PASADENA
Water&Power
SERVING THE COMMUNITY SINCE 1906

2020 Urban Water Management Plan

Public Draft

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150 South Los Robles Avenue, Suite 200, Pasadena, California

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Acronyms and Abbreviations

1,2,3-TCP	1,2,3-trichloropropane
AF	Acre-feet
AFY	Acre-feet per year
AWWA	American Water Works Association
Behner	John L. Behner Water Treatment Plant
BMPs	Best Management Practices
CAP	Climate Action Plan
CCLARP	Climate Change in the Los Angeles Region Project
cfs	Cubic feet per second
CII	Commercial-industrial-institutional
CIMIS	California Irrigation Management Information System
City	City of Pasadena
CMFI	County median family income
CMIP3	Couple Model Intercomparison Project 3
CMIP5	Couple Model Intercomparison Project 5
CRA	Colorado River Aqueduct
CWC	California Water Code
CY	Calendar year
Delta	Sacramento-San Joaquin Delta
DMM	Demand Management Measure
DOF	Department of Finance
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
GCM	Global Circulation Model
GHG	Greenhouse Gas
GLAC	Greater Los Angeles County
GPCD	Gallons per capita per day
GPM	Gallons per minute
Guidebook	2020 UWMP Guidebook for Urban Water Suppliers
HCD	California Department of Housing and Community Development
HCF	Hundred cubic feet
IRP	Integrated Resources Plan
IRWMP	Integrated Regional Water Management Plan

JPL	Jet Propulsion Laboratory
kWh	Kilowatt-hour
L2L	Laundry to landscape
LABSCS	Los Angeles Basin Stormwater Conservation Study
LACDPW	Los Angeles County Department of Public Works
LACSD	Los Angeles County Sanitation District
MCL	Maximum Contaminant Level
MGD	Million gallons per day
MHTS	Monk Hill Treatment System
MSL	Mean sea level
MWD	Metropolitan Water District of Southern California
MWELO	Model Water Efficient Landscape Ordinance
NDMA	N-nitrosodimethlamine
PPCP	Pharmaceuticals and personal care products
PWP	Pasadena Water and Power
RBMB	Raymond Basin Management Board
RUWMP	Regional Urban Water Management Plan
SB X7-7	Water Conservation Act of 2009
SCADA	Supervisory Control and Data Acquisition
SCAG	Southern California Association of Governments
SIP	Seismic Improvement Program
State Board	State Water Resources Control Board
SWP	California State Water Project
TDS	Total dissolved solids
TOC	Total organic carbon
UWMP	Urban Water Management Plan
VOCs	Volatile organic compounds
WeDIP	Water and Energy Direct Install Program
WIRP	Water Integrated Resources Plan
WSCP	Water Shortage Contingency Plan
WSRP	Water System and Resources Plan
WTP	Water Treatment Plant

Executive Summary

ES-1 Purpose and Organization

Preparation of an Urban Water Management Plan (UWMP) is required by the California Department of Water Resources (DWR) for all urban water suppliers within the State of California. In this context, urban water suppliers are defined as water suppliers, either publicly or privately owned, that provide water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet (AF) of water annually (AFY). UWMPs must meet requirements established in the California Water Code (CWC) and the Urban Water Management Planning Act (Act).

This report constitutes the 2020 UWMP and the Water Shortage Contingency Plan (WSCP) – provided as Chapter 8 in this document - for Pasadena Water and Power (PWP), which must be adopted by the City of Pasadena (City) and submitted to DWR by July 1, 2021. This UWMP satisfies the requirements of the Act and its amendments. An overview of the provisions of the Act, and a checklist showing where each requirement has been included in this UWMP is provided in Appendix A. In addition to satisfying regulatory requirements, this report is a resource document that includes an analysis of long-term water supply and demand planning for PWP. Table ES-1 includes a summary of each chapter of this UWMP.

Table ES-1-1: Organizational Overview of the 2020 UWMP

Chapter	Chapter Name	Information Contained within Chapter
Chapter 1	Introduction and Overview	• Legal requirements for 2020 UWMPs • Changes in the Act since 2015 • Local planning efforts • DWR submittal tables
Chapter 2	Plan Preparation and Adoption	• Plan preparation • Coordination and outreach • Plan adoption and submittal
Chapter 3	System Description	• General description of PWP's service area • History and government of PWP • Hydrologic and climate characteristics of PWP's service area • Current and projected population and demographic figures • Other social, economic, and demographic factors • Land uses within the service area
Chapter 4	Water Use Characterization	• Overview of past, current, and projected water use • Information about distribution system water losses • Water use for lower income households
Chapter 5	SB X7-7 Baselines and Targets	• Compliance with 2015 and 2020 interim water use targets • Baseline gross per capita water use

Chapter	Chapter Name	Information Contained within Chapter

Chapter 6	Water Supply Characterization	• Information about existing and projected supplies, including:
		  ○ Imported water
		  ○ Groundwater
		  ○ Surface runoff
		  ○ Stormwater
		  ○ Non-potable water
		• A description of future water projects
		• Existing and planned sources of water

Chapter 7	Water Service Reliability and Drought Risk Assessment	• Overview of the reliability of each of PWP's supplies
		• Projections for water supply and water demands under the following hydrologic conditions:
		  • Normal year
		  • Single dry year
		  • Five consecutive dry years
		• Data, methods, and basis for drought risk
		• Assessment of each water source over the five-consecutive-year drought

Chapter 8	Water Shortage Contingency Plan	• Annual Assessment procedures • Overview of PWP's six water shortage stages • Shortage response actions including supply augmentation and demand reduction • A seismic risk assessment and emergency response • Communication, compliance, and enforcement protocols • Impacts on PWP's revenues and expenditures from a water shortage that reduces water use
Chapter 9	Demand Management Measures	• Summary of the demand management measures implemented by PWP
Chapter 10	Climate Change	• Information about anticipated water supply and water demand impacts in PWP's service area as a result of climate change • Data about the energy intensity of PWP's water system

ES-2 PWP Service Area Background and Water Supplies

PWP's service area is located within the northwestern portion of the San Gabriel Valley in Los Angeles County, encompassing approximately 25 square miles, and is larger than the legal boundary of the City. PWP serves portions of unincorporated areas of Altadena, East Pasadena, and San Gabriel. The service area is bordered on the north by unincorporated Altadena and the Angeles National Forest, on the east

by Arcadia and Sierra Madre, on the south by South Pasadena and San Marino, and the west by Los Angeles, Glendale, and La Canada Flintridge.

Pasadena's weather is characterized as a Mediterranean climate. Temperatures are mild in winter, spring and fall, and hot and dry during summer months. Total precipitation in Pasadena averages about 20 inches per year, with a range between 3.4 to 36 inches per year, with most of the rainfall occurring between January and March. Typically, August is the hottest month of the year with an average daily maximum temperature of 90°F. The average daily maximum temperature in winter months is approximately 68°F.

PWP's current water supplies include: local groundwater from the Raymond Basin (approximately 40%), and purchases of imported water (approximately 60%). In wet and normal years, PWP augments local groundwater with surface water diversions. This provides storage benefits to PWP, with surface water that is diverted and infiltrated during wet years being stored in the basin for use in periods of higher demand. Water demands that are not met with local groundwater are fulfilled with imported water purchased by PWP from the Metropolitan Water District of Southern California (MWD). MWD is a regional water wholesaler with 26 public member agencies, including PWP. MWD obtains its water supplies from the California State Water Project (SWP) and Colorado River Aqueduct (CRA). Both of these sources have become more unreliable since the early 1990's as a result of drought, water rights challenges, water quality concerns, and environmental degradation tied to these programs.

Furthermore, Delta Plan Policy WR P1 - Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit. 23, § 5003) - compels PWP to seek local supplies. As such, PWP has initiated a pilot program to deliver non-potable water for irrigation purposes, is pursuing projects to capture stormwater, has incentivized residential greywater systems, and has implemented a Cyclic Agreement with MWD.

ES-3 PWP Demand Projections

PWP's historical water demands have varied from year to year, mainly attributed to annual variations in weather, but also due to economic activity and droughts. In 2009, the State Legislature passed the Water Conservation Act, referred to as SB X7-7, with targets and compliance to be reported in the UWMP. This Act required each urban retail water supplier to reduce urban per capita water use by 20% by December 31, 2020. Pasadena exceeded its 20% reduction goal by achieving 153 gallons per capita per day (GPCD), which is about 27% less than the 211 GPCD baseline established in 2015. The baseline was calculated using the ten-year average water use for the period from calendar years 1995 to 2004, divided by the population.

In 2020, PWP supplied 29,290 AF of water to serve its 38,421 customer accounts (approximately 170,400 people). Future projected water use can be determined by examining past and current water use trends, along with consideration of land use planning data, climate change, and other factors relevant to sector-specific water use. Population growth in the Pasadena area is not expected to increase significantly between 2020 and 2040, and assumes average growth of only 0.5 percent per year. The projections include mandated reductions imposed by Senate Bill (SB) 606 and Assembly Bill (AB) 1668, which require a reduction in indoor residential water use from the current 57 GPCD to meet the target of 55 GPCD by

2025 and 50 GPCD by 2030 (approximately 1,400 AFY). In addition, the State is required to establish outdoor targets and water loss reductions for which final rules are not yet available. Pasadena is assuming these reductions will equal at least 2,100 AFY by 2030 for a total water use of 25,000 AFY.

Demand projections shown in Tables ES-2 do not reflect additional planned water savings from PWP's conservation programs. In Chapter 9 of this document, PWP describes the Demand Management Measures and the implementation of water waste prevention ordinances, metering, conservation pricing, public education and outreach, programs to assess and manage water system losses, and water conservation program coordination. These measures may further reduce demands in the future.

Table ES-1-2: Multiple Dry-Year Supply and Demand Comparison (AFY)

	2025	2030	2035	2040
Groundwater for Pumping[1]	11,830	11,830	11,830	11,830
Imported Water[2]	19,703	20,113	20,217	20,300
Supply Totals	**31,533**	**31,943**	**32,047**	**32,130**
Demand Totals[3]	**26,750**	**25,000**	**25,320**	**25,630**

[1] Projected dry-year groundwater supplies are equal to voluntary reduced pumping rights of 10,304 AFY plus 1,526 AFY of spreading credits.

[2] Projected imported supplies are equal to projected demands for imported water as represented in the MWD UWMP.

[3] Demand Totals include regulatory required reductions under SB 606 and AB 1668, but are not reduced to reflect additional planned water savings from conservation programs.

ES-4 PWP Water Supply Reliability and Drought Risk Assessment

The Act requires suppliers to conduct three key planning analyses to evaluate supply reliability. The first is a water service reliability assessment that compares the total water supply sources available to the water supplier for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The second is a drought risk assessment that evaluates a drought period that lasts five consecutive water years starting from the year following when the assessment is conducted. And third is the Water Shortage Contingency Plan ("WSCP") which is a detailed proposal for how PWP intends to act during actual water shortage conditions.

Table ES-2 demonstrates the supply-demand balance for PWP's service area in the multiple dry years hydrologic scenarios. These scenarios were selected to be consistent with MWD's UWMP since the agency did extensive hydrological modeling and Pasadena is dependent on MWD for imported water supplies. Due to MWD's investments in programs that consider climate change issues discussed in Chapter 10, the projections shown in Table ES-2 do not vary.

ES-5 Water Shortage Contingency Plan

New for the 2020 UWMP cycle is the adoption of a WSCP – provided as Chapter 8 in this document. The WSCP is a detailed proposal for how PWP intends to act in the case of an actual water shortage condition. The WSCP anticipates a water supply shortage and provides pre-planned guidance for managing and

mitigating a shortage. This plan requires a public hearing and adoption independent of the UWMP and shall be made available to its customers no later than 30 days after adoption.

The Act has six standard water shortage levels, and Water Code Section 10632(a)(3) allows for cross-referencing relating PWP's existing categories to the six standard water shortage levels. PWP's current categories are standardized in the City's municipal code in Chapter 13.10 titled "Water Waste Prohibitions and Water Supply Shortage Plans".

Table ES-1-3: PWP's Water Supply Shortage Restrictions by Level

	Level 1	Level 2	Level 3	Level 4
Watering Days	3 summer* 1 winter	2 summer* 1 winter	1 summer* 1 winter	No watering or irrigating
Obligation to Fix Leaks, Breaks or Malfunctions	72 hours after notification	48 hours after notification	36 hours after notification	24 hours after notification
Additional Prohibitions	None	No filling ornamental lakes/ponds	Same as Level 2	Same as Level 3 and no filling residential pools and spas; No new water services
Estimated Water Use Reduction	10%	20% to 30%	40%	50% and >50%
UWMP Standard Water Shortage Level	Level 1	Levels 2 and 3	Level 4	Levels 5 and 6

**For the water shortage plans, the "summer" season is defined as April 1 to October 31*

Chapter 1 Introduction and Overview

1.1 Urban Water Management Planning Act

In 1983, the California Legislature enacted the Urban Water Management Planning Act (Act). The law required an urban water supplier (Supplier), providing water to more than 3,000 customers or serving more than 3,000 acre-feet annually, to adopt an Urban Water Management Plan (UWMP) every five years. The original Act also required the California Department of Water Resources (DWR) to provide a report to the California Legislature on the status of water supply planning in California.

Since the Act was passed, it has undergone significant expansion and revisions over time with the latest updates to the Water Code enacted on January 1, 2020. Prolonged droughts, groundwater overdraft, regulatory revisions, and changing climatic conditions not only affect water reliability determinations, but also the broad picture of statewide water reliability overseen by DWR, the State Water Resources Control Board (State Board), and the State of California Legislature (Legislature). Accordingly, the Act has grown to address changing conditions and it guides California's water resource management.

This report constitutes the 2020 UWMP for Pasadena Water & Power (PWP). This UWMP satisfies the requirements of the Act and its amendments. This plan shall be adopted by the City of Pasadena (City) and submitted to the DWR. The UWMP requires analyses of management tools and options that will maximize resources and minimize the need to import water from other regions. The Act also requires that UWMPs contain an analysis of total projected water use compared to water supply sources over the next 20 years in five-year increments. Water demand and supply information is compared for single dry-year and multiple dry-year scenarios, and demand management measures necessary to reduce demands in various hydrologic conditions are provided. Furthermore, this 2020 UWMP includes information about potential climate change vulnerabilities related to water resources and data about the energy intensity of PWP's water system.

Chapter 8 of this plan contains the Water Shortage Contingency Plan (WSCP). The WSCP is PWP's operations plan for water shortages and is used to prevent catastrophic service disruptions through proactive, rather than reactive, management. This way, if and when shortage conditions arise, the WSCP allows PWP, the governing body, and the public to identify and efficiently implement pre-determined steps to manage a water shortage. The WSCP is a stand alone document that is to be adopted by City Council separately from the UWMP and can be amended, as needed, without amending the corresponding UWMP.

1.2 Law

California Water Code (CWC) Division 6, Part 2.6, Sections 10610 through 10656 and Section 10608 details the information that must be included in the UWMP as well as who must file them. PWP's 2020 UWMP is organized per the requirements stipulated in the *UWMP Guidebook 2020* (Guidebook), which is prepared in accordance with various sections of the CWC by the DWR. An overview of the provisions of the Act, and a checklist showing where each requirement has been included is provided in Appendix A.

1.3 Changes in the Act Since 2015

There are numerous additional requirements passed by the Legislature for the 2020 UWMP. The following list includes an overview of the amendments to the Act:

- ***Five Consecutive Dry-Year Water Reliability Assessment*** The Legislature modified the dry-year water reliability planning from a "multiyear" time period to a "drought lasting five consecutive water years" designation. This statutory change requires PWP to analyze the reliability of its water supplies to meet its water use over an extended drought period. This requirement is addressed in the Water Use assessment presented in Chapter 4, the Water Supply analysis presented in Chapter 6, and the Water Reliability determinations in Chapter 7.

- ***Drought Risk Assessment*** The California Legislature created a new UWMP requirement for drought planning in part because of the significant duration of recent California droughts and the predictions about hydrological variability attributable to climate change. The Drought Risk Assessment (DRA) requires PWP to assess water supply reliability over a five-year period from 2021 to 2025 that examines water supplies, water uses, and the resulting water supply reliability under a reasonable prediction for five consecutive dry years. Chapter 7 provides the completed DRA based on the Water Use information in Chapter 4, Water Supply analysis in Chapter 6, and the Water Reliability determinations in Chapter 7.

- ***Seismic Risk*** The Water Code now requires PWP to specifically address seismic risk to various water system facilities and to have a mitigation plan. PWP completed a thorough Seismic Vulnerability Assessment of its facilities in 2006, and the results and updates are provided in Chapter 8.

- ***Water Shortage Contingency Plan*** In 2018, the Legislature modified the UWMP laws to require a WSCP with specific elements. The WSCP is a document that provides PWP with an action plan for a drought or catastrophic water supply shortage. Although the new requirements are more prescriptive than previous versions, many of these elements have been included in PWP's Water Waste Prohibitions and Water Supply Shortage Plans since 2009.

- ***System Description*** The Water Code now requires the inclusion of service area socioeconomic information as part of the system description. It also requires coordination with land use agencies and a description of current and projected land uses within the service area.

- ***Climate Change*** Consideration of climate change impacts must be included in the water use (Chapter 4), water supply (Chapter 6), and reliability (Chapter 7) assessments. PWP has presented a separate climate change chapter (Chapter 10) to provide one location where climate change impacts are addressed.

- ***Energy Analysis*** Although PWP provided the optional energy analysis in the 2015 UWMP, the analysis is a Water Code requirement for the 2020 UWMP. The energy analysis is provided in Chapter 10.

- ***Demonstrate Reduced Delta Reliance*** An urban water supplier (Supplier) that anticipates participating in or receiving water from a proposed project such as a multi-year water transfer, conveyance facility, or new diversion that involves transferring water through, exporting water

from, or using water in the Sacramento-San Joaquin Delta (Delta) should provide information in their 2015 and 2020 Urban Water Management Plans (UWMPs) that can then be used in the certification of consistency process to demonstrate consistency with Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit. 23, § 5003). PWP does not directly receive water through Delta projects, however does receive imported water through the Metropolitan Water District of Southern California (MWD). Any reduction in delta reliance will be provided in MWD's 2020 UWMP.

- ***Groundwater Supplies Coordination*** In 2014, the Legislature enacted the Sustainable Groundwater Management Act to address groundwater conditions throughout California. Water Code now requires Suppliers' 2020 UWMPs to be consistent with Groundwater Sustainability Plans, in areas where those plans have been completed by Groundwater Sustainability Agencies. PWP pumps from the Raymond Basin, an adjudicated groundwater basin managed by the Raymond Basin Management Board (RBMB). As such, PWP has always adhered to the requirements of this new legislation.

- ***Lay Description*** The Legislature included a new statutory requirement for PWP to include a lay description of the fundamental determinations of the UWMP, especially regarding water service reliability, challenges ahead, and strategies for managing reliability risks. This section of the UWMP could be viewed as a go-to synopsis for new staff, new governing members, customers, and the media, and it can ensure a consistent representation of the PWP's detailed analysis. The lay description is provided in the Executive Summary.

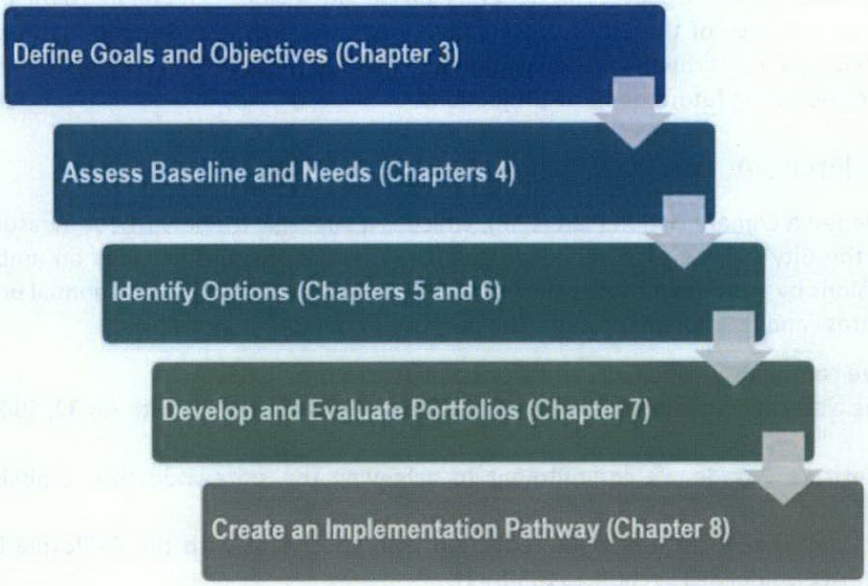
1.4 Local Planning Efforts Related to the UWMP

There are three primary local planning efforts that have been recently completed or are currently being completed by PWP, and have a direct nexus to the 2020 UWMP. Those three efforts are described further in the following sections.

1.4.1 Water System and Resources Plan

PWP initiated the Water System and Resources Plan (WSRP) to update and incorporate both the 2002 Water System Master Plan and the 2011 Water Integrated Resources Plan (WIRP). These two non-regulatory documents were combined into one 25-year plan intending to improve the management and availability of local water supply, prioritize replacement and rehabilitation infrastructure, and set water conservation targets. The WSRP was developed using an open, participatory process, with input from a dedicated stakeholder Advisory Committee and the public at large. Planning objectives were developed by the Advisory Committee, and evaluation criteria or metrics were established for these objectives in order to evaluate various alternatives to meet future water demands. The WSRP was developed in five steps that began in the fall of 2018 and extended through 2020.

Figure 1-1: Water System and Resources Plan Development Process



Thirty-six supply options and a series of infrastructure options were developed to assess gaps when comparing baseline conditions against future goals. Options included projects, programs and strategies to maintain existing supplies and infrastructure, and to improve or create new supplies and infrastructure.

To meet multiple goals and objectives, six water system and resources portfolios were established that combine supply and production, distribution, storage and other solutions into strategies. Each portfolio use unique combinations of water resource options including surface water, groundwater, imported water, stormwater and non-potable water. Options focused on water supply and production were combined with projects and programs to upgrade PWP's water system, including distribution, storage and other CIPs. Maximize Value of the Groundwater Basin and Non-Potable Supplies was selected as the preferred portfolio. This preferred portfolio reflects a backlog of rehabilitation and replacement projects needed to meet 12 to 24 months of demand in the event of an imported water interruption. This portfolio focuses on the use of the Basin for storage and maximizing local supplies by repairing infrastructure implementing new water resource management tools.

An implementation plan describing the policies, scheduling, phasing, finances, tracking and adapting processes needed to implement the selected portfolio is presented in the WSRP. To account for future uncertainty and changing conditions, the implementation plan includes adaptive management, flexibility and a method for assessing progress toward WSRP goals. The WSRP is scheduled for adoption by Pasadena City Council in summer 2021. Throughout this UWMP, various components of the recommended supply portfolio are discussed where applicable.

1.4.2 General Plan Update

The City launched a comprehensive update to its General Plan in 2009. During 2009 over 100 meetings and events were held across the City to identify community concerns and issues. In 2011 the City followed-up from its public meeting process by distributing a survey to receive feedback on potential alternatives and guiding principles of the General Plan. In 2013 the City Council directed staff to begin preparing an Environmental Impact Report (EIR) in conjunction with the General Plan Update.

In August 2015 the City Council adopted the Land Use Element and Mobility Element, and certified the Final EIR for the General Plan Update. The General Plan Update includes an update to the boundaries and development caps in each of the City's specific plan areas. As such, the General Plan Update includes information about planned growth and development in the City, which has been used in this 2020 UWMP, particularly for calculating future demand projections.

1.4.3 Climate Action Plan

The City developed a Climate Action Plan (CAP), which is a strategic framework for measuring, planning, and reducing the City's share of greenhouse gas (GHG) emissions and includes an ambitious goal of reducing emissions by more than half by the year 2035. The City will also provide annual updates to track the CAP's progress and its implementation. The purpose of the CAP is as follows:

- Analyze community-wide GHG emissions at a programmatic-level,
- Outline a strategy to reduce Pasadena's GHG emissions consistent with AB 32, SB 32 and EO S-3-05,
- Demonstrate Pasadena's commitment to achieving the state-wide GHG emissions reduction targets, and
- Serve a qualified GHG emissions reduction plan consistent with the California Environmental Quality Act Guidelines Section 15183(b)(1).

The CAP builds on the goals and policies of the General Plan and complements the State's objectives to address climate change. Specifically, the CAP identifies climate action measures and implementation actions to reduce GHG emissions to achieve the reduction goals presented in Figure 1-2.

The strategy for achieving the goals outlined in the CAP builds on Pasadena's overall success to date, proposing to strengthen existing programs that have contributed to this success, and integrating new efforts to reduce GHG emissions. The CAP identifies 5 climate strategies, 27 measures, and 142 actions to reduce Pasadena's GHG emissions.

Collectively, they have the potential to reduce emissions and contribute to the statewide efforts to combat climate change. The climate strategy is summarized below:

- **Energy Conservation and Efficiency** – reduce energy demand, utilize energy more efficiently, and switch to carbon neutral sources
- **Sustainable Mobility and Land Use** – improve pedestrian and bicycle infrastructure, enhance carpool and public transportation services, and expand the use of electric vehicles and related infrastructure
- **Water Conservation**– increase access to and use storm water infiltration
- **Waste Reduction** – promote reuse, recycling, and composting
- **Urban Greening** – maintain a healthy and expand existing urban forest

Information about potential climate change vulnerabilities and the energy intensity of various water supplies in PWP's service area that is included in this 2020 UWMP was prepared in coordination with the CAP effort to maintain consistency between the two planning documents.

Figure 1-2: Climate Action Plan Goals and Statewide GHG Emissions Reduction Targets

Table 3.2: CAP Goals and State-wide GHG Emissions Reduction Targets		
Year	Pasadena CAP Goals	State-wide Targets
2020	27% below 2009 levels (equivalent to 14% below 1990 levels)	15% below 2009 levels per AB 32 (equivalent to 1990 levels)
2030	49% below 2009 levels (equivalent to 40% below 1990 levels)	49% below 2009 levels per SB 32 (equivalent to 40% below 1990 levels)
2035	59% below 2009 levels (equivalent to 52% below 1990 levels)	The state does not have a 2035 target
2050	83% below 2009 levels (equivalent to 80% below 1990 levels)	83% below 2009 levels per EO S-3-05 (equivalent to 80% below 1990 levels)

1.5 DWR Submittal Tables

This UWMP contains two types of tables; tables that are mandated for inclusion by DWR (labeled with 'Submittal Table' in the blue portion of the table header) and additional tables that were added to provide further clarification and details. All tables are numbered based on the order they appear in the text. DWR tables have specific numbering that is stipulated by DWR. Some of the DWR tables have been modified in the text to better communicate the relevant information. Appendix B contains all of the unmodified DWR tables as they will be submitted to DWR.

Chapter 2 Plan Preparation and Adoption

2.1 Plan Preparation

PWP prepared this 2020 UWMP as an "urban water supplier" pursuant to Section 10617 of the CWC and directly serves potable water to more than 3,000 customers and supplies more than 3,000 acre-feet per year (AFY) at retail for municipal purposes. The City does not provide water at wholesale for municipal purposes and the 2020 UWMP was prepared as an individual plan.

Table 2-1, Table 2-2, and Table 2-3 provide information about PWP and the structure of the 2020 UWMP, as required in the 2020 Guidebook.

Table 2-1: Public Water System Information

Submittal Table 2-1 Retail Only: Public Water Systems			
Public Water System Number	Public Water System Name	Number of Municipal Connections 2020	Volume of Water Supplied 2020
1910124	City of Pasadena Water and Power Department	38,421	29,290
	TOTAL	38,421	29,290

Table 2-2: Plan Identification

Submittal Table 2-2: Plan Identification			
Select Only One	**Type of Plan**		**Name of RUWMP or Regional Alliance** *if applicable*
☑	**Individual UWMP**		
	☐	Water Supplier is also a member of a RUWMP	
	☐	Water Supplier is also a member of a Regional Alliance	
☐	**Regional Urban Water Management Plan (RUWMP)**		

Table 2-3: Supplier Identification

Submittal Table 2-3: Supplier Identification	
Type of Supplier (select one or both)	
☐	Supplier is a wholesaler
☑	Supplier is a retailer
Fiscal or Calendar Year (select one)	
☑	UWMP Tables are in calendar years
☐	UWMP Tables are in fiscal years
If using fiscal years provide month and date that the fiscal year begins (mm/dd)	
Units of measure used in UWMP (select from drop down)	
Unit	AF

2.2 Coordination and Outreach

PWP must coordinate its water supply planning with multiple agencies as it relies on a combination of local and non-local water supply sources. Applicable CWC sections establishing the basis for preparing a plan and the outreach requirements are as follows:

- ***10620(d)(3)*** Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.
- ***10621(b)*** Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.
- ***10642*** Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of both the plan and the WSCP. Prior to adopting either, the urban water supplier shall make both the plan and the WSCP available for public inspection and shall hold a public hearing or hearings thereon. Prior to any of these hearings, notice of the time and place of the hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of a hearing to any city or county within which the supplier provides water supplies. After the hearing or hearings, the plan or WSCP shall be adopted as prepared or as modified after the hearing or hearings.

- ***10608.26(a)*** In complying with this part, an urban retail water supplier shall conduct at least one public hearing to accomplish all of the following:
    1. Allow community input regarding the urban retail water supplier's implementation plan for complying with this part.
    2. Consider the economic impacts of the urban retail water supplier's implementation plan for complying with this part.
    3. Adopt a method, pursuant to subdivision (b) of Section 10608.20, for determining its urban water use target.

Local water supplies from groundwater require coordination with the RBMB. PWP is a member agency of the MWD and must coordinate its imported water demands with that agency. MWD is currently completing an update to their Integrated Resources Plan (IRP) and developing their 2020 UWMP. Both the MWD UWMP and the IRP include data and assumptions about PWP's demands, conservation, and local supplies, which require coordination and communication with MWD. The City's wastewater collection and treatment is provided by the Los Angeles County Sanitation Districts. Finally, since PWP provides water service to several adjacent areas outside of the City's boundaries, it must coordinate with those communities as well.

Information in Table 2-4 indicates that PWP has informed the relevant wholesale supplier (MWD) of projected water use in accordance with CWC 10631. In addition, PWP notified the County of Los Angeles that it would be reviewing the UWMP and considering amendments and changes. The County of Los Angeles was notified as a portion of PWP's service area extends into unincorporated areas as discussed in Chapter 3.

Table 2-5 lists the agencies who received a 60-day notification letter from PWP indicating the preparation and update of the 2020 UWMP, as well as the date of the public hearing. New for this UWMP cycle is the preparation and adoption of the WSCP, which is provided as Chapter 8 in this document.

Table 2-4: Wholesale Information Exchange

Submittal Table 2-4 Retail: Water Supplier Information Exchange
The retail Supplier has informed the following wholesale supplier(s) of projected water use in accordance with Water Code Section 10631.
Wholesale Water Supplier Name *(Add additional rows as needed)*
Metropolitan Water District of Southern California

Table 2-5: Notification of UWMP and WSCP Preparation and Public Hearing

Organization/Agency Name	Organization/Agency Name
California-American Water Company	Lincoln Avenue Water Company
City of Alhambra	Los Angeles County Public Works
City of Arcadia	Los Angeles County Sanitation Districts
City of Glendale	Metropolitan Water District of Southern California
City of Sierra Madre	Pasadena Cemetery Association
City of South Pasadena	Raymond Basin Management Board
East Pasadena Water Company	Rubio Cañon Land and Water Association
Foothill Municipal Water District	San Gabriel County Water District
Huntington Library and Art Gallery	Southern California Association of Governments
Kinneloa Irrigation District	Sunny Slope Water Company
La Cañada Irrigation District	Valley Water Company
Las Flores Water Company	

The public hearing considering adoption of the final UWMP and WSCP is planned to be held at the regularly scheduled City Council meeting of June 7, 2021. Per Government Code 6066, the public hearing will be advertised as follows:

- In a local newspaper for two successive weeks (14 calendar days)
- At least two times
- With at least five days between publication dates
- With the time and place of hearing
- With the location where the plan is available for public inspection.

A proof of publication is provided in Appendix C, as well as any comments received regarding the Draft UWMP.

2.3 Plan Adoption and Submittal

The final UWMP and WSCP is scheduled for adoption by the City Council at its scheduled Council meeting on June 7, 2021. After adoption, the following Water Code applies:

- ***10644(a)(1)*** An urban water supplier shall submit to the department, the California State Library, and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.

Final copies of the UWMP and WSCP will be available to the public and will be provided to the California State Library and County of Los Angeles within 30 days of adoption. In addition, the plans will be available on PWP's website at www.pwpweb.com/UWMP for public viewing. The Resolution of Adoption will be provided in Appendix D.

The 2020 UWMP (including the WSCP and electronic data) will be submitted to DWR within 30 days of adoption and by July 1, 2021. UWMP submittal will be done electronically through the WUE Data Portal, an online submittal tool that will be updated for 2020 UWMPs by the DWR.

Chapter 3 System Description

This chapter describes PWP's service area. Included is a description of the physical environment, the climate, the governance structure, a socioeconomic description, a description of the current and projected land uses, and the current and projected population.

3.1 City Background

3.1.1 General Description

Located at the base of the San Gabriel Mountains in Los Angeles County, the City is home to approximately 150,000 people. The City is a place with scenic, cultural and academic landmarks that include the Arroyo Seco and Eaton Canyon, Rose Bowl Stadium, California Institute of Technology, Art Center College of Design, and NASA's Jet Propulsion Laboratory. It is a beautiful place to live and visit. Supporting its character, economy and diverse land uses requires a reliable water supply.

The City is situated between the Arroyo Seco to the west and Eaton Wash to the east, overlaying the Raymond Groundwater Basin. This combination of surface water and groundwater provided the basis for Pasadena's establishment and early development.

PWP's water service area encompasses approximately 25 square miles and is larger than the legal boundary of the City (Figure 3-1). It includes portions of the unincorporated areas of Altadena, East Pasadena, and San Gabriel. Approximately 15% of the total population served by PWP is located outside of the City's legal boundary. The service area is bordered on the north by the unincorporated community of Altadena and the Angeles National Forest, on the east by Arcadia and Sierra Madre, on the south by South Pasadena and San Marino, and the west by Los Angeles, Glendale, and La Cañada Flintridge.

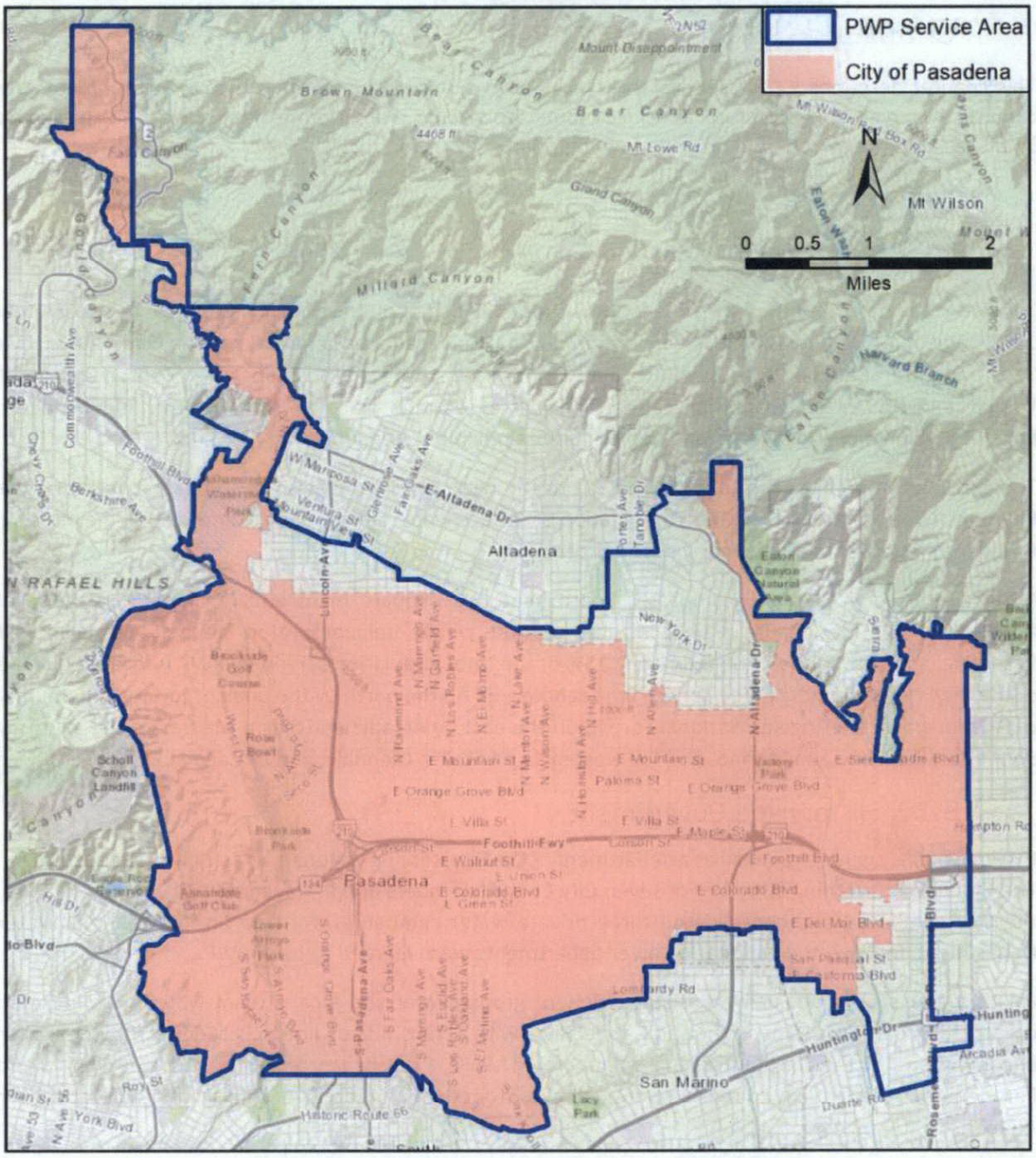
3.1.2 History and Government

PWP is a public agency managed as a department of the City, serving water and electricity to its customers. The City has a governing structure of seven City Councilmembers and a Mayor elected at large. In 1912, the City purchased and consolidated three private water companies, forming an independent Water Department. In 1967, the water and power departments were merged to form PWP.

PWP's water supply originally consisted solely of groundwater and local stream water. This included construction of Morris Dam on the San Gabriel River with a transmission line to Pasadena. However, after becoming one of the thirteen original members of MWD, PWP began receiving imported water, and Pasadena was the first city to receive water supplies from the Colorado River through the Colorado River Aqueduct (CRA) in 1941.

Today, PWP's water supply consists of groundwater, surface water, and imported water that is purchased from MWD. PWP is continuing to diversify its water supply portfolio to increase water supply reliability and use non-potable supply sources.

Figure 3-1: PWP Service Area

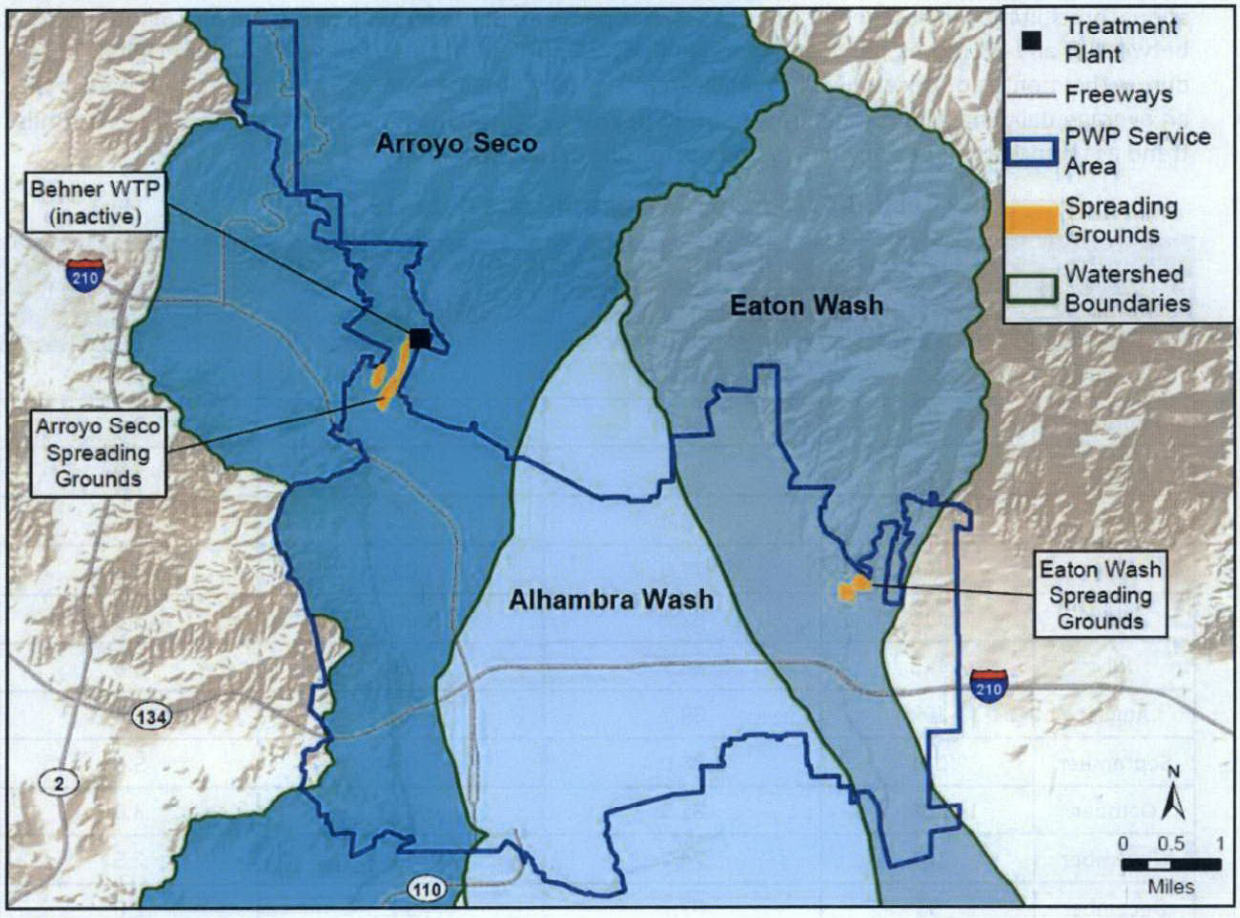


3.1.3 Hydrologic Characteristics

The service area is within the Los Angeles River watershed and is divided across three tributaries. The western portion of the service area drains to the Arroyo Seco, and the eastern portion drains to Eaton Wash. The small drainage area in the central part of the service area is directed to the Alhambra Wash and Rubio Wash which, along with the Eaton Wash, join the Rio Hondo. Both the Rio Hondo and Arroyo Seco join the Los Angeles River beyond the boundaries of the service area.

Figure 3-2 shows the three drainage watersheds within PWP's water service area. PWP has diverted mountain runoff from Arroyo Seco to the Arroyo Seco Spreading Grounds since 1912 and from Eaton Wash to Eaton Wash Spreading Grounds since 1923. PWP owns and operates the Arroyo Seco Spreading Grounds while the Los Angeles County Flood Control District owns and operates the Eaton Wash Spreading Grounds.

Figure 3-2: Hydrologic Characteristics



The large aquifer underling the City and the surrounding areas is referred to as the Raymond Basin. The alluvial gravel, sand, and silt are the main water-bearing materials in the Raymond Basin. It yields water to groundwater wells from a few hundred to several thousand gallons per minute (gpm). The alluvium sit upon impervious bedrock. The alluvial valley slopes to the south, ranging in elevation from 2,000 feet

above mean sea level (MSL) near the mountains to between 500 and 700 feet MSL at the Raymond fault. The fault acts as groundwater barrier along the southern boundary of the Basin.

Urbanization of Pasadena expanded impervious surfaces and replaced the natural ground soils, dramatically reducing the ability of the soil to naturally recharge into the Basin. Additionally, channelizing the Arroyo Seco and Eaton Wash further reduced natural recharge. The first section of the canal of the Arroyo from Devil's Gate Dam past the Rose Bowl was completed in 1935 with soft bottom. After the 1938 floods, the channel was fully lined in concrete in Pasadena, except for a small area south of the dam and one below Colorado Street Bridge.

3.2 Service Area Climate

Pasadena's weather is characterized as a Mediterranean climate (see Table 3-1). Temperatures are mild in the winter, spring and fall, and hot and dry during summer months. Water demand in the PWP service area increases in the summer months due to increased demands for outdoor irrigation. The average annual precipitation in Pasadena is about 20 inches per year. Between 1928 and 2019, precipitation varied between 5 and 48 inches per year. Approximately 75 percent of the average annual precipitation falls during the months of December through March. Typically, August is the hottest month of the year with an average daily maximum temperature of 90 degrees Fahrenheit. Evapotranspiration follows a similar trend as temperature, peaking in July and decreasing in December.

Table 3-1: Monthly Average Climate Data (1928-2019)

Month	Maximum Temperature (^{0}F)[1]	Average of Daily Maximum Temperature (^{0}F)[1]	Average Total Monthly Precipitation (in)[1]	Monthly Average Evapotranspiration (in)[2]
January	93	67.1	4.1	2.2
February	92	68.6	4.5	2.4
March	96	71.0	3.2	3.8
April	105	74.4	1.4	4.6
May	104	77.0	0.4	5.2
June	110	82.1	0.1	5.8
July	113	88.7	0.0	6.8
August	107	89.7	0.1	6.4
September	111	88.0	0.4	5.0
October	108	81.5	0.7	3.6
November	101	74.2	1.7	2.5
December	93	67.7	3.2	2.0
	Maximum: 113 ^{0}F	**Average: 77.5 ^{0}F**	**Average: 19.9 in**	**Total: 50.3 in**

1. NOAA, Pasadena Station ID USC00046719, 1928-2019
2. CIMIS, Monrovia Station ID Number 159, 2000-2018

Three recent and substantial droughts, from 2006 to 2008, 2011 to 2018, and 2020 to 2021, significantly impacted water resources within the state of California. As droughts occur frequently in California, PWP is planning long-term solutions to continue to provide its customers adequate sustainable water supplies at responsible rates. For additional information of the potential impacts of climate change on water resources in PWP's service area, please refer to Chapter 10, Climate Change.

3.3 Service Area Population and Demographic Characteristics

3.3.1 Service Area Population

Recent population growth for the PWP water service area has been slow but steady as the City is largely built-out. Between 1990 and 2020, the service area population increased from 146,840 to 170,400, representing an annual average growth rate of 0.5 percent.

According to the Southern California Association of Governments and population projections provided by the California Department of Finance, minimal population growth is expected through 2040 in PWP's service area. Service area population is forecast to increase by 0.5 percent annually, resulting in approximately 22,000 additional residents over the next 25 years. The City's 2015 General Plan Update is consistent with those estimates. Infill projects consisting of multifamily units is the current trend increasing population density. This has the effect to reduce outdoor irrigation and harden the demand factors.

Table 3-2: Current and Projected Population

Submittal Table 3-1 Retail: Population – Current and Projected					
Population Served	2020	2025	2030	2035	2040
	170,400	173,508	181,466	185,702	189,927

Source: Southern California Association of Governments 2016; California Department of Finance for Los Angeles County 2018.

3.3.2 Other Social, Economic, and Demographic Factors

The City's General Plan Housing Element addresses existing and future housing needs over an eight-year planning period from 2014 to 2021. The following sections provide a thorough description of socioeconomic factors.

3.3.2.1 Age Characteristics

The state and the nation are in the midst of demographic change, with significant increases in age due to the aging of the baby boom generation. These trends are evident in Pasadena. Despite modest population growth during the 2000s, Pasadena's median age of residents rose to 37 years. Mirroring national changes, Pasadena's baby boom (middle-age) age adults also was the fastest growing segment of Pasadena's population. Middle-aged adults (45 to 64 years) increased 25%, and seniors increased 14% since 2000. In contrast, every age group under 45 years old declined in number.

Changes in age distribution are also due to local housing market factors. Pasadena is known for relatively higher housing prices and apartment rents that are more difficult for younger households to afford (as opposed to middle-aged adults established in the workforce). In addition, Pasadena is an attractive community for seniors and middle-aged adults who enjoy the amenities offered by living in the

community. These factors contribute to a nationwide trend, resulting in significant increases in resident age. This has the effect of reducing overall water demand as older population typically have lower indoor water use.

According to demographic and building trends, several trends appear likely. Continued development of apartments and condominiums in the Central District will likely attract younger adults to more affordable housing opportunities in Pasadena. Meanwhile, the aging baby boomer population supports the contention that the senior population will continue to increase. How these demographic changes will affect the demand and type of housing built over the decade remains unclear.[1]

3.3.2.2 Household Income

Households in Pasadena have a median annual income of $76,264, which is more than the median annual income of $61,937 across the entire United States. This is in comparison to a median income of $73,029 in 2016, which represents a 4.43% growth in that year[2]. In 2010, the City's median household income was approximately $68,400, which was 50% higher than the $46,000 median household income in 2000. After taking inflation into account, Pasadena's median income rose only 10%. Relative to the county, however, Pasadena residents have fared much better. Between 2000 and 2010, the City's median income significantly increased, from 110% to 125% of the County median household income.

The State of California Department of Housing and Community Development (HCD) surveys households in each county on an annual basis to determine the median income. The median income is also adjusted for households of different sizes. Households are then grouped into four income groups for purposes of determining the need for assistance. Based on 2013 categories, these income groups and thresholds are:

- Extremely low: households earning up to 30% of the county median family income (CMFI), or a maximum of $25,600 for a household of four.
- Very low: households earning 31% to 50% of CMFI, or a maximum income of $42,700 for a household of four.
- Other low: households earning 51% to 80% of CMFI, or a maximum of $68,300 for a four-person household.
- Moderate: households earning 81% to 120% of CMFI, or a maximum income of $77,750 for a household of four.
- Above moderate: households earning above 120% of CMFI, which is more than $77,750 for a household of four.

Table 3-3 provides a summary of Pasadena households by income group. The majority of households earn above-moderate incomes (47%), yet more than one-third of all Pasadena households earn lower incomes. This is due in part to the General Plan policies encouraging the construction of a significant amount of affordable housing over the past several decades.

[1] City of Pasadena. 2014. *General Plan Housing Element.* February. Available: https://www.cityofpasadena.net/wp-content/uploads/sites/30/Adopted-Housing-Element-2014-02-04.pdf?v=1612194961106

[2] Data USA, https://datausa.io/, accessed November 2020

Table 3-3: Household Income in Pasadena

Income Category	Number of Households	Percent of Total Households
Extremely Low Income	7,245	13%
Very Low Income	5,611	10%
Other Low Income	7,022	13%
Moderate Income	8,636	16%
Above Moderate Income	25,709	47%

Source: Southern California Association of Governments, 2011

3.4 Land Uses within Service Area

Land use in the PWP service area is largely low and medium density residential, with single family and multi-family residential units. High-density residential, commercial and mixed land uses are generally located along major corridors, such as Fair Oaks Avenue and Washington Boulevard, and in Special Districts such as Central Pasadena, East Colorado and South Fair Oaks (Figure 3-3). Areas designated as parks in the General Plan are designated as government in the current land use database.

The *2015 General Plan Update* explains that the long-term vision for growth in the City is to encourage development along major corridors[3]. Also, according to the *2015 General Plan Update*, future growth will occur through urban infill, which means increasing the number of residential units or mixed-use units per acre, typically by replacing single-story structures with multi-story structures.

Table 3-4 presents housing projections for PWP service area.

Table 3-4: Housing Projections

Units/Persons	2020	2025	2030	2035	2040
Occupied Housing Units	67,003	68,704	70,423	72,129	74,015
Single Family Units	37,046	37,561	38,398	39,507	40,199
Multi-Family Units	29,957	31,143	32,025	32,622	33,815
Persons per Household	2.47	2.47	2.52	2.52	2.51
Employment	123,383	127,252	130,008	132,210	135,866

Source: The City's 2015 General Plan Update

[3] City of Pasadena. 2015. *General Plan Land Use Element*. August. Available: https://www.cityofpasadena.net/wp-content/uploads/sites/30/Land-Use-Element-2016-01-25.pdf?v=1612194406951

The projected General Land Use diagram (Figure 3-4) functions as a guide to the general public, planners, and decision-makers, depicting the ultimate pattern of development for Pasadena in 2035, consistent with the requirements of State planning law (Government Code §65302(a)). It depicts the distribution of various uses and intensity of development that shall be permitted as the physical representation of this element's goals and policies. These are implemented through the Zoning Code, Zoning Map, and Specific Plan.

Figure 3-3: Current land use in the PWP service area

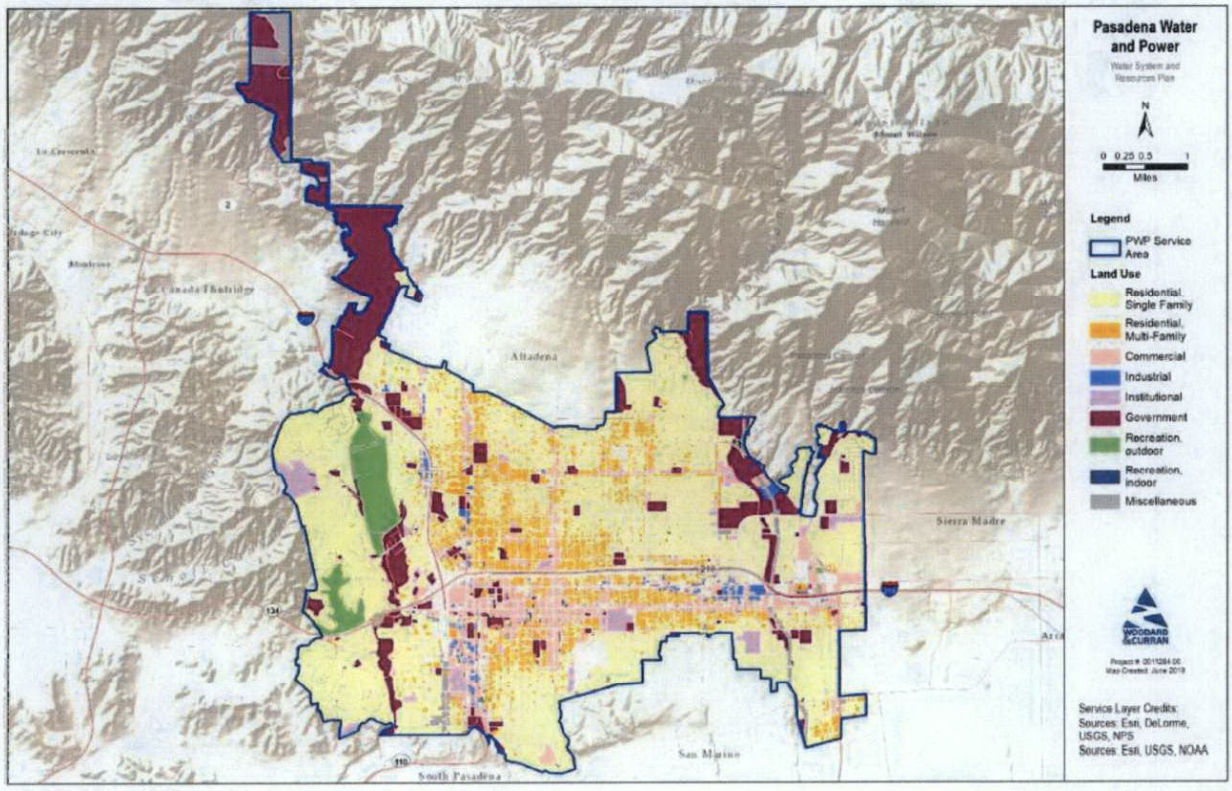
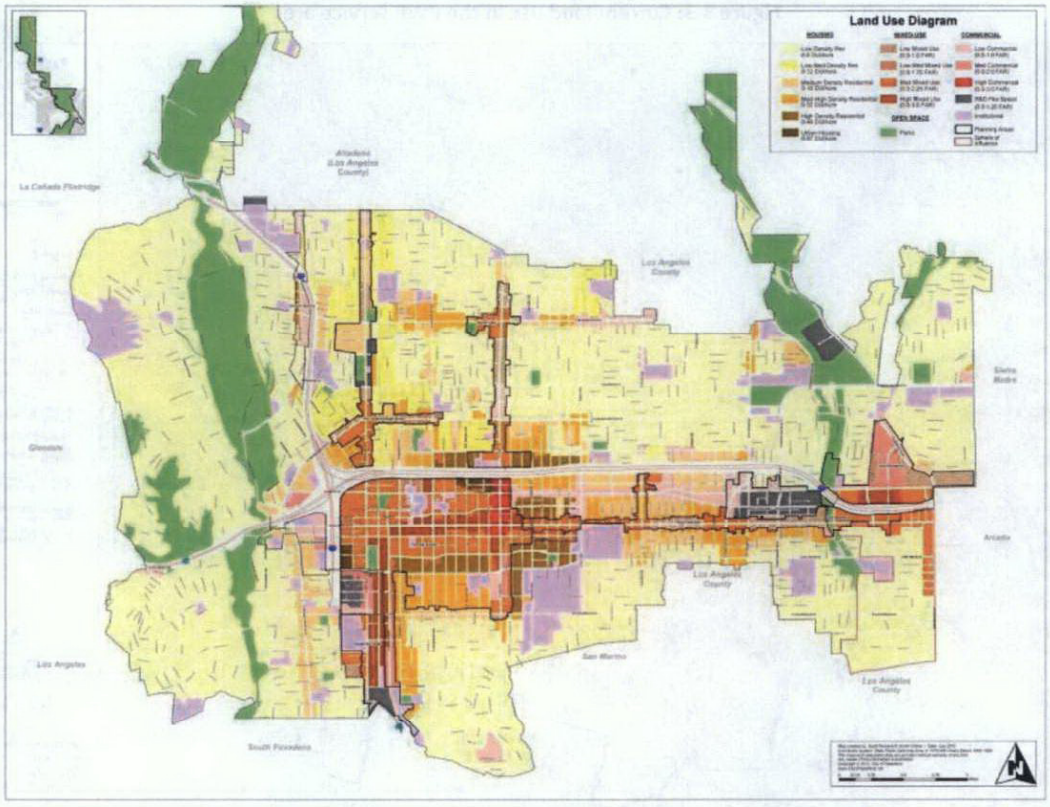


Figure 3-4: General Plan Land Use



Chapter 4 Water Use Characterization

Population, socioeconomic factors, climate, and hydrology, as described in Chapter 3, are all important factors in assessing water demand. Future water use is projected by demand sector, and information associated with distribution system losses, future water savings, lower income household water use, and climate change is also provided in this chapter. The majority of PWP's water demands are met with potable water, however since 2020, some irrigation demands were met with non-potable water.

4.1 Water Use Sectors Definitions

The following definitions for water sectors are listed in the Water Code. Those definitions not present are sectors that PWP does not use. Conjunctive use, groundwater recharge, and exchanges are management strategies that account for the entirety of PWP's water uses.

Single-Family Residential

A single-family dwelling unit. A lot with a free-standing building containing one dwelling unit that may include a detached secondary dwelling.

Multi-Family

Multiple dwelling units contained within one building or several buildings within one complex.

Commercial

A water user that provides or distributes a product or service.

Industrial

A water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification System (NAICS) code sectors 31 to 33, inclusive, or an entity that is a water user primarily engaged in research and development.

Institutional (and Governmental)

A water user dedicated to public service. This type of user includes, among other users, higher-education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions.

Landscape

Water connections supplying water solely for landscape irrigation. Such landscapes may be associated with multi-family, commercial, industrial, or institutional/governmental sites. PWP's non-potable water uses are classified as landscape.

Conjunctive Use

A management strategy where surface water is managed in conjunction with an underground aquifer. Conjunctive use describes the practice of storing water in a groundwater basin in wet years and withdrawing it from the basin in dry years.

Groundwater Recharge

The managed and intentional replenishment of natural groundwater supplies using man-made conveyances such as infiltration basins or injection wells.

Distribution System Losses

Distribution system losses can result from water theft or from seepage, leaks, and pipe failures caused by aging infrastructure or errors in data and water meter inaccuracies. Losses are calculated using the difference of water supplied and water delivered.

Exchanges

Water exchanges are typically water delivered by one water supplier to another water supplier, with the receiving water supplier returning the water at a specified time, or when the conditions of the parties' agreement are met. Water exchanges can be strictly a return of water on a basis agreed upon by the participants or can include payment and the return of water.

Other

Water use in this category includes authorized unbilled water use from distribution system loss analysis, such as for firefighting.

4.2 Past and Current Water Use

Past water use as it relates to PWP's service area is detailed in Chapter 5, SB X7-7 Baseline and Targets. Water use is tracked by PWP's billing system, which categorizes customers into four primary types: residential (including single-family and multi-family residential), commercial and industrial, city accounts, and miscellaneous. The single-family residential customers include individually metered houses, whereas historically the multi-family residential customers include apartments and condominiums that are master-metered for the entire building or complex. However, since January 1, 2018, the SB 7 legislation requires all new multi-family residential units to have individual water meters. In addition to these uses, there is non-revenue water that represents system-wide water losses. These losses are discussed in Section 4.3.

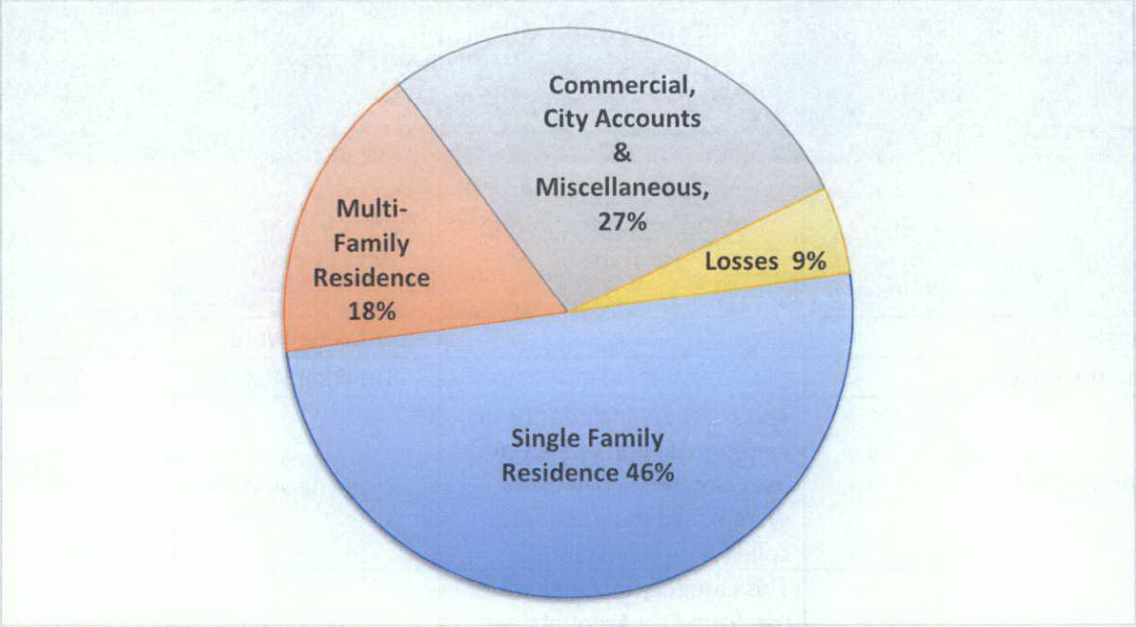
In 2020, PWP's water use totaled approximately 29,290 AFY as shown in Table 4-1. Water demand during this period decreased through 2016 even though population increased during this same period[4]. Single-family residential customers achieved more than 25 percent reduction. This decrease in water consumption is likely the result of the state's conservation measures implemented in 2014 to mitigate drought impacts, as well as social awareness, outreach campaigns by state and water agencies, the economy and weather. Water demand has slightly increased since 2017 following the end of the drought and the relaxing of water use restrictions, yet remains well below historical levels. A breakdown of 2020 water use by sector is provided in Figure 4-1.

[4] Pasadena Water & Power. 2020. *Water System and Resources Plan*. December. Available: https://ww5.cityofpasadena.net/water-and-power/wsrp/

Table 4-1: 2020 Actual Water Use in PWP's Service Area

Submittal Table 4-1 Retail: Demands for Potable and Non-Potable Water - Actual			
Use Type *(Add additional rows as needed)*	2020 Actual		
	Additional Description *(as needed)*	Level of Treatment When Delivered	Volume (AF)
Single Family		Drinking Water	13,593
Multi-Family		Drinking Water	5,190
Commercial	This category includes both commercial and industrial uses per PWP's billing system, including schools, colleges, and hospitals	Drinking Water	6,530
Institutional/Governmental	This category includes water use from City Accounts per PWP's customer billing system, including parks and city buildings	Drinking Water	1,311
Losses	This category includes real and apparent water losses	Drinking Water	2,586
Other	This category includes authorized unbilled water use from water loss	Drinking Water	80
		TOTAL	29,290

Figure 4-1: Water Use per Customer Class



4.3 Distribution System Water Losses

PWP has reported annual distribution system losses as required by Senate Bill 555 and California Code of Regulations Section 638.1 since October 1, 2018. The calculations are based on the water system balance methodology developed by the International Water Association and approved by the American Water Works Association (AWWA). Table 4-1 provides for the 12-month water loss reported in the time period since SB 555 has been in effect.

Table 4-2: PWP's Annual Reported Distribution System Losses

Submittal Table 4-4 Retail: Water Loss Audit Reporting		
Calendar Year	Volume of Water Loss* (AF)	Percent (%)
2017	2,305	8
2018	1,430	5
2019	1,640	6
2020	2,586	9

**Taken from the field "Water Losses" (a combination of apparent losses and real losses) from the AWWA worksheet*

The water audit consists of identifying, validating, and categorizing all of the volumes of water in the system to calculate the components of the water balance. All water entering the system goes to one of two places: authorized consumption, or losses. The water balance method for conducting a water audit

quantifies all water volumes as authorized consumption or losses, whether through measurement or estimation, such that no water is unaccounted for. A visual representation of the components in the water audit is shown in Table 4-3.

Table 4-3: AWWA Water Balance Diagram for 2019* (AFY)

<table>
<tr><td rowspan="7">Water Supplied
27,287</td><td rowspan="4">Authorized Consumption
25,648</td><td rowspan="2">Billed
25,567</td><td>Billed Metered
25,567</td><td rowspan="2">Revenue Water
25,567</td></tr>
<tr><td>Billed Unmetered
0</td></tr>
<tr><td rowspan="2">Unbilled
80</td><td>Unbilled Metered
12</td><td rowspan="5">Non-Revenue Water
1,720</td></tr>
<tr><td>Unbilled Unmetered
68</td></tr>
<tr><td rowspan="3">Water Losses
1,640</td><td rowspan="3">Apparent Losses
815</td><td>Unauthorized Consumption
68</td></tr>
<tr><td>Customer Meter Inaccuracies
683</td></tr>
<tr><td>Data Handling Errors
64</td></tr>
<tr><td colspan="2">Real Losses
825</td></tr>
</table>

* The 2019 Water Loss Audit balance diagram is provided as the 2020 data is not yet verified and due in October 2021 as per SB 555.

4.4 Projected Water Use

Projected water use can be determined by examining past and current water use trends, along with consideration of land use planning data, climate change, and other factors relevant to sector-specific water use. This section provides a detailed description of the current demands and the methodology used to project demands, including the following:

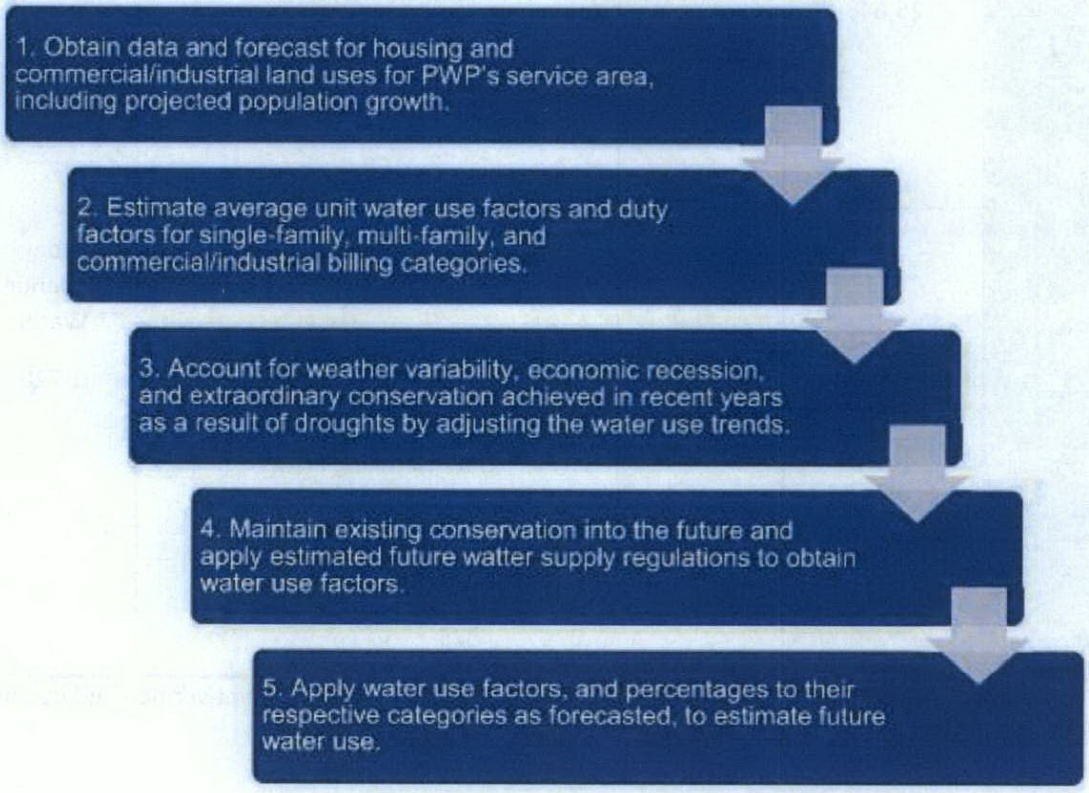
- Land use and demographic projections: Overview of current land use and how land use changes are expected to change demand for water in the future.
- Demand forecast: Provides the methodology used to forecast demand to year 2040 based on 2020 demands.

As explained in Section 3.1.1, PWP's service area includes the area within the jurisdictional boundaries of the City, but also includes some outlying communities that are not located within the City boundaries.

PWP prepared the WSRP (described in Section 1.4.1) as a long-term planning document. The WSRP forecasted water demands for identifying potential water supply shortfalls as well as to develop best strategies for supply choices. The analysis requires understanding of current land use, population and water consumption trends in the service area, as well as projected population growth, future development, and implementation of regulations influencing future water use. This information is presented in Chapters 3 and 5.

The method to forecast demands included the following general steps provided in Figure 4-2.

Figure 4-2: Demand Forecast Methodology



The projected water demand relies on the following data sources:

- *California Department of Finance (DOF) and Southern California Association of Governments (SCAG):* Provide current and projected region demographics, including annual estimates of population, employment, and housing units for cities and counties in California
- *General Plan for the City of Pasadena:* Provides framework for land use development within the City's boundaries and strategies for long-term growth
- *MWD IRP and 2020 MWD UWMP:* Provide forecasted demands, key demographic data, and passive conservation for each of its member agencies, including PWP's service area

- *PWP's billing system:* Provides historical and current water demands in the service area to determine trends and average water use by land use category

Population growth in the Pasadena area is not expected to increase significantly between 2020 and 2040, and assumes average growth of only 0.5 percent per year. Table 3-4 in Section 3.4 presents the housing projections for PWP's service area.

Current land use in the PWP water service area is shown in Figure 3-1 in Section 3.1, while General Plan land use (with a planning horizon to 2035) is shown in Figure 3-4. Current land use in the PWP service area is predominantly single family residential, multi-family residential, and commercial. Commercial land uses are concentrated in areas along major transportation corridors. Pasadena is considered to be largely built-out. Areas designated as parks in the General Plan are designated as government in the current land use database.

Current indoor residential water use within the PWP service area is estimated as 57 GPCD calculated using residential water billing data for two wet months, February and March 2019, assuming 10 percent of the total water is used outdoor. The current indoor water use is estimated at 11,000 AFY or approximately 39% of the total water use. To comply with the recent water-use efficiency legislation, the low demand projection assumes that indoor residential water use within the PWP service area will be decreased by 2 GPCD to 55 GPCD by year 2025, and by 7 GPCD to 50 GPCD by year 2030 (1,400 AFY).

PWP service area has approximately 6,700 acres of landscaped area that is currently irrigated based on 2006 infrared imaging. The current outdoor use is estimated based on the state Model Water Efficient Landscape Ordinance (MWELO) calculations for moderate water use for the Pasadena area evapotranspiration zone. The current annual water use in PWP service area is approximately 29,290 AFY. In 2019 the water use was 28,500 AFY, with an estimated annual outdoor water use of 17,500 AFY. This is approximately 61% of the total use.

At the time of the publication of this report, California has not finalized outdoor conservation objectives, but the requirement and protocol to be used is established. To estimate the water use reduction to meet the future outdoor water conservation requirements, PWP included high irrigation efficiency in the MWELO calculations. As a result, PWP will likely be required to reduce outdoor water use to approximately 16,000 AFY (a reduction of 1,500 AFY). To comply with current indoor and future outdoor water use requirements PWP must reduce its annual water use by at least 3,500 AFY by the year 2030.

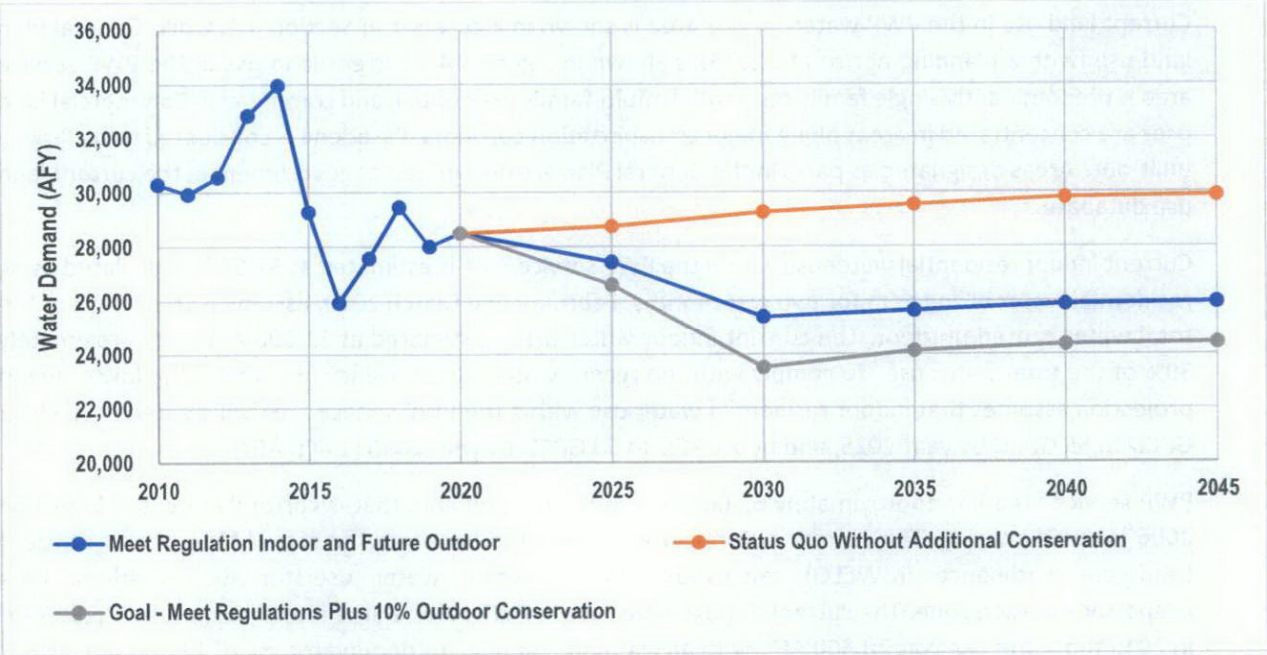
In forecasting demands, the WSRP analyzed the Status Quo (high) demand, Meet Regulations demand, and Goal (low) demand. Current conservation savings from existing codes, ordinances, and standards are included in all demand projections. Figure 4-4 shows the three projected scenarios.

Status Quo (high) demand projection is the current water use projected for future years with current levels of conservation and regulation.

Meet Regulations (mid) projections are based on the Status Quo demand and applying the indoor and outdoor water use reductions imposed by Senate Bill (SB) 606 and Assembly Bill (AB) 1668. This demand projection includes indoor residential water use decrease from the current 57 GPCD to meet the target of 55 GPCD by 2025 and 50 GPCD by 2030 (approximately 1,400 AFY). The WSRP assumes Pasadena will also meet regulations and reduce outdoor water use by 2,100 AFY by 2030. Meeting regulations, Pasadena water demands will be approximately 25,000 AFY.

Goal (low) demand projections include sufficient water use to meet mandated indoor and outdoor regulations, plus an additional 10 percent outdoor conservation goal (approximately 1,500 AFY by 2030). The total water reduction under this projection is approximately 5,000 AFY by 2030 (approximately 23,500 AFY demands).

Figure 4-3: Current and Projected Water Demands



Compared to Status Quo, the Goal is a 18% reduction from 2020 to 2030. This level of conservation plus additional local water supply enhancements will help PWP meet the WSRP objective of 50% local and 50% imported water supplies.

The unit water use factors for single-family and multi-family uses, and the duty factor for commercial/industrial uses, as well as the percentage of total demand for municipal use were applied to their respective categories. The multiplication of the factors with the forecasted units for each category results in the water forecast. The sum of the categories is thus the forecast of water use as indicated in the equation below.

$$Water\ Use = q_{sf} * SF + q_{mf} * MF + DF_{CI} * Area_{CI} + Per_{City}$$

Where:

q is the unit water use factor (volume/housing unit)
SF ad *MF* are residential units for single family and multi-family, respectively
DF_{CI} is the duty factor for commercial/industrial land use (volume/acre)
$Area_{CI}$ is the future land use for commercial/industrial (acres)
Per_{City} is the volume for city uses estimated as a percentage of total water use

Water losses and authorized nonrevenue uses were computed using the AWWA method, as explained in Section 4.3. Per this analysis, the total non-revenue uses in 2019 correspond to 6.3% of water use. This percentage was assumed to remain for the future, and was used to compute total non-revenue water for

forecasted years. Total water demands were then computed adding non-revenue water to the water use calculation outlined in the formula above.

Details from the demand analysis are summarized in Table 4-3 and includes the demand forecast by use type, which shows that the residential sector demand evolves over time with a trend towards lower demand due to the reductions imposed by SB 606 and AB 1668 by 2030, but are not reduced to reflect additional water savings from PWP's conservation programs.

Table 4-4: Projected Water Use per Customer Class (AFY)

Submittal Table 4-2 Retail: Use for Potable and Non-Potable Water - Projected				
Use Type *(Add additional rows as needed)*	Projected Water Use (AFY) *Report To the Extent that Records are Available*			
	2025	2030	2035	2040
Single Family	12,800	12,000	11,900	11,800
Multi-Family	4,800	4,550	5,000	5,250
Commercial	6,500	5,900	5,850	6,000
Institutional/Governmental	900	850	870	900
Losses	1,650	1,600	1,550	1,500
Other	100	100	150	180
TOTAL	26,750	25,000	25,320	25,630

4.5 Water Use for Lower Income Households

The Water Code Section 10631.1 requires retail suppliers to include the projected water use for lower income households in their 2020 UWMP. A lower income household has an annual income below 80% of the area median income, adjusted for family size (California Health and Safety Code Section 50079.5).

Based on the City's General Plan Housing Element, approximately 36% (Section 3.3.2.2) of the City's total households are low-income. To obtain total service area low-income households the same percentage was applied to the households located outside of the City's boundaries. The overall percentage of low-income households is assumed to be constant throughout the projection period. It is estimated that the total number of low-income households in PWP's service area in 2020 was approximately 24,600. The overall housing figures used in this analysis are based on demographic data from MWD and SCAG's modeling. The projections of low-income households were multiplied by a per household water use factor that was assumed to be 30% lower than system average water use. This assumption is based upon a study completed by the California Center for Sustainable Communities at UCLA, which demonstrated that on average, wealthy communities in the Los Angeles area use three times as much water as low-income

communities. Therefore, the 30% assumption is a conservative estimate of low-income water use in PWP's service area.

Table 4-5 presents the projected water demands for low-income customers.

Table 4-5: Low-Income Water Demand

	2020	2025	2030	2035	2040
Single Family Lower Income Units (Number of Units)	13,600	13,800	14,100	14,500	14,800
Multi-Family Lower Income Units (Number of Units)	11,000	11,500	11,800	12,000	12,500
Low-Income Water Demand (AFY)	**4,830**	**4,520**	**4,000**	**4,100**	**4,155**

4.6 Climate Change Considerations

Climate change will impact supplies such as stormwater diversion, imported water availability, and natural groundwater recharge. Long-term reliability in turn are shown to have an effect on water use projections. Chapter 10 includes a detailed discussion of potential water reliability impacts that may occur as a result of climate change.

Chapter 5 SB X7-7 Baseline and Targets

With the adoption of the Water Conservation Act of 2009, also known as Senate Bill (SB) X7-7, PWP was required to reduce its potable water demands by 20% by year 2020. This chapter presents the method used by PWP in 2015 to calculate the 2020 Urban Water Use Target and its baseline. Section 5.2.4 below demonstrates that PWP met the 20% reduction by December 31, 2020, which is substantiated in the SB X7-7 Compliance Forms provided in Appendix E. The baseline and targets are reported in GPCD.

5.1 Water Conservation Bill Requirements

SB X7-7 requires that water suppliers in California reduce their potable water demands by 20% by 2020, with the overall goal of maximizing the state's urban water efficiency and conservation opportunities. The SB X7-7 legislation requires the calculation of three primary figures to determine compliance:

- ***2010 Base Daily per Capita Water Use***: provides the water use baseline against which compliance with the legislation is measured.

  PWP's 2015 UWMP calculated the baseline as 211 GPCD, using the ten year average water use for the period from calendar year (CY) 1995 to CY 2004 divided by the population. The population was estimated with a combination of methods for the different years, including using the 2000 U.S. Census data for the first five years, the DWR's online population figures for some years, and a straight line projections for other years.

- ***2020 Urban Water Use Target***: is the agency's target water use for year 2020.

  The 2015 UWMP used method 1 to calculate the 2020 urban water use target. PWP's 2020 water use target is 169 GPCD, which is 80% of the 211 GPCD baseline. **PWP's calendar year 2020 actual water use of 153 GPCD met the target.**

- ***2015 Interim Water Use Target***: is the mid-point between the 2010 baseline and the 2020 water use target used to evaluate the supplier's compliance in 2015.

  The 2015 interim urban water use target was 190 GPCD. As reported in the 2015 UWMP PWP's actual water use of 148 GPCD met the interim target.

5.2 Updating Calculations from 2015

PWP did not need to update the 2020 target or baseline data because there were no changes in the distribution area. The calculations provided in 2015 UWMP PWP are utilized in this 2020 UWMP.

5.3 Service Area Population

As the U.S. Census 2020 data is not available at the time of the publishing of this report, the 2020 service area population was calculated using the California Department of Finance population for the City as of January 1, 2020, and increased by 15% to account for water customers residing outside City boundaries.

This information and methodology is also provided in Section 3.3.1. The 2020 population is approximately 170,400.

5.3.1 Gross Water Use

The gross water use entering PWP's distribution system is the total volume of water produced by PWP from local groundwater, plus the water imported from MWD, plus the groundwater purchased from local water agencies, minus the water delivered to other suppliers.

In CY 2020 the total water use in PWP's service area was 29,346 AF of which 38% was local groundwater (11,230 AF), 61% was imported from MWD (17,940 AF), and 1% was purchased from local water suppliers (176 AF). In CY 2020 PWP delivered 56 AF to other suppliers. PWP's 2020 gross water use was approximately 29,290 AF. Of this amount less than 1% was used as processed water for cooling towers and at PWP's power plant.

The gross water use for the baseline years 1995 through 2007 is shown below as Table 5-1 and in Appendix E, SB X7-7 Compliance Form Table 4.

Table 5-1: Annual Gross Water Use (AF)

	2020 Volume into Distribution System	Exported Water	2020 Gross Water Use
Compliance Year 2020	29,346	56	29,290

5.3.2 Compliance with 2015 Interim Water Use Target

As shown in Table 5-2 below and reported in the 2015 UWMP PWP met the 2015 interim target.

Table 5-2: 2015 Interim Water Use and Target (GPCD)

2015 Actual	2015 Interim Target	Adjustments	In Compliance? Y/N
148	190	0	Yes

5.3.3 Compliance with 2020 Urban Water Use Target

In the 2015 UWMP, PWP proposed a combination additional water conservation measures to meet the 2020 target, as listed below.

- Ensuring correct application of more stringent design standards related to indoor and outdoor water use for new development projects (e.g. Statewide Model Water Efficient Landscape Ordinance);
- Enforcement of prohibited water uses during Levels 1 and 2 of the Water Shortage Plan ordinance;
- Enhancement of Demand Management Measure implementation; and

- Implementation of additional water conservation best management practices (BMPs).

PWP met its 2020 target as shown in Appendix E, Table 9 and Table 5-3 below.

Table 5-3: 2020 Urban Water Use Compliance

2020 Actual GPCD	2020 Target GPCD	In Compliance? Y/N
153	169	Yes

Chapter 6 Water Supply Characterization

This chapter presents an overview of PWP's water supply sources including imported water purchased through MWD, groundwater, surface water, and stormwater. Supply source volumes are summarized for 2020 and projected to 2040, with climate change considerations included.

The WSRP, in the December 2020 version, describes PWP's plans to implement groundwater, surface water, and stormwater projects to support its ability to use local groundwater. PWP also plans to augment its supply portfolio through the development of a non-potable water supply delivery system that will utilize surface water and non-potable groundwater. In addition to supply projects, PWP will continue to implement water use efficiency programs (active conservation) to balance supplies and demands.

6.1 Imported Water

MWD is the nation's largest water wholesaler, providing an average of 1.34 billion gallons of water per day to 19 million consumers. Enabled by the California legislature in 1927 through the Metropolitan Water District Act (MWD Act), MWD's adopted purpose is to develop, store, and distribute water to southern California residents. Additionally, the MWD Act allows MWD to sell additional water when it is available for other beneficial uses. In 1928, MWD was incorporated as a public agency following a vote by residents in 13 cities in southern California. Operating solely as a wholesaler, MWD owns and operates the CRA, is a contractor for water from the SWP, manages and owns in-basin surface storage facilities, stores imported water within local groundwater basins for conjunctive use storage, develops groundwater banking and water transfer programs to augment direct deliveries of SWP water supplies, and provides incentives to local water agencies for water conservation, recycled water, groundwater recovery, and desalination. Today MWD has 26 member agencies consisting of 11 water districts, one county water authority, and 14 cities, including the City. Figure 6-1 shows the major surface water supply sources and conveyance for California that MWD relies on for direct deliveries and water transfers.

Figure 6-1: Major Water Conveyance Facilities Supporting MWD's Service Area

Source: Metropolitan Water District of Southern California

As a member agency of MWD, PWP has a contract to purchase imported water to supplement/augment local water. On average, PWP receives 63% of its water from MWD based on the period of 2000 through 2019. PWP receives treated water via five turnouts from MWD's Upper Feeder. Water served to PWP is treated at MWD's Weymouth Water Treatment Plant (WTP). During outages at the Weymouth WTP, PWP can receive treated water from MWD's Jensen WTP if available. Sufficient turnout capacity exists to meet existing and projected PWP demands. However, while connection capacity is sufficient, reliability of this supply is insufficient. PWP would be unable to meet local demand in the event of a service disruption from MWD.

Table 6-1 provides PWP's current and forecasted demands for imported water, as estimated by MWD. Current demands represent 2020 actual demands, and the projected demands were provided from MWD with input from PWP.

Table 6-1: MWD Forecasts of Imported Water Demand for PWP's Service Area (AFY)

	2020	2025	2030	2035	2040
PWP Demand on MWD	17,940	19,248	19,362	19,454	19,527

6.1.1 Imported Water Quality

Water quality is a central consideration in MWD's long-term water resources planning activities as there are many water quality issues of concern to MWD for both CRA and SWP supplies. Water quality impacts have been considered by MWD in developing its available water supply forecast in MWD's 2015 IRP Update. Details of MWD's water quality initiatives are available in MWD's 2020 UWMP.

State Water Project

Water quality issues for the SWP include total organic carbon (TOC), bromide, arsenic, nutrients, N-nitrosodimethlamine (NDMA), and pharmaceuticals and personal care products (PPCPs). TOC and bromide in SWP water present the greatest water quality issues and may restrict MWD's ability to use SWP water at various times as the contaminants form disinfection byproducts during water treatment processes. MWD has upgraded its treatment processes to ozone disinfection to reduce formation of disinfection byproducts and lifted potential restrictions on SWP water usage. While salinity levels in SWP supplies are not high, MWD requires low salinity levels to meet blending requirements for CRA water, therefore an increase in salinity levels in SWP supplies is a concern to MWD. MWD expects existing source water protection programs to adequately address the other water quality issues.

MWD actively supports programs operated on behalf of DWR to improve SWP water. MWD supported DWR in establishment of a policy regarding water quality of non-SWP water transported through the SWP system. MWD has also supported expansion of DWR's Municipal Water Quality Investigations Programs to include additional water quality monitoring and advanced warnings to Contractors of water quality issues that may impact water treatment processes.

Colorado River Aqueduct

Water quality issues associated with CRA supplies include high salinity levels (TDS), perchlorate, nutrients, uranium, chromium VI, NDMA, and PPCPs. High salinity levels, also known as total dissolved solids (TDS), present the most significant issue and the only foreseeable water quality constraint for the CRA supply. MWD expects its source control programs for the CRA to adequately address the other water quality issues.

6.1.2 Imported Water Reliability

MWD's 2015 IRP Update is the foundation for the imported water supply forecasts in this plan. That document concluded that MWD has sufficient supplies to meet projected demands from 2020 through

2040 under single dry-year and multiple dry-year conditions. MWD's analysis indicates hydrologic variability can trigger some level of shortages to be managed by strategic allocation. During past extended droughts, MWD has applied water allocations (i.e., reductions in water supply) to member agencies. Based on MWD's 2015 IRP Update, future water shortages could occur up to 15 percent of the projected 20 years (or 3 in 20 years). Shortages were estimated to be less frequent and of lower magnitude after the implementation of the Delta Conveyance Project which proposes to construct a tunnel to convey up to 6,000 cfs of water from the Sacramento River under the Sacramento-San Joaquin Delta to the intake for the SWP. However, this project is still many years from gaining approvals necessary to proceed.

The SWP Delivery Capability Report, used by MWD for their reliability analysis, indicates increased reduction in water deliveries when compared to previous estimates because of environmental constraints and hydrologic changes due to climate change[5]. Multiple issues in the Bay-Delta region, where major SWP pumping facilities are located, include pumping restrictions to protect deteriorating levees and fish species under the Endangered Species Act and failures in the conveyance facilities south of the Delta.

MWD's 2015 IRP Update shows that MWD relies on its full apportionment of Colorado River water supply. Today the reliability of CRA supply is considered less certain as the water level in Lake Mead, a critical part of the system, has steadily declined. CRA has adopted a Colorado River Basin Drought Contingency Plan[6] that would be triggered if Lake Mead levels reach a critical condition (i.e., 1,075 feet of elevation above mean sea level). This condition could reduce the CRA supply to MWD, creating shortage conditions for MWD and its member agencies. It is anticipated that this condition will occur in 2021 and a shortage will be declared.

MWD complies with Delta Plan Policy WR P1 - Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit. 23, § 5003), through investments in non-Delta water supplies, local water supplies, and regional and local demand management measures. PWP indirectly reduces reliance on the Delta through its membership in MWD and collective efforts as a cooperative. MWD's member agencies do not control the amount of Delta water they receive from Metropolitan. Metropolitan manages a statewide integrated conveyance system consisting of its participation in the SWP, its CRA including Colorado River water resources, programs and water exchanges, and its regional storage portfolio. Along with the SWP, CRA, storage programs, and Metropolitan's conveyance and distribution facilities, demand management programs increase the future reliability of water resources for the region. In addition, demand management programs provide system-wide benefits by decreasing the demand for imported water, which helps to decrease the burden on the district's infrastructure and reduce system costs, and free up conveyance capacity to the benefit of all member agencies.

6.1.3 Imported Water for Groundwater Storage

During some years, especially when there is higher than normal rainfall and snow levels, MWD has more water supplies available than it can use or store. In these circumstances, Metropolitan financially incentivizes its members to take these excess water supplies and preserve their own water supplies

[5] California Department of Water Resources. 2018. *State Water Project Delivery Capability Report*. March. Available: http://baydeltaoffice.water.ca.gov/swpreliability/. Accessed: November 10, 2019.

[6] U.S. Department of the Interior Bureau of Reclamation. 2019. Colorado River Basin Drought Contingency Plan. May. https://www.usbr.gov/dcp/finaldocs.html. Accessed: November 11, 2019.

and/or replenish groundwater. These types of water deliveries occur under an agreement called "Cyclic Agreement" which is between MWD and its individual members such as the City.

The underlying intent is that the water purchased under the Cyclic Agreement is in addition to the normal expected annual water purchase from MWD by the purchaser. The purchaser is required to maintain a cyclic water account, subject to review by MWD. The proposed Cyclic Agreement limits water deliveries up to 10,000 AF at any point in time in the cyclic account during the term of ten years. Under the terms of the Cyclic Agreement, PWP has the option to take water deliveries, but no obligation. Specific amounts of water, pricing, recordkeeping and other related documents such as, but not limited to, letter agreement(s) regarding schedule for deliveries and payment, In-Lieu Treated Deliveries to effectuate and administer the Cyclic Agreement are executed on an as-needed-basis.

There are only a few years that are wet enough for such excess water to be available under the Cyclic Agreement and during those years the incentive amount and available quantities are determined by MWD. For the calendar year 2019, PWP reduced groundwater pumping and increased MWD water purchases by about 2,000 AF. The intent for this shift was to provide for an opportunity to influence a long-term strategy to enhance local groundwater storage in the Raymond Basin.

Pasadena has a vested interest in enhancing storage and overall health of the Raymond Basin. The groundwater provides security in case normal water supplies from MWD are interrupted and it is a lower cost water resource. The Cyclic Agreement will allow PWP to purchase water at a discount, recharge the groundwater basin, and allow MWD to use wet year water more efficiently. This agreement creates a shift in the RBMB to actively engage in efforts to improve the Raymond Basin, which is the foundation of long-term water supply reliability for Pasadena.

6.2 Groundwater

Groundwater production is obtained from the Raymond Basin. The Basin is adjudicated and PWP has groundwater pumping rights within the Basin. PWP is also credited with additional pumping rights for infiltrating surface water. PWP can use the Basin for long-term supply storage as an emergency supply. PWP manages its pumping rights, spreading credits, and long-term storage to maintain a reliable source.

6.2.1 Raymond Basin Description

Raymond Basin is an alluvial valley approximately 40 square miles in area underlain by deposits of gravel, sand, silt, and clay. The basin is located in the northwest portion of the San Gabriel Valley in Los Angeles County, California, and is bounded by the San Gabriel Mountains to the north, the San Rafael Hills to the west, and the Raymond Fault to the south/southeast. Raymond Basin is divided into three subareas: the Monk Hill subarea in the northwest, the Pasadena subarea in the central portion of the basin, and the Santa Anita subarea in the east (see Figure 6-2). PWP has water rights in the Monk Hill and Pasadena subareas.

The base of the water-bearing strata of the Raymond Basin is defined by bedrock material that is not considered to yield significant quantities of water. Overlying the bedrock are more than 1,200 feet of unconsolidated alluvial materials consisting of boulders, gravel, sand, silt, and clay. This alluvium is the principal water-bearing unit in the Raymond Basin. Well yields in the alluvium range from a few hundred

to several thousand gallons per minute (gpm). The alluvial aquifer system in the Raymond Basin consists of many individual interconnected water-bearing zones.

Specific yield values in the Raymond Basin are typical of alluvial sediments, and range from approximately 5% to 18% [7]. Groundwater generally flows southerly from areas of recharge at the base of the San Gabriel Mountains to areas of discharge along Raymond Fault at hydraulic gradients ranging from approximately 0.040 feet to 0.090 feet [4]. The Raymond Fault acts as a leaky hydrologic barrier and defines the boundary between the Raymond Groundwater Basin and the main San Gabriel Valley Groundwater Basin to the south. Currently, groundwater levels are relatively higher in the northern half of the basin and lower in the southern half of the basin compared with historical trends.

Groundwater discharge in the Raymond Basin occurs through pumping and subsurface outflow across the Raymond Fault. Current sources of groundwater recharge to the Raymond Basin include [4]:

- Natural infiltration and percolation of rainfall and surface water
- Percolation of applied water from irrigation and other return flows
- Subsurface inflow from adjacent groundwater basins, bedrock areas, and the San Gabriel Mountains
- Artificial recharge through surface water infiltration
- Percolation of water from septic tanks

[7] Pasadena Water & Power. 2011. *Water Integrated Resources Plan.* January. Available: https://ww5.cityofpasadena.net/water-and-power/wp-content/uploads/sites/54/2017/08/PasadenaWIRPFinalApproved013111.pdf