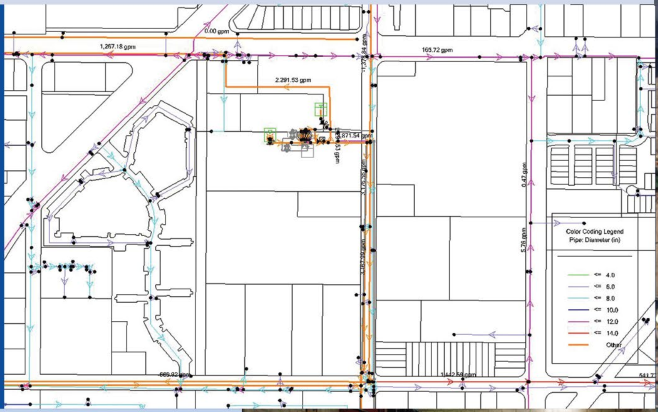
City of
**Huntington Beach**

# WATER MASTER PLAN **UPDATE**



## NOVEMBER **2023**

Prepared for:

City of Huntington Beach
2000 Main Street
Huntington Beach, CA 92648

Prepared by:

TETRA TECH

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# WATER MASTER PLAN UPDATE

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Prepared for:
**CITY OF HUNTINGTON BEACH**
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Huntington Beach, CA 92648

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# EXECUTIVE SUMMARY

## ES.1 Purpose

The purpose of this report is to update the City's water master plan, which was last updated in October 2016 (2016 Water Master Plan). The primary purpose of the master plan is to identify the capital improvement projects needed over the next 20 years, consistent with typical asset management practices to maintain a healthy water infrastructure.

The Water Master Plan Update evaluates the water system performance and facilities for the planning period 2020 through 2040. System supply and demands have been projected for the years 2020 through 2045, consistent with the planning period for the City's 2020 Urban Water Management Plan (UWMP) submitted to and approved on June 7, 2021 by the State Department of Water Resources. This Water Master Plan Update includes the evaluation of City growth, water demands, water supply and reliability, water quality, water storage, emergency water supply, energy use and recovery, and water distribution system piping, in order to determine recommended capital improvements over the next 20 years.

Following the adoption of this Water Master Plan Update by City Council, City staff will prepare a Water Financial Plan with recommendations to replenish the Water Master Plan Fund for on-going improvement efforts. The City is conducting a Water Rate Study and intends on holding a Public Hearing in the Spring of 2024 to adjust rates for the next five (5) years. The Water Financial Plan will evaluate projected costs, scheduling and funding of recommended projects to be paid for in the City's Water Master Plan Capital Improvements Program (CIP). After both the Water Master Plan Update and the Water Financial Plan are completed, the City staff will implement the recommended projects as approved by the City Council.

## ES.2 City Characteristics and Projected Growth

Of the 17,482 acres of land within the City of Huntington Beach boundaries, including the community of Sunset Beach, only 0.59% of the City remains as vacant land (103 acres). It is assumed that ultimately this vacant land may be developed with the exceptions of land designated as open space. Additionally, some areas of the City that are currently developed may experience redevelopment of the existing onsite uses, including the Beach-Edinger Corridors Specific Plan and the Downtown Specific Plan areas. Development in the City may include 13,368 new housing units, which is the City's 6$^{th}$ Cycle regional housing needs assessment (RHNA) allocation determined by the Southern California Association of Governments (SCAG).

The City's population is projected to increase 20.2% from 198,725 in 2020 to 238,770 in 2045, with total dwelling units increasing from 82,524 to 97,061 (17.6%) over the same twenty-five-year period. These increases are predominantly related to the 6$^{th}$ Cycle RHNA allocation.

Historical and projected water service area population and housing for the City's 2020 Urban Water Management Plan (UWMP) and this master plan was based on the Center for Demographic Research (CDR) at California State University Fullerton Orange County Projections (OCP) 2020 data. This data was then adjusted for the RHNA allocation.

## ES.3 Water Demand

City water demands have not changed significantly over the past 15 years even though development has occurred, and the City's population has increased. City potable water supply for the 10 water years 2010/11 through 2019/2020 averaged 27,727 acre-feet per year (AFY). Note that a water year is July through June, whereas the City's fiscal year during this time period ran from October through September. The City has since changed the water fiscal year to July through June. The City has managed to keep total demands flat through the implementation of water conservation practices and by reducing unaccounted-for water.

In 2005, the City's Water Master Plan estimated unaccounted-for water, which is the difference between water supply and water consumption, averaged 6.4%. During the five year period from 2015/16 to 2019/20, unaccounted-for water dropped to 0.9%. This reduction in unaccounted-for water is attributed to leak detection surveys, an on-going leak investigation and repair program, and a comprehensive program of water main replacements undertaken by the City. Additionally, as of 2018 the distribution section switched from hydrant flushing to using NO-DES (Neutral Output Discharge Elimination System) flushing technology. This technology uses a filter system that treats turbidity, allowing the flushed water to be used instead of discharging to waste. The current rate of unaccounted-for water is commendable for a system the size, age, and complexity of the City of Huntington Beach.

Total water use per person in the City has historically been less than total water use per person in Orange County. For comparison, Municipal Water District of Orange County (MWDOC) reported total water use in their service area for 2019/20 of 427,701 AFY serving a population of 2,342,740, which equates to 0.183 acre-feet per person (163 gallons per capita per day (GPCD)). During the same period, the City of Huntington Beach's usage was 25,966 AFY serving a population of 198,725 or 0.131 acre-feet per person (117 GPCD), almost 30% less.

### *Existing Water Demand*

Per the 2020 UWMP, 2019/20 demand, including unaccounted for water, was determined to be an average of 25,966 AFY (23.2 million gallons per day (MGD)) or 16,098 gallons per minute (gpm).

### *Projected Water Demand*

In order to be consistent with the City's UWMP, future 2045 water demands were projected based on the 2020 UWMP. However, the UWMP did not include impacts from RHNA, so those demands were added. Based on the foregoing, the 2045 water demand is projected to increase to 30,538 AFY or approximately 27.3 MGD, 17.6% higher than the 2020 demand of 25,966 AFY. This increased water demand equates to an annual water demand growth of approximately 0.7% per year, compounded annually.

Maximum Day Demand (MDD) is the highest daily demand over the year and is an important metric in water master planning. Typically, an agency provides capacity to meet the MDD from supply sources. Demands above the MDD including peak hour demands and fire flows can then be met from storage facilities such as reservoirs. The City's MDD has been determined to be 1.8 times the average day demand based on analysis of existing historical patterns. With an existing average day demand of 23.2 MGD or 16,098 gpm, the existing MDD is 41.8 MGD or 28,976 gpm. For the year 2045, or Build-out, the projected average day demand increases to 27.3 MGD or 18,932 gpm and the MDD increases to 49.1 MGD or 34,078 gpm.

## ES.4 Water Supply and Reliability

City water supply has historically come from groundwater production and from supplemental, treated, imported water purchased from MWDOC, which is a member agency of the Metropolitan Water District of Southern California (MWD).

As a member agency of Orange County Water District (OCWD), the City is entitled to produce groundwater from the Orange County Groundwater Basin (Basin). The Basin, which is managed by OCWD, is unadjudicated. The City and other Basin producers pay a Replenishment Assessment (RA) to OCWD for all groundwater produced up to a percentage of the producer's total water supplies used to meet demands. This percentage is called the Basin Production Percentage (BPP), which is set uniformly for all producers annually by OCWD based on Basin conditions and long-term projections.

For FY 2021/22, OCWD set the BPP to 77%, where it has been for the previous three years due to drought conditions and low Basin levels. In mid-year FY 2022/23, the BPP was adjusted and was set to an average of 85%. OCWD set a BPP of 85% for FY 2023/24. OCWD increased the RA to $624/acre-foot for FY 2023/24.

In addition to the RA, OCWD charges a Basin Equity Assessment (BEA) for pumping in excess of the BPP, which is basically a penalty to help maintain the Basin at projected levels. The BEA essentially equates the cost of groundwater pumped over and above the BPP to the rate charged for imported replenishment water from MWDOC. The BEA rate will vary slightly between different member agencies of OCWD, as the rate is adjusted based on each member agency's groundwater pumping costs.

It benefits the City to use groundwater up to the maximum allowable BPP because groundwater is less expensive and more reliable than imported water. The City supplements groundwater with treated, imported water from MWDOC at the current rate of $1,124/acre-foot exclusive of connection charges, readiness to serve charges, and other fixed fees, while the groundwater rate for 2021/22 is only $253.50/acre-foot. Both imported water and groundwater rates shown above are costs to purchase water and does not include capital or operating and maintenance expenses such as energy, chemical, well rehabilitation/maintenance and other costs. The City's (FY 2021/22) cost for producing groundwater up to the BPP including the RA and energy costs (but not including other well operation and maintenance costs) is $320.50/acre-foot.

The City's water supply averaged 60% pumped groundwater and 40% imported purchased water over the six-year period (2014/15 to 2019/20). It should be noted, however, that the City participates in the In-Lieu or Cyclic Storage Program offered by OCWD and MWD, when available. This is a groundwater program that refills the Basin by avoiding pumping from the Basin and is usually offered in the wetter years and in the lower demand period of October through April. In addition, OCWD also periodically offers the City water through the Coastal Pumping Transfer Program (CPTP), which is similar to the In-Lieu program.

The City has a current well supply capacity of approximately 27,050 gpm from nine existing wells. However, the normal operating capacity of these existing wells is approximately 20,350 gpm or 75% of total capacity. The reason the normal operating capacity is less than total capacity is that some of these wells are not operated at 100% of capacity in consideration of such factors as groundwater level, water quality, availability of in-lieu water, etc. Additionally, the life of the wells and associated supply equipment can be prolonged when operating at less than full capacity.

The City is fortunate to overly the Basin, which has been able to sustain BPPs from the mid-60s to 70 percent throughout past years. During preparation of the City's 2020 UWMP, OCWD conservatively projected that a BPP of 75 percent could be maintained throughout the next twenty-plus years. This means that the City can assume that at least 75 percent of its projected demands can be met by local groundwater produced from City wells overlying the Basin. However, due to current favorable basin conditions, the continuing move toward water conservation, and the expanded Groundwater Replenishment System (GWRS) projections, OCWD staff has indicated that they will be increasing the BPP to 85% for 2023/24 and feel that agencies could easily use 85% as a conservative BPP projection for long-term planning.

An analysis was conducted to determine the ability of the current well supply to meet a BPP of 85% with projected 2025 (near term) and 2045 (build-out) demands assuming normal operating capacities of the wells and historical demand patterns by month. The result is that without running the wells beyond the normal operating capacity for long periods of time in the summer months there could be reliability issues if one or more wells are down for any reason. If this occurred, the City could still meet these maximum monthly demands by utilizing additional quantities of imported water and could potentially still catch up to the BPP by pumping more in the winter months. However, it is recommended that a well study be conducted to analyze this in more detail as well as evaluate the condition of all existing wells and their remaining useful life, potential water quality issues related to high chloride levels in the vicinity of three of the City's wells near the Peck/Springdale Reservoir complex, potential water quality issues due to future more stringent regulations, and the potential need for replacement wells or new wells at new sites altogether in the future.

### Water Quality

The City's water supply, made up of groundwater and imported treated surface water, consistently meets or exceeds all State and federal potable water quality standards. In addition, based on historic water quality, the groundwater is anticipated to meet recently adopted and proposed federal and State water quality regulations including a new lower maximum contaminant level (MCL) for arsenic, an upgraded rule for groundwater disinfection, an MCL for radon, new monitoring requirements for disinfectant byproducts, and an MCL for hexavalent chromium. However, the City will need to monitor proposed radon regulations, as the State has not yet determined which radon mitigation program will be implemented.

The development of standards for PFOA, PFOS, and other PFAS are among the priorities of the Division of Drinking Water. Currently, there are no maximum contaminant levels (MCLs) established for PFAS, however, notification levels (NLs) are established as precautionary measures for contaminants that may be considered candidates for establishment of MCLs but have not yet undergone or completed the regulatory standard setting process. Response levels (RLs) are set even higher than NLs and represent a recommended chemical concentration level at which water systems consider taking a water source out of service or provide treatment. Starting in January 2020, water systems that receive an order and detect levels of PFAS substances that exceed their RLs shall take that water source out of use, treat the water delivered, or provide public notification. As of the date of writing of this master plan, only one active City well has been affected by the PFAS notification levels. Well 6 had been tested with PFHxS exceeding the notification level in March of 2023.

The City is addressing unique issues at a handful of its wells. Well 3A has recently been taken out of service for exceedance of MCL for Manganese. The City is working on a treatment system in an effort to bring the well back into service with minimum downtime. Additionally, Well 9 has recently experienced odor issues caused by high H2S levels. This odor is currently being mitigated using granular activated carbon.

## ES.5 Facilities and Operation

The City's existing potable water system facilities and pipelines are shown on Figure 4-1 and the system hydraulic schematic is shown on Figure 4-2. The City's existing storage system consists of four reservoirs (Overmyer, Peck, Springdale and Edwards Hill), all located in the lower pressure zone (Zone 1), with a combined storage capacity of 55.0 million gallons (MG). The Peck and Springdale reservoirs are located at the same site in the northerly portion of the City. Booster stations are located at the three reservoir sites to pump water from the reservoirs into the distribution system.

The City's service area is composed of two pressure zones: Zone 1 and Zone 2. Ground elevations in Zone 1 vary between 5 feet below and 80 feet above sea level. The Overmyer, Peck and Edwards Hill booster pump stations boost water from their respective reservoirs into the Zone 1 distribution system. Zone 2 serves the 800-acre Reservoir Hill area that rises to an elevation of 109 feet. The Reservoir Hill Booster

Pump Station, which is located at the Overmyer site, boosts water from Zone 1 into Zone 2. The Edwards Hill Booster Pump Station also has Zone 2 pumps.

In addition to the four booster pump stations and storage reservoirs, the City's existing potable water distribution system includes eight currently active well facilities that pump directly into the distribution system; three imported water service connections; four emergency water connections with neighboring public water systems; and 594 miles of transmission and distribution piping ranging in size from 4 inches to 42 inches in diameter.

## ES.6 Storage and Emergency Supply

The City currently has 55.0 MG of storage capacity located at the Overmyer, Peck, Springdale and Edwards Hill reservoirs. Booster Stations are located at the Overmyer, Peck/Springdale, and Edwards Hill sites to pump water from the reservoirs into the Zone 1 distribution system to appropriate pressures. The Reservoir Hill Booster Pump Station, which is located at the Overmyer site, boosts water from Zone 1 into Zone 2. In addition to pumping to Zone 1, the Edwards Hill Booster Pump Station also boosts water into Zone 2.

As recommended in the City's last four master plans, a 10 MG storage reservoir, the Southeast Reservoir, and a 11,000 gpm booster pump station is proposed in the southeast quadrant of the City to improve water supply reliability and storage for the area south of the Newport-Inglewood Fault and south of Bolsa Chica. Currently there are no storage reservoirs or supply sources located south of the fault and an earthquake on this fault could potentially interrupt water conveyance across the fault, leaving the southern portion of the City with limited ability to obtain potable water or even eliminating all potable water conveyance to the area. Construction of a Southeast Reservoir and Booster Pump Station would increase the total storage capacity to 65.0 MG.

The City's existing storage volume is more than adequate for all operational and the highest fire flow demand in either of the two pressure zones. Emergency storage is calculated after required operational and fire flow volumes are depleted. Using this methodology, the City has 1.62 days of emergency storage volume at existing demands and 1.38 days at projected year 2045 average demands. With the addition of the 10.0 MG Southeast Reservoir, the City would have 2.05 days of existing demand and 1.74 days of projected 2045 demand in storage. These emergency storage volumes place the City approximately in the middle of 24 water agencies surveyed by the City's Department of Public Works in 2001.

Backup water supply can augment storage during certain specific emergency water supply scenarios. In this regard, several different emergency storage/supply scenarios were evaluated including a complete loss of the City's imported water supply coupled with a 7-day electrical power outage.

Likely causes for an imported water outage or reduction in supply could be a break in an imported water transmission main or mains or an outage at a water treatment plant caused by an earthquake or other event. It was determined that the City has sufficient emergency storage, groundwater supply, and emergency power to withstand an imported water outage of 31 days or longer coupled with an electric power outage lasting the first 7 days of this emergency scenario.

Another possible emergency scenario is a complete loss or reduction in the City's groundwater supply from the Orange County Groundwater Basin, conceivably as a result of Basin groundwater contamination. It was determined that the City has sufficient emergency storage and imported water supply capacity to withstand this emergency scenario as well. The maximum allocation of 22,000 gpm of imported water from MWDOC would be more than sufficient to meet the City's average day demands of 14,146 gpm and 15,146 gpm, which is the City's 2025 and year 2045 average day demands, respectively, reduced by 20% through public notification. Assuming that there is a strain on the imported water supply presumably because of other basin producers affected by similar groundwater shortages, the City of Huntington Beach could rely upon emergency storage to supplement supply and has approximately 37 MG of existing emergency storage available.

## ES.7 Water Transmission and Distribution System Modeling

In the 2012 Water Master Plan Update, the hydraulic model provided by the City staff was validated and updated with analysis of projected future 2035 demand conditions. However, since then, annual demands have actually decreased while population increased, primarily due to a steady trend of water reduction through aggressive water conservation efforts. The projected future 2035 demand from the 2012 Water Master Plan was 34,657 AFY, while the projected future 2045 demand from this master plan is 30,538 AFY. In addition, no major physical pipeline or supply improvements have been made since 2012, and any proposed improvements from "New Projects" listed in Table 7-3 would enhance the water system hydraulically. Minor pipeline improvement projects completed since the 2016 Water Master Plan have been added to the model as listed in Table 6-1 and 6-2. In the future, as major improvements are constructed, the City's water engineering team will update the model accordingly.

The City's existing hydraulic network model was originally created by the City in 1998 to analyze the City water transmission and distribution system performance. This model has been updated and refined over the years. For this master plan, the latest model was provided by City staff at the outset of the project. The modeling software is Water GEMS by Bentley Systems. The model is used routinely by City staff and contains numerous scenarios. It contains all pipes in the existing water distribution system, and several demand allocations including those representing existing and estimated future demand conditions for average day, maximum day, and peak hour demands.

For this report, the existing demands were revised to correspond to the reduced demands experienced over the past few years, as consistent with the City's 2020 UWMP. Then a series of validation analyses were conducted to verify that the model adequately simulated observed operating conditions within the distribution system. Hydraulic analyses conducted for this project used the existing system model to create a series of extended period simulation (EPS) analyses using a representative typical week of diurnal curves. Hydraulic analyses were conducted under existing and future year 2045 demand conditions. These hydraulic analyses were then used to confirm or develop sizing on capital improvements and develop system optimization recommendations.

## ES.8 Capital Improvement Program

A financing plan was adopted in 1995 to pay for water system project improvements identified in that master plan as well as projects remaining from the 1988 Water Master Plan. The water master plan Capital Improvement Program (CIP) was last updated through the 2016 Water Master Plan and this plan updates those capital projects based on current and projected system demands, more refined modeling techniques, potential alternative capital projects to the Southeast Reservoir and Booster Station project, the status of the original recommended CIP, and updated cost information.

New projects identified from this Water Master Plan Update, including those that may arise from future studies, may require raising user rates. Savings generated from the recent removal of the water desalination project from the City's Water Master Plan projects, or through savings from any of the other remaining Water Master Plan projects above may lessen the anticipated rate increase.

### *Remaining Water Master Plan Projects*

Water master plan projects that remain to be constructed from the 2016 Water Master Plan are listed below in Table ES-1, identified by their project numbering from previous 1995, 2000, 2005, 2012, and 2016 water master plans. Projects for which money has been encumbered prior to May 30, 2012 are not included as a remaining master plan project and those encumbered funds are therefore not included as available.

The estimated costs for the remaining twenty-two (22) capital projects described above, in 2022 dollars, are summarized along with their year of anticipated design and construction on Table ES-1.

### *New Water Master Plan Projects*

Eleven (11) new Water Master Plan projects and annual programs have been identified below, numbered from No. 58 to No. 68. These new projects and remaining projects above will all be funded by available Water Master Plan funds and will be prioritized and implemented in a reasonable manner in accordance with need and funding ability. The estimated costs for the new capital projects described below, in September 2022 dollars, are summarized along with their year of anticipated design and construction on Table ES-2. This preliminary design and construction phasing can be adjusted as needed following the financial plan analysis.

### Improvement Projects Categorized Into 8 Programs

All 33 improvement projects and programs identified and described above are divided into 8 Capital Improvement Water Programs with recommended phasing over the next 20 years and an estimated uninflated total cost of $ 177 Million. They are as follows:

- Water System Corrosion Control - 3 Projects/Programs - $8.5 Million
- Water Resiliency Program – 3 Projects/Programs - $47.0 Million
- Water Main Replacements - 4 Projects/Programs - $40.8 Million
- Water Production System Improvements - 11 Projects/Programs - $57.7 Million
- Water Facilities Security Improvements - 5 Projects/Programs - $1.2 Million
- Water Engineering Studies - 5 Studies/Programs - $1.1 Million
- Unanticipated/Emergency – 1 Project - $0.2 Million
- Sustainability Projects – 1 Project - $1.5 Million

### Recommendations for Additional Studies

Section 3.3.9 of this Water Master Plan recommends a Groundwater Master Plan be developed. This plan would assess the condition of each of the City's existing wells, determine their remaining useful life, and develop a systematic approach to replacement of wells in their same general location and/or the addition of new wells at future locations.

**Table ES-1**
**Estimated Costs for Remaining Master Plan Projects**

| Project # from 2016 WMP | Project Name | Estimated Design FY | Estimated Design Cost[a,b] | Estimated Construction FY | Estimated Construction Cost[a,c] | Total Estimated Cost | Program Category | Priority |
|---|---|---|---|---|---|---|---|---|
| 12 | Well 13 Permanent Wellhead | 2030 | $289,000 | 2025 | $2,599,000 | $2,888,000 | Production | 4 |
| 13 | Southeast Reservoir and Booster Pump Station | 2033 | $2,306,000 | 2034-35 | $27,653,000 | $29,959,000 | Resiliency | 5 |
| 14 | Southeast Reservoir Transmission Main | 2033 | $726,000 | 2034-35 | $7,733,000 | $8,460,000 | Resiliency | 5 |
| 14A | New Connection – Overmyer to SE TM | 2033 | $781,000 | 2034-35 | $7,811,000 | $8,593,000 | Resiliency | 5 |
| | 1.75 mi. 36” to 42” in Huntington Street | | $723,000 | | $7,225,000 | $7,948,000 | | |
| | Interconnects at Overmyer Reservoir | | $37,000 | | $370,000 | $407,000 | | |
| | PRVs at SE Reservoir and Atlanta/Downtown Lp | | $22,000 | | $218,000 | $238,000 | | |
| 26 | New Well No. 14 | 2025 | $1,083,000 | 2026-27 | $6,138,000 | $7,221,000 | Production | 1 |
| 27 | New Well No. 15 | 2028 | $1,083,000 | 2029-30 | $6,138,000 | $7,221,000 | Production | 1 |
| 31 | Aging Pipe Replacement (Include 5% of AC Pipe) | Annual[f] | $3,610,000 | Annual[f] | $36,104,000 | $39,714,000 | Replacement | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 34 | 8" Pipe Replacement Humboldt Bridge Rehab | 2024 | $36,000 | 2025 | $108,000 | $144,000 | Replacement | 3 |
| 35 | OC-9 Replace 22" for I-405 Widen (OCTA Pays) | 2017 | -- | 2023 | -- | -- | Replacement | DONE |
| 41 | Groundwater Master Plan | 2025 | $217,000 | NA | -- | $217,000 | Study | 2 |
| 42 | Security at Well 3A | 2025 | $72,000 | 2026 | $144,000 | $217,000 | Security | 4 |
| 43 | Security at Well 6 | 2027 | $73,000 | 2028 | $144,000 | $217,000 | Security | 4 |
| 45 | Security at Well 9 | 2031 | $73,000 | 2032 | $144,000 | $217,000 | Security | 4 |
| 46 | Security at Well 10 | 2033 | $73,000 | 2034 | $144,000 | $217,000 | Security | 4 |
| 48 | Water System Corrosion Control | Annual[f] | $60,000 | Annual[f] | $1,444,000 | $1,504,000 | Corrosion | 3 |
| 50 | WMP and Financial Plan Updates | Every 5 Years | $289,000 | NA | -- | $289,000 | Study | 3 |
| 51 | Urban Water Management Plans | Every 5 Years | $289,000 | NA | -- | $289,000 | Study | 3 |
| 52 | 8.6 Miles OC-44 Corrosion Control[d,e] | NA | -- | 2028-29 | $2,475,000 | $2,475,000 | Corrosion | 3 |
| 53 | WOCWB OC-35 and OC-9 Corrosion Control[h] | 2024-26 | $420,000 | 2025-27 | $5,250,000 | $5,670,000 | Corrosion | 1 |
| 54 | OC-44 Scour Protection 30" at Creek Crossing[e] | 2024 | $25,000 | 2025 | $371,000 | $396,000 | Replacement | 3 |
| 55 | Overmyer Booster Station Dual Drive | 2030 | $433,000 | 2031-32 | $2,455,000 | $2,888,000 | Production | 5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 56 | Peck Reservoir Roof Replacement | 2032 | $1,045,000 | 2033-34 | $6,955,000 | $8,000,000 | Production | 1 |
| **TOTAL** | | | **$13,765,000** | | **$121,623,000** | **$135,389,000** | | |

a) Estimated Cost estimates as of August 2022. Includes January CCI (LA ENR = 12556) and an estimated 20% increase to current month (August). Escalation of design and construction costs will be accounted for in the Financial Plan

b) Design Costs range from 5 to 15% of construction costs, depending on project size and complexity and include preliminary design, final design, potholing, geotechnical, survey, and bidding services.

c) Construction Costs include construction management and City project management. Construction management costs range from 2.5 to 5% of construction costs for shop drawings, RFIs, field visits, etc., but do not include inspection services.

d) City project management costs range from 5 to 9% of construction costs and may include inspection services depending on the project type.

e) City of Huntington Beach only responsible for portion of cost based on proportion of ownership (41.4%)

f) Design already complete or costs encumbered.

g) Amount shown is the sum of 20 years.

h) City of Huntington Beach only responsible for portion of cost based on proportion of ownership (52.5%)

**Table ES-2**
**Estimated Costs for New Master Plan Projects**

| Project # | Project Name | Estimated Design FY | Estimated Design Cost | Estimated Construction FY | Estimated Construction Cost | Total Estimated Cost | Program Category | Priority |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 58A | Well 1A Sodium Hypochlorite On-site Generation | 2024-28 | $8,678 | 2025-29 | $368,618 | $377,296 | Production | 2 |
| 58B | Well 3A Sodium Hypochlorite On-site Generation | 2024-28 | $9,553 | 2025-29 | $405,774 | $415,327 | Production | 2 |
| 58C | Well 4 Sodium Hypochlorite On-site Generation | 2024-28 | $15,683 | 2025-29 | $666,204 | $681,887 | Production | 2 |
| 58D | Well 5 Sodium Hypochlorite On-site Generation | 2024-28 | $9,931 | 2025-29 | $421,869 | $431,800 | Production | 2 |
| 58E | Well 6 Sodium Hypochlorite On-site Generation | 2024-28 | $18,291 | 2025-29 | $776,969 | $795,260 | Production | 2 |
| 58F | Well 7 Sodium Hypochlorite On-site Generation | 2024-28 | $22,275 | 2025-29 | $946,196 | $968,471 | Production | 2 |
| 58G | Well 9 Sodium Hypochlorite On-site Generation | 2024-28 | $18,917 | 2025-29 | $803,543 | $822,460 | Production | 2 |
| 58H | Well 10 Sodium Hypochlorite On-site Generation | 2024-28 | $16,534 | 2025-29 | $702,345 | $718,879 | Production | 2 |
| 58I | Well 13 Sodium Hypochlorite On-site Generation | 2024-28 | $20,798 | 2025-29 | $883,466 | $904,264 | Production | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 58J | Edwards Hill Reservoir Sodium Hypochlorite On-site Generation | 2024-28 | $14,195 | 2025-29 | $602,973 | $617,168 | Production | 2 |
| 58K | Overmyer Reservoir Sodium Hypochlorite On-site Generation | 2024-28 | $15,899 | 2025-29 | $675,355 | $691,254 | Production | 2 |
| | | | | | | | | |
| 59A | Well 1A Hydrofluorosilicic Acid On-site Generation | 2024-28 | $8,678 | 2025-29 | $368,618 | $377,296 | Production | 2 |
| 59B | Well 3A Hydrofluorosilicic Acid On-site Generation | 2024-28 | $9,553 | 2025-29 | $405,774 | $415,327 | Production | 2 |
| 59C | Well 4 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $15,683 | 2025-29 | $666,204 | $681,887 | Production | 2 |
| 59D | Well 5 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $9,931 | 2025-29 | $421,869 | $431,800 | Production | 2 |
| 59E | Well 6 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $18,291 | 2025-29 | $776,969 | $795,260 | Production | 2 |
| 59F | Well 7 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $22,275 | 2025-29 | $946,196 | $968,471 | Production | 2 |
| 59G | Well 9 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $18,917 | 2025-29 | $803,543 | $822,460 | Production | 2 |
| 59H | Well 10 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $16,534 | 2025-29 | $702,345 | $718,879 | Production | 2 |
| 59I | Well 13 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $20,798 | 2025-29 | $883,466 | $904,264 | Production | 2 |
| 59J | Edwards Hill Reservoir Hydrofluorosilicic Acid On-site Generation | 2024-28 | $14,195 | 2025-29 | $602,973 | $617,168 | Production | 2 |
| 59K | Overmyer Reservoir | 2024-28 | $15,899 | 2025-29 | $675,355 | $691,254 | Production | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Hydrofluorosilicic Acid On-site Generation | | | | | | | |
| 60 | Independent Review of all City Water Facilities by Engineering Firm. | 2025 | $300,000 | -- | -- | $300,000 | Study | 1 |
| 61 | Lead and Copper Rule Revision (LCRR) Inventory Study and GIS Update | 2024 | $50,000 | -- | -- | $50,000 | Study | 2 |
| 62 | Well No. 8 Replacement / Rehabilitation | 2024 | $330,000 | 2024-25 | $2,900,000 | $3,230,000 | Production | 1 |
| 63 | New Water Well No. 16 | 2025 | $1,083,000 | 2025-26 | $6,138,000 | $7,221,000 | Production | 2 |
| 64 | Water Facilities SCADA Cybersecurity Improvements | 2023 | $300,000 | 2023-24 | -- | $300,000 | Security | 4 |
| 65 | Well Quality Emergency Mitigation/Treatment Program | 2024 | $200,000 | -- | -- | $200,000 | Unanticipated/ Emergency | 5 |
| 66 | Electrical Vehicle Charging Stations at the Utilities Yard | 2028 | $300,000 | 2029 | $1,200,000 | $1,500,000 | Sustainability | 5 |
| 67 | Manganese Treatment System at Well 3A | 2024 | $200,000 | 2024 | $2,000,000 | $2,200,000 | Production | 1 |
| 68 | Well 4 Rehabilitation | 2024 | $150,000 | 2024 | $1,350,000 | $1,500,000 | Production | 1 |
| **TOTAL** | | | **$3,255,000** | | **$28,095,000** | **$31,350,000** | | |

# 1 CITY CHARACTERISTICS AND PROJECTED GROWTH

The City has reached near full development with less than 1% of land remaining vacant. It is assumed that this land will be developed ultimately with the exception of land designated as open space, which is assumed to remain open space, i.e. no projected increase in future water demands. However, development and redevelopment projects that are either on-going or planned will affect future water demands. The City's population is projected to increase 3.6% by 2045, with housing projected to increase 1.42%[1]. However, this number does not include projected population increase due to the City's 6th Cycle RHNA allocation. The City's 6th Cycle RHNA allocation requires the City to demonstrate zoning capacity for 13,368 housing units between the years 2021 through 2029. The City's population (including population associated with RHNA) is projected to increase by 20.2% by 2045 with number of housing units to increase 17.6%. These calculations assume the entire 13,368 RHNA units are constructed and occupied.

## 1.1 Land Use

There are 17,482 acres of land within the City's limits according to the general plan land use categories in the City's current General Plan. Existing land use in the City is shown on Figure 1-1 and is tabulated in Table 1-1. The existing land use presented below is from the City's current General Plan which can be found at https://www.huntingtonbeachca.gov/government/departments/planning/gp/index.cfm and from the vacant land survey in 2018. Land Use presented in this water master plan is solely for the purposes of estimating water demands.

As shown in Table 1-1, only 0.59% of the City remains as vacant land (103 acres). Of this vacant land, approximately 46% is designated residential, 12% mixed use, 4% commercial, 33% industrial, and 5% is designated open space. It is assumed that all of this land will be developed ultimately with the exception of land designated as open space, which is assumed to remain open space, i.e. no projected increase in future water demands.

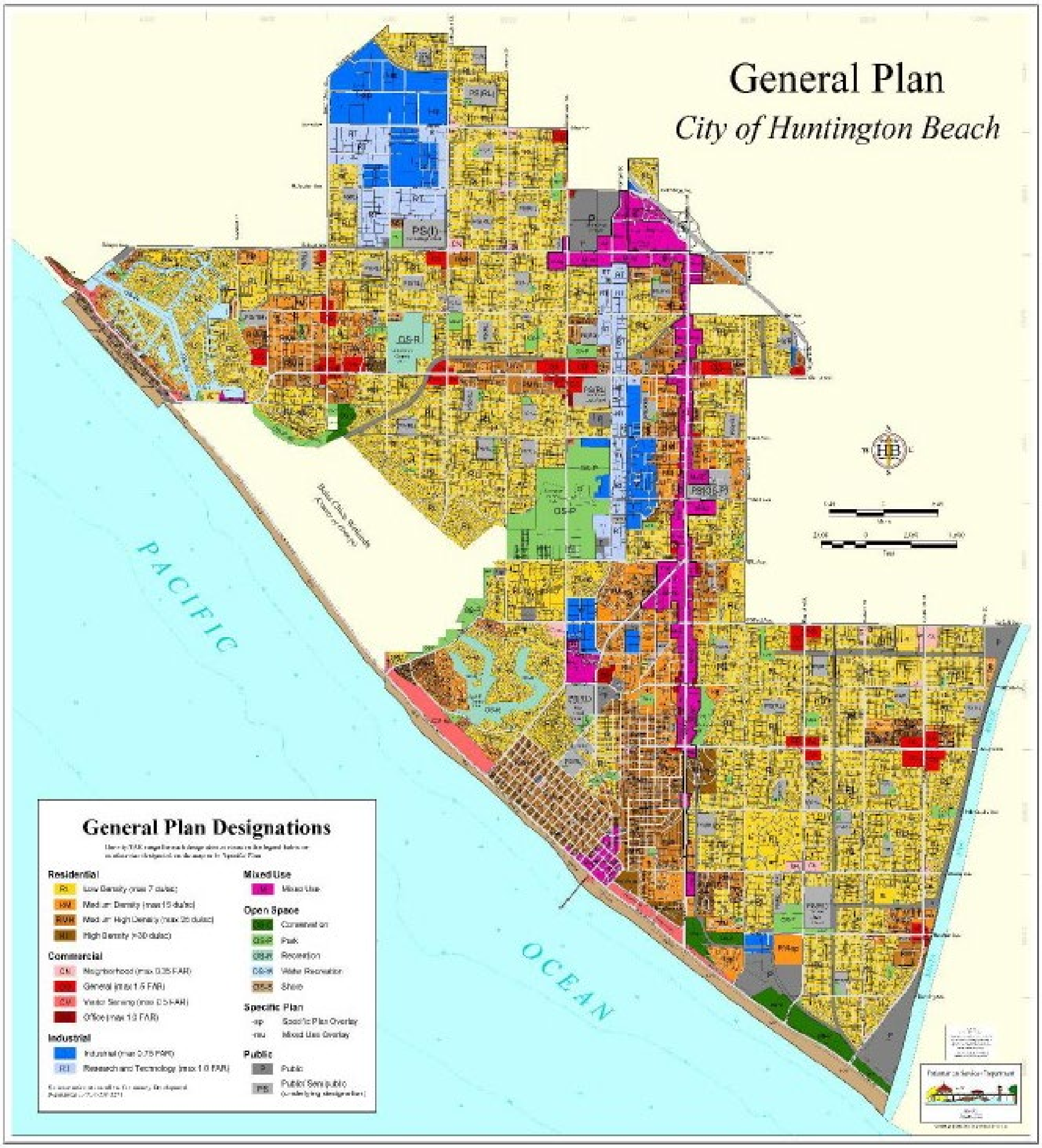
In addition to the General Plan land use designations, the City also has 17 Specific Plans. The Specific Plans that are currently experiencing the most development are the Beach and Edinger Corridors Specific Plan, the Downtown Specific Plan, the Holly-Seacliff Specific Plan, and the Bella Terra Specific Plan.

The largest land use in the City is residential at 8,066 acres (approximately 46% of the total). Approximately 70% of the residential land use is low density residential (3 to 7 dwelling units (DU) per acre). Commercial land use is spread out over the City (570 acres) to provide local services and daily needs to nearby residents.

[1] Center for Demographic Research (CDR) at California State University Fullerton, 2022 Orange County Projections, 2022.

The General Plan Land Use Map is shown on Figure 1-2. Approximately 638 acres in the City are designated for Mixed Use, which permits a combination of commercial uses and a variety of housing types. The Mixed Use designation permits either vertical or horizontal integration of these uses. As shown on Figure 1-2, a large portion of the mixed use land borders Beach Boulevard from Adams Avenue to Edinger Avenue as part of the Beach and Edinger Corridors Specific Plan. Mixed use land use is also designated in the downtown area near the Main Pier. The large mixed use area with horizontal integrated housing located between the Seacliff Golf Course and PCH is already partially developed in accordance with the Palm/Goldenwest Specific Plan.

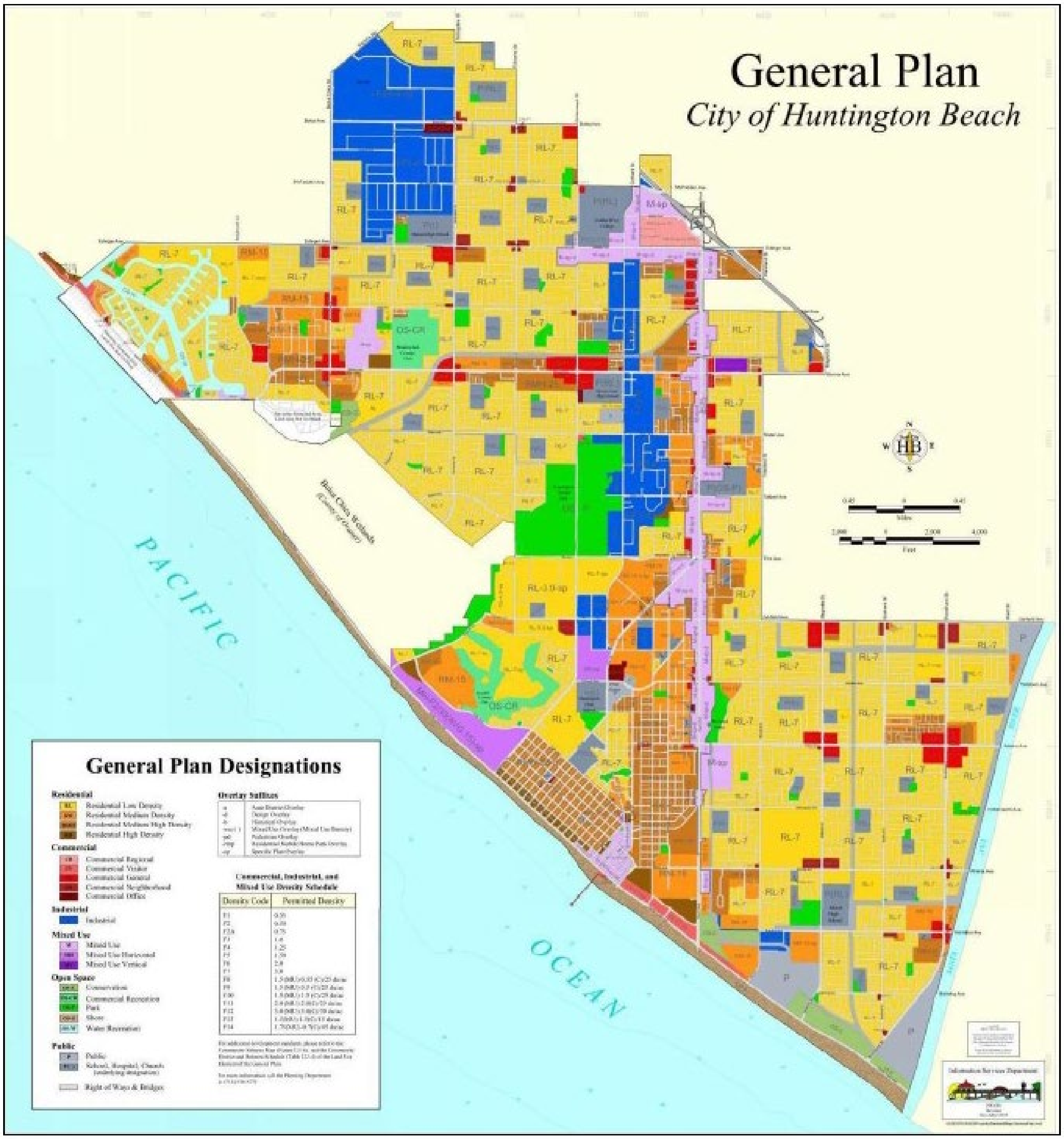
# Figure 1-1
# Existing Land Use



## Table 1-1
## Existing Land Use

| General Plan Land Use Category | Total Net Area (Ac) | % Land Use | Vacant Area (Ac) | % of Vacant Land |
|---|---|---|---|---|
| **Residential** | | | | |
| **Low Density (3 to 7 DU/Ac)** | 5666 | 32% | 26.59 | 26% |
| **Medium Density (15 DU/Ac)** | 1185 | 7% | 19.83 | 19% |
| **Medium High Density (25 DU/Ac)** | 1034 | 6% | 1.29 | 1% |
| **High Density (30+ DU/Ac)** | 181 | 1% | 0.36 | 0% |
| **Subtotal** | 8066 | 46% | 48.07 | 47% |
| **Mixed Use** | 637.9 | 4% | 11.77 | 11% |
| **Commercial** | | | | |
| **Commercial Visitor** | 166 | 1% | 0 | 0% |
| **Commercial General** | 297 | 2% | 2.41 | 2% |
| **Commercial Neighborhood** | 91 | 1% | 1.65 | 2% |
| **Commercial Office** | 16 | 0% | 0 | 0% |
| **Subtotal** | 570 | 3% | 4.06 | 4% |
| **Industrial** | 1128 | 6% | 34.13 | 33% |
| **Open Space & Other** | | | | |
| **Open Space - Conservation** | 172 | 1% | NA | NA |
| **Open Space - Recreation** | 238 | 1% | NA | NA |
| **Open Space - Park** | 701 | 4% | NA | NA |
| **Open Space - Shore** | 434 | 2% | NA | NA |
| **Open Space - Water Recreation** | 239 | 1% | NA | NA |
| **Subtotal** | 1784 | 10% | 4.88 | 5% |
| **Public and Community Service** | 5297 | 30% | 0 | 0% |
| **TOTAL** | **17,482** | **100%** | **102.91** | **100%** |

# Figure 1-2
# General Plan Build-out Land Use



Open space comprises 1,784 acres or 10.2% of the City. Huntington Central Park is the largest public park in the City at 343 acres. The Seacliff Golf Course and the Meadowlark Country Club constitute the open space recreation land use in the City at 238 acres.

There are 1,128 acres of industrial land in the City. The largest industrial area is in the northwest area of the City where Boeing and the McDonnell Center Business Park are located. The second largest industrial area is the Gothard Industrial Corridor that borders Gothard Street between Ellis Avenue and Edinger Avenue.

Another industrial area in the City is the Southeast Industrial Area, which is actually a composite of industrial, public, and open space conservation zoned land uses. The AES Huntington Beach Generating Station (power plant) is located in this area. A 38-acre former land fill is also located in the Southeast Industrial Area. The Orange County Sanitation District No. 2 Wastewater Treatment Plant is located in the far southeast corner of the City. Both the power plant and the treatment plant are large City water users.

In addition to land use and growth anticipated by the General Plan, the City must plan for future regional housing growth. State law requires jurisdictions to plan for their share of the RHNA. SCAG determines the housing growth needs by income for local jurisdictions through the RHNA process. The City's RHNA allocation for the 2021 - 2029 planning period is 13,368 units. This includes 3,661 units for very low-income households, 2,184 units for low-income households, 2,308 units for moderate-income households, and 5,215 units for above moderate-income households. It should be noted that the City's RHNA targets for 2021-2029 reflect greater residential growth than is anticipated in the General Plan, which has a horizon year of 2040. The City is in the process of updating the General Plan Housing Element to provide adequate zoning capacity to accommodate its RHNA allocation. As a result of the Housing Element Update, amendments to the land use map shown in Figure 1-2 will probably occur in the next one to three years.

## 1.2 Population and Housing

The population of the City's water service area is estimated at 198,725 for 2020, and is growing with very little remaining vacant land. Projected population is shown in Table 1-2 and is projected to increase by 3.6% from 2020 to 2045. The City provides water to over 55,028 service connections. The Huntington Beach water service area is predominantly residential with over 92 percent of water service connections serving single-family and multi-family residences.

The population per household for the City of Huntington Beach was estimated at 2.44 by the Center for Demographic Research (CDR) at California State University Fullerton in 2020. This average population per household is for the City of Huntington Beach which makes up almost the entire water service area (excluding Sunset Beach).

Utilizing CDR's 2020 Orange County Projections (OCP), a 3.6 percent increase in population is expected over the next 25 years in the City's water service area, from 198,725 in 2020 to 205,907 in 2045. The total dwelling units in the water service area are projected to increase 1.4 percent from 82,524 in 2020 to 83,693 in 2045. For comparison, population and total dwelling units for Orange County are projected to increase 8% and 7.4%, respectively, between 2020 and 2045. Historical and projected water service area population and housing is shown in Table 1-2.

The population density using the 2020 CDR OCP data is 2.44 and is projected to increase slightly to 2.48 in 2040 and then return to 2.46 in 2045. However, if vacancy rates return to more normal rates; population density will increase in the water service area. Population density is important in that an increase in people per dwelling unit will result in an increase in water demand, even if total housing units remain constant.

**Table 1-2**
**Historical and Projected Population and Housing**

| | Historical | | | Projected | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 |
| Population | 189,594 | 189,992 | 198,725 | 203,713 | 206,499 | 207,479 | 207,402 | 205,907 |
| Annual % Increase | -- | 0.21% | 4.60% | 2.51% | 1.37% | 0.47% | -0.04% | -0.72% |
| Total Dwelling Units | 75,662 | 78,644 | 82,524 | 83,071 | 83,236 | 83,615 | 83,636 | 83,693 |
| Annual % Increase | -- | 3.94% | 4.93% | 0.66% | 0.20% | 0.46% | 0.03% | 0.07% |
| Population/DU | 2.51 | 2.42 | 2.41 | 2.45 | 2.48 | 2.48 | 2.48 | 2.46 |

Source: Center for Demographic Research, California State University Fullerton 2022

### 1.2.1 *Population Projections including RHNA Housing Allocation*

In addition to population growth anticipated in Table 1-2, population and housing growth needs have been determined by SCAG through the RHNA process. The City's RHNA allocation for the 2021-2029 planning period is 13,368 units. Assuming the trajectory for population per dwelling unit as in Table 1-2, the projected population including the RHNA allocation from 2020 to 2045 has been calculated. These calculations assume that the entire 13,368 RHNA units are constructed and occupied. Projected population is shown in Table 1-3 and is projected to increase by 20.2% from 2020 to 2045 with housing units projected to increase by 17.6%.

## Table 1-3
## Projected Population and Housing
## Including RHNA Housing Allocation

| | Historical | | | Projected | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 |
| Population | 189,594 | 189,992 | 198,725 | 219,900 | 239,578 | 240,518 | 240,570 | 238,770 |
| Annual % Increase | -- | 0.21% | 4.60% | 10.66% | 8.95% | 0.39% | 0.02% | -0.75% |
| Total Dwelling Units | 75,662 | 78,644 | 82,524 | 89,755 | 96,604 | 96,983 | 97,004 | 97,061 |
| Annual % Increase | -- | 3.94% | 4.93% | 8.76% | 7.63% | 0.39% | 0.02% | 0.06% |
| Population/DU | 2.51 | 2.42 | 2.41 | 2.45 | 2.48 | 2.48 | 2.48 | 2.46 |

# 2 WATER DEMAND

Water demand has decreased over the past decade even though development has occurred, and the City's population has increased during this time. Unaccounted-for water, which is the difference between water supply and water consumption and represents "lost" water, has decreased since 1995/96 and this decrease is attributed to a number of City programs, including: a leak detection survey conducted for the City in 1996/97, continued annual water loss audits through MWDOC, and a switch from hydrant flushing to using NO-DES (Neutral Output Discharge Elimination System) flushing technology. Water demands are estimated to increase 0.34% by the year 2045 over 2020 demand (which represents the Ultimate System for the planning period) as a result of proposed new development and a projected 3.6% increase in population. However, this number does not include projected demand increase due to the City's RHNA housing allocation. Including demand due to additional RHNA housing allocation, water demands are estimated to increase 16.8% by the year 2045 over 2020 demand.

## 2.1 Historical Potable Water Production

Historical potable water production for 10 years 2010/11 through 2019/20 is shown in Table 2-1. The City's water year for the purposes of this report is July through June, whereas the City's fiscal year during this period was October through September (the City has since changed their water fiscal year to July through June). The water year format is consistent with the Municipal Water District of Orange County (MWDOC) and Orange County Water District (OCWD) projections. All historical data presented in this water master plan is in accordance with the City's water year and what has been presented in the City's 2020 Urban Water Management Plan. Per the 2020 UWMP, 2019/20 demand was determined to represent average water demand at 25,966 AFY (23.2 million gallons per day (MGD) or 16,098 gallons per minute (gpm)).

Goldenwest No. 4 and Meadowlark No. 2 are wells within the City that produce non-potable water (high color) and are used for irrigation purposes only. This non-potable water production is not included in the potable water production Table 2-1. Goldenwest No. 4 was removed from service in 2011.

The effect of rainfall on water demand, primarily irrigation demand, is shown on Figure 2-1. Mean rainfall for the 10-year period shown is less than the long-term average of 11.31 inches. Water production has decreased since 2004 despite dry conditions. This can be attributed in part to the water conservation measures undertaken by the City and its residents in response to drought conditions from 2011 to 2017 and state regulations to reduce water consumption. The long-term effects of these water conservation efforts, even after the drought years, can be seen in the Table.

## Table 2-1
## Historical Potable Water Production (Acre-Feet)

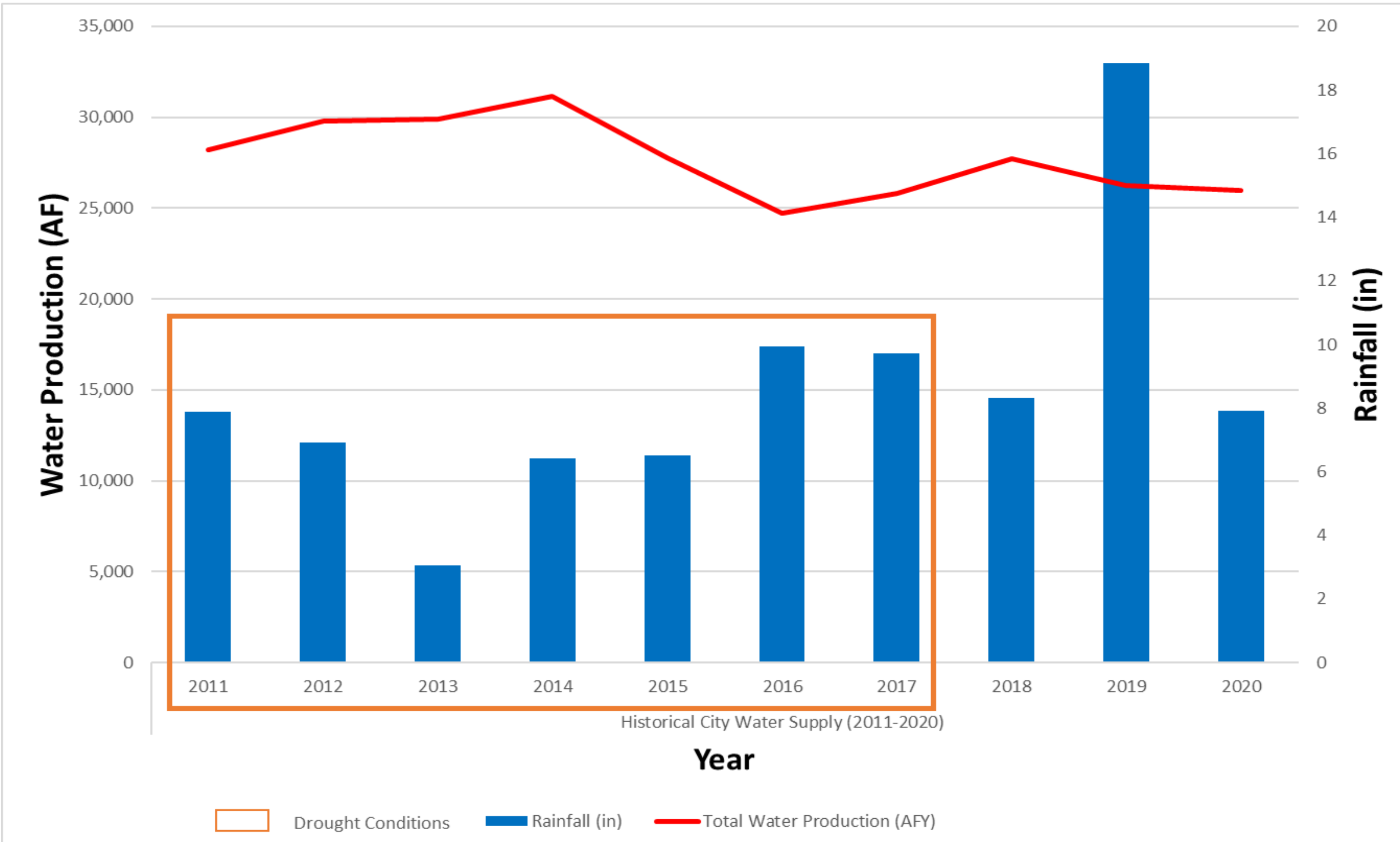
| | Historical City Water Supply (2011-2020) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **Average** |
| Total Water Production (AFY) | 28,200 | 29,801 | 29,897 | 31,138 | 27,753 | 24,728 | 25,816 | 27,720 | 26,251 | 25,966 | 27,727 |
| Non-Domestic Irrigation | 180 | 212 | 237 | 254 | 239 | 248 | 222 | 225 | 182 | 192 | 219 |
| Well to Waste | | | | | | | | | | | |
| Total Domestic Supply | 28,020 | 29,589 | 29,660 | 30,884 | 27,514 | 24,480 | 25,594 | 27,495 | 26,069 | 25,774 | 27,508 |
| Ratio to 10-Yr Average | 1.01 | 1.07 | 1.07 | 1.11 | 0.99 | 0.88 | 0.92 | 0.99 | 0.94 | 0.93 | 1.00 |
| Rainfall (in) | 7.87 | 6.91 | 3.04 | 6.42 | 6.51 | 9.95 | 9.71 | 8.33 | 18.85 | 7.92 | 8.55 |

(1) Groundwater produced by Meadowlark No. 2 is non-potable due to high color and is used for irrigation

(2) Test Pumping

(3) Santa Ana John Wayne Airport #093184. Average for period of record is 11.3 (1921-2020)

**Figure 2-1**
**Historical Potable Water Production vs. Rainfall**



## 2.2 Historical Water Consumption/Unaccounted-For Water

Historical City water consumption and unaccounted-for water for the six years 2015/16 through 2020/21 is shown in Table 2-2. Water consumption was developed from City billing records. Unaccounted-for water, also referred to as non-revenue water is the difference between metered water production and metered water consumption and represents "lost" water. Unaccounted-for water occurs for a number of reasons:

- Water lost from system leaking, i.e. from pipes, valves, pumps, etc.
- Water used by the Fire Department to fight fires. This water is not metered.
- Meter inaccuracies. Meters have an inherent accuracy for a specified flow range. Comparatively, there are few production meters and they are larger and more accurate and well maintained. There are thousands of consumption meters which are much smaller. Consumption meters tend to register at lower rates as they age (this is inherent from the design), and due to the numbers, are difficult to maintain to the same standards as the production meters. For these reasons, metering inaccuracies tend to increase the calculated unaccounted-for-water.
- Estimated uses. Some water consumption is not metered but usage is estimated. This includes water used to flow test fire hydrants and water used to flush the distribution system.

Based on the City's 2016 Water Master Plan, unaccounted-for water averaged 5.6% during the six year period from 2009/10 to 2014/15. During the previous six year period from 2004/05 through 2009/10, unaccounted-for water has averaged 5.9 percent. Thus, over the past 11 years, unaccounted-for water has averaged 5.8 percent.

Unaccounted-for water was 9.9 percent in 1995/96 but has decreased since then and has not reached those level since. This is largely due to a leak detection survey conducted for the City in 1996/97. A total of 498 miles of pipeline was surveyed, with a water loss of approximately 67,000 gpd quantified from 17 identified leaks. The annual water loss from these leaks was quantified as approximately 24.4 million gallons. The City repaired all of the leaks identified in the survey and has since implemented an on-going leak investigation and repair program as a measure to keep water losses to a minimum while facilitating cost savings[2]. As of the end of 2021, unaccounted-for water is at 6.9 percent, and ranks among the lowest rates for unaccounted-for water in the county. Unaccounted-for water from 2015/16 through 2019/20 has averaged 4.4% as shown on Table 2-2. It should be noted that statistical accounting errors occurred in 2016/17, resulting in a consumption exceeding production. This was the year that the accounting fiscal year was changed from October through September to July through June. Consumption numbers prior to 2016/17 and after 2016/17 are accurate as shown.

[2] City of Huntington Beach, 2005 Water Master Plan, March 2006

Additionally, as of 2018 the distribution section switched from hydrant flushing to using NO-DES (Neutral Output Discharge Elimination System) flushing technology. This technology runs the water through a filter system that traps the turbidity and clears the water. No water is discharged to waste and the amount of unaccounted for water is decreased by this technique.

The City will continue to use the calibrated hydraulic model of the water system, which will be updated as part of this master plan, to help estimate fire hydrant pressures. Only those fire hydrant pressures that are found to be deficient or close to deficient in the model will be verified in the field. Utilization of the model has essentially eliminated the need for fire hydrant flow tests.

## Table 2-2
## Historical Water Consumption

| | Historical City Water Consumption/Production/Unaccounted-For Water (Acre-Feet) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
| **Consumption** | **26,499** | **23,381** | **27,464** | **27,634** | **23,279** | **23,010** | **25,211** |
| **Production** | **27,752** | **24,728** | **25,816** | **27,720** | **26,251** | **25,966** | **26,372** |
| Unaccounted-For Water | 1,253 | 1,347 | -1,648 | 86 | 2,972 | 2,956 | 1,161 |
| Unaccounted-For Water % | 4.5% | 5.4% | -6.4%[1] | 0.3% | 11.3% | 11.4% | 4.4% |

[1]Statistical accounting error during switch in fiscal year accounting from October through September to July through June.

The California Urban Water Conservation Council recommends a complete distribution system audit if unaccounted-for water exceeds 10%. With the City currently averaging less than 6%, an audit is not needed.

Average daily per capita municipal and industrial (Per Capita M&I) water demand has been used by the water industry to measure and compare mean urban water demand. Per Capita M&I water demand includes the municipal, industrial, commercial, residential water demand, and unaccounted-for water associated with each person in the population. Historical Per Capita M&I water demand for the City is shown in Table 2-3.

## Table 2-3
## Historical Per Capita M&I Demand

| | Historical Per Capita Municipal and Industrial Water Demands | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
| **Total Demand (AF)** | **27,752** | **24,728** | **25,816** | **27,720** | **26,251** | **25,966** | **26,372** |
| Population | 197,456 | 199,224 | 199,927 | 199,495 | 199,742 | 198,725 | -- |
| Total Per Capita (gpcd) | 125.5 | 110.8 | 115.3 | 124.0 | 117.3 | 116.6 | **118.3** |
| Rainfall (in) | 6.5 | 10.0 | 9.7 | 8.3 | 18.9 | 7.9 | **10.2** |

Although Per Capita M&I water demand is still a useful measure for evaluating urban water demand, the various demand components evaluated separately can offer a more complete perspective. Historical City water demands by billing classifications are shown in Table 2-4.

## Table 2-4
## Historical Water Demand by Billing Class

| Historical City Water Demands Per Billing Classifications (Acre-Feet) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Demands Per City Billing Class** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **Average** |
| Single Family Residential | 12,960 | 11,639 | 12,781 | 12,578 | 11,159 | 11,440 | 12,093 |
| Multi-Family Residential | 5,992 | 5,540 | 6,683 | 6,194 | 5,645 | 5,636 | 5,948 |
| *Population* | *197,456* | *199,224* | *199,927* | *199,495* | *199,742* | *198,725* | 199,095 |
| *Residential Per Capita (gpcd)* | *86* | *77* | *87* | *84* | *75* | *77* | 81 |
| Commercial | 3,706 | 3,122 | 4,360 | 3,659 | 3,646 | 3,039 | 3,589 |
| Industrial | 399 | 307 | 365 | 323 | 301 | 280 | 329 |
| Institutional/Municipal | 149 | 119 | 145 | 149 | 157 | 122 | 140 |
| Irrigation | 2,907 | 2,249 | 2,782 | 4,355 | 2,061 | 2,007 | 2,727 |
| Other | 386 | 405 | 348 | 377 | 309 | 486 | 385 |
| **Total Demand (AF)** | **26,499** | **23,381** | **27,464** | **27,634** | **23,279** | **23,010** | **25,211** |

The demand data is from City billing data and does not include unaccounted-for water. Residential per capita demand for the most recent six years 2014/15 through 2019/20 averaged 83 gpcd, which is 13% less than the previous 6 year (2009/10 through 2014/15) average residential per capita demand of 94.0 gpcd. The downward trend in strictly residential water use can be attributed in part to water conservation programs undertaken by the City including public information programs, school education programs, water survey programs, and plumbing fixture retrofits.

It should be noted that the per capita residential use and total per capita use discussed above is not the same as the per capita calculation that must be reported as a part of the 20 x 2020 water conservation targets required by the State Department of Water Resources in Urban Water Management Plans starting with the 2010 Plan. The formula for developing the baseline per capita, 2020 target, and interim 2015 target to measure an agency's success in meeting the 20% mandated conservation by 2020 is somewhat different. It includes total water use (exclusive of agricultural use) divided by total service area population but allows for credits for recycled water use. The City does not have any direct recycled water use but does get a pro-rata credit for indirect recycled water based on OCWD's Groundwater Replenishment System.

Commercial and industrial water demand decreased from 3,770 in 2014/15 to 3,319 AF in 2019/20 (12% decrease). However, on average over the past 5 years, commercial and industrial demand has remained relatively flat and has decreased compared to previous master plan periods. Decreased water use for the Commercial and Industrial billing categories can be attributed in part to the City's participation in MWDOC's and MWD's regional commercial, industrial, and institutional water-use efficiency programs, as well as the Metropolitan and MWDOC water allocation program put in effect in 2009/10 and lifted just prior to the end of 2010/11. Another reason for this decrease is the gradual implementation by the City of dual meters in place of single meters for metering commercial and industrial accounts as well as multi-family residential accounts. The purpose of this program is to separate irrigation use from potable water use as many of these meters currently measure both potable and irrigation water use.

As new businesses come into the City or renovation of existing businesses occur, a separate irrigation meter is being installed by the owner when the landscape area exceeds 2,500 square feet. However, there is still a substantial amount of irrigation water use that is reported under the Commercial, Industrial and Multi-family billing categories. Implementation of this dual meter program has been occurring gradually over the past decade, plus. Under this program, one meter is dedicated to measuring internal water use under the Commercial or Industrial billing category, while a separate meter would be installed to measure irrigation water use under the Irrigation billing category. Over the five-year period from 2014/15 to 2019/20, total irrigation meters have increased from 993 to 1,521. Even with this 53% increase in irrigation meters, irrigation use has actually decreased from 2,338 AF in 2014/15 to 2,007 AF in 2019/20 due to water conservation, legislation changes, and water efficiency rebates.

Also, Irrigation water use is greatly affected by rainfall amounts. However, due to the reasons indicated above, it is difficult to correlate Irrigation billing amounts to rainfall patterns. If the number of irrigation meters and acres being irrigated remained constant, a pattern could be more easily developed. The City participates in MWDOC's regional landscape irrigation efficiency programs and institutes irrigation efficiency parameters in the City Municipal Code.

## 2.3 Projected Water Demands

Demand projections were developed by MWDOC for each agency within their service area based on available data as well as land use, population and economic growth. The projections in 5-year increments to Year 2045 are shown in Table 2-5 and were obtained from the City's 2020 UWMP.

As shown in Table 2-5, the 2045 water demand is projected to be 26,054 AFY or approximately 23.3 MGD, 0.34% higher than the assumed 2020 normal year demand of

25,966 AFY. This increased water demand equates to an annual water demand growth of approximately 0.01% per year, compounded.

**Table 2-5**
**Projected Water Demands**

| Projected Water Demands | | | | | | |
|---|---|---|---|---|---|---|
| **Water Demand** | **2020** | **2025** | **2030** | **2035** | **2040** | **2045** |
| Total Demand (AFY) | 25,966 | 26,399 | 26,524 | 26,339 | 26,093 | 26,054 |
| Total Demand (MGD) | 23.2 | 23.6 | 23.7 | 23.5 | 23.3 | 23.3 |
| Population (1,000) | 198.7 | 203.7 | 206.5 | 207.5 | 207.4 | 205.9 |
| Total Per Capita (gpcd) | 116.6 | 115.7 | 114.7 | 113.6 | 112.3 | 113.0 |

The projected water demands discussed above are average annual demands typically displayed in AFY or average day demand (ADD) typically displayed in million gallons per day (MGD) or gallons per minute (gpm). Another important projection is maximum day demand (MDD) or the highest 24-hour demand over the course of a year as a water system must be capable of supplying MDD. The peak daily or diurnal fluctuation or the peak hour demand (PHD) is typically handled from operational storage in reservoirs so is not important in determining supply requirements.

Based on extensive analysis, the 2020 Water Master Plan settled on a 1.8 MDD factor (MDD = 1.8 times the ADD) for the entire water system, which included a 15% factor of safety over measured data. A 2.7 MDD factor was selected for Zone 2, which is typical as a smaller area with less land use diversity experiences higher peaking factors. Monthly water use for the five year period ending in FY 2010 resulted in an average maximum monthly demand factor of 1.45, occurring in the month of August. Diurnal curves for a typical week in June of 2007 provided by City staff resulted in the maximum day of that week being 1.06 times the average day of the week. In order to achieve a 1.80 MDD factor, the maximum week would have to be 1.17 times higher than the maximum month (1.45 x 1.17 x 1.06 = 1.80), which is perfectly logical. Therefore, the factors utilized in the previous hydraulic model analyses are deemed to be appropriate for use in the modeling analyses conducted in this master plan.

### 2.3.1 *Projected Water Demands for RHNA Housing Allocations*

In addition to water demands anticipated in Table 2-5, water demand projections for the RHNA allocation have been calculated. The projections in 5-year increments to Year 2045 are shown in Table 2-6. As shown in Table 2-6, the 2045 water demand is projected to be 30,538 AFY or approximately 27.3 MGD, 17.6% higher than the assumed 2020 normal year demand of 25,966 AFY. This increased water demand equates to an annual water demand growth of approximately 0.7% per year, compounded.

Table 1-3 shows the City's population is projected to increase by 20.2% from 2020 to 2045 if the entire 13,368 RHNA units are constructed and occupied. Demand projections from 2020 to 2045 were calculated utilizing the same projected total demand per capita projections and multiplying by the additional population projections due to RHNA.

**Table 2-6**
**Projected Water Demands Including RHNA Allocation**

| Projected Water Demands | | | | | | |
|---|---|---|---|---|---|---|
| **Water Demand** | **2020** | **2025** | **2030** | **2035** | **2040** | **2045** |
| Total Demand (AFY) | 25,966 | 28,523 | 30,786 | 30,560 | 30,512 | 30,538 |
| Total Demand (MGD) | 23.2 | 25.5 | 27.5 | 27.3 | 27.2 | 27.3 |
| Population (1,000) | 198.7 | 219.9 | 239.6 | 240.5 | 240.6 | 238.8 |
| Total Per Capita (gpcd) | 116.7 | 115.8 | 114.7 | 113.4 | 113.2 | 114.2 |

# 3 WATER SUPPLY AND RELIABILITY

The City's existing sources of potable water supply consist of nine groundwater wells, three imported water connections, and three emergency connections with neighboring cities.

Orange County Water District (OCWD) manages the Orange County Groundwater Basin (Basin), which the City overlies. OCWD sets a Basin Production Percentage annually, which allows the City and other Basin producers to pump groundwater up to the BPP percentage of their total water supplies to meet demands. The BPP was set at 77% FY 2021/22 and will increase to 85% for FY 2023/24. OCWD has recently completed the Groundwater Replenishment System Final Expansion, which has increased water levels in the basin and has allowed for more pumping out of the basin by producers.

The City also purchases treated, imported water from the Municipal Water District of Orange County (MWDOC), which is a member agency of the Metropolitan Water District of Southern California (MWD). The City has historically used more groundwater than imported water to meet demands as groundwater production is less expensive, at least in quantities up to the BPP.

The City's water supply consistently meets or exceeds all State and federal potable water quality standards. The City maintains a water quality monitoring program consistent with State requirements.

## 3.1 City Water Supplies

As a member agency of OCWD, the City is entitled to produce groundwater from the Basin. The Basin, which is managed by OCWD, is unadjudicated. The City and other Basin producers pay a Replenishment Assessment (RA) to OCWD for all groundwater produced up to a percentage of the producer's total water supplies used to meet demands. This percentage is called the Basin Production Percentage (BPP), which is set uniformly for all producers annually by OCWD based on Basin conditions and long-term projections.

For FY 2021/22, OCWD set the BPP to 77%, where it had been for the previous three years due to drought conditions and low Basin levels. In mid-year FY 2022/23, purveyors reduced their basin pumping due to PFAS issues coupled with lower demands. Initially in FY 2022/23 the BPP was set to 77% but was raised to 96.2% on February 1, 2023 by the board of directors. The resulting average BPP for FY 2022/23 was 85%. OCWD has established a BPP of 85% for FY 2023/24. OCWD increased the RA to $624/acre-foot for FY 2023/24.

In addition to the RA, OCWD charges a Basin Equity Assessment (BEA) for pumping in excess of the BPP, which is basically a penalty to help maintain the Basin at projected levels. The BEA essentially equates the cost of groundwater pumped over and above the BPP to the rate charged for imported water from MWDOC. BEA rate will vary slightly between different member agencies of OCWD, as the rate is adjusted based on each member agency's groundwater pumping costs. For FY 2023/24 BEA rates have been set at $589/acre-foot.

The City's (FY 2022/23) cost for producing groundwater up to the BPP was $709/acre-foot (including the RA and energy but not including other well operation and maintenance costs $624 for the RA & $85 for energy). The City supplements groundwater with treated, imported water from MWDOC at the current rate of $1124/acre-foot exclusive of connection charges, readiness to serve charges, and other fixed fees.

The City's water supply has averaged 60% groundwater pumped and 40% imported water purchases over the recent six-year period (2014/15 – 2019/20) as shown in Table 3-1 and shown graphically on Figure 3-1. It should be noted, however, that the City participates in the In-Lieu or Cyclic Storage Program offered by OCWD and MWD, when available. This is a groundwater program that refills the Basin by avoiding pumping from the Basin and is usually offered in the wetter years and in the lower demand period of October through April. In the program, OCWD requests the City to leave a number of its wells turned off and the City then takes replacement, or in-lieu, water through its imported water connections, which water is purchased by OCWD from MWD through MWDOC. OCWD purchases the in-lieu water at a reduced rate, and then bills the City the amount it would have had to pay for pumping energy and the RA as if it had produced the water from its wells.

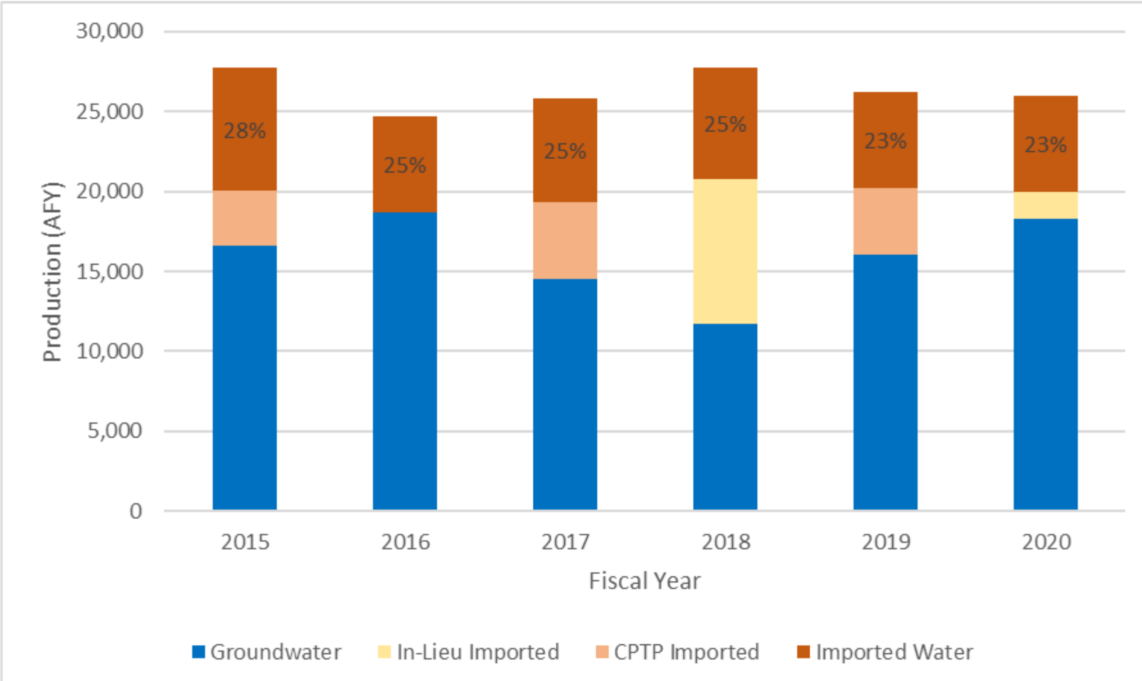
In addition to reducing groundwater pumping as intended by the In-Lieu of program, the City participates in the OCWD Coastal Pumping Transfer Program (CPTP) when available. This program substitutes groundwater pumping from coastal producers with groundwater pumping from inland producers by modifying (reducing) the BEAs of the inland producers. The purpose of this program is to reduce groundwater pumping by the City (of Huntington Beach), specifically near the Sunset Gap area, in order to reduce seawater intrusion into the groundwater basin. The program incentivizes inland producers to over pump without incurring BEA surcharge. OCWD staff anticipates that approximately 5,000 acre-feet of pumping would be transferred inland away from the City as a result of the CPTP program.

## Table 3-1
## Groundwater Production vs. Imported Water Purchases
## (FY15 – FY20)

| Water Supply | Fiscal Year | | | | | | Average |
|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | |
| Groundwater (AFY)[1] | 16,604 | 18,668 | 14,518 | 11,682 | 16,031 | 18,296 | 16,590 |
| Imported Water (AFY) | 11,149 | 6,060 | 11,298 | 16,038 | 10,219 | 7,670 | 10,563 |
| Total (AFY) | **27,753** | **24,728** | **25,816** | **27,720** | **26,251** | **25,966** | **27,153** |
| % Imported | 40% | 25% | 44% | 58% | 38% | 42% | 40% |
| In-Lieu Imported (AFY) | 0 | 0 | 0 | 9,081 | 0 | 1,686 | 1,795 |
| CPTP Imported (AFY) | 3,432 | 0 | 4,848 | 0 | 4,182 | 0 | 2,077 |
| Adjusted % Imported | 28% | 25% | 25% | 25% | 23% | 23% | 25% |

[1]Actual groundwater pumped that does not include adjustment for In-Lieu or CPTP water

**Figure 3-1**
**Groundwater Production vs. Imported Water Purchases**
**(FY15 – FY20)**




In-lieu imported water purchases have been approximately 14% of the total city water supply over this six-year period, with imported water purchases not applicable to this program at approximately 25% for total imported water purchases of 40% as shown on Table 3-1. Also, as shown in that table and the corresponding figure, in-lieu water was not available in one of the six years shown due to drought conditions in southern California and averaged 3,642 AFY over that period. In-lieu water is regarded as groundwater production when calculating a producer's BPP. Therefore, the City's groundwater production for BPP purposes has averaged 75% during this period, adjusted to include in-lieu water. This is calculated taking 100% minus the Average Adjusted % Imported of 25% shown in Table 3-2.

## 3.2 Water Quality

The Safe Drinking Water Act (SDWA), which was enacted in 1974, is the main federal law that regulates potable drinking water standards. Under SDWA, the U.S. Environmental Protection Agency (EPA) sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards.

State potable water quality standards are set by the California Department of Public Health (CDPH). The potable water quality standards listed in the title 22 California Code of Regulations include primary and secondary maximum contaminant levels (MCLs). Primary MCLs are established for a number of organic and inorganic chemicals, trihalomethanes, and radioactivity as they relate to public health. Secondary MCLs are established for chemicals or characteristics as they relate to taste, odor, or appearance of drinking water. These State MCLs are the same or in some cases more stringent than the federal MCLs.

The City's water supply consisting of groundwater and imported surface water consistently meets or exceeds all State and federal potable water quality standards. The City maintains a water quality monitoring program consistent with CDPH requirements.

As a result of the high quality of the City's source water supplies, the only water treatment conducted by the City is disinfection and fluoridation. The City disinfects at each of its well sites through the injection of gaseous chlorine ($CL_2$) typically at a rate of about 1.0 milligrams per liter (mg/l) residual. The City receives imported surface water that has been disinfected by MWD by means of chloramination typically at a rate of about 2.2 mg/l residual.

The City has fluoridated its water supply to aid in the development of healthy teeth since 1972. The natural fluoride concentration in the local groundwater ranges from 0.3 to 0.5 mg/l. The City increases the fluoride concentration to between 0.6 to 1.2 mg/l via injection stations located at all wells. The City previously injected fluoride at the imported water connections until late 2007, when MWD began fluoridation of their water. The average fluoride level of the imported surface water at City turnouts is 0.8 mg/l.

The City is beginning to look into onsite generation of chlorine and fluoridation in lieu of imported gaseous chlorine and has begun a preliminary study.

MWD conducts extensive monitoring of its treated water at the various treatment plants within its system. OCWD also conducts more extensive testing on groundwater samples than as required by all regulatory agencies. This is done on behalf of its member agencies in order to stay on top of any potential contaminant that might be detected as well as to track migration of TDS and other water quality trends. The following is a summary of recent regulations relating to potential constituents of concern and their levels in the City's water supplies.

### ***Arsenic***

In January 2006, a new federal water quality regulation reduced the MCL for arsenic, an inorganic chemical, from 50 parts per billion (ppb) to 10 ppb. California's revised arsenic MCL of 10 ppb became effective in November 2008. The average arsenic level in the City's water supply has historically ranged between "Not Detected" to 3 ppb and has averaged "Not Detected". Accordingly, treatment of City supply sources to meet the stricter arsenic MCL is not required or anticipated.

## ***Groundwater Rule***

EPA initiated the Ground Water Rule (GWR) in November 2006, which specifies the appropriate use of disinfection in groundwater and addresses other components of groundwater systems to protect against bacteria and viruses in portable groundwater supplies. The requirements of the GWR include State-conducted system sanitary surveys and compliance monitoring for systems that disinfect to ensure that they reliably achieve 99.99% (4-log) inactivation or removal of viruses. The City currently disinfects at all of their well sites through the injection of gaseous chlorine.

## ***Radon***

Radon is a naturally occurring radioactive gas that may be found in indoor air and in drinking water. Exposure to radon can increase the risk of contracting cancer. Radon in soil under homes presents a greater risk than radon in drinking water. There is currently no MCL for radon in drinking water. EPA has developed a proposed regulation to reduce radon in drinking water that includes a "Multimedia Mitigation" program option to reduce radon in air.

The proposed regulation offers two options:

- *Option 1*: States can choose to develop enhanced state-wide programs to address the health risks from radon in indoor air known as Multimedia Mitigation (MMM) programs while reducing radon levels in drinking water for individual water systems to 4,000 pCi/L (picoCuries per liter, a standard unit of radiation) or lower. EPA is encouraging states to adopt this option because it is the most cost-effective method and achieves the greatest radon risk reduction.
- *Option 2*: If a state opts not to develop an MMM program, individual water systems in that state would be required to either reduce radon in their system's drinking water to 300 pCi/L or develop individual local MMM programs and reduce levels in drinking water to 4,000 pCi/L. Water systems already at or below the 300 pCi/L standard would not be required to treat their water for radon.

Radon was monitored in the City's water supply between 2001 and 2006 and levels averaged 443 pCi/L (366 pCi/L in 2001, 443 pCi/L in 2002, 356 pCi/L in 2003, 314 pCi/L in 2004, 596 pCi/L in 2005, and 582 pCi/L in 2006). Radon treatment alternatives include aeration and treatment with granular activated carbon filters.

## ***Stage 2 Disinfection Byproduct Rule***

Chlorine and other chemical disinfectants used by public water systems to control microbial pathogens in drinking water interact with organic and inorganic materials in source water to form disinfection byproducts (DBP). Epidemiology and toxicology studies have shown a link between disinfection byproducts, specifically total trihalomethanes (THM) and haloacetic acids (HAA), and some forms of cancer.

Effective in 2002, EPA's Stage 1 Disinfectant Byproduct Rule (DBR) requires water systems to meet THM and HAA MCLs of 80 ppb and 60 ppb, respectively. Compliance is determined by calculating the running annual averages of samples from all monitoring locations across the system. TTHM and HAA5 averages for the Huntington Beach water system have always been well below the MCLs.

In 2006 EPA finalized Stage 2 of the regulation, which further controls allowable levels of DBPs in drinking water without compromising disinfection itself. Under the Stage 2 DBR, systems were required to conduct an evaluation of their distribution system to identify the locations with high THM and HAA concentrations. The City completed the evaluation in 2008 and submitted a Stage 2 monitoring plan for CDPH review. Full Stage 2 compliance monitoring will start in April 2012. The Stage 2 plan changed several of the locations previously monitored in the Stage 1 plan and includes a few new sites. Under the Stage 2 DBR, compliance with the MCLs for THM and HAA are calculated for each monitoring location in the distribution system (locational running annual average), as opposed to the previous less stringent method of calculating running annual averages of samples from all monitoring locations across the system.

The Stage 2 DBR is being implemented in two phases. During Phase 1 of the implementation, the MCLs for THM and HAA are 80 ppb and 60 ppb, respectively, based on running system-wide annual averages at the current Phase 1 monitoring sites. The last Phase 1 monitoring is the First Quarter of 2012. During Phase 2, the compliance sites will be changed based on the system-wide evaluation for high DBP sites and the locational annual MCL averages will be 80 ppb for THM and 60 ppb for HAA. The Phase 2 monitoring began the Second Quarter of 2012, and locational annual averages for the Huntington Beach system are continually below the MCLs.

***Per- and Polyfluoroalkyl Substances (PFAS)***

PFAS are a large and diverse structural family of compounds used in myriad commercial applications due to their unique properties, such as resistance to high and low temperatures, resistance to degradation, and nonstick characteristics. Human studies have found associations between PFOA and/ or PFOS exposure and effects on the immune system, the cardiovascular system, development (e.g., decreased birth weight), and cancer. In June 2022 a new federal Lifetime Drinking Water Health Advisories were issued for Hexafluoropropylene Oxide (HFPO) Dimer Acid and its Ammonium Salt (referred to as "GenX" chemicals) and PFBS of 10 ppt and 2,000 ppt, respectively; the interim federal health advisories for PFOA and PFOS were reduced to 0.004 ppt and 0.02 ppt, respectively. The interim health advisories will remain in place until the EPA establishes a National Primary Drinking Water Regulation.

As of August 2022, there are no primary drinking water standards (maximum contaminant levels or MCLs) for PFAS in California. The development of standards for PFOA, PFOS, and other PFAS are among the priorities of the Division of Drinking Water. Notification levels (NLs) are nonregulatory, health-based advisory levels established for contaminants in drinking water for which maximum contaminant levels have not been established. Notification levels are established as precautionary measures for contaminants that may be considered candidates for establishment of maximum contaminant levels but have not yet undergone or completed the regulatory standard setting process prescribed for the development of maximum contaminant levels and are not drinking water standards. They represent the concentration level of a contaminant in drinking water that does not pose a significant health risk but warrants notification. Notification levels are issued by the Division of Drinking Water (DDW) and developed based on recommendations made by the Office of Environmental Health and Hazard Assessment (OEHHA).

A response level (RL) is set higher than a notification level and represents a recommended chemical concentration level at which water systems consider taking a water source out of service or provide treatment if that option is available to them. Starting in January 2020, water systems that receive an order and detect levels of PFAS substances that exceed their response level, shall take a water source out of use, treat the water delivered, or provide public notification.

The following table 3-2 is a summary of the State of California PFAS notification and response levels issued, requested or proposed by the DDW.

**Table 3-2**
**PFAS Notification and Response Levels**

| State of California PFAS Notification and Response Levels | | | | |
|---|---|---|---|---|
| **Abbreviation** | **Chemical Name** | **Notification Level (ppt)** | **Response Level (ppt)** | **Date Issued / Status** |
| PFOA | Perfluorooctanoic Acid | 5.1 | 10 | Feb-20 |
| PFOS | Perfluorooctane sulfonic acid | 6.5 | 40 | Feb-20 |
| PFBS | Perfluorobutane sulfonic acid | 500 | 5,000 | Mar-21 |
| PFHxS | Perfluorohexane sulfonic acid | 2 | 20 | Requested |
| PFHxA | Perfluoroheanoic acid | -- | -- | Requested |
| PFHpA | Perfluoroheptanoic Acid | -- | -- | Requested |
| PFNA | Perfluorononanoic acid | -- | -- | Requested |
| PFDA | Perfluorodecanoic acid | -- | -- | Requested |
| ADONA | 4,8-Dioxa-3H-perfluorononanoic acid | -- | -- | Requested |

PFAS data reporting is not indicated in the City of Huntington Beach 2022 Water Quality Report. Accordingly, treatment of City supply sources to meet stricter PFAS notification and response levels is not anticipated in the immediate future. However, the City should be prepared for potential changes in their obligation to test the water sources as regulations around PFAS are continuing to become stricter.

In response to DDW's issuance of the revised RL, as of December 2020, approximately 45 wells in the OCWD service area have been temporarily turned off until treatment systems can be constructed. As additional wells are tested, OCWD expects this figure may increase to at least 70 to 80 wells. None of the Huntington Beach wells have been affected by PFAS. The state has begun the process of establishing MCLs for PFOA and PFOS and anticipates these MCLs to be in effect by the Fall of 2023. OCWD anticipates the MCLs will be set at or below the RLs.

In April 2020, OCWD as the groundwater basin manager, executed an agreement with the impacted producers to fund and construct the necessary treatment system for production wells impacted by PFAS compounds. PFAS treatment methods include granular activated carbon (GAC) or ion exchange (IX). These treatment systems utilize vessels in a lead-lag configuration to remove PFOA and PFOS to less than 2 ppt. Construction contracts were awarded for treatment systems for production wells in the City of Fullerton and Serrano Water District in Year 2020. OCWD expects treatment systems to be constructed for most of the initial 45 wells above the RL within the next several years.

***Cyanotoxins***

In June 2022, the California Water Board and OEHHA provided a notification level (NL) recommendation for four (4) cyanotoxins in drinking water: anatoxin-a, mycrocystins, cylindrospermospin and saxitoxins as presented in Table 3-3 below. The following recommendations are supplementary to the short-term NL recommendations provided by the Water Board on May 3, 2021. The City supply sources have no historic presence of cyanotoxins. Accordingly, treatment of City supply sources to meet stricter cyanotoxin NLs is not required or anticipated at this time.

**Table 3-3**
**Cyanotoxins Notification Levels**

| Cyanotoxins Notification Levels | | |
|---|---|---|
| **Chemical** | **Acute NL (duration)** | **Short-Term NL (duration)** |
| Anatoxin-a | 8[c] (up to 1 day) | 4 (up to 1 month) |
| Cylindrospermospin | 3 (up to 1 day) | 0.3 (up to 3 months) |
| Microcystins | 3[c] (up to 1 day) | 0.03 (up to 3 months) |
| Saxitoxins | 0.5[c] (up to 1 day) | NA |

[a] Recommendations for short-term NLs and the one-day NL of 0.6 ug/L for saxitoxins were provided to the water board May 3, 2021.
[b] Table is in units of micrograms per liter (ug/L), which is equivalent to parts per billion (ppb).
[c] NL is for the total concentration of toxin variants.

***Manganese***

The federal secondary MCL for manganese is 0.05 mg/L. The current state of California notification level for manganese is 0.5 mg/L. DDW has initiated the process of revising the current notification and response levels for manganese and has issued a recommended revised NL to 0.02 mg/L.

Manganese is considered an important pollutant given its ubiquitous occurrence in drinking water and food, high exposures potential in sensitive populations, and number human and animal studies suggesting neurotoxicity.

The City supply groundwater sources range from Not Detected to 0.0321 mg/L (2021 City of Huntington Beach Drinking Water Quality Report). Noticeable levels of manganese have been detected at Well 3A. In 2022 manganese levels at Well 3A, were detected at levels above the MCL. This well has been removed from production until a treatment system for well 3A can be installed. The City is currently looking into treatment options for this well. Treatment of City supply sources to meet stricter manganese NL may be required in the near future at any wells with especially high manganese.

***Lead and Copper***

The California Lead and Copper Rule (CA LCR) aligns with the EPA's LCR. The LCR requires water systems to monitor lead and copper levels at the consumer's taps. If action levels for lead or copper are exceeded, installation or modification to corrosion control treatment is required. If the action level for lead is exceeded, public notification is required.

On January 15, 2021, the EPA issued lead and copper rule revisions (LCRR) to the federal LCR. The LCR will require community water systems and non-transient non-community systems throughout the United States to conduct an inventory of service lines and determine the material of those lines and fittings by October 16, 2024. The inventory must include all service lines connected to the water system's distribution system, regardless of ownership status. If the service line ownership is shared, the inventory would include both the portion of the service line owned by the water system and the customer-owned portion of the service line. Water systems are to keep their current tap sampling plans until the LCR comes into effect on October 16, 2024.

The City has taken action to comply with the 2021 LCRR. New capital improvement Project 61 described in Chapter 7 includes steps to comply with the LCRR. Compliance requires an assessment to identify lead/copper service lines. The City has begun the process to determine service line materials by going door to door and visually inspecting the service lines at the meter. To date there has been no evidence of lead pipes at any of the meter service lines. The City intends to complete the inventory by the October 16, 2024 deadline.

***Perchlorate***

On July 1, 2021 the DDW issued a new Detection Limit for Purposes of Reporting (DLR) for perchlorate of 1 ug/L. DDW has notified the public of their intentions to subsequently revise the Perchlorate MCL, should the new DLR data support development of a new standard. Perchlorate and its salts are used in solid propellant for rockets, missiles, and fireworks. The City supply sources have no historic presence of Perchlorate. Accordingly, treatment of City supply sources to meet the perchlorate DLR or any subsequent changes to the MCL is not required or anticipated.

***Total Coliform and E. coli***

As of July 1, 2021, the California Revised Total Coliform Rule (RTCR) became effective. The revisions include the new Coliform Treatment Technique requirements replacing the Total Coliform MCL, and a new E. coli MCL regulatory limit as defined below.

Existing bacteriological sample siting plans may comply with the new RTCR requirements provided the plans:

1. Include the minimum number of routine samples per month in Table 64423-A of the regulations.
2. Identify repeat sample locations for each routine sample location.
3. Identify triggered source sampling needed to comply with the Groundwater Rule.
4. Identify the sample schedule and rotation plan among sampling sites for collection of routine, repeat and triggered source sampling.
5. Identify the raw water sources that are continuously disinfected and require quarterly monitoring.

The water boards provide E. coli MCL exceedances, listed below:

1. E. coli positive repeat sampling following TC-positive routine sampling,
2. TC-positive repeat sample following an E. coli positive routine sample,
3. Failure to collect all required repeat samples following a E. coli positive routine sample,
4. Failure to test for E. coli when any repeat sample is TC-positive.

***Hydrogen Sulfide***

Hydrogen Sulfide (H2S) is a colorless gas known for its pungent "rotten egg" odor at low concentrations. Dissolved H2S could be formed in well water that is anaerobic and contains sulfur reducing bacteria that convert sulfur, present in organic matter, to H2S. H2S concentration in potable water is not regulated, however, presence of H2S, even at a very low concentration of (on the order of 0.05 ppm), will result in a detectable odor.

There are several methods to treat water containing H2S and the best method will depend on the concentration of H2S. The simplest method is to shock chlorinate the well to eliminate sulfur producing bacteria. If H2S is present in well water in low concentration (~ 0.05 ppm), continuous chlorination of the water, pumped from the well, will convert hydrogen sulfur to elemental sulfur. At somewhat higher concentrations a green sand filtration, regenerated with hypochlorite or potassium permanganate, could be applied. When present at even higher concentrations, H2S can be removed by degasification in packed towers, similar to the equipment used to remove carbon dioxide. At very isolated locations, there is the possibility to vent off the gases containing H2S to the atmosphere. If local regulations do not allow direct venting, the off gases can be absorbed in a high pH solution and sent to the sanitation district. The most expensive solution would be to use towers packed with iron catalyst, to bind H2S and convert it to elemental sulfur. After saturation, the catalyst must be disposed of at a land fill site.

Three of the City's wells are currently experiencing issues with H2S. These are: Well 6, Well 8, and Well 9. Well 6 water is blended with other sources to reduce the effects of H2S, and the well is not pumped at full capacity. Well 8 is currently out of service because of H2S and color. At Well 9, a biological treatment system has been installed to remove H2S, and the well is capable of pumping at full capacity.

***Sand***

Sand in the water system has several detrimental effects. Sand can plug pipelines, sprinkler systems, valves, plumbing, and other components of the distributions system. Sand is very destructive to pump bowls and impellers and can reduce the life of the pump. Sand, which is drawn into the well, but not removed with the water, can settle to the bottom of the well. If sufficient sand accumulates, well efficiency or production can be reduced. As portions of the screen are blocked by the sand, drawdown is increased leading to increased entrance velocity, and lowering efficiency. While there is no regulation levels for sand in drinking water, the US EPA recommends that wells supplying water to homes, institutions, municipalities, and industries be limited to 5 ppm of sand by weight, measured 15 minutes after the start of pumping.

The presence of sand in the water pumped from the well could be the result of well pump located too close to the well bottom, damaged well screen or pump flow is too high for the well configuration. Very high sand concentration could result in high readings of water turbidity. Rapid starts of the well pump could increase the drag of sand into the pumped water. If addressing the sand intake at the well is not feasible, sand can be removed from the pumped water by installing sand removing equipment downstream of the well discharge. Such equipment could include screen sand separators (equipped with a suitable size mesh screens) or centrifugal sand separators (hydro cyclone). Sand separators will result in some head losses and does not address increased well pump wear due to the sand. The presence of sand has been reported in water pumped from Well 1A, Well 3A, Well 4, and Well 10.

## 3.3 Groundwater Supply

The City and other OCWD member agencies are charged the RA for groundwater produced from the Basin up to the BPP, and are charged an additional BEA for groundwater produced over this percentage. The BPP is uniform for all members. The BPP was set at 77% FY 2021/22 and will increase to 85% for FY 2023/24. The RA is currently set at $624/acre-foot for FY 2023/2024. On April 19, 2023, OCWD's Board of Directors adopted Resolution D establishing the BPP at 85% for FY 2023/24. This has been possible in part by the increased recharge operation from the completion of the Groundwater Replenishment System (GWRS) final expansion and other programs and projects implemented by OCWD.

### 3.3.1 *OCWD Projects*

OCWD has on-going and proposed projects to protect, clean, and refill/maintain the groundwater basin.

***Talbert Seawater Intrusion Barrier***

Since 1975, OCWD has operated a seawater barrier to keep seawater from migrating inland and mixing with and contaminating potable groundwater. OCWD's Fountain Valley Seawater Intrusion Barrier is a series of 36 injection wells running along Ellis Avenue from Euclid Street to Newland Street and also along the Santa Ana River north of Adams Avenue. A mixture of wastewater purified at Water Factory 21 in Fountain Valley and deep well water is pumped to the wells and injected into the ground to create an underground dam that blocks seawater from entering the groundwater basin.

Of the 36 injection well sites, 23 are the original injection wells that were installed between 1968 and 1927 along Ellis Avenue between the Huntington Beach and Newport Mesas. These original wells are referred to as the "legacy injection wells". 5 additional injection well sites were constructed between 1999 and 2004. As part of the GWRS project, 8 more injection well sites were constructed between 2004 and 2007. These last 13 wells are referred to as the "modern injection wells".

***Groundwater Replenishment System***

The Groundwater Replenishment System (GWRS), a joint project of OCWD and the Orange County Sanitation District (OCSD), takes highly treated wastewater that would have previously been discharged into the Pacific Ocean and purifies it using a three-step process consisting of microfiltration, reverse osmosis, and ultraviolet light with hydrogen peroxide. Some of this highly treated water is used to fortify the seawater intrusion barrier and some is pumped to upstream areas of the Basin where it is recharged at strategic sites into the deep aquifers of the Basin, where it eventually becomes part of the potable groundwater supply. The treated water exceeds all federal and state drinking water standards and is near-distilled water that improves the overall quality of the groundwater basin by lowering the mineral content. This state-of-the-art water purification project, the largest of its kind in the world, has a current capacity of 130 million gallons per day (mgd) resulting in about 140,000 AFY for recharge to the Basin.

The Final Expansion of the GWRS project was completed in early 2023, increasing treatment capacity from 100 mgd to 130 mgd. Additional waste water required for recharge is supplied from OCSD Treatment Plant 2, located in the Huntington Beach, approximately 3.5 miles south of the GWRS.

### 3.3.2 *Groundwater Production*

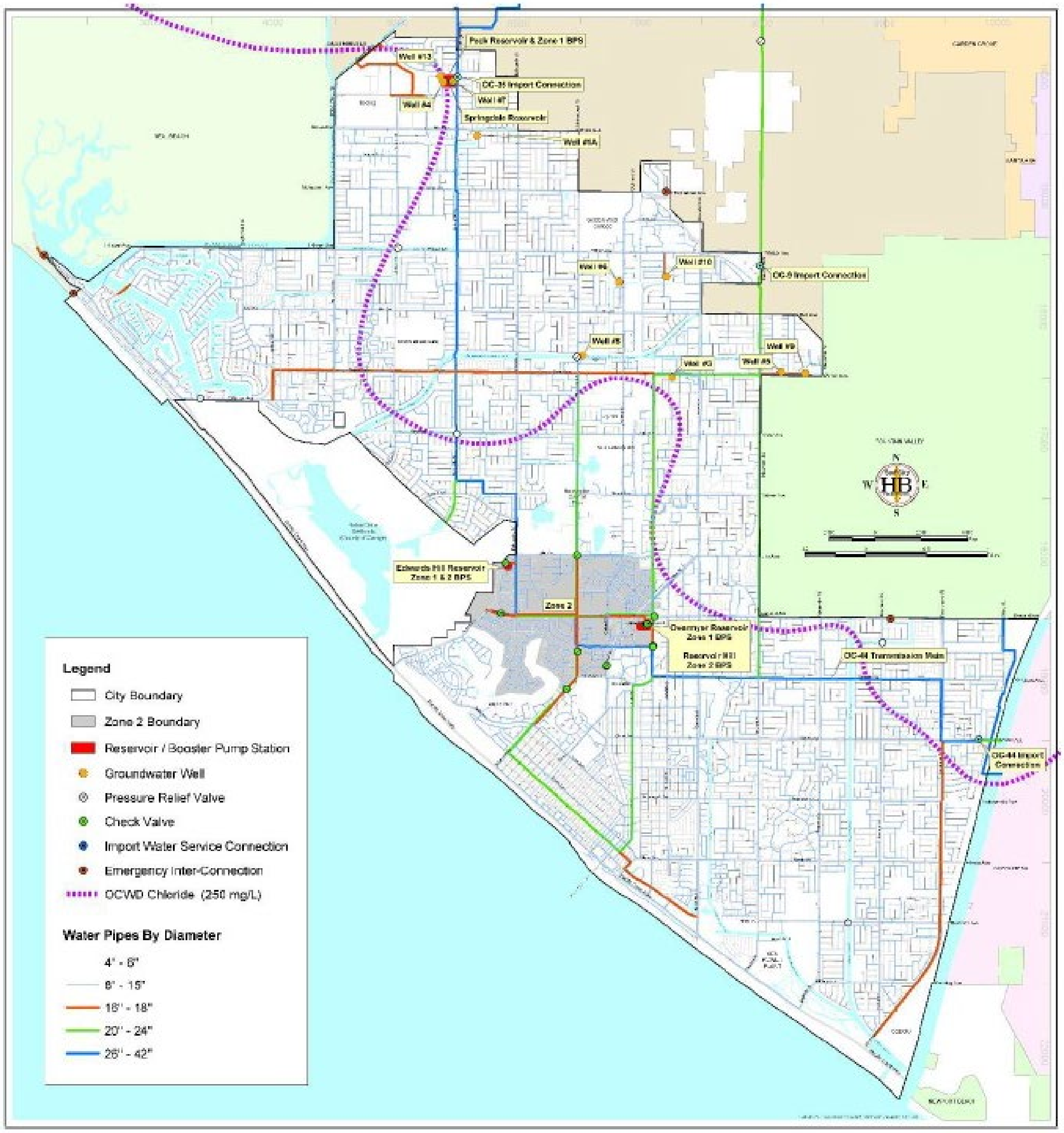
The capacity of the City's active potable wells is shown in Table 3-4 and the locations of these potable wells are shown on Figure 3-2. As shown on Table 3-4, the City has a total potable water well capacity estimated at 27,050 gpm. However, the wells cannot be depended on to operate at 100% capacity due to potential issues relating to groundwater level, water quality, maintenance requirements, and mechanical problems. In addition, the City prolongs the life of the wells and pumping equipment by operating at less than full capacity. This provides time for local groundwater recovery (which promotes the health of the well screens) and preventative maintenance. With the aforementioned in mind, the City's goal is to operate the wells at no more than 75% of total capacity.

**Table 3-4**
**Groundwater Well Production Capacities**

| | Year Drilled | Well Depth (feet) | Capacity (gpm) | Capacity (AFY) |
|---|---|---|---|---|
| Well No. 1A | 2018 | 825 | 2,250 | 3,629 |
| Well No. 3A | 1994 | 716 | 2,500 | 4,033 |
| Well No. 4[1] | 1967 | 804 | 0 | 0 |
| Well No. 5 | 1969 | 820 | 4,000 | 6,452 |
| Well No. 6 | 1973 | 810 | 3,300 | 5,323 |
| Well No. 7 | 1975 | 891 | 4,000 | 6,452 |
| Well No. 9 | 1981 | 996 | 3,000 | 4,839 |
| Well No. 10 | 1981 | 960 | 4,000 | 6,452 |
| Well No. 13 | 2001 | 800 | 4,000 | 6,452 |
| **Total Groundwater** | | | **27,050** | **43,632** |
| **Total Long-Term Reliable Pumping Capacity (75% of Total Capacity)** | | | **20,280** | **32,712** |

Source: City of Huntington Beach 2020 UWMP.
[1]Well No. 4 is currently offline and expected to be replaced FY23/24

# Figure 3-2
# Locations of City Potable Groundwater Wells & Imported Water Turnouts



The City's 2020 UWMP assumed a 77% BPP for future long-range planning purposes. With the current basin conditions, the continuing move toward water conservation, and the expanded GWRS projections, OCWD staff has increased the BPP to 85% for FY 2023/24. Based on 2020 water consumption adjusted for the drought conditions to a normal year consistent with the 2020 UWMP, and 2045 projected demands the amount of water using these two BPP percentages that could be withdrawn from the Basin without paying the BEA are as shown on Table 3-3. As discussed above, the normal operating capacity of the wells is approximately 75% of the total capacity, or approximately 20,280 gpm or 32,712 AFY. This well capacity is adequate to meet the current and future supply requirements assuming a 77% BPP (15,452 AFY and 20,062 AFY, respectively). This well capacity will also be enough to meet the current and future supply requirements assuming an 85% BPP (22,071 AFY and 22,146 AFY, respectively).

**Table 3-5**
**Groundwater Production to BPP**

| Supply (AFY) | 2020 | 2045 |
|---|---|---|
| Total Supply Requirement | 25,966 | 26,054 |
| GW Production to 77% BPP | 15,452 | 20,062 |
| GW Production to 85% BPP | 22,071 | 22,146 |

### 3.3.3 *Regional Imported Water Supply*

The City purchases supplemental treated imported water from MWDOC, which is a member agency of MWD. MWD imports raw water from northern California and the Colorado River, and then treats the majority of this water to potable standards at filtration plants located throughout southern California. MWD water from northern California as part of the State Water Project (SWP) is stored at Castaic Lake on the western side of the MWD service area and at Silverwood Lake near San Bernardino. MWD water imported from the Colorado River is stored at Lake Mathews in Riverside County. The Diamond Valley Reservoir in Riverside County near Hemet provides regional seasonal and emergency storage of SWP and Colorado River water.

### 3.3.4 *Conjunctive Use Storage Program*

In 2003, MWD, MWDOC, and OCWD signed a 25-year agreement to store nearly twenty billion gallons of water in the Orange County Groundwater Basin for use during dry years and emergencies. The agreement also provides for additional protection from seawater intrusion and improved groundwater quality. Under the program, MWD, in cooperation with MWDOC and OCWD, will store more than 60,000 AF of imported water in the Basin during wet periods. During dry periods, droughts, or emergencies, up to 20,000 AFY will be withdrawn for use. The cost of the water supply will be equal to the full-service MWD imported water rate.

Eight groundwater extraction wells were provided to city and local water district participants to ensure that the stored water can be pumped in addition to the normal pumped groundwater. The operating agencies are able to use MWD's new wells as backups for their existing systems and ownership of these wells will transfer to the participating agencies when the agreement expires. Participating agencies include the cities of Buena Park, Fullerton, Garden Grove, Orange, Santa Ana, and Westminster, plus Golden State Water Company, and Yorba Linda Water District.

### 3.3.5 *City Imported Water Supply*

The City receives treated imported potable water from two primary MWD sources. MWD's Jensen Filtration Plant, located in San Fernando Valley, receives only SWP water with no water received from the Colorado River. Jensen-treated water is delivered to the City via service connections OC-9 and OC-35.

The City also receives treated imported potable water from the Diemer Filtration Plant, located just north of Yorba Linda. Typically, the Diemer Plant receives a blend of Colorado River water from Lake Mathews through the MWD lower feeder and SWP water through the Yorba Linda Feeder. At this time the blend is approximately a 50/50 blend of the two sources. Diemer-treated water is delivered to the City via service connection OC-44.

As mentioned above, imported water is delivered to the City via three service connections: OC-9, OC-35, and OC-44. The locations of these service connections or turnouts are shown on Figure 3-2. All three turnouts currently supply water directly to Zone 1. The City's allocated maximum capacities from these connections are shown in Table 3-4. OC-9 and OC-35 are both under the jurisdiction of the West Orange County Board (WOCWB), which normally require 24-hour advance notice to change delivery flows. Both service connections are located at the intersection of Dale and Katella Streets in the City of Stanton. Water from OC-9 enters the City system at the intersection of Newland Street and Edinger Avenue and water from OC-35 enters the City system at the intersection of Springdale and Glenwood Streets. Since the City is the majority owner of the WOCWB, the Public Works Department, Utilities Division is responsible for performing all operation and maintenance on the transmission mains, and the City Utilities Manager acts as the General Manager for WOCWB.

OC-44 is located on MWD's East County Feeder No. 2. MWD, who owns the primary meter, allows the City to take water from OC-44 on a demand basis, and does not require advance notice in order to change flow settings. Water is supplied to the City from OC-44 via a 24- to 42-inch transmission line owned jointly by the City and Mesa Water District. A secondary joint metering station to measure flows to the City is located on Adams Avenue at the Santa Ana River, where the water enters the City system.

**Table 3-6**
**Imported Water Connections**

| Connection | Allocated Capacity (gpm) | Zone Supplied | Turnout Location (Location Entering City System) |
|---|---|---|---|
| OC-9 | 6,300 | Zone 1 | Dale & Katella Streets - Stanton (Newland St. & Edinger Ave.) |
| OC-35 | 9,000 | Zone 1 | Dale & Katella Streets - Stanton (Springdale & Glenwood Streets) |
| OC-44 | 6,700 | Zone 1 | East Orange County Feeder No. 2 (Adams Ave. & Santa Ana River) |
| Total | 22,000 | | |

### 3.3.6 *Seawater Desalination*

A third-party private desalination company was in the process of developing the Huntington Beach Seawater Desalination Project to be located adjacent to the AES Power Plant in the City along Pacific Coast Highway and Newland Street. The proposed project was unanimously rejected by the California Coastal Commissioners, and the project is no longer planned.

### 3.3.7 *Emergency Connections*

The City has emergency mutual-aid interconnections with adjacent water agencies including the City of Fountain Valley, City of Westminster, and the City of Seal Beach. The locations of these emergency interconnections are shown on both Figures 3-2 and 4-1. Each of these agencies could provide Huntington Beach with limited water supply in the event of an emergency, if these supplies are available. Conversely, the City could provide emergency water to these cities, if available from either groundwater or imported water sources. Imported water is also supplied to Huntington Beach from OC-44 via a 24- to 42-inch transmission main jointly owned by the City and Mesa Water District. In an emergency the City could receive water from this source from Mesa and vice versa.

### 3.3.8 *Supply Reliability*

Available water supplies compared to demands determine one component of an agency's overall supply reliability. The City's ability to pull from different sources such as imported water from Metropolitan and groundwater provide a certain degree of reliability. Other local sources such as recycled water can also provide additional supply reliability. However, just because an agency has more supply than demand does not necessarily make the system reliable. For example, all of its supply could come from one source that might be susceptible to interruptions in service from droughts, earthquakes or other elements.

The more different sources or sources with a high degree of reliability an agency has, the more reliable their supply will be. The City is fortunate to overly the Orange County Groundwater Basin (Basin), which has been able to sustain BPPs in the mid-70 percent throughout past years. During preparation of the City's 2020 UWMP, Orange County Water District who manages the Basin conservatively projected that a BPP of 75 percent could be maintained. This means that the City can reasonably count on at least 75 percent of its projected demands being met by local groundwater produced from City wells overlying the Basin. However, due to current favorable basin conditions, the continuing move toward water conservation, and the expanded GWRS projections, OCWD staff has increased the BPP to 85% for FY 2023/24 and feels that agencies could easily use 85% as a conservative BPP projection for long-term planning. At least one more well, ideally with a 4,000 GPM design capacity, must be built for the City to reliably meet the 85% BPP. Imported water is less reliable in that Metropolitan's main sources are the State Water Project which is subject to climate patterns including drought and other environmental constraints and Colorado River Water which also has limitations. However, Metropolitan has projected in its long range water planning documents, including its 2020 Regional UWMP and 2020 Integrated Water Resources Plan (IRP), that supplies will be sufficient to meet projected demands during normal, single dry and multiple dry years through the year 2045.

As discussed in detail in the City's 2020 UWMP, there are additional local programs that were not counted on due to the relatively conservative approach taken in the UWMP that could make the City's overall supply reliability picture even more secure. A couple of these programs include local stormwater capture and reuse and the potential desalination project.

Given the above, the ability of the City to reliably produce sufficient quantities of groundwater from the Basin and imported water from its available wells and turnout facilities, respectively, will be analyzed. Existing City wells with their year of construction, depths, pumping capacities and normal operating capacities are listed in Table 3-7. The reason the normal operating capacities are lower than those listed under the "Capacity" column may be due to the fact that some of the City's wells are not operated at 100 percent capacity in consideration of several factors including groundwater level, water quality, availability of in-lieu water, etc. Additionally, the life of the wells and associated supply equipment can be prolonged when operating at less than capacity resulting in the normal operating supply values shown in Table 3-7.

**Table 3-7**
**Well Capacities (Design & Normal Operating)**

| | Year Drilled | Well Depth (feet) | Capacity (gpm) | Normal Operating Capacity (gpm) |
|---|---|---|---|---|
| Well No. 1A | 2018 | 825 | 2,250 | 2,250 |
| Well No. 3A [c] | 1994 | 716 | 2,500 | 1,750 |
| Well No. 4[b] | 1967 | 804 | 0 | 0 |
| Well No. 5 | 1969 | 820 | 4,000 | 3,000 |
| Well No. 6 | 1973 | 810 | 3,300 | 2,500 |
| Well No. 7 | 1975 | 891 | 4,000 | 3,400 |
| Well No. 9 [a] | 1981 | 996 | 3,000 | 2,250 |
| Well No. 10 | 1981 | 960 | 4,000 | 2,700 |
| Well No. 13 | 2001 | 800 | 4,000 | 2,500 |
| **Total Groundwater** | | | **27,050** | **20,350** |

Source: City of Huntington Beach 2020 UWMP.

(a) Biological treatment system added to Well 9 to treat hydrogen sulfide, and well 9 can produce at full capacity.
(b) Well 4 is currently offline and expected to be replaced FY23/24.
(c) Well 3A is currently offline due to exceeding the MCL for manganese.

Imported water can be supplied directly into the City's Zone 1 via three turnouts, OC-9 at 6,300 gpm, OC-35 at 9,000 gpm, and OC-44 at 6,700 gpm, for a total imported supply availability of 22,000 gpm, as shown on Table 3-4.

Determining the amount pumped from each of the City's supply facilities from month to month is fairly complex due to many variables. First, the City's demand fluctuates with higher demands in summer than winter. Additionally, the BPP typically varies to some degree from year to year based on weather and Basin conditions. And finally, in-lieu water is available from Metropolitan in certain years in certain months when surplus imported water is available (Metropolitan provides imported water in wet years at rates similar to groundwater costs to encourage use of surplus imported supplies and, in essence, increase levels in the Basin for use in dry years). Table 3-8 shows a typical hypothetical annual operational scenario using projected 2025 demands from the City's 2020 UWMP and applying monthly demand distribution based on the average of monthly demand factors from the past five years (FY 2015 through FY 2020). For example, over that period the highest monthly average was August with a factor of 1.24 times average annual demand and the lowest month was February with a factor of 0.72 times average.

# Table 3-8
# 2025 Monthly Demand/Supply Projections
# (acre-feet)

| | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Peaking Ratio | 1.23 | 1.24 | 1.14 | 1.08 | 0.94 | 0.85 | 0.79 | 0.72 | 0.81 | 0.96 | 1.1 | 1.14 | |
| 2025 Demand | 2,924 | 2,947 | 2,710 | 2,567 | 2,234 | 2,020 | 1,878 | 1,711 | 1,925 | 2,282 | 2,615 | 2,710 | 28,523 |
| **Supply Source** | | | | | | | | | | | | | |
| Groundwater | 2,262 | 2,281 | 2,097 | 1,986 | 1,729 | 1,563 | 1,453 | 1,324 | 1,490 | 1,766 | 2,023 | 2,097 | 22,071 |
| Imported | 439 | 442 | 406 | 385 | 335 | 303 | 282 | 257 | 289 | 342 | 392 | 406 | 4,278 |
| **Groundwater (Operating Capacity)** | | | | | | | | | | | | | |
| Well 1 | 372 | 375 | 345 | 327 | 284 | 257 | 239 | 218 | 245 | 290 | 333 | 345 | 3,629 |
| Well 3A | 289 | 292 | 268 | 254 | 221 | 200 | 186 | 169 | 191 | 226 | 259 | 268 | 2,823 |
| Well 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Well 5 | 496 | 500 | 460 | 436 | 379 | 343 | 319 | 290 | 327 | 387 | 444 | 460 | 4,839 |
| Well 6 | 413 | 417 | 383 | 363 | 316 | 286 | 265 | 242 | 272 | 323 | 370 | 383 | 4,033 |
| Well 7 | 562 | 567 | 521 | 494 | 430 | 388 | 361 | 329 | 370 | 439 | 503 | 521 | 5,484 |
| Well 9 | 248 | 250 | 230 | 218 | 190 | 171 | 159 | 145 | 163 | 194 | 222 | 230 | 2,420 |
| Well 10 | 446 | 450 | 414 | 392 | 341 | 308 | 287 | 261 | 294 | 348 | 399 | 414 | 4,355 |
| Well 13 | 413 | 417 | 383 | 363 | 316 | 286 | 265 | 242 | 272 | 323 | 370 | 383 | 4,033 |
| Total GW Capacity | 3,241 | 3,267 | 3,003 | 2,845 | 2,477 | 2,239 | 2,081 | 1,897 | 2,134 | 2,529 | 2,898 | 3,003 | 31,615 |
| **GW Surplus** | **978** | **986** | **907** | **859** | **748** | **676** | **628** | **573** | **644** | **764** | **875** | **907** | **9,544** |
| **Imported Water (Operating Capacity)** | | | | | | | | | | | | | |
| **Imported Water** | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 35,486 |
| **Imported Surplus** | **2,519** | **2,515** | **2,551** | **2,572** | **2,622** | **2,654** | **2,676** | **2,700** | **2,668** | **2,615** | **2,565** | **2,551** | **31,208** |
| **Total Water (Operating Capacity)** | | | | | | | | | | | | | |
| **Total Capacity** | 6,198 | 6,224 | 5,961 | 5,803 | 5,434 | 5,197 | 5,039 | 4,854 | 5,091 | 5,486 | 5,855 | 5,961 | 67,101 |
| **Total Surplus** | 3,497 | 3,501 | 3,457 | 3,431 | 3,370 | 3,330 | 3,304 | 3,273 | 3,313 | 3,378 | 3,440 | 3,457 | 40,752 |

The first row in Table 3-6 shows the projected 2025 demand proportioned across each month based on the average factors for each month as discussed above. The next two rows show the monthly demand split between groundwater and imported water using a BPP of 85 percent, assuming no in-lieu water for simplicity. It is understood that this scenario is somewhat simplified in that an exact BPP is not typically maintained each and every month but at the end of the year it is important to hit the BPP as close as possible since over pumping from the Basin results in Replenishment Assessments over and above normal groundwater pumping rates and taking more imported water is more expensive than groundwater pumped at or below the BPP.

Table 3-8 does illustrate an important point, though. All the groundwater rows and columns show the normal operating pumping rates from Table 3-7 times the number of days in each month converted to acre-feet for each well and then a total for all of the nine wells. The "GW Surplus" row is the difference between the total of all Well Operating Capacities minus the Groundwater Demand from the second row of the table. Table 3-8 shows that the total Surplus Groundwater Pumping Capacity projected for Year 2025 is 9,544 acre-feet, which is substantial. In January and February, the Surplus Groundwater Pumping Capacity is at its lowest, at a monthly surplus of 628 AF and 573 AF, respectively. During that period, if a large capacity producing well, such as Well 7, were to be down for the month, the BPP could not be maintained in any of those months. If this were to occur, other wells could perhaps be pumped at higher rates to compensate during such an outage. Alternatively, more groundwater could be pumped in other months when there is significantly more surplus to catch up with the BPP. However, this analysis does show that there is marginal surplus groundwater production capacity in certain times of the year. This becomes even more significant when you consider that Wells 4, 7, and 13 are all located in close proximity to one another at the Peck/Springdale Reservoir complex and in the area where higher chloride content exists in the Basin. This fact is illustrated on Figure 3-2 by comparing City well locations with the 250 mg/l Chloride concentration lines as developed by OCWD from monitoring in recent years. If the City were to lose these three wells for a year with projected 2025 demands and assuming the Normal Operating Pumping Capacities shown in Table 3-7, they would just barely meet the assumed BPP of 85 percent with a surplus of 27 AF.

A similar table was prepared using projected 2045 demands and that scenario is illustrated in Table 3-9. These are demand projections some 25 years in the future. Because of the downward trends in water usage, BPP is able to be met with adequate surplus. The demands, BPP, and monthly peaking can be easily modified in the Excel files created to generate Tables 3-8 and 3-9 (included as a deliverable to the City) to analyze differing scenarios and assess their impacts. If demands were to increase and with increases in demands and the BPP, the City's groundwater pumping capacity would become less and less reliable, especially in summer months. Additionally, in drier years the monthly demand distribution would be more extreme (i.e. higher summer peak use) than the average monthly distributions used in this analysis, further exacerbating this condition. However, due to recent demand trends, we are not predicting an issue with supply reliability.

# Table 3-9
# 2045 Monthly Demand/Supply Projections
# (acre-feet)

| | JUL | AUG | SEPT | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Peaking Ratio | 1.23 | 1.24 | 1.14 | 1.08 | 0.94 | 0.85 | 0.79 | 0.72 | 0.81 | 0.96 | 1.1 | 1.14 | |
| 2045 Demand | 3,107 | 3,133 | 2,880 | 2,728 | 2,375 | 2,147 | 1,996 | 1,819 | 2,046 | 2,425 | 2,779 | 2,880 | 30,316 |
| **Supply Source** | | | | | | | | | | | | | |
| Groundwater | 2,641 | 2,663 | 2,448 | 2,319 | 2,019 | 1,825 | 1,696 | 1,546 | 1,739 | 2,061 | 2,362 | 2,448 | 25,769 |
| Imported | 466 | 470 | 432 | 409 | 356 | 322 | 299 | 273 | 307 | 364 | 417 | 432 | 4,547 |
| **Groundwater (Operating Capacity)** | | | | | | | | | | | | | |
| Well 1A | 372 | 375 | 345 | 327 | 284 | 257 | 239 | 218 | 245 | 290 | 333 | 345 | 3,629 |
| Well 3A | 289 | 292 | 268 | 254 | 221 | 200 | 186 | 169 | 191 | 226 | 259 | 268 | 2,823 |
| Well 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Well 5 | 496 | 500 | 460 | 436 | 379 | 343 | 319 | 290 | 327 | 387 | 444 | 460 | 4,839 |
| Well 6 | 413 | 417 | 383 | 363 | 316 | 286 | 265 | 242 | 272 | 323 | 370 | 383 | 4,033 |
| Well 7 | 562 | 567 | 521 | 494 | 430 | 388 | 361 | 329 | 370 | 439 | 503 | 521 | 5,484 |
| Well 9 | 248 | 250 | 230 | 218 | 190 | 171 | 159 | 145 | 163 | 194 | 222 | 230 | 2,420 |
| Well 10 | 446 | 450 | 414 | 392 | 341 | 308 | 287 | 261 | 294 | 348 | 399 | 414 | 4,355 |
| Well 13 | 413 | 417 | 383 | 363 | 316 | 286 | 265 | 242 | 272 | 323 | 370 | 383 | 4,033 |
| Total GW Capacity | 3,241 | 3,267 | 3,003 | 2,845 | 2,477 | 2,239 | 2,081 | 1,897 | 2,134 | 2,529 | 2,898 | 3,003 | 31,615 |
| **GW Surplus** | **599** | **604** | **555** | **526** | **458** | **414** | **385** | **351** | **395** | **468** | **536** | **555** | **5,846** |
| **85Projected Import Water vs Operating Capacity** | | | | | | | | | | | | | |
| **Imported Water** | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 2,957 | 35,486 |
| **Imported Surplus** | **2,491** | **2,487** | **2,525** | **2,548** | **2,601** | **2,635** | **2,658** | **2,684** | **2,650** | **2,593** | **2,540** | **2,525** | **30,939** |
| **Total Capacity and Surplus Capacity (After Adjustments)** | | | | | | | | | | | | | |
| **Total Capacity** | 6,198 | 6,224 | 5,961 | 5,803 | 5,434 | 5,197 | 5,039 | 4,854 | 5,091 | 5,486 | 5,855 | 5,961 | 67,101 |
| **Total Surplus** | 3,090 | 3,091 | 3,081 | 3,074 | 3,059 | 3,049 | 3,043 | 3,035 | 3,045 | 3,061 | 3,076 | 3,081 | 36,785 |

These analyses do illustrate that the City has plenty of surplus imported water capacity even in the higher demand months based on the high volume of turnout capacity. The fact that the three turnouts are located at different points on the City distribution system is an added plus for imported water reliability.

### 3.3.9 *Groundwater Well Study*

In conclusion, the City has lost two wells since the 2012 Water Master Plan, a clear indicator that the City should be prepared for a potential loss of one or more wells due to any number of factors. Table 3-10 below shows a history of wells going back to 1956 that have experienced limited capacities and have been abandoned and/or replaced. Illustrated on Table 3-11 below, a total of 16 wells have been drilled since 1956, of which eight currently are still active, with eight being either inactive or destroyed. 5 of the city's active wells exceed 34 years in age, the average age of the City's inactive wells. This is an important indicator that planning for future replacement is necessary and inevitable. The above findings indicate a high risk of a multi-year financial impact resulting from being unable to meet the BPP, especially in a scenario of sudden loss of a water well. This is compounded by the fact that it would take between 3 to 4 years to design and construct a new replacement well (or longer if a new well site must first be acquired). The financial impact would be the result of having to purchase a much costly imported water supply, as that can add an unanticipated operating cost of around $2.4 million if prolonged for one year, or nearly $10 million over the 4 years it could take to design and construct a new well. In other words, failure to meet BPP for 4 years is approximately equivalent to the design and construction cost of two new wells. A sample calculation of this financial impact is illustrated below, assuming no well down time for simplicity:

Assumptions:

Typical Water Well Production = 2,500 gpm or 11AF/Day or 4,032 AF/Yr.
Current Cost difference Between Imported & Groundwater = ~$600/AF
Minimum Cost of New Water Well = $5 million

Financial Impact from Added Cost to the City:

Daily Impact - $600/AF x 11 AF/Day = $6,600/Day
Annual Impact - $600/AF x 4,032 AF/Yr. = $2.4 million/Yr.
4 Year Impact – 4 x $600/AF x 4,032 AF/Yr. = $9.6 million/Yr.

Comparing Added Import Cost vs. New Water Wells:

(4 Year Impact) / (Cost of New Well) =
$9.6 million / $5 million = ~2, or equivalent to 2 New Water Wells

A separate well study should be completed to assess the condition of each of the City's existing wells, determine their remaining useful life, and develop a systematic approach to replacement of wells in their same general location and/or the addition of new wells at future locations.

The study should address the presence of higher levels of dissolved Hydrogen Sulfide at Well No. 6 and Well No. 9. The study should also address the presence of sand which has impacted Well 1A and Well 10. The recommended well study would address the future need for and phasing of any additional wells and recommended locations for these wells. However, new wells are already necessary to begin to restore losses in groundwater pumping capacity, and these wells are discussed in Chapter 7.

# Table 3-10
# Groundwater Well History

| | Year Drilled | Well Status | Well Depth (feet) | Design | | | | Normal Operating Pump Speed Set by City (RPM) | Normal Operating Capacity (GPM) | ** Above Normal Operating Capacity (GPM) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Electric Motor (EM) or Natural Gas Engine (NG) | Capacity (gpm) | Pumping Head (feet) | Pumping Speed (RPM) | | | | |
| DYKE | 1956 | No longer belongs to the City | 204 | -- | *500 | 240 | 1,760 | 1,760 | -- | -- | No longer belongs to City |
| Well No. 1 | 1962 | Abandoned | 306 | -- | *750 | 316 | 1,760 | 1,760 | -- | -- | Destroyed in 2012 |
| Well No. 2 | 1962 | Abandoned | 820 | -- | *2000 | 245 | 1,760 | 1,760 | -- | -- | Destroyed in 2001 |
| Well No. 3 | 1950 | Abandoned | -- | -- | *4000 | 263 | 1,775 | -- | -- | -- | Destroyed in 1980 |
| Well No. 4 | 1967 | Out of Service | 804 | NG | 500 | 252 | 1,775 | 1,350 | 300 | 300 | Out of service as of 2022. To be replaced FY 2024. Well screen and casings are functional. Well requires new pump and above grade equipment. |
| Well No. 5 | 1969 | **Active** | 820 | EM | 4,000 | 263 | 1,775 | 1,666 | 2,500 | 2,500 | Well rehabilitation consisting of new pump and casing repair in 2016 |
| Well No. 6 | 1973 | **Active** | 810 | NG | 3,300 | 330 | 1,190 | 900 | 1,500 | 2,500 | Production reduced by 55% of well capacity due to presence of hydrogen sulfide and color in water |
| Well No. 7 | 1975 | **Active** | 891 | NG | 4,000 | 300 | 1,200 | 1,100 | 3,000 | 3,000 | |
| Well No. 8 | 1978 | Out of Service | 724 | -- | *3000 | Information Not Available | | | -- | -- | Out of service as of 1980 due to presence of hydrogen sulfide and color in the water |
| Well No. 9 | 1981 | **Active** | 996 | NG | 3,000 | 408 | 1,775 | 1,600 | 2,250 | 2,500 | GAC filtration system put online in 2018 increasing the well to normal capacity |
| Well No. 10 | 1981 | **Active** | 960 | NG | 4,000 | 308 | 1,775 | 1,670 | 3,300 | 3,300 | |
| Well No. 11 | 1985 | Abandoned | 775 | -- | -- | Information Not Available | | | -- | -- | Destroyed in 2003. Drilled but never put into service |
| Well No. 3A | 1994 | **Active** | 660 | EM | 2,500 | 406 | 1,785 | 1,680 | 2,000 | 2,000 | Original design capacity reduced due to bottom 25 feet of well cemented in 2015 |
| Well No. 13 | 2002 | **Active** | 830 | NG | 4,000 | 308 | 1,785 | 1,620 | 2,500 | 2,500 | |



-

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Well No. 12 | 1995 | Abandoned | 800 | -- | *3400 | 365 | 1,760 | -- | -- | -- | Destroyed in 2015 |
| Well No. 1A | 2018 | **Active** | 825 | EM | 2,250 | 420 | 1,300<br>1,800 | 1,770 | 2,250 | 2,250 | |
| **TOTAL GROUNDWATER** | | | | | | | | | | | |

* These wells no longer in service. Figures shown are original design capacity
** Well No. 6 & Well No. 9 can operate above normal capacity with acceptable level of lower aesthetic water quality due to presence of color and low level of odor from Hydrogen Sulfide

# Table 3-11
# Comparison of Active & Inactive Water Wells

| Well Name | Age of Active Wells | Age of Non-Active Wells |
|---|---|---|
| DYKE | | 60 |
| Well No. 1 | | 50 |
| Well No. 2 | | 39 |
| Well No. 3 | | 30 |
| Well No. 4 | | 55 |
| Well No. 5 | 54 | |
| Well No. 6 | 50 | |
| Well No. 7 | 48 | |
| Well No. 8 | | 2 |
| Well No. 9 | 42 | |
| Well No. 10 | 42 | |
| Well No. 11 | | 18 |
| Well No. 3A | 29 | |
| Well No. 13 | 21 | |
| Well No. 12 | | 20 |
| Well No. 1A | 5 | |
| **Average Years** | **36** | **34** |
| **No. of Wells** | **8** | **8** |

**0-20 years old**
**20-40 years old**
**40-60 years old**



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# 4 FACILITIES AND OPERATION

## 4.1 Existing Facilities Summary

The City's existing potable water system facilities and pipelines are shown on Figure 4-1 and a schematic of the system showing facility HGL is shown on Figure 4-2. The City's existing storage system consists of four reservoirs (Overmyer, Peck, Springdale and Edwards Hill), all located in the lower pressure zone (Zone 1), with a combined storage capacity of 55.0 million gallons (MG). The Peck and Springdale reservoirs are located at the same site. Booster stations are located at the three reservoir sites to pump water from the reservoirs into the distribution system.

The City's service area is composed of two pressure zones: Zone 1 and Zone 2. Ground elevations in Zone 1 vary between 5 feet below and 80 feet above sea level. The Overmyer, Peck and Edwards Hill booster pump stations boost water from their respective reservoirs into the Zone 1 distribution system. Zone 2 is the 800-acre Reservoir Hill area that rises to an elevation of 109 feet. The Reservoir Hill Booster Pump Station, which is located at the Overmyer site, boosts water from Zone 1 into Zone 2. The Edwards Hill Booster Pump Station also has Zone 2 pumps. Neither of the Zone 2 booster pump stations have a direct connection to pump from a storage reservoir.

In addition to the four booster pump stations, the City's existing potable water distribution system includes eight well facilities that pump directly into the distribution system; three imported water service connections; four emergency water connections with neighboring public water systems; and 620 miles of transmission and distribution piping ranging in size from 4 inches to 42 inches in diameter.

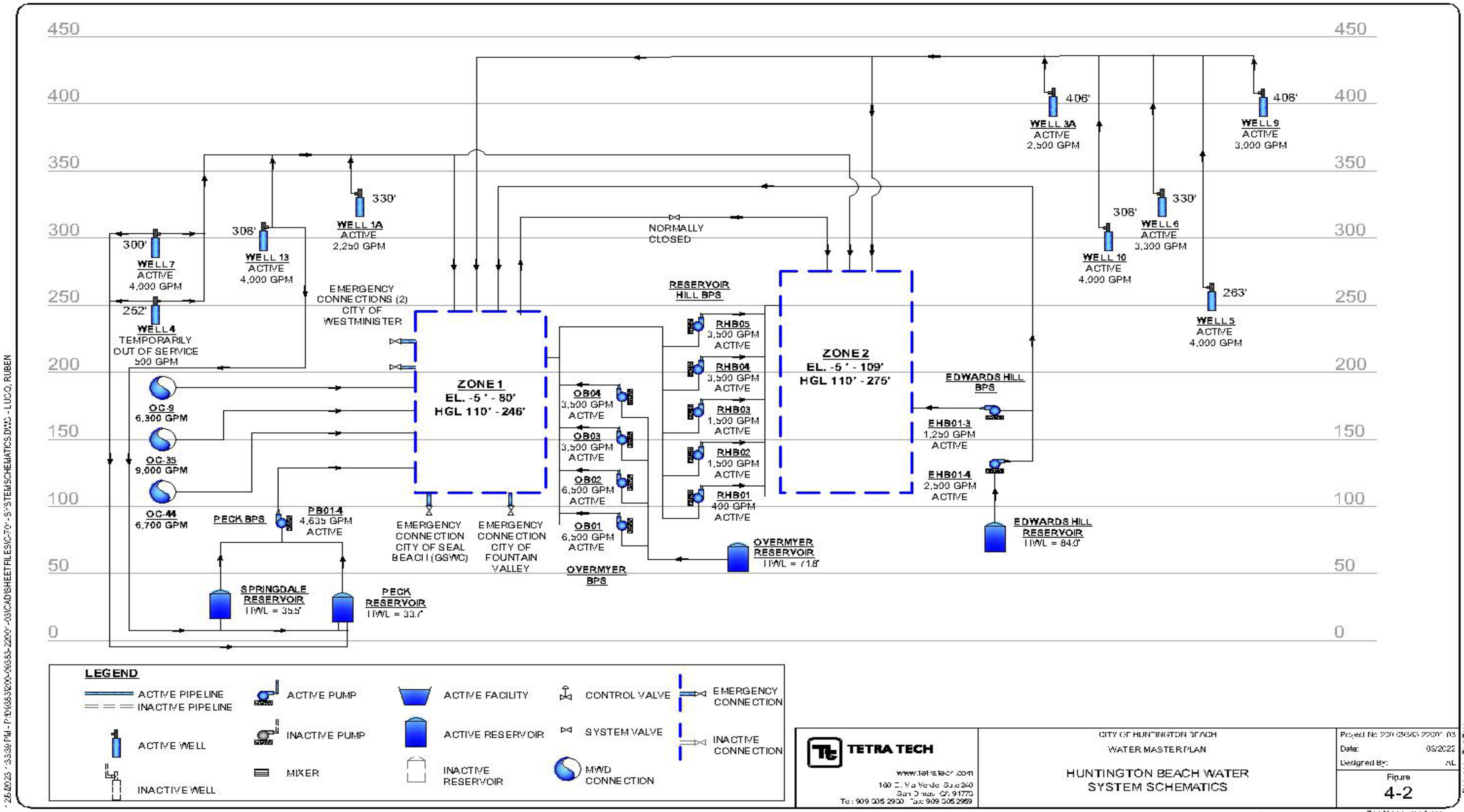
One well within the City, Meadowlark No. 2, is used solely for irrigation of the Meadowlark Golf Course and is not part of the potable water system. A separate, non-potable water distribution system does not currently exist nor is one planned to be implemented. However, the potential for reducing demands on the potable water system through implementation of local projects such as capture and beneficial use of storm runoff for City landscape irrigation does exist and is discussed in the City's 2020 Urban Water Management Plan.

## 4.2 System Operation

Eight existing potable water wells (Well Nos. 1A, 3A, 5, 6, 7, 9, 10, and 13) can pump directly into the distribution system. Well No. 12 is out of service due to water quality issues (high chloride) and has been destroyed. The wells are typically used to satisfy system demands during the day and to fill the four system reservoirs at night when system demands are lower.

# Figure 4-1
# Existing Potable Water System Facilities

# Figure 4-2
# System Schematic



The total combined well supply capacity for the City, assuming all eight wells are operating would be approximately 27,050 gpm. However, due to the presence of Hydrogen Sulfide in some wells, as well as reduced production of aging wells, the current normal operation capacity of the eight wells is approximately 20,350 gpm, as described in Chapter 3.

The pumps at Well No. 1A, 3A, and 5 have VFD (variable frequency drive) electric motors. The pumps at the other well sites can be operated at variable speeds via natural gas engines and are generally operated to maintain constant flow.

The Overmyer, Reservoir Hill, Peck, and Edwards Hill booster pump stations are controlled by system pressure at the respective complex. The lead pump at a station is activated to start when the system pressure drops to a specified level. Pumps are added or removed as necessary based on increased or decreased demand as sensed by an increase or decrease in system pressure.

All of the pumps at the four booster pump stations can be operated at variable speeds. Edwards Hill booster station and Peck booster station are hybrid systems, which can operate either by variable-frequency electric motors or variable speed natural-gas engines. Overmyer booster stations only operates by variable speed natural-gas engines. Peck booster station was converted to a hybrid variable-frequency electric motor and variable speed natural-gas engine system in 2019. Reservoir Hill booster station only services Zone 2 and is primarily operated by variable speed natural-gas engines, with the exception of one small pump operated by variable-frequency electric motors. The Overmyer, Peck and Edwards Hill booster pump stations are operated to maintain constant discharge pressures, which correspond to a discharge hydraulic grade line (HGL) of approximately 180 feet for the Overmyer and Edwards Hill booster pump stations and 189 feet for the Peck Booster Pump Station. The Zone 2 Reservoir Hill Booster Pump Station and the Zone 2 pumps at the Edwards Hill Booster Pump Station are operated to maintain a constant discharge pressure, which corresponds to a discharge HGL of approximately 230 feet.

At each booster pump station, the lead pump is shut off when operating at its minimum speed and decreasing demand causes the pump discharge pressure to rise to the specified stop pressure and system pressure remains above this set point for a specified time. When the respective booster pump station is off-line, various pressure control valves automatically throttle to maintain system pressure by allowing system water to flow into the reservoirs.

Imported water is supplied to the City via three service connections: OC-9, OC-35 and OC-44. The City’s allocated capacities from these connections are 6,300 gpm, 9,000 gpm, and 6,700 gpm, respectively. OC-9 and OC-35 are operated on a fixed-flow basis with prior notification to MWD required in order to change flow settings. Flows from OC-44 can be changed without notifying MWD. All three connections supply water directly to Zone 1.

System pressures throughout the City are generally maintained between 50 and 72 psi during normal operation. The tight range is attributable to the flat terrain of the City and to the utilization of variable-speed pump drives at the booster pump stations to maintain system pressures.

## 4.3 Storage Reservoirs and Booster Pump Stations

The characteristics of the existing storage reservoirs are shown in Table 4-1. The storage capacities of the four existing reservoirs total 55.0 million gallons (MG).

**Table 4-1**
**Existing Storage Reservoir Characteristics**

| Reservoir | Location | Dimensions (ft) | Maximum Water Depth (ft) | High Water Elevation (ft) | Capacity (MG) |
|---|---|---|---|---|---|
| Overmyer | Zone 1 | 441 x 198 | 48.5 | 71.8 | 20.0 |
| Edwards Hill | Zone 1 | 213 dia. | 34.0 | 84.0 | 9.0 |
| Springdale | Zone 1 | 448 x 143 | 24.0 | 35.5 | 9.0 |
| Peck | Zone 1 | 541 x 210 | 23.5 | 33.7 | 17.0 |
| Total | | | | | 55.0 |

The characteristics of the existing booster pump stations are shown in Table 4-2. A 10-MG storage reservoir and 11,000-gpm booster pump station was included in the 2000 Master Plan at the AES property in the southeast quadrant of the City to provide storage and supply to the area south of the Newport-Inglewood fault and east of Bolsa Chica. In 2005, the City purchased the future tank property from AES Huntington Beach Development, LLC. This reservoir and booster pump station, which are still included as a water master plan project in this water master plan, are discussed in Chapters 5 and 7.

### 4.3.1 *Overmyer Reservoir and Booster Pump Station*

The Overmyer Reservoir and the associated booster pump station are located at the City's Utilities Division Yard. The reservoir, which was constructed in 1971, was formed by excavating into natural soils and constructing an embankment of the excavated material. The vertical walls are 25 feet high and the 1.5:1 sloping sides are 22 feet high.

The reservoir was rehabilitated in 2003/04, in accordance with the 1995 Water Master Plan. The work included strengthening the wall footing, installation of a new concrete wall liner, construction of a new roof structure with new roof support columns and column base plates, and construction of gunite floors and slopes. In conjunction with the reservoir rehabilitation, a new booster pump station was also constructed.

The pumping capacity of the Overmyer Booster Pump Station is 20,000 gpm with all four pumps in operation and 13,500 gpm with one of the largest pumps (6,500 gpm) out of service (acting in stand-by as a backup). The pump station is operated to maintain a constant discharge pressure, which corresponds to a discharge hydraulic grade line (HGL) of 180 feet. All four pumps have variable-speed operation via natural-gas engines. Two 3,900-gallon liquefied propane gas (LPG) tanks and associated equipment are located at the site to provide backup propane gas supply for operation of the Overmyer and Reservoir Hill booster pumps.

## Table 4-2
## Existing Booster Station Characteristics

| | | | Electric Motor (EM) or Natural Gas Engine Drive (NG) | | | Pump Design Point | | |
|---|---|---|---|---|---|---|---|---|
| Station | Pump | Zone | Speed | Horse-Power | Type | Flow (gpm) | HGL (ft) | RPM |
| Overmyer[a] | 1 | Zone 1 | Variable | 409 | NG | 6,500 | 180 | 1,160 |
| | 2 | Zone 1 | Variable | 409 | NG | 6,500 | 180 | 1,160 |
| | 3 | Zone 1 | Variable | 150 | NG | 3,500 | 180 | 1,190 |
| | 4 | Zone 1 | Variable | 150 | NG | 3,500 | 180 | 1,160 |
| | | | | | | 20,000[d] | | |
| Reservoir Hill | 1 | Zone 2 | Variable | 10 | EM | 400 | 230 | 1,770 |
| | 2 | Zone 2 | Variable | 25 | NG | 1,500 | 230 | 1,180 |
| | 3 | Zone 2 | Variable | 25 | NG | 1,500 | 230 | 1,180 |
| | 4 | Zone 2 | Variable | 75 | NG | 3,500 | 230 | 1,160 |
| | 5 | Zone 2 | Variable | 75 | NG | 3,500 | 230 | 1,160 |
| | | | | | | 10,400[d] | | |
| Peck | 1-4 | Zone 1 | Variable | 330 | Dual[c] | 4,635 | 185 | 1,200 |
| | | | | | | 18,540[d] | | |
| Edwards Hill | 1-4 | Zone 1 | Variable | 150 | Dual[c] | 2,500 | 180 | 1,780 |
| | | | | | | 7,500[e] | | |
| Edwards Hill | 5-7 | Zone 2 | Variable | 25/45[b] | Dual[c] | 1,250 | 230 | 1,760 |
| | | | | | | 3,750[d] | | |

(a) The Overmyer Zone 1 Pumps can also be used to pump to Zone 2 in an emergency.
(b) The motors are 25 hp and the engines are 45 hp.
(c) The pumps can be driven either by natural gas combustion engines with variable speed, right angle gear drives or by variable frequency electric motors.
(d) The total capacity includes all zone pumps in the station; however, see text description for each station to determine rated capacity, which is capacity with the largest pumping unit out of service.

(e) Edwards Hill Zone 1 station actually includes four 2,500 gpm pumps but only three can be used at a time due to current piping restrictions; thus 7,500 gpm is total capacity, which is same as rated capacity.

### 4.3.2 *Reservoir Hill Booster Pump Station*

The Reservoir Hill Booster Pump Station is located on the same site as the Overmyer Reservoir and Booster Pump Station. The pump station boosts water from Zone 1 to the 800-acre Reservoir Hill area that constitutes Zone 2 of the water system. Zone 2 has a high ground elevation of 109 feet. The booster pump station has a pumping capacity of 10,400 gpm with all five pumps in operation and 6,900 gpm with the largest pump (3,500 gpm) out of service. Pump No. 1 is driven with a variable frequency electric motor. The other four pumps (Pump Nos. 2 through 5) have variable-speed operation via a natural-gas engine. The pump station is operated to maintain a constant discharge pressure, which corresponds to a discharge HGL of approximately 230 feet.

### 4.3.3 *Peck and Springdale Reservoirs and Peck Booster Pump Station*

The 17.0 MG Peck Reservoir, the 9.0 MG Springdale Reservoir and the Peck Booster Pump Station are located at the same site, west of Springdale Street at the northern end of the City. Well Nos. 7, and 13 are also located at this site (as is offline well No. 4). The Peck Reservoir was constructed in 1966. In 1995, the reservoir was rehabilitated with seismic upgrades and a new booster pump station was constructed. The Springdale Reservoir was constructed in 2003, in accordance with the 2000 Water Master Plan. Both reservoirs are above-ground, concrete, rectangular reservoirs with the dimensions shown in Table 4-1. The Peck Booster Pump Station boosts water from both the Peck Reservoir and the Springdale Reservoir into the Zone 1 distribution system. The pump station is operated to maintain a constant discharge pressure, which corresponds to a discharge HGL of approximately 189 feet.

The pumping capacity of the Peck Booster Pump Station is 18,540 gpm with all four pumps in operation and 13,905 gpm with one pump out of service. Pump Nos. 1 through 4, each rated at 4,635 gpm, have variable-speed operation via dual drives, i.e. either a variable-frequency motor or a natural-gas engine. A 10,000-gallon LPG tank and associated equipment are located at the site to provide backup propane gas supply for operation of the engine-driven booster pumps and the engine-driven pumps at Well Nos. 4, 7 and 13.

### 4.3.4 *Edwards Hill Reservoir and Booster Pump Station*

The 9.0 MG Edwards Hill Reservoir and Booster Pump Station are located at the corner of Edwards Street and Overlook Drive. The reservoir and pump station were constructed in 2001. The prestressed-concrete, circular reservoir is above-ground, with the dimensions shown in Table 4-1.

The Edwards Hill Reservoir Pump Station houses both Zone 1 and Zone 2 pumps. In 2001, the Zone 1 pumping system was upgraded with larger capacity pumping assemblies, variable frequency motors and natural gas engines. While the size of each new pump nearly doubled, from 1,500 gpm to 2,500 gpm, no improvements to the suction or discharge piping were made. Therefore, only three of the four pumps can operate at a time due to piping restrictions and total capacity is limited to 7,500 gpm (3 x 2,500), up from the 6,000 gpm previous total capacity (4 x 1,500). However, the reliability was greatly improved as the rated capacity (one pump out of service) is now 7,500 gpm vs. the previous rated capacity of only 4,500 gpm (3 x 1,500). The Zone 1 pumps are operated to maintain a constant discharge pressure, which corresponds to a discharge HGL of approximately 180 feet. The pumping capacity of the Zone 2 pumps is 3,750 gpm with all three pumps in operation and 2,500 gpm with one of the three 1,250-gpm pumps out of service. The Zone 2 pumps are operated to maintain a constant discharge pressure, which corresponds to a discharge HGL of approximately 230 feet.

All of the pumps (Zone 1 and Zone 2) have variable speed operation via dual drives, i.e. either a variable-frequency motor or a natural-gas engine. A 2,000-gallon LPG tank and associated equipment are located at the site to provide backup propane gas supply for operation of the engine driven pumps.

## 4.4 Potable Water Well Pumps

The characteristics of the existing potable water well pumps and corresponding drives are shown in Table 4-3. The pumps at Well Nos. 6, 7, 9, 10, and 13 can be operated at variable speeds via natural gas engines and are generally operated to maintain constant flow. The pump at Well No. 5 is driven by constant-speed electric motors. The pump at Well No. 1A is driven by VFD.

### Table 4-3
### Existing Potable Water Well Pump Characteristics

| | Electric Motor (EM) or Natural Gas Engine (NG) | | | Pump Design Point | | |
|---|---|---|---|---|---|---|
| Well | Speed | Horsepower | Type | Flow (gpm) | HGL (ft) | RPM |
| Well No. 1A | Variable | 250 | EM | 2,250 | 320 | 1,770 |
| Well No. 3A | Variable | 350 | EM | 4,000 | 263 | 1,775 |
| Well No. 5 | Constant | 400 | EM | 4,000 | 263 | 1,775 |
| Well No. 6 | Variable | 395 | NG | 3,340 | 330 | 1,190 |
| Well No. 7 | Variable | 409 | NG | 4,000 | 300 | 1,200 |
| Well No. 9 | Variable | 338 | NG | 3,000 | 408 | 1,775 |
| Well No. 10[a] | Variable | 395 | NG | 4,000 | 308 | 1,775 |
| Well No. 13 | Variable | 330 | NG | 4,000 | 308 | 1,770 |

(a) In 2011, Well 10 was retrofitted with improvements designed such that the addition of an EM and VFD will be facilitated easily in the future.

A 10,000-gallon LPG tank and associated equipment provide backup propane gas supply for operation of the engine-driven pumps at Well Nos. 4, 7, and 13, and the engine-driven pumps at the Peck Booster Pump Station. In accordance with the 1995 Water Master Plan recommendations to provide energy back-up at well sites, the City purchased a portable trailer-mounted 500 gallon propane storage vessel in 2010 and constructed vaporizers at Well Site Nos. 6, 9, and 10.

## 4.5 Transmission and Distribution Piping

As shown in Table 4-4 through Table 4-7 below, there are approximately 610 miles of transmission and distribution piping in the water system with sizes ranging from 4- to 42-inches in diameter. The majority of the piping in the system is 6 to 8 inches in diameter (74.7%) and the most common material is asbestos cement (AC) pipe (76%). Figure 4-3 shows these different pipe materials within the City's system.

## Table 4-4
## Transmission and Distribution System Mains

| Pipe Diameter (inches) | Length (feet) – Total Owned By the City Excluding Transmission Mains and Shared Ownership with WOCWB and Mesa Water District | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Asbestos Cement | Copper | Ductile Iron | CI | HDPE | PE | PVC | RC | SS | STL | STL CYL | STL CYL CML | Unknown | Total |
| 4 | 34,574 | 8 | 262 | 0 | 129 | 36 | 3,493 | 0 | 0 | 468 | 42 | 7 | 12,948 | 51,965 |
| 6 | 925,823 | 0 | 905 | 3 | 0 | 0 | 36,264 | 0 | 0 | 0 | 213 | 15 | 120,586 | 1,083,810 |
| 8 | 1,057,255 | 0 | 1,645 | 0 | 208 | 6 | 255,274 | 0 | 0 | 773 | 1,548 | 32 | 7,225 | 1,323,965 |
| 10 | 39,454 | 0 | 0 | 0 | 0 | 0 | 12,963 | 0 | 0 | 0 | 92 | 21 | 1,461 | 53,991 |
| 12 | 360,820 | 0 | 3,862 | 0 | 0 | 0 | 128,651 | 0 | 0 | 266 | 1,301 | 4,620 | 666 | 500,186 |
| 14 | 9,044 | 0 | 0 | 0 | 216 | 0 | 201 | 0 | 0 | 0 | 2,055 | 214 | 2 | 11,732 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,390 | 0 | 3,390 |
| 16 | 26,188 | 0 | 0 | 0 | 669 | 0 | 16,226 | 9 | 0 | 48 | 145 | 13,948 | 121 | 57,354 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 8,300 | 0 | 0 | 0 | 871 | 237 | 0 | 9,408 |
| 20 | 0 | 0 | 5,065 | 0 | 0 | 0 | 9,629 | 0 | 0 | 0 | 16,702 | 4,027 | 48 | 35,471 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 352 | 16,352 | 0 | 16,704 |
| 24 | 1,343 | 0 | 7,608 | 0 | 0 | 0 | 10,031 | 0 | 0 | 0 | 584 | 426 | 2,625 | 22,617 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 20 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,413 | 14,502 | 0 | 16,915 |
| 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 13,003 | 564 | 0 | 13,580 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,774 | 16,664 | 0 | 20,438 |
| **Total** | 2,454,501 | 8 | 19,346 | 3 | 1,222 | 42 | 481,033 | 9 | 0 | 1,568 | 43,094 | 75,038 | 145,682 | 3,221,546 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **(Feet)** | | | | | | | | | | | | | | |
| **Total (Miles)** | 465 | 0 | 4 | 0 | 0 | 0 | 91 | 0 | 0 | 0 | 8 | 14 | 28 | 610 |
| **Pct.** | 76.19% | 0.00% | 0.60% | 0.00% | 0.04% | 0.00% | 14.93% | 0.00% | 0.00% | 0.05% | 1.34% | 2.33% | 4.52% | 100.00% |

PVC = Polyvinyl Chloride, STL CYL = Steel Cylinder, CML = Cement Mortar Lined

# Table 4-5
# OC-9 Transmission Main

| Pipe Diameter (inches) | Length (feet) – OC-9 City Share Through WOCWB Feeder 1 Transmission Main | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Asbestos Cement | Copper | Ductile Iron | CI | HDPE | PE | PVC | SS | STL | STL CYL | STL CYL CML | Unknown | Total |
| **16** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 19 |
| **24** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10,689 | 534 | 11,223 |
| **26** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8,737 | 0 | 8,737 |
| **28** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,890 | 0 | 7,890 |
| **Total (Feet)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27,334 | 534 | 27,869 |
| **Total (Miles)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 5 |

# Table 4-6
# OC-35 Transmission Main

| Pipe Diameter (inches) | Length (feet) – OC-35 City Share Through WOCWB Feeder 2 Transmission Main | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Asbestos Cement | Copper | Ductile Iron | CI | HDPE | PE | PVC | SS | STL | STL CYL | STL CYL CML | Unknown | Total |
| **27** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 4,035 | 0 | 4,059 |
| **30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,341 | 0 | 2,341 |
| **33** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12,313 | 0 | 12,313 |
| **36** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13,397 | 0 | 13,397 |
| **Total (Feet)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 32,085 | 0 | 32,109 |
| **Total (Miles)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6 |

# Table 4-7
# OC-44 Transmission Main

| Pipe Diameter (inches) | Length (feet) – OC-44 City Share Through Mesa Water District Transmission Main | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Asbestos Cement | Copper | Ductile Iron | CI | HDPE | PE | PVC | SS | STL | STL CYL | STL CYL CML | Unknown | Total |
| **36** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8,480 | 0 | 8,480 |
| **Total (Feet)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8,480 | 0 | 8,480 |
| **Total (Miles)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |

# Figure 4-3
# Transmission and Distribution Piping by Material

The transmission mains constitute the majority of the steel pipe in the system. Water transmission pipelines associated with the three imported water service connections are vital to transmit water throughout the City and to all water storage facilities. Corrosion protection of the 30-inch, 36-inch, and 42-inch pipelines was included in the 1995 Water Master Plan. All City owned transmission mains have been completely retrofitted with corrosion protection systems. However, the vital transmission mains upstream of the City's three imported water service connections that are either jointly owned with the West Orange County Water Board (WOCWB) or Mesa Water District have not been installed with any corrosion protection systems. WOCWB has stated their intention to retrofit OC-9 with impressed current cathodic protection in 2024 through 2025. The WOCWB is also planning to retrofit OC-35 with impressed current cathodic protection in 2027 and 2028.

The 36-inch to 42-inch OC-35 transmission main begins at a connection with the West Orange County Water Board Feeder No. 2 (AKA OC-35) connection at Glenwood Drive/Springdale Street and runs south on Springdale Street and Edwards Street, then east on Clay Street to a connection with the OC-44 transmission main at Huntington Street, which is near to the Overmyer facilities. A non-rectified corrosion protection system was installed in 2009 for this transmission pipeline that included insulating fittings/test stations and all necessary appurtenances, including replacement of valves for the 42-inch coal-tar enamel coated steel water main. The 36-inch mortar coated steel water main was fitted with an impressed current rectifier corrosion protection system in 2013.

The 30-inch transmission main begins at the jointly owned OC-44 service connection with Mesa Water District at Adams Avenue and the Santa Ana River and runs west on Adams Street, north on Brookhurst Street, west on Yorktown Avenue, then north on Huntington Street to a connection with the 42-inch transmission main in Clay Street. An impressed current rectified corrosion protection system was installed in 2012 for this transmission pipeline that included insulating fittings/test stations, an all-necessary appurtenances, including replacement of valves for the 30-inch cement mortar lined and coated steel water main.

In accordance with the 1995 Water Master Plan, beginning at the West Orange County Water Board Feeder No. 1 connection at Edinger Avenue and Newland Street, a new 20-inch to 24-inch transmission main was constructed in 2007, running south on Newland Street to a connection with the OC-44 transmission main in Yorktown Avenue. The transmission main is primarily ductile iron pipe, with some segments being Polyvinyl Chloride (PVC), and was installed with a non-rectified corrosion protection system.

In 2011, the remaining 2.5 miles of the original 21-inch OC-9 coal-tar enamel coated steel transmission main was extensively re-evaluated by a corrosion specialist. Their finding was extremely favorable in that the transmission main was found to be in very good condition.

Another transmission main in the system is the Downtown Loop that transmits water around and through the Downtown area. The 20-inch steel transmission main has an impressed current rectifier system for corrosion protection that was retro-fitted in 2007. The 20-inch steel transmission main connects with the 30-inch OC-44 transmission main at Yorktown Avenue/Huntington Street and runs west on Yorktown Avenue, then south on Lake Street, then west on Olive Street through Downtown, then north on Goldenwest Street to a connection with the 42-inch OC-35 transmission main on Clay Street. Table 4-8 is a summary of pipes with Cathodic Protection.

## Table 4-8
## Pipes with Cathodic Protection

| Pipe Diameter (inches) | Length Protected (Feet) | Length Total (Feet) | % Protected |
|---|---|---|---|
| 4 | 468 | 51,965 | 0.90% |
| 6 | 653 | 1,083,810 | 0.06% |
| 8 | 932 | 1,323,965 | 0.07% |
| 12 | 1,780 | 500,046 | 0.36% |
| 14 | 2,048 | 11,732 | 17.46% |
| 20 | 25,862 | 30,306 | 85.34% |
| 21 | 339 | 352 | 96.31% |
| 24 | 8,042 | 9,427 | 85.31% |
| 30 | 18,204 | 19,255 | 94.54% |
| 36 | 12,697 | 13,580 | 93.49% |
| 42 | 17,245 | 20,438 | 84.38% |
| **Total (Feet)** | **88,270** | | |
| **Total (Miles)** | **16.7** | | |

The remaining distribution system is a well-gridded system with the majority of the arterial grids composed of 12-inch or larger diameter Asbestos Cement (AC) pipe.

Originally, only 1% of the piping in the system consisted of cast iron (35,000 linear feet). However, even this small amount is significant because unlined and uncoated cast iron pipe is prone to severe interior and exterior corrosion, respectively. Unlined cast iron pipe loses much of its original carrying capacity with age due to interior pipeline tuberculation. This is especially true for small diameter pipe.

Up until 2005, there was a substantial amount of cast iron pipe in the City's distribution system, the majority of which was 8 inches in diameter or smaller. Some of this pipe dated back 75 to 100 years based on City records. In accordance with the 2000 Water Master Plan, the City undertook an aggressive cast iron main replacement program and eliminated the cast iron pipe. Other Distribution Appurtenances & Essentials

### 4.5.1 *Metered Service Connections*

The distribution system has 54,363 metered service connections. The majority of the metered services, 92.8% of total metered connections are ¾" to 1" in diameter (largely for single family residences). The City has recently completed converting all of its water meters from touch read to advance metering infrastructure (AMI). The conversion process began in 2009 and was completed in 2020. Touch read meters require a meter reader to only touch the top of the meter box with a sensor in order to read the meter. AMI meters send out a radio signal that provides not only the amount of water used by a customer, but also timestamps when the customer is using water. AMI infrastructure allows the City to analyze data on customer's water consumption patterns, to better understand water demand, and can also be used locate leaky water services.

**Table 4-9**
**Meter Connections**

| Meter Size (Inch) | Number of Meter Connections | Pct. |
|---|---|---|
| ¾ | 40,529 | 74.55% |
| 1 | 9,006 | 16.57% |
| 1.5 | 1,508 | 2.77% |
| 2 | 1,989 | 3.66% |
| 3 | 139 | 0.26% |
| 4 Compound | 82 | 0.15% |
| 4 FM | 205 | 0.38% |
| 6 Compound | 30 | 0.06% |
| 6 FM | 631 | 1.16% |
| 8 FM | 213 | 0.39% |
| 10 FM | 31 | 0.06% |
| **TOTAL** | 54,363 | 100.00% |

### 4.5.2 *Large Valves*

The distribution system has 18,035 valves, the majority of which are 4-inch in diameter and larger. Distribution system valves allow maintenance personnel to isolate discrete portions of the water system to perform repairs or to clean segments of the system. Water pipeline systems are cleaned by unidirectional flushing of water mains. Additionally, distribution system valves require periodic maintenance by exercising the valves. Exercising valves is simply closing and opening the valves, so that valves don't become in-operable in one position.

## Table 4-10
## Distribution Valves (Excluding Small Diameter Service Valves)

| Valve Diameter (inches) | Valve Type (All Valves Owned by the City or Share Ownership with Other Agencies) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Line Valve | Fire Service Valve | Meter Valve | Air Vac Valve | Pump Out Valve | Inter-connect Valve | Blow Off Valve | Backflow Valve | Hydrant Valve | Line Stop | Unknown | Total |
| **Unknown** | 43 | 3 | 5 | 4 | 5 | 1 | 6 | 0 | 19 | 8 | 1 | 95 |
| **1** | 1 | 0 | 1 | 13 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 16 |
| **2** | 4 | 2 | 10 | 277 | 0 | 0 | 798 | 0 | 0 | 0 | 0 | 1,091 |
| **3** | 3 | 0 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| **4** | 170 | 199 | 200 | 75 | 88 | 0 | 244 | 1 | 3 | 0 | 0 | 980 |
| **6** | 2,931 | 622 | 63 | 0 | 63 | 14 | 10 | 2 | 5,764 | 0 | 0 | 9,469 |
| **8** | 4,143 | 176 | 20 | 1 | 86 | 21 | 12 | 3 | 43 | 0 | 0 | 4,505 |
| **10** | 173 | 21 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 200 |
| **12** | 1,281 | 7 | 3 | 0 | 2 | 40 | 0 | 0 | 1 | 10 | 0 | 1,344 |
| **14** | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 29 |
| **15** | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **16** | 131 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| **18** | 35 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 36 |
| **20** | 36 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 37 |
| **21** | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| **22** | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **24** | 29 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 30 |
| **27** | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **30** | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| **36** | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| **42** | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| **Total** | 9,064 | 1,030 | 315 | 373 | 244 | 81 | 1,071 | 6 | 5,830 | 20 | 1 | 18,035 |
| **Pct.** | 50.26% | 5.71% | 1.75% | 2.07% | 1.35% | 0.45% | 5.94% | 0.03% | 32.33% | 0.11% | 0.01% | 100.00% |

### 4.5.3 *Public and Private Fire Hydrants*

The City distribution system has 5,833 public fire hydrants and 957 private fire hydrants. Fire hydrants need to be painted on a regular basis to prevent corrosion. Also, similar to valves, fire hydrants need to be exercised periodically. Distribution system flushing exercises valves, hydrants, and also cleans distribution mains. In the past, flushing maintenance had a negative impact in that it would waste significant amounts of water directly to the storm drain. The City has improved this process, and as of 2018 the process was switched from hydrant flushing to using NO-DES (Neutral Output Discharge Elimination System) flushing technology. This technology runs the water through a filter system that treats the turbidity and clears the water. No water is discharged to waste and the amount of unaccounted for water is decreased by this technique.

The City has a Standard Operating Procedure for Fire Hydrant Servicing. All public fire hydrants are serviced once per year to ensure all hydrants and hydrant valves are operational.

**Table 4-11**
**Public and Private Fire Hydrants**

| Type | Number of Fire Hydrants | Pct. |
|---|---|---|
| **Public** Fire Hydrants | 5,833 | 85.91% |
| **Private** Fire Hydrants (Estimated) | 957 | 14.09% |
| **Total** | **6,790** | |

### 4.5.4 *Dedicated Fire Services*

The City has approximately 752 fire services with either a Double Check Detector Assembly (DCDA) or a Reduced Pressure Detector Assembly (RPDA). The DCDAs and RPDAs allow only unidirectional flow from the distribution system to the fire services, and thus they protect the distribution system from back siphon events or from contamination from fire protection systems. In accordance with California State law, all of the DCDAs and RPDAs require annual testing, paid for by property owners. The property owner is also responsible for the cost of installing and maintaining the backflow devices. The City's Cross Connection Control Specialists insure compliance with State law and protect the integrity of the distribution system.

**Table 4-12**
**Dedicated Fire Services and Backflow Devices**

| Valve Diameter (Inches) | Fire Services with Backflow Devices | | |
|---|---|---|---|
| | w/ Double Check Detector Assembly (DCDA) | w/ Reduced Pressure Detector Assembly (RPDA) | Total Fire Services |
| 2.5 | 11 | 1 | 12 |
| 3 | 21 | 1 | 22 |
| 4 | 161 | 5 | 166 |
| 6 | 340 | 5 | 345 |
| 8 | 172 | 2 | 174 |
| 10 | 28 | 2 | 30 |
| 12 | 3 | 0 | 3 |
| **Total** | **736** | **16** | **752** |
| **Pct.** | **97.5%** | **2.5%** | **100%** |

### 4.5.5 *Water System Personnel, Utilities Yard, Trucks, Equipment, etc.*

The City employs approximately 75 full-time equivalent personnel, to operate, maintain, repair, design, and renew the water system facilities. The City has a 7.2 acre utilities yard, complete with administration buildings, warehouse, materials and equipment storage, and workshops for maintenance of water facilities. The Water Utility has approximately 13 passenger vehicles, 57 light duty service trucks, 5 dump trucks, 5 backhoes, 1 boom truck, 1 water truck, 1 fluoride tanker, 1 ditch witch, and 1 skid steer. Operations and maintenance personnel are on call and available on an emergency basis to respond to emergency situations and provide high quality uninterrupted water service to the residents of the City's water service area.

## 4.6 Distribution System Treatment

Gaseous chlorine ($CL_2$) is injected at all of the well sites to disinfect the water. The City receives imported water that has been disinfected by MWD by means of chloramination. The City disinfects at each of its well sites through the injection of gaseous chlorine ($CL_2$) typically at a rate of about 1.0 milligram per liter (mg/l) residual, while the imported water disinfected by chloramination, is typically at a rate of about 2.2 mg/l residual.

In accordance with the 1995 Water Master Plan, chlorination facilities at Well Site Nos. 6, 7, 9 and 10 were all upgraded by 2002. The upgrades included room modifications, some building construction, and the installation of secondary containment vessels with $CL_2$ leak monitors and earthquake sensors. In accordance with the 2000 Water Master Plan, similar chlorination upgrades were constructed at Well No. 13 and completed by 2010. In the next few years, the City plans to move to onsite chlorine and fluoride generation, as discussed in section 7.3 of this master plan.

The City has fluoridated its water supply since 1972. The natural fluoride concentration of the groundwater ranges from 0.3 to 0.4 mg/l, and the City increases the fluoride concentration to between 0.70 and 1.30 mg/l. The natural fluoride concentration of the imported water supply has a fluoride content of 0.2 mg/l, and MWD increase the fluoride concentration to 1. 0 mg/l.

# 5 STORAGE AND EMERGENCY SUPPLY

## 5.1 Overview

Storage is required in a water system to balance variations in demand above and below normal supply settings (operational storage), to provide water for fighting fires (fire storage), and to provide water when normal supplies are reduced or unavailable due to unusual circumstances (emergency storage).

The City currently has 55.0 million gallons (MG) of storage capacity located at the Overmyer, Peck, Springdale, and Edwards Hill storage reservoirs as shown in Table 5-1. Booster stations are located at the Overmyer, Peck/Springdale, and Edwards Hill sites to pump water from the reservoirs into the Zone 1 distribution system at appropriate pressures. The Reservoir Hill Booster Pump Station, which is located at the Overmyer site, boosts water from Zone 1 into Zone 2, which does not have the capability to directly pump from a storage reservoir. In addition to Zone 1 pumps, the Edwards Hill Booster Pump Station also houses pumps to boost water from Zone 1 into Zone 2.

**Table 5-1**
**Existing and Proposed Reservoir Capacities**

| Reservoir | Location | Capacity (MG) |
|---|---|---|
| **Existing** | | |
| Overmyer | Zone 1 | 20.0 |
| Edwards Hill | Zone 1 | 9.0 |
| Springdale | Zone 1 | 9.0 |
| Peck | Zone 1 | 17.0 |
| Subtotal Existing | | 55.0 |
| **Proposed** | | |
| Southeast (with 11,000 gpm booster pump station) | Zone 1 | 10.0 |
| TOTAL | | 65.0 |

As shown in Figure 5-1, the Newport-Inglewood Fault runs through the City. Currently there are no sources of supply and no storage reservoirs south of the fault. Water is supplied to the south from supply sources north of the fault. An earthquake on this fault could potentially sever water transmission and distribution pipelines crossing the fault and leave the southern portion of the City without potable water.

## Figure 5-1
## Newport-Inglewood Fault and Southeast Service Area

As adopted in the 2000 Water Master Plan, a 10 MG storage reservoir and an 11,000 gpm booster pump station is proposed in the southeast quadrant of the City, south of the fault. The reservoir and booster station were sized to supply demands to the area south of the fault and south of Bolsa Chica. The reservoir will serve to provide emergency storage to the southeast service area in the emergency event of an earthquake that could sever the watermains along the Newport-Inglewood fault line, isolating the service area. With the construction of this “Southeast Reservoir and Booster Pump Station”, the City would have 65.0 MG of storage capacity as shown in Table 5-1.

The cost to build the Southeast Reservoir is estimated in chapter 7 of this report. These cost include $29M for the reservoir and the booster pump station and $25M for the extension of transmission pipelines to connect the facility from the site located South of the City’s Beach Maintenance Yard. In an effort to save the expense of the transmission mains, an alternative Southeast Reservoir site was assessed near the intersection of Pacific Coast Highway and Goldenwest Street. This location is very near the City’s 20-inch Downtown Transmission Main. A reservoir and booster pump station was modeled at this location with the assumption that a major earth quake on the Newport-Inglewood fault has severed all pipelines crossing the fault. Under this scenario, a reservoir and booster pump station would be able to successfully provide emergency water, albeit with reduced pressures, to the portion of the City located on the Southwest side of the Newport Englewood fault. Prior to constructing the Southeast Reservoir at the site South of the City’s Beach Maintenance Yard, the City is advised to attempt to purchase a tank site in closer proximity to an existing City transmission main.

The four existing reservoirs are located in Zone 1. The proposed Southeast Reservoir would also be located in Zone 1. Operational, fire, and emergency storage for Zone 2 is available from the Zone 1 reservoirs and booster pumps. Additionally, a series of check valves connections are able to provide flow from Zone 1 to Zone 2, albeit at lower pressure.

Each of the City’s reservoirs is a pumped storage reservoir that requires a booster pump station to boost water from the reservoir into the distribution system at appropriate pressure. Accordingly, the booster pump stations must be reliable. Natural-gas power is considered by some to be more reliable than electrical power. Emergency power is necessary at the booster pump stations to ensure supply from the storage reservoirs during a power outage. Emergency supply can take the place of emergency storage if the supply is available during the emergency scenario being considered. It then becomes important, whenever possible, to have emergency power or a dual source of energy at supply sites, such as the City’s wells, to ensure a reliable source supply.

All of the City’s supply sources, wells and imported water connections, are located in Zone 1. The Zone 1 supply sources must provide peak-hour supply to the Zone 2 Edwards Hill and Reservoir Hill booster pumps because Zone 2 does not have a direct connection to a storage reservoir to supply operational storage. The Reservoir Hill Booster Pump Station and Edwards Hill Booster Station, together, must have sufficient pumping capacity to convey the Zone 2 peak-hour demand and the Zone 2 maximum-day demand plus fire-flow demand, and must be reliable.

## 5.2 Reservoir Operating Levels

Table 5-1 shows the capacities of the City's reservoirs corresponding to the reservoirs being filled to their maximum levels. However, during a normal operating day, the reservoir levels typically vary between the maximum and minimum levels in order to supply water into the system when needed. The City typically fills reservoirs at night when system demands are low, but even then, not all reservoirs are full at the same time. Reservoirs supply water into the system during the day when demands exceed the total supply from wells and imported water connections. The wells and imported water connections are set such that the reservoirs are exercised during high demand hours of a day. The volume that is drained and then refilled on a daily basis is operational storage. With this in mind, a total volume of 55 MG is rarely available at any one time.

In assessing system storage, the full storage capacity of 55 MG is taken as a starting point. The operational storage needed for the maximum day demand (MDD) is then calculated. This volume is then subtracted from the 55 MG capacity to assess available storage when all reservoirs are at their lowest levels simultaneously during a normal operating day.

Fire storage necessary for fire protection is then assessed assuming that complete system operational storage has been depleted during a normal MDD (worst case). Emergency storage, which is reservoir volume necessary to satisfy system demands when normal supplies are reduced or unavailable due to unusual circumstances, is then assessed after operational and fire storage volumes have been subtracted from system reservoirs (again, worst case). This is the industry standard methodology for assessing water system storage sufficiency.

## 5.3 Operational Storage

As a general rule, supply sources other than reservoirs are designed to supply average day demand (ADD) up to MDD, and storage reservoirs are sized to supply the hourly demands in excess of MDD. This storage volume is termed operational storage. The reservoirs fill when demand falls below the total output from the wells and the imported water connections. Water agencies often reserve approximately 25% of MDD for operational storage.

The City is located along the Pacific Ocean, which results in a moderate to mild climate. Accordingly, high demand variations in the summer are less severe than more inland areas. As a result, the City's actual operational storage may be slightly less than 25% of MDD. However, to be conservative, 25% of MDD will be used as the operational storage requirement for the City's water system for this water master plan. The year 2020 MDD for the City is estimated at 28,976 gpm (ADD of 16,098 gpm multiplied by a 1.80 MDD peaking factor as discussed in Section 2.3). At 25% of MDD, the operational storage requirement is 10.43 MG. The projected year 2045 MDD for the City is estimated at 34,078 gpm (ADD of 18,932 gpm multiplied by a 1.80 MDD peaking factor). At 25% of MDD, the operation storage requirement is 12.28 MG.

## 5.4 Fire Storage

Fire flow is the flow rate of a water supply that is available for firefighting from fire hydrants at a minimum residual pressure of 20 pounds per square inch (psi). City fire flow requirements are set by the City Fire Department and are based on the current Uniform Fire Code (UFC). The fire flow requirements are based on land use, construction materials, and building floor area (fire area). The UFC requirements are minimum requirements and additional fire flow and storage might be required as determined by the City's fire department.

General fire flow requirements based on general land use classifications as shown in Table 5-2 will be used to analyze fire flow pressures and storage in this water master plan. Actual fire flow requirements would be determined by the City Fire Department in accordance with the UFC. The fire flows shown in Table 5-2 could be reduced if the building in question is provided with an approved automatic sprinkler system. It should be noted that, as of January 2011, all new residential construction is required to have fire sprinklers.

**Table 5-2**
**General Fire Flow Requirements for Water Master Plan Analysis[a]**

| Land Use Designations | Fire Flow (gpm) | Flow Duration (hours) |
|---|---|---|
| One and Two-Family (Low Density) Residential | 1,000 to 2,000 | 2 |
| Multi-Family (High Density) Residential, Mobile Home Park, and School | 3,500 | 3 |
| All Commercial (other than Regional), Hospital | 5,000 | 5 |
| Regional Commercial, Industrial | 6,000 | 6 |

(a) The data in this table provides general City fire flow criteria to be used in this water master plan. Actual fire flow requirements would be determined by the City Fire Department in accordance with the Uniform Fire Code. As of Jan. 2011, all residential, including Low Density is required to have fire sprinklers, which should reduce flows above by up to 50% with a minimum of 500 gpm.

Because a fire can occur on any day and at any time, the adequacy of fire storage and supply was analyzed under a MDD, after operational storage had been depleted. A Zone 1 fire flow storage requirement of two simultaneous 5,000-gpm fire flows for 5 hours (3.0 MG) was used in the 2005 and previous years' City Water Master Plans and will be used as the Zone 1 requirement in this water master plan. It assumed that the two simultaneous Commercial or Mixed-Use fires would occur in the Downtown Area.

Zone 2 has some industrial land use. Accordingly, per the general fire flow requirements in Table 5-2, the maximum Zone 2 fire flow requirement is 6,000 gpm for 6 hours (2.16 MG gallons as indicated in Section 5.5.1). Because Zone 2 does not have a reservoir, this storage must be provided in Zone 1 reservoirs. The total Zone 1 fire storage requirement is then 5.16 MG. Booster pump stations utilized to satisfy fire flow requirements must be reliable with a redundant pump available for back up. For this reason, the largest pump at the Reservoir Hill Booster Pump Station was assumed out of service in analyzing the adequacy of Zone 2 fire-flow supply.

## 5.5 Emergency Storage/Supply

Emergency storage is the volume in reservoirs that is available to satisfy demands when normal supplies are reduced or unavailable due to unusual circumstances. For the City, normal water supply is from wells and imported water connections. An emergency reduction in normal water supplies can occur at any time and it must be assumed that emergency storage is available only after operational and fire storage have been depleted (or reserved) from the reservoirs on the MDD.

One way to gauge the magnitude of available emergency storage is to determine the equivalent number of days of average demand that can be provided. Year 2045 operational plus fire storage requirement for the City is estimated at 17.44 MG (12.28 MG operational plus 5.16 MG fire). Currently, the City has 55.0 MG of storage capacity. After the operational and fire storage have been depleted, 37.56 MG of storage is available as emergency storage. At actual 2020 demands of 23.18 MGD this equates to 1.62 average days of storage. At a year 2045 average demand of 27.26 MGD, 1.38 days of emergency storage would be available. With the construction of the proposed 10.0 MG Southeast Reservoir, 2.05 days of storage would be available using actual 2020 average demands and 1.74 days of storage would be available at 2045 demands. However, this is a rather abstract barometer of emergency storage that is primarily useful for comparison with other water purveyors.

Emergency storage can also be measured in terms of "days" of operational storage. Based on the current emergency storage of 37.56 MG and the 2020 operational storage, the city currently has 3.60 days of supply. For the 2045 operational storage, this value decreases to 3.06 days. With the construction of the Southeast Reservoir, these values increase to 4.56 days and 3.87 days, respectively.

In a 2001 survey conducted by the City of Huntington Beach Department of Public Works, various water agencies in California, Washington, and Arizona were asked how much emergency storage the water agency had "if they lost their major source of supply". Emergency storage as the number of days of average demand (unless otherwise footnoted) for the various agencies contacted are shown in Table 5-3. Twenty six agencies were surveyed and 24 are listed in Table 5-3, with the high and low thrown out. The days of emergency storage calculated below puts Huntington Beach in the upper third of the agencies surveyed. Note that some agencies responded with days of "peak-day" demand or days of "emergency storage", which are footnoted in Table 5-3. It is not known if days of "emergency storage" are days of average demand or peak demand.

## Table 5-3
## Emergency Storage for Other Water Purveyors

| Water Agency | Emergency Storage (# Days Average Demand)[a] |
|---|---|
| City of Huntington Beach[b] | |
| Without Southeast Reservoir (2020 demand) | 1.6 |
| With Southeast Reservoir (2020 demand) | 2.0 |
| Respondents to 2001 City of Huntington Beach Survey | |
| City of Phoenix | 1.9 |
| City of Tucson | 2.6 |
| City of Anaheim | 0.5 |
| City of Pomona | 1.5 |
| City of Azusa | 0.6 |
| Palmdale Water District | 2.1 |
| Seattle Public Utilities[c] | 1.5 |
| City of Sacramento[d] | 0.5 |
| City of Garden Grove[d] | 1.1 |
| City of Inglewood[d] | 1.4 |
| City of Santa Ana[d] | 0.4 |
| City of Hawthorne[d] | 0.7 |
| City of Torrance[d] | 0.7 |
| City of San Diego[d] | 0.4 |
| Otay Water District[d] | 0.6 |
| City of Sacramento[d] | 2.1 |
| From Published Water Master Plans | |
| Irvine Ranch Water District | 1.8 |
| Capistrano Beach Water District – 1997 | 0.5 |
| City of Tustin – 2000 | 0.4 |
| City of Westminster – 1999 | 0.3 |
| Yucaipa Valley Water District | 2.0 |
| City of Ontario | 1.0 |

(a) Unless otherwise footnoted
(b) Based on estimated average-day demand for 2015
(c) Days of "peak-day" demand
(d) Days of "emergency storage"

Emergency storage for other local water agencies (as days of average demand) from information published in recent water master plan reports are also included in Table 5-3.

The City of Huntington Beach is approximately in the middle for emergency storage as days of average demand relative to the other agencies listed in Table 5-3. However, the amount of emergency storage needed by a given agency is dependent on the availability of other supply sources during a specific emergency scenario. Emergency storage as days of average demand pertains to an emergency scenario where no other source of supply is expected to be available. For Huntington Beach, this translates to complete loss of both groundwater supply and imported water supply. This is a possible scenario, but highly unlikely relative to a scenario where either groundwater supply or imported water supply is lost or reduced.

In an emergency situation where water supply is lost or reduced, the City would go to public notification to reduce water demand. A reduction in demand to 80% of average-day demand is assumed in this water master plan for the emergency scenarios evaluated. Note that the days of average demand emergency storage shown in Table 5-3 is for normal average-day demand, i.e. not reduced.

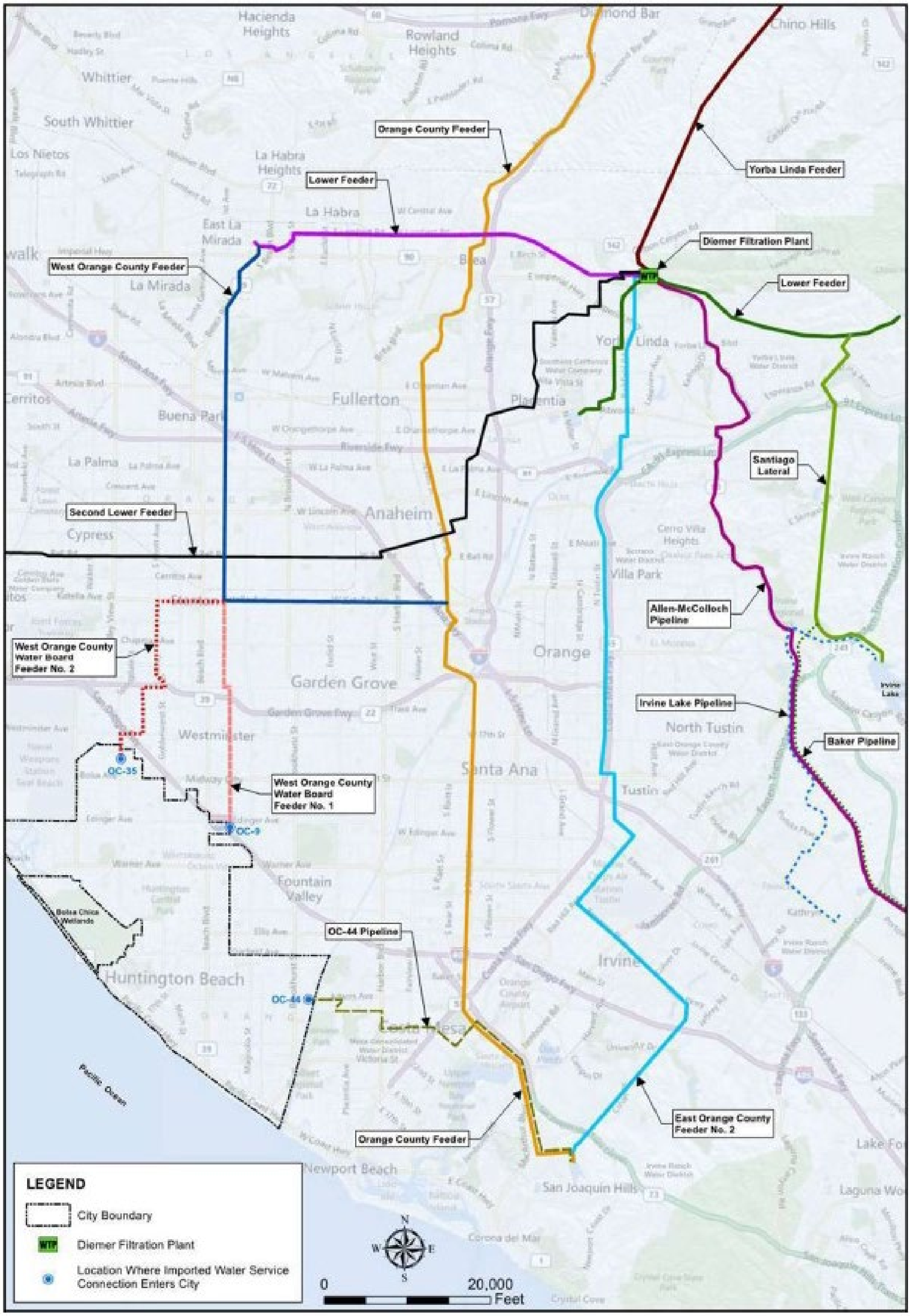
In this water master plan, five different emergency storage/supply scenarios were evaluated:

- Emergency Scenario No. 1: A complete loss of the City's imported water supply.
- Emergency Scenario No 2: A complete loss of the City's imported water supply coupled with a 7-day electric power outage.
- Emergency Scenario No 3: A complete loss of the City's groundwater supply.
- Emergency Scenario No 4: A complete loss of the City's imported water and groundwater supplies.
- Emergency Scenario No 5: A complete loss of water supply to the portions of the City south of the Newport-Inglewood fault as a consequence of an earthquake on this fault.

### *Emergency Scenario No. 1: A complete loss of the City's imported water supply*

As discussed previously, the City purchases supplemental, treated, imported water from MWDOC, which is a member agency of MWD. MWD imports raw water from northern California and the Colorado River, then treats the majority of this water to potable standards at filtration plants located in throughout Southern California. As shown on Figure 5-2, imported water is conveyed to the City via the following routes:

# Figure 5-2
# Imported Water Pipeline System



1. From the Diemer Filtration Plant to the East Orange County Feeder No. 2 (EOCF2) to the OC44 Transmission Line to the OC-44 Service Connection at Adams Street and the Santa Ana River.

2. From the Diemer Filtration Plant and/or the Jensen Filtration Plant (to either the Lower Feeder or the Second Lower Feeder) to the West Orange County Feeder to:

    a. the West Orange County Water Feeder No. 1 to the OC-9 Service Connection at Newland Street and Edinger Street, and

    b. the West Orange County Water Feeder No. 2 to the OC-35 Service Connection at Springdale Street and Glenwood Street.

The City's allocated capacities in OC-9, OC35, and OC-44 are shown in Table 5-4.

## Table 5-4
## City Imported Water Service Connections

| Connection | Allocated Capacity (gpm) | Zone Supply | Location |
|---|---|---|---|
| OC-9 | 6,300 | Zone 1 | Dale and Katella Streets (City of Stanton) |
| OC-35 | 9,000 | Zone 1 | Dale and Katella Streets (City of Stanton) |
| OC-44 | 6,700 | Zone 1 | Adams Ave. & Santa Ana River (East Orange County Feeder No. 2) |
| **TOTAL** | **22,000** | | |

The most likely causes for an imported water outage or reduction in supply would be a break in an imported water transmission main or mains or an outage at a filtration plant. Imported water transmission pipelines are well designed, with most of the pipelines constructed of welded steel pipe. However, the imported water transmission pipelines traverse hundreds of miles in areas with high seismic potential and this makes the imported water supply system susceptible to damage in a seismic event. Additionally, aging pipelines are subject to failure, especially metal pipes without corrosion protection systems in place. The MWD recommendation has been for water agencies to have seven days of storage/supply independent of imported water in order to have supply when MWD must take facilities down for repair or maintenance and as a safeguard against an emergency imported water outage.

The imported water pipelines (outside of the City) also operate at high pressures and a pressure surge could rupture a pipeline. In December 1999, a pressure surge on the Allen McColloch Pipeline (AMP) ruptured a section of pipe. Because the rupture occurred on a section of pipe that was easily accessible and occurred in the winter, repairs took four weeks. Otherwise, the repair could have taken much longer.

MWD's "Infrastructure Reliability and Protection Plan (IRPP)" is a program where MWD evaluates the reliability of its aqueduct facilities, treatment plants and distribution system. MWD conducted a regional evaluation of the risks to its facilities from earthquakes and categorized recovery times for four types of defined events, as summarized in Table 5-5.

In addition to the recovery times shown in Table 5-5, MWD also provided a more detailed assessment of the time required for specific facilities in Orange County. An outage of the Diemer Filtration Plant is estimated to have a recovery time of 31 days and repairs on the East Orange County Feeder No. 2 is estimated to take 10 days. For Orange County, the most significant risk to imported water supply is believed to be movement of the Whittier-Elsinore fault system.

**Table 5-5**
**MWD IRRP-Defined Events and Recovery Times**

| Defined Event | Type of Failure | Recovery Time |
|---|---|---|
| Nominal Single Event | Single location pipe failure due to earthquake, operational occurrences, or 3rd party incidents | 3 to 10 days |
| Recovery Plan Event | Multiple location pipe failures due to a moderate earthquake | 14 to 21 days |
| Complex Single Event | Single location pipe failure in a difficult location with interfering utilities | 21 to 31+ days |
| Extreme Event | Failures of treatment plants and distribution system due to seismic events that significantly exceed design criteria | 1 to 6 months |

The City has some protection against losing its entire imported water supply because imported water can be conveyed from the Diemer Plant to the City via several routes to OC-9 and OC-35 and a separate route to OC-44. Although concurrent breaks on several routes are possible, concurrent breaks on all of the routes is not considered likely. The City can also receive treated imported water from the Diemer Filtration Plant and the Jensen Treatment Plant via the West Orange County Feeder conveyance route, leaving the City less vulnerable to an outage at either of the two plants.

MWDOC was contacted to discuss imported water supply reliability for Huntington Beach and their position is that the City might receive all, some, or none of its normal imported water supply after a major facility outage depending on circumstances. MWDOC would act to send imported supply to where it is most needed. Most likely, the City would see at least some reduction in its normal imported water supply because of the City's strong groundwater supply relative to other areas entirely dependent on imported water. MWDOC would prioritize who most needed imported water, and conceivably the City could be asked to get by on groundwater alone if that is where the City fell on the priority list.

Under an extreme emergency in which no imported water were available, the City would have to rely on 100% groundwater supply to meet demands of 17,683 gpm and 18,795 gpm, which is the City's projected year 2025 and 2045 average-day demand, respectively, reduced by 20% through public notification. In evaluating this emergency condition, it is assumed that "normal" booster pumping capacity, i.e. capacity from duty pumps not including the largest backup pump at each site, is available at all of the booster pump stations. If a duty pump were to be out of service for repair, it is assumed that the backup pump would take its place. To be conservative, it is assumed that one well pump is out of service for repair at the time of the emergency. For this evaluation, Well No. 5 is assumed to be out of service.

As discussed previously, the City has a total potable water well capacity estimated at 20,350 gpm as shown in Table 5-6, with the assumptions footnoted. This is greater than the estimated 2025 and 2045 demands. However, under the assumption that Well No. 5 is out of service, the capacity is reduced to 17,350 gpm, which is less than the estimated 2025 and 2045 demands under a reduced scenario. The City would also have approximately 36 to 46 MG of emergency storage available depending on whether the 10 MG Southeast is on line.

**Table 5-6**
**Well Supply under Emergency and Electrical Power Outage**

| Well | Estimated Operating Capacity (gpm) | Electric Motor (EM) or Natural Gas Engine (NG) | Available Capacity w/Electrical Power Outage (gpm) |
|---|---|---|---|
| Well No. 1A | 2,250 | EM | 2,250 |
| Well No. 3A | 1,750 | EM | 0 |
| Well No. 5 | 3,000 | EM | 0 |
| Well No. 6 | 2,500 | NG | 2,500 |
| Well No. 7 | 3,400 | NG | 3,400 |
| Well No. 9 | 2,250 | NG | 2,250 |
| Well No. 10 | 2,700 | NG | 2,700 |
| Well No. 13 | 2,500 | NG | 2,500 |
| **TOTAL (gpm)** | 20,350 | | 15,600 |
| **TOTAL (mgd)** | 29.3 | | 22.5 |

***<u>Emergency Scenario No 2</u>: A complete loss of the City's imported water supply coupled with a 7-day electrical power outage***

Under this emergency scenario, it is assumed that an earthquake would disable the imported water supply for up to 31 days and would create a 7-day electrical power outage. In this scenario it is assumed that natural gas supply is not lost at any of the booster pump stations or well sites. The City has backup propane storage/equipment at each of the booster pump sites to power natural-gas engines in the event of an outage of the normal natural-gas supply, i.e. natural gas pipelines. Well Nos. 4, 7, and 13 also can receive emergency propane supply from the 10,000-gallon LPG tank at the Peck facilities site.

In accordance with the 1995 Water Master Plan, to provide energy back-up at well sites, the City purchased a portable, trailer-mounted propane storage vessel in 2010 and constructed vaporizers at Well Site Nos. 6, 9, and 10.

As in Emergency Scenario No. 1, it is assumed that normal booster pumping capacity is available, but that Well No. 5 is out of service for repairs.

As shown in Table 5-6, Well Nos. 4, 6, 7, 9, 10, and 13 operate off of natural-gas engines and these wells would be available during an electrical power outage, whereas Well Nos. 3A and 12 have electric motors and would be out of service as backup generators are not available. Well No. 1A has an electric motor with a backup generator and would be available during an electrical power outage. Well No. 5 is assumed out of service due to repairs consistent with the assumption made in Emergency Scenario 1. Therefore, the well supply would be 15,600 gpm as shown in Table 5-6.

As discussed in Chapter 4, all pumps at the booster pump stations with one exception are powered by a natural gas engine or can be powered by either an electric motor or a natural gas engine. All of these pumps would be available during an electrical power outage. The exception is the 400-gpm pump at the Zone 2 Reservoir Hill Booster Pump Station that is powered by an electric motor only and is assumed to be out of service during the electrical power outage.

The City's projected 2025 average-day demand reduced by 20% through public notification is estimated at 14,146 gpm. During an electrical power outage, available well supply is estimated to be 15,600 gpm, which results in a supply surplus of 8.0 MG for a 7-day outage. Additionally, the City would have 35.9 MG of emergency storage available from existing reservoirs, resulting in a supply surplus of 43.9 MG for the 7-day electrical power outage.

The estimated year 2045 average-day demand reduced by 20% through public notification is 15,146 gpm. During an electrical power outage, a supply surplus of 4.6 MG for the 7-day period would occur. Additionally, the City will have 35.9 MG of emergency storage available (even without considering the proposed 10.0 MG Southeast Reservoir to satisfy demand during the 7 days) resulting in over 40 MG of supply surplus for the 7-day electrical power outage.

***Emergency Scenario No 3**: A complete loss of the City's groundwater supply*

Another emergency scenario is a complete loss in the City's groundwater supply from the Orange County Groundwater Basin, conceivably as a result of basin groundwater contamination. This emergency scenario is not deemed as likely as an imported water outage. In such an emergency, other basin producers would also be affected and a larger strain would be placed on imported water supply. Again, MWD and MWDOC would prioritize imported water delivery to agencies on a most needed basis. The City may or may not receive all of its imported water supply, which is 22,000 gpm as shown in Table 5-4. The maximum allocation of 22,000 gpm is more than sufficient to meet demands of 14,146 gpm and 15,146 gpm, which is the City's 2025 and year 2045 average-day demand, respectively, reduced by 20% through public notification. The City would also have approximately 36 to 46 MG of emergency storage available depending on whether the 10 MG Southeast or the new reservoir from the potential desalination project is online. The existing emergency storage alone is equivalent to an 833-gpm supply for 30 days for the existing system and a 1,065-gpm supply for 30 days for the year 2045 system, assuming the additional 10 MG reservoir is online by then.

***Emergency Scenario No 4**: A complete loss of both the City's imported water and groundwater supplies*

A scenario where the City completely lost both its groundwater supply and its imported water supply is considered extremely unlikely. This would be the scenario where the total emergency supply for the City would need to come from emergency reservoir storage because it is assumed that neighboring cities would also be affected by such an extreme water supply emergency and that supply from emergency connections with other cities would not be available. Available emergency storage is equivalent to 1.41 days of operation for the projected 2025 water system demands and 1.32 days of operation for the 2045 system demands, assuming no additional storage is constructed; and 1.69 days assuming the 10 MG Southeast reservoir is online by then.

However, under such an extreme outage scenario, the City would go to immediate public notification and demand would be reduced well below average demand. Because of the severe condition, it could be assumed that water demand would be reduced to 40% of average. A 40% reduction results in emergency storage equivalent to 2.35 days of operation for the projected 2025 water system demand and 2.20 days of operation for the 2045 system demands, assuming no additional storage is constructed; and 2.81 days assuming the additional 10 MG reservoir is on line by then.

***Emergency Scenario No 5**: A complete loss of water supply to the portions of the City south of the Newport-Inglewood fault as a consequence of an earthquake on this fault*

Pumped storage in the southern part of the City, south of the Newport-Inglewood fault, was recommended in both the 2000 and 2005 Water Master Plans and is recommended in this water master plan update based on the findings in the 1999 City of Huntington Beach Infrastructure Restoration Study (Special Study Report on the Water and Drainage System Infrastructure) prepared by the U.S. Army Corp (1999 Army Corps Study).

Currently, there are no sources of supply and no storage reservoirs in the City south of the fault. The 1999 Army Corps Study concluded that water transmission supply pipelines crossing the fault would be ruptured by a design-basis earthquake on this fault, leaving the area south of the fault without a water supply. The study anticipated that a portion of the major water mains crossing the fault could be repaired after the earthquake to provide partial service to the southern areas isolated by the fault.

A potential site at the oil property at the corner of Goldenwest St. and PCH has been identified. When the new reservoir and adjacent booster station is constructed, they would provide fire plus emergency storage for the area south of the fault and east of Bolsa Chica. These projects are recommended to remain for inclusion in the City's Water CIP as discussed in Chapter 7.

### 5.5.1 *Pressure Zone 2*

The 2045 maximum day demand projected for Zone 2 is 2,390 gpm (3.44 MGD) using a 2.7 MDD factor as discussed in Section 2.3. At 25% of the maximum day demand, the operational storage requirement for Zone 2 is 0.86 MG. A 6,000-gpm fire flow for five hours is the Zone 2 fire flow requirement because of industrial land use in Zone 2. This equates to a fire storage requirement of 2.16 MG. The combined Zone 2 fire and operational storage requirement of 3.02 MG is well within the overall system requirement of 19.08 MG as described previously in Section 5.5.

The Reservoir Hill Booster Pump Station has a Zone 2 pumping capacity of 6,060 gpm with the largest pump (3,500 gpm) out of service. The Edwards Hill Booster Pump Station has a pumping capacity of 3,750 gpm with all three Zone 2 pumps in operation. The combined Zone 2 pumping capacity of 9,810 gpm is sufficient to supply the MDD plus fire flow requirement of 8,390 gpm (2,390 + 6,000).

The Reservoir Hill booster pumps with the exception of Pump No. 1 are powered by natural gas engines and the Edwards Hill booster pumps can be powered by either an electric motor or a natural gas engine. All of these pumps would be available during an electrical power outage. The exception is the 400-gpm Pump No. 1 at the Reservoir Hill Booster Pump Station that is powered by an electric motor only and is the only pump that would be out of service during an electrical power outage.

A 1,500-gallon LPG tank and associated equipment are located at the Edwards Hill site to provide backup propane gas supply for operation of the engine-driven pumps. Two 3,900-gallon LPG tanks and associated equipment are located at the Overmyer/Reservoir Hill site to provide backup propane gas supply for operation of the Reservoir Hill booster pumps as well as the Overmyer booster pumps.

## 5.6 Storage/Supply Adequacy for Emergency Operating Conditions

The City has sufficient reservoir storage to satisfy City operational plus fire storage requirements through the planning period ending in the year 2045. As scheduled in the City's current Water CIP, a 10-MG storage reservoir and an 11,000-gpm booster pump station will be constructed in the southeast quadrant of the City to ensure supply reliability and storage for the area south of the Newport Inglewood Fault and south of Bolsa Chica.

The City has sufficient emergency storage, groundwater supply, imported water supply, and emergency power to withstand a number of emergency supply outage scenarios evaluated in this Chapter.

In accordance with the 1995 Water Master Plan to provide energy back-up at well sites, the City purchased a portable, trailer-mounted 500 gallon propane storage vessel in 2010 and constructed vaporizers at Well Site Nos. 6, 9, and 10.

# 6 HYDRAULIC MODEL CONSTRUCTION, MODEL VALIDATION & SCENARIO MODELING

In the 2016 Water Master Plan Update, the hydraulic model provided by the City staff was validated and updated with analysis of projected future 2040 demand conditions. However, as stated below in Section 6.2, annual demands have actually stayed the same even with increasing population, primarily due to a steady trend of water reduction through aggressive water conservative efforts. The projected future 2040 demand from the 2016 Water Master Plan was 30,396 AFY, while this master plan is projecting future 2045 demand at 30,538 AFY. In addition, several major physical pipeline and water supply improvements have been made since 2016 to enhance the water system hydraulically, including newly constructed Well 1A and various pipeline upsizing and new connection projects to enhance fire flow availability at high density areas. The water model has been updated accordingly to reflect these improvements.

## 6.1 Hydraulic Model Description

The hydraulic model used for this master plan was provided by City staff at the outset of the project. The model is in WaterCAD format and is compatible with Water GEMS modeling software by Bentley Systems. The model is used routinely by City staff and contains numerous scenarios. It contains all pipes, wells, reservoirs, imported water connections, and booster stations in the existing water distribution system, and several demand allocations including those representing existing and estimated future demand conditions for average day, maximum day and peak hour demands.

## 6.2 Model Validation

Existing demands were first revised to correspond to the reduced demands experienced over the past few years as described in Chapter 2, which are also consistent with the 2020 UWMP, as discussed in Chapter 2. Then a series of validation analyses were conducted to verify that the model adequately simulated observed operating conditions within the distribution system. An existing demand condition was selected for the validation analyses after review of the model and discussion with City staff. The validation analyses were run under various existing demand conditions. The results were reviewed with City staff, and it was determined that the existing model provided accurate results for use on this project. The review determined that the existing piping system was sufficiently accurate and the existing demand allocation was suitable for analyses for this Water Master Plan.

The WaterCAD model simulates pump station flows and pressures into the system using reservoirs set to an overflow elevation equal to the hydraulic gradient in the system. Refill rates to the water storage facilities are simulated with control valves and a separate reservoir to receive the refill water. Imported supplies from the three turnouts and from City wells are simulated as input flow to the system (negative demand) equal to the reported typical yield of each well and turnout. In cases where a well or turnout is not operating, input flows are set to zero.

Hydraulic analyses conducted for this project used the existing system model to create a series of extended period simulation (EPS) analyses that represent demands experienced over a typical week in June 2020. These demand curves were then uniformly increased to reflect conditions that could be expected during a week of maximum demand. Hydraulic analyses were conducted under existing and future year 2045 demand conditions.

## 6.3 2022 Hydraulic Model Update

The WaterCAD hydraulic model was update as of September 2022 for the purpose of the 2022 Water Master Plan Update. Prior to this, the last known update to the model was for the 2016 Water Master Plan Update. The model was updated to include recently completed CIP projects (per the 2016 Water Master Plan) as of FY 2022. 3 CIP projects have been added to the model at described in Table 6-1.

**Table 6-1**
**Recently Completed CIP Projects Added to Model**

| 2016 CIP Project No. | Description | Date Completed |
|---|---|---|
| Project No. 1 – Beach Blvd. Pipe Improvements | Approx. 1,400 linear feet of 12-inch pipe added on the east side of Beach Blvd. between Blaylock Dr. and Robidoux Dr. to connect 2 dead end segments and improve fire flow in the area. | 2018 |
| Project No. 16 – Pacific Shores Development | Approx. 310 linear feet of 8-inch pipe added from Attleboro Circle to the Pacific Shores Private Development. The Pacific Shores Private Development watermain connects to the City's 12-inc pipeline on Newland St. | 2013 |
| Project No. NA – Well No. 1 Replacement | Well No. 1A with a capacity of 2,250 gpm was constructed to replace Well No. 1 on the same site. | 2018 |

It should be noted that various other CIP projects have been completed since the 2016 Water Master Plan, however it was discovered that those projects were already included in the model. Specifically, Bolsa Chica Water Main Extension Project No. 23 was completed in 2017 and connects dead end pipeline at the ends of Graham St., Falkir Ln., Bankton Dr. and Allstone Dr. This project was already included in the model. Additionally, Sunset Beach Water Main Replacement and Extension Project No. 32 was completed in 2020 and was found to be included in the model.

A general comparison against the latest version of the system GIS was performed. The City's GIS is the most up to date and accurate representation of the City's water system, and a general comparison was performed to ensure the model mirrored the GIS. Table 6-2 is a list of pipes added to the model as a result of the comparison. One pipeline segment was added. This segment was not part of the 2016 Water Master Plan CIP.

**Table 6-2**
**Pipes Added to Model from Comparison to GIS**

| Description | Date Completed |
|---|---|
| Approx. 500 linear feet of 6-inch pipe added on Geneva Ave. between Indianapolis Ave. and Delaware St. | 2020 |

## 6.4 Distribution System Modeling

Various scenarios were set up by varying demand conditions and modeled to analyze the transmission and distribution system to determine system responses and develop recommended capital improvements. These scenarios are summarized in the following sections and described in the technical memorandums in the appendices.

### 6.4.1 Maximum Week Condition

#### 6.4.1.1 Existing Demands

Demand data for a typical week in June of 2007 was provided by City staff, including diurnal curves for the entire week. These typical daily demands were factored up to represent a typical week during the maximum week. Current data for a typical week in June 2020 was also provided by City staff, for comparison purposes to determine if maximum demands require adjusting and additional model updates accomplished. Due to the fact that water use may rebound in the future, and to remain somewhat conservative in hydraulic modeling, peaking factors will remain the same as that determined from the 2012 Water Master Plan. The June 2007 data had an average daily demand of just over 23,000 gpm and a maximum peak hourly demand of 34,700 gpm. While the June 2020 data had a significantly lower average daily demand of approximately 19,190 gpm, the maximum hourly demand was just over 28,700 gpm for both Zone 1 and Zone 2, which is only slightly lower than what was modeled in the previous master plan. Since the peak demands used in the previous modeling were somewhat conservative but similar, no additional modeling is required for this master plan update.

Capital projects included in the previous master plans that remain to be completed are discussed in detail in Chapter 7 and were analyzed in 2016 Water Master Plan to determine/confirm proper sizing and location.

#### 6.4.1.2 Future (2045) Demands

The future 2045 demand projections (sometimes referred to as Build-out in this master plan) were described previously in Chapter 2. The additional demands over and above existing demands come mostly from the demands associated with the City's 2021-2029 RHNA allocation of 13,368 housing units. The location of these demands is discussed the Housing Element Update and specific sites are identified in Appendix B of the Housing Element Update. These sites are primarily located in the Beach-Edinger Corridor Specific Plan Area and the Holly-Seacliff Specific Plan Area. Therefore, projected additional demands are placed on nodes within the water distribution system in accordance with the location where they are anticipated to occur. As discussed in Chapter 2, the RHNA accounts for approximately 2,642 gpm of additional average day demand, which was distributed throughout the areas identified in the Housing Element Update.

Similar to the existing system hydraulic modeling discussed above, the future demands projected for 2045, were placed on the hydraulic model and week-long EPS runs were analyzed for average and maximum day conditions.

Under these Build-out system hydraulic analyses, the water transmission and distribution system, including all of the remaining master plan improvement projects discussed in Section 7.3, performed very well. There are capital improvement concepts analyzed that can help meet build-out maximum day demands totaling almost 38,700 gpm.

It should, however, be pointed out that the Well Study recommended in this master plan could also have an impact on the potential build-out improvements. However, if average demands do not reach these levels due to continued water conservation, then these improvements could be reduced in size and scope.

# 7 CAPITAL IMPROVEMENT PROGRAM

## 7.1 Overview

On September 18, 1995, the City Council adopted the Capital Surcharge, a pay-as-you-go (cash) basis to fund master plan projects listed in the City's Water Master Plan. The Capital Surcharge is a flat monthly charge to each water customer, regardless of water usage. The surcharge first became effective December 1, 1995 and was initially set at $3.00 per month per equivalent dwelling unit (EDU). It increased $0.50 each December 1 through December 1, 2000, when it became $5.50 per month per EDU. On December 1, 2007, the surcharge was decreased to $2.00 per EDU and was to remain at that level in perpetuity to pay for the maintenance of facilities built from water master plan recommendations. On November 19, 2007, City Resolution 2007-78 rolled the $2.00 surcharge into the monthly water meter rate of Water Fund for on-going maintenance of facilities. The water meter rate is adjusted annually by the Consumer Price Index. A summary of monthly Capital Surcharges appears in Table 7-1. As of July 1, 2022, the Water Master Plan Fund balance was approximately $19.4 million.

**Table 7-1**
**History of Monthly Capital Surcharges**

| Effective Date[a] | Monthly Surcharge ($/EDU) | Effective Date | Monthly Surcharge ($/EDU) |
|---|---|---|---|
| December 1, 1995 | $3.00 | December 1, 2008 | $0 |
| December 1, 1996 | $3.50 | December 1, 2009 | $0 |
| December 1, 1997 | $4.00 | December 1, 2010 | $0 |
| December 1, 1998 | $4.50 | December 1, 2011 | $0 |
| December 1, 1999 | $5.00 | December 1, 2012 | $0 |
| December 1, 2000 | $5.50 | December 1, 2013 | $0 |
| December 1, 2001 | $5.50 | December 1, 2014 | $0 |
| December 1, 2002 | $5.50 | December 1, 2015 | $0 |
| December 1, 2003 | $5.50 | December 1, 2016 | $0 |
| December 1, 2004 | $5.50 | December 1, 2017 | $0 |
| December 1, 2005 | $5.50 | December 1, 2018[c] | $3.00 |
| December 1, 2006 | $5.50 | December 1, 2019 | $3.00 |
| December 1, 2007[b] | $2.00 | December 1, 2020 | $3.00 |
| | | December 1, 2021 | $3.50 |
| | | December 1, 2022 | $4.00 |

a) City Resolution 99-34 Adopted the Capital Surcharge Schedule

b) City Resolution 2007-78 rolled the $2.00 Capital Surcharge into the monthly water meter rate of Water Fund for on-going maintenance of facilities. The water meter rate is adjusted annually by the Consumer Price Index.

c) A capital surcharge was re-enacted in 2018.

The water master plan CIP is periodically updated, typically every five years, with the last update completed in 2016. The list of capital projects is determined based on current and projected system demands, the estimated remaining useful life of existing water system infrastructure, and the necessity to enhance and improve water quality and reliability. While many original projects have been completed since the inception of the Water Master Plan, capital projects with a project cost of approximately $119.9 million remain to be constructed. Furthermore, this current Water Master Plan update has identified a significant number of new capital projects, with total costs of an additional approximately $28.6 million that are essential to replace aging critical water system infrastructure throughout the City. Therefore, a sum total of approximately $148.5 million (based on present value, not including future escalation) in water infrastructure improvements are necessary over the next 20 years.

## 7.2 Remaining Water Master Plan Capital Improvement Projects

Water master plan projects that remain to be constructed from the 2016 Water Master Plan to be funded from the water master plan project funds are described below and are identified with project numbering consistent with the previous 1995, 2000, 2005, 2012, and 2016 water master plans.

***Project No. 12: Permanent Wellhead Facilities for Well No. 13***

Well No. 13, a fairly new well, has been operating with temporary facilities. Building a permanent well head enclosure will utilize the existing casing but will include a larger building, new mechanical equipment, improved controls, along with electrical equipment to allow this pump to operate as a hybrid, using electricity as well as natural gas.

***Project No. 13: Southeast Reservoir and Booster Pump Station***

A 10 million gallon storage reservoir and an 11,000 gpm booster pump station are recommended in order to increase reliability to the southeast service area. The storage reservoir and pump station is proposed to be located near the Downtown Loop transmission main and will provide adequate pressure to the southeast service area in the emergency event that the southeast service area is isolated from the rest of the system. A potential site at the oil property at the corner of Goldenwest St. and PCH has been identified. A reservoir located at this site has been verified to be hydraulically feasible. A short 500 linear foot, 36-inch transmission main will be constructed to connect the reservoir to the Downtown Loop.

***Project No. 14: Southeast Reservoir Transmission Main***

A 10,400 linear foot, 36-inch distribution/transmission main will be constructed from the potential desalination booster station or City Southeast Reservoir Booster Pump Station to transmit water to the Downtown Loop. This new line will be interconnected with existing distribution lines along its route to distribute water to the southeast service area. The proposed routing from the Booster Station is north on Newland Street, then west on Atlanta Avenue to a tie-in with the 20-inch Downtown Loop at 3rd Street/Lake Street. This segment was undersized in the 2005 Water Master Plan at 16- to 24-inches and needs to be 36-inches in diameter.

***Project No. 14A: Southeast Reservoir Transmission Main Extension to Overmyer***

Modeling conducted with this current master plan also determined that an additional water transmission pipeline is needed to connect the Southeast Transmission Main to Overmyer Reservoir to handle day-to-day operations and to maintain water quality throughout the system. This additional transmission pipeline should have been included with the previous master plan and will be included as part of this current list of updated master plan projects.

The project involves a 1.5 mile, 36-inch and 0.25 mile 42-inch pipeline extension from the Southeast Reservoir Transmission Main at Atlanta Avenue up Huntington Street to Overmyer Reservoir. Additionally, two pressure regulating stations are needed for the two interconnects to the smaller diameter distribution system pipelines near the proposed Southeast Reservoir site and at the tie-in to the 20-inch Downtown Loop.

This project would, of course, only be constructed in conjunction with or following the construction of the Southeast Reservoir Transmission Main, Project No. 14, above. This new, 1.75 mile transmission main could be operated under system pressure to move water from Overmyer Reservoir to maintain levels in the Southeast Reservoir. Along with the Southeast Booster Station, it could also be operated to back-up Overmyer Reservoir if the reservoir needs to be taken down for maintenance. In the event desalinated water becomes available, this line could operate either (1) under system pressure; or (2) under low pressure as a dedicated fill line to Overmyer Reservoir.

***New Project No. 26: New Water Well No. 14 (Beach Blvd./Heil Ave.)***

New well required to provide redundancy within the HB well field. Design capacity TBD. Will offset the supply capacity that was recently lost from the well casing failure at Well No. 12 and the shutdown of Well No. 4. Well No. 12 was permanently capped and abandoned in 2015 (refer to Table 3-9 for history of active and abandoned water wells). Well No. 4 has been temporarily placed out of commission with a rehabilitation project scheduled for FY23/24. A tentative location for this well has already been determined to be an open lot at the intersection of Beach Blvd. and Heil Ave. The design capacity and location can be verified/finalized during the design, and no other studies are needed to precede this project.

***New Project No. 27: New Water Well No. 15 (Location TBD)***

New well required to provide redundancy within the HB well field. Design capacity TBD. Will offset the supply capacity that was recently lost from the well casing failure at Well No. 12 and the shutdown of Well No.4. Well No. 12 was permanently capped and abandoned in 2015 (refer to Table 3-9 for history of active and abandoned water wells). Well No. 4 has been temporarily placed out of commission with a rehabilitation project scheduled for FY23/24.

***New Project No. 31: Aging Water Main Replacement Program – Primarily Asbestos Cement Pipe and Other Aging Water Mains throughout the City***

Asbestos Cement Pipe (ACP) was commonly used around 50 years ago due to its competitive unit cost and because it was believed to be superior in resisting pipe corrosion. Unfortunately, studies have shown that ACP tends to become brittle with age, is prone to gradual loss in structural integrity from both high ground water on the outside, as well as permeation from the inside. Typical life expectancy of ACP is around 100 years. As of today, there are nearly 465 miles of ACP in the City's water system, primarily between 45 and 55 years old. This Aging Water Main Replacement Program will initially target older ACP in areas of highest groundwater level. The cost for this program assumes replacing 45 percent, or 200 miles, of this aging pipe over the next 20 years, or 10 miles/year.

***New Project No. 34: 8-Inch Water Main Replacement in Conjunction with Federally Funded Humboldt Bridge Rehabilitation & Widening Project***

The Humboldt Drive Bridge is a multi-span steel I-girder bridge constructed in 1963. The bridge is approximately 35 feet wide and approximately 156 feet long; it measures 26 feet curb to curb, which is below the minimum roadway width required for this bridge. The bridge provides one 13-foot lane in each direction for vehicular traffic. The rehabilitation and widening of the bridge are being funded through the federal Highway Bridge Replacement and Rehabilitation Program. Since the existing waterline has nearly reached its useful life and cannot be protected in place, replacing it during the bridge rehabilitation will be more cost effective than replacing the waterline as a separate standalone project.

***New Project No. 41: Groundwater Master Plan***

This 2016 Water Master Plan Update contains several new wells to replace losses experienced in groundwater pumping capacity due to aging well infrastructure or degradation in water quality. The useful life of water wells can vary greatly but is typically between 40 and 60 years. The Orange County Water District regulates the basin and dictates the Basin Pumping Percentage (BPP), which is subject to annual changes. Typically the City is allowed to produce a minimum of 60-70% of our potable water needs from the groundwater basin with OCWD's long-term goal to maintain a BPP of 85%. The balance of the City's potable water needs is purchased from our imported water wholesaler, MWDOC. Imported water is nearly three times the cost of well water, so it is in the City's best interest to have adequate well pumping capacity to provide groundwater to the annual BPP limit. The City also needs reliable water wells with surplus capacity to handle scenarios when existing wells are temporary removed from service for routine maintenance or if imported supplies are curtailed. The purpose of the Groundwater Master Plan is to capture all relevant data pertaining to existing active water wells, to estimate remaining useful life, and to identify an on-going water well replacement schedule, taking into account the fact that it takes many years to plan, acquire right-of-way, design, permit, equip and put a well into operation. The Groundwater Master Plan should, at a preliminary design level, identify feasible well sites for purchase/acquisition.

***New Project No. 42: Water Security Improvements at Well No. 3A***

Water Well No. 3A is located near Warner Avenue and Gothard Street, was drilled around 1994, and has a design pumping capacity around 2,500 gpm, but is currently operating at approximately 80 percent of that capacity. In 2015, a deeper section of the well was filled with concrete to deter lower quality water from entering into the pump column. This method was successful in improving water quality at a very reasonable cost; however, capping the lower section did decrease the well's ability to produce water at its original design capacity. The existing well infrastructure at Well No. 3A is in good condition. There will be new state-of-the-art monitoring equipment such as intrusion alarms to enhance physical security at this critical facility.

***New Project No.43: Water Security Improvements at Well No. 6***

Water Well No. 6 is located near Gothard Street and Heil Avenue, was drilled around 1973, and has a design pumping capacity around 3,000 gpm. The existing well infrastructure at Well No. 6 is in good condition. There will be new state-of-the-art monitoring equipment such as intrusion alarms to enhance physical security at this critical facility.

***New Project No. 44: Water Security Improvements at Well No. 8***

Water Well No. 8 is located near Goldenwest Street and Warner Avenue, was drilled around 1978, and has a design pumping capacity over 3,000 gpm. The existing well infrastructure at Well No. 8 is in good condition. There will be new state-of-the-art monitoring equipment such as intrusion alarms to enhance physical security at this critical facility.

***New Project No. 45: Water Security Improvements at Well No. 9***

Water Well No. 9 is located near Newland Street and Warner Avenue, was drilled around 1981, and has a design pumping capacity over 3,000 gpm. The existing well infrastructure at Well No. 9 is in good condition. There will be new state-of-the-art monitoring equipment such as intrusion alarms to enhance physical security at this critical facility.

***New Project No. 46: Water Security Improvements at Well No. 10***

Water Well No. 10 is located near Edinger Avenue and Beach Blvd, was drilled around 1981, and has a design pumping capacity around 3,400 gpm. The existing well infrastructure at Well No. 10 is in good condition. There will be new state-of-the-art monitoring equipment such as intrusion alarms to enhance physical security at this critical facility.

***New Project No. 48: Annual Water System Corrosion Control Program***

Typically, on an annual basis, engineering and operation staff will evaluate and identify new projects in the category of corrosion control improvements. This is consistent with past Water Master Plan projects to apply corrosion control to City owned transmission mains within City limits, specifically OC-9, OC-44, and OC-35. To date, including corrosion control applied on the 20-inch Downtown Transmission Main Loop, approximately 16.5 miles of transmission mains have had cathodic protection installed to deter corrosion. The objective of these improvements is to prolong the life expectancy of metallic infrastructure, including but not limited to pipelines, fittings, and valves. Two projects identified in this Water Master Plan are also categorized under this annual program, they are No. 53: 8.6 Miles of OC-44 Transmission Main; No. 54: 5.3 Miles of OC-9 and 5.9 Miles of OC-35 Transmission Main. As with Project 48, this funding is for future, currently undefined projects of this nature.

***New Project No. 50: Water Master Plan and Financial Plan Update (Typically Every 5 Years)***

Typically, on a five (5) year cycle, the Water Master Plan and Financial Plan are updated to evaluate current projected infrastructure needs and available funds for capital improvement projects. Per City's Municipal Code, Section 14.12.040(B), "A Capital Surcharge to be charged monthly as may be determined by the City shall be set by resolution of the City Council. All monies collected as the Capital Surcharge shall be used for water projects that are consistent with the goals and objectives of the Water Master Plan adopted by the City Council." The 1995 Water Master Plan and Financial Plan Update outlined a substantial amount of costly water infrastructure needs, which eventually led to the City Council's adoption of a Capital Surcharge for approximately 12 years (City Resolution No. 6713). This 2016 Water Master Plan and Financial Plan Update similarly identifies a large number of costly critical water infrastructure requirements for the next 20 years. The Financial Plan addresses financial needs and recommends various approaches to funding projects such as use of a Capital Surcharge, similar to the one adopted in 1995.

***New Project No. 51: Urban Water Management Plan (Typically Every 5 Years)***

Water agencies, such as the City, must update their Urban Water Management Plan (UWMP) every five years (for years ending with "0" and "5"), consistent with the requirements of the 1983 Urban Water Management Planning Act (Act). These updates detail each agency's efforts to ensure water supply reliability under a range of hydrologic conditions as well as comply with any new regulatory requirements under the Act. The UWMP plays a key role from the City's perspective to determine if adequate surplus water is available for future private developments. The UWMP will typically accomplish the following major objectives:

- Evaluate the supplies necessary to meet demands over a 25-year period in normal year, single-year and multi-year droughts.

- Document the stages of actions the agency would undertake to address up to 50% reduction in its water supplies.
- Describe the actions to be undertaken in the event of a catastrophic interruption in water supplies.
- Evaluate the water use efficiency measures to satisfy the requirements of California SBx7-7.

***New Project No. 52: 8.6 Miles of OC-44 Transmission Main, Between 16-Inch to 42-Inch, Corrosion Control Improvements through Mesa Water District***

As described under Project No. 21, OC-44 Pipeline was constructed in the 1960's, and is jointly owned by the Mesa Water District (58.6%) and the City (41.4%). Though nearly all of the existing 8.6 miles of transmission main does not have a history requiring leak repairs, it lacks cathodic protection, a proven cost-effective corrosion control method to indefinitely protect metallic pipelines from corrosion. While the expensive "one-time" cost of this method requires welding of wires between metal pipe joints to create electrical continuity, the overall cost of rehabilitation has shown to be a small fraction of the cost of transmission main replacement.

***New Project No. 53: 5.3 Miles of OC-9 & 6.0 Miles of OC-35 Transmission Main, Between 24-Inch to 36-Inch, Corrosion Control Improvements through West Orange County Water Board***

As described under Project No. 25 and No. 26, 6.0 miles of OC-35 and 5.3 miles of OC-9 were constructed in 1963 and 1956, respectively. Both transmission mains, located outside of City limits, are jointly owned by the WOCWB. WOCWB is jointly owned by the City (52.5%), City of Westminster (25.4%), City of Seal Beach (14.3%), and City of Garden Grove (7.8%). While nearly all of the existing 11.3 miles of transmission main does not have a history needing leak repairs, it lacks cathodic protection, a proven cost-effective corrosion control method to indefinitely protect metallic pipelines from corrosion. While the expensive "one-time" cost of this method requires welding of wires between metal pipe joints to create electrical continuity, the overall cost of rehabilitation has shown to be a small fraction of cost of transmission main replacement.

***New Project No. 54: OC-44 San Diego Creek Crossing Pipeline Protection with Rip Rap Scour Protection - Phase II***

After completion of Project No. 21, slip-lining the existing 42-inch OC-44 Pipeline with a new 30-inch diameter Ductile Iron earthquake resistant pipe, that section of new pipe across San Diego Creek is expected to once again be a reliable pipeline. However, this pipeline is lacking erosion or scour protection through the creek crossing section. This pipeline is vulnerable to damage from large flood events. Although large flood events are infrequent, there is still the probability that this pipeline will need to endure large scale flooding sometime during its remaining design life. Metropolitan Water District also maintains a transmission main crossing this creek, and their section of pipeline is encased in concrete rip-rap and shows no signs of erosion. Therefore, Phase II of this project, following Project No. 21, is to obtain necessary permits and funding to install concrete rip-rap to permanently protect the section of the pipeline crossing the creek from future erosion and scour.

***New Project No. 55: Overmyer Booster Station Dual Energy Drive***

The Overmyer Booster Station is the largest of three Zone 1 booster stations that primarily maintains pressure and meets daily water demand in the heart of the City. The backbone of this booster station consists of two large natural gas engines, each over 400 horsepower and capable of delivering over 6,500gpm. Additionally, there are two more natural gas engines, each over 150 horsepower and capable of delivering around 3,500 gpm. Similar to Project No. 22, due to greater air quality concerns with natural gas driven engines, it has become increasingly difficult to satisfy South Coast Air Quality Management District's regulatory requirements. To address this challenge, the Overmyer Booster Station Dual Drive Project will convert the existing natural gas driven system into a dual drive hybrid system, having options to run by electricity or natural gas. This project will further increase reliability of this vital booster station, and also allow City's operation and maintenance team the flexibility to meet water demands while operating within regulatory requirements.

***New Project No. 56: Peck Reservoir Roof Replacement***

The Peck Reservoir roof is showing signs of wear and will soon need to be replaced. Although replacing the existing roof with similar material is likely the most cost-effective solution, a feasibility study will be performed with an objective to identify other potentially feasible alternatives to a new roof with a greater design life. In addition to the roof replacement, the project includes removal and replacement of under reservoir steel pipes and the installation of cathodic protection for these facilities.

***New Project No. 57: Annual Water Facilities Security Improvements Program***

Typically, on an annual basis, engineering and operation staff will evaluate and identify new projects in the category of facilities physical security improvements. Post-911, a Water System Vulnerability Assessment was performed in 2003 and various security features have been implemented. A number of projects identified in this Water Master Plan are also categorized under this annual program, such as No. 31: Peck Reservoir Site and Well No. 13 Security Improvements; No. 43: Water Security Improvements at Well No. 3A. However, additional projects that are currently unknown are anticipated to arise in the future and this annual funding is envisioned to cover those.

## Table 7-2
## Estimated Costs for Remaining Water Master Plan Projects

| Project # from 2016 WMP | Project Name | Estimated Design FY | Estimated Design Cost[a,b] | Estimated Construction FY | Estimated Construction Cost[a,c] | Total Estimated Cost | Program Category | Priority |
|---|---|---|---|---|---|---|---|---|
| 12 | Well 13 Permanent Wellhead Facilities | 2030 | $289,000 | 2025 | $2,599,000 | $2,888,000 | Production | 4 |
| 13 | Southeast Reservoir and Booster Pump Station | 2033 | $2,306,000 | 2034-35 | $27,653,000 | $29,959,000 | Resiliency | 5 |
| 14 | Southeast Reservoir Transmission Main | 2033 | $726,000 | 2034-35 | $7,733,000 | $8,460,000 | Resiliency | 5 |
| 14A | New Connection – Overmyer to SE TM | 2033 | $781,000 | 2034-35 | $7,811,000 | $8,593,000 | Resiliency | 5 |
| | 1.75 mi. 36" to 42" in Huntington Street | | $723,000 | | $7,225,000 | $7,948,000 | | |
| | Interconnects at Overmyer Reservoir | | $37,000 | | $370,000 | $407,000 | | |
| | PRVs at SE Reservoir and Atlanta/Downtown Lp | | $22,000 | | $218,000 | $238,000 | | |
| 26 | New Well No. 14 | 2025 | $1,083,000 | 2026-27 | $6,138,000 | $7,221,000 | Production | 1 |
| 27 | New Well No. 15 | 2028 | $1,083,000 | 2029-30 | $6,138,000 | $7,221,000 | Production | 1 |
| 31 | Aging Pipe Replacement (Include 5% of AC Pipe) | Annual[e] | $3,610,000 | Annual[e] | $36,104,000 | $39,714,000 | Replacement | 3 |
| 34 | 8" Pipe Replacement Humboldt Bridge Rehab | 2024 | $36,000 | 2025 | $108,000 | $144,000 | Replacement | 3 |
| 35 | OC-9 Replace 22" for I-405 Widen (OCTA Pays) | 2017 | -- | 2023 | -- | -- | Replacement | DONE |
| 41 | Groundwater Master Plan | 2025 | $217,000 | NA | -- | $217,000 | Study | 2 |
| 42 | Security at Well 3A | 2025 | $73,000 | 2026 | $144,000 | $217,000 | Security | 4 |
| 43 | Security at Well 6 | 2027 | $73,000 | 2028 | $144,000 | $217,000 | Security | 4 |
| 45 | Security at Well 9 | 2031 | $73,000 | 2032 | $144,000 | $217,000 | Security | 4 |
| 46 | Security at Well 10 | 2033 | $72,000 | 2034 | $144,000 | $217,000 | Security | 4 |
| 48 | Water System Corrosion Control | Annual[e] | $60,000 | Annual[e] | $1,444,000 | $1,504,000 | Corrosion | 3 |
| 50 | WMP and Financial Plan Updates | Every 5 Years | $289,000 | NA | -- | $289,000 | Study | 3 |
| 51 | Urban Water Management Plans | Every 5 Years | $289,000 | NA | -- | $289,000 | Study | 3 |
| 52 | 8.6 Miles OC-44 Corrosion Control[d] | NA | -- | 2028-29 | $5,979,000 | $2,475,000 | Corrosion | 3 |
| 53 | WOCWB OC-35 and OC-9 Corrosion Control | 2024-26 | $800,000 | 2025-27 | $10,000,000 | $5,670,000 | Corrosion | 1 |
| 54 | OC-44 Scour Protection 30" at Creek Crossing | 2024 | $60,000 | 2025 | $897,000 | $396,000 | Replacement | 3 |
| 55 | Overmyer Booster Station Dual Drive | 2030 | $433,000 | 2031-32 | $2,455,000 | $2,888,000 | Production | 5 |
| 56 | Peck Reservoir Roof Replacement | 2032 | $1,045,000 | 2033-34 | $6,955,000 | $8,000,000 | Production | 1 |
| | **TOTAL** | | **$13,765,000** | | **$121,623,000** | **$135,389,000** | | |

a) Estimated Cost estimates as of August 2022. Includes January CCI (LA ENR = 12556) and an estimated 20% increase to current month (August). Escalation of design and construction costs will be accounted for in the Financial Plan
b) Design Costs range from 5 to 15% of construction costs, depending on project size and complexity and include preliminary design, final design, potholing, geotechnical, survey, and bidding services.
c) Construction Costs include construction management and City project management. Construction management costs range from 2.5 to 5% of construction costs for shop drawings, RFIs, field visits, etc., but do not include inspection services.
d) City project management costs range from 5 to 9% of construction costs and may include inspection services depending on the project type.
e) Design already complete or costs encumbered.
f) Amount shown is the sum of 20 years.



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## 7.3 New Water Master Plan Capital Improvement Projects

Eleven (11) new Water Master Plan projects and annual programs have been identified below, numbered from No. 58 to No. 68. These new projects and remaining projects above will all be funded by available Water Master Plan funds and will be implemented in order of their respective priority, as determined by Public Works staff.

The estimated costs for the new capital projects described below, in September 2022 dollars, are summarized along with their year of anticipated design and construction on Table 7-3.

***New Project No. 58A-58K: City Wells and Booster Pump Stations Sodium Hypochlorite On-site Generation***

The City currently disinfects all of its well water through the injection of gaseous chlorine ($CL_2$) typically at a rate of about 1.0 milligrams per liter (mg/l) residual. This project will convert all well sites to on-site sodium hypochlorite generation. Additionally, all booster pump sites will be fitted with on-site sodium hypochlorite generation. On-site generation of hypochlorite from inert feedstock will reduce hazards and costs associated with chemical storage and handling.

***New Project No. 59A-59K: City Wells and Booster Pump Stations Hydrofluorosilicic Acid On-site Generation***

The City currently injects Fluoride at all of its well sites. This project will convert all well sites to on-site generation of hydrofluorosilicic acid.

***New Project No. 60: Independent Review of all City Well Sites by Engineering Firm***

A project to perform an evaluation and produce a report with recommendations to enhance reliability, uniformity, and functionality of all City well sites. Note that this study is to assess existing well sites and is not a water supply study and should not attempt to recommend additional supply sources.

***New Project No. 61: Lead and Copper Rule Revision (LCRR) Inventory Study and GIS update***

The LCRR requires public water systems to develop an initial inventory of all lead service lines in their distribution system by October 16, 2024. This project will assess the City's service lateral lines and provide an inventory of materials of all lines. The project will also update the City's GIS to include material information for all City service laterals.

***New Project No. 62: Well No. 8 Replacement / Rehabilitation***

Well No. 8 has been out of service since 1980 due to presence of hydrogen sulfide and color in the water. The project will salvage the existing well site and rehabilitate the well to place it back in active service. Rehabilitation of Well No. 8 will be a more cost-effective means of providing additional supply to the system than new well construction.

The cost for this project includes a preliminary study that includes dynamic testing and a water quality analysis, with and feasibility for rehabilitation and recommendations. The cost for this project includes a preliminary study that includes dynamic testing and a water quality analysis, with recommendations of feasibility and rehabilitation. The study should include dynamic profiling of the well to determine if water quality can be improved by plugging and eliminating certain strata along the pipe column.

***New Project No. 63: New Water Well No. 16 (Location TBD)***

A third new well required to provide redundancy within the HB well field. Design capacity TBD. Will offset the supply capacity that was recently lost from the well casing failure at Well No. 12 and the shutdown of Well No. 4. Well No. 12 was permanently capped and abandoned in 2015 (refer to Table 3-9 for history of active and abandoned water wells). Well No. 4 has been temporarily placed out of commission with a rehabilitation project scheduled for FY23/24.

***New Project No. 64: Water Facilities / SCADA Cybersecurity Improvements***

In response to an uptick in worldwide cybersecurity threats the City will conduct an IT security audit and implement cybersecurity measures to prevent cyberattacks and modernize existing IT infrastructure.

***New Project No. 65: Well Quality Emergency Mitigation/Treatment Program***

In light of new regulations regarding PFAS and recent water quality issues at several City Wells (H2S, sand, manganese, PFAS), the City is in need of a systematic program for the quick and efficient design and construction of well head treatment on an as-needed basis. When wells are impacted by sand, odor, manganese, PFAS, and other constituents of concern, this program will allow staff to immediately begin design of mitigation/treatment. The program should include studies for initial testing, pre-design, bench-scale, and pilots. Program should also include quick deployment of temporary interim solutions, as needed, to maintain normal production of the wells

***New Project No. 66: Electric Vehicle Charging Stations at Utilities Yard***

To keep up with the growing trend of sustainable technologies, the City is proposing to provide level 2 charging stations at the utilities yard for city fleet vehicles.

***New Project No. 67: Manganese Treatment System at Well 3A***

Well 3A has been taken out of service for exceedance of MCL for Manganese. The City proposes to install well head treatment to lower manganese levels and place Well 3A back into service immediately.

***New Project No. 68: Well 4 Rehabilitation***

Well 4 was taken out of service due to poor production and the City proposes to rehabilitate the well to place it back online.

**Table 7-3**
**Estimated Costs for New Water Master Plan Projects**

| Project # | Project Name | Estimated Design FY | Estimated Design Cost | Estimated Construction FY | Estimated Construction Cost | Total Estimated Cost | Program Category | Priority |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 58A | Well 1A Sodium Hypochlorite On-site Generation | 2024-28 | $8,678 | 2025-29 | $368,618 | $377,296 | Production | 2 |
| 58B | Well 3A Sodium Hypochlorite On-site Generation | 2024-28 | $9,553 | 2025-29 | $405,774 | $415,327 | Production | 2 |
| 58C | Well 4 Sodium Hypochlorite On-site Generation | 2024-28 | $15,683 | 2025-29 | $666,204 | $681,887 | Production | 2 |
| 58D | Well 5 Sodium Hypochlorite On-site Generation | 2024-28 | $9,931 | 2025-29 | $421,869 | $431,800 | Production | 2 |
| 58E | Well 6 Sodium Hypochlorite On-site Generation | 2024-28 | $18,291 | 2025-29 | $776,969 | $795,260 | Production | 2 |
| 58F | Well 7 Sodium Hypochlorite On-site Generation | 2024-28 | $22,275 | 2025-29 | $946,196 | $968,471 | Production | 2 |
| 58G | Well 9 Sodium Hypochlorite On-site Generation | 2024-28 | $18,917 | 2025-29 | $803,543 | $822,460 | Production | 2 |
| 58H | Well 10 Sodium Hypochlorite On-site Generation | 2024-28 | $16,534 | 2025-29 | $702,345 | $718,879 | Production | 2 |
| 58I | Well 13 Sodium Hypochlorite On-site Generation | 2024-28 | $20,798 | 2025-29 | $883,466 | $904,264 | Production | 2 |
| 58J | Edwards Hill Reservoir Sodium Hypochlorite On-site Generation | 2024-28 | $14,195 | 2025-29 | $602,973 | $617,168 | Production | 2 |
| 58K | Overmyer Reservoir Sodium Hypochlorite On-site Generation | 2024-28 | $15,899 | 2025-29 | $675,355 | $691,254 | Production | 2 |
| | | | | | | | | |
| 59A | Well 1A Hydrofluorosilicic Acid On-site Generation | 2024-28 | $8,678 | 2025-29 | $368,618 | $377,296 | Production | 2 |
| 59B | Well 3A Hydrofluorosilicic Acid On-site Generation | 2024-28 | $9,553 | 2025-29 | $405,774 | $415,327 | Production | 2 |
| 59C | Well 4 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $15,683 | 2025-29 | $666,204 | $681,887 | Production | 2 |
| 59D | Well 5 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $9,931 | 2025-29 | $421,869 | $431,800 | Production | 2 |
| 59E | Well 6 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $18,291 | 2025-29 | $776,969 | $795,260 | Production | 2 |
| 59F | Well 7 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $22,275 | 2025-29 | $946,196 | $968,471 | Production | 2 |
| 59G | Well 9 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $18,917 | 2025-29 | $803,543 | $822,460 | Production | 2 |
| 59H | Well 10 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $16,534 | 2025-29 | $702,345 | $718,879 | Production | 2 |
| 59I | Well 13 Hydrofluorosilicic Acid On-site Generation | 2024-28 | $20,798 | 2025-29 | $883,466 | $904,264 | Production | 2 |
| 59J | Edwards Hill Reservoir Hydrofluorosilicic Acid On-site Generation | 2024-28 | $14,195 | 2025-29 | $602,973 | $617,168 | Production | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 59K | Overmyer Reservoir Hydrofluorosilicic Acid On-site Generation | 2024-28 | $15,899 | 2025-29 | $675,355 | $691,254 | Production | 2 |
| 60 | Independent Review of all City Water Facilities by Engineering Firm. | 2025 | $300,000 | -- | -- | $300,000 | Study | 1 |
| 61 | Lead and Copper Rule Revision (LCRR) Inventory Study and GIS Update | 2024 | $50,000 | -- | -- | $50,000 | Study | 2 |
| 62 | Well No. 8 Replacement / Rehabilitation | 2024 | $330,000 | 2024-25 | $2,900,000 | $3,230,000 | Production | 1 |
| 63 | New Water Well No. 16 | 2025 | $1,083,000 | 2025-26 | $6,138,000 | $7,221,000 | Production | 2 |
| 64 | Water Facilities SCADA Cybersecurity Improvements | 2023 | $300,000 | 2023-24 | -- | $300,000 | Security | 4 |
| 65 | Well Quality Emergency Mitigation/Treatment Program | 2024 | $200,000 | -- | -- | $200,000 | Unanticipated/ Emergency | 5 |
| 66 | Electrical Vehicle Charging Stations at the Utilities Yard | 2028 | $300,000 | 2029 | $1,200,000 | $1,500,000 | Sustainability | 5 |
| 67 | Manganese Treatment System at Well 3A | 2024 | $200,000 | 2024 | $2,000,000 | $2,200,000 | Production | 1 |
| 68 | Well 4 Rehabilitation | 2024 | $150,000 | 2024 | $1,350,000 | $1,500,000 | Production | 1 |
| **TOTAL** | | | **$3,255,000** | | **$28,095,000** | **$31,350,000** | | |

## 7.4 Improvement Projects Categorized Into 8 Programs

All 33 improvement projects and programs identified and described above are divided into 8 Capital Improvement Water Programs with recommended phasing over the next 20 years and an estimated uninflated total cost of $ 177 Million. They are as follows:

- Water System Corrosion Control - 3 Projects/Programs - $8.5 Million
- Water Resiliency Program – 3 Projects/Programs - $47.0 Million
- Water Main Replacements - 4 Projects/Programs - $40.8 Million
- Water Production System Improvements - 11 Projects/Programs - $57.7 Million
- Water Facilities Security Improvements - 5 Projects/Programs - $1.2 Million
- Water Engineering Studies - 5 Studies/Programs - $1.1 Million
- Unanticipated/Emergency – 1 Project - $0.2 Million
- Sustainability Projects – 1 Project - $1.5 Million

### 7.4.1 *Water System Corrosion Control*

The Water System Corrosion Control Program consists of extending the life of existing buried metallic infrastructure such as pipelines, valves, fittings, and appurtenances. The annual capital improvement projects for water would combine all similar projects into this program for budgeting purposes. The City also performs annual evaluations and testing of all metallic pipelines and will make any necessary adjustments, enhancements and improvements, based on the results of these activities.

### 7.4.2 *Water Distribution System Improvements*

The Water Distribution System Improvements Program consists of expanding and improving the existing distribution system, with the exception of complete replacements of small to large diameter pipelines. This program also includes water main extension projects to improve hydraulic circulation and system redundancy. The annual capital improvement projects would combine all similar projects into this program for budgeting purposes.

### 7.4.3 *Water Main Replacements*

All improvement projects that are directly related to replacing aging water mains, both large and small diameters, are grouped into this Water Main Replacements Program. The long-term plan for this program is to gradually replace aging water infrastructure consisting primarily of old asbestos cement (AC) pipelines. The annual capital improvement projects would combine all similar projects into this program for budgeting purposes.

### 7.4.4 *Water Production System Improvements*

All improvement projects that are directly related to production facilities, such as water wells, reservoirs, booster stations, treatment facilities, and import connections are grouped into this Water Production System Improvements category. This category also includes the program for well quality emergency mitigation and treatment. Many high priority projects identified in Chapter 7 are part of this program, such as new water wells and odor treatment facilities. The annual capital improvement projects for water would combine all similar projects into this program for budgeting purposes.

### 7.4.5 *Water Facilities Security Improvements*

All improvement projects that are directly related to improving and enhancing security at all production facilities, such as water wells, reservoirs, booster stations, treatment facilities, and imported water connections are grouped into this Water Facilities Security Improvements Program. In 2003, the City performed a vulnerability assessment study at various production facilities and identified the need for security improvements varying from new security switches, to high-tech cameras and new structures. The annual capital improvement projects for water would combine all similar projects into this program for budgeting purposes

### 7.4.6 *Water Engineering Studies*

The Water Engineering Studies Program consists of preparing studies such as Water Master Plan Updates, Urban Water Management Plans, a Groundwater Master Plan, or other unique studies serving planning purposes. Both Water Master Plan Updates and Urban Water Management Plans are typically accomplished on a 5-year cycle.

### 7.4.7 *Unanticipated/Emergency Projects*

All improvement projects intended to maintain water supply in the event of an unanticipated shut-down of a supply source such as a water well. This program is intended to address the growing trend of groundwater wells being taken off line due to exceedance of water quality contamination levels as state and federal agencies continue to adopt and revise water quality regulations.

### 7.4.8 *Sustainability Projects*

Improvement projects intended to promote green and sustainable technologies. These projects will keep City facilities up to date with state and national trends in green technology especially in the context of low emission vehicles. This program will provide the infrastructure for such vehicles.

## 7.5 Capital Improvement Priorities

The capital improvement projects in Table 7-2 and Table 7-3 have been grouped into 5 priority categories, with Priority 1 projects being the highest priority and Priority 5 projects being the lowest priority.

Priority 1 projects are projects that maintain a clean and reliable groundwater supply. In light of growing water quality concerns surrounding PFAS and other constituents, additional redundant supply sources will help the City keep ahead of source outages due to water quality. Priority 1 projects will allow the City to supply up to the BPP when operating at normal operating conditions (approximately 75-85% of full capacity). Priority 1 projects are also to provide treatment at well sites and corrosion control for City Transmission Mains. The Peck Reservoir roof replacement is also a priority 1 project.

Priority 2 projects include well projects to allow the City to supply groundwater in excess of the BPP when operating at normal operating conditions. Priority 2 projects also include studies for future groundwater planning, including the groundwater master plan.

Priority 3 projects include water distribution system pipeline replacement projects and projects to address corrosion. Priority 3 projects also include long term planning studies and reports.

Priority 4 projects include cybersecurity improvement projects.  Priority 4 projects are also reserved for projects to increase security at the well sites.

Priority 5 projects are miscellaneous projects that include projects that are related to optimizing the system but are not immediately needed. These projects include new connections, enhancements to the Overmyer booster pump station, and the Southeast Reservoir and Booster Pump Station.

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# WATER MASTER PLAN **UPDATE**

NOVEMBER **2023**

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