SCOTTSDALE WATER

Integrated Water Resources Master Plan

Executive Summary

August 2022

carollo

in association with

BLACK & VEATCH

City of Scottsdale
Integrated Water Resources Master Plan

EXECUTIVE SUMMARY

FINAL | August 2022

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Abbreviations

µg/L	micrograms per liter
AADF	average annual daily flow
ac-ft	acre-feet
ac-ft/ac	acre-feet per acre
ADWR	Arizona Department of Water Resources
AFY	acre-feet per year
AMWUA	Arizona Water Users Association
ASR	aquifer storage and recovery
AWBA	Arizona Water Bank Authority
AWT	Advanced Water Treatment
AWWA	American Water Works Association
BIDD	Buckeye Irrigation and Drainage District
BMP	Best Management Practices
CAP	Central Arizona Project
CAP WTP	Central Arizona Project Water Treatment Plant
CAWCD	Central Arizona Water Conservation District
CCL	Contaminant Candidate List
CIP	Capital Improvement Program
CGTF	Central Groundwater Treatment Facility
CRIT	Colorado River Indian Tribes
CT	contact time
cVOC	carcinogenic volatile organic compounds
CWTP	Chaparral Water Treatment Plant
DAWS	Designation of Assured Water Supply
DBP	disinfection byproducts
DCP	Drought Contingency Plan
DIA	Development Impact Area
DMP	Drought Management Plan
DPR	direct potable reuse
EPA	United States Environmental Protection Agency
EUM	Effective Utility Management
FCS	flood control space
GAC	granular activated carbon
GPCD	gallons per capita per day
HAL	Health Advisory Level
HVID	Harquahala Valley Irrigation District

IIP	Infrastructure Improvement Plan
IWDS	Irrigation Water Distribution System
IWRMP	Integrated Water Resources Master Plan
LCRR	Lead and Copper Rule Revisions
M&I	municipal and industrial
MAG	Maricopa Association of Governments
MCL	maximum contaminant level
MDF	maximum daily flows
mgd	million gallons per day
NCS	New Conservation Space
NDMA	N-nitrosodimethylamine
ng/L	nanograms per liter
NGTF	North Indian Bend Wash Granular Activated Carbon Treatment Facility
NIBW	North Indian Bend Wash
NPCCP	Non-Per Capital Conservation Program
NPDWR	National Primary Drinking Water Regulations
O&M	operations and maintenance
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
POPTAC	Population Technical Advisory Committee
RO	reverse osmosis
RWDS	Reclaimed Water Distribution System
SOC	synthetic organic contaminant
SROG	Sub-Regional Operating Group
SRP	Salt River Project
TAZ	Traffic Analysis Zone
TGTF	Thomas Groundwater Treatment Facility
TOC	total organic carbon
TTHM	total trihalomethanes
UCMR	Unregulated Contaminant Monitoring Rule
VOC	volatile organic compound
WRP	water reclamation plant
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

ES.1 Introduction

ES.1.1 Background

Scottsdale Water (the City's water utility) has provided quality drinking water and advanced water reclamation services to Scottsdale businesses and residents for over 50 years. Through decades of strategic planning and action, Scottdale Water has implemented innovative water resources projects that have diversified its water portfolio, improved the City's drought resiliency, and established practices to maintain consistent levels of service for its customers.

The 2022 Integrated Water Resources Master Plan (IWRMP) updates and integrates the City's water resources, water system, and wastewater system master plans using a common framework that establishes the same growth and planning assumptions for all systems. The 2022 IWRMP builds on the work of recent water, wastewater, and reclaimed water master planning efforts, including:

- 2008 Integrated Water and Wastewater Master Plan
- 2012 Water Reuse Master Plan Update
- 2015 Water Master Plan Update
- 2017 Infrastructure Improvements Plan

ES.1.2 Scottsdale Water Vision, Goals, and Planning Approach

Scottsdale Water's vision is to achieve water sustainability through stewardship, innovation, and people. To achieve this vision, Scottsdale Water has adopted the American Water Works Association (AWWA) Effective Utility Management (EUM) framework for continued improvement and strategic planning. The EUM approach is based on 10 attributes of effectively managed utilities and provides a path to proactive and sustainable operations. Scottsdale Water's standards, based on the EUM framework (*Scottsdale Water Strategic Plan 2019 – 2024*), that are relevant to the IWRMP include:

- Product Quality
  - Meet or exceed all water quality standards
  - Monitor and prepare for all future regulatory requirements
- Infrastructure Strategy and Performance
  - Implement Integrated Water Master Plans every five years
  - Maintain an asset management system that guides the creation of the Capital Improvement Program (CIP) budget and maximizes the value of capital assets.
- Water Resources Sustainability
  - Maintain safe yield
  - Maintain a proactive conservation program

The planning approach for the IWRMP incorporates these standards while focusing on several key planning challenges that the City will most likely face in the future, including:

- Increased growth potential in the Greater Airpark, Old Town (downtown), and Scottsdale Road/McDowell Roads corridor that will likely stress existing water supplies and require new infrastructure.
- Future water quality regulations from the United States Environmental Protection Agency (EPA), including the recent Lead and Copper Rule Revisions (LCRR) that require action by year 2024 and the Draft Contaminant Candidate List (CCL) 5, which includes considerations for per- and polyfluoroalkyl substances (PFAS), 1,4-dioxane, and nitrosamines.
- Pending Colorado River shortages that could potentially reduce the amount of Central Arizona Project (CAP) water that the City receives annually, thereby impacting the single largest source of supply for Scottsdale.
- Growth areas in north Scottsdale that will require significant infrastructure investments that are timed to meet anticipated demands.
- Needs to expand both potable water treatment and wastewater treatment capacity over the next 5 to 10 years to meet challenges of water resource uncertainties, maintain service levels, and serve new customers.

ES.1.3 Scenario Planning, Inherent Limitations, and Adapting to Change

In line with Scottsdale Water's strategic planning approach, a scenario planning exercise was utilized early in the IWRMP development to envision potential future outcomes the City may face so that the IWRMP could be prepared to address plausible future events. This was done by identifying those forces that could impact supplies, demands, and operations of Scottsdale Water. By recognizing the potential implications of these forces and identifying and implementing strategies that would be successful across many scenarios, Scottsdale Water can be better prepared to meet the challenges of the future.

Despite a strategic planning approach that employs best practices of Scenario Planning, all utility master plans on the scale of Scottsdale Water's have inherent limitations based on the window of time the plan is prepared and changing conditions in both the near-term and long-term. The IWRMP is a long-term plan developed through a process that began in 2019, with assumptions that were shaped at a point in time that do not fully reflect all water challenges in 2022. Significant assumptions for this plan include:

- **Increasing Stresses on the Colorado River:** The continuing historic drought that has extended beyond two decades of increasing arid conditions in the southwestern U.S. has stressed Colorado River water supply availability. This directly affects supplies to the CAP (Scottsdale's largest water source) which is also relied upon by many other municipal water providers in the state. The IWRMP projections assume availability of Scottsdale's full allocation of CAP water, while also evaluating impacts of some supply reduction scenarios developed early in the planning process. This master plan does not address significant Colorado River water cutbacks to be mandated in 2023 due to increasingly receding water levels in Lakes Mead and Powell, as announced by the U.S. Bureau of Reclamation in June 2022. While the specific impacts of these cutbacks to Arizona, the CAP, and the City's allocation are not yet defined, Scottsdale Water staff are focused on preparing for the immediate challenges.

- **Population, Demand, and Flow Projections:** Regional and municipal master plans are required to use official sets of population projections. The Maricopa Association of Governments (MAG) (formed in 1967 as a Council of Governments) provides regional planning information for use in water, transportation, and other master planning efforts. MAG data includes population and employment projection distributions by individual municipal planning area and smaller sub-geographies. The City participates in regular updates of this data as part of MAG's Population Technical Advisory Committee (POPTAC). MAG population projections through year 2055 (that were available in 2019) formed a foundational basis for growth projections and the associated water demands and wastewater flows in the IWRMP. Adjustments to the spatial distribution of water demands and wastewater flows were made to recognize specific areas experiencing and planned for greater development intensity.
- **Impacts of Pandemic:** Over the past two and a half years, the COVID-19 pandemic has changed how and where many people live and work. This directly impacts water demand and wastewater flow projection assumptions throughout the City's service area, and it is uncertain if these changes are temporary or will be permanent. For these reasons, pre-pandemic data related to the distribution of water demands and wastewater flows were relied upon as being more likely to represent long-term conditions for planning purposes.

Accordingly, the IWRMP is not intended to be a plan that addresses immediate drought conditions, impending CAP water shortages, future changes in planned development patterns, or currently unknown long-term impacts of COVID-19. City staff use the most recent IWRMP as a roadmap for required infrastructure improvements over the next 30+ years while also re-assessing projects, prioritization, and timing each year based on actual prevailing conditions.

ES.1.4 Report Organization

The IWRMP report is organized as follows:

- **Executive Summary**, Summarizes the major findings and recommendations of the IWRMP.
- **Chapter 1 – Introduction**, Includes project background, project scope, and major task outcomes.
- **Chapter 2 – Planning Framework**, Presents the population growth, water demand, wastewater flow, and reclaimed water production projections.
- **Chapter 3 – Water Resources**, Includes a summary of the City's water portfolio and an evaluation of physical, operational, and legal constraints for each supply source. A water supply and demand balance for normal and dry years, including moderate and severe supply shortages, groundwater management strategies, and overall water resource management strategies, is also provided.
- **Chapter 4 – Water Distribution System Evaluation**, Presents an evaluation of Scottsdale's water distribution system infrastructure capacity and recommendations for improvements needed to deliver potable water. Candidate capital improvement projects are identified including water mains, booster pumping stations, water storage tanks, and pressure reducing valves.

- **Chapter 5 – Wastewater Collection System Evaluation**, Presents an evaluation of Scottsdale's wastewater collection system infrastructure capacity and recommendations for improvements needed to covey wastewater to treatment locations. Candidate capital improvement projects are identified including wastewater mains, lift stations, and force mains.
- **Chapter 6 – Water Quality**, Presents an evaluation of the City's current water quality data and identification of focus areas to address potential future water quality requirements.
- **Chapter 7 – Water and Wastewater Facility Evaluations**, Includes a review of both water and wastewater treatment facilities and identification of recommended improvements to expand capacity to accommodate growth.
- **Chapter 8 – Integrated Planning Recommendations**, Summarizes the phased candidate capital project recommendations and associated project cost opinions to assist the Scottsdale Water in annual programming of CIP projects.

Major outcomes of the planning processes, evaluations, and recommendations described in detail in Chapters 2 through 8 are summarized below.

ES.2 Planning Framework Summary

The planning framework includes a common set of key assumptions that are used to develop projections for the water resources, water, wastewater, and reclaimed water systems analyses. These assumptions guide the outcomes and capital recommendations of the IWRMP. The planning framework is used to align project timing with needs dictated by the growth projections to make certain that projects are sized appropriately and programmed to be in service ahead of projected development.

ES.2.1 Planning Area

The planning area for the IWRMP coincides with the Scottsdale City Limits (see Figure ES.1). The City is divided into four regional planning areas that have unique development characteristics and growth assumptions as described below.

- **Desert Mountain**. The Desert Mountain area is in the northernmost part of the City. It is characterized by hilly terrain and primarily low-density residential development with limited commercial development. Some of the Desert Mountain area was not developed as of year 2020. There are some parts of Desert Mountain that are anticipated to remain undeveloped in perpetuity due to their location within the Hillside Conservation area, which prohibits development.
- **Northern**. The Northern area has large amounts of low-density housing but also has medium density residential as well as multi-family housing. Commercial development serves primarily local residential needs. A portion of the Northern area is comprised of preserve lands that will not develop. The Northern area has the largest amount of undeveloped land of the four regional planning areas.
- **Central**. The Central area has a full range of housing densities. This area includes the Greater Airpark Development Intensity Area (DIA) and a wide range of commercial development. Additional vertical (multi-story) development is expected around the Scottsdale Airpark. As of year 2020, the Central area was mostly developed.
- **Southern**. The Southern area includes Downtown DIA, the Scottsdale/McDowell Road Corridor DIA and has a wide range of residential and commercial development. The amount of vertical development and redevelopment in the Southern area is expected to increase, but is mostly developed.

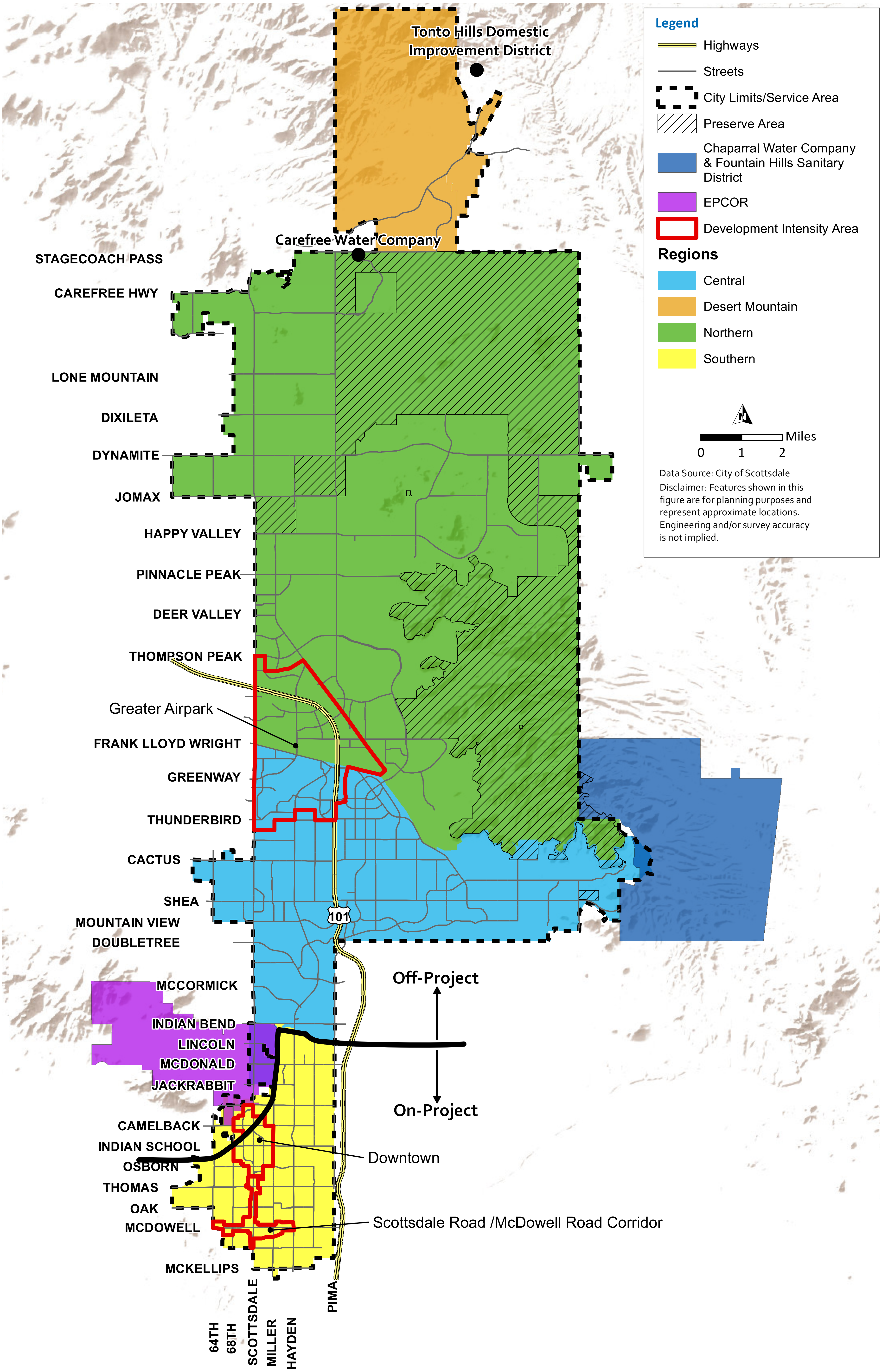

Figure ES.1 City of Scottsdale Planning Area

In addition to providing water and wastewater service within these four regional planning areas, Scottsdale Water provides water service to several locations outside the City including:

- Tonto Hills Domestic Improvement District (the City treats the District's water and wheels it to them).
- Carefree Water Company (the City treats the Company's water and wheels it to them).

There are two locations within the City of Scottsdale that receive water service from other utilities, including:

- A small portion of the eastern part of Scottsdale near Fountain Hills is served by the Chaparral Water Company (EPCOR).
- A small portion of the City (approximately 2,000 connections) west of the Arizona Canal between Indian Bend Road and Jackrabbit Road is served by EPCOR.

ES.2.2 Growth and Population Projections

The rate and location of growth within the City is established in this plan based on the information provided by MAG and developed with information provided by the City. The project team also met with the City's Planning Department to gain insights into the strategies for the State lands development, particularly along the Loop 101 corridor and Greater Airpark DIA. Growth in these areas is dynamic and several additional developments have advanced towards proposed approval since this initial planning meeting for the IWRMP.

Growth projections were made at five-year intervals from year 2020 through year 2055. For the purposes of the IWRMP, it was assumed that the year 2055 population represents the buildout conditions for the City. Table ES.1 summarizes the IWRMP population projections. The City is expected to grow to a population of approximately 316,000 by year 2055.

Table ES.1 MAG Population Growth Projections

Type of Development	Year							
	2020(1)	2025	2030	2035	2040	2045	2050	2055
Single Family Residential	182,750	193,310	198,010	201,280	203,820	205,940	207,400	208,600
Multi-Family Residential	70,620	77,430	83,700	90,200	95,140	99,280	103,240	107,220
Total	**253,370**	**270,740**	**281,720**	**291,480**	**298,960**	**305,220**	**310,640**	**315,820**

Note:
(1) Year 2020 values are projections based on MAG's 2019 data, not verified year 2020 actuals.

ES.2.3 Water Demand Projections

Potable water demand projections were developed to address future growth and development. As part of the IWRMP Scenario Planning Process, the need to plan for greater demands in the DIAs, illustrated in Figure ES.1, was identified. The following approach was used to develop water demand projections for the IWRMP:

- First, a **Baseline Projection** was developed based on the City's current water use and zoning classifications. The unit water demands applied in this projection assumed that future water demands would be the same on a per-acre basis as current water demands. The timing of these demands was based on the MAG Traffic Analysis Zone (TAZ) projections.

- Second, an **Adjusted Projection** was prepared that accounted for increased demands within the Greater Airpark, Downtown, and the Scottsdale Road/McDowell Road Corridor DIAs. These were assumed to have the potential to develop or redevelop with multi-story buildings.
- Third, a projection that accounts for the potential long-term impacts of water conservation was developed as it relates to water resources decisions. This **Water Conservation Projection** assumed that the Adjusted Projection would be reduced over time as a result of the City's water conservation program efforts and corresponding water use reductions from Scottsdale Water customers as a whole.

Non-potable demand projections were also developed for the portion of the Reclaimed Water Distribution System (RWDS) and Irrigation Water Distribution System (IWDS) that are met with raw CAP water.

ES.2.3.1 Non-potable Water Demands

Table ES.2 summarizes the raw CAP water demand assumptions for the IWRMP. While untreated CAP water is used to meet summer delivery peaks in the RWDS system, the City's long-term goal is to have the RWDS system completely reliant on tertiary treated reclaimed water and advanced treated RO water from the Advance Water Treatment (AWT) facility at the Water Campus. The IWDS demands that are currently met with raw CAP water are estimated to be replaced with supplies delivered from the Harquahala Valley Irrigation District (HVID) by year 2025. The City has other existing agreements to deliver raw CAP water to meet additional irrigation demands.

Table ES.2 Raw CAP Water Non-Potable Demand Summary

Source	Annual Average Demand (AFY)				
	Year 2020	Year 2025(1)	Year 2030(1)	Year 2035(1)	Year 2055(1)
RWDS	4,950	0 - 4,950	0 - 4,950	0 - 4,950	0 - 4,950
IWDS(2)	1,900	0	0	0	0
Other Irrigation Demands(3)	780	780	780	780	780
Minimum Total Demand (ac-ft)	7,630	780	780	780	780
Maximum Total Demand (ac-ft)	**7,630**	**5,730**	**5,730**	**5,730**	**5,730**
Maximum Total Demand (mgd)(4)	**6.8**	**5.1**	**5.1**	**5.1**	**5.1**

Notes:
(1) The City's intent is to have the RWDS system completely reliant on tertiary treated reclaimed water and advanced treated RO water from the AWT facility as soon as possible. This is projected to occur between year 2025 and 2035. However, for water supply planning purposes, a range is shown.
(2) Assumes 1,900 AFY HVID supply replaces raw CAP water beginning in year 2025.
(3) Projected Westworld and Ancala raw CAP water demand.
(4) Conversion from AFY to mgd includes rounding error.
Abbreviations:
AFY = acre-feet per year; ac-ft = acre-feet; mgd = million gallons per day

ES.2.3.2 Potable Water Demands

Baseline Water Demand Projections

The Baseline Projection reflects the MAG growth projections and was used as a reference only to establish the Adjusted Projection, which was ultimately used for the IWRMP analyses.

Adjusted Water Demand Projections

Table ES.3 summarizes the Adjusted Projection average annual water demand. By year 2055, the adjusted estimated annual average water demand is 93.3 mgd, which is approximately 35 percent higher than the City's current average annual demand. The Adjusted Projection, along with the appropriate maximum day peaking factor, was used as the basis for the water system capacity evaluations.

Table ES.3 Adjusted Projection – Average Annual Potable Water Demands

Region	Average Annual Potable Water Demand by Year (mgd)							
	2020	2025	2030	2035	2040	2045	2050	2055
Desert Mountain	2.5	4.3	4.4	4.4	4.6	4.7	4.7	4.7
Northern	20.9	23.4	25.5	27.8	29.3	30.7	31.8	32.6
Central	26.2	26.4	26.6	26.8	27.8	28.9	29.6	30.0
Southern	15.0	16.0	16.7	17.4	17.9	18.6	19.0	19.4
Outside Scottsdale(1)	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9
Non-Revenue Water(2)	4.3	4.6	4.8	5.0	5.2	5.4	5.6	5.7
Total Potable Water Demand(3)	**69.7**	**75.5**	**78.8**	**82.2**	**85.7**	**89.2**	**91.6**	**93.3**

Notes:
(1) Water delivered to Carefree, Paradise Valley, Phoenix, and part of unincorporated Maricopa County. This water is wheeled through the City's system but is not part of the City's potable water resources.
(2) Non-revenue water is currently estimated as 6.5 percent of total water production, which is well below ADWR's 10 percent threshold for large water providers within Active Management Areas (AMAs). Scottsdale Water has a goal to achieve 6 percent non-revenue water, but this current percentage (6.5%) is assumed to remain constant for planning purposes.
(3) Total water production in the future would include potable water recharged to the aquifer and other water uses that are not customer deliveries. These water uses would be in addition to the water demand projections in this table.

The Adjusted Projection of the average annual potable water demands is shown by Planning Region in Figure ES.2.

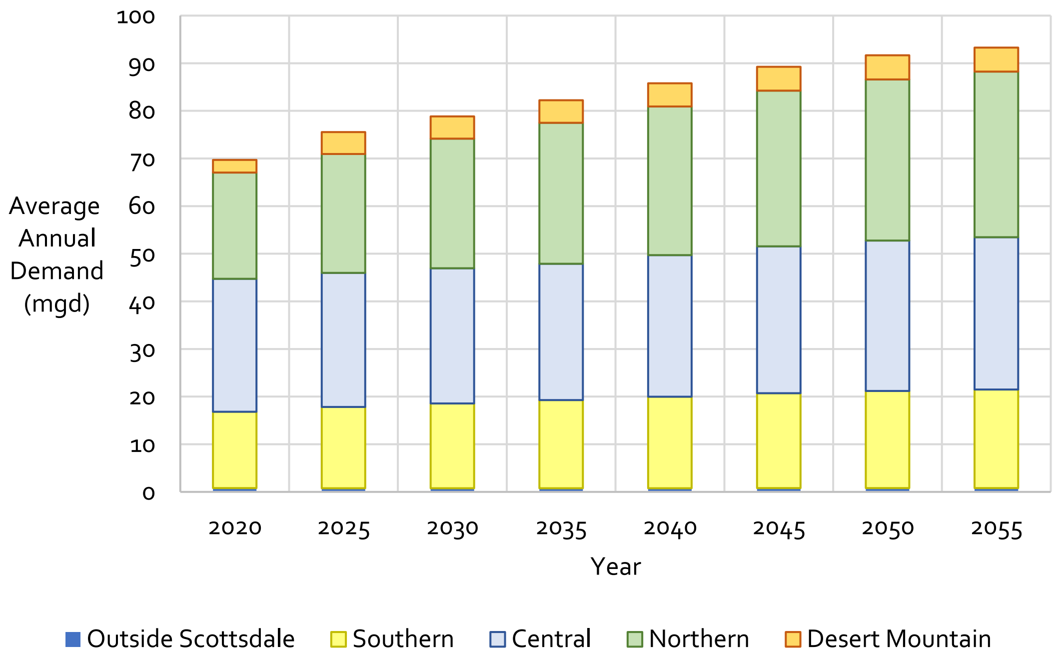

Figure ES.2 Adjusted Projection – Average Annual Potable Water Demand by Planning Region

Conservation Demand Projections

A Conservation Projection was developed to estimate the effects of increased customer water conservation in response to the City's continued implementation of their water conservation program. The Conservation Projection was used in the water resources analysis and is based on reductions from the Adjusted Projection (rather than the Baseline Projection) to provide a more realistic basis for the City's average annual water supply requirements during drought.

A conservation projection was also developed for the Baseline Projection for comparative purposes only to provide a range of future water demand estimates for the City as illustrated in Figure ES.3.

Potable Water Demand Projection Summary

Figure ES.3 presents a comparison of the Adjusted Projection and the Baseline Projection with the Conservation Projection applied to each. The Adjusted Projection, which was used as the basis for the water supply and water infrastructure capacity analyses is estimated to reach 93.3 mgd by year 2055. This is 9.7 mgd higher than the Baseline Projection by year 2055.

The Conservation Projection applied to either the Adjusted or Baseline Projection results in approximately a four percent reduction of water demand (3.1 to 3.5 mgd or 3,470 to 3,900 AFY).

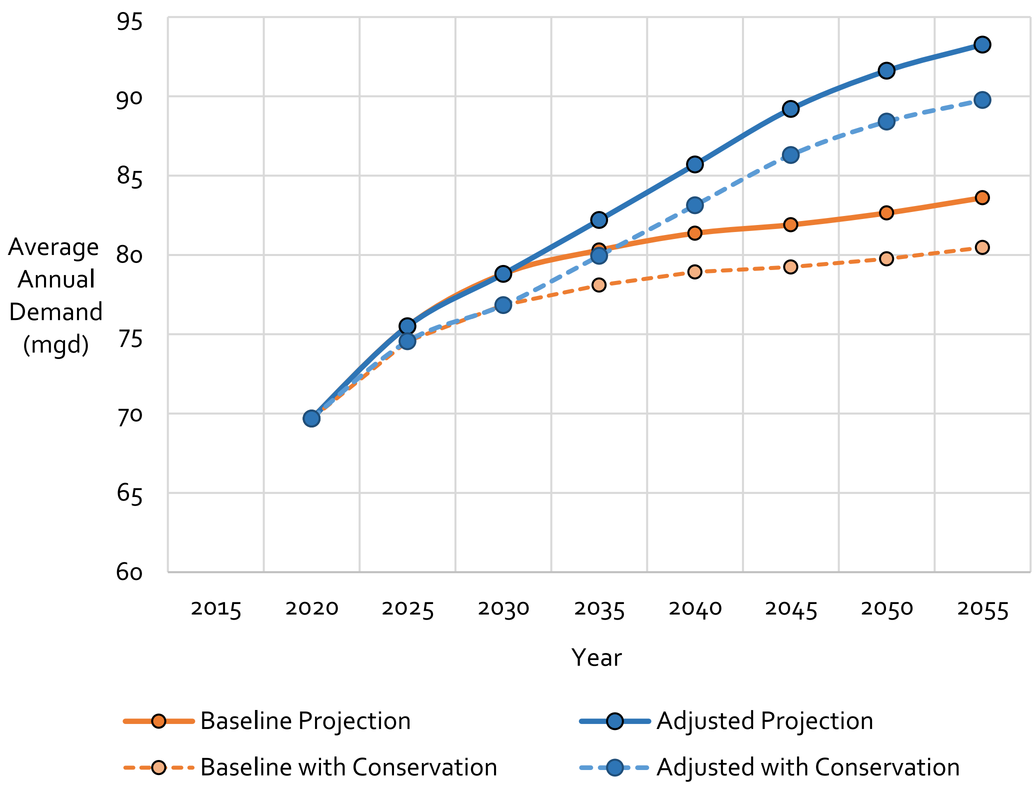

Figure ES.3 Potable Water Demand Projections

ES.2.3.3 Total Water Demands

Table ES.4 summarizes the Adjusted Projection total water demands that are used for the water resources supply and demand analysis in Chapter 3. Note that the non-potable demands shown in Table ES.4 include only the portions of the RWDS and IWDS demands that are assumed to be met with raw CAP water. It does not include the portion of RWDS demand that is met by tertiary treated reclaimed water or advanced treated RO water from the AWT facility.

Table ES.4 Adjusted Total Water Demand Projections

Region	Average Annual Water Demand by Year (mgd)							
	2020	2025	2030	2035	2040	2045	2050	2055
On Project	13.5	13.7	13.8	14.3	14.8	15.3	15.7	15.9
Off Project	55.4	61.0	64.2	67.1	70.0	73.0	75.0	76.5
Outside Scottsdale(1)	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9
Non-Potable Demand met with Raw CAP Water(2)	6.8	0.7-5.1	0.7-5.1	0.7-5.1	0.7-5.1	0.7-5.1	0.7-5.1	0.7-5.1
Minimum Total Water Demand	76.5	76.2	79.5	82.9	86.4	89.9	92.3	94.0
Maximum Total Water Demand	**76.5**	**80.6**	**83.9**	**87.3**	**90.8**	**94.3**	**96.7**	**98.4**
Maximum Total Water Demand (AFY)(3)	**85,680**	**90,270**	**93,970**	**97,780**	**101,700**	**105,620**	**108,300**	**110,210**

Notes:
(1) Water delivered to Carefree, Paradise Valley, Phoenix, and part of unincorporated Maricopa County. This water is wheeled through the City's system but is not part of the City's potable water resources.
(2) Includes portion of RWDS and IWDS demand met with raw CAP water only. Does not include portions of demand from RWDS that are met by tertiary treated reclaimed water or advanced treated RO water from the AWT facility. By year 2025 the raw CAP water deliveries to IWDS are assumed to be replaced with HVID supplies. The City also intends that the RWDS system will be completely reliant on tertiary treated reclaimed water and advanced treated RO water from the AWT facility as soon as possible. This is projected to occur between year 2025 and 2035. For water supply planning purposes, a range is shown beginning in year 2025, which includes projected Westworld and Ancala raw CAP water demands (0.7 mgd).
(3) Values rounded to the nearest 10 AFY. Conversion from mgd to AFY includes rounding error.

ES.2.4 Wastewater Flow Projections

Scottsdale's wastewater collection system serves the entire City except for a small area adjacent to Fountain Hills. The collection system receives wastewater flows from a portion of Paradise Valley through ten metered connections, the City of Phoenix, and the Black Mountain Sewer Company (a subsidiary of Liberty Utilities) in Carefree. The collection system is divided into five different sub-catchments or basins based on the way that the Pumpback system operates to capture flows. Figure ES.4 presents the wastewater collection system service area with the five basins as follows:

- Basin 1. This basin serves the southern portion of the City and is south of both the Southeast and Southwest Pumpback stations. Wastewater from Basin 1 flows to the Sub-Regional Operating Group (SROG) interceptors and cannot be returned to the Water Campus Water Reclamation Plant (WRP).
- Basin 2. This basin serves the East Shea portion of the City. Wastewater from this basin is primarily pumped through the Southeast and Northeast Pumpback stations to the Water Campus WRP.
- Basin 3. This basin is served primarily by the Southwest and Northwest Pumpback stations. Wastewater from this basin goes to the Water Campus WRP. The Gainey Ranch WRP also takes water from Basin 3 via a set of pumps located at the Southwest Pumpback station.
- Basin 4. Basin 4 is in the central part of the City. Wastewater from this basin is pumped to the Water Campus WRP through the North Pumpback system.
- Basin 5 is in the northern part of the City. Wastewater flows in this basin flow primarily by gravity to the Water Campus WRP.

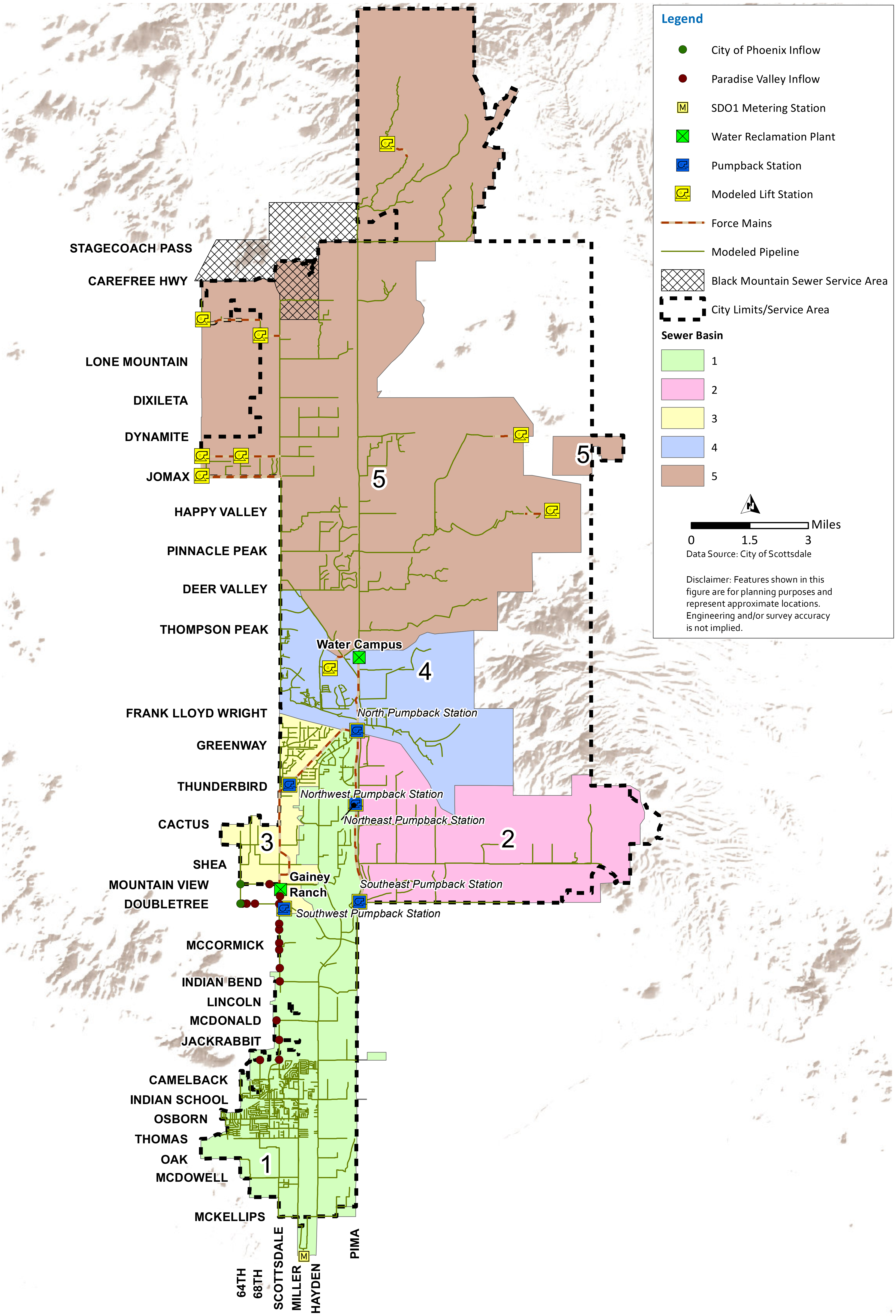

Figure ES.4 Wastewater Service Area

Along with data from the City's permanent wastewater flowmeters, short-term flow monitoring in the collection system provided information to develop wastewater flow projections.

ES.2.4.1 Annual Average Daily Flow Projections

Average annual daily flow (AADF) projections were prepared for each of the five sub-basins within the collection system. These represent flows generated by the City of Scottsdale's customers. Because the wastewater flow projections are directly tied to the potable water demand projections, the timing of future flows corresponds with the same population and growth assumptions used for the water demand projections.

In addition to the City's wastewater flow, the City's collection system flows include flows from outside Scottsdale including the Black Mountain system (0.2 mgd), Paradise Valley (0.3 mgd), and the City of Phoenix (5.7 mgd). The City of Phoenix flows are assumed to increase over time to a maximum of 10 mgd. There are also RO brine flows from the Central Arizona Project Water Treatment Plant (CAP WTP) and solids flows from the Water Campus WRP that enter the collection system.

Table ES.5 summarizes the Adjusted Projection for average annual wastewater flows.

Table ES.5 Adjusted Wastewater Flow Projections – Average Annual Daily Flow

Wastewater Area	Average Annual Wastewater Production (mgd)							
	2020	2025	2030	2035	2040	2045	2050	2055
Basin 1	8.7	9.0	9.2	9.3	10.5	11.6	12.2	12.4
Basin 2	3.9	4.0	4.1	4.1	4.1	4.1	4.1	4.1
Basin 3	1.3	1.3	1.4	1.5	1.6	1.7	1.8	1.9
Basin 4	2.7	3.1	3.4	4.5	4.9	5.3	5.7	6.0
Basin 5	4.7	6.0	6.4	6.7	6.8	6.9	7.1	7.1
City Generated Flow Subtotal	**21.3**	**23.4**	**24.5**	**26.1**	**27.9**	**29.6**	**30.9**	**31.5**
Water Campus Residuals(1)	2.1	2.5	2.6	2.9	3.0	3.1	3.2	3.3
Black Mountain System Flow(2)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Paradise Valley Flow(3)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
City of Phoenix Flow(4)	5.7	7.9	10.0	10.0	10.0	10.0	10.0	10.0
Subtotal	**8.3**	**10.9**	**13.1**	**13.4**	**13.5**	**13.6**	**13.7**	**13.8**
System Total	**29.6**	**34.3**	**37.6**	**39.5**	**41.4**	**43.2**	**44.6**	**45.3**

Notes:
(1) Assumed to be 17% of Water Campus WRP average annual daily flow (AADF).
(2) Black Mountain Sewer Flows are conveyed by gravity the Water Campus WRP.
(3) Paradise Valley Flows to Scottsdale's collection system are either pumped back to the Water Campus WRP or conveyed to the SROG system and counted towards the City's SROG commitment.
(4) Includes projected City of Phoenix flows that are conveyed through Scottsdale's collection system to SROG.

Figure ES.5 shows the Adjusted Flow Projections (AADF) for the flows generated with each of the five sub-basins.

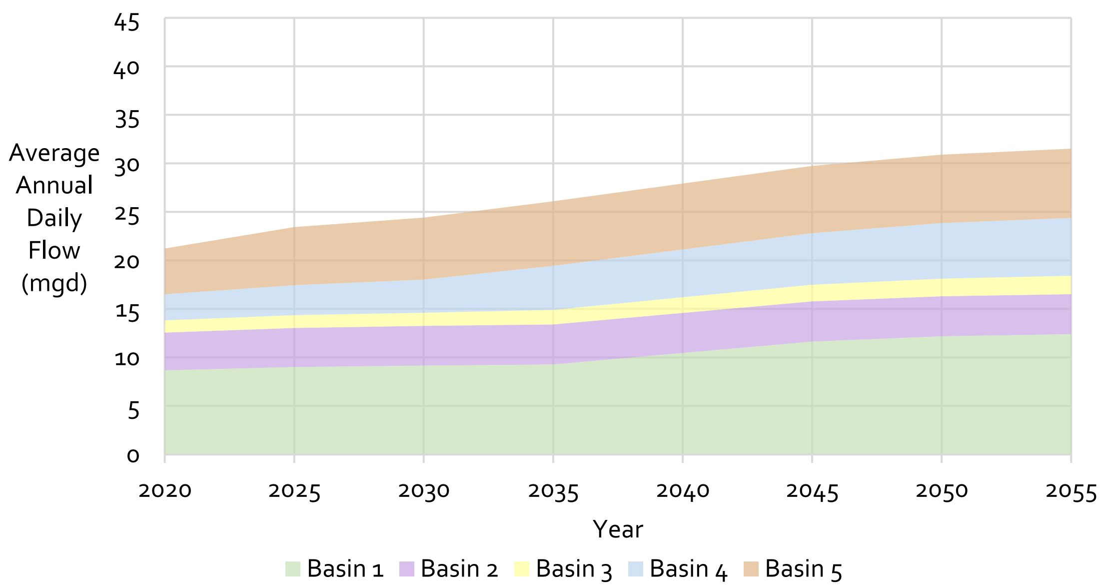

Figure ES.5 Adjusted Average Annual Daily Wastewater Flow Projection

ES.2.4.2 Maximum Daily Flow Projections

Maximum daily flow (MDF) projections were prepared for each of the five sub-basins within the collection system. These are also based on the Adjusted Projections developed for the water demands and are calculated using the MDF/AADF peaking factors developed from a review of the City's historical flow data. These flows are summarized in Table ES.6. The wastewater collection system capacity evaluations described in Chapter 5 are based on the Adjusted MDF Projection.

Table ES.6 Adjusted Wastewater Flow Projections – Maximum Daily Flow

Wastewater Area	Maximum Daily Wastewater Production (mgd)							
	2020	2025	2030	2035	2040	2045	2050	2055
Basin 1	12.0	12.4	12.6	12.8	14.4	16.1	16.8	17.1
Basin 2	4.9	5.1	5.2	5.2	5.2	5.2	5.2	5.2
Basin 3	1.6	1.7	1.7	1.9	2.0	2.2	2.3	2.4
Basin 4	3.4	3.9	4.3	5.7	6.2	6.7	7.2	7.5
Basin 5	5.9	7.6	8.0	8.4	8.6	8.7	8.9	9.0
City Generated Flow Subtotal	**27.8**	**30.7**	**31.8**	**34.0**	**36.4**	**38.9**	**40.4**	**41.2**
Water Campus Residuals(1)	2.1	2.5	2.6	2.9	3.0	3.1	3.2	3.3
Black Mountain System Flow(2)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Paradise Valley Flow(3)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
City of Phoenix Flow(4)	5.7	7.9	10.0	10.0	10.0	10.0	10.0	10.0
Subtotal	**8.3**	**10.9**	**13.1**	**13.4**	**13.5**	**13.6**	**13.7**	**13.8**
System Total	**36.1**	**41.6**	**44.9**	**47.4**	**49.9**	**52.5**	**54.1**	**55.0**

Notes:
(1) Assumed to be 17% of Water Campus WRP AADF.
(2) Black Mountain Sewer Flows are conveyed by gravity the Water Campus WRP.
(3) Paradise Valley Flows to Scottsdale's collection system are either pumped back to the Water Campus WRP or conveyed to the SROG system and counted towards the City's SROG commitment.
(4) Includes projected City of Phoenix flows that are conveyed through Scottsdale's collection system to SROG.

Figure ES.6 shows the Adjusted Flow Projections (MDF) for the flows generated with each of the five sub basins.

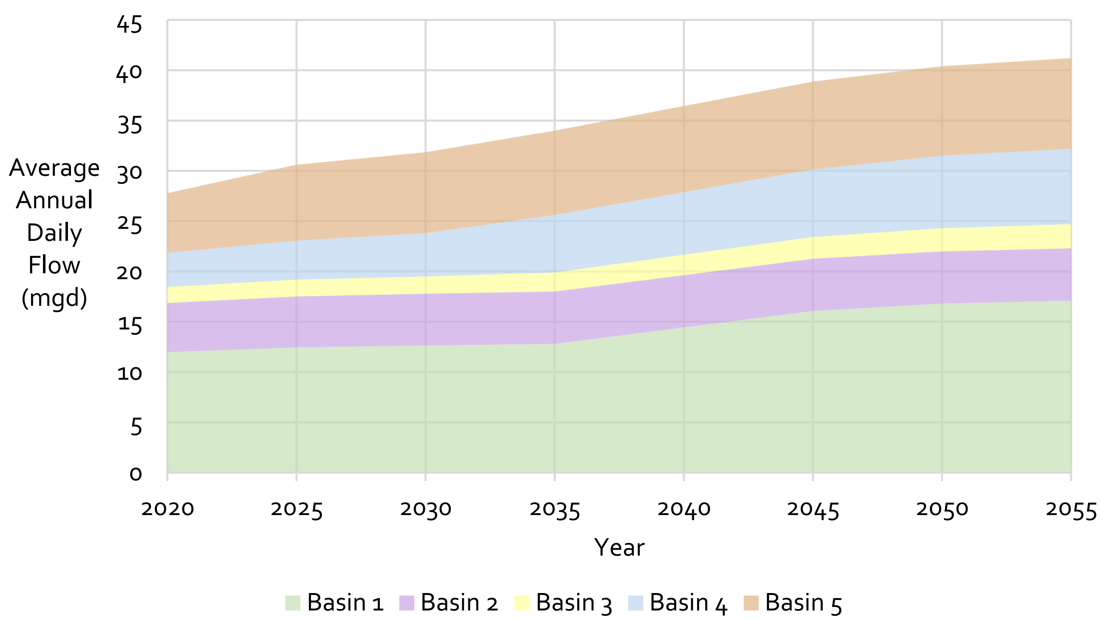

Figure ES.6 Adjusted Maximum Daily Wastewater Flow Projections

ES.2.5 Reclaimed Water Flow Projections

The majority of Scottsdale's reclaimed water flow passes through the AWT facility where 10 percent of the water is lost as brine. This brine water is conveyed through the collection system through Basin 1 to the SROG collection system. This results in an overall reclaimed water production factor of 94 percent of the wastewater flow.

Daily operating decisions are made to determine how much wastewater flow goes to SROG and how much goes to the Water Campus. The portion of the City's wastewater that goes to SROG is treated at the 91st Avenue Wastewater Treatment Plant (WWTP). The reclaimed water produced at the 91st Avenue WWTP is committed to the Palo Verde nuclear power plant, the Tres Rios wetlands project, and the Buckeye Irrigation and Drainage District (BIDD) and is therefore not available for use within the City. Table ES.7 presents the average annual reclaimed water production for the Adjusted Projection flows generated within Scottsdale that can be conveyed to the Water Campus WRP.

Table ES.7 Adjusted Reclaimed Water Flow Projections

Location	Average Annual Reclaimed Water Production (mgd)							
	2020	2025	2030	2035	2040	2045	2050	2055
Basins 2-5(1)	11.8	13.6	14.3	15.8	16.4	17.0	17.6	18.0
Basins 2-5 (AFY)(1)	13,210	15,182	16,059	17,714	18,382	19,051	19,719	20,137

Note:
(1) Assumed to be 94% of the City of Scottsdale average annual wastewater flow (Adjusted Projections, See Table ES.5).

The City is pursuing a sixth Pumpback station that would be located along Indian Bend Road, between Scottsdale Road and Hayden Road. Depending on where flows are diverted, this Pumpback station would enable the City to potentially capture an additional 1.2 to 3.4 mgd of wastewater and convey it to the Water Campus WRP via the Southwest Pumpback station. This range could increase if upstream flows in addition to those currently projected become available in the collection system. This would increase the amount of reclaimed water available to the City as a water resource.

ES.3 Water Resources

The City has a diverse water resources portfolio consisting of surface water, groundwater, wastewater effluent (reclaimed) water, and stored water credits. The City's surface water supplies come from the Salt and Verde Rivers within Arizona, and from the Colorado River. The City owns and operates potable groundwater production and aquifer storage and recovery (ASR) wells that provide supply resilience and redundancy. The City actively manages deployment of water supplies in a way that promotes aquifer sustainability. Scottsdale utilizes 100 percent of its reclaimed water supply for direct, non-potable reuse or recharge. Reclaimed water recharge offsets pumped groundwater and accrues long-term storage credits.

Each of these supply sources has its own set of delivery and use restrictions that impact where and how they can be used. Scottsdale manages its water resources to meet the demands in its service area by providing a flexible and reliable water supply that can accommodate both normal and dry year conditions.

The City's overall water resources deployment strategy focuses on maximizing the use of renewable surface water resources whenever possible. The City has obtained and maintains a Designation of Assured Water Supply (DAWS) from the Arizona Department of Water Resources (ADWR). This demonstrates that Scottsdale has secured the water resources required to provide a physical, legal, and continuously available water supply for 100 years.

ES.3.1 Planning Area

Figure ES.7 shows the planning area for the IWRMP, which coincides with the Scottsdale City Limits, along with major water resources features. The two primary water rights service areas within Scottsdale are On- and Off–Project lands, which refer to the Salt River Project (SRP). SRP surface water supplies originate in the Salt and Verde watersheds and are dependent on annual precipitation in central and northeastern Arizona. SRP also owns and operates numerous wells throughout the Phoenix metropolitan area, including within Scottsdale. SRP water is delivered to Scottsdale through the Arizona Canal where water is conveyed to the Chaparral Water Treatment Plant (CWTP). SRP water must be used On-Project (also referred to as "SRP Member Lands" or "Member Lands") unless it is replaced by an equal volume of Off-Project water.

A substantial portion of Scottsdale's water service area is Off-Project, which must be served with either CAP water, groundwater, or another renewable supply. CAP water is delivered to the CAP WTP from the CAP Canal. The City's groundwater wells are dispersed throughout the water service area both On- and Off-Project.

ES.3.2 Water Resources Portfolio

The following water resources are the major components of Scottsdale's existing water resources portfolio:

1. SRP surface water and groundwater
2. CAP water, including the City's municipal and industrial (M&I) sub-contract and leases
3. New conservation space (NCS) water, from the "Plan 6" expansion at Roosevelt Dam
4. Groundwater that can be legally pumped, consisting of a "Phase-In" groundwater allowance and an Incidental Recharge allowance, as determined by the ADWR
5. Reclaimed water, used for direct use, non-potable reuse and recharge
6. Long-term storage credits derived from recharge of reclaimed water, NCS, and CAP water
7. HVID groundwater supplies

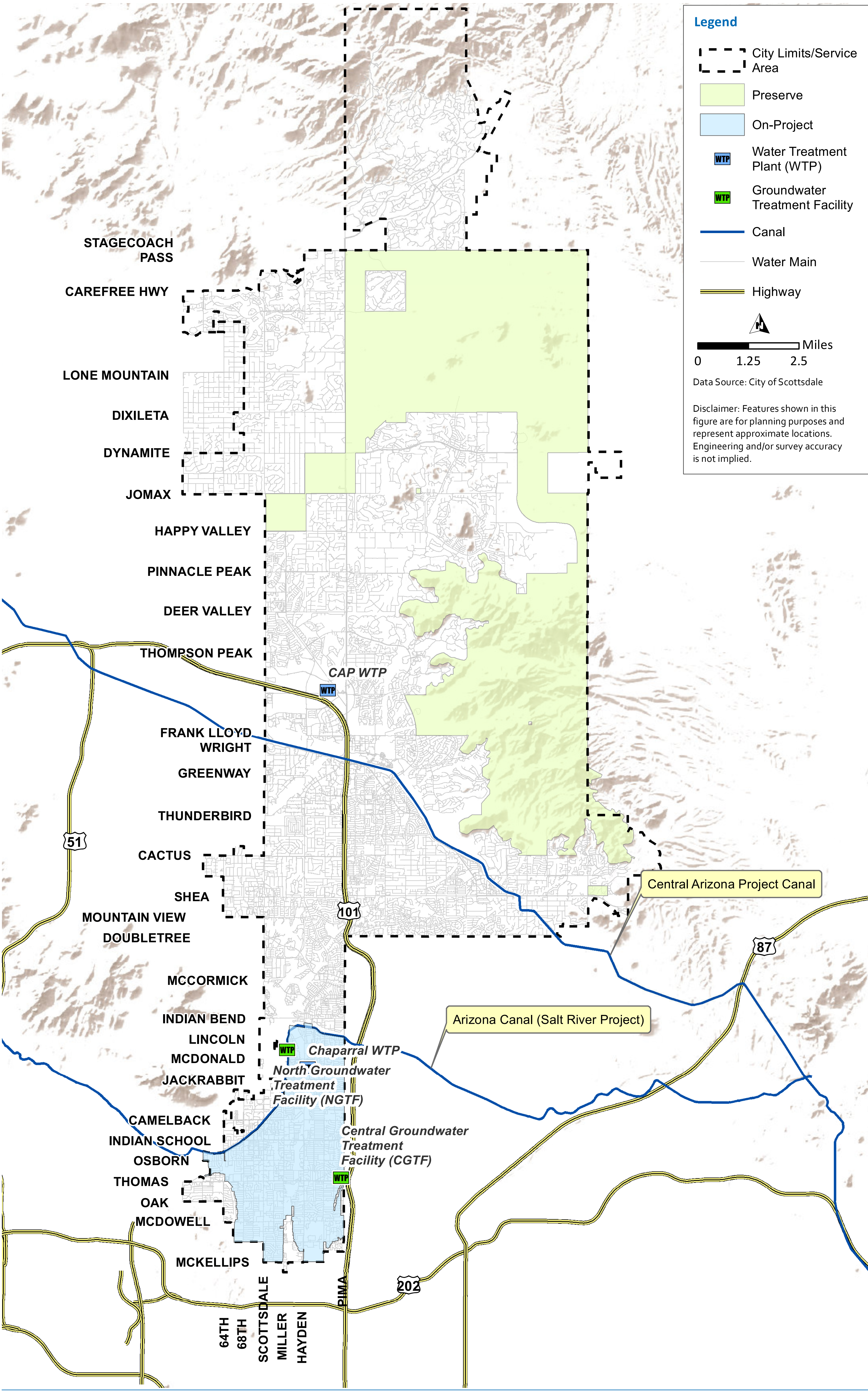

Figure ES.7 Planning Area with Major Water Resources Features

The yield and delivery capability of each of Scottsdale's water resources is impacted by hydrologic/climatologic effects, institutional restrictions on the location of use, the location of the service area demand, and the capacity of the water transmission and distribution infrastructure to deliver water to customers.

Table ES.8 summarizes the City's water portfolio as outlined in the City's 2013 DAWS. The SRP allocation in the 2013 DAWS is 19,000 AFY, which is 700 AFY higher than the estimated yield for the IWRMP. Therefore, for planning purposes a total of 140,252 AFY is assumed to be available to meet demands.

Table ES.8 Scottsdale Designation of Assured Water Supply Summary

Description	Normal Year Yield (AFY)(1)
SRP Surface Water and Groundwater(2)	18,300
CAP Entitlements	81,271
NCS Water	8,600
Central Arizona Water Conservation District (CAWCD) Water/HVID	2,910
Effluent	15,328
Groundwater Allowance	12,905
Long-term Storage Credits	938
Total	**140,252**

Notes:
(1) Values from 2013 Designation of Assured Water Supply, except where noted.
(2) 2013 Designation of Assured Water Supply identifies 19,000 AFY.

ES.3.3 Water Supply and Demand Balance

Normal Water Years

Available water supplies were compared to the projected average annual demands for each planning period. This analysis was completed separately for On-Project and Off-Project areas for both normal and dry water year and conditions.

Table ES.9 summarizes the comparison of On- and Off-Project supplies and demands for a normal water year. These supplies represent the renewable water resources only for SRP, not the full production capacity to serve On-Project areas (Member Lands.)

Table ES.9 Water Supplies and Demands – Normal Year

Description	Water Supply or Demand by Planning Year (ac-ft)				
	2020	2025	2030	2035	2055
On-Project Demand	15,150	15,280	15,450	15,970	17,830
Off-Project Demand[(1)]	70,530	74,990	78,520	81,810	92,380
Total Demand	**85,680**	**90,270**	**93,970**	**97,780**	**110,210**
On-Project Supplies					
SRP Surface Water[(2)]	13,500	13,500	13,500	13,500	13,500
Groundwater Allowance[(3)]	1,310	1,382	1,417	1,452	1,567
Remediated Groundwater	1,981	1,981	1,981	1,981	1,981
Long-term Storage Credits[(3)]	150	150	150	150	150
New Conservation Space Water[(3)]	688	688	688	688	688
Reclaimed Water[(3)]	761	875	925	1,020	1,160
Total Supplies (On-Project)	***18,420***	***18,576***	***18,661***	***18,791***	***19,046***
Off-Project Supplies					
CAP Water	81,271	81,271	81,271	81,271	81,271
Groundwater Allowance[(3)]	7,034	7,257	7,437	7,623	8,227
Long-term Storage Credits[(3)]	788	788	788	788	788
New Conservation Space Water[(3)]	3,612	3,612	3,612	3,612	3,612
Reclaimed Water[(3)]	3,995	4,591	4,856	5,357	6,089
HVID Water[(4)]	0	1,260	1,260	1,260	1,260
Total Supplies (Off-Project)	***96,700***	***98,780***	***99,224***	***99,910***	***101,247***
Total Supply	**115,120**	**117,356**	**117,885**	**118,701**	**120,293**

Notes:

(1) Includes non-potable (raw CAP demands) for RWDS/IWDS of 6,850 AFY, reducing to 4,950 AFY beginning in year 2025 with assumed delivery of HVID supplies to meet all IWDS demand effectively reducing the raw CAP demands by 1,900 AFY. Also includes 780 AFY of raw CAP water delivery to Westworld and Ancala.

(2) Assumed 2.0 ac-ft/ac allocation for 6,095 Member Land acres plus 1,300 AFY of Normal flow (estimated average yield).

(3) Groundwater allowance, long-term storage credits, NCS and reclaimed water are shown as supplies for both Member and Non-member Lands. Volumes identified in the table are proportional to the estimated On/Off Projection Demand (16%/84%, respectively).

(4) City's portion of HVID water that can be used anywhere within the service area.

Figure ES.8 and Figure ES.9 illustrate the individual On- and Off-Project supply volumes compared to the projected demand for each planning period. The use of renewable groundwater such as long term storge credits, incidental recharge, groundwater allowance, reclaimed water and remedial groundwater requires production wells to work in conjunction with surface water treatment at the CAP WTP and CWTP to meet customer demands throughout the service area.

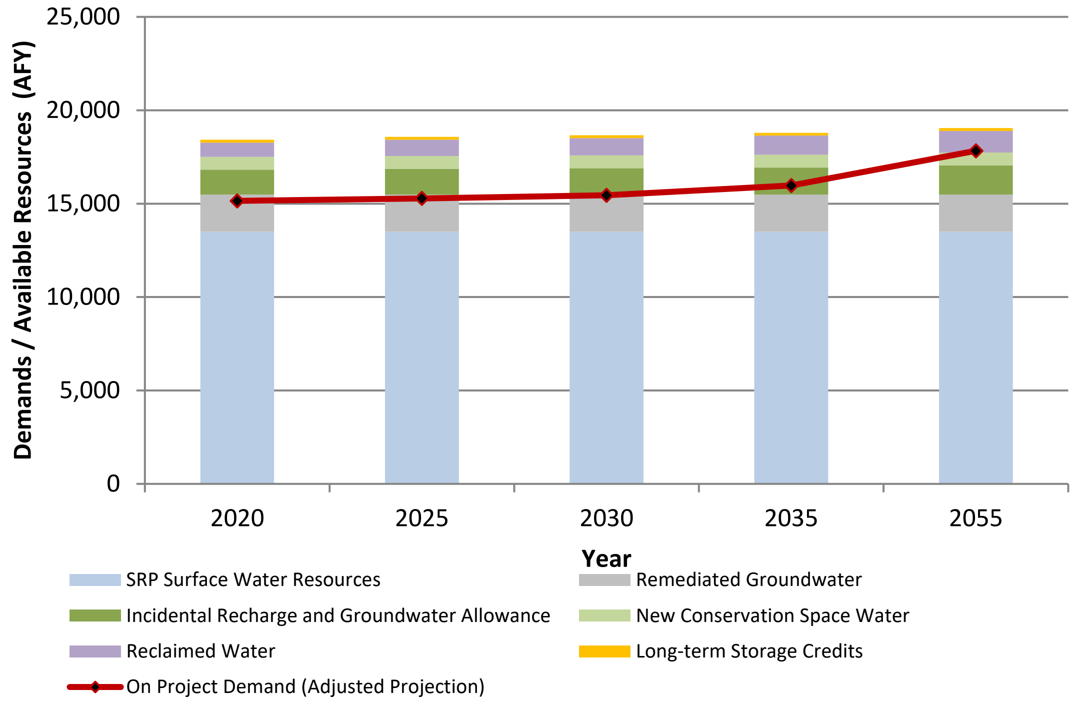

Figure ES.8 Normal Year On-Project Supplies and Demands

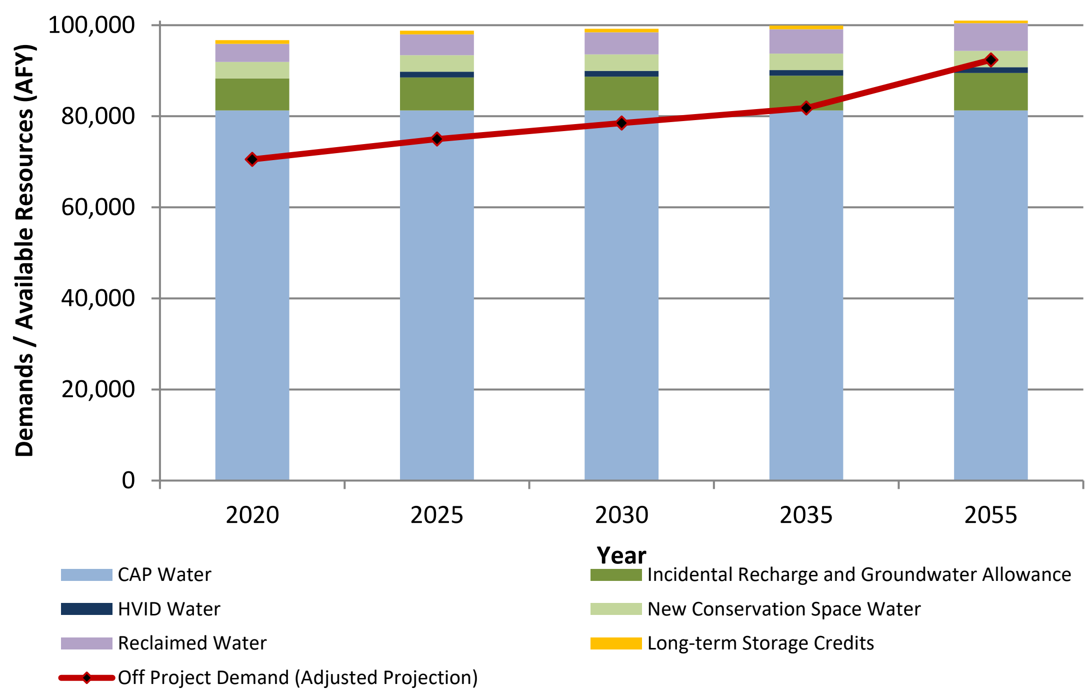

Figure ES.9 Normal Year Off-Project Supplies and Demands

The following summarizes the observations of the normal year water supply and demand analysis:

- In a normal, non-shortage year, the City has sufficient renewable supplies to meet the projected On- and Off-Project demands for each planning period through year 2055.
- For water accounting purposes, the City should continue to maximize the use of SRP surface water (stored water allocations and normal flow). This will enable the City to recharge more reclaimed water (or potentially expand direct potable reuse [DPR]) and avoid using long-term storage credits or the need to annually store and recover credits, thereby increasing the City's resiliency for dry years.
- Through 2035, remediated groundwater will be a critical renewable supply that will enable the City to meet On-Project demands while accruing long-term storage credits and avoiding non-renewable groundwater pumping. By year 2055, remediated groundwater will be necessary for renewable supplies to meet 100 percent of the projected On-Project demands.
- Taking delivery of NCS water provides another opportunity for the City to accrue long-term storage credits. Developing a NCS/CAP water exchange agreement with another municipality that receives both Salt/Verde River and CAP water is one option that would provide the City with flexibility to "deliver" their NCS supply to the CAP WTP, without the need for additional infrastructure.

Dry Water Years

The water supply and demand analysis for the IWRMP assumes two water shortage conditions, as defined in the City's Drought Management Plan (DMP), for the City's supplies as follows:

- Stage 2 Moderate Shortage
  - CAP supplies reduced by 9 percent (2019 Drought Contingency Plan [DCP] Tier 2B)
  - SRP stored water allocation 1.0 acre-feet per acre (ac-ft/ac), developed water allocation 2.0 ac-ft/ac
- Stage 3 Severe Shortage
  - CAP supplies reduced by 19 percent (2019 DCP Tier 3)
  - SRP stored water allocation 0 ac-ft/ac, developed water allocation 2.5 ac-ft/ac

The intent of the water supply and demand analysis in the IWRMP is to provide a range of conditions that will identify potential shortfalls and provide the City with guidance in selecting mitigation strategies. The IWRMP does not forecast specific year-to-year water supply reductions or durations.

It is important to note that these are just two potential scenarios when considering both surface water supplies. The duration of a shortage is not considered in the IWMRP process nor is a reduction in Colorado River supplies that is outside of the current governance framework. It is prudent for the City to evaluate additional planning scenarios to consider the impacts of long-term shortages and the effects on the City's supplies, as well as possibilities of cuts to the Colorado River that do not fall under the DCP framework.

Moderate Shortage

The following summarizes the observations of the Stage 2 Moderate Shortage water supply and demand analysis:

- There are not sufficient On-Project renewable supplies to meet the projected demands for any planning year. However, there is a sufficient water supply (groundwater) available to meet these demands. These groundwater resources are estimated to be 12,220 AFY. The impact of an On-Project surface water shortage of this magnitude (surface water allocation of 1.0 ac-ft /ac) would primarily be in reducing the City's long-term storage credit account in order to pump groundwater to meet demands.
- There are sufficient Off-Project renewable supplies to meet the projected demands through year 2055, if the water demand reductions represented by the Conservation Projection can be achieved.
- For all planning periods, renewable supply surpluses Off-Project can be used to meet demands On-Project through direct delivery of CAP water or through recovered groundwater.
- The City's ability to continue to use remediated groundwater pumping will be critical during years when On-Project surface water is reduced, to limit the impact to the City's long-term storage credit account.

Severe Shortage

The following summarizes the observations of the Stage 3 Severe Shortage water supply and demand analysis:

- There are not sufficient On-Project renewable supplies to meet the projected demands for any planning year. However, there is a sufficient water supply (groundwater) available to meet these demands. These groundwater resources are estimated to be 15,300 AFY. From a renewable supply standpoint, this is a "worst case" condition for the City that represents a year in which there is no surface water available from the Salt and Verde watershed. Because groundwater could be used to provide a physical supply, the primary impact of this scenario would be in reductions to the City's long-term storage credit account in order to replenish pumped groundwater. SRP could still deliver groundwater to the City through the Arizona Canal which would allow the CWTP to continue to operate to meet customer demands.
- There are sufficient Off-Project renewable supplies to meet the projected demands through year 2035, if the water demand reductions represented by the Conservation Projection can be achieved.
- Beyond year 2035 it is anticipated that there will be an Off-Project supply deficit that is expected to increase to 6,980 AFY by year 2055. The City's ASR well program could be expanded to deliver the physical supply needed to make up this difference.
- The City's ability to continue to use remediated groundwater pumping will be critical during years when On-Project surface water is reduced, to limit the impact to the City's long-term storage credit account.

ES.3.4 Water Conservation

Under ADWR's Phoenix AMA 4th Management Plan, the City of Scottsdale operates under the Non-Per Capita Conservation Program (NPCCP) as the City does not meet the Gallons Per Capita Per Day (GPCD) Program. In 2020, the ADWR calculated the City's full-service area demand at 353 GPCD, which accounts for all uses in the service area. The residential demand was calculated to be 208 GPCD.

The City is currently exceeding the required number of Best Management Practices (BMP) based on requirements in the 4th Management Plan. The voluntary additional BMPs that the City has implemented has positioned the City to be ready to meet the proposed requirements of the 5th Management Plan.

Demand Management & Efficiency

While the BMPs provide a useful bearing, a more detailed road map is necessary to properly address the City's demand management regarding its water resources. The City of Scottsdale, as an active member of the Arizona Municipal Water Users Association (AMWUA), participated in development meetings for both the 4th and 5th Management Plans. During management plan meetings, AMWUA developed a "Beyond Conservation" concept– a tiered system in which there are point requirements for both meeting and exceeding BMP goals. Considering the lasting impacts of drought and the continued potential for shortage on the CAP system, it is important that conservation shift gears and focus more acutely on inefficiencies within the service area to balance water savings with sustainable economic goals.

To manage demand and conserve supply, precision conservation that identifies inefficiencies should become a more focused area of conservation program management. While these activities may not have a correlating BMP, a focus on inefficiency will conserve water and benefit customers who are overusing water.

In the new era of demand management and efficiency, the following program additions meet the needs as outlined in the service provider profile for the City:

- Leak identification, notification, and prevention
- Commercial equipment efficiency, including but not limited to cooling tower technology
- Large commercial audits and tailored rebates for process efficiency improvements
- Large landscape budgeting
- Irrigation efficiency and proper controller programming
- Landscape revitalization efforts, including low-impact development and green infrastructure
- Limitations on turf areas
- Limitations on winter overseeding

These programs are more technical than previous generalized education programs and may require expertise of additional staff to properly measure program efficacy. Additionally, if drought persists and surface water supply shortages continue, additional resources may be needed to meet both customer inquiries and develop programs to quickly adapt to changing circumstances. While the BMPs will provide state compliance, additional program demand management and efficiency will provide more salient results to both customers and the City's water supplies.

ES.3.5 Water Supply Shortage Contingency Planning

The City is actively pursuing opportunities to add water supplies to their portfolio. The following opportunities exist for the City to mitigate water supply shortages and increase water supply resilience, which are further discussed in Chapter 3:

- Bartlett Dam New Conservation Storage (New Verde Space)
- NCS Water Deployment Opportunities
- Roosevelt Dam Flood Control Space (FCS)
- Horseshoe Credit Transfer
- Water Exchanges
- Priority 3 or 4 Colorado River Contract Water
- Long-term Storage Credit Utilization for Drought
- Colorado River Indian Tribes (CRIT) Water
- Imported Groundwater

ES.4 Integrated Planning Recommendations

Integrated planning recommendations resulting from evaluations throughout the IWRMP were compiled to summarize the capital, operations and maintenance (O&M), and general recommendations, including:

- Water resources strategies that maximize use of renewable supplies, support sustainable aquifer management practices, and identify potential opportunities to expand the City's water portfolio.
- Candidate capital improvement projects for the water distribution and wastewater collection systems, including projects defined for the City's 2021 Infrastructure Improvements Plan (IIP).
- Candidate capital improvement projects for the water, wastewater, and advanced water treatment facilities.
- Recommendations to address potential future water quality challenges.
- Recommendations to improve operations.

ES.4.1 Water Resources Recommendations

Scottsdale has a diverse water supply portfolio that provides flexibility in delivering supply for its customers. The water supply planning contained herein relies on assumptions that could change in the future. Risks to the City's water supply planning include:

- Higher than currently planned development densities, large individual developments, or other development impacts that result in higher intensity water demands.
- Continuation of climate change/climate aridification effects/long-term drought conditions or water supply allocation structural changes for CAP and/or SRP water that result in overall reduced supplies to the City.

The following recommendations are provided to guide the City with respect to water resources planning:

1. Continue to purchase Scottsdale's full CAP entitlement in years when it is available. This water supply represents approximately 60 percent of the City's total supply. In years when supplies exceed customer demands, this water can be recharged in the aquifer and banked for long-term storage credits.
2. Maximize underground water storage within the City's service area to promote restoration of groundwater levels and potentially dilute ambient arsenic concentrations.
3. Develop data management systems to track groundwater levels, well performance (yield), and the lateral movement of water with respect to the City's recharge program.
4. Conduct a well assessment study to evaluate Scottsdale inactive wells. This evaluation should focus on developing a road map that would delineate next steps, which may include well abandonment (i.e., to eliminate potential cross-contamination between aquifers), well rehabilitation, well replacement, and conversion to monitoring wells to track groundwater levels and water quality.
5. Seek opportunities to use NCS and FCS water in years when it is available, either through direct delivery to the CWTP or an exchange with another provider that would result in CAP (or similar) water delivered to the CAP WTP for recharge at the Water Campus.
6. Seek opportunities to use the City's Horseshoe Dam credits in years when they are available. Explore adding this supply to the City's next modification of its DAWS.
7. Continue to engage with SRP in discussions regarding Bartlett Dam New Conservation Storage surface water.
8. Continue to explore opportunities to lease CRIT water.
9. If drought and renewable water supply reductions continue and are severe, seek opportunities to use the ADWR drought exemption and the Arizona Water Banking Authority (AWBA) storage to offset impacts to the City's long-term storage credit account.
10. Explore opportunities to have high water use industries bring renewable water supplies with them as a condition of development approval.
11. Continue to track the proposed changes to ADWR's water conservation BMPs that are expected to be included in the 5th Management Plan while examining programs outside of the BMPs that could more effectively target Scottsdale's customer needs and efficiency opportunities.
12. Explore ordinance amendments to direct water conservation in new developments and re-development areas to address efficiency in building and landscape codes.
13. Explore opportunities to take wastewater from neighboring communities to enhance recycled water volumes at the Water Campus.
14. Consider further development of Water Campus/AWT-to-CAP WTP DPR in conjunction with the CAP WTP expansion planning and design. This additional purified water supply can increase redundancy and resiliency of the City's current water portfolio in light of increasing pressures of long-term drought on the Colorado River basin and the CAP.

ES.4.2 Water and Wastewater Infrastructure and Facilities Recommendations

Candidate capital improvement projects were identified through the water distribution system, wastewater collection system, and water/wastewater facilities evaluations. Each candidate capital improvement project (including the 2021 IIP projects) was identified as benefitting existing customers, future growth, or both. Key strategic drivers identified in the Scenario Planning exercise completed early in development of the IWRMP were also associated with each project. These drivers include:

- Water Resources and Supply Security.
- Infrastructure Capacity, Reliability, and Redundancy.
- Regulatory Compliance.
- Water Quality Improvements.

The timing of each project is indicated as either current (complete or ongoing) or projected in alignment with the IWRMP planning horizons: 2025, 2030, 2035 and 2055. These years indicate the estimated start of construction, but the City has flexibility to adjust the actual timing of projects to align with its annual CIP budgeting updates and available funding.

The IWRMP identified a total of $578 million in candidate capital project improvements required by year 2055. This includes the nearly $290 million in projects defined in the 2021 IIP. The IWRMP and IIP projects address the following areas:

- Water Distribution - $240 million
- Water Treatment - $88 million
- Water Supply - $69 million
- Wastewater Collection - $136 million
- Wastewater Treatment - $45 million

Table ES.10 summarizes the water and wastewater candidate capital project cost opinions for each IWRMP planning period by project type.

Table ES.10 IWRMP and IIP Candidate Capital Improvement Project Cost Summary

Project Type	On-going/ Complete	2025	2030	2035	2036 - 2055	Total
Water Distribution	$21,605,000	$75,951,000	$103,321,000	$20,343,000	$18,454,000	**$239,674,000**
Water Treatment	-	$50,100,000	$13,813,000	$23,900,000	-	**$87,813,000**
Water Supply	$36,000,000	$28,779,000	$4,000,000	-	-	**$68,779,000**
Wastewater Collection	$8,265,000	$88,398,000	$20,175,000	$13,901,000	$5,435,000	**$136,174,000**
Wastewater Treatment	-	-	$45,280,000	-	-	**$45,280,000**
Total	**$65,870,000**	**$243,228,000**	**$186,589,000**	**$58,144,000**	**$23,889,000**	**$577,720,000**

ES.4.3 Operations and Maintenance Recommendations

Potential efforts related to water and wastewater system operations and maintenance were identified through the IWRMP system evaluations and include:

- **Site 42** - Replacement of chemical metering pumps.
- **Water Campus WRP** - More detailed evaluation of:
  - Potentially interrelated issues regarding grit, chemical oxygen demand (COD) deficit and supplemental carbon addition, and achieving a lower nitrate concentration.
  - Increased frequency of acid washing of the odor control system scrubber packing, high hydrogen sulfide concentrations, and sedimentation basin corrosion.
- **Water Campus WRP, AWT, CAP WTP** - Evaluation of Water Campus complex electrical power loads, including the CAP WTP, WRP, and AWT facility, to confirm present backup power capacity aligns with reliability needs.
- **Water Campus WRP** - Conduct hydrogen sulfide sampling at the Water Campus WRP, including aqueous and air-borne samples, to measure the effectiveness of the odor control system to treat the measured hydrogen sulfide concentrations.
- **Various Water System Remote Sites** - Conduct a feasibility study to investigate options for installing additional back-up power generators at Site 143-Z13, Site 145, Site 110, Site 126, Site 115A, Site 42B, and Site 68.
- **CAP WTP** - Consider including the following efforts with the 20 mgd Plant 3 expansion:
  - Investigate the CAP WTP finished water reservoirs to identify potential hydraulic limitation to the effective storage volume and achievable contact time (CT).
  - Evaluate the CAP WTP long-term chemical storage and feed needs.
  - Evaluate the capacity of the existing residuals drying beds, and potential addition of mechanical dewatering to augment the capacity of the drying beds.
  - As previously stated under water resources recommendations, consider further development of Water Campus/AWT-to-CAP WTP DPR in conjunction with the CAP WTP expansion planning and design.
- **All Water and Wastewater Treatment Facilities** – Conduct periodic reviews of condition and operational status at all of the City's water and wastewater treatment facilities approximately every five years to identify potential rehabilitation and equipment replacement needs.

ES.4.4 Water Quality Recommendations

ES.4.4.1 Disinfection Byproduct Management Recommendations Summary

Based on the analysis of the disinfection byproducts (DBP) control strategies, the recommendations in Table ES.11 are provided for both operations and infrastructure.

Table ES.11 DBP Management Recommendations

#	Region	Recommendations
1	CAP WTP	Option 1 - Reduce total organic carbon (TOC) concentrations at CAP by increasing the carbon change out frequencies.
2	CAP WTP	Option 2 - Optimize CAP WTP granular activated carbon (GAC) scheduling by creating a new GAC scheduling tool.(1)
3	Central	GAC on-site treatment at Site 124 to mitigate total trihalomethanes (TTHM) issues.(2)
4	Desert Mountain	Use well blending from Well 85A to mitigate TTHM issues. If well blending does not achieve desired water quality, GAC on-site treatment at Site 92B is recommended.(3)

Notes:
(1) Recommended if Option 1 does not provide better water quality in the Desert Mountain and East Shea areas.
(2) Recommended if Option 2 for CAP WTP fails to achieve desired water quality in the East Shea area.
(3) Recommended if Option 2 fails to achieve desired water quality in the Desert Mountain area.

Increased blending of groundwater from the Cluster 6 wells with finished water at the CAP WTP should also have a beneficial effect with respect to reduced DBP formation potential and TTHM levels in the distribution system supplied by the CAP WTP. This blending can be considered as an opportunistic measure, either alone or in combination with recommendations listed in Table ES.11. Beyond TTHM concentration reductions, groundwater blending using the Cluster 6 wells will also help offset CAP water supply reductions.

ES.4.4.2 Overall Drinking Water Quality Recommendations Summary

A summary of the City's potential water quality challenges and overall recommendations from the water quality evaluation is presented in Table ES.12.

Table ES.12 Water Quality Recommendations Summary

Contaminant of Concern	Potential Water Quality Challenge	Recommendations
Lead and Copper	• Recent LCRR updates created effects on the City for recommended strategies, requiring additional efforts to be completed by 2024 for compliance with the LCRR.	• Develop an Lead Service Lines (LSL) inventory. • Develop an LSL replacement plan unless the City can confirm that all service lines are non-lead and are not galvanized requiring replacement (GRR) by the compliance deadline. • Update the lead and copper sampling pool to reflect the revised tiering structure under the LCRR. • Prepare updated communication on lead to comply with the LCRR. • Identify schools and childcare facilities requiring sampling starting in 2024 and prepare communication to alert the schools and facilities of the requirements. The City is in the process of confirming whether sampling can begin earlier than 2024.
TTHM	• Concentration spikes in the Desert Mountain and East Shea areas despite maintaining EPA LRAA compliance with current mitigation strategies.	• Potential hotspot treatment with GAC at Site 92 for Desert Mountain and in the East Shea Corridor. • Improvements / optimization of water distribution system as covered in Chapter 4.
PFAS	• EPA Regulatory Determination 4 puts PFOS & PFOA up for inclusion in NPDWR by March 2023. • Draft CCL 5 includes additional PFAS compounds for consideration. • UCMR 5 requires monitoring 29 PFAS.	• PFOS & PFOA detections localized to wells in the NIBW Superfund Site, which are treated by CGTF, TGTF, and the NGTF, and are at concentrations well below the EPA HAL of 70 ng/L for PFOS + PFOA. • PFOS & PFOA are readily removed through GAC contactors, which are currently installed at the NGTF. RO at the TGTF would also reduce PFOS & PFOA in CGTF flows. Efficacy of the existing treatment would require further investigation pending the release of the future EPA MCL, which should be by March 2023.
1,4-Dioxane	• Previously included in CCL 3, CCL 4, and monitored under UCMR 3, indicating continued interest for proposed regulation. • Included in latest draft CCL 5.	• 1,4-Dioxane detections localized to wells in the NIBW Superfund Site, which are treated by CGTF, TGTF, and NGTF, and are at concentrations above the 0.78 µg/L Region 9 Screening Level. • Partial-stream RO treatment at TGTF would remove 1,4-dioxane and blend with the remainder of CGTF treated water. • Continued monitoring of 1,4-dioxane is recommended.
Nitrosamines	• Previously included in CCL 3, CCL 4, and monitored under UCMR 2, indicating continued interest for proposed regulation. • Included in latest draft CCL 5.	• Nitrosamine detection was limited to NDMA at Wells 33, 122, and 140 – all of which are part of Cluster No. 6—these wells feed into and are blended at the CAP WTP. Detected concentrations were below 15 ng/L. • Continued monitoring of nitrosamines is recommended.
Hexavalent Chromium	• Well 23 exceeded EPA MCL concentrations of 100 µg/L.	• Well 23 is part of Well Cluster 8 and is treated at Arsenic Treatment Facility (ATF) 32. Due to issues with hexavalent chromium, Well 23 is only operated for water quality sample collection.
Perchlorate	• Well 86 is the only area with perchlorate detections.	• The EPA final determination on perchlorate was to not regulate it. Arizona's existing HAL is set at 11 µg/L, and the Well 86 maximum concentration was 1.80 µg/L. • Continued monitoring is recommended to confirm concentrations remain below the Arizona HAL.
VOCs	• Existing known contamination plumes and further regulatory standards anticipated.	• Continue monitoring for VOCs/SOCs at CGTF and NGTF wells. • Track EPA's progress toward a new carcinogenic VOCs (cVOCs) Rule, which began over a decade ago.

Abbreviations:
LCRR = Lead and Copper Rule Revisions; PFOS = perfluorooctanesulfonic acid; PFOA = perfluorooctanoic acid; CCL = Contaminant Candidate List; NPDWR = National Primary Drinking Water Regulations; UCMR = Unregulated Contaminant Monitoring Rule; TGTF = Thomas Groundwater Treatment Facility; CGTF = Central Groundwater Treatment Facility; NGTF = North Indian Bend Wash Granular Activated Carbon Treatment Facility; EPA = United States Environmental Protection Agency; HAL = Health Advisory Level; RO = reverse osmosis; NIBW = North Indian Bend Wash; NDMA = N-nitrosodimethylamine; VOC = volatile organic compound; SOC = synthetic organic contaminant; MCL = maximum contaminant level; µg/L = micrograms per liter; ng/L = nanograms per liter