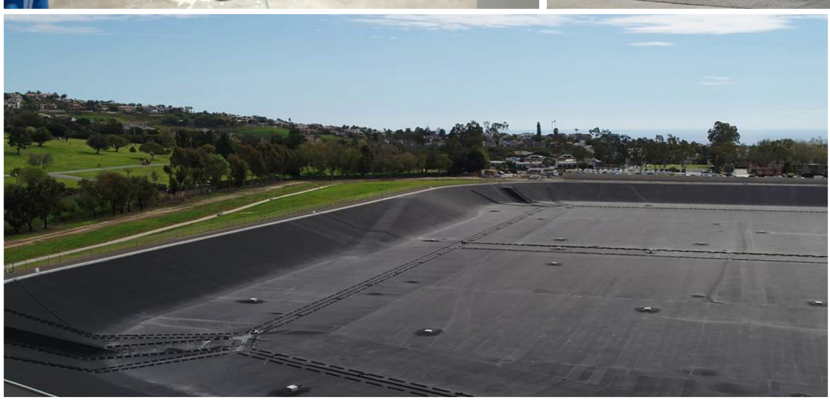
2019 Water Master Plan

100% Draft

March 6, 2019



EXECUTIVE SUMMARY

Introduction

Background

The City of Newport Beach (City) provides water services to a population of approximately 84,270 over 11 square miles of the land located within its boundaries.

The City's last comprehensive Water Master Plan (WMP) was completed in 1999 followed by an update in 2008 to revise the hydraulic model and conduct additional modeling of completed pipeline improvement projects. Because there have been many changes since 1999 and 2008, the WMP needs to be updated again to reflect current water use and future infrastructure needs. The prolonged drought in California from 2010-2016 and Bay-Delta water reliability issues have been major drivers of regulatory changes in California water law. The Water Conservation Act of 2009 (Senate Bill X7-7) mandated urban water suppliers reduce water usage by 20 percent by 2020. The California Governor's State of Emergency ordered urban water suppliers to cut back water use with a collective state goal of 25 percent reduction (based on 2013 usage). Additionally, California passed Senate Bill 555 requiring urban water suppliers to submit a water loss audit annually beginning in 2016. Many changes are occurring, and the regulatory landscape is evolving in response.

Project Purpose and Scope

This 2019 WMP represents the City's water infrastructure planning efforts based on the new reality of the California water climate. The project began in 2017 with the following scope:

- Develop water demand projections and determine the impact of recent water consumption and resultant effect on system demand and peaking factors based on the most recent 10 years of water use trends (2007 – 2016).
- Incorporate the City's 2006 General Plan and subsequent amendments for land use projections and housing density into the water demand analysis.
- Develop a calibrated hydraulic model, using current water demands to analyze the City's water supply and distribution system.
- Conduct a risk analysis to provide the basis for a prioritized pipeline and facilities rehabilitation and replacement program.
- Develop and prioritize recommendations for system improvements over the next 30 years as part of the City's Capital Improvement Program (CIP).

Water Supply Analysis

The City relies on a combination of local groundwater and imported water to meet its potable water demands. Recycled water was added in 1997 to the City's water supply portfolio for irrigation purposes. The City relies on 70 to 75 percent groundwater, 22 to 27 percent imported water, and approximately 3 percent recycled water. The City, along with the agencies managing the water supplies, ensure that a safe and high-quality water supply will be available during periods of drought or supply shortage.

Groundwater - The City's main water supply source is groundwater from the Orange County Groundwater Basin (OC Basin). Groundwater has been the least expensive and most reliable source of supply for the City. The City has four active wells that pump from the OC Basin. Orange County Water District (OCWD) is the entity that manages the OC Basin. OCWD regulates groundwater levels in the OC Basin by implementing and managing various aquifer recharge projects and by regulating the annual amount of pumping within a safe basin operating range to protect the long-term sustainability of the basin. Pumping is managed through a process that uses financial incentives referred to as Basin Pumping Percentage (BPP) to encourage groundwater producers to pump a sustainable amount of water.

Imported Water - The City supplements its local groundwater with imported water purchased from Metropolitan Water District of Southern California (MWD) through the Municipal Water District of Orange County (MWDOC). MWD's principal sources of water are the Colorado River via the Colorado River Aqueduct and the Lake Oroville watershed in northern California through the State Water Project. The water obtained from these sources is treated at the Robert B. Diemer Filtration Plant located in Yorba Linda for delivery to MWDOC customers.

Recycled Water - The City owns and operates recycled water pump stations for Big Canyon Country Club and the Newport Beach Country Club. In addition to these two sites, there are currently 12 other recycled water connections that supply three different customers. Recycled water is purchased from OCWD and sold to the City's customers. Recycled water is managed in a distribution system separate from the potable distribution system and is, therefore, not further addressed in this WMP and is not included in the City's hydraulic model.

Water Demand Analysis

Water demand analysis for this 2019 WMP includes a review of the City's historic water production and water consumption to determine water usage factors that are used in projecting water demands, and in evaluating existing and future water system performance to identify required system improvements. The developed water usage factors include existing water demands by customer class, non-revenue water (NRW), and peaking factors for maximum month, maximum day, and peak hour water demand variations.

Water Demand Trends

A review of the water production data of the most recent 10 years of water production data (2007 to 2016) indicates the following:

- Although the City population increased by approximately 26 percent since 1990, total water demand has continued to decrease. The 10-year average annual demand for 2007-2016 (15,991 AF) is 14 percent less than the 1986-1996 average annual demand (18,626 AF).
- The decrease in demand starting in 2008 is likely due to the national economic downturn.
- The decrease in demand starting in 2014 is due to the mandatory drought restrictions that were set in place by the State.

Non-Revenue Water

The annual water production data was compared to water consumption records (extracted from the City's water billing system) to determine water that is lost in the system before reaching the customer. This lost water is termed non-revenue water (NRW) and is the difference between the distribution system input volume (i.e. production) and billed authorized consumption. During 2007 to 2016, the City's NRW ranged from 2.1 percent to 7.2 percent, and averaged 5.1 percent.

Water Demand Peaking Factors

Water demands vary on a seasonal and daily basis. The adequacy of existing infrastructure and needed system improvements are based on analyses of the system during peak demand periods. The peak demands needed for the analysis include the average demand during maximum demand month (maximum month), the average demand during the maximum demand day (maximum day), and the average demand during the peak demand hour (peak hour).

- **Maximum month peaking factor** represents the maximum monthly production divided by the annual average monthly production. Based on water production data from 2007 to 2016, the maximum month peaking factor ranged from 1.25 to 1.33. To add a degree of conservatism, a factor of 1.35 was used for this WMP.
- **Maximum day peaking factor** represents the maximum day demand (MDD) divided by average day demand (ADD) for the maximum demand month. While daily production data was available for the City wells, corresponding data was not available for the imported water connections to provide a complete depiction of daily demands during the maximum demand month. For this WMP, the peak day demand factor of 1.85 was determined by comparing values used by neighboring communities which ranged from 1.5 to 1.8. This MDD factor is also consistent with the 1999 WMP.
- **Peak hour factor** represents the peak hour demand (PHD) divided by ADD. Peak hour factors were calculated for each of pressure zone based on the City's supervisory control and data acquisition (SCADA) data from July and August 2017. The peak hour factors were 2.6 for Zones 1 and 2; 3.1 for Zone 3, and 4.0 for Zones 4 and 5.

Water Demand Projections

One objective of this WMP was to develop water demand projections to determine the impact of the change in water demand on future distribution system capacities. The water demand projection methodology used in this WMP to project future water demands involved developing water demand factors based on areal use patterns expressed as gallons per acre per day (gpad) for the range of land uses present in the water service area, and applying the water demand factors to existing and anticipated future land use acreages. This methodology provides water demand projections that are spatially distributed throughout the water service area sufficient for hydraulic modeling and determination of required system improvements and expansions.

Land Use Categories and Water Demand Factors

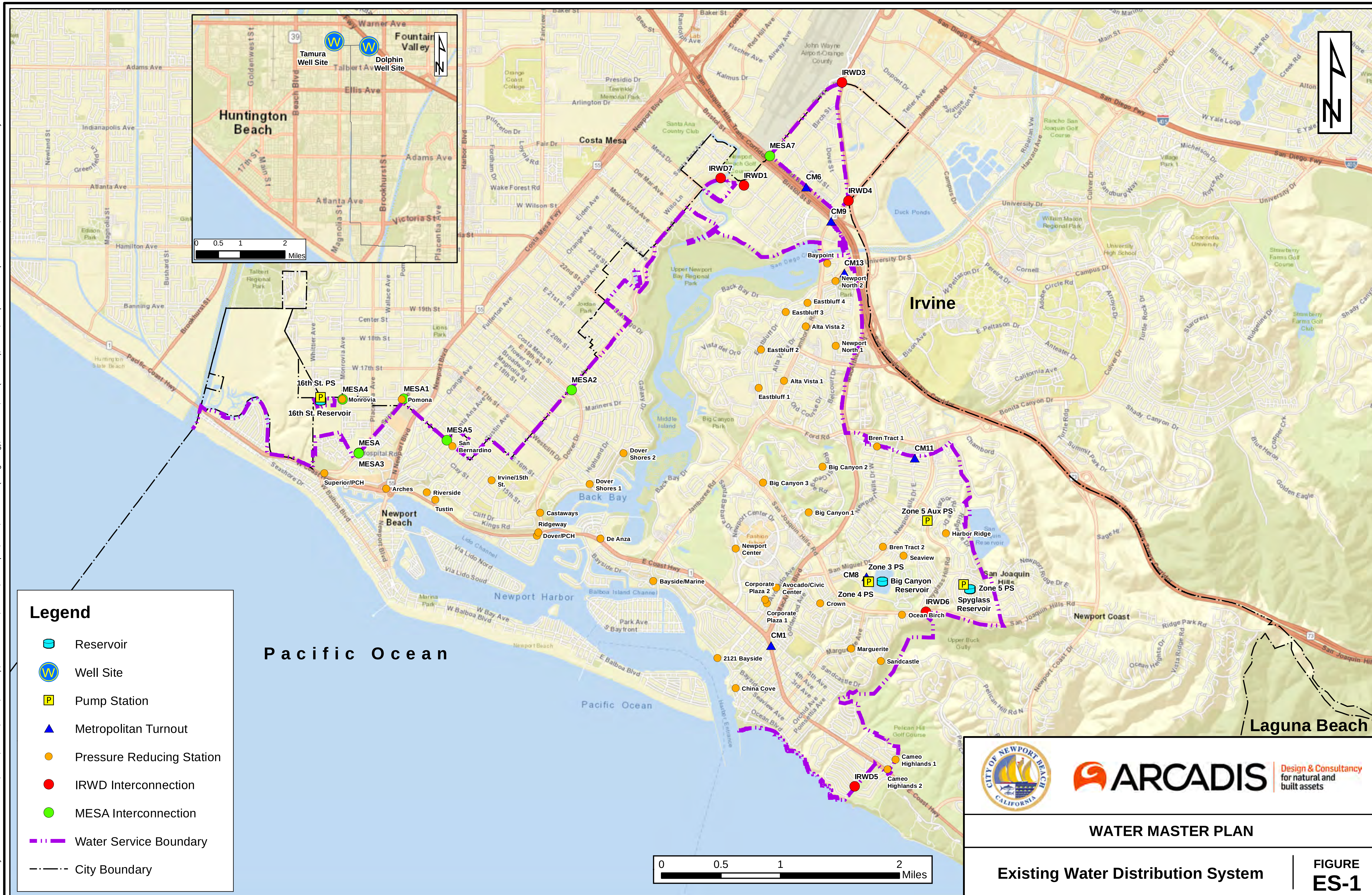
Land use categories from the 1999 WMP and the 2006 General Plan were recategorized for this WMP to establish a manageable 14 land use categories and a land use demand factor for each. The land use categories established for the 2019 WMP are similar to those used in 1999. Examples of new land use categories added in this WMP as identified in the 2006 General Plan include “Residential Very High” to reflect residential densities over 25 dwelling units per acre (DU/ac), and “Office” and “Mixed Use” were separated out from “General Commercial”.

Projected Water Demands

Projected water demands were calculated by multiplying water demand factors to projected total acreage for each land use category. This WMP conservatively assumes that the Banning Ranch tract will be developed. The top ten largest water users were assumed to be point loads. The total projected water demands at build out including Banning Ranch development and adjusted for NRW of 5.1 percent was estimated to be approximately 16,818 acre feet per year (AFY) i.e. a 5.2 percent increase from the 10-year (2007-2016) average of 15,991 AFY.

Existing System Infrastructure

The City’s distribution system consists of approximately 300 miles of distribution pipelines and is divided into five main pressure zones: Zone 1 through Zone 5 with 16 minor zones. Zones 1 and 2 are the largest and cover most of the system demands. Zones 3, 4 and 5 are smaller pumped zones. The system infrastructure consists of four wells, three storage reservoirs, five pump stations and 43 pressure reducing stations (PRS) that manage pressure across the system. Figure ES-1 illustrates the water system schematic.



WATER MASTER PLAN

Existing Water Distribution System

FIGURE ES-1

ARCADIS Design & Consultancy for natural and built assets

City: Newport Beach, CA Div/Group:WTR Created By: KHernandez Last Saved By: KHernandez Project: Newport Beach Water Master Plan (Project # 05317005.0000)
\\arcadis-us.com\officedata\LosAngeles-CA\projects\5317 - Newport Beach\005 - Water Master Plan\GIS\MXD\Report Figures\Figure ES-1 Existing System.mxd 3/6/2019 1:39:01 PM
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Hydraulic Model Development

As part of this 2019 WMP development, a new geographic information system (GIS) integrated hydraulic model of the City's existing water system, which includes all pipelines, was developed with the Innovyze InfoWater software to effectively model the water system conveyance and distribution improvements. Data from previous modeling and master planning efforts were also used, along with projections of future water use and land use development to also help prioritize future facility needs. The hydraulic model included all components of the City's distribution system including wells, reservoirs, pressure reducing stations (PRS), pump stations, interconnections, and pipes.

Demand Allocations

Customer water use throughout the system is converted to model demands at nodes (or junction points) along pipelines. These water demands were developed and allocated based upon land use parcel. Each parcel was given a unit demand factor based on the land use category in gallons per minute per acre (gpm/ac) and are based on a 10-year (2007-2016) average consumption. For each parcel, consumption was calculated by multiplying the unit demand factor by the acreage. Parcel centroids were then defined and used to spatially allocate the water use to the hydraulic model junctions using parcel centroids as GIS meter point data and the InfoWater's demand allocator add-on tool. Demands were allocated to model junctions by pressure zone using the closest pipe methodology in the demand allocator.

Demand Patterns

A diurnal water use pattern represents typical daily fluctuation in customer water use over a 24-hour period. Diurnal curves were developed using the City's SCADA data for storage and incoming and outgoing flows for each pressure zone. A 15-minute increment was used to capture peak water use during the day and establish a more accurate diurnal pattern. Diurnal curves were developed per zone for use during calibration.

Hydraulic Model Calibration

The purpose of the hydraulic model calibration is to compare simulated results to actual measured data and make necessary adjustments to achieve a reasonable match to produce a model that can be used with confidence to predict system performance for the purpose of system planning. The City's water system model was calibrated for steady-state and extended period simulation (EPS) conditions. The model results were compared against 10 fire hydrant flow tests for steady-state and 13 hydrant pressure recorder (HPR) locations for EPS. In addition, available SCADA data were used as additional comparisons for EPS model analysis.

Calibration Procedures and Results

After model construction, system controls and setpoints were added to accurately represent actual system operations based on observed HPR data, SCADA data and/or input from City operations staff. The calibration procedure was an iterative process that required a trial-and-error approach to resolve differences between hydrant test, HPR, and SCADA data and the model. Model simulations were run, and the results were compared graphically to the hydrant test, HPR, and SCADA data. Where obvious differences existed between the model and observed data, these differences were investigated and adjustments to pipe roughness coefficients (C-factors) and distribution facility setpoints and controls were explored. The City's staff provided additional information when available to help reconcile the differences.

Calibration Results

The hydraulic model was validated using calibration criteria and comparing field testing to the model's results. Overall, the model results matched the measured data reasonably well, and the model can confidently be used as a tool to perform system evaluation and predict future hydraulic conditions.

- **Steady-state calibration** was performed using hydrant flow test data collected on July 18 and 19, 2017. For each test, a flow hydrant was used to record flow and an observation hydrant used to record static and residual pressures. Steady-state calibration results show excellent results at all ten hydrant test locations with the difference in pressure drop (between static and residual) of 3 psi or less.
- **EPS calibration** was performed using HPR data at 13 locations and available SCADA data from July 19, 2017. EPS calibration results at the HPR locations showed excellent results at 8 of the 13 locations and very good results at the remaining 5 locations. EPS calibration results at the SCADA locations overall showed very good to excellent results with few exceptions.

Hydraulic System Analysis

The calibrated hydraulic model and design criteria were used to evaluate the existing and future system under current and built-out demands to assess system performance. Deficiencies, if any, were identified during this hydraulic analysis and were incorporated in the CIP development process.

System Performance and Design Criteria

The City has established performance and design criteria for its water system as summarized in Table ES-1.

Table ES-1: System Performance and Design Criteria

Parameters		Criteria
Pipes	Velocity	< 8 ft/s for pipe <= 10 inch
		< 5 ft/s for pipe >= 12 inch
		10 ft/s during Fire Flow
	Headloss	< 5 ft/1000 ft for all pipe sizes
Storage (per Zone)	Regulatory Storage	25% of MDD[1]
	Fire Storage	Depends on area of influence of Zone
	Emergency Storage*	7 average days' demand
System Pressure	Maximum Pressure	140 psi
	Peak Hour Demands	40 psi minimum
	Max Day + Fire Flow Demands	20 psi minimum
	Minimum Day Demand	60-90 psi
Wells	Capacity of direct supply wells	ADD[2]
Booster Pump Station Capacity	Demand Conditions	Assuming the largest pump within the station is out of service, the higher between the PHD[3] or MDD plus fire flow or MDD plus fire flow in case of available floating storage.
Peaking Factors	Maximum Month	1.35
	Maximum Day	1.85
	Peak Hour	Zone 1 & 2 – 2.6 Zone 3 – 3.1 Zone 4 & 5 – 4.0
Fire Flow	Single Family	1,000 gpm for 2 hours
	Community Facilities	1,500 gpm for 2 hours
	Multiple Family & Closely Built Residential (one & two stories)	2,000 gpm for 2 hours
	Multiple Family & Closely Built Residential (three stories or more)	2,500 gpm for 3 hours
	Multiple Family Attached Residential	3,000 gpm for 3 hours
	Commercial (≤ two stories)	3,000 gpm for 3 hours
	Commercial (> two stories)	5,000 gpm for 5 hours
	High-Rise Residential	5,000 gpm for 5 hours
	Business Park/Industrial Park	5,000 gpm for 6 hours
	Regional Shopping Center	6,000 gpm for 6 hours

Note: [1]MDD = Maximum Day Demand, [2]ADD = Average Day Demand, [3]PHD = Peak Hour Demand

*Emergency Storage is based on MWD Administrative Code Section 4503 b1

Existing System Analysis

The system was analyzed under existing demands against the design criteria. The system storage and pumping were compared against the criteria to identify any deficiencies. The distribution system was analyzed using the hydraulic model under ADD, MDD and fire flow scenarios.

- **Existing Storage and Pumping Analysis** - The storage in the system is used to meet operational daily demand peaks, fire flow, and emergency storage. The sum of these three criteria must be met by the available storage in each pressure zone. Sub-pressure zones that are hydraulically connected and are served by the same facilities are grouped together. Based on the system analysis, the City's available storage (202.5 MG) significantly exceeds the City's storage criteria (108.3 MG). For the pumping analysis, the firm capacity (largest pump out of service) of a pump station in a pressure zone must be greater than the higher of the MDD plus fire flow or the PHD. The analysis shows a small pumping deficiency (0.8 mgd) in Zones 1 and 2. This is not a true deficiency because when demands in Zones 1 and 2 exceeds the capacity of 16th Street Pump Station, the water from Big Canyon Reservoir flows via gravity to make up the difference.
- **Maximum and Minimum Day Demand Analysis** - The distribution system was analyzed under MDD to identify minimum pressures. Three nodes were found to have pressure marginally below 40 psi. These locations were further evaluated with help from the City's staff. All three locations are next to closed pressure zone division valves which the City intends to keep closed, and no low-pressure complaints have been received from these locations. It is recommended that the City monitor pressures at these locations and adjust strategy if pressures decrease over time. No improvements are suggested to improve pressures at these locations. The distribution system was evaluated for high pressures using the minimum day demand scenario (0.66 times ADD) in the hydraulic model (greater than 140 psi). There were a few locations with pressure greater than 140 psi, and most of them were on transmission pipes. These locations do not need any improvements as no customers are directly connected to these high-pressure pipes.
- **Fire Flow Analysis** - The available fire flow across the City was calculated at each node and compared with the requirement using the automated fire flow routine in the hydraulic model. Only four locations were identified where available fire flow at 20 psi residual pressure was less than the City's requirements. Three of the four locations have a 4- or 6-inch pipes. Upsizing these pipes to 8 inches will increase the available fire flow and exceed the City's requirements. The fourth location is next to a pressure zone division valve which is closed. Under emergencies such as a fire, this valve can be opened to provide the required fire flow. No improvement is recommended for this site.

Future System Analysis

The City's water distribution system was also analyzed for future build-out demands using the City's system performance criteria.

- **Future Storage and Pumping Analysis** – The City has enough available storage in the system under future build out demands as well. Proper and regular maintenance of this available storage should suffice to maintain its reliability to the City. The pumping analysis showed a deficit in available pumping in Zones 1 and 2 under build-out demands similar to the one seen under existing system demands. As with the existing storage and pumping analysis, this is not a true deficiency as water from Big Canyon Reservoir can flow to Zones 1 and 2 via gravity to make up the difference.

- **Maximum and Minimum Day Demand Analysis** – The analysis under future build-out demands showed similar results consistent with the existing system demand analysis. The same three locations show low pressures as seen under existing system analysis as they are at dead end zone boundaries near closed valves. Since pressures at these locations are just slightly (3-5 psi) below 40 psi, therefore no improvements are recommended to address them, but the City should continue to monitor these areas for low pressure. Similar to existing system analysis, the few locations that violate maximum pressure criteria under minimum day future demands are on transmission lines and not directly connected to customers. No improvements are recommended for these.
- **Fire Flow Analysis** - Fire flow analysis was performed using the hydraulic model under maximum day future demands. The same four nodes, as found in the existing system analysis, were found deficient in this analysis. Upsizing these pipes to 8 inches will address the City's fire flow criteria.

System Improvements

Hydraulic modeling of the City's distribution system under existing and future build-out demands revealed the necessity for very few improvements. The only system improvements identified in this WMP involves upsizing three pipes from 4 or 6-inch to 8 inches to meet fire flow criteria.

Risk Analysis Methodology

The City's 30-year CIP was developed using a risk-based approach. Both horizontal assets (i.e. pipelines) and vertical facilities were analyzed using a risk method to determine their priority in the CIP. To identify projects that should be incorporated into the City's CIP, a field assessment was performed to evaluate all facilities and a desktop analysis was performed on all pipes within the distribution system.

Information from both efforts were combined to assess the physical condition, performance, and impact of failure of the City's individual assets. The scoring of an asset's physical and performance condition is represented as Likelihood of Failure (LoF) and impact to the City if a failure were to occur is referred to as Consequence of Failure (CoF). The LoF and CoF were used to calculate the risk score for each individual asset.

Risk Score = Likelihood of Failure (LoF) x Consequence of Failure (CoF)

Pipeline (Horizontal Asset) Assessment Methodology

For this WMP, assessment was performed only on system pipes (distribution and transmission) and not on the appurtenances along the pipes. An asset's risk was determined by quantifying the LoF score (1-5) based on its physical and performance condition and the CoF score (1-5) based on the impact of the asset failure on the City's water operations and ability to serve its customers. Physical condition was defined as the current state of operation and repair of an asset that is influenced by age, breaks, historical maintenance, and operating environment. It was inferred using the pipe characteristics like age (install year), number of breaks, and material documented in the City's GIS. Performance condition was assigned based on how well assets are accomplishing their designed tasks. This was inferred from the hydraulic analysis of the pipes. CoF was assigned through proximity analysis of pipes to environmentally sensitive areas, critical customers, and pipe characteristics. The risk of an asset (1 through 25) was calculated as the product of the LoF multiplied by the CoF.

Facility (Vertical Asset) Assessment Methodology

A vertical asset was defined as a single item that relates to the storage, transmission, or distribution of potable water. The vertical assets in the City includes valves, pumps, buildings, storage reservoirs, and flowmeters. This WMP established a complete inventory of all assets within the City's water distribution system. To catalogue assets within the system, hierarchies were developed for vertical assets. Hierarchies help filter and find asset records within the database and allow information to be summarized at various hierarchical levels. For vertical assets, a seven-tiered system was used to store component information and accommodate the variety of assets seen in the City's system. Asset attributes and physical condition assessment criteria were also defined for each asset classifications. The classifications include structural, electrical, and mechanical.

Facility Assessment

Every asset that is a part of the City's water system was visually inspected to help prioritize their rehabilitation or replacement and inclusion in the CIP. The sites inspected include the City's interconnections and turnouts with other agencies, 5 pump stations, 3 reservoirs, 2 well buildings, and 43 PRS accounting for 734 assets in total.

Likelihood of Failure for Vertical Assets

- **Physical Condition** – Seventy-seven percent of inspected assets scored either very good condition or minor defects only. Nineteen percent received a score of maintenance required leaving only three percent of assets requiring renewal or asset being unserviceable (e.g. CM-9 turnout, IRWD-7 interconnect, and Zone 5 auxiliary pump station).
- **Performance Condition** – Based on hydraulics evaluation and interview of City staff, 91 percent of the inspected assets are in very good condition to minor defects only. Six percent require maintenance and three percent require renewal. The two assets deemed unserviceable were the pump and motor located at the Zone 5 auxiliary pump station due to missing bolts and equipment, high pressures, and proximity to electrical panel.

Consequence of Failure for Vertical Assets

Ninety-eight percent of the City's assets were assigned a low to medium consequence score as most of the assets have redundancies in the system. All sixteen assets with a high consequence are located at the 16th street reservoir and pump station. As the first major pump station and reservoir after the City's wells, the assets within the facility play a crucial role in the operation of the City's water system. No assets were scored as very high consequence.

Risk for Vertical Assets

There are no high or very high-risk assets in the inspected facilities. Only three assets were identified to have moderate risk which were prioritized to be included in the City's CIP. This includes the Zone 5 auxiliary pump station and Zone 4 Pump No. 4 that runs on an old motor and requires renewal.

Vertical Assets for CIP Inclusion

The assessment of vertical assets identified 25 assets that were found to require renewal or be in unserviceable condition. Three assets in Zone 5 Auxiliary Pump Station and Zone 4 Pump Station were identified as moderate risk, the highest risk calculated for all vertical assets assessed. These assets are included in the CIP to address these elevated risk scores.

Water Mains Assessment

The City's water mains were assessed using the risk framework and criteria where a risk score was assigned to every pipe. The desktop analysis included assessment of the City's break data, identification of pipe cohorts, and development of effective useful life (EUL) by pipe material to assign a LoF score for each pipe segment.

Likelihood of Failure for Horizontal Assets

Physical condition score was assigned to each pipe segment using the EUL estimates for each material. The pipe segments were also assigned a performance score based on the hydraulic constraints. The majority of the City's pipes were installed in the second half of the 20th century, and hence most of them are predicted to be in excellent condition (94.4 percent).

Consequence of Failure for Horizontal Assets

The Triple Bottom Line approach was used to assign CoF scores for each pipe segment using GIS tools. To evaluate each individual criterion, GIS calculated the proximity to roads and environmentally sensitive areas, identified pipes that served critical customers, and related the pressure output from the model to pipes. Only 10 percent of the City's pipes are highly critical.

Risk for Horizontal Assets

Overall the system has only 3.3 percent of its pipes at an elevated risk score (high or very high) as shown in Table ES-2. While this shows the City's system is at low risk overall, as pipes continue to age, the risk score will continue to rise. Therefore, the riskiest pipes will be targeted in the CIP followed by older pipes that will eventually raise the risk score.

Table ES-2: Pipe Risk Score Breakdown

Risk	Segments of Pipes	Pipe Length (miles	Percentage of Pipe Length
Very Low	5,954	171.5	57.6
Low	3,092	86.7	29.1
Medium	787	30.1	10.1
High	171	7.4	2.5
Very High	38	2.3	0.8

Capital Improvement Program

The City's 30-year CIP was developed based on risk analysis and inclusion of projects requested by the City to maintain the level of service and operation of the distribution system. Planning level budgets were assigned to the developed CIP projects using unit costs developed from recent projects the City has completed and contacting vendors. The level of accuracy for the cost estimates corresponds to the Class 4 estimate as defined by the Association for the Advancement of Cost Engineering (AACE) International. The accuracy range of a Class 4 estimate is minus 15 percent to plus 20 percent in the best case and minus 30 percent to plus 50 percent in the worst case.

The 30-year CIP covers facilities projects, pressure reducing stations (PRS) projects, and pipeline projects assuming an escalation factor of 2.5 percent per year. Over the 30-year period an average of $7.2M will be needed each year. The majority of projects in the CIP cover the water main replacement projects (64.6 percent), followed by facilities projects (34.9 percent), and PRS projects (0.5 percent) as summarized in Table ES-3.

Table ES-3: 30-Year CIP Cost by Project Category

Project Category	2018 Cost
Pipeline Replacement and Relining	$103,540,000
Facilities	$60,451,000
Pressure Reducing Stations	$1,207,000
Total	**$165,198,000**

Pipeline Projects

A total of 30 pipe renewal or replacement projects are included in the CIP. For larger pipes on major streets, the City preferred relining of pipes as these projects are estimated to cost 70 percent of a full replacement. Near-term projects include the Balboa Island Water Main Replacement (Phase 2) project and the design of the Bay Crossing Water Main project. Figure ES-2 shows all of the pipeline CIP projects.

Facilities Projects

Fifteen facilities projects were identified in the City's 30-year CIP including facility improvements, system wide rehabilitation programs, and distribution system upgrades that fall outside of pipeline replacements or specific PRS projects. The inclusion of these projects are based on the risk assessment and insight from the City. Facilities projects range from near-term projects such as installation of advanced metering infrastructure (AMI), installation of a mixing system for Spyglass Reservoir, or water well rehabilitation to long-term projects such as installation of new wells and associated pipelines.

Pressure Reducing Stations Projects

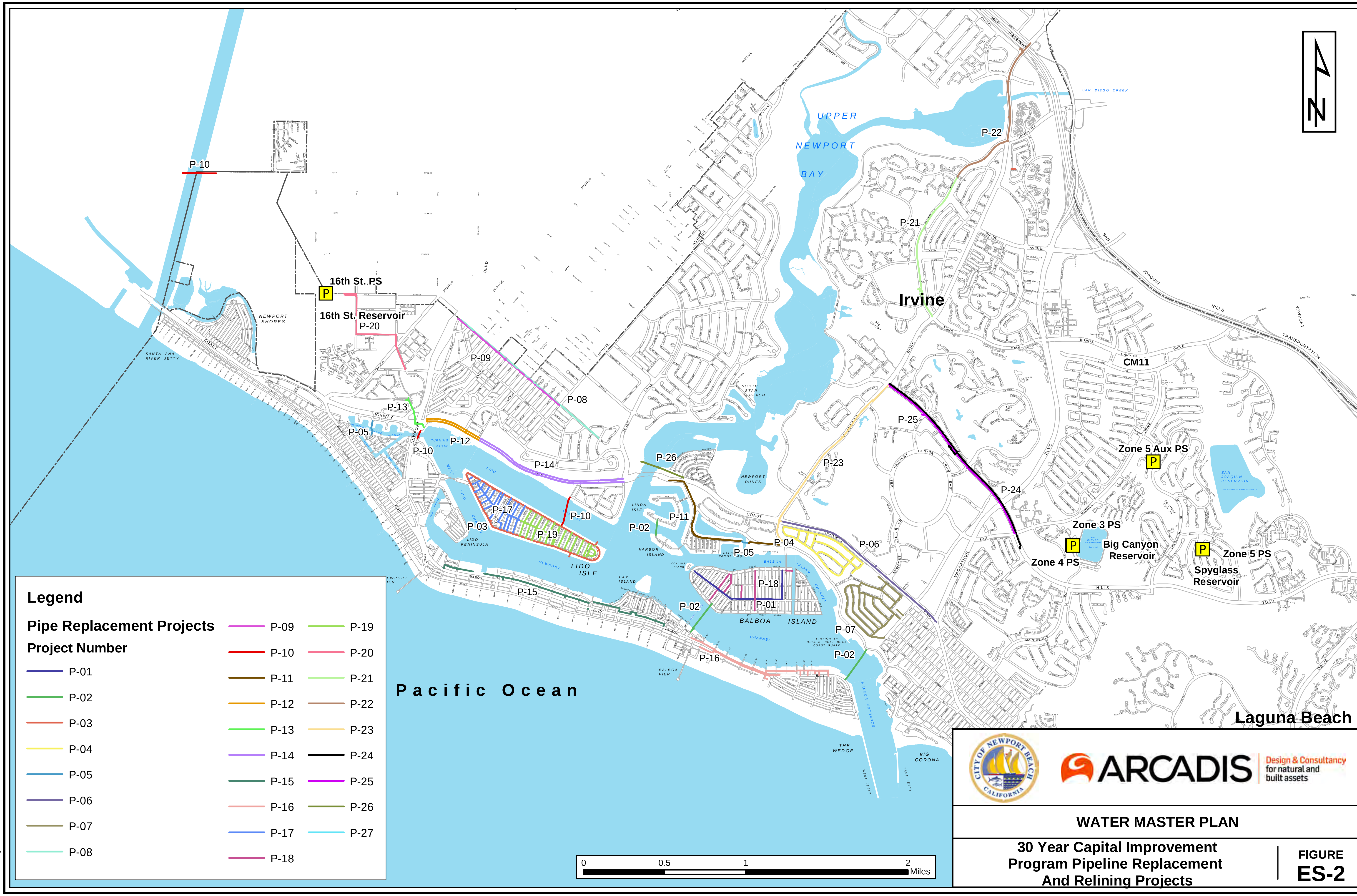
With 43 PRSs in the City's distribution network, the City needs to be proactive in their maintenance. Five PRS projects that have been included to improve system operations.

General Recommendations

Through developing the WMP, implementing the projects outlined in the CIP can be supported with continued effort by the City. This includes the following actions that can be implemented at minimal cost to support items in the CIP.

- The City should take the updated water system model from this WMP and continue to keep it current through coordination with field staff and the City's GIS department.
- The 30-year CIP identified in this WMP should be updated to reflect completed, postponed, or new projects.
- The risk calculation for the City's assets can be updated with visual inspection to better understand the appropriate replacement of aging assets in the City's system.

By beginning to perform analysis of water main breaks in this WMP, the City can now collect more information on breaks and conduct studies on pipe wall thickness to better establish a water main's estimated useful life. This information can feed into the planned replacement projects and help the City prioritize future work.



City: Newport Beach, CA Div/Group:WTR Created By: KHernandez Last Saved By: KHernandez Project: Newport Beach Water Master Plan (Project # 05317005.0000)
\\arcadis-us.com\officedata\LosAngeles-CA\projects\5317 - Newport Beach\005 - Water Master Plan\GIS\MXD\Report Figures\Figure ES-2 CIP Pipe Replacement Projects.mxd 3/5/2019 2:18:47 PM
Service Layer Credits: