh and 307.19 pounds $CO_2e$/MWh was applied to the calculated electricity used for water and wastewater services in 2008 and 2017, respectively. Table 12 and Table 13 include the activity data, emission factors, and total emissions from water use and wastewater generation in 2008 and 2017, respectively. Energy consumption related to water use and wastewater generation by Metropolitan facilities resulted in the generation of approximately 13 MT $CO_2e$ in 2008 and 184 MT $CO_2e$ in 2017, respectively.

### Table 12 Water and Wastewater Emissions for Year 2008

| Source | Activity Data (MWh) | Emission Factor (MT $CO_2e$/MWh) | Total Emissions (MT $CO_2e$) |
|---|---|---|---|
| **Water Use** | **93** | **0.12209** | **11** |
| Supply, Conveyance, Distribution | 81 | 0.12209 | 10 |
| Treatment | 1 | 0.12209 | 0.1 |
| Distribution | 11 | 0.12209 | 1 |
| Recycled Water Distribution | 0 | 0.12209 | 0 |
| **Wastewater Generation** | **16** | **0.12209** | **2** |
| Treatment | 16 | 0.12209 | 2 |
| **Total** | **109** | **0.12209** | **13** |

MWh: megawatt hours; MT: metric tons; $CO_2e$: carbon dioxide equivalent
Numbers may not sum due to rounding

25 Per ICLEI guidance, CalEEMod 2016.3.2 energy intensity (EI) factors were used and are based on electricity use in typical urban water systems in Southern California (CEC 2006).

26 California Energy Commission (CEC). 2006. *Refining Estimates of Water-Related Energy Uses in California*. https://calisphere.org/item/ark:/86086/n2hq3xr1/

**Table 13 Water and Wastewater Emissions for Year 2017**

| Source | Activity Data (MWh) | Emission Factor (MT $CO_2$e/MWh) | Total Emissions (MT $CO_2$e) |
|---|---|---|---|
| **Water Use** | **1,126** | **0.13934** | **157** |
| Supply, Conveyance, Distribution | 983 | 0.13934 | 137 |
| Treatment | 11 | 0.13934 | 2 |
| Distribution | 129 | 0.13934 | 18 |
| Recycled Water Distribution | 3 | 0.13934 | 0.4 |
| **Wastewater Generation** | **193** | **0.13934** | **27** |
| Treatment | 193 | 0.13934 | 27 |
| **Total** | **1,319** | **0.13934** | **184** |

MWh: megawatt hours; MT: metric tons; $CO_2$e: carbon dioxide equivalent
Numbers may not sum due to rounding

## Solid Waste

GHG emissions result from management and decay of organic material solid waste. ICLEI guidance provides multiple accounting methods to address emissions arising from solid waste generated (regardless of where it is disposed of) as well as emissions arising from solid waste disposed of inside a community's boundaries (regardless of where it was generated). Because Metropolitan does not have operational control of any landfill, GHG emissions associated with solid waste are based solely on the amount of waste generated by Metropolitan facilities. ICLEI guidance for local entities recommends using the EPA's Waste Reduction Model (WARM) model. The WARM emissions factors account for the lifecycle of waste generation, including the collection and transport, processing, landfilling, and potential carbon reduction associated with the type of waste.

Waste data was derived from service provider invoices and utility providers. Metropolitan estimated waste generation based on bin size, pick up schedule of bins, and the conservative assumption that bins were completely full when emptied. Three types of waste bins were categorized as mixed municipal solid waste (MSW), mixed recyclables, and mixed organics. Cubic yards of waste reported by Metropolitan was converted to tons based on the type of waste.[27] Mixed organic waste was considered to include food, yard and other green waste and assumed to all be sent to a landfill. It was assumed that 11 percent of mixed MSW was combusted, while the remaining 89 percent was sent to a landfill.[28] Recycled waste included mixed paper, cardboard, mixed plastics, glass, aluminum and steel cans. It was assumed that all material within this category was recycled. Emissions factors from EPA's WARM version 14 were applied to the three categories of waste generated.[29] Offset or negative emissions calculated by the WARM model associated with recycling material were not included in the total solid waste emissions to provide a conservative estimate.

A summary of the emissions associated with solid waste generated during Metropolitan operations in 2008 and 2017 is provided in Table 14 and Table 15, respectively. Process emissions and energy consumption related to waste generation and disposal by Metropolitan facilities resulted in the generation of approximately 2,363 MT $CO_2$e in 2008 and 3,157 MT $CO_2$e in 2017, respectively.

[27] National Recycling Coalition Measurement Standards and Reporting Guidelines; EPA; FEECO and CIWMB 2006

[28] https://archive.epa.gov/epawaste/nonhaz/municipal/web/pdf/2012_msw_fs.pdf

[29] Per ICLEI guidance, emission factors for solid waste generation were obtained from U.S. EPA's Waste Reduction Model (WARM) version 14 (https://www.epa.gov/warm/versions-waste-reduction-model-warm#WARM Tool V14).

### Table 14 Summary of Solid Waste Emissions for Year 2008

| Source | Activity Data (tons) | Emission Factor (MT $CO_2e$/ton) | Total Emissions (MT $CO_2e$) |
|---|---|---|---|
| Mixed Organic Waste | 11,817 | 0.204 | 2,363 |
| Recycled Waste | 3,125 | -2.825 | -8,813 |
| Mixed MSW | – | – | – |
| **Total Waste Emissions** | **14,942** | **0.158** | **2,363** |

MSW: municipal solid waste; MT $CO_2e$: metric tons of carbon dioxide equivalent
Numbers may not sum due to rounding

### Table 15 Summary of Solid Waste Emissions for Year 2017

| Source | Activity Data (tons) | Emission Factor (MT $CO_2e$/ton) | Total Emissions (MT $CO_2e$) |
|---|---|---|---|
| Mixed Organic Waste | 14,759 | 0.204 | 2,952 |
| Recycled Waste | 3,153 | -2.825 | -8,892 |
| Mixed MSW | 644 | 0.288 | 206 |
| **Total Waste Emissions** | **18,557** | **0.170** | **3,157** |

MSW: municipal solid waste; MT $CO_2e$: metric tons of carbon dioxide equivalent
Numbers may not sum due to rounding

## Construction

Construction emissions were estimated using the Capital Investment Plan (CIP) projections for 2019 through 2024. To estimate the annual emissions associated with construction, the GHG emissions associated with all CIP projects between 2019 and 2024 were calculated and then divided by six to gain an annual emission rate which was then applied to all previous years including 1990. A complete list of every project analyzed and the associated GHG emissions can be found in Attachment 1 of Appendix B. Emissions associated with construction of the RRWP were not included in the inventory. Because construction of the RRWP is a future program, it is not representative of past construction projects and therefore would not be appropriate to apply such emissions to previous years.[30]

Construction emissions data is based on Metropolitan's CIP which provides information on capital programs and projects scheduled to begin in fiscal year (FY) 2018/19 through FY 2023/24. Projects without emissions include feasibility studies, computer system development and other planning initiatives. The CIP program includes projects at varying levels of design and specificity. Because of this variability in available project specifics, emissions for planned projects were estimated using the following three methodologies:

(1) GHG emissions estimates were derived for specific projects from previously prepared GHG studies used in environmental documentation (CEQA)

(2) GHG emissions were estimated for projects using project-specific details from design and engineering documents and emissions factors from the EPA, CalEEMod and EMFAC2011

[30] Construction and operational estimates for the RRWP are included in the GHG Emissions forecast.

(3) GHG emissions were developed for an example project within specific categories (e.g., pipeline repair, valve repair, minor construction) and then applying the calculated GHG emissions to similar projects of equal or smaller size

GHG emissions were calculated using conservative assumptions and were scaled based on project size, duration, or activity level. The sum of the FY 2018/19 through FY 2023/24 CIP emissions estimates was then averaged to produce an annual construction emissions rate. Emissions from the Prestressed Concrete Cylinder Pipe Rehabilitation (PCCP) program, which is a 20-year program, were calculated for the entire 20-year program, then divided by 20 years and added to Metropolitan's construction emissions to create an annual total. As previously discussed, construction emissions from the RRWP are included in the forecast, but not the inventory. When analyzing the Annual Capital Expenditures for Metropolitan, Rincon determined construction activities during the period analyzed represents an average or less than average level of construction activity when compared to historical annual capital expenditures adjusted to current dollars. Therefore, the GHG inventory provides a conservative estimate of past emissions.[31] Table 16 provides a summary of construction emissions determined by construction category.

### Table 16 Capital Investment Program Construction Emissions Estimate 2019-2024

| Construction Category | GHG Emission MT $CO_2e$ (2019-2024) |
|---|---|
| Pipelines | 3,026 |
| Paving | 1,255 |
| Equipment Replacement | 9,061 |
| CRA Domestic Water Systems | 959 |
| Building Construction | 1,419 |
| Utility Upgrades | 2,070 |
| Pump Rehab | 742 |
| Power Plant Rehab | 495 |
| Reservoir Cover Replacement | 4,943 |
| Treatment Plant Reliability | 4,796 |
| Pipeline Repairs/Refurbishment | 1,538 |
| **CIP Emissions (6-year total)[1]** | **30,305** |
| CIP Emissions Annual Estimate | 5,051 |
| **PCCP Program (20-year total)[1]** | **140,609** |
| Annual PCCP Emissions | 7,030 |
| **Total Annual Construction Emissions Estimate** | **12,081** |

[1] CIP and PCCP emissions are annualized based on program length.

MT = metric tons; $CO_2e$ = carbon dioxide equivalent; CRA = Colorado River Aqueduct; CIP = Capital Improvement Plan; PCCP = Prestressed Cylinder Concrete Pipeline

[31] A lower historical GHG estimate for construction means an overall lower 1990 emission level and more stringent GHG reduction targets.

### *Capital Investment Plan (CIP)*

CIP projects occurring annually include pipeline additions and improvements, paving projects, equipment replacement, improvements to CRA domestic water systems, building construction, utility upgrades, pump rehabilitation, power plant rehabilitation, reservoirs cover replacements, treatment plant reliability projects, and pipeline repairs/refurbishments. Construction emissions include emissions from construction activity as well as emissions associated with worker and haul trips. The following subsections provide additional detail on methodology specific to the construction project type.

#### PIPELINES

GHG emissions factors for the RRWP were utilized to estimate emissions associated with these pipelines. To be conservative, the most carbon intensive type of pipeline construction methodology was utilized. Emissions were estimated for each project based on the miles of pipeline installed.

#### PAVING

CalEEMod was used to estimate the GHG emissions associated with the demolition and replacement of 1 acre of paving. This emission factor (23 MT $CO_2e$/ acre) was then applied to the total acreage for each project to estimate GHG emissions.

#### EQUIPMENT REPLACEMENT

These projects utilized similar equipment as modeled for the “New Valve/Meter Valve Structure” activity quantified in the Program Environmental Impact Report (PEIR) for the PCCP program. The New Valve/Meter Valve Structure activity was estimated to generate 407 MT $CO_2e$ and was applied to equipment replacement projects that involved excavation. For equipment replacement projects that did not involve excavation activities but did involve construction or installation of new equipment, the project generated 247 MT $CO_2e$

#### CRA DOMESTIC WATER SYSTEMS

CalEEMod was used to estimate the emissions associated with the wastewater system replacement projects using a 500 by 500-foot grading scenario. A trenching machine was also added to the analysis. This modeled scenario generated 107 MT $CO_2e$ per project.

#### BUILDING CONSTRUCTION

CalEEMod was used to estimate the emissions associated with each building construction project and was specific to the building dimensions (i.e., square footage) and land use type as specified by Metropolitan.

#### UTILITY UPGRADE

These projects utilized similar equipment as modeled for the “New Valve/Meter Valve Structure” activity quantified in the PEIR for the PCCP program except for the need for excavation. The removal of activities involving excavation, shoring, dewatering, and backfilling from the “New Valve/Meter Valve Structure” emission estimates result in 247 MT $CO_2e$ per project. If the upgrade project did not involve the construction of a new structure, then new construction emissions were further removed from the PCCP PEIR estimations for the “New Valve/Meter Valve Structure” activity resulting in approximately 108 MT $CO_2e$ per project that only involved restoration and replacement of utilities.

#### PUMP REHABILITATION

These projects utilized similar equipment as modeled for the "New Valve/Meter Valve Structure" activity quantified in the PEIR for the PCCP program except for the need for excavation. The removal of activities involving excavation, shoring, dewatering, and backfilling from the "New Valve/Meter Valve Structure" emission estimates result in 247 MT $CO_2e$ per project

#### POWER PLANT REHABILITATION

These projects utilized similar equipment as modeled for the "New Valve/Meter Valve Structure" activity quantified in the PEIR for the PCCP program except for the need for excavation. The removal of activities involving excavation, shoring, dewatering, and backfilling from the "New Valve/Meter Valve Structure" emission estimates result in 247 MT $CO_2e$ per project per year. These projects were further scaled by the length of the project.

#### RESERVOIR COVER REPLACEMENT

These projects were considered similar as the modeled project in the Palos Verdes Reservoir Initial Study-Mitigated Negative Declaration.[32] Therefore, the estimated emissions of 2,321 MT $CO_2e$ were applied per project. This estimation is considered conservative because the Palos Verdes Reservoir project consists of other improvements not included in the reservoir cover replacement projects.

#### TREATMENT PLANT RELIABILITY

Various project and construction activities ranging in size and duration are associated with the treatment plant reliability program. Emissions were estimated using CalEEMod based on the specific activities involved in each project.

#### TRAVEL EMISSIONS ESTIMATES

Worker truck trips and associated emissions were estimated using data from the Weymouth Basin Refurbishment Program.[33] The program is considered a conservative estimate of the worker truck trips occurring for projects involving new construction (95 MT $CO_2e$). For projects identified to be upgrades, worker trip data from the Weymouth Administration and Control Buildings Seismic Upgrades Project (150 miles round trip and 1402 workdays) were applied (143 MT $CO_2e$).

### *Prestressed Concrete Cylinder Pipe Rehabilitation (PPCP)*

The PPCP encompasses specific construction work related to the PCCP program that will span 20-years. Metropolitan prepared a Program Environmental Impact Report (PEIR) for the project which quantified the GHG emissions associated with the construction activities conducted for this program.[34] For the purpose of this inventory and forecast, the total construction emissions reported for this program were divided by 20 years to obtain an annual average of construction emissions related to the PCCP program.

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32 http://mwdh2o.granicus.com/MetaViewer.php?view_id=21&clip_id=4988&meta_id=112355

33 https://ceqanet.opr.ca.gov/2013121074/3

34 The Metropolitan Water District of Southern California. 2016. *Programmatic Environmental Impact Report for the Prestressed Concrete Cylinder Pipe Rehabilitation Program.*

### SCOPE 3 SUMMARY

The average annual Scope 3 emissions were calculated using the annual Scope 3 emissions for 2008 and 2017. Because Scope 3 emissions are related to standard Metropolitan operations, they do not change substantially over time unlike Scope 1 and 2 emissions which can fluctuate annually. As such, the annual average Scope 3 emissions were applied to each year's inventory to provide a complete estimate of overall operational emissions. Furthermore, Scope 3 emissions represent a small portion (9 percent to 10 percent annually) of all Metropolitan emissions.

Table 17 summarizes the annual average Scope 3 emissions by sector that were included in the completed inventory.

**Table 17 Average Scope 3 Emissions**

| Sector | Activity Data | Emission Factor | Emissions ($MT\ CO_2e$) |
|---|---|---|---|
| Employee Commute (passenger VMT) | 28,624,230 | 0.000288 MT $CO_2e$/passenger VMT | 8,247 |
| Waste (tons) | 16,749 | 0.1673 MT $CO_2e$/tons | 2,760 |
| Water (mgy) | 55 | 1.5238 MT $CO_2e$/tons | 84 |
| Wastewater (mgy) | 55 | 0.2615 MT $CO_2e$/tons | 14 |
| CIP Construction (year) | 6 | 5,051 MT $CO_2e$/year | 12,081 |
| PCCP Construction (years) | 20 | 7,030 MT $CO_2e$/year | |
| **Annual Total** | | | **23,188** |

VMT: vehicle miles travelled; mgy: million gallons per year; MT $CO_2e$: metric tons of carbon dioxide equivalent; CIP: Capital Investment Plan; PCCP: Prestressed Concrete Cylinder Pipe Rehabilitation

## 3.3 Completed Inventory

The ICLEI Community Protocol recommends local governments examine their emissions in the context of the sector responsible for those emissions. Many local governments or entities like Metropolitan will find a sector-based analysis more directly relevant to policy making and project management, as it assists in formulating sector-specific reduction measures for climate action planning. The reporting sectors are made up of multiple subsectors to allow for easier identification of sources and targeting of reduction policies.

With the addition of the Scope 3 emissions, the updated 2008 and 2017 inventory reports all Basic Emissions Generating Activities[35] required by the Community Protocol[36] by the following main sectors:

- Energy (electricity and natural gas)
- Transportation
- Water and Wastewater
- Solid Waste

[35] Required emissions generating activities include: use of electricity by the community, use of fuel in residential and commercial stationary combustion equipment, on-road passenger and freight motor vehicle travel, use of energy in potable water and wastewater treatment and distribution, and generation of solid waste by the community.

[36] ICLEI. 2012. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Section 2.2.

Given the extensive construction and associated emissions generated, construction emissions have also been included as a Scope 3 emission source.

Table 18 and Table 19 include all of the activity data, emission factors, and total emissions available for the 2008 inventory and the 2017 inventory, respectively. The inventories include Scope 1 and Scope 2 data provided by Metropolitan as well as Scope 3 data used to bring Metropolitan's GHG inventories into consistency with applicable CAP guidelines. Figure 6 presents a summary of the 2008 and 2017 Metropolitan emissions by Scope.

### Table 18 Updated 2008 GHG Inventory

| Source | Activity Data | Emission Factor | Total Emissions (MT of $CO_2e$) |
|---|---|---|---|
| **Scope 1** | | | **8,073** |
| Natural Gas (Stationary) | 16,308 MMBtu | 0.0532 MT $CO_2e$/MMBtu | 868 |
| Propane (Stationary) | 401 MMBtu | 0.0631 MT $CO_2e$/MMBtu | 25 |
| Gasoline (Mobile) | 663,738 gallons | 0.0092 MT $CO_2e$/gallon | 6,076 |
| Diesel (Mobile) | 108,644 gallons | 0.0017 MT $CO_2e$/gallon | 1,104 |
| SF6 Fugitive Emissions[1] | 0 pounds | N/A | 0 |
| **Scope 2** | | | **226,651** |
| Electricity | 1,835,580 MWh | 0.122 MT $CO_2e$/MWh | 224,105 |
| Electricity T&D Losses | 26,593 MWh | 0.0957 MT $CO_2e$/MWh | 2,546 |
| **Scope 3** | | | **23,681** |
| Employee Commute | 28,869,800 passenger VMT | 0.00032 MT $CO_2e$/passenger VMT | 9,237 |
| Water/Wastewater[2] | 109 MWh | 0.12209 MT $CO_2e$/MWh | 13 |
| Solid Waste | 14,942 tons | 0.158 MT $CO_2e$/ton | 2,363 |
| Construction (2019-2024) | 1 year | 12,081 MT $CO_2e$/year | 12,081 |
| **Total** | | | **258,419** |

Numbers may not sum due to rounding

MWh: megawatt hours; MMBtu: one million British Thermal Units; MT $CO_2e$: metric tons of carbon dioxide equivalent; N/A: not applicable; VMT: vehicle miles traveled

[1] Fugitive emissions are estimated using a mass balance approach and are directly converted from estimated quantify to $CO_2e$ using the appropriate GWP factor.

[2] Includes the sum of water and wastewater generation.

### Table 19 Updated 2017 GHG Inventory

| Source | Activity Data | Emission Factor | Total Emissions (MT of $CO_2e$) |
|---|---|---|---|
| **Scope 1** | | | **8,876** |
| Natural Gas (Stationary) | 21,360 MMBtu | 0.0532 MT $CO_2e$/MMBtu | 1,136 |
| Propane (Stationary) | 317 MMBtu | 0.0621 MT $CO_2e$/MMBtu | 20 |
| Diesel (Stationary) | 10,244 MMBtu | 0.0744 MT $CO_2e$/MMBtu | 762 |
| Gasoline (Mobile) | 637,079 gallons | 0.0089 MT $CO_2e$/gallon | 5,673 |
| Diesel (Mobile) | 89,866 gallons | 0.0104 MT $CO_2e$/gallon | 931 |
| Aviation Gasoline (Mobile) | 10,237 gallons | 0.0085 MT $CO_2e$/gallon | 87 |
| Jet Fuel (Mobile) | 16,171 gallons | 0.0098 MT $CO_2e$/gallon | 159 |
| CNG (Mobile) | 5,525 gallons | 0.0066 MT $CO_2e$/gallon | 36 |
| SF6 Fugitive Emissions[1] | 2 pounds | N/A | 24 |
| HFC Fugitive Emissions[1] | 66 pounds | N/A | 47 |
| **Scope 2** | | | **194,480** |
| Electricity | 1,381,602 MWh | 0.1393 MT $CO_2e$/MWh | 192,511 |
| Electricity T&D Losses | 14,687 MWh | 0.1341 MT $CO_2e$/MWh | 1,969 |
| **Scope 3** | | | **22,666** |
| Employee Commute | 28,378,660 passenger VMT | 0.000256 MT $CO_2e$/passenger VMT | 7,257 |
| Water/Wastewater[2] | 1,319 MWh | 0.13934 MT $CO_2e$/MWh | 184 |
| Solid Waste | 18,557 | 0.170 MT $CO_2e$/ton | 3,157 |
| Construction (2019-2024) | 1 year | 12,067 MT $CO_2e$/year | 12,081 |
| **Total** | | | **226,036** |

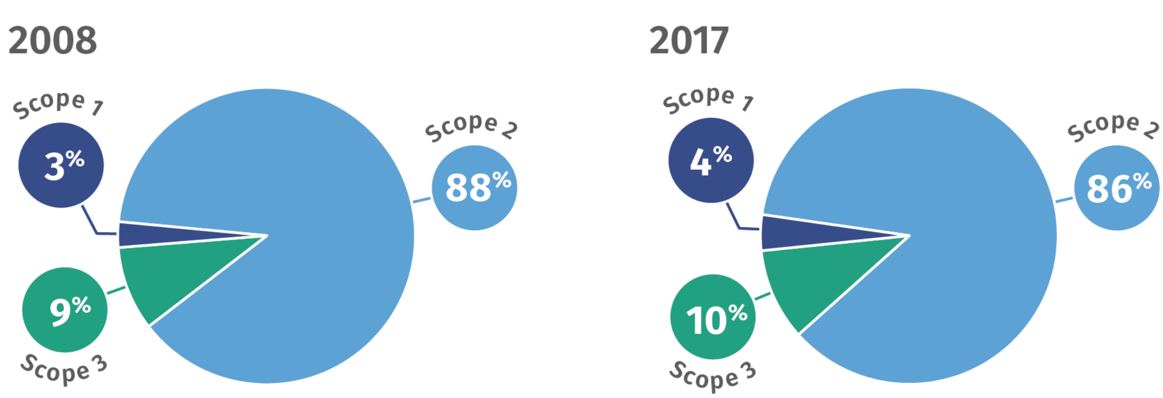
Numbers may not sum due to rounding

MWh: megawatt hours; MMBtu: one million British Thermal Units; MT $CO_2e$: metric tons of carbon dioxide equivalent; N/A: not applicable

[1] Fugitive emissions are estimated using a mass balance approach and are directly converted from estimated quantify to $CO_2e$ using the appropriate GWP factor.

[2] Includes the sum of water and wastewater generation.

### Figure 6 Metropolitan Emissions by Scope



As shown in Figure 6, a majority (86 to 88 percent) of Metropolitan's emissions in 2008 and 2017 are from Scope 2 emissions (electricity). Scope 1 (combustion) emissions comprise about 3 to 4 percent of total emissions and Scope 3 emissions (other and construction) comprise approximately 10 percent of Metropolitan's overall emissions. The following subsections discuss the emission trends by Scope.

## Scope 1

Scope 1 emissions comprise approximately four percent of total emissions. The largest Scope 1 emission source was mobile combustion of fuel for Metropolitan's vehicle fleet. In 2008, gasoline and diesel were used to fuel the vehicle fleet. In 2017, Metropolitan's vehicle fleet also used compressed natural gas as well as jet and aviation fuel. The second largest Scope 1 emission source is from stationary combustion of fuel at Metropolitan's facilities including natural gas and diesel usage.

Scope 1 emissions increased from 2008 to 2017, primarily because of the use of diesel fuel for generators. Fugitive emissions make up a small percentage of Scope 1 emissions and include sulfur hexafluoride emissions leakage from electrical equipment, emissions associated with additional electricity generation to offset T&D, hydrofluorocarbon emissions from refrigerants and fleet air conditioning, and welding gas fugitive emissions. Fugitive emissions were measured directly by Metropolitan.

## Scope 2

Over 86 percent of Metropolitan emissions are from the generation of electricity used at Metropolitan's facilities. Direct electricity consumption makes up 99 percent of Scope 2 emissions while T&D losses consistently make up about one percent of Scope 2 emissions. Emissions associated with electricity consumption are expected to decrease due to State regulations requiring electricity providers to increase procurement of eligible renewable energy resources to 100 percent by 2045.[37] The level of pumping on the CRA is the primary driver of Metropolitan's electricity demand and, therefore, GHG emissions. Availability of hydropower from Hoover Dam and Parker Dam are also significant contributors to emissions variability since hydropower contributes electricity with zero GHG emissions when it is available.

## Scope 3

Scope 3 emissions included in the GHG inventories are from water consumption and wastewater generation at Metropolitan facilities, construction activities, solid waste generation, and mobile emissions from employee commutes. The largest portion of Scope 3 emissions was due to construction activities which contributed 51 to 53 percent of total Scope 3 emissions annually. The second largest Scope 3 emissions source was from employee commute. Employee commuting generated 39 percent of inventoried Scope 3 emissions in 2008, but by 2017 had decreased to 32 percent. Solid waste associated emissions contributed between 10 in 2008 and 14 percent in 2017 of Scope 3 emissions while water-related emissions contribute about one percent.

## Water Conservation

Water conservation reduces GHG emissions. The emissions savings from conservation projects conducted by Metropolitan since 1990 were responsible for a portion of the GHG emissions

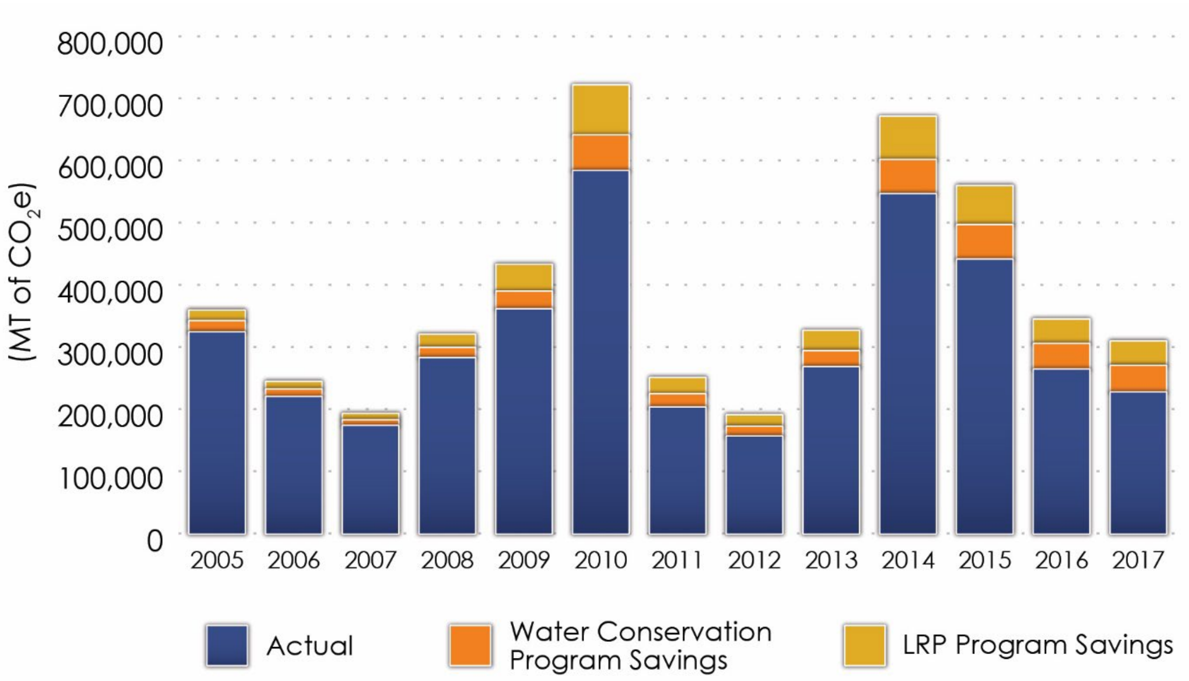
[37] Senate Bill 100 was signed into law in 2018.

reductions seen over time. The impact of these projects is already accounted for in the activity data, which is the basis for the GHG inventory. By applying the annual emissions factor per acre-foot of deliveries, estimates were developed to show what emissions would have been without these measures. Figure 7 shows annual GHG emissions both with (actual) and without (estimated) the implementation of conservation programs.

To calculate savings from conservation programs, Rincon analyzed water savings data by program by year. Programs included in the analysis included the Local Resources Program (LRP) and other conservation programs including turf removal, fixture replacement, weather controllers, and a variety of other projects. For the LRP, total water savings per project per year were calculated and summed for each individual year. For the other conservation measures, it was assumed water saved through each program would continue over time. This means that if 100-acre feet were saved in 2005 and another 50-acre feet were saved in 2006, the total savings in 2006 would be 150 acre feet.[38] This assumption was made because when those fixtures need to be replaced at the end of their useful life, it is unlikely that a less efficient model would be installed that would increase water use. Instead, it is likely that the same or more efficient fixture will be available for replacement.

After calculating the total acre feet saved per year, the annual total was then multiplied by the emission factor (MT of $CO_2$e per acre-foot delivered) calculated for that year. The resulting emissions were then added to the inventory emissions to show an emissions scenario in which the conservation efforts did not occur. The amount of emissions saved varies between years even if total acre feet conserved is consistent. This is due to annual variations in the emissions factor per acre-foot.

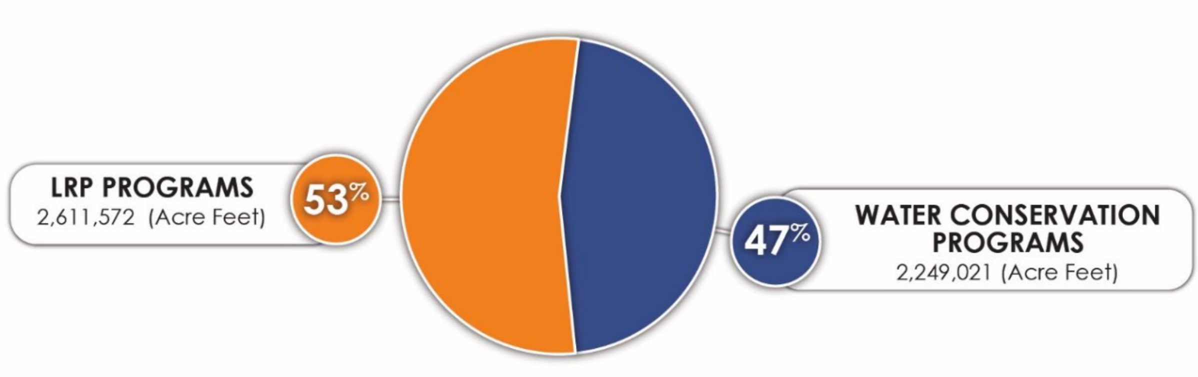
**Figure 7 Emissions Avoided through Conservation Efforts**




[38] Per Senate Bill 60, Metropolitan has filed annual progress reports with the California Legislature detailing water conservation achievements and progress.

As shown in Figure 7, emissions offsets from conservation efforts have grown from 9.8 percent (35,093 MT of $CO_2e$) in 2005 to 25 percent (74,714 MT of $CO_2e$) in 2017. Figure 8 shows the total acre feet of water conserved by the LRP and other water conservation programs between 2005 and 2017.

**Figure 8 Acre Feet Saved by Conservation Programs (2005-2017)**



# 4 Forecast

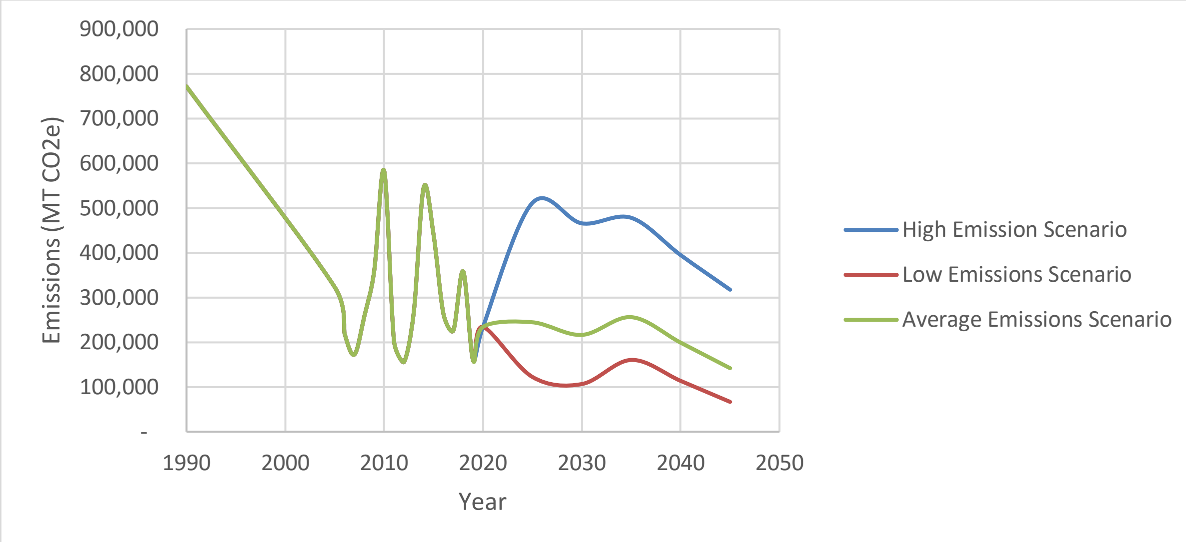
The GHG inventory provides accurate reference points for emissions levels in past years. However, annual emissions change over time due to external factors such as hydrology, climate, population growth, operational changes, and construction projects. An emissions forecast accounts for these projected changes and presents an estimate of GHG emissions in a future year. Calculating the difference between the forecasted GHG emissions and the reduction targets set by Metropolitan determines the gap to be closed through Metropolitan's CAP policies.

GHG emissions associated with Metropolitan operations are influenced by where water is sourced. Metropolitan has two sources of imported water supply: the Colorado River through the CRA and the SWP. Water pumped from the Colorado River results in substantially higher electrical usage as it requires additional pumping to bring the water to Lake Mathews. In contrast, SWP water does not require significant additional pumping. Because of the variability in electricity usage, and therefore, GHG emissions, three scenarios were modeled for each forecast: Dry-year SWP with high CRA pumping (high emissions); average-year SWP with average CRA pumping (average emissions); and wet-year SWP with low CRA pumping (low emissions). The three scenarios capture the full range of possible future emissions. In reality, Metropolitan's GHG emissions will continue to oscillate around the average emissions trend as they have in the past.

## 4.1 Forecast Results Summary

California has enacted several regulations which will assist in reducing Metropolitan's emissions over time. The impact of these regulations was quantified and incorporated into an adjusted forecast to provide a more accurate estimate of Metropolitan's future emissions. These projections include emissions associated with the construction and operation of the proposed RRWP as well as expected annual construction emissions associated with other CIP construction projects. Figure 9 presents the projected emissions for Metropolitan through 2045 associated with the three different GHG reduction scenarios (high, average, low). Table 20 includes a comparison of the projected emissions for each scenario in each target year (2030 and 2045) compared to the 1990 emissions baseline.

**Figure 9 Adjusted Emissions Forecast 1990-2045**




### Table 20 Anticipated Changes to Mass GHG Emissions between 1990 and 2045 (MT $CO_2e$)

| Emissions Scenario | 1990 Emissions | 2030 Forecast Emissions | Percent Reduction | 2045 Forecast Emissions | Percent Reduction |
|---|---|---|---|---|---|
| High | 771,514 | 465,664 | 40% | 317,441 | 59% |
| Average | 771,514 | 216,460 | 72% | 142,059 | 82% |
| Low | 771,514 | 106,615 | 86% | 66,812 | 91% |

In addition to the mass emissions inventory and forecast, Rincon also conducted a per capita GHG emissions analysis on both historical and forecasted emissions. This analysis considers the substantial population growth occurring in Metropolitan's service area and the past and ongoing water conservation efforts made by Metropolitan. Since 1990, population in the Metropolitan service area has increased by nearly 3.95 million people.[39] Table 21 presents the historical service population of Metropolitan and the projected population from 2020 through 2045. Additionally, Table 21 presents emissions per capita for historical data and the projected emissions per capita based on the three forecasted scenarios.

[39] 2020 UWMP

**Table 21 Absolute and Per Capita Emissions Forecast**

| Year | Population | Absolute Emissions ($MT\ CO_2e$) | Per Capita ($MT\ CO_2e$) |
|---|---|---|---|
| **Historical** | | | |
| 1990 | 14,961,310 | 771,514 | 0.05157 |
| 2005 | 17,617,613 | 323,224 | 0.01835 |
| 2006 | 17,676,282 | 219,355 | 0.01241 |
| 2007 | 17,757,684 | 172,768 | 0.00973 |
| 2008 | 17,862,613 | 258,419 | 0.01447 |
| 2009 | 17,936,649 | 360,457 | 0.02010 |
| 2010 | 18,042,021 | 582,952 | 0.03231 |
| 2011 | 18,186,668 | 202,374 | 0.01113 |
| 2012 | 18,347,771 | 155,637 | 0.00848 |
| 2013 | 18,499,407 | 267,352 | 0.01445 |
| 2014 | 18,623,266 | 545,830 | 0.02931 |
| 2015 | 18,732,068 | 440,400 | 0.02351 |
| 2016 | 18,808,234 | 263,420 | 0.01401 |
| 2017 | 18,906,970 | 226,036 | 0.01196 |
| 2018 | 18,962,475 | 358,287 | 0.01889 |
| 2019 | 18,998,737 | 159,200 | 0.00838 |
| 2020 | 19,035,000 | 234,329 | 0.01231 |
| **Projected** | | **Emission Range (Low - High)** | **Emission per Capita Range** |
| 2025 | 20,089,000 | 122,519 – 511,428 | 0.00610 - 0.01218 |
| 2030 | 20,634,000 | 106,615 – 465,664 | 0.00517 - 0.02257 |
| 2035 | 21,145,000 | 160,515 – 478,049 | 0.00759 - 0.02261 |
| 2040 | 21,610,000 | 113,728 – 394,783 | 0.00526 - 0.01827 |
| 2045 | 22,026,000 | 66,812 – 317,441 | 0.00303 - 0.01441 |

$MT\ CO_2e$: metric tons of carbon dioxide equivalent

As shown in Figure 10 and Table 22, emissions per capita have decreased substantially and are expected to continue to decline. When comparing emissions reductions from Table 20 (mass emissions only) with Table 22 (per capita emissions), the effect of increased water conservation is clear. For example, under the average emissions scenario, total emissions are expected to decrease by 72% compared to 1990 by 2030. However, on a per capita basis (which captures the increase in conservation efforts) reductions are expected to be 80%.

**Figure 10 Historical and Forecasted Per Capita Emissions**

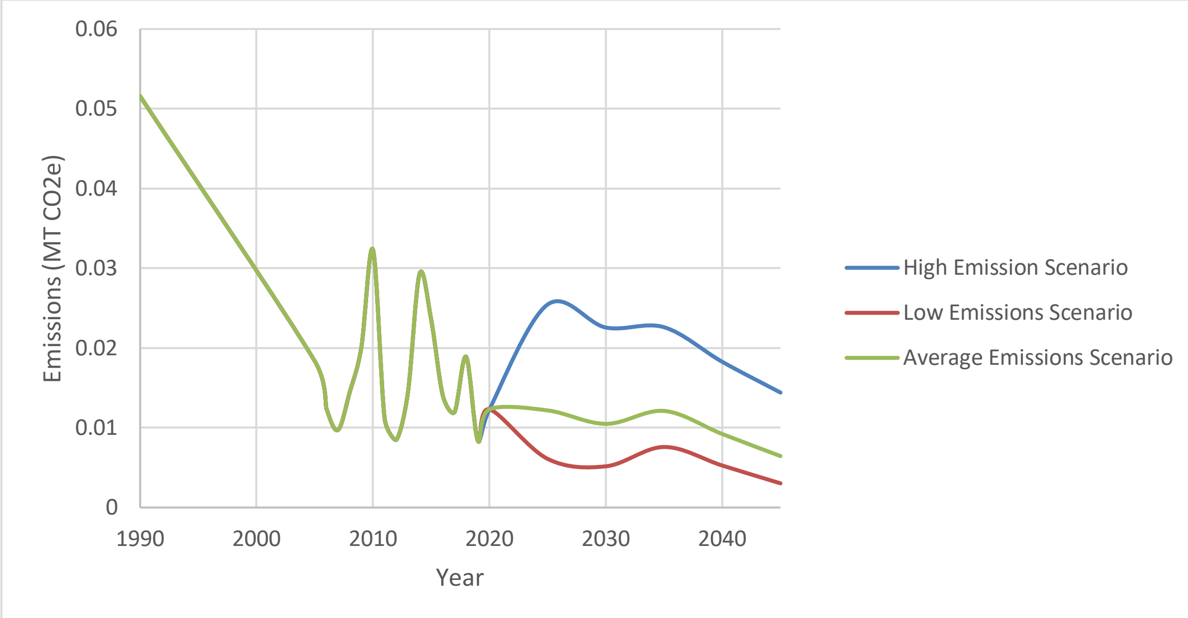



**Table 22 Per Capita Emissions Reductions Over Time**

| Emission Scenario | 1990 Emissions (MT/person/year) | 2030 Forecast (MT/person/year) | Percent Reduction | 2045 Forecast (MT/person/year) | Percent Reduction |
|---|---|---|---|---|---|
| High | 0.0516 | 0.0226 | 56% | 0.0144 | 72% |
| Average | 0.0516 | 0.0105 | 80% | 0.0064 | 87% |
| Low | 0.0516 | 0.0052 | 90% | 0.0030 | 94% |

Population assumptions for the Metropolitan service area are as follows: 1990 population = 14,961,310; 2030 population = 20,634,000; 2045 population = 22,026,000

## 4.2 State Legislation

The forecast presented here estimates future Metropolitan emissions under codified GHG reduction strategies currently being implemented at the State and federal level. The 2017 Scoping Plan Update identified several existing State programs and targets, or known commitments required by statute which can be assumed to achieve GHG reductions without Metropolitan action. However, since State regulations such as clean car standards may or may not impact Metropolitan directly, many of these reductions were not quantified as part of the forecast. The one exception is SB 100 which has had and will continue to have a significant impact on Metropolitans GHG emissions into the future.

### Renewables Portfolio Standard & Senate Bill 100

Established in 2002 under SB 1078, California's Renewables Portfolio Standard (RPS) was accelerated in 2006 under SB 107 by requiring 20 percent of electricity retail sales be served by renewable energy resources by 2010. Subsequent recommendations in California energy policy reports advocated a goal of 33 percent by 2020, and on November 17, 2008, Governor Arnold Schwarzenegger signed Executive Order S-14-08 setting the goal that "...[a]ll retail sellers of electricity shall serve 33 percent of their load with renewable energy by 2020." Senate Bill X1-2 was signed by Governor Edmund G. Brown, Jr. in April 2011 setting the RPS target at 33 percent by 2020.

This new RPS applied to all electricity retailers in the State including publicly-owned utilities, investor-owned utilities, electricity service providers, and community choice aggregators. All retail power providers were required to adopt the new RPS goals of 20 percent of retail sales from renewables by the end of 2013, 25 percent by the end of 2016, and 33 percent by the end of 2020. The State is currently on track to meet these goals.

Most recently, Governor Edmund G. Brown, Jr. signed into law SB 100 in September 2018, which requires retail sellers and publicly-owned utilities to procure 60 percent of their electricity from eligible renewable energy resources by 2030 and 100 percent of their electricity from eligible renewable energy by 2045.[40]

Because SB 100 requirements are only applicable to California utilities, wholesale purchases made by Metropolitan from out-of-state electricity suppliers would not be affected. However, many other states also have their own RPS standards. To incorporate these emissions reductions, Rincon conducted a complete contribution analysis of the RPS standards for each state contributing power to the AZNM eGrid region and applied those reductions to the portion of power purchased from out-of-state providers. AZNM is the eGrid factor which is used in Metropolitan's TCR reporting methodology for out-of-state electricity purchases. The percent carbon free electricity assumed for this analysis is shown in Table 23. No additional GHG reductions beyond those levels were assumed. Texas for example has already surpassed 10 percent renewables. Therefore, no adjustment was made to that emission factor into the future.

**Table 23 State Level Renewable Commitments Included in the Metropolitan Forecast**

| State | Percent Carbon Free | Target Year |
|---|---|---|
| Arizona | 15% | 2025 |
| California | 100% | 2045 |
| Colorado | 30% | 2020 |
| New Mexico | 100% | 2045 |
| Nevada | 25% | 2025 |
| Texas | 10% | 2025 |
| Utah | 20% | 2025 |
| Wyoming | None | N/A |

The ratio of electricity Metropolitan purchases changes year to year. The forecast applied a different ratio of out-of-state versus in-state electricity purchases for each of the three emissions scenarios (high, average, and low). This ratio was calculated by analyzing historical energy purchases. For the high emissions scenario, year 2010 was used since it represents a year of high out of state electricity purchases and therefore, emissions. For the average emissions scenario, year 2017 was used, and for the low emissions scenario the 2011 data year was used. The ratio of electricity used for each year only included electricity sources with GHG emissions (i.e., hydropower was excluded).

Overall, both retail and wholesale electricity and water/wastewater sectors all experience a strong downward trend, approaching near-zero GHG emissions in 2045 due to extremely stringent RPS from SB 100.

40 SB 100 full text. September 2018. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100

## 4.3 Forecast Scenario Methodology

Because a majority of Metropolitan emissions are associated with electricity for importing water, Metropolitan emissions are highly dependent on where water is sourced. Metropolitan's 2020 Urban Water Management Plan (UWMP) provided historical data on water delivery from 1990 to 2020, which was used as a proxy to develop an emission factor for future deliveries.[41] Emissions factors for water delivery were calculated for years spanning 2005 to 2020 based on the historical water deliveries and the developed inventory discussed in Section 3, which included Metropolitan Scope 1 and 2 emissions and Rincon calculated Scope 3 emissions. Table 24 summarizes the historical water delivery emission factors.

**Table 24 Historical Water Delivery Emissions**

| Year | Water Deliveries (AF) | Absolute Emissions ($MT\ CO_2e$) | Emission Factor ($MT\ CO_2e/AF$) |
|---|---|---|---|
| 2005 | 2,044,000 | 323,224 | 0.15813 |
| 2006 | 2,202,000 | 219,355 | 0.09962 |
| 2007 | 2,415,000 | 172,768 | 0.07154 |
| 2008 | 2,094,000 | 258,419 | 0.12341 |
| 2009 | 1,860,000 | 360,457 | 0.19379 |
| 2010 | 1,642,000 | 582,952 | 0.35503 |
| 2011 | 1,618,000 | 202,374 | 0.12508 |
| 2012 | 1,756,000 | 155,637 | 0.08863 |
| 2013 | 1,956,000 | 267,352 | 0.13668 |
| 2014 | 2,018,000 | 545,830 | 0.27048 |
| 2015 | 1,740,000 | 440,400 | 0.25310 |
| 2016 | 1,660,000 | 263,420 | 0.15869 |
| 2017 | 1,450,000 | 226,036 | 0.15589 |
| 2018 | 1,558,000 | 358,287 | 0.22997 |
| 2019 | 1,327,000 | 159,200 | 0.11997 |
| 2020 | 1,374,000 | 234,329 | 0.17054 |
| **Average** | **1,794,625** | N/A | **0.16941** |

AF: acre-foot; $MT\ CO_2e$: metric tons of carbon dioxide equivalent

Forecasted emissions are based on the 2020 UWMP projected deliveries for 2025, 2030, 2035, and 2040. Although not included in the 2020 UWMP, to forecast for 2045, it was assumed that deliveries in 2045 would remain consistent with those projected for 2040. Deliveries were projected in the 2015 UWMP for three hydrological conditions: a single dry year, multiple dry years, and an average year. In the Section 4.3.1, the emission factors and forecasted emissions for each of the three scenarios are discussed and results are summarized. Emission factors applied to forecasted years were further adjusted to account for anticipated reductions associated with electricity use due to SB 100 and other states' carbon-free electricity goals. GHG reductions from these electricity targets were calculated based on the electricity consumption in the representative years (2010, 2011, and 2017) and the percent emissions attributed to electricity consumption in those years. The percent

[41] The Metropolitan Water District of Southern California (2021). 2020 Urban Water Management Plan.

GHG emissions from electricity was then adjusted based on the forecasted reduction in GHG emissions from electricity. In addition to forecasting the GHG emissions from current operations and construction projects, the expected construction and operational emissions from the proposed RRWP were also modeled and included in the forecast. The section below discusses and summarizes the methodology related to the inclusion of RRWP related emissions in the forecast.

## Forecasting Scenarios

### *Dry-year SWP with High CRA Pumping (High Emissions)*

Under the high emissions scenario, the water delivery demands for multiple dry years as defined in Metropolitan's 2020 UWMP were used.[42] The high emissions factor (0.3550 MT $CO_2e$/AF) was derived by calculating the MT of $CO_2e$ per acre-foot of delivered water from the highest emissions year from 2005 to 2020 (calendar year 2010). This emission factor was further adjusted based on the forecasted year, where approximately 85 percent of the operational emission factor will be reduced due to SB 100. Table 25 summarizes the forecasted water deliveries, associated emission factors, and total emissions anticipated for a high emissions scenario. This scenario provides the highest potential GHG emissions.

**Table 25 Forecasted Emissions for Dry-Year SWP with High CRA Pumping**

| Year | Water Deliveries (AF) | Emission Factor (MT $CO_2e$/AF) | Absolute Emissions (MT $CO_2e$) |
|---|---|---|---|
| 2025 | 1,629,000 | 0.314 | 511,428 |
| 2030 | 1,610,000 | 0.289 | 465,664 |
| 2035 | 1,575,000 | 0.304 | 478,049 |
| 2040 | 1,568,000 | 0.252 | 394,783 |
| 2045 | 1,591,000 | 0.200 | 317,441 |

Numbers may not sum due to rounding

AF: acre-foot; MT $CO_2e$: metric tons of carbon dioxide equivalent

### *Average-year SWP with Average CRA Pumping (Average Emissions)*

Under the average emissions scenario, the water delivery demands of a single dry year as defined in the 2020 UWMP were used. The average emissions factor (0.1694 MT $CO_2e$/AF) was calculated by averaging the MT of $CO_2e$ per acre-foot delivered during the period of 2005 to 2020. Similar to the above discussed scenario, the emission factor was further adjusted to account for SB 100 impacts on emissions associated with electricity. Table 26 summarizes the forecasted water deliveries, associated emission factors, and total emissions anticipated for an average emissions scenario.

[42] The Metropolitan Water District of Southern California (2021). 2020 Urban Water Management Plan.

**Table 26 Forecasted Emissions for Average-Year SWP with Average CRA Pumping**

| Year | Water Deliveries (AF) | Emission Factor ($MT\ CO_2e/AF$) | Absolute Emissions ($MT\ CO_2e$) |
|---|---|---|---|
| 2025 | 1,597,000 | 0.1532 | 244,645 |
| 2030 | 1,548,000 | 0.1398 | 216,460 |
| 2035 | 1,505,000 | 0.1702 | 256,089 |
| 2040 | 1,524,000 | 0.1307 | 199,141 |
| 2045 | 1,551,000 | 0.0916 | 142,059 |

Numbers may not sum due to rounding

AF: acre foot; MT $CO_2e$: metric tons of carbon dioxide equivalent

### *Wet-year SWP with Low CRA Pumping (Low Emissions)*

Under the low emissions scenario, the water delivery demands for the average year as defined in the 2020 UWMP were used. The emissions factor (0.0886 MT $CO_2e$/AF) was derived by calculating the MT of $CO_2e$ per acre-foot delivered water from the lowest emissions year between 2005 and 2020 (calendar year 2012). Similar to the other scenarios, the emission factor was further adjusted to account for SB 100 impacts on emissions associated with electricity. Table 27 summarizes the forecasted water deliveries, associated emission factors, and total emissions anticipated for a low emissions scenario. This scenario provides the lowest expected emissions forecast.

**Table 27 Forecasted Emissions for Wet-Year SWP with Low CRA Pumping**

| Year | Water Deliveries (AF) | Emission Factor ($MT\ CO_2e/AF$) | Absolute Emissions ($MT\ CO_2e$) |
|---|---|---|---|
| 2025 | 1,469,000 | 0.08340 | 122,520 |
| 2030 | 1,420,000 | 0.07508 | 106,615 |
| 2035 | 1,379,000 | 0.11640 | 160,515 |
| 2040 | 1,394,000 | 0.08158 | 113,728 |
| 2045 | 1,418,000 | 0.04712 | 66,812 |

Numbers may not sum due to rounding

AF: acre foot; MT $CO_2e$: metric tons of carbon dioxide equivalent

## Forecasting Regional Recycled Water Program

Construction of the RRWP is a future program and therefore has been included in the emissions forecast, but not the inventory. The methodology calculating RRWP construction and operation emissions is discussed below along with the results.

### *RRWP Construction*

A conservative estimate of construction emissions associated with the construction of the advanced water treatment plant (AWTP), pipelines, pump stations, and groundwater injection wells were all included in the analysis. Estimates include emissions from projected construction equipment fuel consumption, labor travel, material travel, and temporary electric power usage.

Emissions from pipeline construction were estimated by calculating the emissions from eight different pipeline/trenching methods on a linear foot basis to develop an emissions factor for each construction method. The total linear feet of each pipeline construction type was then multiplied by the corresponding emissions factor to calculate the total GHG emissions from pipeline construction. All estimates were based on industry standards and/or data provided by Metropolitan.

Regardless of the duration of construction or start date of construction, the same total amount of emissions will be generated. To approximate annual construction emissions, total construction emissions were divided by an assumed 6-year construction schedule which is modelled to begin in 2025 and with completion during 2030 (Table 28). Operational emissions were assumed to begin in 2031 (Table 29). This construction schedule assumes the fastest feasible start to the project. However, as previously mentioned, if a shift in the project start date or overall construction duration does occur, the total impacts of construction and operation will remain unchanged. The emissions would simply shift to a later date while overall volume of emissions would remain constant.

### Table 28 Total Construction Emissions for RRWP

| System | Absolute Emissions (MT $CO_2e$) |
|---|---|
| Advanced Water Treatment | 10,895 |
| Pipelines | 70,506 |
| Pump Stations | 633 |
| Well Facilities | 383 |
| **Total** | **82,417** |
| 6 Year Annual | 13,736 |

### *RRWP Operations*

Operational emissions included an analysis of both electricity use and process emissions due to consumption of MicroC2000® and $N_2O$ generation as shown in Table 29. Emissions associated with electricity were modeled assuming 100 percent of electricity purchased would be from the retail market. With the implementation of SB 100, GHG emissions from electricity consumed at the AWTP would be reduced to zero MT of $CO_2e$ by 2045. Operational electricity demand was estimated to be 264,988 MWh per year for operations at the AWTP and an additional 329,687 MWh per year to operate the pump stations which will move water from the AWTP to the spreading grounds and injection wells. This value represents a worst-case scenario for pump electricity use based on pumping all 150 MGD to Weymouth and may not represent actual final design. Changes to projected annual electricity emissions are shown in Table 30.

### Table 29 Process Operational Emissions for RRWP

| System | Process Emissions (MT $CO_2e$) | |
|---|---|---|
| Process $N_2O$ | 5,340 | (non-biogenic) |
| MicroC2000® | 22,271 | (biogenic) |

MT $CO_2e$ = metric tons of carbon dioxide equivalent; $N_2O$ = nitrous oxide

### Table 30 Electricity Emissions Over Time for RRWP Operation

| Year | Emissions (MT $CO_2e$) |
|---|---|
| 2031 | 84,090 |
| 2035 | 60,064 |
| 2040 | 30,032 |
| 2045 | – |

MT $CO_2e$ = metric tons of carbon dioxide equivalent

Overall emissions for the RRWP for each milestone year are included in Table 31. In 2025 construction is underway so the annual construction estimate of 13,736 MT of $CO_2e$ was applied. By 2031 the plant is assumed to be fully operational (150 MGD) which is reflected in the larger emissions total. These dates do not reflect actual construction and operational start dates. Since, a shift in these dates would not affect the GHG emissions in the target years of 2030 and 2045 and a modelling an earlier start date provides a more conservative emissions forecast, the earlier timeline was used. Over time, GHG emissions associated with electricity use will decrease due to SB 100 while process emissions at the AWTP will remain constant.

### Table 31 Overall Estimated RRWP Emissions

| Year | Emissions (MT $CO_2e$) |
|---|---|
| 2025 (construction) | 13,736 |
| 2030 (construction) | 13,736 |
| 2035 (operational) | 87,675 |
| 2040 (operational) | 57,643 |
| 2045 (operational) | 27,611 |

MT = metric tons

$CO_2e$ = carbon dioxide equivalent

The forecasted emissions for the RRWP were included in each of the Metropolitan emissions forecast scenarios and therefore, are mitigated by the overall CAP which charts a clear pathway for Metropolitan to reach its GHG reduction targets consistent with State goals.

# 5 Targets and Carbon Budget

## 5.1 GHG Reduction Targets

As noted in Section 1.2, CARB has issued several guidance documents concerning the establishment of GHG emission reduction targets for CAPs to comply with legislated GHG emissions reductions targets and California Environmental Quality Act Guidelines (CEQA) § 15183.5(b). In the first California *Climate Change Scoping Plan,*[43] the CARB encouraged local governments to adopt a reduction target for community emissions that parallels the State commitment to reduce GHG emissions. In 2016, the State adopted SB 32 mandating a reduction of GHG emissions by 40 percent below 1990 levels by 2030 and in 2017 the CARB published the SB 32 Scoping Plan Update.[44] With the release of the *2017 Climate Change Scoping Plan Update*, the CARB recognized the need to balance population growth with emissions reductions and in doing so, provided a new methodology for proving consistency with State GHG reduction goals through the use of per capita efficiency targets. These targets are generated by dividing a jurisdiction's GHG emissions for each horizon year by the jurisdiction's total population for that target year.

In addition to SB32, Metropolitan has also set a long term goal of achieving carbon neutrality consistent with EO B-55-18. Table 32 shows Metropolitan's GHG reduction targets for the milestone years of 2030 and 2045 as well as several interim years. In order to better prepare for the goal of carbon neutrality, Metropolitan has set a GHG reduction target more aggressive than the SB32 by reducing its emissions along a linear trajectory from 2017 emission levels to carbon neutrality in 2045.

**Table 32 Metropolitan's GHG Reduction Targets**

| Target | Per Capita Emissions ($MT\ CO_2e$) | Associated Mass Emissions[2] ($MT\ CO_2e$) | Percent Reduction (Below 1990) |
|---|---|---|---|
| Metropolitan's 1990 Per Capita Emissions | 0.0516 | 771,514 | N/A |
| Minimum Per Capita Reduction Target for SB 32 Consistency (40% below 1990 levels) | 0.0309 | 638,423 | 40% |
| Metropolitan's Per Capita 2030 GHG Emissions Target[2] | 0.0141 | 290,192 | 73% |
| Metropolitan's 2045 Per Capita Goal | 0.0000 | 0 | 100% |
| California's EO B-55-18 Per Capita Goal | 0.0000 | 0 | 100% |

$MT\ CO_2e$ = metric tons of carbon dioxide equivalent
[1] Pending final population numbers
[2] Associated Mass Emissions are calculated by multiplying the per capita emissions target by the projected population in that year. Final mass emission values will be updated based on actual population data.

[43] 2008 Climate Change Scoping Plan https://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf
[44] CARB. November 2017. California's 2017 Climate Change Scoping Plan. https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf

Figure 11 describes the complete reduction pathway. The figure shows Metropolitan's targets meet the per capita emissions target for all three California goals described by AB 32, SB 32, and EO B-55-18. Metropolitan exceeds all per capita emissions (in MT $CO_2e$) at all targets and meets the EO B-55-18 goal of zero per capita emissions by year 2045. The use of per capita reduction targets to show progress towards GHG reduction goals was established and promoted by the State in the 2017 Scoping Plan Update.[45]

**Figure 11 Metropolitan's GHG Reduction Targets**

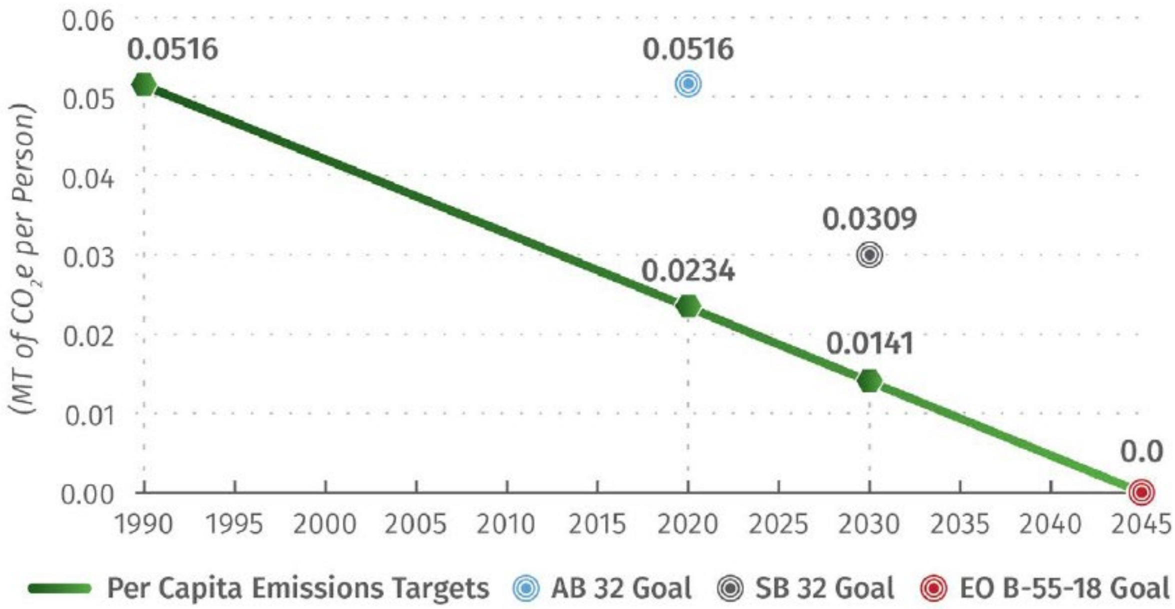
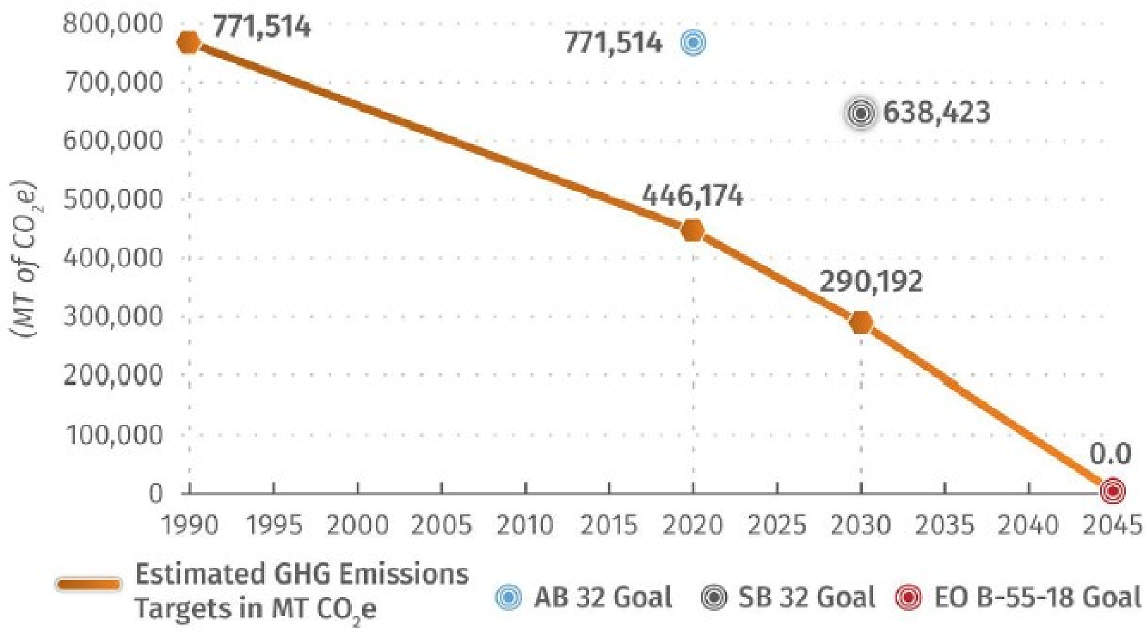



Figure 12 illustrates the per capita reduction pathway translated into mass emissions. Per capita emissions are translated to mass emissions by multiplying by the population in each year. As shown in Figure 12, Metropolitan's target pathway exceeds the State's emissions reduction goal in 2020 and 2030 before ultimately reaching carbon neutrality in line with the State's long-term goal in 2045. The current population values are projected and will need to be updated over time as final population numbers are established. This will change the allowable emissions (MT $CO_2e$) in each year by effectively including a variable that considers the actual service population in determining the emission reductions. Normalizing the emissions by removing population as a variable allows Metropolitan to focus on deep decarbonization over time. Furthermore, achieving the 2045 target of carbon neutrality will be an iterative process and require revisions between now and 2045, with changes to policy or new statewide GHG emissions targets established by the California legislature.

45 https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf

**Figure 12 Metropolitan's GHG Emissions Targets Translated to MT $CO_2e$**




Metropolitan's estimated emissions in 2030 are well below the State's 2030 target. However, due to the variability associated with Metropolitan's GHG emissions (as shown in Section 3.0), using any individual year to gain an understanding of Metropolitan's GHG emissions reduction progress would not provide a clear picture of overall emissions reduction trends. Therefore, Metropolitan intends to implement a carbon budget approach to determine GHG emissions reduction progress.

## 5.2 Carbon Budget Methodology

In order to calculate Metropolitan's carbon budget (really a greenhouse gas budget since it incorporates all greenhouse gases normalized to $CO_2e$), the sum of the area underneath Metropolitan's target trajectory is summed. Table 33 shows the target emissions for each individual year between 2005 and 2045 (the years for which the carbon budget was calculated). The 2005 target was calculated based on a linear reduction in per capita emissions to carbon neutrality in 2045 from the 1990 per capita number. The start year for the carbon budget is 2005 because it is the first year for which Metropolitan has annual GHG inventories, which are required to track the carbon budget accurately. As shown in Table 33, Metropolitan was below its milestone budget for the period of 2005-2020. During this period, it had a total of 8,924,539 MT $CO_2e$ which could be emitted, but it only emitted 4,770,038 MT $CO_2e$. This means that Metropolitan has a remaining budget of 4,154,596 MT $CO_2e$ from that period and a total budget remaining of 9,890,437 MT $CO_2e$ which can be emitted between 2021 and 2045. Metropolitan plans to be carbon neutral by 2045 regardless of the remaining carbon budget.

### Table 33 Data Used for Calculating Metropolitan's Carbon Budget

| Year | Annual GHG Emissions Targets | Actual GHG Emissions | Remaining Budget |
|---|---|---|---|
| **2005** | 660,722 | 323,224 | 337,498 |
| **2006** | 646,349 | 219,355 | 426,994 |
| **2007** | 632,676 | 172,768 | 459,908 |
| **2008** | 619,667 | 258,419 | 361,247 |
| **2009** | 605,418 | 360,457 | 244,961 |
| **2010** | 592,059 | 582,952 | 9,107 |
| **2011** | 579,754 | 202,374 | 377,379 |
| **2012** | 567,687 | 155,637 | 412,050 |
| **2013** | 555,034 | 267,352 | 287,682 |
| **2014** | 541,289 | 545,830 | (4,541) |
| **2015** | 526,888 | 440,400 | 86,488 |
| **2016** | 511,396 | 263,420 | 247,976 |
| **2017** | 496,354 | 226,036 | 270,318 |
| **2018** | 480,032 | 358,287 | 121,746 |
| **2019** | 463,137 | 159,200 | 303,937 |
| **2020** | 446,174 | 234,329 | 211,846 |
| **Subtotal (Carbon Budget 2005-2020)** | **8,924,634** | **4,770,038** | **4,154,596** |
| **2021** | 433,071 | | |
| **2022** | 419,572 | | |
| **2023** | 405,678 | | |
| **2024** | 391,388 | | |
| **2025** | 376,704 | | |
| **2026** | 359,810 | | |
| **2027** | 342,712 | | |
| **2028** | 325,410 | | |
| **2029** | 307,904 | | |
| **2030** | 290,192 | | |
| **Subtotal (Carbon Budget 2005-2030)** | **12,577,075** | **N/A**[1] | **7,807,037**[2] |
| **2031** | 272,188 | | |
| **2032** | 253,992 | | |
| **2033** | 235,604 | | |
| **2034** | 217,024 | | |
| **2035** | 198,253 | | |
| **2036** | 179,212 | | |
| **2037** | 159,997 | | |
| **2038** | 140,608 | | |
| **2039** | 121,044 | | |
| **2040** | 101,306 | | |

| Year | Annual GHG Emissions Targets | Actual GHG Emissions | Remaining Budget |
|---|---|---|---|
| **2041** | 81,357 | | |
| **2042** | 61,252 | | |
| **2043** | 40,991 | | |
| **2044** | 20,573 | | |
| **2045** | | | |
| **Total Carbon Budget (2005-2045)** | **14,660,475** | **N/A**[1] | **9,890,437**[2] |

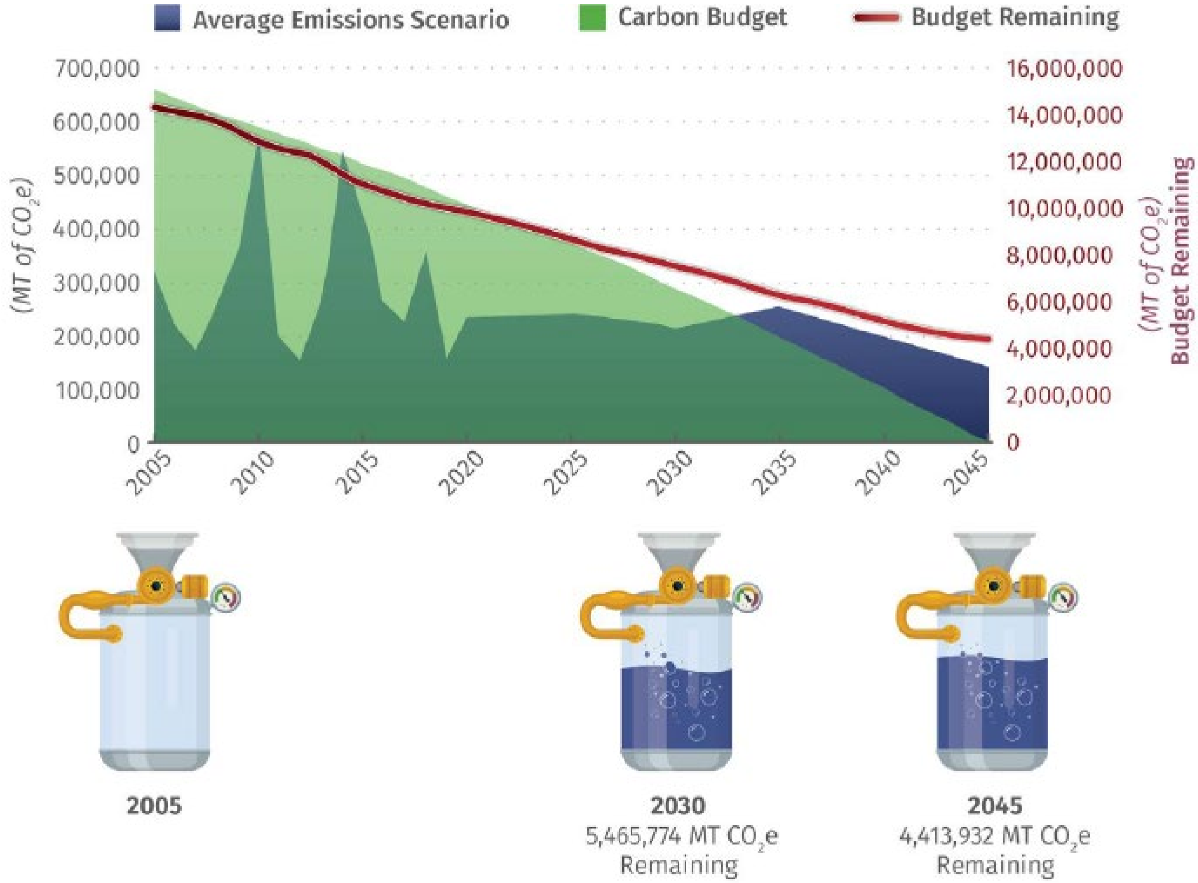
Numbers may not sum due to rounding

[1] The total carbon budget used and budget remaining will be calculated by Metropolitan as GHG inventories for each year are completed.

[2] This number represents the total carbon budget left in the corresponding milestone year on current carbon usage. These totals will be reduced as Metropolitan completes GHG inventories over time. The goal in each milestone year will be considered complete as long as the carbon budget does not reach zero.

Figure 13 shows the carbon budget for Metropolitan's per capita targets based on the average emissions forecast. Under this scenario Metropolitan never exceeds the carbon budget (through 2045). This is only one of the scenarios that Metropolitan may experience. Metropolitan has developed a CAP that provides a pathway to stay within the carbon budget through 2030 under even the highest emission scenario. However, as noted above, emissions would need to fall to carbon neutral by 2045 in order to meet the intent of EO B-55-18 and Metropolitan's stated GHG emissions goal. Metropolitan will need to continue to update its GHG reduction strategy over time to respond to and incorporate the newest science, technologies, and legislation.

**Figure 13 Metropolitan's Carbon Budget Using Mass Emissions Methodology and a Straight Line to Carbon Neutrality by 2045 Target (Average Emissions Forecast)**




Based on the data presented in the inventory and forecast Metropolitan has developed a suite of GHG reduction measures to stay within the carbon budget through 2030 and establish substantial progress towards the 2045 goal of carbon neutrality. A full description of the GHG reduction measures can be found in the CAP and Appendix C.

# 6 Attachment 1: Modeled Metropolitan CIP Projects

### Table 34 Complete List of Metropolitan CIP Projects and Associated GHG Emissions

| | Policy Changes and Other Projects Without Emissions | | |
|---|---|---|---|
| Program | Program Name | Project Name | Emissions |
| Cost Efficiency & Productivity | Business Operations Improvement | Budget System Replacement System | |
| Cost Efficiency & Productivity | Enterprise Content Management | Enterprise Content Management Phase II | |
| CRA Reliability | CRA - Reliability for FY2018/19 through FY2023/24 | CRA Desert Region Security Improvements | |
| CRA Reliability | CRA Main Pump Reliability | CRA Main Pump Rehabilitation (Stage 1) - Design Phase for Demonstration Project | |
| PCCP Reliability | PCCP Rehabilitation and Replacement | PCCP Rehabilitation - Program Management | |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | Chief Administrative Officer Group Labor Adjustment | |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | ESG Labor Adjustment | |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | General Manager's Group Labor Adjustment | |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | Second Lower Feeder PCCP Rehabilitation - Phase I: Pipe Procurement | |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | WSO Labor Adjustment | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Programmatic Environmental Documentation for the Los Angeles Co. Operating Region | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Programmatic Environmental Documentation for the Orange County Operating Region | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Programmatic Environmental Documentation for the Riverside/San Diego Co. Operating Region | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Programmatic Environmental Documentation for the Western San Bernardino County Operating Region | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Real Property Group Labor Adjustment | |
| System Reliability | Enterprise Data Analytics | Enterprise Data Analytics Project | |
| System Reliability | Information Technology System - Security | Cyber Security Remediation Phase 2 | |

| | Policy Changes and Other Projects Without Emissions | | |
|---|---|---|---|
| **Program** | **Program Name** | **Project Name** | **Emissions** |
| System Reliability | Infrastructure Reliability Information System | Asset Monitoring and Management System | |
| System Reliability | Infrastructure Reliability Information System | Maximo Mobile Computing Upgrade | |
| System Reliability | IT Infrastructure Reliability | Headquarters and Field Facilities WiFi Upgrade | |
| System Reliability | IT Infrastructure Reliability | MWD Headquarters Boardroom Technology Upgrade | |
| System Reliability | Water Operations Control | Control System Upgrade Phase 3 Proof-of-Concept | |
| System Reliability | Water Operations Control | Control System Upgrade Phase 4 and 5, Preliminary Design and Selection | |
| System Reliability | Water Operations Control | IT Group Labor Adjustment | |
| System Reliability | Water Operations Control | Water System Control Master Plan | |
| Treatment Plant Reliability | Mills Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Mills Ozone PLC Control and Communication Equipment Upgrade | |
| Treatment Plant Reliability | Mills Water Treatment Plant - Improvements FY2006/07 through FY2011/12 | Mills Modules 3 & 4 Flash Mix Chemical Containment Upgrades | |
| Treatment Plant Reliability | Skinner Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Skinner Ozone Generator PLC Control & Communication Equipment Upgrade | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Los Angeles County Region Environmental Mitigation Monitoring | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Orange County Region Environmental Mitigation Monitoring | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Riverside/San Diego County Environmental Mitigation Monitoring | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Western San Bernardino County Region Environmental Mitigation Monitoring | |
| PCCP Reliability | PCCP Rehabilitation and Replacement | PCCP Rehabilitation - Program Management | |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | Chief Administrative Officer Group Labor Adjustment | |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | ESG Labor Adjustment | |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | General Manager's Group Labor Adjustment | |

| | Policy Changes and Other Projects Without Emissions | | |
|---|---|---|---|
| **Program** | **Program Name** | **Project Name** | **Emissions** |
| PCCP Reliability | Second Lower Feeder PCCP Rehab | WSO Labor Adjustment | |
| Distribution System Reliability | Dam Rehabilitation & Safety Improvements | Diamond Valley Lake Dam Monitoring System Upgrades | |
| Distribution System Reliability | Dam Rehabilitation & Safety Improvements | Dam Monitoring System Upgrades - Lake Mathews | |
| Distribution System Reliability | Dam Rehabilitation & Safety Improvements | Dam Monitoring System Upgrades - Lake Skinner | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Riverside/San Diego County Environmental Mitigation Monitoring | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Western San Bernardino County Region Environmental Mitigation Monitoring | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Right of Way Infrastructure Protection Program - Los Angeles County Region | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Right of Way Infrastructure Protection Program - O. C. Region | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Right of Way Infrastructure Protection Program - Riverside and San Diego County Region | |
| Right of Way & Infr. Protection | Right of Way & Infrastructure Protection | Right of Way Infrastructure Protection Program - Western San Bernardino County Region | |
| CRA Reliability | CRA - Electrical/Power Systems Reliability | Iron Mountain Auxiliary Power System Rehabilitation (Part of Auxiliary Power System Upgrades) | |
| Distribution System Reliability | Reservoir Cover Replacement | Mills Finished Water Reservoir Rehabilitation (Only Operational Change) | |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Jensen Filter Backwash Biological Control System (No emissions) | |
| Treatment Plant Reliability | Mills Water Treatment Plant - Improvements FY2006/07 through FY2011/12 | Mills Modules 3 & 4 Flash Mix Chemical Containment Upgrades | |
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements | Weymouth Administration Building Seismic Upgrades and Building Improvements | |

| | Policy Changes and Other Projects Without Emissions | | |
|---|---|---|---|
| **Program** | **Program Name** | **Project Name** | **Emissions** |
| **Pipelines** | | | |
| Supply Reliability/System Flexibility | Hayfield and Lake Perris Groundwater Recovery | Lake Perris Seepage Water Conveyance Pipeline | 1,261 |
| Supply Reliability/System Flexibility | Perris Valley Pipeline | Perris Valley Pipeline - Tunnels | 1,765 |
| **Subtotal** | | | **3,026** |
| **Paving** | | | |
| System Reliability | System-Wide Paving & Roof Replacements | CRA Pumping Plants Asphalt Replacement | 690 |
| System Reliability | System-Wide Paving & Roof Replacements | Skinner Facility Area Paving | 23 |
| System Reliability | System-Wide Paving & Roof Replacements | System-wide Asphalt Replacement | 197 |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Water Distribution System Replacement and CRA Roadway Asphalt Replacement - All PP | 345 |
| **Subtotal** | | | **1,255** |
| **Equipment Replacement** | | | |
| CRA Reliability | CRA - Reliability for FY2006/07 through FY2011/12 | 2.4 kV Standby Diesel Engine Generator Replacement - Gene | 247 |
| CRA Reliability | CRA - Reliability for FY2006/07 through FY2011/12 | 2.4 kV Standby Diesel Engine Generator Replacement - Intake | 247 |
| CRA Reliability | CRA - Reliability for FY2006/07 through FY2011/12 | 2.4 kV Standby Diesel Engine Generator Replacement - Iron | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | San Dimas and Red Mountain Power Plants Standby Diesel Engine Generator Replacements | 407 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Olinda Pressure Control Structure and Santiago Tower Emergency Generators | 407 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Lake Skinner Area Distribution System Valve Replacement | 247 |

| Program | Policy Changes and Other Projects Without Emissions<br>Program Name | Project Name | Emissions |
|---|---|---|---|
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Orange County Area Distribution System Valve Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Lake Mathews Outlet Tower No. 2 Valve Rehabilitation | 95 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Olinda PCS Valve Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Palos Verdes Feeder - Long Beach Lateral Turnout Structures Sta. 1442+15 Valve Replacements | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Sepulveda-West Basin Interconnection Valve Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Appian Way Valve Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Flow Meter Replacement Project | 342 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Foothill Feeder - Castaic Valley Blow-off Valves Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Lake Mathews Aboveground Storage Tank Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Lake Mathews Sodium Hypochlorite Tank Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | Rio Hondo Pressure Control Structure Valve Replacements | 247 |

| Program | Policy Changes and Other Projects Without Emissions | | Emissions |
|---|---|---|---|
| | Program Name | Project Name | |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | West Orange County Feeder Valve Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | 108th Street Pressure Control Structure Valve Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Service Connections CB-12 & CB-16 Turnout Valve Replacement & Electrical Upgrade | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | San Diego Canal Radial Gate (V0-6) Rehabilitation | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2018/19 through FY2023/24 | San Jacinto Diversion Structure Slide Gate V-03 Replacement | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | San Diego Canal Radial Gate (VO-8) Rehabilitation | 247 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Hollywood Tunnel North Portal Equipment Upgrades | 247 |
| CRA Reliability | CRA - Conveyance Reliability | Copper Basin and Gene Wash Reservoirs Discharge Valve Rehabilitation | 407 |
| CRA Reliability | CRA - Reliability for FY2006/07 through FY2011/12 | CRA Pump Plant Sump System Rehabilitation | 1,236 |
| Water Delivery System Improvements | Greg Avenue PCS - Pump Modifications (See building construction for new control building portion of estimate) | | 407 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation | West Valley Feeder No. 1 Access Roads and Structure Improvements (Stage 3) | 407 |
| CRA Reliability | CRA - Electrical/Power Systems Reliability | CRA Main Transformer Replacement /Rehabilitation | 407 |
| **Subtotal** | | | **9,061** |

| Program | Policy Changes and Other Projects Without Emissions<br>Program Name | Project Name | Emissions |
|---|---|---|---|
| **CRA Domestic Water** | | | |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Pumping Plants Water Treatment Systems Replacement | 95 |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Water Distribution System & Wastewater System Replacement - Gene & Iron Mtn Construction | 108 |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Water Distribution System & Wastewater System Replacement - Intake Construction | 108 |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Water Distribution System Replacement - Hinds & Eagle Mountain | 108 |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Water Distribution System Replacement - Intake | 108 |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Water Distribution System Replacement - Iron Mountain & Gene | 108 |
| Distribution System Reliability | Reservoir Cover Replacement | PVR Facility Sewer Connection | 108 |
| System Reliability | Operations Support Facilities Improvement | Lake Mathews Wastewater System Replacement | 108 |
| Regulatory Compliance | CRA - Discharge Containment | Wastewater System Rehabilitation - Gene/Iron Mtn | 108 |
| **Subtotal** | | | **959** |
| **Building Construction** | | | |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Pumping Plant Storage Buildings at Hinds, Eagle Mountain, and Iron Mountain | 80 |
| Water Delivery System Improvements | Greg Avenue PCS - New Control Building | | 311 |
| System Reliability | Operations Support Facilities Improvement | CRA Housing Improvements - Renovation of Short-Term Accommodations at Eagle Mountain and Iron Mountain Pumping Plants | 1,028 |
| **Subtotal** | | | **1,419** |

| Program | Policy Changes and Other Projects Without Emissions | | Emissions |
|---|---|---|---|
| | **Program Name** | **Project Name** | |
| **Utility Upgrades** | | | |
| Cost Efficiency & Productivity | DVL Recreation Facilities | Diamond Valley Lake (DVL) East Marina Utilities | 158 |
| CRA Reliability | CRA - Electrical/Power Systems Reliability | Auxiliary Power System Rehabilitation/Upgrades | 324 |
| CRA Reliability | CRA - Electrical/Power Systems Reliability | CRA 6.9 kV Power Cables Replacement | 541 |
| CRA Reliability | CRA - Reliability for FY2012/13 through FY2017/18 | CRA Pump Plants 2.3kV and 480V Switch Rack Rehabilitation | 95 |
| CRA Reliability | CRA - Reliability for FY2018/19 through FY2023/24 | CRA 230 kV Transmission System Regulatory and Operational Flexibility Upgrades | 342 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Conveyance and Distribution System Electrical Structures Rehabilitation | 203 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Electrical Upgrades at 15 Structures in the OC Region | 203 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Lake Mathews Electrical Reliability | 203 |
| **Subtotal** | | | **2,070** |
| **Utility Upgrades** | | | |
| CRA Reliability | CRA Main Pump Reliability | CRA Main Pump and Motor Refurbishment | 247 |
| CRA Reliability | CRA Main Pump Reliability | CRA Main Pump Discharge Valve Refurbishment | 247 |
| CRA Reliability | CRA Main Pump Reliability | CRA Main Pumping Plants Discharge Line Isolation Bulhead Couplings | 247 |
| **Subtotal** | | | **742** |
| **Power Plant Upgrades** | | | |
| Distribution System Reliability | Hydroelectric Power Plant Improvements | Red Mountain Power Plant Rehabilitation | 247 |
| Distribution System Reliability | Hydroelectric Power Plant Improvements | Yorba Linda Power Plant Reliability Upgrades | 247 |
| **Subtotal** | | | **495** |

| | Policy Changes and Other Projects Without Emissions | | |
|---|---|---|---|
| **Program** | **Program Name** | **Project Name** | **Emissions** |
| **Reservoir Cover Replacement** | | | |
| Distribution System Reliability | Reservoir Cover Replacement | Garvey Reservoir Cover and Liner Replacement Project | 2,321 |
| Distribution System Reliability | Reservoir Cover Replacement | Jensen Finished Water Reservoir No. 1 Cover Rehabilitation | 301 |
| Distribution System Reliability | Reservoir Cover Replacement | Jensen FWR # 2 Floating Cover Replacement | 2,321 |
| **Subtotal** | | | **4,943** |
| **Treatment Plant Reliability** | | | |
| Treatment Plant Reliability | Diemer Water Treatment Plant - Improvements | Diemer Basin Rehabilitation | 95 |
| Treatment Plant Reliability | Diemer Water Treatment Plant - Improvements | Diemer Plant Washwater Reclamation Facilities Reliability Improvement | 486 |
| Treatment Plant Reliability | Diemer Water Treatment Plant - Improvements for FY2006/07 through FY2011/12 | Chemical Feed System Improvements | 95 |
| Treatment Plant Reliability | Diemer Water Treatment Plant - Improvements for FY2006/07 through FY2011/12 | Diemer Filter Building Seismic Upgrades | 274 |
| Treatment Plant Reliability | Diemer Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Diemer Slope Erosion Remediation | 108 |
| Treatment Plant Reliability | Diemer Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Diemer Emergency Ozone Backup Disinfection | 95 |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements | Jensen Caustic Tank Farm Containment Upgrades | 275 |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Jensen Caustic Metering and Control Facilities | 247 |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Jensen Fluorosilicic Acid (Fluoride) Tank Replacement | 95 |

| | Policy Changes and Other Projects Without Emissions | | |
|---|---|---|---|
| **Program** | **Program Name** | **Project Name** | **Emissions** |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Jensen Liquid Polymer Containment Upgrades | 253 |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Jensen Ozone PSU and Critical Component Upgrades | 95 |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Jensen Site Security Upgrade | 48 |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Jensen Solids Lagoon Nos. 9 & 10 | 1,144 |
| Treatment Plant Reliability | Jensen Water Treatment Plant - Improvements Program for FY2006/07 through FY2011/12 | Jensen Modules 2 and 3 Flocculator Rehabilitation | 95 |
| Treatment Plant Reliability | Mills Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Mills Fluorosilicic Acid Tank Replacement | 95 |
| Treatment Plant Reliability | Mills Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Mills Plant Perimeter Security and Erosion Control Improvements | 113 |
| Treatment Plant Reliability | Mills Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Mills Ozone PLC Control and Communication Equipment Upgrade | 95 |
| Treatment Plant Reliability | Skinner Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Skinner Ozone Generator PLC Control & Communication Equipment Upgrade | 48 |
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements | Weymouth Administration and Control Buildings Seismic Upgrades Project | 411 |
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements | Weymouth Filter Valve Replacement | 95 |
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements | Wheeler Gate Security Improvements | 95 |

| Program | Policy Changes and Other Projects Without Emissions<br>Program Name | Project Name | Emissions |
|---|---|---|---|
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements for FY2006/07 through FY2011/12 | Weymouth Basins 5-8 Refurbishment | 95 |
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements for FY2006/07 through FY2011/12 | Weymouth Dry Polymer System | 74 |
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Weymouth Chlorine System Upgrades | 95 |
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements for FY2012/13 through FY2017/18 | Weymouth Water Quality Instrumentation Improvements | 95 |
| Treatment Plant Reliability | Weymouth Water Treatment Plant - Improvements for FY2018/19 through FY2023/24 | Weymouth Hazardous Waste Staging and Containment | 74 |
| **Subtotal** | | | **4,796** |
| **Treatment Plant Reliability** | | | |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | West Orange County Feeder OC-09 Rehabilitation | 407 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation | Orange County Feeder Lining Repairs | 377 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2006/07 through FY2011/12 | Etiwanda Pipeline Lining Repairs | 240 |
| Distribution System Reliability | Conveyance and Distribution System - Rehabilitation for FY2012/13 through FY2017/18 | Lakeview Pipeline Repair | 350 |
| CRA Reliability | CRA - Reliability for FY2018/19 through FY2023/24 | CRA Pumping Plant Delivery Line Rehabilitation | 165 |
| **Subtotal** | | | **1,538** |
| **Total CIP Projects** | | | **30,305** |

| Program | Program Name | Project Name | Emissions |
|---|---|---|---|
| | Policy Changes and Other Projects Without Emissions | | |
| **PCCP Program** | | | |
| PCCP Program | PCCP Program (Multiple Projects) | 20 year total program | 140,609 |
| PCCP Program | PCCP Program (Multiple Projects) | Average Annual Emissions | 7,030 |
| **Total Annual Construction Emissions Estimate** | | | |
| **Total Annual Construction Emissions (Total CIP emissions divided by 6 years plus annual PCCP Project emissions)** | | | **12,081** |

# 7 Attachment 2: Metropolitan Emission Factors for Department of Water Resources Water Deliveries

Metropolitan understands that many of its member agencies and stakeholders wish to better understand the GHG emissions associated with the water they receive. The water system in California is complex and can pass through the operational control of multiple agencies. Thus, varying emission factors are associated with each water source. To be able to assign an aggregated GHG emission factor per acre foot of water, it is important to understand the source of the water and the specific operational control that the water passed through to understand the total emissions associated with water.

Metropolitan developed this CAP to guide how it will reduce GHG emissions from its operations, projects, and activities over which it has authority (i.e., operational control). Metropolitan's historical absolute emissions and associated emissions factor is presented in Table 24 of this CAP. However, as described in the Excluded Emissions section of the CAP, these emission factors exclude DWR's SWP emissions as well as emissions from other agencies that maintain operational control over the water both upstream and downstream of Metropolitan. To gain a better understanding of the emissions associated with California water delivered in cooperation with other agencies, Metropolitan has combined Scope 2 (electricity) emissions from DWR operations with the emissions estimated by Metropolitan's Climate Action Plan (Scope 1, 2, and 3). Electricity emissions make up a majority of DWR's emissions profile[46] and have been calculated as part of the energy water nexus project being undertaken by Metropolitan and DWR. The information presented has been estimated using the available data and is intended to support member agencies and other stakeholders in better understanding their own GHG emissions. This information should be used for informational purposes only.

## 7.1 Estimating a Combined Metropolitan and SWP Emission Factor

Since DWR emissions are outside of the operational control of Metropolitan, detailed operational data is not available for SWP emissions. However, Metropolitan is working directly with DWR to better understand the energy embedded in the SWP deliveries which are received. As part of this work DWR has provided the total Scope 2 emissions associated with the SWP water Metropolitan received in 2019 and 2020. To estimate the combined emissions required to deliver an acre foot of water which includes both Metropolitan and upstream DWR emissions, the Scope 2 emissions from water received from DWR was combined with Metropolitan's operational emissions to calculate a new total. This total was then divided by the water deliveries for each year reported in the 2020 UWMP to provide a combined Metropolitan and SWP per acre foot estimate emissions factor (see Table 35).

[46] Between 2014 and 2018 electricity consumption made up 60% to 94% of DWR's emissions profile depending on the year. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Climate-Change-Program/Climate-Action-Plan/Files/CAP-I-GGERP-Update-2020.pdf

Other initiatives such as the energy water nexus project with TCR[47] may use different metrics (such as water received) and include different emission scopes. The use of different water metrics does not change the total emissions but results in a different per acre foot average. It is important to note that the combined emission factor reported here will not align with information provided on TCR's water energy water nexus website because the number included here uses Metropolitan's total emissions (i.e., Metropolitan's Scope 1, 2 and 3 emissions) and the total water deliveries as reported in Metropolitan's 2020 UWMP[48] and used in the CAP while the water energy nexus reporting protocol uses only Scope 2 emissions and water delivered  Though the total emissions factor is different than what is reported to TCR, it is consistent with the metrics within this planning context.

While these estimates may provide a clearer picture of total embodied GHG emissions for downstream water users, emissions associated distribution and delivery of water downstream of Metropolitan should also be considered when determining the total embedded energy associated with water.

47 GHG Data and Water-Related Performance Metrics – The Climate Registry

48 The Metropolitan Water District of Southern California (2021). 2020 Urban Water Management Plan.

**Table 35 Estimation of Department of Water Resources Acre Foot Emission Factor**

| Year | Metropolitan Operational Emissions (MT $CO_2$e) | Metropolitan Deliveries (AF) | Metropolitan Operational Emission Factor (MT $CO_2$e per acre delivered) | SWP Scope 2 Emissions (MT $CO_2$e) | Metropolitan Emissions with Upstream SWP Emissions Included (MT $CO_2$e) | Updated Metropolitan Emission Factor with Upstream SWP Emissions Included (MT $CO_2$e/AF) |
|---|---|---|---|---|---|---|
| 2019 | 159,200 | 1,327,000 | 0.1200 | 307,186 | 466,386 | 0.3515 |
| 2020 | 234,329 | 1,374,000 | 0.1705 | 146,594 | 380,923 | 0.2772 |

# APPENDIX C:
# MEASURE SUBSTANTIAL EVIDENCE AND REDUCTION QUANTIFICATION METHODOLOGY

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## Tables

# 1 Introduction

Metropolitan Water District of Southern California (Metropolitan) has developed a Climate Action Plan (CAP) or greenhouse gas (GHG) reduction plan that meets the requirements of Section 15183.5 of the California Environmental Quality Act (CEQA) Guidelines, which provides the opportunity for tiering and streamlining CEQA review and mitigation of project-level GHG emissions. Thus, the CAP fulfills the regulatory obligation under CEQA to mitigate potential GHG impacts while also providing a pathway to streamline CEQA review of future projects included in the CAP. Metropolitan has developed a GHG emissions inventory[1] and established GHG emissions reduction targets consistent with the State's GHG reduction goals established by Senate Bill (SB) 32 and Executive Order (EO) B-55-18.[2] SB 32 establishes a statewide goal of reducing GHG emissions to 40 percent below 1990 levels by 2030, while EO-B-55-18 sets the long-term goal of statewide carbon neutrality by 2045. Metropolitan has established a more conservative target of a linear reduction to carbon neutrality by 2045, exceeding the SB 32 target.[3] The CAP also forecasts GHG emissions associated with Metropolitan operations and future projects out to 2045 and commits to implementing specific GHG reduction measures that contribute to reducing emissions and achieving Metropolitan's targets.[4,5] The CAP will be considered for adoption by Metropolitan's Board of Directors following completion of public review of the CAP and its associated CEQA document.[6]

With the release of the 2017 Scoping Plan,[7] the California Air Resources Board (CARB) recognized the need to balance population growth with emissions reductions and in doing so, provided a new methodology for proving consistency with State GHG reduction goals through the use of per capita efficiency targets. These targets are generated by dividing a jurisdiction's GHG emissions for each horizon year by the jurisdiction's total population for that target year. Metropolitan will pursue a linear per capita GHG emission reduction pathway to exceed the State's 2030 target of 40 percent below 1990 levels by 2030 (0.0309 metric tons of carbon dioxide equivalents [MT $CO_2e$] per person) and make significant progress towards the ultimate goal of achieving carbon neutrality by 2045 (0.0 MT $CO_2e$ per person). Measuring progress towards meeting the established target using a per capita emissions approach is achieved by using Metropolitan's 1990 GHG emissions and then dividing by the population of Metropolitan's service area in that year to get a baseline per capita emissions rate of 0.0516 MT $CO_2e$ per person in 1990. Using Metropolitan's long-term goal of carbon neutrality, a per capita emissions rate of 0.0 MT $CO_2e$ per person was established for the year 2045, interim targets (between 1990 and 2045) were established by drawing a straight line between these two points. The straight line approach results in a per capita target that is 73 percent below 1990 levels by 2030, as shown in Table 1, which exceeds the State's 40 percent reduction goal.

[1] Consistent with CEQA Guidelines Section 15183.5(b)(1)(A) Quantify GHG emissions, existing and projected over a specified time period, resulting from activities within a defined geographic area.
[2] Consistent with CEQA Guidelines Section 15183.5(b)(1)(B) Establish a level of GHG emissions, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable.
[3] For a complete analysis of Metropolitan's GHG reduction targets, see the Climate Action Plan.
[4] Consistent with CEQA Guidelines Section 15183.5(b)(1)(C) Identify and analyze the GHG emissions resulting from specific actions or categories of actions anticipated in the defined geographic area.
[5] Consistent with CEQA Guidelines Section 15183.5(b)(1)(D) Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates if implemented on a project-by-project basis, would collectively achieve the specified emissions level.
[6] Consistent with CEQA Guidelines Section 15183.5(b)(1)(F) Be adopted in a public process following environmental review.
[7] https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf

While the GHG reduction targets have been determined using a per capita approach, Metropolitan will measure progress towards these goals by calculating its total operational GHG emissions in MT $CO_2$e. To better understand the total emissions allowable in each year, the per capita target in MT $CO_2$e per person is translated to mass emissions by multiplying the per capita target by the expected service area population in each year. Table 1 shows Metropolitan's GHG reduction targets, both as per capita and mass emissions, for the milestone years of 2030 and 2045 as well as several interim years. The mass emissions targets that correspond with the per capita targets is presented in Table 1 in the "Associated Mass Emissions" column.

**Table 1 Comparison of Metropolitan GHG Targets and California GHG Reduction Goals**

| Target | Per Capita Emissions and Targets (MT $CO_2$e) | Percent Reduction[2] (Below 1990) | Population[3] | Associated Mass Emissions* (MT $CO_2$e) |
|---|---|---|---|---|
| Metropolitan's 1990 Per Capita Emissions | 0.0516 | N/A | 14,961,310 | 771,514 |
| Minimum Per Capita Reduction Target for SB 32 Consistency | 0.0309 | 40% | 20,634,000 | 638,423+ |
| Metropolitan's Per Capita 2030 GHG Emissions Target[1] | 0.0141 | 73% | 20,634,000 | 290,192+ |
| California's EO B-55-18 Per Capita Goal | 0.0 | 100% | 22,026,000 | 0.0 |
| Metropolitan's 2045 Per Capita Goal | 0.0 | 100% | 22,026,000 | 0.0 |

MT $CO_2$e - metric tons of carbon dioxide equivalent

[1] Metropolitan's per capita emissions targets for 2030 determined based on the linear trajectory between calculated 1990 per capita emission levels and carbon neutrality by 2045.

[2] Percent reduction from 1990 levels is based on the per capita approach.

[3] Service population obtained from the 2020 Urban Water Management Plan and utilized to translate the per capita emissions targets into mass emissions by multiplying the population by the per capita emissions target.

+ Pending final population numbers in 2030 and 2045

* Associated Mass Emissions are calculated by multiplying the per capita emissions target by the projected population in that year. Final mass emission values will be updated based on actual population data in 2030 and 2045.

While Metropolitan has made significant progress in reducing GHG emissions since 1990, achieving carbon neutrality by 2045 will require a focused action plan. The CAP includes specific strategies that, when implemented, can achieve carbon neutrality and provide co-benefits such as improved infrastructure reliability, increased energy reliability, and decreased costs associated with energy procurement and maintenance. Due to the variable nature of Metropolitan's annual operations and associated fluctuations in annual GHG emissions, progress towards Metropolitan's GHG reduction goals will be tracked using a carbon budget as described in the CAP. The carbon budget sets a total mass emission cap between 2005 and 2045, where Metropolitan is pursuing carbon neutrality by 2045. As long as Metropolitan reduces GHG emissions to remain below the overall carbon budget, the GHG reduction targets will be achieved regardless of the emissions achieved during any particular year.

CEQA Guidelines Section 15183.5(b)(1)(D) notes that a CEQA Guideline-consistent CAP must include, "measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level." This appendix details the evidence to demonstrate that the strategies included in the Metropolitan CAP have established a pathway to achieve carbon neutrality and satisfy the requirements of the CEQA Guidelines Section 15183.5(b)(1)(D) for a qualified GHG reduction plan.

Each strategy outlined in the CAP focuses on the GHG emissions over which Metropolitan has direct operational control and on sources (e.g., emissions from construction equipment or employee commute) that generate the highest current GHG emissions. The strategies are made up of measures (action items) that have a quantified GHG reduction potential and clear progress tracking metrics and performance standards. Rincon worked closely with Metropolitan staff to craft and refine comprehensive, realistic, and achievable strategies and measures that can meet or exceed the GHG reduction goals and remain under the carbon budget. The quantification in this report is intended to illustrate one of several viable paths to pursue as the strategies and measures of the CAP are implemented at full scale. The GHG reductions were calculated using published evidence provided through adequately controlled third party investigations, studies, and articles carried out by qualified experts that establish the effectiveness of the strategies and measures included in the CAP. Further, the strategies and measures were developed to achieve Metropolitan's 2030 target and make substantial progress towards the 2045 carbon neutrality target. The estimates and detailed methodology for GHG emission reduction potential, provided in this report, include the substantial evidence and a transparent approach to achieving Metropolitan's GHG emissions reduction target.

As required in CEQA Guidelines Section 15183.5, mechanisms to monitor the CAP's progress toward achieving the GHG emissions reduction targets have been established through the CAP development process. If, based on the annual tracking of Metropolitan GHG emissions, Metropolitan is found to be exceeding the GHG carbon budget such that it will not be able to achieve the respective targets, the CAP will be amended to include altered or additional strategies and measures, with evidence proving, that upon implementation, the CAP can achieve Metropolitan's GHG emissions targets.

## 1.1 Measure Quantification with a Carbon Budget

Metropolitan has a goal to achieve carbon neutrality by 2045 via a linear per capita emissions reduction methodology in combination with an established carbon budget. The use of per capita reduction targets to show progress towards GHG reduction goals was established and promoted by the State in the 2017 Scoping Plan Update.[8] To calculate the total carbon budget that corresponds to Metropolitan's per capita GHG emissions reduction targets, the emissions below the curve are summed, which equates to the carbon budget. Carbon budgets are most commonly used for the development of global-scale GHG emission targets and international climate policy.[9,10] Reliable data is not available for the years 1990 through 2004; therefore, the carbon budget begins in 2005, the year in which Metropolitan began submitting data to The Climate Registry. According to this methodology, between 2005 and 2045 Metropolitan's total carbon budget is 14,660,475 MT $CO_2e$. For additional detail regarding the carbon budget calculations, see Appendix B.

As discussed in Section 4.0, Regulatory Context and Targets, Table 2 details the carbon budget compared to Metropolitan's expected emissions between 2005 and 2030 under the low, average, and high emission scenarios developed from Metropolitan's 2020 Urban Water Management Plan water demand forecast. The three scenarios are intended to capture the full range of possible future emissions including a high emission scenario where there are multiple-dry years and high Colorado River Aqueduct (CRA) pumping levels, an average emission scenario that assumes a single dry year demand level and average emission factors, and a low emission scenario associated with an average demand year and a low emission factor. As seen in the Table 2, Metropolitan is expected to stay

[8] https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf
[9] https://essd.copernicus.org/articles/11/1783/2019/
[10] https://www.carbonbrief.org/analysis-why-the-ipcc-1-5c-report-expanded-the-carbon-budget

within the carbon budget in all three of the emissions forecasts. This is due in part to current Metropolitan efficiency measures, which are reducing emissions, as well as State legislation and programs that will reduce GHG emissions without Metropolitan's action. However, Metropolitan will still need to enact measures to achieve carbon neutrality by 2045. The modeled forecasts represent the likely best, worst, and average case for any particular year. The most likely scenario is an oscillation around the mean with some high emission years and some low emission years.

### Table 2 Carbon Budget and Projected GHG Emissions Reduction Gap Through 2030 Without CAP Implementation

| Scenario | Total Allowable Budget MT $CO_2e$ (2005-2030) | Estimated Metropolitan Emissions MT $CO_2e$ (2005-2030) | 2030 Remaining Budget MT $CO_2e$ |
|---|---|---|---|
| Low Emissions Scenario | 12,577,075 | 6,171,139 | 6,405,936 |
| Average Emissions Scenario | 12,577,075 | 7,111,301 | 5,465,774 |
| High Emissions Scenario | 12,577,075 | 9,192,827 | 3,384,248 |

A parenthesis () denotes a negative number.

One of the primary differences between quantifying measures for a carbon budget compared to a threshold for one specific year is the need to track GHG emissions reductions in every year between the current year and the milestone year. With a single year threshold (ex: 40 percent reduction below 1990 in 2030) the only reduction that counts towards the target is the reduction occurring in 2030. Utilizing a carbon budget approach incentivizes Metropolitan to complete GHG reduction measures as soon as possible to reduce GHG emissions, "saving" for drought conditions and high energy requirements in the future. Therefore, the quantifications included in this section include the cumulative GHG reductions between 2022 and 2030. Table 3 summarizes the cumulative GHG reductions by scope and strategy expected from the implementation of Metropolitan's CAP by 2030.

## Table 3 Metropolitan's GHG Emissions Reduction Strategy and Associated Emission Reductions

| Scope | Strategy | | GHG Emissions Reduction Contribution |
|---|---|---|---|
| Scope 1 | 1 | Phase Out Natural Gas Combustion at Facilities | 2030: 2,830 MT $CO_2$e<br>2045: 15,854 MT $CO_2$e |
| | 2 | Zero Emission Vehicle Fleet | 2030: Supportive[1]<br>2045: Supportive[1] |
| | 3 | Use Alternative Fuels to Bridge the Technology Gap to Zero Emission Vehicles and Equipment | 2030: 998 MT $CO_2$e<br>2045: 2,662 MT $CO_2$e |
| Scope 2 | 4 | Utilize Low-Carbon and Carbon-Free Electricity[2] | 2030: 1,986,390 MT $CO_2$e<br>2045: 4,126,183 MT $CO_2$e |
| | 5 | Improve Energy Efficiency | 2030: 1,220 MT $CO_2$e<br>2045: 3,222 MT $CO_2$e |
| Scope 3 | 6 | Incentivize More Sustainable Commutes | 2030: 6,772 MT $CO_2$e<br>2045: 17,958 MT $CO_2$e |
| | 7 | Increase Waste Diversion to Achieve Zero Waste | 2030: 4,517 MT $CO_2$e<br>2045: 34,923 MT $CO_2$e |
| | 8 | Increase Water Conservation and Local Water Supply | 2030: 968 MT $CO_2$e<br>2045: 3,387 MT $CO_2$e |
| | 9 | Investigate and Implement Carbon Capture and Sequestration Opportunities | 2030: Supportive[1]<br>2045: Supportive[1] |
| Total Phase 1 Reduction Under High Emission Scenario | | | 2030: 2,003,695 MT $CO_2$e<br>2045: 4,204,189 MT $CO_2$e |
| Budget Remaining Under High GHG Emissions Scenario[3] | | | 2030: 3,384,248 MT $CO_2$e<br>2045: (718,236) MT $CO_2$e |
| Budget Remaining After Phase 1 Measure Implementation[3] | | | 2030: 5,387,943 MT $CO_2$e<br>2045: 3,485,953 MT $CO_2$e |

Notes: MT $CO_2$e = metric tons of carbon dioxide equivalent; ZEV/EV = zero emission vehicle/ electric vehicle; GHG = greenhouse gas

[1] Supportive measures are those that are not quantifiable as a standalone action but may support quantifiable actions through providing opportunities for studying technologies, establishing policies, etc. Additionally, some strategies are listed as supportive as they are in the early phase of implementation and the extent of quantifiable GHG reductions is dependent on the completion of the preceding actions (e.g., conduct feasibility study). Therefore, such strategies are conservatively listed as supportive to not overestimate GHG reduction potential.

[2] Strategy 4 includes estimates based on the worst-case emissions scenario, i.e., drought.

[3] A parenthesis () denotes a negative number. This indicates that the carbon budget has been exceeded under this scenario.

## 1.2 Metropolitan Greenhouse Gas Emission Reductions from Strategies and Measures

This section presents an analysis of the GHG emissions reduction pathway to achieve Metropolitan's fair share of GHG emissions reductions necessary to support the State's achievement of the SB 32 GHG reduction goal and provide substantial progress to achieve the 2045 goal of carbon neutrality. Metropolitan has organized its GHG reduction measures around the three emission scopes: either direct (Scope 1) or indirect (Scope 2 and Scope 3) emissions and, nine core strategies that will systematically reduce GHG emissions across all three emission scopes.[11] At this time, Metropolitan has developed two implementation phases for the GHG reduction measures considered in the CAP, Phase 1 and Phase 2. Phase 1 measures are ready for implementation over the next five to ten years based on their cost, available technology, and certainty about future conditions. Phase 2 projects show promise, but need more research, new technologies, or different financial conditions before they can be implemented. Therefore, this document presents GHG emission reductions from Phase 1 measures and discusses the potential of Phase 2 measures.

The GHG emissions reduction from the measures are calculated individually to identify which measures are most impactful for each strategy and then are combined to determine the total GHG emissions reduction that can be achieved by the strategy. Some strategies and measures provide minimal or non-quantifiable GHG emissions reduction; however, they support the implementation and sustainability of the strategy through internal education, funding, evaluating feasibility, and increasing resilience to the impacts of climate. These strategies and measures are considered "supportive," as they do not directly result in measurable GHG emissions reduction; however, they support the overall goals of the CAP. In addition, some strategies require a series of steps or actions to be implemented or completed prior to quantifiable GHG reductions being achieved. Other measures may require more study before implementation. These measures are thus characterized as a Phase 2 strategies and do not contribute to meeting the 2030 target. In other cases, where the quantifiable GHG reductions are dependent on the implementation of preceding measures or additional research (e.g., conduct a feasibility study), the strategy and measures are listed as supportive in this document to ensure GHG emissions reductions are not overestimated. Future CAP updates will include GHG emission reductions associated with completion of supportive measures. The following sections detail the methodology and assumptions used to quantify the GHG emissions reduction measures.

The analysis and emission reduction calculations for each of the strategies in the CAP are outlined in the following pages and include:

- Description of the basis for GHG emissions reduction behind the strategy
- Description of the methodology and assumptions for calculating GHG emissions reduction for applicable strategies and measures, including reference to data sources
- Calculation of the GHG emissions reduction
- Summary table of the impact that the specific strategy has on the overall 2030 GHG carbon budget

[11] The GHG Protocol, which is discussed in detail in *Section 3.0, GHG Emissions Inventory and Forecast,* segregates GHG emission sources into three scopes based on varying levels of control: **Scope 1 –Direct Emissions** from the activities that are directly under an organization's control, such as on-site fuel combustion from boilers, use of fleet vehicles and air-conditioning leaks; **Scope 2 – Indirect Emissions** from purchased electricity - emissions are created during the production of the electricity that is eventually used by the organization; and, **Scope 3 – All Other Indirect Emissions** from activities of the organization, occurring from sources that it does not own or control, including emissions associated with business travel, procurement, waste and water.

GHG emissions reduction calculations use conservative values to avoid over-representing the GHG emissions reduction potential for any individual strategy or measure. Special care has been taken to avoid double counting GHG emissions reduction for strategies and measures. Supportive measures are discussed qualitatively. A summary of the expected cumulative GHG emissions reduction from each of the quantifiable Phase 1 measures by 2030 and 2045 is provided in Table 4. The 2045 GHG emissions reductions quantified in this CAP are not yet enough to meet the long-term 2045 goal of carbon neutrality. However, as the current strategies and measures are implemented, Metropolitan will gain more information, new technologies will emerge, and current pilot projects and programs are anticipated to scale to the size needed to reach carbon neutrality. Furthermore, the State is expected to continue providing updated regulations and support once the 2030 target is achieved.

**Table 4 Summary of GHG Emissions Reduction from CAP Strategies and Phase 1 Measures**

| Phase | Number | Measure | Cumulative Reduction by 2030 (MT $CO_2$e) | Cumulative Reduction by 2045 (MT $CO_2$e) |
|---|---|---|---|---|
| 1 | DC-1 | Conduct a survey of all natural gas consuming devices in offices, control buildings, and residential structures and establish a schedule to replace natural gas equipment with electric by 2025. | Supportive | |
| 1-2 | DC-2 | Reduce natural gas emissions by 50 percent by 2030 and 100 percent by 2045 through electrification. | 2,830 | 15,854 |
| 1 | DC-3 | Update Metropolitan building standards to require all-electric construction for new buildings and retrofits. | Supportive | |
| 1 | FL-1 | Conduct a ZEV/EV Feasibility Study to determine which fleet vehicles can be converted, what chargers/fueling stations are required, and where they should be located by the end of 2022. | Supportive | |
| 1 | FL-2 | Adopt a ZEV/EV first policy for fleet vehicles to obtain ZEVs when technological, operational, or cost effectiveness parameters are met. | Supportive | |
| 1 | FL-3 | Replace fossil fuel passenger fleet vehicles as identified in the ZEV/EV Feasibility Study (FL-1). | Supportive | |
| 1 | FL-4 | Install electric vehicle charging and/or ZEV infrastructure at facilities pursuant to the findings of the ZEV/EV Feasibility Study (FL-1). | Supportive | |
| 1 | AF-1 | Complete a pilot study on the use of renewable diesel rather than conventional diesel for all stationary equipment by 2025. | Supportive | |
| 1 | AF-2 | Conduct a pilot study of renewable diesel use in on-road and off-road vehicles by providing at least one renewable diesel tank at Metropolitan-owned fueling depots in 2021. | Supportive | |
| 1 | AF-3 | Based on the results of the study in AF-2, Metropolitan will begin using renewable diesel fuel in 100 percent of Metropolitan's diesel-consuming on-road and off-road vehicles by 2025. | 998 | 2,662 |
| 1 | E-1 | Analyze marginal emissions rates and evaluate the feasibility of shifting energy use to lower emission periods. | Supportive | |

| Phase | Number | Measure | Cumulative Reduction by 2030 ($MT\ CO_2e$) | Cumulative Reduction by 2045 ($MT\ CO_2e$) |
|---|---|---|---|---|
| 1 | E-2 | Connect the Yorba Linda Hydroelectric Power Plant (YLHEP) behind Metropolitan's Southern California Edison (SCE) electricity meter to directly utilize carbon-free electricity at Metropolitan's Diemer facility by 2025. | 6,301 | 14,018 |
| 1 | E-3 | In markets where available, Metropolitan will switch its retail accounts to green tariff options offered by power providers by 2025 to reduce the Scope 2 GHG emissions associated with retail electricity use. | 18,048 | 28,712 |
| 1 | E-4 | Install 3.5 Mega Watt (MW) battery storage systems at the Jensen, Skinner, and Weymouth treatment plants. Investigate the use of a software system to track and optimize GHG emissions reduction due to time-of-use strategies by 2025. | 219 | 473 |
| 1 | E-5 | Manage Metropolitan’s energy purchases to ensure cost-effective energy supply while achieving the required GHG emissions objective. | 1,961,822 (high emissions scenario) | 4,082,980 (high emissions scenario) |
| 1 | EE-1 | Convert all interior and exterior lighting at 50 percent of Metropolitan facilities to light emitting diode (LED) technologies by 2030 and 100 percent by 2045. | 1,220 | 3,222 |
| 1 | EE-2 | Continue programs to analyze Colorado River Aqueduct pump efficiency and replace or refurbish pumps when cost effective. | Supportive | |
| 1 | EC-1 | Expand subsidized transit commute program to reduce employee commute miles. | Supportive | |
| 1 | EC-2 | Expand employee use of carbon-free and low carbon transportation by providing education programs on the benefits of commute options including public transportation, EV/ ZEV options, and vanpools. | Supportive | |
| 1 | EC-3 | Install zero emission and/or electric vehicle infrastructure as directed by the ZEV/EV Feasibility Study to support at least a 15 percent transition to ZEVs/EVs by 2025. | 3,427 | 10,860 |
| 1 | EC-4 | Continue to offer benefits to employees who use alternative modes of transportation (e.g., public transportation, bikes). | Supportive | |
| 1 | EC-5 | Allow 50 percent of employees located at Metropolitan’s headquarters to telecommute or utilize flexible schedules through 2030 to reduce travel time, vehicle miles travelled, and GHG emissions. | 3,345 | 7,098 |
| 1 | WA-1 | Develop and implement net zero waste policies and programs at all facilities to reduce landfilled waste by 30 percent by 2030 and achieve zero landfilled waste by 2045. | 4,517 | 34,923 |

| Phase | Number | Measure | Cumulative Reduction by 2030 (MT $CO_2e$) | Cumulative Reduction by 2045 (MT $CO_2e$) |
|---|---|---|---|---|
| 1 | WA-2 | Implement a program to reduce organic waste at Metropolitan's Union Station building. Contract or team with local organizations and waste disposal companies to route organic waste to anaerobic digestion or composting facilities and edible food-to-food recovery centers. | Supportive | |
| 1 | WA-3 | Develop and implement a sustainable procurement policy. | Supportive | |
| 1 | WC-1 | Expand programs which educate customers on water conservation initiatives through workshops and speaking engagements. | Supportive | |
| 1 | WC-2 | Continue to implement innovative water use efficiency programs. | Supportive | |
| 1 | WC-3 | Continue Turf Removal Program to install an average of 1,500,000 square feet of water efficient landscapes per year through 2030 through the use of a rebate program. | 968 | 3,387 |
| 1 | WC-4 | Provide funding for the development and monitoring of local stormwater recharge and use projects to evaluate the water supply benefit of stormwater. | Supportive | |
| 1 | WC-5 | Continue to promote water efficiency technologies and innovative practices that can be adopted into future water conservation program updates. | Supportive | |
| 1 | CS-1 | Study carbon capture protocols in the Sacramento-San Joaquin River Delta. | Supportive | |
| 1 | CS-2 | Conduct a five-year research program to increase Metropolitan's knowledge of regenerative agriculture and carbon sequestration opportunities on Metropolitan properties in the Palo Verde Valley. | Supportive | |
| Total Phase 1 Reduction Under High Emission Scenario | | | **2,003,695** | **4,204,189** |
| Budget Remaining Under High GHG Emissions Scenario[1] | | | **3,384,248** | **(718,236)** |
| Budget Remaining After Phase 1 Measure Implementation[1] | | | **5,387,943** | **3,485,953** |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; ZEV/EV = zero emission vehicle/ electric vehicle

A parenthesis () denotes a negative number. This indicates that the carbon budget has been exceeded under this scenario.

To assess the magnitude of GHG emissions reduction needed to provide Metropolitan's fair share GHG emissions reduction and contribute to achieving the State's goal for 2030 (40 percent below 1990 levels) and 2045 (carbon neutrality), Metropolitan forecasted GHG emissions that encompassed the impact of service population growth, operational changes, hydrology, and climate on Metropolitan's GHG emissions. Because a majority of Metropolitan GHG emissions are associated with electricity used for importing water, Metropolitan's GHG emissions are highly dependent on where water is sourced and hydrological conditions. As such, forecasted GHG emissions for Metropolitan were based on three scenarios: Dry-year State Water Project (SWP) with High CRA Pumping (High Emissions Forecast), Average-year SWP with Average CRA Pumping (Average Emissions Forecast), and Wet-year SWP with Low CRA Pumping (Low Emissions Forecast). Forecasted emissions calculations and details can be found in Appendix B of this CAP. Many of the State's regulations may not directly impact Metropolitan, therefore, reductions from such legislation were not quantified as part of the forecast scenarios. The one exception is SB 100, which has had and will continue to have a substantial impact on Metropolitan's GHG emissions into the future and was accounted for in the forecasted emissions scenarios. SB 100, adopted in 2018, requires that all retail energy sold in California be 100 percent carbon-free by 2045.

The combined operational reductions from the strategies and measures, if implemented entirely, have been calculated to result in a cumulative reduction of 2,003,695 MT $CO_2e$ by 2030 and 4,204,189 MT $CO_2e$ by 2045 based on the assumed implementation dates. Under the forecasted worst-case scenario, Metropolitan does not exceed the 2030 target. The reductions provided by the GHG reduction measures have the potential to further buffer the carbon budget which may be needed if demand exceeds the projections. While the strategies and measures identified in this CAP will lead to significant progress in reducing GHG emissions and provide a foundation for achieving net carbon neutrality by 2045; achieving carbon neutrality will require significant additional changes to the technology and systems currently in place at both the state and local level. Future CAP updates will outline new measures needed to reach the ultimate target of carbon neutrality.[12]

With implementation of the strategies and measures in the CAP, Metropolitan's 2030 goals can be reasonably achieved through operational actions and substantial progress towards reaching the long-term goal of carbon neutrality has been demonstrated. While the CAP does not provide the GHG emissions reductions to achieve carbon neutrality by 2045, it provides evidence-based actions Metropolitan can take towards eventually attaining this target. Table 3 and Table 4 demonstrate that the strategies developed in this CAP can achieve the 2030 target and show substantial progress towards the 2045 target. They also illustrate that reaching carbon neutrality will require significant additional effort by Metropolitan and support from the state and federal governments.

[12] Consistent with AEP Climate Change Committee recommendations, SB 32 is considered an interim target toward meeting the 2045 State goal. Consistency with SB 32 is considered to be contributing substantial progress toward meeting the State's long-term 2045 goals. Making substantial progress toward these long-term State targets is important as these targets have been set at levels that achieve California's fair share of international emissions reduction targets that will stabilize global climate change effects and avoid the adverse environmental consequences described under *Section 3.1.3, Potential Effects of Climate Change* (Executive Order B-55-18).

# 2 Greenhouse Gas Emissions Reduction

As mentioned above, the strategies and measures are summarized by Scope. This document is summarized using the same organization (Scope, Strategy, and Measure) and the substantial evidence for each quantifiable strategy and measure is detailed below.

## 2.1 Assumptions

Achievable GHG emissions reduction were quantified using a number of assumptions and developed emission factors. Emission factors, assumptions, and references used in the quantification of multiple measures are detailed here and referenced in each quantifiable measure as appropriate in the following sections.

### 2.1.1 Emission Factors

#### Electricity

Metropolitan acquires electricity from both retail and wholesale sources for operations. To calculate GHG emissions from electricity consumption, the sum total of kilowatt hours (kWh) derived from a specific source is totaled and multiplied by the corresponding annual GHG emissions factor. Two emissions factors were used when quantifying GHG emission reduction potential: United States Environmental Protection Agency's (U.S. EPA) Emissions and Generation Resource Integrated Database (eGRID) for the Southwest (WECC Southwest or AZNM) and U.S. EPA eGrid emissions factor for California (WECC California or CAMX). All electricity purchases from California retail markets utilized the WECC California (CAMX) emissions factor, while wholesale purchases from outside California utilized the WECC Southwest (AZNM) emissions factor. The eGrid emissions factors are updated annually based on the types of electricity procured for that year. Additionally, due to State renewable goals and associated legislation, electricity emission factors are anticipated to decrease over time. Emission factors for the 2017 reporting year are based on U.S. EPA reported eGRID emission factors reported for 2016.[13,14]

Emission factors were interpolated between the 2017 baseline year and future years based on the percent of renewable and carbon neutral sources reported for electricity by eGRID subregion and the anticipated percent of renewable or carbon neutral sources for future years based on state legislation. CAMX emission factors were assumed to achieve the Renewable Portfolio Standards (RPS) established by SB 100 such that in 2030, electricity will be 60 percent renewable and by 2045 electricity will be 100 percent carbon-neutral.[15] Based on the electricity mix that makes up the AZNM subregion, in 2017 approximately 33 percent of the electricity sources for AZNM were carbon neutral. Given the various states' contribution to AZNM electricity and California's and New Mexico's goals to reach carbon-neutral electricity by 2045, AZNM electricity was assumed to be made up of approximately 52 percent carbon-neutral sources by 2045. Assuming a linear trend, AZNM emission factors between 2017 and 2045 were interpolated based on the percent change in composition of the electricity that was carbon-neutral. Table 5 presents the CAMX and AZNM

[13] https://www.epa.gov/egrid/download-data

[14] eGRID emission factors and reports were not prepared for data year 2017.

[15] SB 100 established a landmark policy requiring renewable energy and zero-carbon resources supply 100% of electric retail sales to end-use customers by 2045. SB 100 also sets in interim target of 60% renewable or carbon-free electricity by 2030.

emission factors and percent of carbon-neutral electricity for 2017, 2030 and 2045 that were used to interpolate annual electricity emission factor for the interim years. Additionally, the retail emission factors under the Green Tariff Clean Power option are presented. Based on the amount of carbon-free electricity sources that make up retail electricity versus the clean power Green Tariff option, the emission factors for the Green Tariff Clean Power electricity were 42 percent lower than retail electricity in 2018 and anticipated to be 23 percent lower than retail electricity in 2030 while in 2045 the emission factors for both will be carbon-free.[16] These emission factors were used to quantify several of the strategy and measure GHG emissions reductions. Additionally, a weighted emission factor was developed for Metropolitan electricity use and was used in calculations where it was unclear whether power would be acquired from retail or wholesale power sources. The weighted emission factor is based on the current split in electricity received by Metropolitan and assumes it would remain consistent over time where 53 percent of power was from retail sources (CAMX) and 47 percent was from wholesale sources (AZNM). The weighted emission factor was further adjusted to account for implementation of Strategy 4 and avoid double counting of GHG emissions reduction, specifically the switch of retail accounts to the Clean Power Green Tariff option for retail electricity sources by 2025.

### Table 5 Electricity Emission Factors

| Electricity Source1 | 2017 | 2030 | 2045 |
|---|---|---|---|
| **CAMX (Retail)** | | | |
| Percent Renewable Sources[2,3] | 37% | 60% | 100% |
| Emission Factor (MT $CO_2e$/MWh) | 0.229 | 0.145 | 0 |
| **AZNM (Wholesale)** | | | |
| Percent Carbon-neutral Sources [2,4] | 33% | 43% | 52% |
| Emission Factor (MT $CO_2e$/MWh) | 0.476 | 0.405 | 0.341 |
| **Weighted Emission Factors5** | | | |
| Emission Factor (MT $CO_2e$/MWh) | 0.345 | 0.267 | 0.160 |
| **CAMX (Retail) with Implementation of Strategy 46** | | | |
| Percent Renewable Sources | 88% | 93% | 100% |
| Emission Factor (MT $CO_2e$/MWh) | 0.129 | 0.112 | 0 |
| **Weighted Emission Factors with Implementation for Strategy 47** | | | |
| Emission Factor (MT $CO_2e$/MWh) | 0.288 | 0.250 | 0.160 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; MWh =-megawatt-hour; RPS = Renewable Portfolio Standard

[1] U.S. EPA. The Emissions & Generation Resource Integrated Database: Technical Support Document for eGRID with Year 2016 Data. https://www.epa.gov/egrid/download-data.

[2] Renewable sources are considered hydro, biomass, wind, solar and geo-thermal sources. Carbon-neutral includes the listed renewables as well as nuclear sources. Percent of 2017 electricity generation source is based on source by state within each sub region (i.e., CAMX and AZNM).

[3] CAMX forecasted emissions are based on RPS targets of 60% renewable sources by 2030 and carbon-neutral by 2045.

[4] AZNM forecasted emissions are based on the individual state targets within the AZNM subregion and the contribution to source mix by state where of the 8 states in the subregion only California and New Mexico have carbon-neutral targets for 2045. Because California only contributes 4% of the electricity for the AZNM while New Mexico contributes 15% of the electricity, the overall increase in carbon-neutral electricity sources is limited.

[5] Approximately 53% of Metropolitan's overall electricity comes from CAMX and 47% from AZNM. A weighted emission factor for Metropolitan was developed assuming this ratio remained consistent over time.

[6] The emission factors for the Green Tariff Clean Power electricity were 42 percent lower than retail electricity in 2018 and anticipated to be 23 percent lower than retail electricity in 2030 while in 2045 the emission factors will both be carbon-free.

[7] The weighted emission factor was further modified to account for the implementation of Strategy 4, specifically the switch of retail accounts to the Clean Power Green Tariff option for retail electricity sources by 2025.

[16] https://cleanpoweralliance.org/power-sources/

# 2.2 Scope 1: Direct Combustion

## 2.2.1 Strategy 1: Phase out Natural Gas Combustion at Facilities

Scope 1 emissions from stationary combustion of natural gas at Metropolitan's facilities comprised approximately one percent of total emissions of the 2017 baseline. While natural gas and other fossil fuels are not the most substantial source of GHG emissions, natural gas consuming equipment can be replaced with electric-powered equipment over time as current equipment reaches the end of its useful life. California adopted SB 100 in 2018, making electrification an important strategy for reducing GHG emissions. SB 100 requires that all retail energy sold in California be 100 percent carbon-free by 2045; therefore, electrifying a fossil fuel source means that piece of equipment will also be carbon-free by 2045. In addition to GHG emissions reduction, removing natural gas from facilities would also improve indoor and local outdoor air quality by reducing atmospheric particulate matter less than 2.5 micrograms in size (PM2.5).[17]

### Methodology and Assumptions

*Measure DC-1 – Phase 1: Conduct a survey of all natural gas consuming devices in offices, control buildings, and residential structures and establish a schedule to replace natural gas equipment with electric by 2025.*

Measures DC-1 would incrementally support the strategy through ensuring that all natural gas consuming equipment is identified. Also, identifying cost-effective equipment replacements improves the feasibility of the strategy and allows for equipment replacements to be prioritized. Further, strategic planning such as the establishment of a replacement schedule and budget helps ensure successful implementation of Strategy 1.

*Measure DC-2 – Phase 1: Reduce natural gas emissions by 50 percent by 2030 and 100 percent by 2045 through electrification.*

Measure DC-2, the reduction of natural gas emissions through electrification, would result in emissions reduction associated with Strategy 1 by replacing natural gas and propane consuming equipment with electrically powered equivalents.

Direct GHG emissions reductions for this strategy are dependent on the active removal of natural gas combustion. Therefore, for the purposes of this calculation, it is assumed that through the adoption of the CAP, Metropolitan will commit to the reduction of 50 percent of natural gas use by 2030 and 100 percent by 2045 through electrification of current equipment. Since Metropolitan has full operational control of its facilities, it is assumed that these targets will be fully realized. Emission reduction calculations assume that equipment replacement will begin starting in 2022.

Natural gas combustion at Metropolitan facilities was forecasted to be approximately 21,360 million British Thermal Unit (MMBtu) annually. It was assumed for this calculation that annual natural gas consumption would remain constant over time. Natural gas consumption reduced annually between measure inception date, 2022, and the target date (i.e., 2030 and 2045) was calculated as annual natural gas consumption multiplied by the anticipated annual percent reduction. For this calculation, it was assumed the replacement of natural gas consuming equipment would occur in a linear trend starting in 2022 to the target year (i.e., 2030 and 2045) where 50 percent of natural gas consuming equipment would be replaced by 2030 and 100 percent by 2045. Total reductions of

[17] https://www.nrdc.org/experts/pierre-delforge/gas-appliances-pollute-indoor-and-outdoor-air-study-shows

natural gas consumption between 2022 and the target date are multiplied by the U.S. EPA emission factor of 0.0531 MT $CO_2e$/MMBtu to determine the natural gas emissions cumulatively avoided between 2022 and the target year, i.e., 2030 and 2045, respectively.

Space heating is the largest energy use in buildings and is dominated by non-electric fuels.[18] According to the United States Energy Information Administration (EIA) 2020 Annual Energy Outlook, electric heat pumps for commercial space heating and cooling are two to five times more efficient than natural gas fueled equipment.[19] Emission reductions account for this increased efficiency by conservatively assuming replacement of natural gas fueled equipment with electric equipment will be three times more efficient than natural gas fueled equipment. Since electric appliances are approximately three times more efficient over similar natural gas burning equipment and appliances,[20] the use of electric equipment instead of natural gas would result in improved energy efficiency and a reduction in overall energy consumption for replaced natural gas equipment. The electricity consumption would generate GHG emissions that would offset the reduction in natural gas emissions from electrification; however, these emissions would be minimized assuming full implementation of Strategy 4, specifically the switch of retail accounts to the Clean Power Green Tariff option for retail electricity sources by 2025. Therefore, it was assumed that natural gas sources would be replaced by heat pump water heaters that are 300 percent more efficient and that Strategy 4 would be implemented by 2025 further reducing electricity emissions post-2025.[21] The calculations and assumptions used to estimate emission reductions from Strategy 1 are provided in Table 6.

[18] Deason, Jeff, et al. 2018. Electrification of buildings and Industry in the United States. pp.10. https://pdfs.semanticscholar.org/27f0/d125d5316ee10565560545c0fc17d6c447a8.pdf?_ga=2.3238896.1101123906.1590438648-1004765093.1590438648. Accessed May 25th, 2020.

[19] EIA. 2020. Annual Energy Outlook. Table 22. Commercial Sector Energy Consumption, Floorspace, Equipment Efficiency, and Distributed Generation. https://www.eia.gov/outlooks/aeo/data/browser/#/?id=32-AEO2020&cases=ref2020&sourcekey=0. Accessed May 25th, 2020.

[20] Dennis, Keith. 2015. Environmentally Beneficial Electrification: Electricity as the End-Use Option. The Electricity Journal. 28(9). pp. 100-112. https://doi.org/10.1016/j.tej.2015.09.019

[21] https://www.eec.org.au/for-energy-users/technologies-2/heat-pumps#:~:text=So%20a%20leading%20edge%20(at,reductions%20in%20greenhouse%20gas%20emissions.

**Table 6 Measure DC-2 GHG Emissions Reduction Calculations**

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Equipment Replacement Goal[1] | 50% | 100% |
| Cumulative NG Consumption since 2022 (MMBtu)[2] | 192,240.00 | 512,640.00 |
| Average % of Equipment Replacement since 2022[1] | 27.78% | 58.33% |
| Natural Gas Consumption Reductions since 2022 (MMBtu)[3] | 53,404 | 299,023 |
| Natural Gas Emission Factor (MT $CO_2e$/MMBtu)[4] | 0.0531 | 0.0531 |
| Cumulative Natural Gas GHG Emissions Avoided (MT $CO_2e$) | 2,836 | 15,878 |
| Cumulative Increase in Electricity Consumption since 2022 (kWh)[5,6] | 52,158 | 292,047 |
| Average Electricity Emission Factor Assuming Implementation of Strategy 4 (MT $CO_2e$/MWh)[7] | 0.120 | 0.081 |
| Additional Cumulative GHG Emission from Increased Electricity Consumption (MT $CO_2e$) | 6 | 24 |
| Cumulative GHG Emission Reductions since 2022 (MT $CO_2e$)[8] | 2,830 | 15,854 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; MMBtu = one million British thermal units; kWh =kilowatt-hour; RPS = Renewable Portfolio Standard

Values have been rounded and may not add up exactly.

[1] It was assumed that the replacement of natural gas consuming equipment would occur in a linear trend starting in 2022 to the target year (i.e., 2030 and 2045) where 50% of natural gas consuming equipment would be replaced by 2030 and 100% by 2045.

[2] Annual natural gas consumption is based on Metropolitan data reported for the 2017 inventory, provided in Appendix B. For the purposes of this calculation, it was assumed that annual natural gas consumption would remain constant over time.

[3] Total natural gas reduction from 2022 to the target year (i.e., 2030 and 2045) is calculated as the annual natural gas consumption multiplied by the annual percent reduction described in note 1. This correlates with an average reduction of ~28% in natural gas consumption between 2022 and 2030 (i.e., 50% divided by 9 years of phase out), and an average reduction of ~58% in natural gas consumption between 2022 and 2045 (i.e., 100% divided by 24 years of phase out).

[4] Emission factors obtained from U.S. EPA Emission Factors for Greenhouse Gas Inventories, Table 1. https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf.

[5] Natural gas consumption converted to electricity using the conversions: 1 MMBtu = 0.10 therm; 1 Therm = 29.3001 kWh. https://dothemath.ucsd.edu/useful-energy-relations/

[6] The resulting increase in electricity consumption estimates a three times increase in efficiency due to the improved efficiency of electric heat pumps and other electrical equipment of natural gas. Dennis, Keith. 2015. Environmentally Beneficial Electrification: Electricity as the End-Use Option. The Electricity Journal. 28(9). pp. 100-112. https://doi.org/10.1016/j.tej.2015.09.019

[7] Due to RPS, retail electricity emission factors (i.e., CAMX), will reduce over time. As described in Section 2.1, Assumptions, annual electricity emission factors are interpolated based on the 2017 emission factor and percent of renewable sources and the 2030 emission factor that would result with the required 60% renewable sources. The presented emission factor is the weighted average retail electricity emission factors based on years 2022 to 2030, and 2022 to 2045 with implementation of Strategy 4 where retail electricity accounts would be switched to the Clean Power Green Tariff option for retail electricity sources by 2025.

[8] Cumulative Strategy 1 GHG Emission Reductions are calculated by subtracting the Additional Cumulative GHG Emissions from Increased Electricity Consumption from the Cumulative Natural Gas GHG Emissions Avoided.

### *Measure DC-3 – Phase 1: Update Metropolitan building standards to require all-electric construction for new buildings and retrofits.*

Measures DC-3 would incrementally support the strategy through updated building standards that would require any new construction or retrofits to be all-electric. In addition to active replacement of stationary combustion equipment fueled by natural gas, this supporting measure would further the phasing out of natural gas use at Metropolitan facilities for future projects.

#### RESULTS

The measures associated with Strategy 1 would result in a cumulative reduction of 2,830 MT $CO_2e$ between 2022 and 2030, and 15,854MT $CO_2e$ between 2022 and 2045 as shown in Table 7.

**Table 7 GHG Emissions Reduction Associated with Strategy 1**

| Measures | Cumulative Emission Reductions (MT $CO_2e$) 2030 | Cumulative Emission Reductions (MT $CO_2e$) 2045 |
|---|---|---|
| DC-1 Conduct a survey of natural gas consuming devices in offices, control buildings, and residential structures and establish a schedule to replace natural gas equipment with electric by 2025. | Supportive | |
| DC-2 Reduce natural gas emissions by 50 percent by 2030 and 100 percent by 2045 through electrification. | 2,830 | 15,854 |
| DC-3 Update Metropolitan building standards to require all-electric construction for new buildings and retrofits. | Supportive | |
| **Total Cumulative Emissions Reduction** | **2,830** | **15,854** |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent

## 2.2.2 Strategy 2: Zero Emission Vehicle Fleet

Metropolitan's vehicle fleet represents approximately two to three percent of total annual GHG emissions, however, electrifying the fleet is essential in the reduction of direct fossil fuel consumption by Metropolitan for operations and will be a key step towards achieving carbon neutrality. Electric passenger vehicles are quickly reaching cost parity with internal combustion vehicles and can even provide cost savings over the lifetime of the vehicle.[22,23] While heavy duty vehicles are not currently available for all commercial options, innovative technologies are being developed and additional options will likely become available in the near future.[24] Furthermore, zero emission vehicle (ZEV) adoption will continue to be driven at the State level in part by EO N-79-20, which directs the CARB to develop regulations to achieve 100 percent zero-emission car sales in California by 2035 and zero-emission medium- or heavy-duty vehicles by 2045. Currently the most promising ZEV are electric vehicles (EV); however, Metropolitan will continue to consider new technologies as they become available and may shift to alternative ZEV in the future.

The conversion to an electric fleet requires not just replacement of current fleet vehicles with EV or ZEV options, but also the development of supporting infrastructure. The measures making up Strategy 2 provide a roadmap for Metropolitan to develop a fleet replacement program and infrastructure development to support the EV fleet.

### Methodology and Assumptions

*Measure FL-1 – Phase 1: Conduct a ZEV/EV Feasibility Study to determine which fleet vehicles can be converted, what chargers/fueling stations are required, and where they should be located.*

Measure FL-1, conducting a ZEV/EV Feasibility Study for fleet vehicles, provides the first step necessary to effectively plan and follow-through with fleet conversion to ZEV/EVs. The feasibility study will analyze the existing fleet, fleet vehicles operational purpose, and current available ZEV/EV technology allowing Metropolitan to establish a realistic and feasible vehicle replacement schedule that is aligned with available ZEV/EV technology and is cost effective. The feasibility study

[22] Raustad, R. *Electric Vehicle Life Cycle Cost Analysis,* Electric Vehicle Transportation Center. https://rosap.ntl.bts.gov
[23] http://energy.mit.edu/news/study-low-emissions-vehicles-less-expensive-overall/
[24] https://www.atlasevhub.com/resource/race-to-zero-how-manufacturers-are-positioned-for-zero-emission-commercial-trucks-and-buses-in-north-america/

conducted under Measure FL-1 will also evaluate the infrastructure needed to accommodate a ZEV/EV fleet and identify where charging or fueling stations would need to be installed to meet operational needs.

### *Measure FL-2 – Phase 1: Adopt an ZEV/EV first policy for fleet vehicles to obtain ZEVs when technological, operational, or cost effectiveness parameters are met.*

Measure FL-2, adopt an ZEV/EV first policy for fleet vehicles, provides the policy change enforcing the implementation of fleet conversion based on the findings from the feasibility study conducted under Measure FL-1. The purpose of the policy is to prioritize the purchase of ZEVs/EVs at the time of replacement of existing vehicles, as feasible. This measure would also support infrastructure development to accommodate ZEV/EV fleet vehicles.

### *Measure FL-3 – Phase 1: Replace fossil fuel passenger fleet vehicles as identified in the ZEV/EV Feasibility Study (FL-1).*

Measure FL-3, replacement of fossil fuel fleet vehicles, will be executed based on the findings from the feasibility study conducted under Measure FL-1. Measure FL-3 will be refined with tangible goals for fleet vehicle replacement. Because the timeline for fleet conversion and level of fleet conversion is dependent on the findings from the feasibility study conducted under Measure FL-1, GHG emissions reduction from Strategy 2 are not yet known and therefore, have not been quantified as part of this CAP. This measure is identified as supportive.

### *Measure FL-4 – Phase 1: Install EV charging and/or ZEV infrastructure at facilities pursuant to the findings of the ZEV/EV Feasibility Study (FL-1).*

Measure FL-4, installation of EV charging and/or ZEV infrastructure at facilities, will also be executed based on the findings of the Measure FL-1 feasibility study. Measure FL-4 ensures that ZEV/EV fueling/charging station infrastructure exists to support the fleet conversion. Because the timeline for fleet conversion and level of fleet conversion is dependent on the findings from the feasibility study conducted under Measure FL-1, GHG emissions reduction from Strategy 2 are not yet known and therefore, have not been quantified as part of this CAP. This measure is identified as supportive.

#### RESULTS

The measures associated with Strategy 2 were not quantified since the actual implementation will not be known until the ZEV/EV Feasibility Study is completed, as shown in Table 8. However, implementation of all Strategy 2 measures would lay the groundwork for a seamless conversion to a ZEV fleet when the technology is available and feasible.

**Table 8 GHG Emissions Reduction Associated with Strategy 2**

| Measures | Cumulative Emission Reductions (MT $CO_2e$) 2030 | Cumulative Emission Reductions (MT $CO_2e$) 2045 |
|---|---|---|
| FL-1 Conduct a ZEV/EV Feasibility Study to determine which fleet vehicles can be converted, what chargers/fueling stations are required, and where they should be located. | Supportive | |
| FL-2 Adopt an ZEV/EV first policy for fleet vehicles to obtain ZEVs when technological, operational, or cost effectiveness parameters are met. | Supportive | |
| FL-3 Replace fossil fuel passenger fleet vehicles as identified in the ZEV/EV Feasibility Study (FL-1). | Supportive | |
| FL-4 Install electric vehicle charging and/or zero emission vehicle infrastructure at facilities pursuant to the findings of the ZEV/EV Feasibility Study (FL-1). | Supportive | |
| **Total Cumulative Emissions Reduction** | **Supportive** | |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent

### 2.2.3 Strategy 3: Use Alternative Fuels to Bridge the Technology Gap to Zero Emission Vehicles and Equipment

While ZEV/EV options for passenger vehicles are commercially available, the technology and/or cost for heavy-duty vehicles may not yet be feasible. However, the technology is rapidly changing, and more ZEV options are becoming cost effective and readily available. Because much of Metropolitan's fleet is comprised of heavy-duty vehicles necessary for operations, Strategy 3 is designed to provide an interim opportunity to reduce GHG emissions from medium- and heavy-duty fleet vehicles until the transition to ZEV/EV technology for medium- and heavy-duty vehicles becomes feasible and cost effective. As a short-term strategy, build-out of significant infrastructure for transition fuels is not expected. As such, Strategy 3 focuses on the use of transition fuels in the existing fleet, while Strategy 2 will establish the path for replacement of the existing fleet and infrastructure.

#### Methodology and Assumptions

*Measure AF-1 – Phase 1: Complete a pilot project on the use of renewable diesel rather than conventional diesel for all stationary equipment by 2025.*

Metropolitan operates a variety of stationary equipment currently powered by diesel fuel. Replacing the existing diesel fuel with renewable diesel as a short-term measure would reduce emissions with no change in existing infrastructure.[25] Currently, large scale renewable diesel is utilized by the United States military and is also used by a variety of city, state, and private fleets.[26] Conducting a pilot study to evaluate the replacement of traditional diesel fuel with renewable diesel in stationary equipment through Measure AF-1 will incrementally support Strategy 3 by identifying existing stationary equipment that can feasibly use renewable diesel over traditional diesel until an electric option becomes available.

[25] https://www.government-fleet.com/156621/what-you-need-to-know-about-renewable-diesel
[26] https://www.caranddriver.com/research/a31883731/biodiesel-vs-diesel/

*Measure AF-2 – Phase 1: Conduct a pilot project of renewable diesel use in on-road and off-road vehicles by providing at least one renewable diesel tank at Metropolitan-owned fueling depots in 2021.*

Metropolitan vehicles generally fuel at Metropolitan-owned fueling depots. By contracting with fuel suppliers to replace diesel with biodiesel/renewable diesel at these facilities, Metropolitan can reduce GHG emissions and easily track the amount of low carbon fuels being utilized in the fleet. Conducting a pilot study to evaluate the replacement of traditional diesel fuel with renewable diesel in on-road vehicles through Measure AF-2 will incrementally support Strategy 3 by serving as a bridge until on-road equipment can be replaced with an EV or ZEV option. This measure will be implemented through new contracts for renewable fuels and a change in Metropolitan's policy to use only renewable diesel fuel following the results of the pilot study.

*Measure AF-3 – Phase 1: Based on the results of the study in AF-2, Metropolitan will begin using renewable diesel fuel in 100 percent of Metropolitan's diesel-consuming on-road and off-road vehicles by 2025.*

Measure AF-3, ensures that Metropolitan will convert all of its diesel use for on-road equipment to renewable diesel by 2025 by replacing carbon intense diesel fuel with a renewable substitute. Renewable diesel can be used interchangeably in a traditional diesel-powered engine and typically does not result in any negative operational impacts.[27] Because the carbon dioxide emissions associated with biodiesel/renewable diesel fuels are biogenic, those emissions do not contribute to climate change.[28] Only the nitrous oxide ($N_2O$) and methane ($CH_4$) emissions increase net GHG emissions in the atmosphere, leading to a significantly lower GHG emission factor for those fuels. Furthermore, renewable diesel fuel is operationally similar to regular diesel and is readily available.[29] It has been assumed that the renewable diesel would be domestically produced and that no modification would be necessary for the internal combustion engines of on-road vehicles.

Direct GHG emissions reduction for Strategy 3 are dependent on the full conversion of Metropolitan's diesel-fuel use in on-road vehicles to renewable diesel. With this measure, Metropolitan commits to convert its diesel fleet to 100 percent renewable diesel in 2025.

Based on Metropolitan 2019 fleet data and recorded miles travelled, approximately 184,467 miles were travelled by vehicles fueled by diesel. It was assumed that the mileage would remain relatively consistent for future operations. An average fuel economy for fleet vehicles of 17.25 miles per gallon was applied to annual mileage resulting in approximately 10,694 gallons of diesel consumed annually in diesel fueled on-road vehicles. Renewable diesel has a slightly lower energy density than traditional diesel, such that one gallon of renewable diesel has approximately 93 percent of the energy as one gallon of traditional diesel.[30] As such, 100 percent conversion of renewable diesel in fleet vehicles would result in a slightly higher fuel consumption of approximately 11,499 gallons of renewable diesel annually. GHG emission reductions were calculated as the emissions generated from combustion of 11,499 gallons of renewable diesel in on-road vehicles subtracted from the emissions that would be generated from the combustion of 10,694 gallons of diesel fuel in on-road vehicles. As previously mentioned, renewable diesel is a biogenic fuel where GHG emissions generated are limited to nitrous oxide and methane emissions. The calculations and assumptions used to estimate GHG emissions reduction from Strategy 3 are provided in Table 9.

[27] https://www.government-fleet.com/156621/what-you-need-to-know-about-renewable-diesel
[28] https://climatechange.ucdavis.edu/climate-change-definitions/biogenic-carbon/
[29] https://www.government-fleet.com/156621/what-you-need-to-know-about-renewable-diesel
[30] https://afdc.energy.gov/fuels/fuel_comparison_chart.pdf

### Table 9 Measure AF-3 GHG Emissions Reduction Calculations

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Cumulative Diesel-fueled VMT since 2022 (miles)[1] | 1,660,203 | 4,427,208 |
| Average Diesel Fuel Economy (mpg)[2] | 17.25 | 17.25 |
| Cumulative Diesel Fuel Consumption (gallons) | 96,244 | 256,650 |
| Diesel Fuel [mobile] Emission Factor (MT $CO_2e$/gallon)[3] | 0.0104 | 0.0104 |
| Cumulative Emissions from Diesel-fueled Fleet (MT $CO_2e$) | 1,001 | 2,669 |
| Average Biodiesel Fuel Economy (mpg)[2] | 16 | 16 |
| Cumulative Biodiesel Fuel Consumption (gallons) | 103,763 | 276,701 |
| Renewable Diesel Emission Factor (MT $CO_2e$/gallon)[3] | 0.000027 | 0.000027 |
| Renewable Diesel Fuel GHG Emissions (MT $CO_2e$) | 3.0 | 7 |
| Cumulative GHG Emissions Avoided since 2022 (MT $CO_2e$)[4] | 998 | 2,662 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; mpg = miles per gallon; VMT = vehicle miles travelled

Values have been rounded and may not add up exactly.

[1] Annual vehicle miles travelled by Metropolitan diesel fueled on-road equipment was obtained from Metropolitan 2019 fleet data. It was assumed to remain consistent with future operations.

[2] Fuel consumption in gallons is based on an average fuel economy of 17.25 mpg for diesel fuel and 16 mpg for renewable diesel fuel.

[3] Emission factors obtained from United States Environmental Protection Agency Emission Factors for Greenhouse Gas Inventories, Table 2 and Table 4. https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

[4] Cumulative Strategy 3 GHG emissions reduction are calculated by adding the avoided emissions that occurred each year between 2022 to 2030 (i.e., 9 years) and 2022 to 2045 (i.e., 24 years). Note that this strategy is meant to be short term before electric technologies are available for heavy duty and medium duty on-road vehicles, therefore cumulative emissions between 2022 and 2045 will likely be lower as ZEVs replace biodiesel fueled vehicles.

#### RESULTS

As shown in Table 9, the 100 percent conversion to renewable diesel in on-road diesel vehicles would result in a reduction of GHG emissions annually. As such, Strategy 3 would result in a cumulative reduction of approximately 998 MT $CO_2e$ between 2022 and 2030, and approximately 2,662 MT $CO_2e$ between 2022 and 2045 due to implementation of Measure AF-3. Table 10 summarizes the measures associated with Strategy 3 and overall GHG emissions reduction.

**Table 10 GHG Emissions Reduction Associated with Strategy 3**

| Measures | Cumulative Emission Reductions (MT $CO_2e$) 2030 | Cumulative Emission Reductions (MT $CO_2e$) 2045 |
|---|---|---|
| AF-1 Complete a pilot project on the use of renewable diesel rather than conventional diesel for all stationary equipment by 2025. | Supportive | |
| AF-2 Conduct a pilot project of renewable diesel use in on-road and off-road vehicles by providing at least one renewable diesel tank at Metropolitan-owned fueling depots in 2021. | Supportive | |
| AF-3 Based on the results of the study in AF-2, Metropolitan will begin using renewable diesel fuel in 100 percent of Metropolitan's diesel-consuming on-road and off-road vehicles by 2022. | 998 | 2,662 |
| **Total Cumulative Emissions Reduction** | **998** | **2,662** |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent

## 2.3 Scope 2: Electricity

### 2.3.1 Strategy 4: Utilize Low-Carbon and Carbon-free Electricity

Over two thirds of Metropolitan's GHG emissions result from the use of electricity to power its pumps, treatment plants, and facilities.[31] As such, a majority of Metropolitan's GHG emissions could be reduced by switching to electricity that is generated from renewable or carbon-free sources. Metropolitan acquires electricity from both retail and wholesale sources for operations where currently 53 percent of electricity is retail power and 47 percent is wholesale.[32] With the adoption of SB 100 in 2018, all of California's retail power is required to be carbon-free by 2045. However, the fraction of wholesale power Metropolitan consumes is not subject to the requirements of SB 100. The GHG emissions associated with Metropolitan's wholesale power purchases can be offset through preferentially purchasing carbon-free power from the grid. Strategy 4 encompasses one of Metropolitan's most potent GHG emissions reduction actions (Measure E-6) in which Metropolitan will offset significant portions of GHG emissions by purchasing low-carbon electricity from the CAISO. Metropolitan will also investigate "time-of-use" strategies, which entails changing the time of day that pumps and other infrastructure consume electricity, by increasing usage during times of low grid emissions and reduce use during times of peak grid emissions. Metropolitan annually will track GHG emissions and ensure operational emissions remain within the carbon budget by adjusting the ratio of renewable power in its power purchases.

#### Methodology and Assumptions

Because electricity consumption is the largest source of emissions for Metropolitan operations, the strategy involves several different types of measures that support the planning phase of this process, implementation of operation-wide changes in electricity purchases and consumption, as well as execution of specific projects that would reduce GHG emissions associated with electricity usage. Measures that are supportive to the planning phase of this process such as Measure E-1 and

[31] The use of electricity generates emissions when it is generated by non-renewable sources such as natural gas.
[32] Wholesale power refers to electricity purchased directly from the electricity grid rather than through a utility like Southern California Edison. The actual ratio of retail to wholesale power changes year to year depending on pumping needs.

E-3, are not considered to result in quantifiable GHG emissions reduction, but support the efforts to achieve carbon-free electricity.

### *Measure E-1 – Phase 1: Analyze marginal emissions rates and evaluate the feasibility of shifting energy use to lower emissions periods.*

Under Measure E-1, Metropolitan will investigate the technical and cost-related feasibility of time-of-use measures including the impact to pumps and other infrastructure, the current time-of-use trends, and the cost and GHG reduction implications. This supports the prioritization of operational changes where it may not be feasible to obtain carbon-free electricity and assists in future planning of projects.

### *Measure E-2 – Phase 1: Connect the Yorba Linda Hydroelectric Power Plant (YLHEP) behind Metropolitan's Southern California Edison (SCE) electricity meter to directly utilize carbon-free electricity at Metropolitan's Diemer facility by 2025.*

To support the preparation of Metropolitan's Energy Sustainability Plan, a Technical Memorandum (TM-2) was prepared by Stantec Consulting Services Inc. (Stantec) to identify and assist in the selection of renewable and energy storage opportunities at select Metropolitan sites. Assumptions regarding energy use for specific projects is largely based on the data reported in TM-2.[33]

The YLHEP currently generates carbon-free electricity by harnessing the power of water as it flows through turbines on its way to the Robert B. Diemer Water Treatment Plant (Diemer Plant). GHG emissions generated from electricity consumption at the Diemer Plant are related to the use of retail electricity which has an emission factor greater than zero. By reconfiguring the YLHEP power source behind the meter, the electricity it generates would become directly available to the Diemer Plant, offsetting the need for retail power while the YLHEP is in operation. This reconfiguration would allow Metropolitan to power the Diemer Plant with carbon-free electricity and generate cost savings for Metropolitan by eliminating external electricity purchases.

GHG emissions reduction for this measure are calculated as the emissions avoided from the use of carbon-free electricity to power the Diemer Plant instead of retail electricity. The calculations and assumptions used to estimate emission reductions from Measure E-2 are provided in Table 11. Based on historical data of Diemer's hourly energy demand from year 2015 to year 2018, the Diemer Plant consumes approximately 8.9 GWh annually. As discussed in Section 2.1, Assumptions, annual retail emission factors are based on the eGRID CAMX subregional factors that reduce annually as the RPS target year is approached. The avoided emissions are calculated as the annual electricity consumption multiplied by the respective retail emission factor for that year. However, these emissions would be minimized assuming full implementation of Strategy 4, Measure E-3, specifically the switch of retail accounts to the Clean Power Green Tariff option for retail electricity sources by 2025. Therefore, it was assumed that Strategy 4, Measure E-3 would be implemented by 2025 further reducing electricity emissions post-2025. This results in a cumulative reduction of approximately 6,301 MT $CO_2e$ by 2030 and 14,018 MT $CO_2e$ by 2045 from implementation of Measure E-2 and incorporation of Measure E-3.

[33] Stantec Consulting Services Inc. 2019. Technical Memorandum No.2 Development of Renewable Energy Options.

## Table 11 Measure E-2 GHG Emissions Reduction Calculations

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Diemer Annual Energy Demand (GWh/year)[1] | 8.9 | 8.9 |
| Cumulative Diemer Energy Demand since 2025 (MWh)[2] | 53,400 | 186,900 |
| Average Electricity Emission Factor Assuming Implementation of Strategy 4 Measure E-3 (MT $CO_2e$/MWh)[3] | 0.118 | 0.075 |
| Cumulative GHG Emissions Avoided since 2025 (MT $CO_2e$)[4] | 6,301 | 14,018 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; GWh = gigawatt-hour; MWh =-megawatt-hour

Values have been rounded and may not add up exactly.

[1] Based on historical data of Diemer's hourly energy demand from year 2015 to year 2018, the Diemer Plant consumes approximately 8.9 GWh annually (Stantec 2019).

[2] Based on 8.9GWh consumed annually from 2025 through 2030 (i.e., 6 years) and 2025 through 2045 (i.e., 21 years). 1GWh = 1,000 MWh

[3] As described in Section 2.1, Assumptions, annual electricity emission factors are interpolated based on the 2017 emission factor and percent of renewable sources and the 2030 emission factor that would result with the required 60% renewable sources. The presented emission factor is the weighted average retail electricity emission factors based on years 2025 to 2030, and 2025 to 2045 with implementation of Strategy 4, Measure E-3 where retail electricity accounts would be switched to the Clean Power Green Tariff option for retail electricity sources by 2025. Green Tariff Clean Power emission factor is on average 27% lower than the retail emission factor between 2025 through 2030 and on average 15% lower than the retail emission factor between 2025 through 2045 due to a greater amount of carbon-free sources.

[4] Cumulative GHG emissions reduction are calculated by adding the avoided emissions that occurred each year between 2025 to 2030 (i.e., 6 years) and 2025 to 2045 (i.e., 21 years) based on the annual electricity demand of 8.9 GWh and retail electricity factor as detailed in note 3.

### *Measure E-3 – Phase 1: In markets where available, Metropolitan will switch its retail accounts to green tariff options offered by power providers by 2025 to reduce the Scope 2 GHG emissions associated with retail electricity use.*

Metropolitan can reduce its retail electricity emissions by purchasing low carbon electricity through green tariff options (lower carbon electricity options provided by the utility or CCA) and potentially reduce the cost of electricity simultaneously. Most retail providers offer a portfolio of green energy options, each with a guaranteed percentage of green energy.[34]

The emissions reduction impact of Measure E-3 results from the increased renewable and carbon-free electricity supplied to Metropolitan from switching its retail accounts to green tariff options offered by power providers by 2025. The calculations and assumptions used to estimate emission reductions from Measure E-3 are provided in Table 12. The avoided emissions are calculated as the difference between emissions generated from current annual retail electricity consumption versus that same electricity purchased using an example green tariff option for electricity. Based on the amount of carbon-free electricity sources that make up retail electricity versus the green tariff option, the emission factor for the green tariff electricity is anticipated to be an average of 27 percent lower than retail electricity between 2025 through 2030 and an average 15 percent lower than retail electricity between 2025 through 2045.[35] This results in a cumulative reduction of 18,868 MT $CO_2e$ between 2025 and 2030, and 21,534 MT $CO_2e$ between 2025 and 2045 due to implementation of Measure E-3. However, additional reductions could be achieved by switching to an even lower carbon option like 100% carbon free or 100% renewable options.

[34] Annual renewable electricity composition is based on composition of carbon-free sources for both the green tariff and SCE retail power that currently exist and an assumed linear trend to 100% carbon neutral by 2045. In 2018 the example green tariff which is provided by Clean Power Alliance was 87% carbon-free while SCE retail electricity was 46% carbon-free. The average difference in the percent of carbon-free sources between the CPA and SCE averaged across 2025-2030 is 27% and 15% across 2025-2045. https://cleanpoweralliance.org/power-sources/

[35] https://cleanpoweralliance.org/power-sources/

### Table 12 Measure E-3 GHG Emissions Reduction Calculations

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Cumulative Retail Power Purchased since 2025 (kWh)[1,2] | 410,172,996 | 1,435,605,486 |
| Cumulative Retail Power Purchased (MWh) | 410,173 | 1,435,605 |
| Average Retail GHG Emission Factor (MT $CO_2e$/MWh)[3] | 0.162 | 0.095 |
| Cumulative GHG Emissions Generated using Retail Electricity (MT $CO_2e$)[5] | 66,448 | 136,382 |
| Average CPA Clean Power Electricity Emission Factor (MT $CO_2e$/MWh)[4] | 0.118 | 0.075 |
| Cumulative Electricity Emissions w CPA Clean Power (MT $CO_2e$)[5] | 48,400 | 107,670 |
| Cumulative GHG Emissions Avoided between since 2025 (MT $CO_2e$)[6] | 18,048 | 28,712 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; kWh =-kilowatt-hour; MWh = megawatt-hour

Values have been rounded and may not add up exactly.

[1] Based on Metropolitan operational data for calendar year 2017 and power purchases for retail power. For the purposes of this calculation it is assumed that this value stays constant over time.

[2] Cumulative retail power purchased is based on the sum of annual retail power purchased between 2025 through 2030 (i.e., 6 years) and between 2025 through 2045 (i.e., 21 years). 1,000 kWh = 1 MWh

[3] Due to RPS, retail electricity emission factors (i.e., CAMX), will reduce over time. As described in Section 2.1, Assumptions, annual electricity emission factors are interpolated based on the 2017 emission factor and percent of renewable sources and the 2030 emission factor that would result with the required 60% renewable sources. The presented emission factor is the average retail electricity emission factors based on years 2025 through 2030 and years 2025 through 2045.

[4] Annual renewable electricity composition is based on composition of carbon-free sources for both the Green Tariff and SCE retail power that currently exist and an assumed linear trend to 100% carbon neutral by 2045. In 2018 Green Tariff clean power mix was 87% carbon-free while SCE retail electricity was 46% carbon-free. The CPA emission factor averaged across 2025-2030 is 27% lower than SCE and averaged across 2025-2045 is 15% lower than SCE. https://cleanpoweralliance.org/power-sources/

[5] Cumulative GHG emissions generated using either retail or green tariff power is calculated by multiplying the average emission factor by the cumulative amount of retail power that is anticipated to be purchased between 2025 through 2030 and 2025 through 2045.

[6] Cumulative E-4 GHG emissions reduction are calculated as the difference between the cumulative emissions generated using retail power versus cumulative emissions generated using Green Tariff Clean Power.

### *Measure E-4 – Phase 1: Install 3.5 MW battery storage systems at the Jensen, Skinner, and Weymouth treatment plants. Investigate the use of a software system to track and optimize GHG emissions reduction due to time-of-use strategies by 2025.*

TM-2 prepared by Stantec identified several opportunities for distinct battery storage systems to be incorporated into Metropolitan’s operations. By storing renewable energy, Metropolitan will reduce GHG emissions by charging the battery system periods during times of low grid emissions and discharging them during periods of high emission electricity.

For this GHG emissions reduction calculation, the battery capacity was assumed to be 3.5 MW based on the scenarios identified in TM-2 and it was assumed the battery storage systems would be installed by 2025. The relationship between battery capacity and potential annual renewable energy use was evaluated with linear regression ($R^2 = 0.9382$). The potential renewable energy to be used in place of grid energy is related to battery power using the following equation:

$y = 342.35x - 125.91$

x= battery capacity (MW)

y= energy storage (MWh)

This results in approximately 1,072 MWh of energy storage per year. Avoided GHG emissions annually is based on the difference in emission factors between the low grid times, when the battery would be loaded, and grid times when the battery discharge would occur. The electricity emission factor at low grid times was found to be approximately 28 percent lower than the daily average emission factor.[36] These emissions would be minimized assuming full implementation of Strategy 4, Measure E-3, specifically the switch of retail accounts to the Clean Power Green Tariff option for retail electricity sources by 2025. Therefore, it was assumed that Strategy 4, Measure E-3 would be implemented by 2025 further reducing electricity emissions post-2025. This results in a cumulative reduction of approximately 219 MT $CO_2e$ by 2030 and 473 MT $CO_2e$ by 2045 due to implementation of Measure E-4 and incorporation of Measure E-3.

The potential GHG emissions avoided from this measure are conservative since each of the proposed sites for battery storage have photo voltaic (PV) solar power arrays associated with them. To be conservative, grid mix was assumed to feed the battery storage systems rather than power generated from the PV systems. Additional GHG emissions reductions would be achieved with the displacement of wholesale power rather than retail power as assumed in this calculation.

### Table 13 Measure E-4 GHG Emissions Reduction Calculations

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Battery Capacity (MW)[1] | 3.5 | 3.5 |
| Annual Energy Storage (MWh)[2] | 1,072 | 1,072 |
| Cumulative Energy Storage (MWh)[3] | 6,434 | 22,519 |
| Average Electricity Emission Factor Assuming Implementation of Strategy 4 Measure E-3 (MT $CO_2e$/MWh)[4] | 0.118 | 0.075 |
| Cumulative Electricity Emissions at Average Times (MT $CO_2e$) | 759 | 1,689 |
| Deviation between Low and Average Electricity Emission Factor[5] | 28% | 28% |
| Average Low Retail Electricity Emission Factor w/ Strategy 4 (MT $CO_2e$/Mwh)[6] | 0.084 | 0.054 |
| Cumulative Electricity Emissions at Low Times (MT $CO_2e$)[7] | 540 | 1,216 |
| Cumulative GHG Emissions Avoided since 2025 (MT $CO_2e$)[7,8] | 219 | 473 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; kWh =-kilowatt-hour; RPS = Renewable Portfolio Standard

Values have been rounded and may not add up exactly.

[1] Battery capacity was assumed based on scenarios presented in TM-2 (Stantec 2019).

[2] The relationship between battery capacity and potential annual renewable energy use reported in TM-2 was evaluated with linear regression resulting in the following equation: $y = 342.35x - 125.91$, where x is the battery capacity and y the energy storage. The relationship had an $R^2$ of 0.9382, indicating a strong linear relationship.

[3] Based on 1,072 MWh of energy storage annually from 2025 through 2030 (i.e., 6 years) and 2025 through 2030 (i.e., 21 years).

[4] Due to RPS, retail electricity emission factors (i.e., CAMX), will reduce over time. As described in Section 2.1, Assumptions, annual electricity emission factors are interpolated based on the 2017 emission factor and percent of renewable sources and the 2030 emission factor that would result with the required 60% renewable sources. The presented emission factor is the weighted average retail electricity emission factors based on years 2025 to 2030, and 2025 to 2045 with implementation of Strategy 4, Measure E-3 where retail electricity accounts would be switched to the Clean Power Green Tariff option for retail electricity sources by 2025. Green Tariff Clean Power emission factor in on average 27% lower than the retail emission factor between 2025 through 2030 and on average 15% lower than the retail emission factor between 2025 through 2045 due to a greater amount of carbon-free sources.

[5] CAISO tracks demand and emissions data in 5 min increments throughout the day for every day of the year. The lowest emission factor during the day due to high renewables on the grid was found to be approximately 28% lower than the average electricity grid emission factor.

[6] Based on note 5, on average emissions would be reduced by approximately 28% for the energy discharged from the battery loaded at peak time. The difference in emission factors between average grid electricity and the emission factor for batteries charged at low-emissions times and discharged at higher-emissions time.

[7] Cumulative GHG emissions avoided between 2025 through 2030 is calculated as the cumulative energy that could be stored and discharged multiplied by the emission factor difference between average grid electricity and the emission factor for batteries charged at low-emissions times, as described in note 6.

[8] GHG emissions avoided could be increased if the battery were charged from on-site renewables rather than the grid.

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[36] Variation in daily electricity emission factors due to incorporation of renewable energy during the day is based on CAISO daily emissions and electricity tracking. (Source: http://www.caiso.com/TodaysOutlook/Pages/emissions.aspx)

### *Measure E-5 – Phase 1: Manage Metropolitan's energy purchases to ensure cost-effective energy supply while achieving the required GHG emissions objective.*

The single largest source of GHG emissions associated with Metropolitan's operations is related to electricity consumption. Most of Metropolitan's Scope 2 GHG emissions are tied to the consumption of electricity needed for pumping water along the CRA, which is directly tied to public water demand. Metropolitan's demand is met through its imported water supplies, which vary year-to-year and largely depend on supply availability. When Metropolitan is required to meet its demand through increased pumping on the CRA, higher GHG emissions may result. Electricity used to power the pumps along the CRA comes from three distinct sources: Hoover and Parker Dam hydroelectric power which has an emission factor of zero, California grid energy which had an emission factor of approximately 0.239 MT $CO_2e$ per MWh in 2017, and out-of-state electricity which is delivered through the AZNM regional grid which receives power from multiple states outside California and had an emission factor of 0.480 MT $CO_2e$ in 2017.[37] The amount of electricity purchased from each source varies year-to-year depending on multiple factors and in general, AZNM makes up a higher percentage of Metropolitan's electricity in high pumping years, adding to the higher GHG emissions in those years.

This measure would change electricity procurement policies to reduce reliance on AZNM electricity and increase the use of energy from the CAMX grid or specific lower GHG emission generation resources. Not only will this action reduce a significant amount of GHG emissions in the short term, but emissions will likely continue to decrease over time due to SB 100. Energy sales in both markets will likely continue to transition to carbon-free sources, further reducing GHG emissions. However, it is difficult to predict the future market energy mix or the cost of lower emission energy. Since the emissions reduction associated with this measure will change depending on the actual amount of electricity purchased and the source of purchased energy, Metropolitan has committed to ensuring that it will meet any shortfall in its carbon budget through low or no carbon energy purchases and other measures that most cost-effectively achieve the carbon budget objective. To quantify this measure's ability to meet Metropolitan's GHG reduction goal in the High Emissions Scenario, the estimated electricity consumption from the AZNM gird was estimated based on historical high pumping years.

[37] https://www.epa.gov/sites/production/files/2020-01/documents/egrid2018_summary_tables.pdf

**Table 14 Measure E-5 GHG Emissions Reduction Calculations**

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Electricity Usage for Water Deliveries under High Pumping Scenario (kWh/Acre Foot)[1] | 458.85 | 458.85 |
| Annual Average Forecasted Water Deliveries under High Pumping Scenario (Acre Foot)[2] | 2,170,334 | 2,170,334 |
| Cumulative Wholesale Power Purchased for Pumping (kWh)[3] | 9,958,489,001 | 24,896,222,502 |
| Cumulative Wholesale Power Purchased for Pumping (MWh) | 9,958,489 | 24,896,223 |
| Annual Average AZNM Emission Factor between 2021 and target year (MT $CO_2e$/MWh)[4] | 0.426 | 0.393 |
| Cumulative High Emission Scenario Forecasted Emissions from AZNM Electricity since 2021 (MT $CO_2e$) | 4,242,316 | 9,784,215 |
| CAMX Emission Factor between 2021 and target year (MT $CO_2e$/MWh)[5] | 0.229 | 0.229 |
| Cumulative High Emissions Scenario Forecasted Emissions with CAMX Electricity (MT $CO_2e$) | 2,280,494 | 5,701,235 |
| Cumulative GHG Emissions Avoided since 2021 (MT $CO_2e$)[6] | 1,961,822 | 4,082,980 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; kWh =-kilowatt-hour, MWh = Megawatt hour; RPS = Renewable Portfolio Standard

Values have been rounded and may not add up exactly.

[1] Electricity usage for water deliveries during high pumping scenarios corresponding with drought years is based on historical data for water deliveries and electricity usage obtained from the Urban Water Management Plan and Metropolitan electricity data for year 2010. Calculations are detailed in Appendix B.

[2] Based on forecasted water deliveries under the high pumping scenario detailed further in Appendix B.

[3] Total electricity purchases for the high pumping scenario are calculated as the annual average forecasted water deliveries under the high pumping scenario multiplied by the electricity usage per acre foot. Cumulative electricity purchased for pumping is calculated as the annual grid purchases multiplied by the number of years between 2021 through 2030 (i.e., 10 years), and between 2021 through 2045 (i.e., 25 years). Total electricity consumption is converted using 1,000 kWh = 1 MWh

[4] Majority of electricity for pumping is purchased through wholesale providers (i.e., AZNM). As described in Section 2.1, Assumptions, annual AZNM emission factors between 2017 and 2045 were interpolated based on the percent change in composition of the electricity that was carbon-neutral and assuming a linear trend. The presented emission factor is the average wholesale electricity emission factors based on years 2021 through 2030 and years 2021 through 2045.

[5] CAMX grid emission factor assumed to be equivalent to the 2017 CAMX emission factor. As wholesale power, CAMX not subject to RPS therefore conservatively assumed emission factor says constant over time. This is considered conservative as the CAMX grid mix will likely decrease along with retail due to SB100.

[6] Cumulative E-5 GHG emissions reduction are calculated as the difference between the cumulative emissions generated using AZNM wholesale power for pumping and cumulative emissions generated from switching to CAMX power for pumping.

### RESULTS

Table 15 summarizes the measures associated with Strategy 4 and potential GHG emissions reduction. Because this electricity consumption is the largest source of emissions for Metropolitan operations, Strategy 4 involves several different types of measures that support the planning phase of this process, including implementation of operation-wide changes in electricity purchases and consumption, as well as execution of specific projects. Measures E-2, E-3, and E-4 would result in a cumulative reduction of approximately 24,568 MT $CO_2e$ by 2030 and 43,203 MT $CO_2e$ by 2045. Measure E-5 has the potential to result in a cumulative GHG emission reduction under the worst-case drought scenario (i.e., High Pumping Scenario) of approximately 1,961,822 MT $CO_2e$ between 2021 and 2030, and approximately 4,126,183 MT $CO_2e$ between 2021 and 2045.

**Table 15 GHG Emissions Reduction Associated with Strategy 4**

| Measure | Cumulative Emission Reductions ($MT\ CO_2e$) 2030 | Cumulative Emission Reductions ($MT\ CO_2e$) 2045 |
|---|---|---|
| E-1 (Phase 1) Analyze marginal emissions rates and evaluate the feasibility of shifting energy use to lower emission periods. | Supportive | |
| E-2 (Phase 1) Connect the Yorba Linda Hydroelectric Power Plant (YLHEP) behind Metropolitan's Southern California Edison (SCE) electricity meter to directly utilize carbon-free electricity at Metropolitan's Diemer facility by 2025. | 6,301 | 14,018 |
| E-3 (Phase 1) In markets where available, Metropolitan will switch its retail accounts to green tariff options offered by power providers by 2025 to reduce the Scope 2 GHG emissions associated with retail electricity use. | 18,048 | 28,712 |
| E-4 (Phase 1) Install 3.5 MW battery storage systems at the Jensen, Skinner, and Weymouth treatment plants. Investigate the use of a software system to track and optimize GHG emissions reduction due to time-of-use strategies by 2025. | 219 | 473 |
| E-5 (Phase 1) Manage Metropolitan’s energy purchases to ensure cost-effective energy supply while achieving the required GHG emissions objective.[1] | 1,961,822 | 4,082,980 |
| Total Cumulative Emissions Reduction | 1,986,390 | 4,126,183 |

Notes: $MT\ CO_2e$ = metric tons of carbon dioxide equivalent; PPA = Power Purchase Agreement

[1] Potential GHG emission reductions due to implementation of measure E-6 are based on the high pumping scenario or the scenario that has the highest emissions generated due to increased energy use.

## 2.3.2 Strategy 5: Improve Energy Efficiency

In addition to Strategy 4, reduction of carbon intensity of the electricity used, Metropolitan can further reduce GHG emissions associated with electricity use by improving energy efficiency and thereby reducing electricity demand for operations. There are several opportunities for increased energy efficiency that can be employed at various points throughout Metropolitan’s operations. While some of the specific measures discussed below have quantifiable GHG emission reductions, some are presented here as supportive measures and have not been quantified to avoid double counting of GHG emissions reduction. Additionally, several of the measures supporting Strategy 5 will be implemented during Phase 2 of the CAP. Since Phase 2 measures are dependent on Phase 1 implementation, the anticipated GHG reductions may vary depending on the outcome of Phase 1 implementation.

### Methodology and Assumptions

The measures making up Strategy 5 include specific energy efficiency actions that can be completed now, such as Measure EE-1, upgrading the lighting system, while other measures require further investigation to determine the course of implementation. Continued efforts to reduce electricity consumption by identifying opportunities to improve energy efficiency are supportive to Strategy 5. Measures that are considered quantifiable if implemented now due to adequate data availability, are discussed in detail below.

### *Measure EE-1 – Phase 1: Convert all interior and exterior lighting at 50 percent of Metropolitan facilities to light emitting diode (LED) technologies by 2030 and 100 percent by 2045*

Conversion of interior and exterior lighting to more energy efficiency light bulbs throughout Metropolitan's facilities has the potential to reduce cost and reduce GHG emissions generated from electricity use. According to the United States Department of Energy, ENERGY STAR-qualified LEDs use only 20 to 25 percent of the energy of traditional incandescent bulbs while high-efficiency incandescent bulbs could use between 80 and 30 percent of the energy of the traditional incandescent bulbs they replace.[38] For the purposes of this calculation, it is estimated approximately 10 percent of Metropolitan's electricity use is due to lighting, that this electricity use for lighting would remain constant over time, and that lighting improvements are on average 50 percent more efficient than previous lighting.[39] It is assumed that for lighting a majority of the electricity supplied is from retail sources.

The emission reduction impact of Measure EE-1 is based on 50 percent of lighting electricity being improved by 50 percent by 2030, and by 100 percent by 2045. Avoided emissions are calculated as the amount of annually reduced electricity multiplied by the annual retail emission factor. The calculations and assumptions used to estimate emission reductions from Measure EE-1 are provided in Table 16. Emissions reductions are based on Metropolitan achieving a 50 percent implementation (50% of buildings have been retrofit with LEDs) of Measure EE-1 by 2030 and achieving a 100 percent implementation by 2045. Metropolitan has already begun this process and therefore, the phase in of this measure was assumed to start in 2020. This results in a cumulative reduction of approximately 1,220 MT $CO_2e$ between 2020 and 2030, and approximately 3,222 MT $CO_2e$ between 2020 and 2045 due to implementation of Measure EE-1.

[38] https://www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/how-energy-efficient-light

[39] Lighting conservatively assumed to make up 10% of total energy use based on CalEEMod defaults for warehouses, where lighting makes up 6-50% of total electricity use (CalEEMod). Additionally, U.S. EPA suggests that lighting makes up 35-45% of building energy use for water treatment systems (https://www.epa.gov/sites/production/files/2015-04/documents/epa816f13004.pdf), however because not all energy uses for Metropolitan are related to building energy use, the lighting demand of overall electricity demand is likely lower.

### Table 16 Measure EE-1 GHG Emissions Reduction Calculations

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Annual Electricity Consumption (MWh)[1] | 68,362 | 68,362 |
| Annual Lighting Electricity Consumption (MWh)[2] | 6,836 | 6,836 |
| Cumulative Electricity for Lighting since 2020 (MWh) | 75,198.00 | 177,742.00 |
| Annualized Average % of Facility Upgraded[3] | 27.27% | 55.77% |
| Efficiency Improvement (%)[4] | 50% | 50% |
| Cumulative Reduced Electricity since 2020 (MWh)[5] | 10,253 | 49,563 |
| Average Retail GHG Emission Factor (MT $CO_2e$/MWh)[6] | 0.119 | 0.065 |
| Cumulative GHG Emissions Avoided since 2020 (MT $CO_2e$)[7] | 1,220 | 3,222 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; kWh =-kilowatt-hour; MWh = megawatt-hour

Values have been rounded and may not add up exactly.

[1] Based on Metropolitan operational data for calendar year 2017 and total electricity consumed. For the purposes of this calculation, it is assumed that this value stays consistent over time.

[2] Lighting conservatively assumed to make up 10% of total energy use based on CalEEMod defaults for warehouses, where lighting makes up 6-50% of total electricity use (CalEEMod).

[3] Annualized average based on a linear increase in retrofit buildings of 50% in 2030 and 100% in 2045.

[4] Assumed that lighting improvements are half LED and half high efficiency bulbs resulting in approximately 50 percent reduction in energy usage (https://www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/how-energy-efficient-light).

[5] Avoided electricity is based on 50 percent of current electricity usage for lighting being improved by 50 percent by 2030 and 100 percent of current electricity usage for lighting being improved by 50 percent starting in 2030 through 2045. Cumulatively avoided electricity is based on consumption starting in 2020 through 2030 (i.e., 11 years). Cumulative avoided electricity in 2045 is based on the assumption of full implementation of measure at 50 percent of facilities from 2020 through 2030 (i.e., 10 years) and 100 percent of the facilities from 2030 through 2045 (i.e., 15 years).

[6] As described in Section 2.1, Assumptions, annual electricity emission factors are interpolated based on the 2017 emission factor and percent of renewable sources and the 2030 emission factor that would result with the required 60% renewable sources. The presented emission factor is the average retail electricity emission factors based on years 2020 through 2030 and average retail emission factor based on years 2020 through 2045 with implementation of Strategy 4, Measure E-3 where retail electricity accounts would be switched to the Clean Power Green Tariff option for retail electricity sources by 2025. Green Tariff Clean Power emission factor in on average 27% lower than the retail emission factor between 2020 through 2030 and on average 15% lower than the retail emission factor between 2020 through 2045 due to a greater amount of carbon-free sources.

[7] Cumulative EE-1 GHG emissions reduction are calculated as the cumulatively avoided electricity multiplied by the Green Tariff Clean Power retail emission factor averaged across 2020 to 2030 and 2020 to 2045.

#### *Measure EE-2 – Phase 1: Continue programs to analyze CRA pump efficiency and replace or refurbish pumps when cost effective.*

Measure EE-2 supports energy efficiency in the pumping process – one of the primary sources of energy consumption for Metropolitan operations. Metropolitan pumps a significant amount of water from CRA, which further fluctuates depending on the amount of water pumped each year. Improving CRA pump efficiency would maximize cost savings and GHG emissions through reduced energy usage. Measure EE-2 provides the study necessary to determine which pumps can be refurbished or replaced.

#### *Measure EE-3 – Phase 2: Investigate feasibility of a large scale (100 MW) battery storage system for the CRA.*

Measure EE-3, complete a feasibility study of large-scale battery storage system for CRA, would be implemented during Phase 2 of the CAP. Establishing a system to store large amounts of energy would increase resilience and further reduce GHG emissions as a large-scale battery system could be charged during periods of high renewable energy and discharged when electricity has a higher emission factor. A 100 MW battery storage array has the potential to reduce GHG emissions by 20,000 MT $CO_2e$ annually. However, evaluation to determine the actual GHG emissions reduction upon implementation is required. Therefore, Measure EE-3 is considered supportive.

*Measure EE-4a-d – Phase 2: Implement findings of the CRA pump assessment (from Measure EE-2) to either refurbish or replace pumps at Eagle Mountain, Iron Mountain or Hinds pumping plants.*

Based on the findings of Measure EE-2, Metropolitan would refurbish or replace some CRA pumps in Phase 2 of the CAP implementation. Potential GHG emission reductions are based on the improved efficiency of the pumps at Eagle Mountain, Iron Mountain, and Hinds Pump Plants. The actual efficiency gain for refurbishment/replacement of these pumps will be identified by the pump assessment. With marginal efficiency improvements, such as an efficiency gain of 2 percent for replacements and 0.5 percent for repairs, Metropolitan could substantially reduce GHG emissions over time. However, because the actual efficiency gain will be based on the pump assessment and the implementation would not occur until Phase 2 of the CAP, emission reduction estimates for this measure are not yet quantifiable. Therefore, Measure EE-4A-D and is considered supportive.

*Measure EE-5 – Phase 2: If the proposed Regional Recycled Water Plant (RRWP) is ultimately constructed, install an inter-stage pumping system on the reverse osmosis brine stream to reduce energy use.*

Metropolitan is currently investigating the feasibility of constructing a Regional Recycled Water Plant (RRWP). If it were to be constructed, installation of an inter-stage pumping system has the potential to decrease energy demand by 6% by improving the balance throughout the Reverse Osmosis (RO) system.[40] The RO system would have the largest energy demand at the RRWP, so improving energy efficiency would significantly decrease electricity demand. Because the RRWP has not yet been approved and the actual efficiency gain is not yet known, this measure is not considered quantifiable for the purposes of this assessment. If this project is approved, the implementation would not occur until Phase 2 of the CAP, therefore emission reduction estimates for this measure are not included in the overall quantified emission reductions discussed herein.

### RESULTS

As shown below in Table 17, total GHG emissions reduction from this strategy are considered supportive to avoid double counting. However, reducing electricity demand has the potential to reduce costs and need for carbon-free electricity.

[40] https://membranes.com/wp-content/uploads/Documents/Technical-Papers/Application/Waste/Operational-Performance-and-Optimization-of-RO-Wastewater-Treatment-Plants-1.pdf

**Table 17 GHG Emissions Reduction Associated with Strategy 5**

| Move | Cumulative Emission Reductions ($MT\ CO_2e$) 2030 | Cumulative Emission Reductions ($MT\ CO_2e$) 2045 |
|---|---|---|
| EE-1 (Phase 1) Convert all interior and exterior lighting at 50 percent of Metropolitan facilities to light emitting diode (LED) technologies by 2030 and 100 percent by 2045. | 1,220 | 3,222 |
| EE-2 (Phase 1) Continue programs to analyze CRA pump efficiency and replace or refurbish pumps when cost effective. | Supportive | |
| EE-3 (Phase 2) Investigate feasibility of a large scale (100 MW) battery storage system for the CRA. | Supportive[1] | |
| EE-4a-d (Phase 2) Implement findings of the CRA pump assessment (from Measure EE-2) to either refurbish or replace pumps at Eagle Mountain, Iron Mountain or Hinds pumping plants. | Supportive[1] | |
| EE-5 (Phase 2) If the proposed Regional Recycled Water Plant (RRWP) is ultimately constructed, install an inter-stage pumping system on the reverse osmosis brine stream to reduce energy use. | Supportive[1] | |
| Total Cumulative Emissions Reduction | 1,220 | 3,222 |

Notes: $MT\ CO_2e$ = metric tons of carbon dioxide equivalent; CRA = Colorado River Aqueduct

[1] Measures to be implemented in Phase 2 require more data gathering and evaluation to quantify GHG emissions reduction and therefore are not included herein.

## 2.4 Scope 3: Indirect Emissions and Sequestration

### 2.4.1 Strategy 6: Incentivize More Sustainable Commutes

Metropolitan does not have direct control over how its employees travel to and from their jobs. Strategy 6 focuses on initiatives that promote and facilitate alternative commute strategies including use of active and shared/subsidized transit, as well as ZEVs. GHG emissions reduction quantification was based on measures that improve infrastructure, facilitate ZEV commuting, and operational policy changes that would reduce employee vehicle miles travelled (VMT) on an annual basis.

#### Methodology and Assumptions

The quantified emissions reductions associated with Strategy 6 are either from the replacement of traditional passenger vehicles for employee commute to ZEVs (e.g., Measure EC-3 and EC-6) or the reduction in employee commute VMT (e.g., EC-5). Measures EC-1, EC-2, and EC-3 incrementally support Strategy 6 through focusing efforts on promoting employee use of alternative modes of transportation for commuting that would reduce employee commute miles. Examples include the use of mass transit, active transportation, or reducing emissions through the use of carbon-free or low-carbon transportation options. The following section details the measures relating to Strategy 6 as well as the methodologies and assumptions used for the GHG emission reduction calculations associated with the quantifiable measures which include Measure EC-3 and EC-5.

### *Measure EC-1 – Phase 1: Expand subsidized transit commute program to reduce employee commute miles.*

Measure EC-1 focuses on expanding the subsidized transit commute program to incentivize employees to use mass transit over single occupancy vehicles. Incentivizing employees to use transit programs for commuting versus single occupancy vehicles reduces the emissions generated per person when commuting. Because it is unclear to what extent expanding transit commute programs and employee commuter incentive programs will decrease employee commuter GHG emissions, Measure EC-1 was not quantified, and the measure is considered supportive.

### *Measure EC-2 – Phase 1: Expand employee use of carbon-free and low-carbon transportation by providing education programs on the benefits of commute options including public transportation, ZEV/EV options, and vanpools.*

Providing education to staff on the use of new programs and policies is a fundamental component of achieving significant and impactful change. Metropolitan has established an employee-commute education program that provides clear information on the various commute options available to Metropolitan employees including public transportation, ZEV/EV options, and vanpools. Measure EC-2 supports this current effort and Strategy 6 by providing education to motivate commuters to utilize less GHG emitting commuter options. However, the impacts of education on employee's commuter behavior is not quantifiable, therefore potential GHG reductions from Measure EC-2 was not quantified and the measure is considered supportive.

### *Measure EC-3 – Phase 1: Install ZEV and/or EV infrastructure as directed by the ZEV/EV Feasibility Study to support at least a 15 percent employee transition to ZEVs/EVs by 2025.*

Metropolitan does not have direct control over how its employees travel to and from their jobs. However, by providing EV charging infrastructure, Metropolitan can encourage employees to drive personal EVs, and shift how some individuals commute to work. One recognized hurdle for the use of EVs is range. By allowing employees to charge their vehicles during work, Metropolitan encourages the use of EVs. Estimates indicate that approximately 98 percent of EV charging occurs either at home or at work with 40 percent of charging events happening at work.[41] The number of chargers that would be needed to support the transition of 15 percent of employees currently commuting using internal combustion vehicles to EV's was calculated based on the number of car-commuting employees, number of connections per EV charger, and average number of charging hours per connection per day. The number of employees commuting to work by car is tracked in Metropolitan's 2017 commuter survey. According to the 2017 survey there were approximately 1,143 single occupancy vehicle (SOV) commuters and 4 recorded carpoolers. For the purposes of this calculation, it was assumed that installed EV chargers would have two connections per charger and that employees would rotate vehicles throughout the day so that each charger plug could charge 3 vehicles, for 3 hours each, per day. As such, it was estimated that 26 chargers would need to be installed to support a transition of 15 percent of employees (172 vehicles) to electric vehicles.

GHG emissions reduction from this measure are calculated as the difference in emissions generated from those employees commuting via an internal combustion engine (ICE) vehicle fueled by fossil fuels and the emissions generated indirectly from electricity use to charge the EVs. Electricity use for EV charging was calculated assuming an average of 3 hours of charging per day per connection and

[41] https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf

that charging only occurred during workdays, assumed to be 260 days per year.[42] Electricity consumption was based on approximately 10 kWh of electricity needed per hour of charge.[43] Emissions generated from annual electricity assumption were calculated as the annual electricity consumption for all chargers multiplied by the annual weighted electricity emission factor, presented in Table 5. The weighted electricity emission factor was further adjusted to account for full implementation of Strategy 4, Measure E-3, specifically the switch of retail accounts to a green tariff option for retail electricity sources by 2025. Therefore, it was assumed that Strategy 4, Measure E-3 would be implemented by 2025 further reducing electricity emissions post-2025. This results in a cumulative generation of approximately 626 MT $CO_2e$ between 2025 and 2030 and approximately 1,874 MT $CO_2e$ between 2025 and 2045 due to electricity use from EV charging associated with the implementation of Measure EC-3.

The GHG emissions that would be avoided by the commuter population transitioning to EVs is based on the assumption that approximately 15 percent of VMT generated annually from traditional ICE vehicles would be avoided. Annual commuter VMT is based on Metropolitan's 2017 commuter survey. As shown in Table 18, it was estimated that approximately 2,659,493 miles (i.e., 15 percent of 17,729,950 annual commuter VMT) travelled by ICE-vehicles would be replaced by EV-vehicles if 15 percent of commuters transitioned to EVs. GHG emissions generated from ICE-vehicles traveling 2,659,493 miles annually was calculated as the annual VMT multiplied by the annual running emission factor for ICE-vehicles obtained from EMFAC2017.[44] Emission factors are weighted based on the percent of fuel type used per category of vehicle class (i.e., passenger vehicle). Because vehicle emissions are improving overtime, the annual emission factor applied to the annual vehicle miles travelled was interpolated between average vehicle emission factors in 2017 and anticipated in 2030 using EMFAC2017 data.[45] The calculations and assumptions used to estimate emissions reduction from Measure EC-3 are provided in Table 18. As shown, with the implementation of Measure EC-3 and the transition of 15 percent of commuting from ICE-vehicles to EV, the cumulative GHG emissions avoided between 2025 and 2030 would be approximately 3,427MT $CO_2e$ and 10,860 MT $CO_2e$ between 2030 and 2045.

[42] Limits to charging time would be set by Metropolitan Policy to ensure maximum use of charging infrastructure.

[43] https://www.clippercreek.com/wp-content/uploads/2017/12/SMUD_Charge-Times-Chart-20171208_Final_Low-Res.pdf

[44] https://arb.ca.gov/emfac/2017/

[45] Annual emission factors were interpolated between 0.00034 MT $CO_2e$/mile in 2017 and 0.00023 MT $CO_2e$/mile in 2030 and 0.00020 MT $CO_2e$/mile in 2045.

## Table 18 Measure EC-3 GHG Emissions Reduction Calculations

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Number of SOV and carpool commuters[1] | 1,143 | 1,143 |
| Commuter VMT[1] | 17,729,950 | 17,729,950 |
| % of Commuters that Switch to EV Use [2] | 15% | 15% |
| Number of Anticipated Commuters with EVs | 172 | 172 |
| Number of Chargers[3] | 26 | 26 |
| Number of Charging Hours for All Chargers Annually (hours)[4] | 40,560 | 40,560 |
| Annual Electricity Demand (kWh/year)[5] | 405,600 | 405,600 |
| Cumulative Electricity Demand since 2025 (MWh)[6] | 2,434 | 8,518 |
| Average Weighted Electricity Emission Factor Assuming Implementation of Strategy 4 (MT $CO_2e$/MWh)[7] | 0.257 | 0.220 |
| Cumulative Emissions from EV Charging since 2025 (MT $CO_2e$)[8] | 626 | 1,874 |
| Cumulative ICE-vehicle VMT Replaced with EVs since 2025 (VMT)[9] | 15,956,955 | 55,849,343 |
| Average Weighted ICE Emission Factor (MT $CO_2e$/mile)[10] | 0.00025 | 0.00023 |
| Cumulative Emissions from ICE-vehicle VMT if not replace with EVs (MT $CO_2e$) | 4,053 | 12,734 |
| Cumulative GHG Emissions Avoided since 2025 (MT $CO_2e$)[11] | 3,427 | 10,860 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; VMT = vehicle miles travelled; MWh = megawatt-hour; kWh =-kilowatt-hour

Values have been rounded and may not add up exactly.

[1] SOV and carpool commuter number and total miles travelled by car is based on Metropolitan 2017 commuter survey.

[2] Assumed 15% of total commuter VMT would be replaced with EVs with implementation of EC-3 by 2025. Measure EC-3 does not include a 2045 target therefore it is assumed the percent change in commuters to EV use remains constant.

[3] Number of chargers necessary to accommodate 172 employee EV vehicles was calculated assuming that on a given day employees with EVs would connect to a charger for 3 hours per day before switching out (to allow 3 cars to charge per connection) and that each charger has 2 connections.

[4] Number of hours of charge per workday for all chargers was calculated assuming that each charger had two connections and on average each connection would charge for 3 hours per day. Annual number of hours of charging for all chargers is based on 260 workdays annually.

[5] It is assumed that per one hour of charge approximately 10 kWh of electricity is consumed.

[6] Cumulative Electricity Demand since 2025 is calculated as the annual electricity demand multiplied by the number of years between full measure implementation in year 2025 and the target year. Implementation by 2025 through 2030 equates to 6 years and 2025 through 2045 equates to 21 years.

[7] The presented emission factor is the weighted average retail and wholesale electricity emission factor presented in Table 5 based on years 2025 through 2030 (i.e., 6 years), and 2025 through 2045 (i.e., 21 years) with implementation of Strategy 4, Measure E-3, specifically the switch of retail accounts to the green tariff option for retail electricity sources by 2025.

[8] Cumulative emissions associated with charging of EV chargers is calculated as the cumulative electricity demand since 2025 to the target year multiplied by the average weighted electricity emission factor assuming implementation of Strategy 4.

[9] Assumed 15% of total commuter VMT would be replaced with EVs with implementation of EC-3.

[10] Annual emission factors were obtained from EMFAC2017 and interpolated between 2017 and 2030 and 2045. Emission factors were weighted based on fuel type per vehicle class (i.e., passenger vehicles). The presented emission factor is the weighted average mobile combustion emission factor based on years 2025 through 2030 (i.e., 6 years), and 2025 through 2045 (i.e., 21 years).

[11] Cumulative avoided emissions are calculated by subtracting the Cumulative Emissions from EV charging from the Cumulative Emissions from internal combustion engine-vehicle VMT.

### *Measure EC-4 – Phase 1: Continue to offer benefits to employees who use alternative modes of transportation (e.g., public transportation, bikes).*

Measure EC-4 focuses on the expansion of other benefits or incentive program to encourage employees to use alternative modes of transportation for commuting. This supports Strategy 6 by providing education and incentive to motivate commuters to utilize less GHG emitting commuter options. However, it is unclear to what extent expanding employee commuter incentive programs will decrease employee commuter GHG emissions, therefore Measure EC-4 is not quantified herein and is considered supportive.

### *Measure EC-5 – Phase 1: Allow 50 percent of employees located at Metropolitan's headquarters to telecommute or utilize flexible schedules through 2030 to reduce travel time, vehicle miles travelled (VMT), and GHG emissions.*

GHG emissions reduction associated with implementation of Measure EC-5 are calculated as the emissions avoided from the reduction in commuter VMT. Metropolitan's 2017 commuter survey included data on the number of one-way miles travelled for each employee and by which mode of transport. Daily commuter VMT was calculated as the sum of all miles travelled by employees in a single day for a particular mode of transport. Annual commuter VMT was then calculated as the miles travelled per day multiplied by the number of workdays in a year including a two week vacation, assumed to be 250. In 2017 there was an estimated 28,378,660 miles travelled by commuters. To avoid double counting, commuter VMT from SOV and carpooling estimated to switch to EVs with implementation of Measure EC-3 have been excluded from commuter miles used in the calculation for Measure EC-5. Based on the data in Table 18, implementation of Measure EC-3 is anticipated to reduce annual vehicle VMT by 2,659,493. As such, Measure EC-5 can apply to approximately 25,719,168 VMT by commuters annually.

Remote work practiced during COVID-19 pandemic has demonstrated that a majority of employees can feasibly work from home via telecommuting. However, to provide a conservative assumption for the purposes of this calculation it was assumed that 50 percent of all staff would telecommute on average 1.5 times per week starting in 2020 and continuing through 2030. Studies have found that the percent reduction in VMT associated with flexible work schedules is based on the type of flexible work schedule and employee participation.[46] For telecommuting an average of 1.5 days a week, the adjustment factor, or slope of the linear trend between employee participation and corresponding reduction in VMT is 0.22. As such, with 50 percent employee participation, VMT could be reduced by 11 percent, which equates to a reduction in VMT of approximately 1,414,554 miles annually. For the purposes of this calculation, the total VMT reported in the 2017 commuter survey was used as the baseline and assumed to be consistent over time. Annual avoided emissions were calculated by multiplying the annually reduced VMT by the annual commuter emission factor. The annual commuter emission factor was calculated as the total estimated emissions from commuting divided by the total commuter miles travelled. Emissions factors derived from the EMFAC2017 model were used to estimate GHG emissions from personal vehicle commutes and the Los Angeles County Metropolitan Transportation Authority emission factors were used to calculate emissions from alternative trips including bus and rail.[47,48] Annual emission factors were interpolated between 2017 and the forecasted commuter emissions in 2030 and 2045, where the emission factor

[46] CAPCOA TRT-6 http://www.aqmd.gov/docs/default-source/ceqa/handbook/capcoa-quantifying-greenhouse-gas-mitigation-measures.pdf

[47] California Air Resources Board, https://arb.ca.gov/emfac/

[48] Metro's 2016 Energy and Resource Report, Metro (https://media.metro.net/projects_studies/sustainability/images/report_sustainability_energyandresource_2016.pdf)

was 0.000256 MT $CO_2$e/commuter mile in 2017, 0.00019 MT $CO_2$e/commuter mile in 2030, and 0.00017 MT $CO_2$e/commuter mile in 2045. Emission factors decrease due to improved vehicle emissions. Total emissions from employee commute in 2017 and forecasted in 2030 and 2045 were calculated using annual mileage travelled by mode multiplied by the associated emission factor.[49]

The calculations and assumptions used to estimate emissions reduction from Measure EC-5 are provided in Table 19. The avoided emissions are calculated as the annual avoided VMT multiplied by the annual commuter emission factor. This results in a cumulative reduction of reduction of 3,345 MT $CO_2$e between 2020 and 2030 and 7,098 MT $CO_2$e between 2020 and 2045 due to implementation of Measure EC-5.

### Table 19 Measure EC-5 GHG Emissions Reduction Calculations

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Annual Commuter VMT[1] | 25,719,168 | 25,719,168 |
| Participation (%) | 50% | 50% |
| Annual Participating Commuter VMT | 12,859,584 | 12,859,584 |
| % VMT Reduced[2] | 11% | 11% |
| Annual Commuter VMT Reduced | 1,414,554 | 1,414,554 |
| Cumulative Commuter VMT Reduced since 2020[3] | 15,560,094 | 36,778,404 |
| Average Commuter GHG Emission Factor (MT $CO_2$e/commuter mile)[4] | 0.000215 | 0.000193 |
| Cumulative GHG Emissions Avoided since 2020 (MT $CO_2$e) | 3,345 | 7,098 |

Notes: MT $CO_2$e = metric tons of carbon dioxide equivalent; VMT = vehicle miles travelled; SOV = single occupancy vehicles

Values have been rounded and may not add up exactly.

[1] Metropolitan 2017 commuter survey provided the number of one-way miles each employee travelled and by which mode. Annual commuter VMT is estimated as the sum of miles travelled daily multiplied by the number of annual workdays including a two week vacation (i.e., 250). To avoid double counting, commuter VMT from SOV and carpooling estimated to switch to EVs with implementation of Measure EC-3 have been excluded from this total.

[2] Percent VMT reduction is based on the linear trend between employee participation and % reduction in commuter VMT for telecommuting 1.5 times a week (CAPCOA TRT-6). As a 2045 target was not set in the measure, it is assumed that the trends stay constant post 2030. http://www.aqmd.gov/docs/default-source/ceqa/handbook/capcoa-quantifying-greenhouse-gas-mitigation-measures.pdf

[3] Cumulative commuter VMT reduced is calculated as the annual reduced commuter VMT multiplied by the number of years since implementation (i.e., 2020) through the target year (i.e., 2030 and 2045).

[4] A commuter emission factor (MT $CO_2$e/commuter mile) was developed based on the total emissions from commuting and total commuter miles travelled. This commuter emission factor was calculated for Metropolitan's 2017 inventory and forecasted out for 2030 and 2045 to account for changes in emission factors by mode (i.e., single occupancy vehicles, vans, rail, and buses). Annual commuter emission factors were interpolated between 2017 and 2030 and 2045, where the emission factor was 0.000256 MT $CO_2$e/commuter mile in 2017, 0.00019 MT $CO_2$e/commuter mile in 2030, and 0.00017 MT $CO_2$e/commuter mile in 2045. Average commuter emission factor for this measure is based on implementation starting in 2020 through 2030 (i.e., 11 years) and 2020 through 2045 (i.e., 26 years).

### *Measure EC-6 – Phase 2: Replace all Metropolitan vanpool vehicles with electric vehicles. Start with a pilot study (Measure FL-1) to evaluate the best approach.*

This measure builds off of Measure FL-1, where based on the ZEV/EV feasibility study on fleet vehicles, Metropolitan will replace conventional fossil fuel operated vans with electric vans. Although new technologies for passenger vans are already being developed and some electric options for commercial vans are already available, this measure is part of Phase 2 as it would be implemented based on the results of the feasibility study. Because more data and evaluation are

[49] Detailed methodology describing the calculation for employee commute emissions and emission factors by mode can be found in Appendix B – Inventory and Forecast Methodology, of Metropolitan Water District of Southern California Climate Action Plan.

needed for this measure to be implemented, the true magnitude of GHG emissions reduction has not been quantified herein and is considered supportive.

### RESULTS

Table 20 summarizes the measures associated with Strategy 6 and potential GHG emissions reduction. Measures EC-3 and EC-5 would result in a cumulative reduction of approximately 6,772 MT $CO_2$e by 2030 and 17,958 MT $CO_2$e by 2045.

**Table 20 GHG Emissions Reduction Associated with Strategy 6**

| Measure | Cumulative Emission Reductions (MT $CO_2$e) 2030 | Cumulative Emission Reductions (MT $CO_2$e) 2045 |
|---|---|---|
| EC-1 (Phase 1) Expand subsidized transit commute program to reduce employee commute miles. | Supportive | |
| EC-2 (Phase 1) Expand employee use of carbon-free and low carbon transportation by providing education programs on the benefits of commute options including public transportation, EV/ZEV options, and vanpools. | Supportive | |
| EC-3 (Phase 1) Install zero emission and/or electric vehicle infrastructure as directed by the ZEV/EV Feasibility Study to support at least a 15 percent transition to ZEVs/EVs by 2025. | 3,427 | 10,860 |
| EC-4 (Phase 1) Continue to offer benefits to employees who use alternative modes of transportation (e.g., public transportation, bikes). | Supportive | |
| EC-5 (Phase 1) Allow 50 percent of employees located at Metropolitan's headquarters to telecommute or utilize flexible schedules through 2030 to reduce travel time, vehicle miles travelled (VMT), and GHG emissions. | 3,345 | 7,098 |
| EC-6 (Phase 2) Replace all Metropolitan vanpool vehicles with electric vehicles. Start with a pilot study (Measure FL-1) to evaluate the best approach. | Supportive[1] | |
| **Total Cumulative Emissions Reduction** | **6,772** | **17,958** |

Notes: MT $CO_2$e = metric tons of carbon dioxide equivalent; ZEV = zero emission vehicle; EV = electric vehicle

[1] Measures to be implemented in Phase 2 require more data gathering and evaluation to quantify GHG emissions reduction and therefore are not included herein.

## 2.4.2 Strategy 7: Increase Waste Diversion to Achieve Zero Waste

Organic materials are the focus of the recent California legislation SB 1383 (Short-Lived Climate Pollutants: Organic Waste Reductions). Now in the final rulemaking stage, this state law has the immediate goal of reducing organic waste sent to landfill and the ultimate objective of reducing statewide methane emissions. Specifically, it sets a statewide goal for the reduction in organic waste to landfills – 50 percent by 2020 and 75 percent by 2025 – in addition to the recovery of 20 percent of edible food waste for human consumption. SB 1383 will require local governments to provide organics collection to all generators and require all generators to subscribe. It also has specific mandates for container systems, education and outreach programs, monitoring and contamination reporting, and enforcement of regulations. Full SB 1383 implementation will begin in 2022, allowing some time for jurisdictions to plan and prepare for achieving compliance.[50] While SB 1383 does require this reduction from Metropolitan, SB 1383 was not included in the Metropolitan GHG emissions forecast. Therefore, this plan includes measures that will allow Metropolitan to support this goal and reduce its own GHG emissions in alignment with SB 1383.

Waste generation at Metropolitan facilities accounts for approximately one percent of total GHG emissions in the 2017 baseline. A majority of the GHG emissions resulting from Metropolitan generated waste are caused by decomposition of organic material under anaerobic conditions. The remainder of the emissions come from inorganic wastes, such as plastic, which have both upstream and downstream emissions. Therefore, increasing the diversion of organic and inorganic waste streams is a primary measure to reduce waste related GHG emissions under Strategy 7. The execution of the policies established under this strategy are supported by measures that promote the development of programs and partnerships that help divert waste. Because most of Metropolitan's waste stream is organics and organics diversion is a major driver of State regulations, including SB 1383, Strategy 7 prioritizes organic waste stream reduction first.[51]

## Methodology and Assumptions

### *Measure WA-1 – Phase 1: Develop and implement net zero waste policies and programs at all facilities to reduce landfilled waste by 30 percent by 2030 and achieve zero landfilled waste by 2045*

Measure WA-1, the implementation of net zero waste policies and programs at all Metropolitan facilities, generates all the emissions reduction associated with Strategy 7 by reducing landfilled waste by 30 percent by 2030 and to zero landfilled waste by 2045.

Direct GHG emissions reductions from this strategy are dependent on the active diversion of waste from the landfill. Therefore, for the purposes of this calculation, it is assumed that through the adoption of the CAP, Metropolitan is committed to the reduction of 30 percent of waste by 2030. Since Metropolitan has full operational control of its facilities, it is assumed that these targets will be fully realized through the development of policies, programs and contracts as detailed in Measures WA-2, WA-3, and WA-4. Implementation of this measure will be tracked and adjustment will be made as necessary to achieve this target. Based on the prepared inventory and forecast, it is estimated that the 14,759 tons of waste generated by Metropolitan in 2017 will continue through 2045. For the purposes of this calculation it is assumed that this will remain consistent over time. Emission reduction calculations assume a linear reduction of waste starting in 2022 with 30 percent reduction achieve by 2030. Linear interpolation between 2022 and 2030 shows that this correlates with an additional 3.3 percent waste reduction annually. Annual emissions reductions were calculated by multiplying the percent of waste reduction by the total tonnage of waste by a mixed organic emission factor obtained from the Waste Reduction Model (WARM).[52] Cumulative avoided emissions by 2030 and 2045 are calculated by summing annual avoided emissions between the year of inception, 2022, and the target year, i.e., 2030 or 2045, respectively. The calculations and assumptions used to estimate emissions reduction from Strategy 7 are provided in Table 21.

[50] California Air Resources Board. 2017. Short-Lived Climate Pollution Reduction Strategy.

[51] https://www.calrecycle.ca.gov/climate/slcp

[52] The WARM model is a waste reduction model created by U.S. EPA to help solid waste planners and organizations track and report GHG reductions from several different waste management practices. https://www.epa.gov/sites/production/files/2019-06/documents/warm_v15_organics.pdf

**Table 21 Measure WA-1 GHG Emissions Reduction Calculations**

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Annual Waste (tons)[1] | 14,759 | 14,759 |
| Cumulative Waste Generated since 2022 (tons) | 132,831 | 354,216 |
| Average % Waste Annual Reduced[2] | 16.67% | 48.33% |
| Cumulative Waste Reduced since 2022 (tons)[4] | 22,143 | 171,193 |
| Waste Emission Factor (MT $CO_2$e/ton)[3] | 0.204 | 0.204 |
| Cumulative GHG Emissions Avoided since 2022 (MT $CO_2$e)[4] | 4,517 | 34,923 |

Notes: MT $CO_2$e = metric tons of carbon dioxide equivalent

Values have been rounded and may not add up exactly.

[1] 2017 annual waste generation based on Metropolitan data for the inventory and forecast.

[2] Based on the linear interpolation of waste reduction from 0 percent in 2021 to 30 percent by 2030 and 100 percent by 2045. The average annual percent reduction in waste annually is based on the number of years between measure implementation and the target year. 2022 through 2030 equates to 9 years, and 2022 through 2045 equates to 24 years.

[3] Majority of Metropolitan waste is organic therefore the emission factor is for mixed organics obtained from WARM.

[4] Cumulative GHG emission avoided is the sum of annual emissions avoided from waste diversion from landfill from 2022 through 2030, and from 2022 through 2045.

### *Measure WA-2 – Phase 1: Implement a program to reduce organic waste at Metropolitan's Union Station building. Contract or team with local organizations and waste disposal companies to route organic waste to anaerobic digestion or composting facilities and edible food-to-food recovery centers.*

Measure WA-2 would incrementally support Strategy 7 through the implementation of a targeted organic waste reduction program at Metropolitan's Union Station building and the development of partnerships to implement the program. Measure WA-2 would involve a combination of efforts such as the implementation of composting at Union Station food services areas and the development of contracts with local facilities for organic waste pickup. This measure is considered supportive.

### *Measure WA-3 – Phase 1: Develop and implement a sustainable procurement policy.*

Strategy 7 is further supported with Measure WA-3, development and implementation of a sustainable procurement policy, as the measure targets upstream emissions of the inorganic waste stream. By setting guidelines on materials Metropolitan regularly purchases, Measure WA-3 prioritizes products with a lower waste generating lifecycle and helps reduce Metropolitan's waste generation. Because the estimated waste that could be diverted from implementation of a sustainable procurement policy is not known at this time, this measure is considered supportive.

### *Measure WA-4 – Phase 2: Partner with municipal agencies, like the City of Los Angeles, to create programs that will allow Metropolitan to provide its fair share of diversion and help local jurisdictions meet the goals of SB 1383 for organics diversion, including food waste and composting.*

Measure WA-4, partnering with municipal agencies to develop organic diversion programs, allows Metropolitan to provide its fair share of diversion and helps local jurisdictions to meet SB 1383 goals. Programs developed under this measure may include composting at Metropolitan facilities and investigating opportunities to utilize the compost on Metropolitan-owned lands. Compost application would have added benefits such as carbon sequestration, promotion of plant growth and soil health, as well as enhancing water retention in some soils.[53,54] This measure supports the CAP's long-term planning efforts, as well as developing partnerships that will allow Metropolitan to reach a zero waste goal by 2045 while supporting local communities. This measure is considered supportive.

#### RESULTS

Table 22 summarizes the measures associated with Strategy 7 and potential GHG emissions reduction. Measures WA-1 would result in a cumulative reduction of approximately 4,517 MT $CO_2e$ by 2030 and approximately 34,923 MT $CO_2e$ by 2045.

**Table 22 GHG Emissions Reduction Associated with Strategy 7**

| Measures | Cumulative Emission Reductions (MT $CO_2e$) 2030 | Cumulative Emission Reductions (MT $CO_2e$) 2045 |
|---|---|---|
| WA-1 (Phase 1) Develop and implement net zero waste policies and programs at all facilities to reduce landfilled waste by 30 percent by 2030 and achieve zero landfilled waste by 2045. | 4,517 | 34,923 |
| WA-2 (Phase 1) Implement a program to reduce organic waste at Metropolitan's Union Station building. Contract or team with local organizations and waste disposal companies to route organic waste to anaerobic digestion or composting facilities and edible food-to-food recovery centers. | Supportive | |
| WA-3 (Phase 1) Develop and implement a sustainable procurement policy. | Supportive | |
| WA-4 (Phase 2) Partner with municipal agencies, like the City of Los Angeles, to create programs that will allow Metropolitan to provide its fair share of diversion and help local jurisdictions meet the goals of SB 1383 for organics diversion, including food waste and composting. | Supportive | |
| **Total Cumulative Emissions Reduction** | **4,517** | **34,923** |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent

## 2.4.3 Strategy 8: Increase Water Conservation and Local Water Supply

As discussed, most of Metropolitan's emissions are a result of pumping, treatment, and delivery of water to its member agencies. Water conservation strategies that reduce per capita water consumption indirectly reduce energy emissions used to supply water and provide a co-benefit of protecting one of California's scarcest resources, water.

Through the implementation of water conservation programs, per capita water consumption in the Metropolitan service area has decreased from 0.14 acre-feet of deliveries per person in 1990 to 0.09 acre-feet of deliveries per person in 2017, an approximate 35 percent reduction in per capita water use. This increase in water efficiency is a result of a variety of actions by the State, Metropolitan, and the community. Metropolitan has invested millions of dollars to support actions that reduce

[53] https://www.ioes.ucla.edu/project/carbon-sequestration-through-compost/
[54] https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=16800#:~:text=In%20sandy%20soils%20with%20poor,structure%20ie.%2C%20aggregate%20stability.&text=Adding%20compost%20as%20a%20thin,garden%20and%20farm%20raised%20plants.

water use, including educational programs and incentives for water efficient appliances and turf removal. Metropolitan will continue and potentially expand its water conservation efforts into the future by incentivizing conservation and through construction of the proposed RRWP which, if completed, will provide a substantial source of local water to the Los Angeles Basin.

## Methodology and Assumptions

Strategy 8 involves several different types of measures for water conservation including supportive measures that promote water conservation by consumers, implementation of water conservation programs and initiatives, and implementation of water efficient practices and technologies. The quantified emissions reductions associated with Strategy 8 result from the implementation of programs that reduce water use (e.g., WC-3) and reduce energy use associated with importing water due to replacing a fraction of currently imported water with local recycled water (e.g., WC-6).

### *Measure WC-1 – Phase 1: Expand programs which educate customers on water conservation initiatives through workshops and speaking engagements.*

Measure WC-1 incrementally supports Strategy 8 by providing educational programs throughout Metropolitan's service area to educate customers on water conservation initiatives and strategies. Such educational programs can encourage end user behavioral changes that promote water conservation. However, the impacts of education on customers' behavior is not quantifiable, therefore, the measure is considered supportive.

### *Measure WC-2 – Phase 1: Continue to implement innovative water use efficiency programs.*

Measure WC-2, continue implementation of innovative water use efficiency programs, supports Metropolitan's water conservation initiatives and future program expansion. Through reviewing current water reduction programs under Measure WC-2, Metropolitan can gain an understanding of the successes and identify new opportunities not currently employed allowing for a more informed expansion of the program. Because it is unclear to the extent that evaluating existing programs and initiatives or piloting new programs will improve water conservation, Measures WC-2 is not quantified and is considered supportive.

### *Measure WC-3 – Phase 1: Continue Turf Removal Program to install an average of 1,500,000 square feet (sq. ft) of water efficient landscapes per year through 2030 through the use of a rebate program.*

Metropolitan already implements landscape water reduction programs for residents and businesses by offering rebates through its BeWaterWise program.[55] To further encourage the transition from high-water use landscapes throughout the Metropolitan service area, Measure WC-3 will continue implementation of the Turf Removal Program to install 1,500,000 square feet of water efficient landscapes per year through 2030. The measure will be implemented using incentives via rebates and supported with provided education. Given Metropolitan's existing success with landscape water conversion programs, it is reasonable to assume that the targets of this program will be achieved.

GHG emissions reduction associated with implementation of Measures WC-3 are calculated based on the amount of water saved due to turf conversion and the associated reduction in energy needed for supplying that amount of water. It is assumed that the conversion of conventional

[55] http://www.bewaterwise.com/

landscapes or turf to a drought tolerant landscape would save approximately 35 gallons of water per square foot annually.[56] As such, replacement of 1,500,000 square feet of turf would save approximately 52.5 million gallons, or 161 acre feet, of water annually.[57] Because the measure would involve 1,500,000 square feet of new turf converted through 2030, each year after 2020 would have a greater amount of converted turf than the year before. Annual water savings can be interpolated between 2020, at the beginning of measure implementation with only 1,500,000 square feet converted, and 2030, at full implementation of 16,500,000 square feet of total converted turf. The amount of annual water savings was calculated based on the amount of converted turf existing in the year. Based on historical water and emissions data from between 2005 to 2017, the average emission factor per acre-foot of imported water is 0.091 MT $CO_2e$.[58] Annual emissions reduction was calculated by multiplying the annual amount of water saved by the imported water emission factor. Since the total square feet of turf will increase every year (and continue saving water) the average annualized amount of turf was used to calculate the total savings since 2020. Average annualized turf replacement was approximately 9,000,000 sq. ft. and total savings were found to be 10,634 AF of water over 11 years based on the 35 gallons per sq. ft. reduction factor. Though the measure does not have a 2045 goal, 16.5 million square feet of converted turf achieved by 2030 will continue to save water through 2045. Cumulative avoided emissions by 2030 are calculated by multiplying the cumulative amount of water due to turf conversion saved between 2020 and 2030 and from 2020 through 2045 by the imported water emissions factor. The calculations and assumptions used to estimate emission reductions from Measure WC-3 are provided in Table 23.

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[56] Based on historic Metropolitan conservation programs.

[57] http://mwdh2o.com/PDF_Newsroom/Turf_Removal_Program.pdf

[58] Calculated based on Metropolitan's GHG emissions inventory's and delivered acre feet 2005-2017.

### Table 23 Measure WC-3 GHG Emissions Reduction Calculations

| Calculation Factor | 2030 | 2045 |
|---|---|---|
| Annual Turf Converted (sf) | 1,500,000 | 1,500,000 |
| Total Turf Converted by target year (sf)[1] | 16,500,000 | 16,500,000 |
| Averaged Annual Existing Converted Turf Based on Target Year (sf)[2] | 9,000,000 | 13,326,923 |
| Water Savings Conversion Factor (gallons/sf turf)[3] | 35 | 35 |
| Average Annual Water Savings since 2020 (gallons)[4] | 315,000,000 | 466,442,305 |
| Cumulative Water Savings since 2020 (gallons) | 3,465,000,000 | 12,127,499,930 |
| Conversion Factor (gallons water/AF) | 325,851.427 | 325,851.427 |
| Total Water Savings by target year (AF)[5] | 10,634 | 37,218 |
| Water Emission Factor (MT $CO_2e$/AF)[6] | 0.091 | 0.091 |
| Cumulative GHG Emissions Avoided since 2020 (MT $CO_2e$) | 968 | 3,387 |

Notes: MT $CO_2e$ = metric tons of carbon dioxide equivalent; sf = square feet; AF = acre-feet

Values have been rounded and may not add up exactly.

[1] The Turf Removal Program is already in existence; therefore, it is assumed that the conversion goal would be achieved each year starting in 2020 through 2030 (i.e., 11 years). The measure does not have a 2045 goal therefore the total turf converted by 2045 is the same as for 2030.

[2] Measure implementation is based on an annual goal therefore each year there is an increase in the amount of converted turf compared with the previous year. Based on the increase of converted turf from 1,500,000 sf in 2020 to 16,500,000 sf in 2030, the average existing converted turf on an annual basis between 2020 through 2030 (i.e., 11 years) and between 2020 through 2045 (i.e., 26 years) is presented.

[3] It is assumed that conversion from conventional turf to drought tolerant landscapes would save approximately 35 gallons of water per square foot based on past Metropolitan experience.

[4] Annual average gallons of water saved based on the average annual existing converted turf between 2020 and 2030 and 2020 and 2045 is calculated as averaged annual existing converted turf multiplied by the water savings conversion factor. Gallons is converted to acre-feet where 325,851 gallons = 1 AF.

[5] Cumulative water saved is calculated as the annual average water savings multiplied by the years since measure implementation and target year where 2020 through 2030 is 11 years of savings from converted turf and 2020 through 2045 results in 26 years of water savings from converted turf.

[6] Average emission factor for imported water pumped is based on historical imported water pumped and the associated GHG emissions from between 2005 and 2017. With reduced electricity emission factors this water emission factor is anticipated to decrease.

#### *Measure WC-4 – Phase 1: Provide funding for the development and monitoring of local stormwater recharge and use projects to evaluate the water supply benefit of stormwater.*

Measure WC-4, provide funding for the development and monitoring of local stormwater recharge and use projects, supports water conservation efforts by allowing Metropolitan to evaluate the potential water supply benefit of stormwater. There are currently three pilot programs focused on these types of projects: Stormwater Pilot Program, Recharge Pilot Program, and Direct Use Pilot Program. These studies provide a basis for Metropolitan to evaluate how stormwater can benefit the regional water supply or stormwater use in offsetting non-potable demands. Increasing regional water supply could reduce GHG emissions associated with the energy used to import water when there is not enough local water supply available. Because it is unclear to the extent that evaluating existing programs and initiatives or piloting new programs will improve water conservation, Measures WC-4 is not quantified and is considered supportive.

*Measure WC-5 – Phase 1: Continue to promote water efficiency technologies and innovative practices that can be adopted into future water conservation program updates.*

Measure WC-5, continue to promote water efficiency technologies and innovative practices that can be adopted into future water conservation programs or updates, will be implemented through various Metropolitan programs that either provide funding or financial incentives for water efficiency projects or provide a venue for new technologies to be evaluated. This measure ensures that water conservation efforts will continue to evolve and improve. Improvements in water conservation programs or technologies can indirectly reduce GHG emissions associated with water management. Because it is unclear to the extent that evaluating existing programs and initiatives or piloting new programs will improve water conservation, Measures WC-5 is not quantified and is considered supportive.

*Measure WC-6 – Phase 2: Implement advanced technology systems to increase Metropolitan-owned recycled and groundwater recovery systems to maintain local water supply (e.g., proposed Regional Recycled Water Plant [RRWP]).*

Metropolitan is in the process of investigating the feasibility of a RRWP that would treat wastewater to potable water standards and then inject potable water into wells to increase groundwater supplies within the Los Angeles area. Measure WC-6, the implementation of this proposed RRWP, would substantially increase the amount of local water available and reduce the amount of imported water which, in turn, would reduce the GHG emissions associated with the energy needed for to import water. Direct GHG emission reductions from Measure WC-6 would be based on the estimated reduction in imported water pumped. Because the RRWP has not yet been approved and the actual efficiency gain is not yet known, this measure is not considered quantifiable for the purposes of this assessment. If this project is approved, implementation would not occur until Phase 2 of the CAP, therefore emission reduction estimates for this measure are not included in the overall quantified emission reductions discussed herein and the measure is considered supportive.

#### RESULTS

Table 24 summarizes the measures associated with Strategy 8 and potential GHG emissions reduction. Measure WC-3 would result in a cumulative reduction of approximately 968 MT $CO_2e$ between 2020 and 2030 and 3,387 MT $CO_2e$ between 2020 and 2045.

**Table 24 GHG Emissions Reduction Associated with Strategy 8**

| Measures | Cumulative Emission Reductions ($MT\ CO_2e$) 2030 | Cumulative Emission Reductions ($MT\ CO_2e$) 2045 |
|---|---|---|
| WC-1 (Phase 1) Expand programs which educate customers on water conservation initiatives through workshops and speaking engagements. | Supportive | |
| WC-2 (Phase 1) Continue to implement innovative water use efficiency programs. | Supportive | |
| WC-3 (Phase 1) Continue Turf Removal Program to install an average of 1,500,000 square feet (sq. ft.) of water efficient landscapes per year through 2030 through the use of a rebate program. | 968 | 3,387 |
| WC-4 (Phase 1) Provide funding for the development and monitoring of local stormwater recharge and use projects to evaluate the water supply benefit of stormwater. | Supportive | |
| WC-5 (Phase 1) Continue to promote water efficiency technologies and innovative practices that can be adopted into future water conservation program updates. | Supportive | |
| WC-6 (Phase 2) Implement advanced technology systems to increase Metropolitan-owned recycled and groundwater recovery systems to maintain local water supply (e.g., proposed RRWP).[1] | Supportive | |
| **Total Cumulative Emissions Reduction** | **968** | **3,387** |

Notes: $MT\ CO_2e$ = metric tons of carbon dioxide equivalent; RRWP = Regional Recycled Water Plant

[1] The RRWP is not yet operational and would be implemented in phase 2 of the CAP.

### 2.4.4 Strategy 9: Investigate and Implement Carbon Capture and Sequestration Opportunities

While GHG emissions reduction through electrification, purchase of carbon-free electricity, and efficiency will drive a significant portion of the GHG reduction that Metropolitan needs, sequestering and storing carbon from the atmosphere will likely play a critical role in achieving and maintaining carbon neutrality for both Metropolitan and California.[59] Carbon capture technology is largely an emerging technology for large scale operations, however, Metropolitan will continue to track such technology and opportunities as they progress. With the extensive amount of land under Metropolitan's operational control, there may be opportunities for carbon sequestration projects potentially providing Metropolitan a "negative" source of GHG emissions. Such opportunities need to be evaluated further in conjunction with existing programs that regulate carbon sequestration projects and associated carbon markets.[60]

#### Methodology and Assumptions

Direct GHG emissions reduction for this strategy are dependent on the carbon capture or sequestration opportunities available and the extent to which these opportunities actively remove $CO_2e$ from the atmosphere. As such, the measures making up Strategy 9 focus on conducting research to understand opportunities and conducting pilot studies to evaluate the benefit.

[59] https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf

[60] The CARB adopted a "Carbon Capture and Sequestration Protocol" in 2018. Other carbon sequestration opportunities will be vetted through the "Restoration of California Deltaic and Coastal Wetlands" protocol adopted in 2017 by the American Carbon Registry, which operates in the voluntary and regulated carbon markets until the time CARB adopts the protocol into the compliance market.

*Measure CS-1 – Phase 1: Study carbon capture protocols in the Sacramento-San Joaquin River Delta.*

Measure CS-1, study carbon capture protocols in the Sacramento-San Joaquin River Delta, establishes the first step in identifying opportunities for Metropolitan to pursue carbon capture or sequestration opportunities in the future. Metropolitan plans on conducting an assessment that will investigate opportunities within Metropolitan's Delta property boundaries. As such, this measure is not quantifiable at this time and is considered supportive.

*Measure CS-2 – Phase 1: Conduct a five-year research program to increase Metropolitan's knowledge of regenerative agriculture and carbon sequestration opportunities on Metropolitan properties in the Palo Verde Valley.*

Measure CS-2, conduct a five-year research program to increase Metropolitan's knowledge of regenerative agriculture and carbon sequestration opportunities on Metropolitan properties in the Palo Verde Valley, further expands Metropolitan's potential opportunities for carbon sequestration. The development of a smaller scale study through a partnering agreement with the California State University, Chico Center for Regenerative Agriculture and Resilient Systems, will help inform the scalability of these types of programs. This measure is considered supportive.

*Measure CS-3 – Phase 2: Establish baseline science approaches through pilot projects and implement carbon sequestration projects as deemed feasible.*

Based on the assessments in Measure CS-1 and outcomes of the study conducted under Measure CS-2, Measure CS-3 would establish pilot projects and a carbon sequestration feasibility study on Metropolitan-owned lands. The potential GHG emissions that could be reduced through such carbon sequestration projects is estimated to be between 100,000 MT $CO_2e$ to 300,000 MT $CO_2e$ annually on Metropolitan owned lands based on research completed by the University California, Davis. However, the size and scope of the actual future carbon sequestration projects will dictate the actual reductions gained from carbon sequestration. This measure is considered supportive.

#### RESULTS

Table 25 summarizes the measures associated with Strategy 9 and potential GHG emissions reduction. The measures are collectively supportive and are aimed at increasing carbon sequestration on Metropolitan owned lands. Measure CS-3 has the potential to result in an annual reduction of approximately 100,000 to 300,000 MT $CO_2e$, however, more data and evaluation is needed to accurately estimate GHG emissions reductions from the measure.

### Table 25 GHG Emissions Reduction Associated with Strategy 9

| Measures | Cumulative Emission Reductions ($MT\ CO_2e$) 2030 | Cumulative Emission Reductions ($MT\ CO_2e$) 2045 |
|---|---|---|
| CS-1 (Phase 1) Study carbon capture protocols in the Sacramento-San Joaquin River Delta. | Supportive | |
| CS-2 (Phase 1) Conduct a five-year research program to increase Metropolitan's knowledge of regenerative agriculture and carbon sequestration opportunities on Metropolitan properties in the Palo Verde Valley. | Supportive | |
| CS-3 (Phase 2) Establish baseline science approaches through pilot projects and implement carbon sequestration projects as deemed feasible. | Supportive | |
| **Total Cumulative Emissions Reduction** | **Supportive** | |

# 3 Conclusion

The strategies and measures identified in this CAP will lead to a significant reduction in GHG emissions and provide a foundation for Metropolitan to achieve net carbon neutrality. The strategies and measures developed to achieve a reduction target that is consistent with State's 2030 goal established by SB 32 provide the foundation and establish the trajectory for this long-term transformation. However, the 2045 GHG emissions reductions quantified in this CAP are not yet enough to meet the long-term 2045 goal of carbon neutrality. As the current strategies and measures are implemented, Metropolitan will gain more information, new technologies will emerge, and current pilot projects and programs are anticipated to scale to the size needed to reach carbon neutrality. Furthermore, the State is expected to continue to update regulations and provide support once the 2030 target is achieved. To monitor progress over time, Metropolitan will conduct annual implementation monitoring of the GHG emission reduction measures and report on progress. Metropolitan will also conduct an annual GHG inventory of its operations in order to maintain the accuracy of the carbon budget. The process for monitoring and quantifying measure implementation status relies on key target metrics identified for each of the strategies and measures. By committing to annual monitoring of CAP implementation progress and adjusting where necessary, and completing updates to the CAP every five years, Metropolitan will rise to meet the local and global imperative of reducing GHG emissions.

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