SJWD Retail Water Master Plan Update

Executive Summary

San Juan Water District

December 18, 2020

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Acronyms and Abbreviations

The following acronyms and abbreviations have been used throughout this Retail Water Master Plan Update to improve document clarity and readability.

AC	Asbestos Cement
af	Acre-feet
afa	Acre-feet annually
af/ac/yr	Acre-feet per acre per year
ARC	American River Canyon
AWWA	American Water Works Association
BMPs	Best Management Practices
CCI	Construction Cost Index
CFC	California Fire Code
CHWD	Citrus Heights Water District
CIP	Capital Improvement Program
CTP	Cooperative Transmission Pipeline
CVP	Central Valley Project
District	San Juan Water District
DDW	Department of Drinking Water
ENR	Engineering News Record
EPS	Extended Period Simulation
FOWD	Fair Oaks Water District
FPP	Full Program in Place
fps	Feet per second
ft	Feet
ft/kft	Feet per thousand feet
GIS	Geographical Information System
gpcd	Gallons per capita per day
gpm	Gallons per minute
Hp	Horsepower
HPRs	Hydrant pressure recorders
ISO	Insurance Service Office, Inc.
JWSF	Joint Water Storage Facility
kVA	Kilovolt – Ampere
kW	Kilowatt
MG	Million gallons
mgd	Million gallons per day

NFPA	National Fire Protection Association
O&M	Operations and Maintenance
OVWC	Orange Vale Water Company
PCWA	Placer County Water Agency
PL	Public Law
PRS	Pressure Reducing Station
PRVs	Pressure Reducing Valves
psi	Pounds per square inch
PSS	Pressure Sustaining Station
PVC	Polyvinyl chloride
RCCP	Reinforced Concrete Cylinder Pipe
rpm	Revolutions per minute
SCADA	Supervisory Control and Data Acquisition
UFC	Uniform Fire Code
UGB	Upper Granite Bay
USBR	United States Bureau of Reclamation
VFD	Variable frequency drive
VOC	Volatile Organic Chemical
WTP	Sidney N. Peterson Water Treatment Plant

Executive Summary

ES.1 Introduction

The purpose of this master plan is to update is to provide a description of the current system, along with changes since the previous master plan, present the projections for future growth and the system analysis. These analyses, along with an evaluation of system renewal, result in a plan for improving the system performance and longevity.

The objectives of this Retail Water Master Plan Update are:

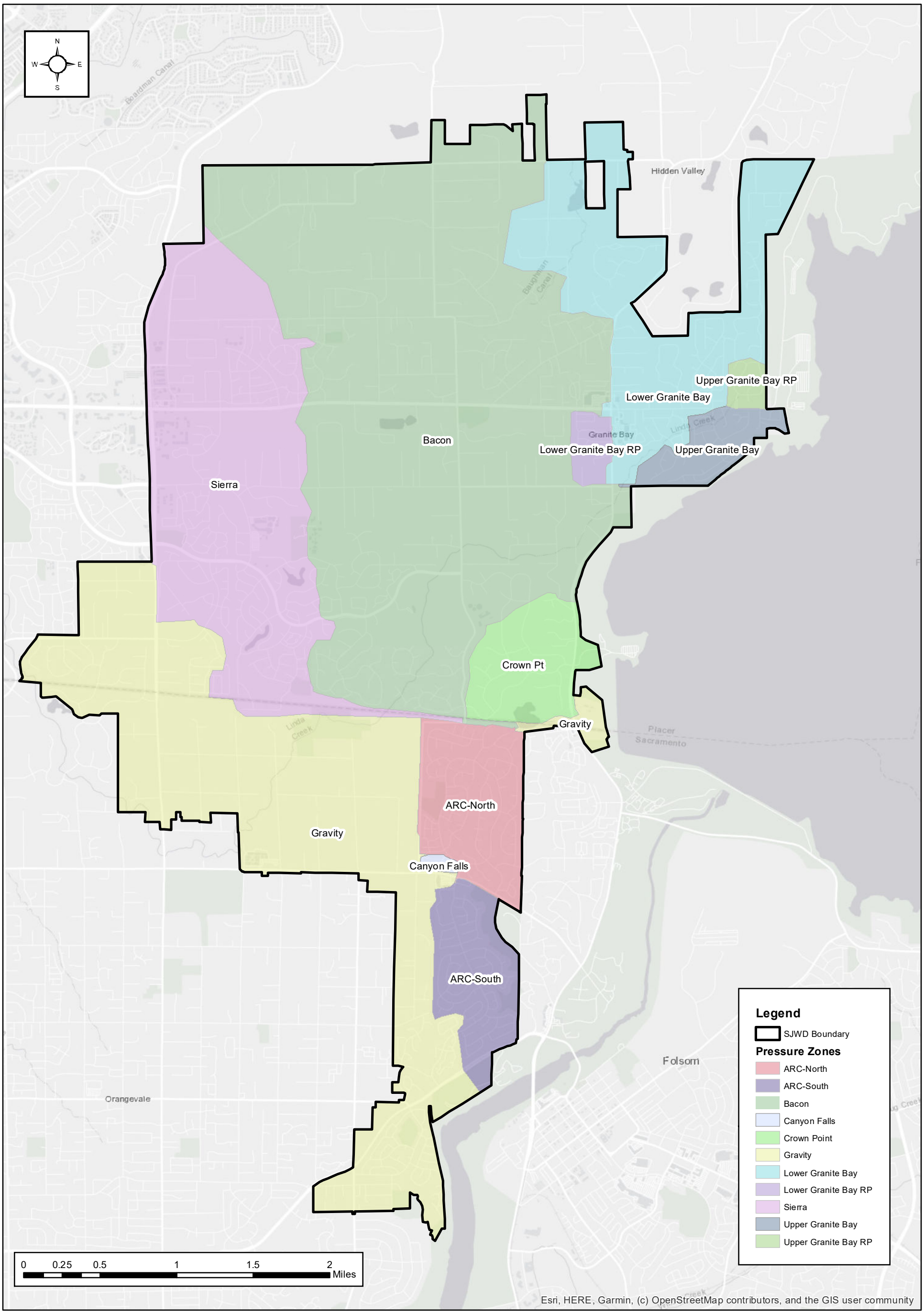
- Develop operational and design criteria under which the existing system will be analyzed, and future facilities will be formulated.
- Evaluate existing water demands and project future water demands.
- Develop an updated hydraulic model to assist with the analysis of the District's water system.
- Evaluate facility replacement and renewal, such as the Kokila Reservoir and customer service replacements.
- Analyze the existing system under existing demand conditions and identify deficiencies.
- Analyze the system under projected future (2025) demand conditions and identify required improvements.
- Recommend a retail water system CIP which meets the needs of existing and future customers.

ES.2 Existing Retail Water Distribution System

The District's Retail Service Area (RSA) encompasses approximately 17 square miles (about 10,880 acres) and is located approximately 15 miles northeast of Sacramento at the edge of the foothills of the Sierra Nevada. The RSA is bounded by the Town of Loomis and City of Rocklin to the north, the City of Folsom and Folsom Lake to the east, the American River to the south, and the Cities of Roseville and Citrus Heights to the west. The RSA is divided into eight separate pressure (i.e., service) zones due to the variation in elevation across the service area. The eight pressure zones are illustrated on Figure ES-1. Figure ES-2 shows existing pump stations and reservoirs, and all pipelines 12 inches in diameter and larger serving the retail area.

Treated water is provided on a retail basis to customers in the following areas:

- Unincorporated areas of Granite Bay, Placer County,
- The northeast portion of Sacramento County,
- A portion of the City of Roseville, and
- A portion of North Folsom.



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PRESSURE ZONES

SAN JUAN WATER DISTRICT, CA

FIGURE ES-1

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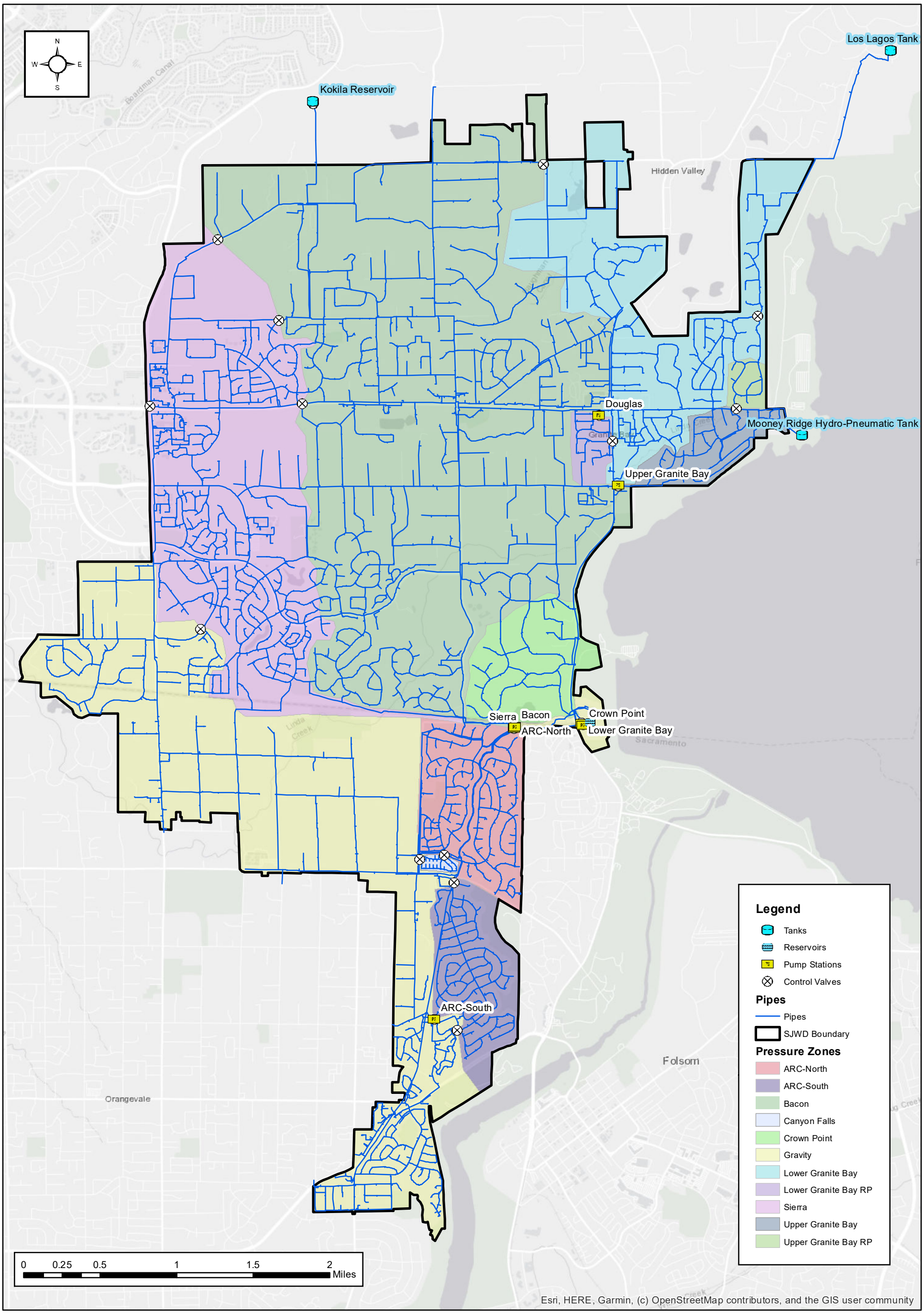


EXISTING DISTRIBUTION SYSTEM

SAN JUAN WATER DISTRICT, CA

FIGURE ES-2

SJWD Retail Master Plan Update

ES.3 Planning and Design Criteria

Planning and design criteria for the performance of system analysis of the District's retail water system are defined. These criteria include the desired minimum and maximum pressures, maximum velocity and head loss, fire flow and duration, definition of "emergency events", and storage components, including operational, fire flow and emergency. Other criteria include:

- Fire Flow Requirements.
- Water System Supply Capacity during High Demand Periods.
- Pumping Facility Capacity.
- Water Storage Capacity.
- Water Transmission and Distribution System Sizing.

These criteria reflect typical water system industry standards, including the California Safe Drinking Water Act and related laws, and American Water Works Association standards.

ES.4 Water Supply

The District's sole source of water supply is Folsom Reservoir, which is fed from the North, Middle and South Forks of the American River. The American River originates in the Sierra Nevada and has three forks that combine at Folsom Lake, the watershed's largest reservoir.

The District possesses water rights and contract entitlements for delivery of up to 82,200 acre-feet annually (afa) of surface water from Folsom Reservoir, including: (1) pre-1914 and post-1914 water rights totaling 33,000 afa; (2) a Central Valley Project (CVP) Repayment Contract providing up to 24,200 afa; and, (3) a contract entitlement from Placer County Water Agency (PCWA) for up to 25,000 afa of water stored in PCWA reservoirs above Folsom Lake. Historically, this water supply has been sufficient to meet the needs of the retail system and wholesale customers.

Raw water is moved either by gravity or by pumping from the United States Bureau of Reclamation (USBR) pumping plant located at the base of Folsom Dam, depending on lake levels. An 84-inch diameter pipeline from the USBR's facilities splits into a 72-inch diameter pipeline and then into a 72 inch and 42 inch diameter pipelines that conveys water to the District's WTP.

Folsom Lake water quality is considered to be excellent with low turbidity, cool temperatures, and low indications of pathogen presence. The District's WTP is designed to treat the surface water supply to meet all applicable drinking water quality requirements.

The 2008 Retail Area Groundwater Study was done to determine if sufficient groundwater supplies could be found to support the RSA. The findings of the study resulted in a determination that groundwater supplies are insufficient.

Although the District is capable of supplying all its water needs from the WTP, the District maintains intertie connections in the Retail Service Area (RSA) with the following five neighboring water agencies. Placer County Water Agency and the City of Roseville are capable of supplying water to the District. The other agency connections are lower head and can only flow out of the RSA.

- Placer County Water Agency
- City of Folsom
- City of Roseville
- Citrus Heights Water District
- Fair Oaks Water District

ES.5 Current and Future Water Demands

Historic and current water demands were analyzed to determine future system demands. The demand projections showed that future demands are anticipated to be the same or lower than existing demands due to future customers demand being offset by existing customers conservation.

ES.6 Hydraulic Model Update

This master plan update utilized a hydraulic computer model of the District's Retail water distribution system. The retail water system was modeled using InfoWater, a pipe network program developed by Innovyze. The hydraulic model was developed using a previous hydraulic model updated to reflect current District GIS data and operational characteristics for the Retail water distribution system.

The hydraulic model was updated to reflect the GIS mapping as provided by the District to HDR in mid-2019. Hydraulic pressure zone boundaries within the model were verified against closed valves indicated within the GIS mapping and discrepancies between hydraulic boundaries were provided to the District for clarification.

Additional updates to the model included:

- Addition of recently constructed pipelines for the Colinas Estates and Bacon Ranch developments;
- Update of the geographical distribution of demands within the model based on analysis of geocoded water demands;
- Update of model node elevations based on topographic contours with a 2-foot interval;
- Updates of control valve set points based on discussions with District staff.

Peaking factors for the RSA were updated to reflect water use patterns for 2018 and 2019 consumer use data. The peaking factors used in the model are 2.0 for average day to maximum day and 2.0 for maximum day to peak hour.

A series of model scenarios were created to simulate conditions during hydrant tests to calibrate the model. For each flow test, model demands were added at nodes located at the test hydrants to simulate the flow test. The model scenarios were then used to calculate static and residual pressures.

Once results were tabulated, they were compared to the observed field data. The calibration target was for modeled pressures to be within 5 pounds per square inch (psi) of observed pressures. The model results generally showed good agreement with the field observations. There were no changes made to any pipeline C-factors.

Based on the comparison of model results to field observations, the model was considered to be suitable for system simulations of the existing system.

ES.7 System Analysis

The water system analysis evaluated the existing pressure zones, storage, pumping, PRVs and hydraulic performance (system pressure, pipeline velocity/headloss, and fire flow capabilities). The demand projections showed that future demands are anticipated to be the same or lower than existing demands. Therefore, separate evaluations were not performed using future demands.

The existing storage facilities were evaluated to determine whether they have sufficient capacity to provide the total required operational, fire flow and emergency storage using the District's current design criteria. The volumes required for each of these three storage components are detailed below:

- Operational Storage: 25 percent of the MDD for planning purposes; the hydraulic model was also used to evaluate the amount of storage used due to diurnal variation in demand.
- Emergency Storage: Equal to one average day demand.
- Fire Flow Storage: The required fire flow times the fire flow duration period.

The existing storage facilities' capacities were compared to the required storage for the zones. The RSA relies on the pump stations for day to day operations as well as emergency operations. Based on the operational criteria, each pump station's firm capacity shall be able to meet either MDD plus fire flow or PHD, whichever is greater, for the zone(s) it services.

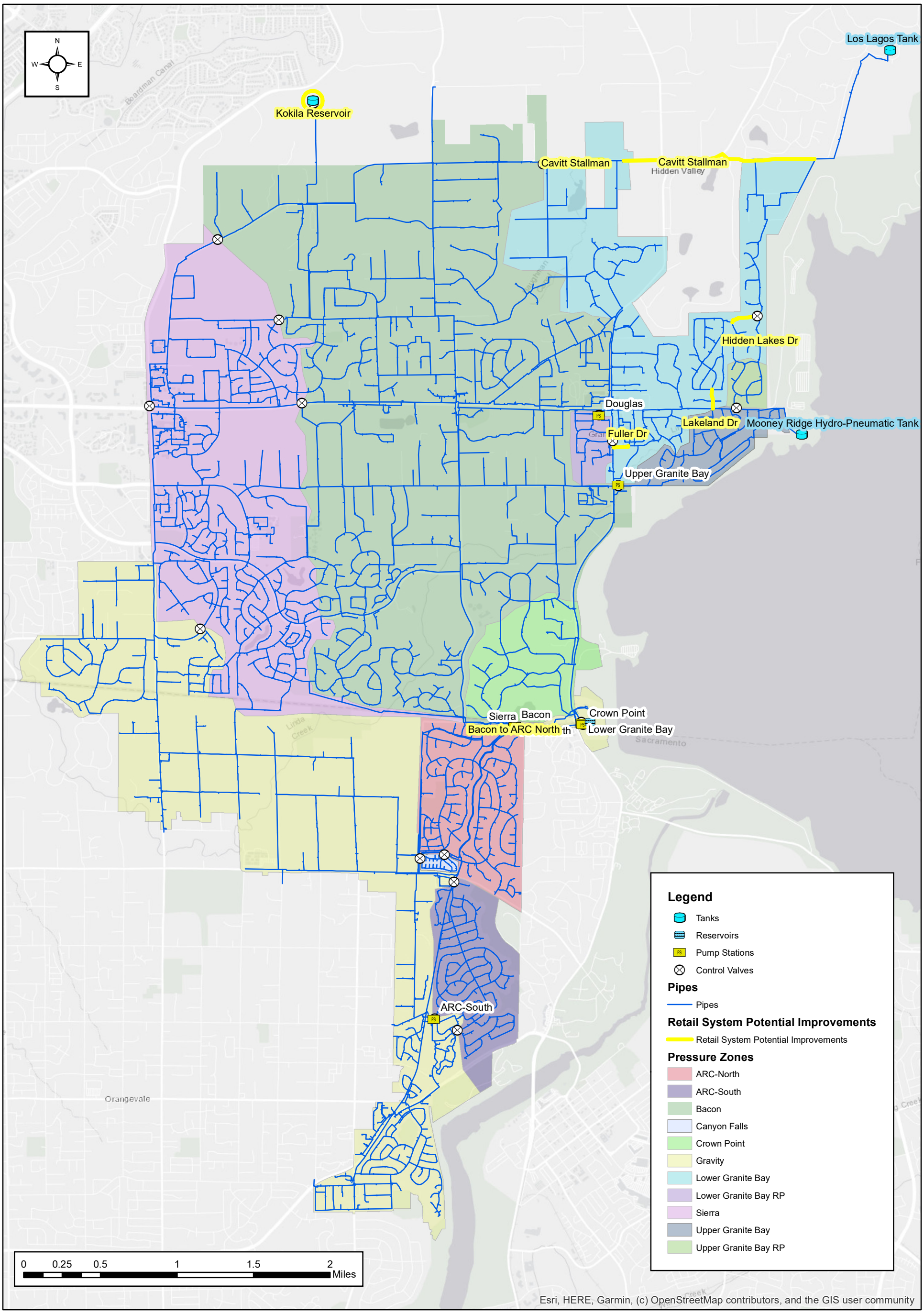
A hydraulic analysis was performed on the District's existing pipeline network to assess its performance in terms of velocity and headloss per 1,000 feet. Under PHD conditions, the District's criteria are that velocity should not exceed 7 feet per second and headloss should not exceed 10 feet per 1,000 feet.

Providing protection during a fire is a critical function of a water distribution system. The required fire flow was defined for each model node.

Available fire flow within the system was modeled with MDD and typical facility conditions. Overall, available fire flow is greater than 1,000 gpm; areas of available fire flow below 1,000 gpm are located at dead ends of the system or on smaller pipes.

Scenarios to improve system reliability and performance were also analyzed. Several improvement projects were identified. The locations of the analyzed improvements based on hydraulic modeling are shown in Figure ES-3 and are listed in Table ES-1 below.

The distribution system model was run for an extended simulation to calculate average water age throughout the system during winter demands. The areas with highest predicted water age occurred around the Kokila Reservoir and the Los Lagos Tank. Because each of these tanks is located at the opposite end of the pressure zone from the source of water entering the zone, the model-calculated water age is at the upper end of the range within the zone. The analysis did not identify any system improvements to reduce water age. It is recommended that the District continue to monitor water quality in its reservoirs and manage pump station operations to increase water turnover.



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IMPROVEMENTS ANALYZED

SAN JUAN WATER DISTRICT, CA

FIGURE ES-3

SJWD Retail Master Plan Update

Table ES-1. Improvements Analyzed

Improvement Project	Zone	Project Description	Reason for Project	Recommended Next Steps
Sierra – Gravity Zone Conversion	Sierra/Gravity	Combine the existing Gravity and Sierra zones. A connection between the Sierra zone's 30" transmission main and the Wholesale's 72" transmission main along Santa Juanita Ave.	This change could simplify operations if the Sierra and Gravity zones were merged.	This project would require a more detailed analysis prior to rezoning. The analysis should focus on determining any individual customer pressure or sprinkler issues along with any areas that could be rezoned to the Bacon zone to increase low pressures.
Boulder Canyon PRV	ARC South	This existing PRV has a sustaining feature not currently in use.	Activating the sustaining feature could prevent excessive flows from Arc-South into the Gravity zone during a major main break. Modeling determined this was not expected to be a major concern.	No further action
Stoneridge Tank	Sierra	Addition of 2.6 MG tank and 24" transmission main from the tank site to the existing 24" transmission main in Sierra College Blvd. The Sierra pump station will also need to be upsized in order to fill tank	The project was originally developed to provide storage to the Sierra zone which currently is only serviced by the Sierra pump station.	The HGL of the tank is not at an optimal elevation to serve the District's retail zones so no further development of the project is recommended. It is recommended that this tank be included in the wholesale master plan.
Cavitt Stallman Pipeline	Lower Granite Bay	Cavitt Stallman pipes, which consist of a 16-in pipeline along Twin Rocks Rd (connected to the pipe currently in Cavitt Stallman Rd) and a 12-in pipeline along Cavitt Stallman Rd from Sierra Ponds Ln to Oak Pine Ln	This new pipeline would provide a new connection across the northern part of the zone and would increase available fire flow in the northwest part of the zone.	Consider moving forward with further analysis and preliminary design
Kokila Reservoir	Bacon	Operations: Evaluated alternative operating scenarios to increase turnover in existing tank Replacement: Considered alternative dimensions for a new tank at the site	Increase turnover to improve water quality Consider replacement tank because existing reservoir is near the end of its useful life	New tank recommended at highest elevation practical at the site and no more than 5 MG to prevent creation of water age issues.
Lakeland Drive Pipeline	Lower Granite Bay	Replace approximately 670 ft of existing 8" main along Lakeland Dr with a 12" main from Douglas Blvd to Granite Dr.	Meet design criteria during MDD + FF and increase available FF throughout Lower Granite Bay.	Determine if main should be replaced or if a parallel pipe is desired to increase redundancy to Los Lagos Tank.
Hidden Lakes Drive Pipeline	Lower Granite Bay	Replace approximately 980 ft of existing 8" along Hidden Lakes Dr with a 12" main from Haley Rd to the existing 8" connecting Hidden Lakes Dr & W Granite Dr.	Meet design criteria during MDD + FF and increase available FF throughout Lower Granite Bay.	Consider moving forward with further analysis and preliminary design.

ES.8 Aging Water Distribution System Infrastructure

As the system continues to age and deteriorate, one of the District's primary goals is to cost effectively sustain desired service levels. To accomplish this, the District has initiated this effort to continuously improve the way distribution infrastructure is managed. The three primary objectives of this project are to:

- Establish prudent, transparent, and defensible investment levels that will enable the District to sustain desired levels of service as the system continues to age and deteriorate.
- Focus those investments to ensure ratepayers realize the greatest return on their investment.
- Develop a cost-effective condition assessment program.

Figure ES-4 summarizes the annual investment need over the next fifty years by investment type:

- Replacement – Pipe replacement due to condition and performance issues. During replacement, adjacent valves, services, and other appurtenances will also be replaced.
- Services & Appurtenances – A project that replaces poorly performing services and/or appurtenances, including air release valves, while leaving the main in operation.
- Condition Assessment – A targeted pipeline condition assessment program will support cost effective system management and risk mitigation. The cost to perform non-destructive condition assessment and ensure the right pipes are replaced at the right time.

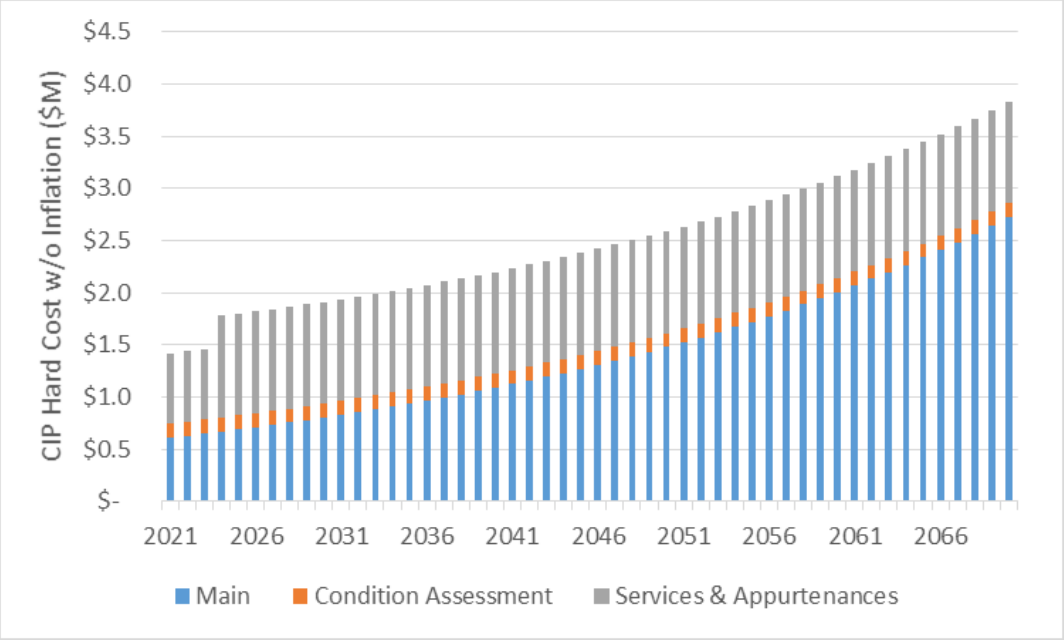

Figure ES-4. Performance Based 50-Year Renewal Budget

The foundation of the District's renewal and replacement program is the development of a risk model called the Project Risk Score (PRS). The PRS quantifies relative risk on a scale of zero (lowest risk) to 10 (highest risk) based on a weighted summation of the break count, service breaks per GIS main, and years since last break.

The only mains that showed repeated and recent main breaks were on Douglas Boulevard, Erwin Avenue, Snipes Boulevard, and Santa Juanita Avenue. With the exception of Santa Juanita Avenue, the District has recently renewed a significant portion of these mainlines. Therefore, near term investments are expected to shift towards renewing problem services.

Some mainlines are so consequential that it is appropriate to perform direct condition assessment and manage risk before they begin to break. High consequence mainlines should be proactively inspected once every 30 years to manage the risk of infrastructure failure.

The hydraulic consequence of failure (hCoF) of pipes and valves was measured using the hydraulic model with an automated routine that simulates a break requiring isolation for pipe in the distribution system and measures how many customers are without water, how much flow can't be delivered, and how many valves must function to isolate a pipe.

ES.9 Recommended Capital Improvement Program

Evaluation of the existing system, use of the planning and design criteria, and updates to the hydraulic model, led to recommendations for the capital improvement projects (CIP).

Five priority areas were identified as high-risk areas where the service replacement projects should focus. Service replacement investment over 30 years was analyzed for the CIP.

One mainline replacement project was identified on San Juanita Avenue. Additional main replacements over 30 years were added to the CIP recommendations.

Another aspect of the water system which needs replacement is the system air release valves (ARVs). The majority of the 878 ARVs in the system have not been replaced or upgraded in many years and some are leaking and/or not operating properly. The CIP includes replacement/upgrade of approximately 45 ARVs each year to improve all system ARVs in 20 years.

Some improvements to the existing system were recommended to increase fire flow and system redundancy, along with tank replacement. These projects include:

- Pipeline improvements to meet existing peak hour and maximum day demand plus fire flow demand conditions on Lakeland Drive and Hidden Lake Drive.
- Pipeline improvements to increase fire flow availability and improve system reliability through looping in Cavitt Stallman Road.
- Replacement of the existing Kokila Reservoir with a new partially buried concrete reservoir of similar size.

- An extension of the main in Fuller Drive from the existing turnout to the existing main near the south entrance of the shopping center to provide looping outside the shopping center property.
- A connection between Bacon and ARC-N zones at the Bacon Booster Pump Station for emergency backup supply.

The CIP costs for each water system improvement and infrastructure renewal are summarized in Table ES-2. The expenditures by year to complete each CIP project are shown in Table ES-3.

Table ES-2. Water System Improvements CIP

Improvement Project	Zone	Project Description	Reason for Project	Estimated Construction Cost
Cavitt Stallman Pipeline	Lower Granite Bay	Cavitt Stallman pipes, which consist of 6,900 LF of 16-in pipeline along Twin Rocks Rd (connected to the pipe currently in Cavitt Stallman Rd) and 2,200 LF of 12-in pipeline along Cavitt Stallman Rd from Sierra Ponds Ln to Oak Pine Ln.	This new pipeline would provide a new connection across the northern part of the zone and would increase available fire flow in the northwest part of the zone.	$6,070,000[1]
Kokila Reservoir	Bacon	Replacement of the Kokila reservoir with a new partially buried concrete tank of similar size but lower height to decrease head changes in Bacon pressure zone and increase tank turnover to improve water quality.	Replace tank because existing reservoir liner and cover are near the end of useful life. A new reservoir can Increase turnover to improve water quality	$7,180,000[1]
Lakeland Drive Pipeline	Lower Granite Bay	Replace approximately 670 ft of existing 8" main along Lakeland Dr with a 12" main from Douglas Blvd to Granite Dr.	Meet design criteria during MDD + FF and increase available FF throughout Lower Granite Bay.	$440,000[1]
Hidden Lakes Drive Pipeline	Lower Granite Bay	Replace approximately 980 ft of existing 8" along Hidden Lakes Dr with a 12" main from Haley Rd to the existing 8" connecting Hidden Lakes Dr & W Granite Dr.	Meet design criteria during MDD + FF and increase available FF throughout Lower Granite Bay.	$600,000[1]
Fuller Drive Pipeline Extension	Lower Granite Bay	Install approximately 550 ft of new 12” main within Fuller Dr. between the existing turnout at the intersection of Fuller Dr. and Auburn Folsom Rd., and the existing 10” main near the south entrance to the shopping center property on the north side of Fuller Dr. Also abandon existing 12” main that currently runs across the Cordoso parcel at 8989 Auburn Folsom Rd.	Connect and loop system along Fuller Dr. from Auburn Folsom Rd. when the existing 10” ACP pipe is to be abandoned. Existing pipeline runs through shopping center and this project will maintain the pipe in the roadways for better access and maintenance.	$360,000[1]

Improvement Project	Zone	Project Description	Reason for Project	Estimated Construction Cost
Bacon and ARC-N Bypass	Bacon and ARC-N	Install new piping between the discharge of the Bacon pumps and the ARC-N pumps at the Bacon BPS, along with either a controlled MOV or a pressure sustaining and pressure reducing control valve.	Facilitate an automatic connection between the systems in the event that there is an operational or emergency need to transfer water to the ARC-N zone.	$190,000[1]
Mains Renewal	All	Pipe replacement. During replacement, adjacent valves, services, and other appurtenances will also be replaced.	Condition and high number of breaks.	$31,300,000[2]
Service Replacement	All	Replaces services with main still in operation.	Age, Condition and performance issues.	$34,500,000[2]
ARV Replacement	All	The CIP includes replacement/upgrade of approximately 45 ARVs each year to improve all system ARVs in 20 years.	Many ARVs do not meet current Water Works Standards and are leaking or non-operational.	$23,800,000[2]
Condition Assessment	All	A targeted pipeline condition assessment program will support cost effective system management and risk mitigation. The projects include non-destructive condition assessment.	Mitigate risk of pipe failure, and support prioritizing pipeline replacements in future years.	$7,200,000[2]

[1]These do not include soft costs estimated at 25%; [2]Total costs incurred over 30 years including soft costs, see Table ES-3.

Table ES-3. CIP Budget by Year

Year	Mains Renewal ($M)	Condition Assess-ment ($M)	Service Replace-ment ($M)	ARV Replace-ments ($M)	Kokila Tank Replace-ment ($M)	Cavitt Stallman Pipeline ($M)	Lakeland Dr Pipeline ($M)	Hidden Lakes Dr Pipeline ($M)	Fuller Dr Pipeline ($M)	Bacon and ARC-N Bypass ($M)	Total ($M)
2022	0.24	0.09	1.42	0.84	0.52				0.07	0.04	3.22
2023	0.25	1.23	1.49	0.87	0.94				0.37	0.20	4.77
2024	0.27	0.09	1.56	0.90	4.43						6.63
2025	0.29	0.10	2.07	0.93	3.65		0.09	0.14			6.59
2026	0.82	1.04	1.65	0.96			0.52	0.71			5.51
2027	0.87	1.72	1.72	1.00		1.48					6.56
2028	0.93	0.93	1.78	1.03		1.59					6.04
2029	0.99	0.19	1.85	1.07		1.65					5.50
2030	1.06	0.29	1.93	1.11		1.70					5.82
2031	1.55	0.12	1.58	1.15		1.76					6.30
2032	1.66	0.12	1.63	1.19		1.52					6.27
2033	1.77	0.13	1.68	1.23							4.97
2034	1.89	0.13	1.73	1.27							5.20
2035	2.02	0.14	1.79	1.32							5.44
2036	2.35	0.14	1.65	1.36							5.89
2037	2.50	0.15	1.70	1.41							6.17
2038	2.67	0.15	1.74	1.46							6.47
2039	2.85	0.16	1.79	1.51							6.78
2040	3.04	0.16	1.84	1.56							7.11
2041	3.25	0.17	1.88	1.62							7.46
Total	31.3	7.2	34.5	23.8	9.54	9.70	0.61	0.85	0.45	0.24	118.7