MID-PENINSULA WATER DISTRICT

Comprehensive System Analysis and Capital Improvement Program FY 2016 – 2017 Update

August 19, 2016

Acknowledgements

The Mid-Peninsula Water District's Comprehensive System Analysis and Capital Improvement Program for Fiscal Year 2016-2017 represents a collaborative effort between the District Engineer, *Pakpour Consulting Group* and the Mid-Peninsula Water District. We would like to acknowledge and thank the following key personnel whose invaluable knowledge, experience, and contributions were instrumental in the preparation of this program.

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TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

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EXECUTIVE SUMMARY

In 2014 as part of its long-term strategic planning, the Mid-Peninsula Water District (District) undertook a comprehensive review and assessment of its water system infrastructure and facilities. This significant challenge involved a team comprised of senior operations personnel with many years of institutional knowledge of the District's system, management with many years of public utility and water operations experience and master planning, and the District Engineer experienced with water system operations and infrastructure/facilities design and engineering. The goal was to complete this project with not only a comprehensive prioritized Capital Improvement Program (CIP) but a functional hydraulic model that could be used by the District. An added benefit was the capturing of operational institutional knowledge from long-time District personnel for succession planning purposes.

For planning purposes, this comprehensive analysis and resulting CIP is intended to replace the District's July 2008 Water System Master Plan. On May 26, 2016, the District Board of Directors adopted the 2016-2017 Comprehensive Capital Improvement Program with Resolution 2012-06, a copy of which can be found in Appendix E.

The first step was to update and calibrate the District's existing hydraulic model. The existing model was fragmented by each pressure zone and dysfunctional from a system-wide operational perspective. Next, the hydraulic model was used over a course of 18 months to develop a comprehensive District wide CIP, which currently totals $51,820,000 (2015 dollars) over 92 projects. The projects where then ranked as detailed in Section 5.1 of this report. For a complete listing of ranked projects please refer to Appendix A. Appendix B provides a detailed analysis for each individual project. Appendix C includes completed projects. A list of projects per zone is detailed in Table 1 below:

Table 1 - CIP Projects by Zone

Zone	Number of Projects	Cost
1	18	$12,080,000
2	27	$11,935,000
3	19	$14,385,000
4	1	$745,000
5	7	$1,655,000
6	1	$200,000
7	5	$3,385,000
8	9	$1,745,000
9	0	$0
DW	5	$5,690,000
Total	**92**	**$51,820,000**

1.0 PURPOSE

The purpose of this summary report is to identify the steps in developing the District's CIP. Each of the steps are identified in the following sections including calibrating/updating the hydraulic model, performing fire flow analysis with distribution system analysis reports, identifying CIP projects, ranking criteria, and a pay as you go funding scenario.

2.0 HYDRAULIC MODEL CALIBRATION / UPDATE

Hydraulic models are used to simulate operating conditions under multiple analysis scenarios, primarily steady state and extended period simulations.

Steady State

A steady state model predicts behavior in a water distribution system during a hypothetical condition where the effects of all changes in the operation and demands of the system have stopped. Steady state simulations are typically used in determining fire flows and infrastructure related problems. For the purposes of the CIP development, steady state simulations were primarily used to identify system bottlenecks and fire flow limitations. The existing hydraulic model, prior to updates, was developed to where only steady state analyses could be performed. Each zone was essentially treated as individual models where they were unable to communicate with one another. This type of model only allowed previous users to determine available fire flows by zone and no additional analysis capabilities beyond that.

Extended Period Simulation

Extended Period Simulation is a series of steady state calculations linked together to approximate the behavior of the system over one or more days. Extended period simulations are generally used to model change in pump operations, how tank levels fluctuate over time, valve operations, how water moves throughout the system, and water quality analyses. In order to develop this type of simulation, concrete information is needed of the system features. At this time of this report, no EPS analysis has been performed as system information continues to be gathered. However, the model is in a state where upon the receipt of this information, the entire system will be able to be modeled where zones communicate with each other. This will allow much more in depth system analysis.

Calibration

Calibrating the model and ensuring all system components match the field allow the user to accurately mimic operational conditions. The existing model did not appear to have gone through a calibration process.

To update the model, it was calibrated in a systematic way where each zone was calibrated independently of the other zones under steady state conditions. This involved preventing water from entering and leaving each zone through pump station shutdowns, closing of pressure reducing valves, and using only the static pressures provided by the tanks in each respective zone. As each zone was calibrated, they were reintroduced into the model. The following sections identify the calibration process.

2.1 HYDRANT FLOW TESTING

Over the course of several months between July 2013 and June 2015, fire flow tests were conducted zone by zone in the following order: 4, 6, 9, 5, 3, 7, 8, 2, 1. Depending on the size of the zone, anywhere between 3-10 hydrants spaced evenly throughout each zone were flow tested during low demand periods. Before the tests were conducted, the zone was isolated from the rest of the system (no water coming in or going out).

Two hydrants were used at each test location; one hydrant was used to monitor system pressures by attaching a pressure gauge to the 2 ½-inch port, and the other hydrant was used to measure flows using a special hydrant diffuser equipped with a flow gauge. Each test measured the system pressure drop at the residual hydrant at a specific flow rate as determined by the flow gauge on the flow hydrant. Static pressures represent the system pressures prior to the test and residual pressures represent the pressure during the test. Generally a pressure drop of 10 psi or greater during the test is recommended to ensure greater accuracy. In almost all cases, the tests were able to achieve a 10 psi pressure drop.

2.2 MODEL CALIBRATION RESULTS

Model calibration generally involves simulating each hydrant flow test in the model; comparing field results against model results, and making adjustments or corrections to the model, as necessary, to match the model against field conditions. Typically to calibrate the model, pipe roughness coefficient values (C-factors) are adjusted to simulate the stress placed on the system during hydrant flow testing. A model is generally considered calibrated when it is able to simulate a pressure drop and flows within 10 percent of those measured in the field. Fire flows were compared under average day demands.

The first step in using the fire flow test results is to compare the static pressures with those stated in the model. The static pressure is the difference between the hydrant elevation and the water elevation in the tank. In comparing the results, the majority of the static pressures, both at the test and residual hydrants, were within 0-3 psi with a few outliers in which case the reasons for the differences were analyzed and resolved by making small elevation adjustments in the model if needed.

The second step is to compare residual pressures at the flow rate measured in the field. Residual pressures represent the system pressures under stressed scenarios such as fire flows. To perform the comparison, the flow information from the field test is input into the model at the specific node representing the hydrant. The model is then run to compute the residual pressures given the flow input. The residual pressure comparison is measured at the node representing the residual hydrant from the field test. If there were significant discrepancies between the model and fire flow test result, we performed an additional hydrant flow test.

The third and final step is to adjust pipe roughness coefficients if necessary to bring model results in line with field results. Commonly used roughness coefficients are as follows:

- Old Cast / Ductile Iron Pipe – 110
- Newer Ductile Iron Pipe – 130
- PVC / AC Pipe – 150

Although calibration range guidelines have not yet been adopted, acceptable calibration limits within the water industry when comparing residual pressures generally range around 10 percent. Following are the average calibration residual results by zone:

- Zone 1 – 2.3% average
- Zone 2 – 3.1% average
- Zone 3 – 4.3% average
- Zone 4 – 8.6% average
- Zone 5 – 10% average
- Zone 6 – 1.4% average
- Zone 7 – 10.4% average
- Zone 8 – 8.7% average
- Zone 9 – 13.0 % average

Given the above calibration results, the model represents actual operating conditions fairly well. Although Zone 9 is slightly above the 10% average, this is a very small Zone within the District supplied by Zone 3 through a PRV configuration. Zone 9's effect on the overall operation of the system is minimal and therefore determined calibration in this zone was sufficient.

2.3 WATER DISTRICT SYSTEM MAP / MODEL RECONCILATION

The District has a detailed map book showing the various system components including tanks, pump stations, pressure reducing stations / valves, pipes, hydrants, etc. It is maintained by the District and is an accurate representation of existing infrastructure. In reviewing the existing model, many discrepancies became apparent between the model and what was shown in the maps including differing water main sizes, types, abandonments not shown in the model, and missing water mains to name a few. To reconcile the data, meetings were held to compare the map and model information and ultimately the model was updated to reflect the map. In addition, tank, pump station, and pressure reducing information was also verified in the model.

3.0 FIRE FLOW ANLAYSIS / DISTRIBUTION SYSTEM ANALYSIS

Upon completing the model calibration/update, fire flow analyses were conducted in each zone to determine available fire flows and to identify any flow deficiencies. In all analyses, each zone was modeled independently (no water in or out) given normal tank operating levels under maximum day demand scenarios. In addition, the following constraints were used in each analysis:

- A minimum 1,500 gpm fire flow
- A maximum 2,500 gpm fire flow
- A maximum pipe velocity of 15 ft/s
- A minimum 20 psi pressure residual
- A minimum 5 psi zone pressure
- A minimum system pressure of 1 psi

All nodes within the model not meeting the above constraints were analyzed to determine what improvements, if any, could improve the available fire flows. Distribution System Analysis (DSA) reports were prepared from the fire flow analysis results and typically identified existing conditions, various system reconfigurations to improve flows (mostly pipe size/type modifications), flow comparison charts, cost estimates, and recommendations. In most cases, simply increasing pipe size alleviated any fire flows under minimum fire flow recommendations. The DSA reports became the basis of identifying potential capital improvement projects and matched fairly well with previous reports indicating recommended improvements.

4.0 CAPITAL IMPROVEMENT PROJECTS

Currently, the capital improvement projects identified comprise of 92 projects. Projects fell into several work categories, a few of which are highlighted below. The majority of the projects identified were direct results from performing the distribution system analyses and resulting fire flow analysis but also include projects identified by District operations personnel.

- Abandoning cross country water mains
- Eliminating parallel water mains
- Eliminating dead ends by creating loops
- Eliminating lengthy water mains serving only one or two connections
- Eliminating all 4-inch water mains (undersized)
- Replacing aging pipes prone to leaks or expected to leak
- Increasing fire flows by adding fire hydrants
- Tank structural analyses
- Adding system redundancy
- Increasing water main size where capacity is needed

Exhibits were prepared for each project detailing the project background, proposed improvements, project benefits, and a project budget based on 2015 dollars. The exhibits also included a map of the area showing the intended improvements. Please refer to Appendix B for exhibits. Following is a zone by zone breakdown of identified projects. Those projects generated as a result of a DSA report are identified accordingly.

Zone 1 (18 Projects)

Table 2 - Zone 1 CIP Projects

Project No.	DSA No.	Description	Cost
15-68	073	Wessex Way Dead End Improvements	$185,000
15-69	074	Sussex Court Improvements	$90,000
15-70	075	Shoreway Road Improvements	$125,000
15-71	076	Wessex Way Loop Improvements	$150,000
15-72	077	SR 101 Crossing at PAMF Hospital	$1,670,000
15-73	078	Karen Road Improvements	$425,000
15-74	079	Malcolm Avenue Improvements	$265,000
15-75	080	Old County Road Improvements	$3,400,000
15-76	081	El Camino Real Improvements	$2,100,000
15-77	082	Sixth Avenue (Zone 1) Improvements	$190,000
15-78	083	Civic Lane Improvements	$800,000
15-79	084	F Street Improvements	$235,000
15-80	085	Bragato Road Improvements	$420,000
15-81	086	Sixth / O'Neill Avenue Improvements	$990,000
15-82	n/a	Ralston Avenue Improvements	$290,000
15-84	n/a	Ralston Avenue Regulator Relocation	$345,000
15-85	n/a	O'Neill Slough Bridge Crossing Assessments	$55,000
15-87	n/a	Hillcrest Pressure Regulating Station	$345,000
		Zone 1 Total:	**$12,080,000**

A brief description of each project in Zone 1 follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project.

15-68 - Wessex Way Dead End Improvements – Replaces 220 LF of a dead end 4" PVC with 8" PVC to replace aging / undersized infrastructure and improve fire flows.

15-69 - Sussex Court Improvements – Replaces 130 LF of a dead end 4" PVC with 8" PVC in addition to a new fire hydrant to replace aging / undersized infrastructure and improve fire flows.

15-70 - Shoreway Road Improvements – Abandons 850 LF of 8" AC paralleling a 12" PVC to eliminate aging infrastructure and reduce maintenance.

15-71 - Wessex Way Loop Improvements – Eliminates an 825 LF 6" PVC dead end by installing 230 LF of 8" PVC to loop the water main within the Sterling Place Development, provides system redundancy, improves fire flows, and improves water quality.

15-72 - SR 101 Crossing at PAMF Hospital – Abandons 500 LF of 12" AC under SR 101 in favor of a new 12" PVC crossing at the PAMF location eliminating aging infrastructure, dead ends, creates a looped system, and constructs a serviceable underground inter-tie utility vault.

15-73 – Karen Road Improvements – Replaces 800 LF of parallel 12" AC and 8" CIP with a single 8" PVC to replace aging infrastructure and minimize maintenance.

15-74 - Malcolm Avenue Improvements – Installs 550 LF of 8" DIP to allow a Zone 1 and Zone 2 boundary reconfiguration improving static pressures, eliminating 4 dead ends, and creating looped systems in both Zones.

15-75 - Old County Road Improvements – Abandons 6,475 LF of parallel water mains and installs 3,700 LF of 8" PVC to replace aging infrastructure, reduce maintenance, and improve fire flows.

15-76 - El Camino Real Improvements – Replaces 4,100 LF of 8" CIP with 8" DIP to replace aging infrastructure, reduce maintenance, and improve fire flows.

15-77 - Sixth Avenue (Zone 1) Improvements – Installs 200 LF of 8" DIP and a 6" PRV to eliminate 4 dead ends, provide Zone 1 redundancy with a Zone 2 connection, and to improve water movement.

15-78 – Civic Lane Improvements – Replaces 1,800 LF of various sized water main with new 8" DIP to replace aging infrastructure, shorten a dead end, loop the water main, and improve fire flows.

15-79 – F Street Improvements – Installs 400 LF of new 8" DIP to replace an out-of-service 10" CC with an unknown break location, relocates District facilities out of private property, increase system redundancy.

15-80 – Bragato Road Improvements – A replacement / new installation combination of 1,000 LF of 8" PVC to replace aging infrastructure, shorten a dead end, loop the water main, and improve fire flows.

15-81 - Sixth / O'Neill Avenue Improvements – Abandons 1,400 LF of 4"-8" CIP/PVC and replaces 1,500 LF of 18" CC with DIP to eliminate parallel water mains, reduce maintenance, and improve fire flows.

15-82 - Ralston Avenue Improvements – Replaces 500 LF of 6" CIP with 8" PVC to replace aging infrastructure.

15-84 – Ralston Avenue Regulator Relocation – Relocates the regulating station to a more accessible location.

15-85 – O'Neill Slough Bridge Crossing Assessments – Assesses existing water main conditions, their associated suspension systems, and seismic resistance.

15-87 – Hillcrest Pressure Regulating Station – Installs a pressure regulating station off the District's Zone 1 connection to SFPUC to eliminate Zone 1 pressure fluctuations.

Zone 2 (27 Projects)

Table 3 - Zone 2 CIP Projects

Project No.	DSA No.	Description	Cost
15-41	042	Mills Avenue Improvements	$195,000
15-42	043	North Road Improvements	$220,000
15-43	044	North Road Cross Country / Davey Glen Road Improvements	$680,000
15-44	045	South Road Abandonment	$415,000
15-45	046-049	Hainline Drive and Vicinity Improvements	$890,000
15-46	050	Miramar Terrace Improvements	$600,000
15-47	051	Virginia Avenue Improvements	$510,000
15-48	052	Willow Lane Improvements	$320,000
15-49	053	Mid-Notre Dame Improvements	$160,000
15-50	054	Fairway Drive Improvements	$630,000
15-51	055	Francis Avenue / Court Improvements	$425,000
15-52	056	Chevy / Clee Streets Improvements	$375,000
15-53	057	Academy Avenue / Belburn Drive Improvements	$270,000
15-54	058	Villa Avenue Improvements	$730,000
15-55	059	Covington Road Improvements	$500,000
15-56	060	Carlmont Drive Improvements	$170,000
15-57	061	Alomar Avenue Improvements	$350,000
15-58	062	Fernwood Way Improvements	$380,000
15-59	063	Valdez Avenue Improvements	$485,000
15-60	065	Escondido Way Cross Country Abandonment	$45,000
15-61	066	Chula Vista Drive Improvements	$440,000
15-62	067	Sixth Avenue Improvements	$760,000
15-63	069	Lower Notre Dame Avenue Improvements	$815,000
15-64	070	Tierra Linda Isolation Valve Install	$25,000
15-65	n/a	Folger Drive Improvements	$420,000
15-66	071	Vine Street / Oak Tree Lane Improvements	$355,000
15-67	n/a	Village Drive Area Improvements	$770,000
		Zone 2 Total:	**$11,935,000**

A brief description of each project in Zone 2 follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project.

15-41 - Mills Avenue Improvements – Replaces 280 LF of 4" CIP with 8" DIP and adds an additional fire hydrant to replace aging / undersized infrastructure and improve fire flows.

15-42 - North Road Improvements – Abandons 500 LF of 8" CIP paralleling an 8" PVC and relocates services to the 8" PVC to eliminate aging infrastructure and reduce maintenance.

15-43 - North Road Cross Country / Davey Glen Road Improvements – Abandons 400 LF of cross country 6" CIP and replaces 1,400 LF of 6"-8" CIP with 8" DIP to eliminate the cross country water main, reduce district maintenance, and replace aging infrastructure.

15-44 - South Road Abandonment – Abandons 1,325 LF of 4" CIP paralleling an 8" PVC and reconnects the branches to the 8" PVC to reduce maintenance, eliminate aging infrastructure and improve fire flows.

15-45 – Hainline Drive and Vicinity Improvements – Abandons 400 LF of cross country 4" CIP, replaces 1,740 LF of 4" CIP with 8" DIP along with additional hydrants to eliminate a cross country water main and to improve fire flows.

15-46 – Miramar Terrace Improvements – Replaces 1,250 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-47 – Virginia Avenue Improvements – Abandons 210 LF of cross country 6" CIP/PVC and replaces 950 LF of 6" CIP with 8" DIP to abandon an inaccessible cross country water main, replace aging infrastructure, and improve fire flows.

15-48 – Willow Lane Improvements – Abandons 230 LF of cross country 4" CIP in favor of a new 600 LF 8" DIP located within the roadway and adds a fire hydrant to eliminate a cross country water main and improve fire flows.

15-49 – Mid-Notre Dame Avenue Improvements – Abandons 650 LF of 6" CIP paralleling an 8" CIP to remove aging infrastructure and reduce maintenance.

15-50 – Fairway Drive Improvements – Replaces 1,420 LF of 4" PVC with 8" DIP and adds an additional fire hydrant to eliminate undersized insfrastructure and improve fire flows.

15-51 – Francis Avenue / Court Improvements – Replaces 830 LF of 4" PVC with 8" DIP and adds an additional fire hydrant to eliminate undersized infrastructure and improve fire flows.

15-52 – Chevy / Clee Streets Improvements – Replaces 780 LF of 4" PVC with 8" DIP and adds an additional fire hydrant to eliminate undersized infrastructure and improve fire flows.

15-53 – Academy Avenue / Belburn Drive Improvements – Abandons 600 LF of 4" PVC paralleling a 6" CIP and replaces 300 LF of 4" PVC with 8" DIP to eliminate undersized infrastructure and improve fire flows.

15-54 – Villa Avenue Improvements – Replaces 1,500 LF of 4" PVC / 6"CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows. This project also reconfigures water services connections so each resident has their own dedicated service line.

15-55 – Covington Road Improvements – Replaces 1,000 LF of 4" CIP / 6"DIP with 8" DIP and adds an additional fire hydrant to replace aging / undersized infrastructure and improve fire flows.

15-56 – Carlmont Drive Improvements – Abandons 800 LF of 8" CIP paralleling a 10" PVC to reduce maintenance.

15-57 – Alomar Way Improvements – Replaces 750 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-58 – Fernwood Way Improvements – Replaces 800 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-59 – Valdez Avenue Improvements – Replaces 1,000 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-60 – Escondido Way Cross Country Abandonment – Abandons 300 LF of 4" CIP located between two homes to eliminate aging / undersized infrastructure.

15-61 – Chula Vista Drive Improvements – Replaces parallel 6" / 8" CIP with a single 10" DIP to complete a uniform 10" water main between Hannibal Pump Station and Exborne Tanks, eliminates aging infrastructure and reduces maintenance.

15-62 – Sixth Avenue Improvements – Abandons 700 LF of cross country 6" – 8" CIP that crosses over an existing creek at two locations and replaces it with a combination of 350 LF 8" and 1,260 LF 10" DIP to relocate the water mains to accessible locations.

15-63 – Lower Notre Dame Improvements – Replaces 3,400 LF of parallel 6" - 8" CIP with a single 10" DIP to replace aging infrastructure and reduce maintenance.

15-64 – Tierra Linda Improvements – Installs an in-line gate valve at Tierra Linda Middle School in order to monitor water quality under an experimental dead-end scenario.

15-65 – Folger Drive Improvements – Replaces 830 LF of 6" CIP with 8" / 10" DIP to replace aging infrastructure and improve fire flows.

15-66 – Vine Street Improvements – Abandons 250 LF of 4" CIP and the Vine Street Regulator, replaces 700 LF of 4" CIP with 6" / 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-67 – Village Drive Area Improvements – Replaces 1,600 LF of 6" CIP with 8" DIP to replace aging infrastructure and eliminate two small dead-end stubs.

Zone 3 (19 Projects)

Table 4 - Zone 3 CIP Projects

Project No.	DSA No.	Description	Cost
15-09	012	Dekoven Tank Utilization Project	$1,035,000
15-10	013	Notre Dame Avenue Loop Closure	$910,000
15-11	014	Carmelita Avenue Improvements	$635,000
15-12	015	Buena Vista Avenue Improvements	$585,000
15-13	016	Monroe, Bellemonti, Coronet Avenues Improvements	$1,445,000
15-14	017	Mezes Avenue Improvements	$175,000
15-15	018	Shirley Road Improvements	$325,000
15-16	019	Williams Avenue, Ridge Road, Hillman Avenue Improvements	$1,100,000
15-17	020	Monte Cresta Drive, Alhambra Drive Improvements	$1,075,000
15-18	021	Pine Knoll Drive Improvements	$260,000
15-19	022	Oak Knoll Drive Improvements	$690,000
15-20	023	Thurm and Bettina Avenues Improvements	$525,000
15-21	024	Lincoln, Monserat Avenues Improvements	$125,000
15-22	025	Arhtur Avenue Improvements	$475,000
15-24	026	San Juan Boulevard Improvements	$320,000
15-30	032	Alameda De Las Puglas Improvements	$780,000
15-31	033	Monserat Avenue Cross Country Abandonment	$30,000
15-89	n/a	Dekoven Tanks Replacement	$3,500,000
15-90	096	Alameda De Las Pulgas Loop Improvements	$395,000
		Zone 3 Total:	**$ 14,385,000**

A brief description of each project in Zone 3 follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project.

15-09 – Dekoven Tank Utilization Project – A replacement / new installation combination of 2,300 LF of 12" DIP allowing abandonment of two cross country water mains and zone wide fire flow improvement.

15-10 – Notre Dame Avenue Loop Closure – A replacement / new installation combination of 2,230 LF of 8" DIP to eliminate dead ends, replace aging / undersized infrastructure, and improve fire flows.

15-11 – Carmelita Avenue Improvements – Replaces 1,300 LF of 4"- 6" CIP/PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-12 – Buena Vista Avenue Improvements – Replaces 1,250 LF of 4"- 6" CIP/PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-13 – Monroe, Bellemonti, Coronet Avenues Improvements – Replaces 3,200 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-14 – Mezes Avenue Improvements – Replaces 310 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-15 – Shirley Road Improvements – A replacement / new installation combination of 720 LF of 8" DIP to eliminate dead ends, replace aging / undersized infrastructure, and improve fire flows.

15-16 – Williams Avenue, Ridge Road, Hillman Avenue Improvements – A replacement / new installation combination of 2,460 LF of 8" DIP to eliminate dead ends, replace aging / undersized infrastructure, minor zone reconfiguration, and improve fire flows.

15-17 – Monte Cresta Drive, Alhambra Drive Improvements – Replaces 2,250 LF of 6" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-18 – Pine Knoll Drive Improvements – Replaces 430 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-19 – Oak Knoll Drive Improvements –Replaces 920 LF of 4" PVC with 8" DIP, relines or installs 350 LF 8" HDD DIP to reduce a long dead end, replace aging / undersized infrastructure, and improve fire flows.

15-20 – Thurm and Bettina Avenues Improvements – Replaces 1,150 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-21 – Lincoln, Monserat Avenues Improvements – Installs 250 LF of 8" DIP with 8" DIP to eliminate two dead ends, creates a loop, and improves fire flows.

15-22 – Arthur Avenue Improvements – A replacement / new installation combination of 880 LF of 8" DIP to replace aging / undersized infrastructure, eliminate two dead ends between Zone 2 and Zone 3, install a PRV connection between the Zones, and improve fire flows.

15-24 – San Juan Boulevard Improvements – Abandons 200 LF of 4" CIP paralleling an 8" PVC, replaces 520 LF of 6" CIP with 8" DIP to replace aging / undersized infrastructure, reduce maintenance, and improve fire flows.

15-30 – Alameda de las Pulgas Improvements – Replaces 1,455 LF of 6" - 8" CIP with 8" DIP to eliminate bottlenecks, replace aging infrastructure prone to breaks, minor reconfigurations to simplify system.

15-31 – Monserat Avenue Cross Country Abandonment – Abandons 355 LF of 6" CIP to eliminate an inaccessible cross country water main.

15-89 – Dekoven Tanks Replacement – Replaces the existing 1.0 MG and 0.7 MG originally constructed in 1952 with two 0.8 MG tanks to improve seismic reliability.

15-90 – Alameda De Las Pulgas Loop Improvements – Installs 1,100 LF of 8" DIP to eliminate two dead ends, creates a loop, and improves water quality.

Zone 4 (1 Project)

Table 5 - Zone 4 CIP Projects

Project No.	DSA No.	Description	Cost
15-08	011	Zone 4 Water Main Improvement Project	$745,000
		Zone 4 Total:	**$745,000**

A brief description of each project in Zone 4 follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project.

15-08 – Zone 4 Water Main Improvement Project – Replaces 1,300 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

Zone 5 (7 Projects)

Table 6 - Zone 5 CIP Projects

Project No.	DSA No.	Description	Cost
15-01	003	Buckland / Shelford Avenue Improvements	$110,000
15-02	004	Courtland Road Improvements	$345,000
15-03	005	Spring Lane Improvements	$165,000
15-04	006	Rose Lane Improvements	$110,000
15-05	n/a	Calwater Intertie	$170,000
15-06	n/a	Zone 5 Fire Hydrant Upgrades	$150,000
15-88	098	Vine Street Improvements	$605,000
		Zone 5 Total:	**$1,655,000**

A brief description of each project in Zone 5 follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project.

15-01 – Buckland / Shelford Avenues Improvements – Abandons 270 LF of 6" CIP paralleling a 12" DIP. New connections will be made to the 12" DIP along with other pipe installation to improve fire flows.

15-02 – Courtland Road Improvements – Replaces 780 LF of 4" – 6" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-03 – Spring Lane Improvements – Replaces 270 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-04 – Rose Lane Improvements – Replaces 170 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-05 – Calwater Intertie – Installs an intertie connection to permit the District the ability to provide water to Calwater in the event of an emergency.

15-06 – Zone 5 Fire Hydrant Upgrades – Adds 7 hydrants between Desvio Way, Solana Drive and Altura Way improving fire flow protection and flushing operations.

15-88 – Vine Street Improvements – Replaces 1,400 LF of 6" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

Zone 6 (1 Project)

Table 7 - Zone 6 CIP Projects

Project No.	DSA No.	Description	Cost
15-07	010	Dartmouth Avenue Improvements	$200,000
		Zone 6 Total:	**$200,000**

A brief description of each project in Zone 6 follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project.

15-07 – Dartmouth Avenue Improvements – Replaces 410 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

Zone 7 (5 Projects)

Table 8 - Zone 7 CIP Projects

Project No.	DSA No.	Description	Cost
15-25	027	Christian Court Improvements	$200,000
15-26	028	West Belmont Tank Water Main Improvements	$1,400,000
15-27	029	Lassen Drive Improvements	$855,000
15-28	030	Tahoe Drive Area Improvements	$510,000
15-29	031	Belmont Canyon Road Improvements	$420,000
		Zone 7 Total:	**$3,385,000**

A brief description of each project in Zone 7 follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project.

15-25 – Christian Court Improvements – Replaces 300 LF of 4" CIP with 8" DIP and installs an additional fire hydrant to replace aging / undersized infrastructure, improve flushing capabilities, and improve fire flows.

15-26 – West Belmont Tank Water Main Improvements – A combination of abandonments / replacement / new installation of 1,400 LF of 8" DIP and 2,400 LF of 12" DIP to eliminate cross country and parallel water mains, improve zone wide fire flows, and replace aging infrastructure.

15-27 – Lassen Drive Improvements – Replaces 1,800 LF of 6" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-28 – Tahoe Drive Area Improvements – Replaces 900 LF of 4" CIP with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-29 – Belmont Canyon Road Improvements – Replaces 900 LF of 4" – 8" CIP with 8" DIP to eliminate a local bottle neck, replace aging infrastructure, and improve fire flows.

Zone 8 (9 Projects)

Table 9 - Zone 8 CIP Projects

Project No.	DSA No.	Description	Cost
15-32	034	Soho Circle Improvements	$95,000
15-33	035	Paddington Court Improvements	$110,000
15-34	036	Ridgewood Court Improvements	$135,000
15-35	037	Bridge Court Improvements	$160,000
15-36	038	Parkridge Court Improvements	$160,000
15-37	039	Waterloo Court Improvements	$95,000
15-38	040	Cliffside Court Improvements	$220,000
15-39	n/a	Zone 8 - 14" Cross Country Improvements	$460,000
15-40	041	Hastings Drive Improvements	$310,000
		Zone 8 Total:	**$1,745,000**

A brief description of each project in Zone 8 follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project.

15-32 – Soho Circle Improvements – Replaces 130 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-33 – Paddington Court Improvements – Replaces 160 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-34 – Ridgewood Court Improvements – Replaces 200 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-35 – Bridge Court Improvements – Replaces 280 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-36 – Parkridge Court Improvements – Replaces 270 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-37 – Waterloo Court Improvements – Replaces 130 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-38 – Cliffside Court Improvements – Replaces 330 LF of 4" PVC with 8" DIP to replace aging / undersized infrastructure and improve fire flows.

15-39 – Zone 8 – 14" Cross Country Improvements – Installs 8 trench dams, 2 remotely controlled gate valves, and a flow meter and/or pressure gauge vault to allow the District to quickly identify a leak along the water main, the ability to isolate a shorter section of repair length.

15-40 – Hastings Drive Improvements – Replaces 550 LF of 4" CIP/PVC with 8" DIP to replace aging / undersized infrastructure, improve fire flows, and also installs a Zone 8 to Zone 2 jumper to be used in emergency situations.

Zone 9 (0 Projects) - No projects identified in Zone 9.

District Wide Projects (5 Projects)

Table 10 - District Wide CIP Projects

Project No.	DSA No.	Description	Cost
15-83	n/a	Emergency Intertie Rebuilds	$620,000
15-86	n/a	Folger Pump Station Site Demolition	$70,000
15-91	n/a	SCADA System Replacement	$1,500,000
15-92	n/a	AMI Installation Completion	$2,000,000
15-93	n/a	Dairy Lane Facility Rehabilitation and Improvements	$1,500,000
		District Wide Total:	**$5,690,000**

A brief description of each District Wide project follows. Please refer to the corresponding Exhibits in Appendix B for a more detailed description and background on each project. Note there are no exhibits for projects 15-91, 15-92, and 15-93.

15-83 – Emergency Intertie Rebuilds – Rebuilds / reconfigures the existing interties to obtain more accurate meter readings.

15-86 – Folger Pump Station Site Demolition – Demolishes the existing pump station building at the abandoned Folger Pump Station.

15-91 – SCADA System Replacement – Replaces the existing SCADA system.

15-92 – AMI Installation Completion – Adds automatic meter reading capabilities to each service meter allowing the District and residents to monitor water use remotely.

15-93 – Dairy Lane Facility Rehabilitation and Improvements – Includes various improvements to the District's facilities.

Capital Improvement Project Cost Summary by Zone

Table 11 - CIP Project Cost by Zone

Zone	Number of Projects	Cost
1	18	$12,080,000
2	27	$11,935,000
3	19	$14,385,000
4	1	$745,000
5	7	$1,655,000
6	1	$200,000
7	5	$3,385,000
8	9	$1,745,000
9	0	$0
DW	5	$5,690,000
Total	**92**	**$ 51,820,000**

Additional Potential Projects

- Zone 1 – 20" CC and Zone 8 – 24" Transmission Main Assessments
- Zone 2 – Notre Dame EPS (10-inch from Hannibal to Hersom)
- Zone 3 – Hersom Pump Station EPS – Effects of pressure increase
- Zone 7 – Ralston – 12-inch from West Belmont Pump Station to West Belmont Tanks EPS
- District Wide Poly Service Connection Replacements
- Various Tank Site / Pump Station Improvements

4.1 CIP PROJECT RANKING

Of the current projects identified in Section 5.0, the District used specific criteria to evaluate and rank each of the projects in order of importance / immediate benefit to the system. The higher the score, the higher the priority for the District's rolling 5-year CIP. The criteria and subsequent scoring were as follows:

1. Pipe Failure Score – Operation's personnel assigned scores based on institutional knowledge of the District's distribution/transmission system during a 5-year period.

6 or more water leaks	30
5 water leaks	25
4 water leaks	20
3 water leaks	15
2 water leaks	10
1 or fewer water leaks	5

2. Distribution System Benefits, Hydraulic Capacity & Low Flow Hydrants Affected - Operation's personnel developed this scoring matrix. (Add up score from each cell selected)

	Deficient by 2 or more pipe sizes	Deficient by 1 or fewer pipe sizes	Min. standard for fire hydrants affects 2 or more fire hydrants	Min. standard for fire hydrants affects 1 or fewer fire hydrants
Improves distribution system capabilities	2	1	2	1
Can or is Serving as Backbone Infrastructure	2	1	2	1
Serves to intertie or eliminate a pressure zone	2	1	2	1

3. Water Main Age – It is not unusual, but not always true, for older water mains to have a higher rate of failure as they approach the end of their engineered life. Operations personnel scored each proposed project based on the age of the pipe to be replaced.

Water Main Construction Year	
Before 1939	10
1940 – 1959	8
1960 – 1979	6
1980 – 1999	4
2000 – newer	1

4. Water Main Material – The current standard for water pipe is based on restrained ductile iron or PVC pipe materials. In the past, steel pipe, cast iron pipe and asbestos cement pipe were materials of choice. This criteria will score each project based on a pipe material, where District history has provided information on the types of pipe material that do not perform as well as other pipe materials.

Water Main Material	
Unlined Cast Iron	5
Steel (Not Cathodically Protected) & Cast Iron	4
Asbestos Cement	3
Other Unrestrained Pipe	2
Appropriate Pipe Material (Restrained PVC/DI)	0

5. Scheduled Paving – Each of the proposed projects were scored in relation to the City of Belmont's Pavement Condition Index (PCI). A higher priority will be given to water mains under streets with a low PCI.

Street's PCI	
PCI under 49	5
PCI of 50 to 59	4
PCI of 60 to 69	3
PCI of 70 to 79	2
PCI of 80 and >	1
Cross Country Water Main	1

6. Static Pressure – Normally, the higher the static water pressure, the more potential damage caused by the leaking water main once it bursts. Additionally, higher system pressures increase the long-term stress on the pipe increasing the chance of failure when combined with corrosion.

Static Pressure	
Over 100 psi	5
75 – 99 psi	3
Less than 75 psi	1

5.0 PAY AS YOU GO CAPITAL IMPROVEMENT NEEDS / ANALYSIS

The District conducted a small scale asset management analysis to determine how much funding would be necessary per year to replace old and aging infrastructure. The analysis involved compiling water main information including material type, linear footage, and date installed; and tank information including capacity, build date, and recoating dates. This information along with a variety of assumptions was used to determine infrastructure remaining life and annual replacement costs.

5.1 WATER MAIN ASSESSMENT

The District has a total 493,492 feet (ft) (93 miles) of water main ranging in size between 4-inch and 24-inch in a variety of material types including cast iron (CIP), asbestos cement (ACP), ductile iron (DIP), polyvinylchloride (PVC), concrete (CCP) and steel (STL). The average age of the water mains throughout the system is approximately 47 years old with an average install date of 1969. The following assumptions were made in the pipe assessment:

Table 12 - Water Main Life Expectancy

Water Main Life Expectancy					
Material	ACP	CIP	DIP	PVC	STL
Years	75	75	100	100	75

Table 13 - Water Main Replacement Costs

Water Main Replacement Costs					
Size	8”	10”	12”	18”	24”
Cost/lf (2016)	$275	$300	$325	$400	$450

Using the above life expectancy values and costs, the average life remaining and annual replacement costs were calculated and grouped by water main material as shown in Table 14. Calculations indicate the District needs to replace approximately 20,600 lf (4 miles) of water main each year at a cost of $6,000,000. For a breakdown of annual replacement costs by pipe size (used to generate Table 14), refer to Appendix D.

Table 14 - Water Main Annual Replacement Costs

Material	% of System	Length (lf)	Average Install Year[1]	Average Age (yrs)[2]	Avg Life Remain (yrs)[3]	Annual Replacement Length (lf)[4]	Annual Replacement Cost[5]
CIP	38.6%	190,591	1955	61	14	13,460	$3,783,200
PVC	28.9%	142,504	1989	27	73	1,980	$558,000
ACP	18.5%	91,225	1964	52	23	4,020	$1,390,100
DIP	9.8%	48,335	1979	37	63	780	$237,300
STL	0.8%	3,813	1957	59	16	240	$71,100
Unknown	3.4%	17,024					
Totals		**493,492**	**1969**	**47**	**38**	**20,660**	**$6,000,000**

[1]Average Install Date = Weighted Average of Pipe Lengths * Installation Year
[2]Average Age = Current Year (2016) – Average Install Year
[3]Average Remaining Life = Water Main Life Expectancy – Average Age
[4]Annual Replacement Length = Length / Average Remaining Life
[5]Annual Replacement Cost = (Linear feet * Replacement Costs) / Average Life Remaining

5.2 WATER TANK ASSESSMENT

The District has 11 water storage tanks throughout the system ranging from 720,000 gallons to 2,500,000 gallons, all made of steel. Most of the tanks within the District have been rebuilt, recoated, or seismically retrofitted within the past 15 years with the exceptions of Dekoven and Hallmark Tanks. To assist in the tank assessments of useful life remaining and costs, the following assumptions were made:

- Tank Life Expectancy: 75 years
- Tank Coating Life Expectancy: 25 years
- Cost of Reconstruction per Gallon: $1.00/gal
- Cost of Recoating per gallon: $0.50/gal

The tank assessment also utilized size factors to illustrate how unit price costs ($/gal) fluctuate given the size of the tank. As an example, the smaller the tank, the more it costs per gallon to reconstruct and recoat. The following size factors were used:

- 1 – 1,000,000 to 3,000,000 gallons
- 2 – 500,000 to 1,000,000 gallons
- 3 – 100,000 to 500,000 gallons
- 4 – 100,000 gallons or less

The water tank assessment is shown in Table 15 below. This is a condensed version of the overall table found in Appendix D which also includes size factors and year built/recoated data to generate the below table. Calculations indicate annual costs of $2,800,000 for tank reconstruction/recoating.

Table 15 - Water Tank Annual Replacement Costs

Tank	Capacity (gal)	Remaining Tank Life[1]	Annual Replacement Cost[2]	Remaining Coating Life[3]	Annual Coating Cost[4]	Total Cost[5]
Zone 2						
Exbourne 1	1,000,000	67	$14,295	17	$29,412	$44,337
Exbourne 2	1,500,000	69	$21,739	19	$39,474	$61,213
Hersom	1,500,000	62	$24,194	12	$62,500	$86,694
Zone 3						
Dekoven 1	720,000	11	$130,909	1	$720,000	$850,909
Dekoven 2	1,000,000	11	$181,818	1	$1,000,000	$1,181,818
Zone 5						
Buckland 1	100,000	74	$5,405	24	$8,333	$13,739
Buckland 2	100,000	74	$5,405	24	$8,333	$13,739
Zone 7						
West Belmont 1	800,000	61	$26,230	11	$72,727	$98,957
West Belmont 2	800,000	61	$26,230	11	$72,727	$98,957
Zone 8						
Hallmark 1	2,500,000	26	$96,154	13	$96,154	$192,308
Hallmark 2	2,500,000	26	$96,154	13	$96,154	$192,308
				Annual Cost		**$2,800,000**

[1]Remaining Tank Life = Tank Life Expectancy – (Current Year (2016) - Year of Construction/Retrofit)
[2]Annual Replacement Cost = (Capacity * Size Factor * Cost of Reconstruction per Gallon) / Remaining Tank Life
[3]Remaining Costing Life = Coating Life Expectancy – (Current year (2016) – Year Coated
[4]Annual Coating Cost = (Capacity * Size Factor * Cost of Recoating per Gallon) / Remaining Coating Life
[5]Total Cost = Annual Replacement Cost + Annual Coating Cost

5.3 PAY AS YOU GO SUMMARY

Table 16 illustrates the total annual funding needed to address aging water mains and tanks within the District. Note the pay go funding does not take into account building facilities, pump stations, pressure reducing valve stations, etc.

Table 16 - Pay As You Go Summary

Infrastructure Item	Annual Cost ($/yr)
Water Main Replacement	$6,000,000
Water Tank Reconstruction / Retrofit / Recoating	$2,800,000
Not Included: Pump Stations, PRV's, Buildings	
Total	**$8,800,000**

Mid-Peninsula Water District
Capital Improvement Program Summary

Appendix A

Priority	Project Number	DSA	Zone	Project Name	Quantity			Construction	Planning, Design & CM	Contingency	2015 Dollars	Running Total
					LF	SRV	HYD					
1	15-14	017	3	Mezes Avenue Improvements	310	10	1	$ 122,500	$ 37,000	$ 15,500	$ 175,000	$ 175,000
2	15-30	032	3	Alameda De Las Pulgas Improvements	1460	32	4	$ 591,000	$ 118,000	$ 71,000	$ 780,000	$ 955,000
3	15-76	081	1	El Camino Real Improvements	4100	23	12	$ 1,463,000	$ 360,000	$ 277,000	$ 2,100,000	$ 3,055,000
4	15-65	n/a	2	Folger Drive Improvements	830	12	3	$ 306,000	$ 77,000	$ 37,000	$ 420,000	$ 3,475,000
5	15-73	078	1	Karen Road Improvements	800	9	2	$ 307,000	$ 80,000	$ 38,000	$ 425,000	$ 3,900,000
6	15-10	013	3	Notre Dame Avenue Loop Closure	2230	29	3	$ 689,500	$ 138,000	$ 82,500	$ 910,000	$ 4,810,000
7	15-44	045	2	South Road Abandonment	0	19	3	$ 302,000	$ 75,000	$ 38,000	$ 415,000	$ 5,225,000
8	15-22	025	3	Arthur Avenue Improvements	880	15	2	$ 345,000	$ 87,000	$ 43,000	$ 475,000	$ 5,700,000
9	15-16	019	3	Williams Avenue, Ridge Road, Hillman Avenue Improvements	2460	59	4	$ 834,000	$ 166,000	$ 100,000	$ 1,100,000	$ 6,800,000
10	15-43	044	2	North Road Cross Country / Davey Glen Road Improvements	1400	17	5	$ 496,000	$ 124,000	$ 60,000	$ 680,000	$ 7,480,000
11	15-06	n/a	5	Zone 5 Fire Hydrant Upgrades	0	0	7	$ 105,000	$ 31,000	$ 14,000	$ 150,000	$ 7,630,000
12	15-78	083	1	Civic Lane Improvements	1800	20	5	$ 605,000	$ 120,000	$ 75,000	$ 800,000	$ 8,430,000
13	15-17	020	3	Monte Cresta Drive / Alhambra Drive Improvements	2250	48	5	$ 781,500	$ 195,000	$ 98,500	$ 1,075,000	$ 9,505,000
14	15-87	n/a	1	Hillcrest Pressure Regulating Station	0	0	0	$ 250,000	$ 65,000	$ 30,000	$ 345,000	$ 9,850,000
15	15-09	012	3	Dekoven Tank Utilization Project	2300	14	2	$ 782,000	$ 158,000	$ 95,000	$ 1,035,000	$ 10,885,000
16	15-28	030	7	Tahoe Drive Area Improvements	900	28	4	$ 369,000	$ 94,000	$ 47,000	$ 510,000	$ 11,395,000
17	15-29	031	7	Belmont Canyon Road Improvements	900	17	2	$ 306,000	$ 76,000	$ 38,000	$ 420,000	$ 11,815,000
18	15-38	040	8	Cliffside Court Improvements	330	14	2	$ 154,500	$ 46,500	$ 19,000	$ 220,000	$ 12,035,000
19	15-42	043	2	North Road Improvements	0	19	1	$ 152,000	$ 46,000	$ 22,000	$ 220,000	$ 12,255,000
20	15-02	004	5	Courtland Road Improvements	780	9	2	$ 252,000	$ 63,000	$ 30,000	$ 345,000	$ 12,600,000
21	15-24	026	3	San Juan Boulevard Improvements	520	16	3	$ 223,000	$ 67,000	$ 30,000	$ 320,000	$ 12,920,000
22	15-75	080	1	Old County Road Improvements	5500	111	26	$ 2,580,500	$ 510,000	$ 309,500	$ 3,400,000	$ 16,320,000
23	15-41	042	2	Mills Avenue Improvements	280	12	2	$ 136,000	$ 41,000	$ 18,000	$ 195,000	$ 16,515,000
25	15-46	050	2	Miramar Terrace Improvements	1250	21	4	$ 435,500	$ 110,000	$ 54,500	$ 600,000	$ 17,115,000
26	15-61	066	2	Chula Vista Drive Improvements	800	10	2	$ 320,000	$ 80,000	$ 40,000	$ 440,000	$ 17,555,000
27	15-11	014	3	Camelita Avenue Improvements	1300	31	3	$ 463,000	$ 115,000	$ 57,000	$ 635,000	$ 18,190,000
28	15-72	077	1	SR 101 Crossing at PAMF Hospital	2300	0	2	$ 1,040,000	$ 350,000	$ 280,000	$ 1,670,000	$ 19,860,000
29	15-49	053	2	Mid-Notre Dame Improvements	0	0	10	$ 110,000	$ 33,000	$ 17,000	$ 160,000	$ 20,020,000
	15-89	n/a	3	Dekoven Tanks Replacement	0	0	0	$ 2,500,000	$ 400,000	$ 600,000	$ 3,500,000	$ 23,520,000
24	15-63	069	2	Lower Notre Dame Avenue Improvements	1700	25	5	$ 617,500	$ 123,000	$ 74,500	$ 815,000	$ 24,335,000
30	15-01	003	5	Buckland / Shelford Avenue Improvements	210	1	1	$ 73,500	$ 26,000	$ 10,500	$ 110,000	$ 24,445,000
31	15-26	028	7	West Belmont Tank Water Main Improvements	3800	2	2	$ 1,106,000	$ 165,000	$ 129,000	$ 1,400,000	$ 25,845,000
32	15-19	022	3	Oak Knoll Drive Improvements	1270	33	2	$ 499,000	$ 128,000	$ 63,000	$ 690,000	$ 26,535,000
33	15-27	029	7	Lassen Drive Improvements	1800	46	4	$ 648,000	$ 130,000	$ 77,000	$ 855,000	$ 27,390,000
34	15-03	005	5	Spring Lane Improvements	270	6	2	$ 115,500	$ 35,000	$ 14,500	$ 165,000	$ 27,555,000

Mid-Peninsula Water District
Capital Improvement Program Summary

Appendix A

Priority	Project Number	DSA	Zone	Project Name	Quantity			Construction	Planning, Design & CM	Contingency	2015 Dollars	Running Total
					LF	SRV	HYD					
35	15-40	041	8	Hastings Drive Improvements	550	0	2	$ 217,500	$ 65,000	$ 27,500	$ 310,000	$ 27,865,000
36	15-50	054	2	Fairway Drive Improvements	1420	24	2	$ 457,000	$ 115,000	$ 58,000	$ 630,000	$ 28,495,000
37	15-15	018	3	Shirley Road Improvements	720	11	1	$ 228,000	$ 68,000	$ 29,000	$ 325,000	$ 28,820,000
38	15-18	021	3	Pine Knoll Drive Improvements	430	14	2	$ 179,500	$ 56,000	$ 24,500	$ 260,000	$ 29,080,000
39	15-21	024	3	Lincoln / Monserat Avenue Improvements	250	2	1	$ 83,500	$ 30,000	$ 11,500	$ 125,000	$ 29,205,000
40	15-31	033	3	Monserat Avenue Cross Country Abandonment	0	0	0	$ 20,000	$ 7,000	$ 3,000	$ 30,000	$ 29,235,000
41	15-25	027	7	Christian Court Improvements	300	11	2	$ 138,000	$ 44,000	$ 18,000	$ 200,000	$ 29,435,000
42	15-69	074	1	Sussex Court Improvements	130	4	1	$ 59,500	$ 22,000	$ 8,500	$ 90,000	$ 29,525,000
43	15-79	084	1	F Street Improvements	400	2	1	$ 161,000	$ 54,000	$ 20,000	$ 235,000	$ 29,760,000
44	15-81	086	1	Sixth / O'Neill Avenue Improvements	1500	15	2	$ 745,000	$ 150,000	$ 95,000	$ 990,000	$ 30,750,000
45	15-45	046-049	2	Hainline Drive and Vicinity Improvements	1740	42	5	$ 676,000	$ 135,000	$ 79,000	$ 890,000	$ 31,640,000
46	15-08	011	4	Zone 4 Water Main Improvement	1650	40	2	$ 562,500	$ 114,000	$ 68,500	$ 745,000	$ 32,385,000
47	15-64	070	2	Tierra Linda Isolation Valve Installation	0	0	0	$ 20,000	$ 3,000	$ 2,000	$ 25,000	$ 32,410,000
48	15-66	071	2	Vine Street / Oak Tree Lane Improvements	700	7	2	$ 255,500	$ 65,000	$ 34,500	$ 355,000	$ 32,765,000
49	15-56	060	2	Carlmont Drive Improvements	0	5	1	$ 120,000	$ 36,000	$ 14,000	$ 170,000	$ 32,935,000
50	15-59	063	2	Valdez Avenue Improvements	1000	24	2	$ 352,000	$ 90,000	$ 43,000	$ 485,000	$ 33,420,000
51	15-13	016	3	Monroe, Bellemonti, Coronet Avenues Improvements	3200	94	4	$ 1,142,000	$ 172,000	$ 131,000	$ 1,445,000	$ 34,865,000
52	15-82	n/a	1	Ralston Avenue Improvements	500	5	1	$ 205,000	$ 60,000	$ 25,000	$ 290,000	$ 35,155,000
53	15-52	056	2	Chevy / Clee Streets Improvements	780	16	2	$ 273,000	$ 70,000	$ 32,000	$ 375,000	$ 35,530,000
54	15-57	061	2	Alomar Avenue Improvements	750	14	1	$ 244,500	$ 74,000	$ 31,500	$ 350,000	$ 35,880,000
55	15-12	015	3	Buena Vista Avenue Improvements	1250	27	2	$ 423,500	$ 107,000	$ 54,500	$ 585,000	$ 36,465,000
56	15-34	036	8	Ridgewood Court Improvements	200	8	1	$ 89,000	$ 33,000	$ 13,000	$ 135,000	$ 36,600,000
57	15-35	037	8	Bridge Court Improvements	280	9	1	$ 112,000	$ 34,000	$ 14,000	$ 160,000	$ 36,760,000
58	15-51	055	2	Francis Avenue / Court Improvements	830	23	2	$ 306,500	$ 78,000	$ 40,500	$ 425,000	$ 37,185,000
59	15-55	059	2	Covington Road Improvements	1000	23	3	$ 364,000	$ 91,000	$ 45,000	$ 500,000	$ 37,685,000
60	15-58	062	2	Fernwood Way Improvements	800	16	2	$ 278,000	$ 70,000	$ 32,000	$ 380,000	$ 38,065,000
61	15-67	n/a	2	Village Drive / Geraldine Way Improvements	1600	34	4	$ 582,000	$ 118,000	$ 70,000	$ 770,000	$ 38,835,000
62	15-20	023	3	Thurm and Bettina Avenues Improvements	1150	26	1	$ 380,500	$ 96,000	$ 48,500	$ 525,000	$ 39,360,000
63	15-68	073	1	Wessex Way Dead End Improvements	220	20	1	$ 130,000	$ 40,000	$ 15,000	$ 185,000	$ 39,545,000
64	15-71	076	1	Wessex Way Loop Improvements	230	0	1	$ 99,000	$ 36,000	$ 15,000	$ 150,000	$ 39,695,000
65	15-54	058	2	Villa Avenue Improvements	1500	44	3	$ 552,000	$ 112,000	$ 66,000	$ 730,000	$ 40,425,000
66	15-04	006	5	Rose Lane Improvements	170	5	1	$ 72,500	$ 26,000	$ 11,500	$ 110,000	$ 40,535,000
67	15-07	010	6	Dartmouth Avenue Improvements	410	7	1	$ 138,500	$ 42,500	$ 19,000	$ 200,000	$ 40,735,000
68	15-36	038	8	Parkridge Court Improvements	270	10	1	$ 112,500	$ 34,000	$ 13,500	$ 160,000	$ 40,895,000
69	15-47	051	2	Virginia Avenue Improvements	950	17	3	$ 370,500	$ 92,000	$ 47,500	$ 510,000	$ 41,405,000

Mid-Peninsula Water District
Capital Improvement Program Summary

Appendix A

Priority	Project Number	DSA	Zone	Project Name	Quantity			Construction	Planning, Design & CM	Contingency	2015 Dollars	Running Total
					LF	SRV	HYD					
70	15-62	067	2	Sixth Avenue Improvements	1610	2	5	$ 575,000	$ 115,000	$ 70,000	$ 760,000	$ 42,165,000
71	15-05	n/a	5	Calwater Intertie	50	0	0	$ 117,500	$ 36,000	$ 16,500	$ 170,000	$ 42,335,000
72	15-32	034	8	Soho Circle Improvements	130	5	1	$ 62,500	$ 23,000	$ 9,500	$ 95,000	$ 42,430,000
73	15-37	039	8	Waterloo Court Improvements	130	5	1	$ 62,500	$ 23,000	$ 9,500	$ 95,000	$ 42,525,000
74	15-39	n/a	8	Zone 8 - 14" Cross Country Improvements	0	0	0	$ 335,000	$ 85,000	$ 40,000	$ 460,000	$ 42,985,000
75	15-70	075	1	Shoreway Road Improvements	0	5	2	$ 85,000	$ 30,000	$ 10,000	$ 125,000	$ 43,110,000
76	15-53	057	2	Academy Avenue / Belburn Drive Improvemetns	300	25	0	$ 190,000	$ 57,000	$ 23,000	$ 270,000	$ 43,380,000
77	15-60	065	2	Escondido Way Cross Country Abandonment	0	0	0	$ 30,000	$ 10,000	$ 5,000	$ 45,000	$ 43,425,000
79	15-33	035	8	Paddington Court Improvements	160	6	1	$ 73,000	$ 27,000	$ 10,000	$ 110,000	$ 43,535,000
80	15-48	052	2	Willow Lane Improvements	600	8	2	$ 224,000	$ 67,000	$ 29,000	$ 320,000	$ 43,855,000
81	15-80	085	1	Bragato Road Improvements	1000	8	2	$ 304,000	$ 78,000	$ 38,000	$ 420,000	$ 44,275,000
82	15-74	079	1	Malcolm Avenue Improvements	550	2	0	$ 183,500	$ 57,000	$ 24,500	$ 265,000	$ 44,540,000
83	15-77	082	1	Sixth Avenue (Zone 1) Improvements	200	5	2	$ 130,000	$ 42,000	$ 18,000	$ 190,000	$ 44,730,000
84	15-84	n/a	1	Ralston Avenue Regulator Relocation	0	0	0	$ 250,000	$ 63,000	$ 32,000	$ 345,000	$ 45,075,000
85	15-85	n/a	1	O'Neill Slough Bridge Crossing Assessments	0	0	0	$ -	$ 50,000	$ 5,000	$ 55,000	$ 45,130,000
	15-83	n/a	DW	Emergency Intertie Rebuilds	0	0	0	$ 450,000	$ 115,000	$ 55,000	$ 620,000	$ 45,750,000
	15-88	098	5	Vine Street Improvements	1400	15	3	$ 440,000	$ 110,000	$ 55,000	$ 605,000	$ 46,355,000
	15-90	096	3	Alameda De Las Pulgas Loop Improvements	1100	0	0	$ 275,000	$ 83,000	$ 37,000	$ 395,000	$ 46,750,000
	15-86	n/a	DW	Folger Pump Station Demolition	0	0	0	$ 50,000	$ 10,000	$ 10,000	$ 70,000	$ 46,820,000
	15-91	n/a	DW	SCADA System Replacement	0	0	0	$ 1,500,000	$ -	$ -	$ 1,500,000	$ 48,320,000
	15-92	n/a	DW	Complete AMI Installation	0	0	0	$ 2,000,000	$ -	$ -	$ 2,000,000	$ 50,320,000
	15-93	n/a	DW	Dairy Lane Facility Rehabilitation & Improvements	0	0	0	$ 1,500,000	$ -	$ -	$ 1,500,000	**$ 51,820,000**
				Material Totals	**78840**	**798**	**96**				**$ 51,820,000**	
				ASSUMPTIONS								
				Linear foot Cost for 8" DIP	$ 250							
				Linear foot Cost for 10" DIP	$ 275							
				Linear foot Cost for 12" DIP	$ 300							
				Cost per Service	$ 3,000							
				Cost per Hydrant	15,000							
				Assumes inflation rate	4%							
POTENTIAL CAPITAL IMPROVEMENT PROJECTS												
			1, 8	Zone 1 - 20" CC and Zone 8 - 24" Transmission Main Assessments								

Mid-Peninsula Water District
Capital Improvement Program Summary

Appendix A

Priority	Project Number	DSA	Zone	Project Name	Quantity			Construction	Planning, Design & CM	Contingency	2015 Dollars	Running Total
					LF	SRV	HYD					
			2	Zone 2 - Notre Dame 10" from Hannibal Pump Station to Hersom Tanks EPS								
			2	Zone 2 - South Road Connection to Laurel - DSA 094 Recommend to Abandon								
			3	Zone 3 - Cipriani Blvd EPS								
			3	Zone 3 - Hersom Pump Station Pressure Increase EPS								
			7	Zone 7 - Ralston 12" from West Belmont Pump Station to Tanks EPS								
			DW	Polyethylene Service Replacements								

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	ACP	CIP	DIP	PVC	STL
Life Expectancy of Pipe (Years)	75	75	100	100	75
	8"	10"	12"	18"	24"
Replacement Cost DIP (per LF)	$275	$300	$325	$400	$450
Current Year	2016				

Summary

Material	Percentage of Total System	Linear Feet	Avg Installed Date	Avg Age (Y)	Avg Life Remaining (Y)	Annual Repl Length (ft)	Annual Replacement Cost
ACP	18.5%	91,225	1964	52	23	4,020	$1,390,100
CIP	38.6%	190,591	1955	61	14	13,640	$3,783,200
DIP	9.8%	48,335	1979	37	63	780	$237,300
PVC	28.9%	142,504	1989	27	73	1,980	$558,000
STL	0.8%	3,813	1957	59	16	240	$71,100
Unknown	3.4%	17,024					
	Total (ft):	493,492	1969	47	38	20,660	$6,000,000
	Total (miles):	93				4	

Detail

Material	Percentage of Total System	Linear Feet	Avg Installed Date	Avg Age (Y)	Avg Life Remaining (Y)	Annual Repl Length (ft)	Annual Replacement Cost
2"& 4" ACP	0.1%	300	1966	50	25	10	$3,400
2"& 4" CIP	4.7%	23,164	1952	64	11	2,030	$557,600
2"& 4" DIP	0.3%	1,247	1978	38	62	20	$5,600
2"& 4" PVC	3.8%	18,634	1974	42	58	320	$88,800
2"& 4" STL	0.0%	0	0	0	0	0	$0
Total 2" & 4"	8.8%	43,344	1962	54	33	2,380	$655,400
6" ACP	5.4%	26,855	1966	50	25	1,090	$299,900
6" CIP	21.3%	105,304	1955	61	14	7,500	$2,063,000
6" DIP	4.5%	22,161	1978	38	62	360	$98,200
6" PVC	8.0%	39,380	1984	32	68	580	$158,500
6" STL	0.0%	83	1953	63	12	10	$1,900
Total 6"	39.3%	193,783	1965	51	32	9,540	$2,621,500

Material	Percentage of Total System	Linear Feet	Avg Installed Date	Avg Age (Y)	Avg Life Remaining (Y)	Annual Repl Length (ft)	Annual Replacement Cost
8" ACP	**4.0%**	19,587	1965	51	24	800	$220,300
8" CIP	**9.7%**	48,069	1957	59	16	3,070	$843,700
8" DIP	**2.6%**	12,764	1984	32	68	190	$51,900
8" PVC	**12.8%**	63,185	1994	22	78	810	$222,800
8" STL	**0.0%**	0	0	0	0	0	$0
Total 8"	**29.1%**	**143,606**	**1977**	**39**	**49**	**4,870**	**$1,338,700**
10" ACP	**0.2%**	877	1972	44	31	30	$8,600
10" CIP	**2.0%**	9,748	1952	64	11	870	$260,100
10" DIP	**0.7%**	3,659	1980	36	64	60	$17,100
10" PVC	**1.1%**	5,562	1993	23	77	70	$21,600
10" STL	**0.8%**	3,731	1957	59	16	230	$69,200
Total 10"	**4.8%**	**23,576**	**1968**	**48**	**37**	**1,260**	**$376,600**
12" ACP	**2.8%**	13,919	1969	47	28	510	$164,300
12" CIP	**0.8%**	3,942	1965	51	24	160	$53,200
12" DIP	**0.2%**	795	1993	23	77	10	$3,400
12" PVC	**3.0%**	14,741	1994	22	78	190	$61,200
12" STL	**0.0%**	0	0	0	0	0	$0
Total 12"	**6.8%**	**33,398**	**1980**	**36**	**51**	**870**	**$282,100**
14" & 18" ACP *	**1.6%**	7,888	1962	54	21	370	$148,700
14" & 18" CIP	**0.1%**	363	1967	49	26	10	$5,600
14" & 18" DIP	**0.4%**	1,738	1973	43	57	30	$12,200
14" & 18" PVC	**0.2%**	1,003	1995	21	79	10	$5,100
14" & 18" STL	**0.0%**	0	0	0	0	0	$0
Total 14" & 18"	**2.2%**	**10,992**	**1967**	**49**	**32**	**420**	**$171,600**
20" & 24" ACP *	**4.4%**	21,797	1959	57	18	1,210	$544,900
20" & 24" CIP	**0.0%**	0	0	0	0	0	$0
20" & 24" DIP	**1.2%**	5,971	1971	45	55	110	$48,900
20" & 24" PVC	**0.0%**	0	0	0	0	0	$0
20" & 24" STL	**0.0%**	0	0	0	0	0	$0
Total 20" & 24"	**5.6%**	**27,768**	**1962**	**54**	**26**	**1,320**	**$593,800**
Unknown Pipe Size and/or Type (ft)		**17,024**	**3.4%**				
Total (ft):		**493,492**				**20,660**	**$6,000,000**
Total (miles):		**93**				**4**	

* Includes Concrete Cylinder Pipe (CCP)

Mid-Peninsula Water District
Asset Management Analysis - Storage Tanks

DRAFT

Life Expectancy of Tank Coating (Y)	**25**	
Cost of Recoating per Gallon	**$0.50**	**Excluding Size Factor**
Life Expectancy of Tanks (Y)	**75**	
Cost of Reconstruction per Gallon	**$1.00**	**Excluding Size Factor**
Current Year	**2016**	

Name	Capacity (Gal)	Size Factor *	Year of Construction or Retrofit	Remaining Tank Life	Annual Replacement Cost	Year Painted	Remaining Paint Life	Annual Paint Cost	Total Cost
Buckland Tank 1	100,000	4	2015	74	**$5,405**	2015	24	**$8,333**	**$13,739**
Buckland Tank 2	100,000	4	2015	74	**$5,405**	2015	24	**$8,333**	**$13,739**
Exbourne 1	1,000,000	1	2008	67	**$14,925**	2008	17	**$29,412**	**$44,337**
Exbourne 2	1,500,000	1	2010	69	**$21,739**	2010	19	**$39,474**	**$61,213**
Hersom	1,500,000	1	2003	62	**$24,194**	2003	12	**$62,500**	**$86,694**
Dekoven #1	720,000	2	1952	11	**$130,909**	1992	1	**$720,000**	**$850,909**
Dekoven #2	1,000,000	2	1952	11	**$181,818**	1992	1	**$1,000,000**	**$1,181,818**
West Belmont #1	800,000	2	2002	61	**$26,230**	2002	11	**$72,727**	**$98,957**
West Belmont #2	800,000	2	2002	61	**$26,230**	2002	11	**$72,727**	**$98,957**
Hallmark #1	2,500,000	1	1967	26	**$96,154**	2004	13	**$96,154**	**$192,308**
Hallmark #2	2,500,000	1	1967	26	**$96,154**	2004	13	**$96,154**	**$192,308**

4 (100,000 or less), 3 (100,000 to 500,000) , 2 (500,000 to 1,000,000), 1 (1,000,000 to 3,000,000), .5 (Over 3,000,000)

Annual Cost: $2,800,000