SPECIAL MEETING OF THE BOARD OF DIRECTORS
DEL PASO MANOR WATER DISTRICT

May 25th, 2021 5:30PM
1817 Maryal Drive, Suite 300, Sacramento 95864

NOTICE: THIS MEETING WILL BE HELD IN ACCORDANCE WITH EXECUTIVE ORDER N-29-20, ISSUED BY CALIFORNIA GOVERNOR GAVIN NEWSOM ON MARCH 17, 2020, THE RALPH M. BROWN ACT (CALIFORNIA GOVERNMENT CODE SECTION 54950, ET SEQ.), AND THE FEDERAL AMERICANS WITH DISABILITIES ACT.

Note: Given the state of emergency regarding the threat of COVID-19, the meeting will be held via teleconference only. Members of the public may call into the teleconference.

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We encourage Board members and participants to join the teleconference 15 minutes early. Due to high call volumes, we ask that Board members and participants retry calling in if there is a busy signal or if you cannot successfully connect to the meeting when you call in.

A G E N D A

The Board will discuss all items on its agenda, and may act on any of those items, including information items and continued items. The Board may also discuss other items that do not appear on its agenda but will not act on those items unless action is urgent, and a resolution is passed by two-thirds (2/3) vote declaring the need for action arose after posting of the agenda.

This agenda has been prepared and posted in compliance with the provisions of the Ralph M. Brown Act, and specifically the provisions of Sections 54954.2 and 54954.3 of the Government Code. Board action may occur on any identified agenda item. Any

member of the public may address the Board on any identified agenda item of interest after board discussion has ended on that item, and if there is a motion, before the vote is taken. Public comment on items within the jurisdiction of the Board is welcomed, subject to reasonable time limitations for each speaker.

In compliance with the Americans with Disabilities Act, Del Paso Manor Water District encourages those with disabilities to participate fully in the public hearing process. If you have a special need in order to allow you to attend or participate in our public meeting and public hearing processes, including receiving notices, agendas, and other writings in appropriate alternative formats, please contact our office at (916) 487-0419 at least 24 hours in advance of the public meeting or hearing you wish to attend so that we may make every reasonable effort to accommodate you.

Call to order and roll call

Public Comment
(*ALL MEMBERS OF THE PUBLIC WILL BE GIVEN THE SAME TIME ALLOTMENT FOR COMMENTS AS NORMALLY ALLOWED FOR MEETINGS SUBJECT TO THE PROVISIONS OF EXECUTIVE ORDER N-29-20*)

The Public may address the Board on any items not on the agenda which are within the jurisdiction of the Del Paso Manor Water District Board of Directors. Comments shall be limited to five (5) minutes.

Items for Discussion and/or Action

1. **Adoption of Agenda**

2. **Discussion Master Plan Update**

Adjournment

* *

Upcoming Meetings

June 1st, 2021 Regular Meeting

* *

I certify that the foregoing agenda for the May 25th, 2021 meeting of the Del Paso Manor Water District Board of Directors was posted by May 21st, 2021 in a publicly accessible location at the Del Paso Manor Water District Board office, 1817 Maryal Drive, Suite 300, Sacramento, California, and was freely available to the public.

Victoria Hoppe
Board Secretary
Del Paso Manor Water District

ITEM 2

2009 Master Plan Update

Technical Memorandum

HydroScience
Strategic Water Solutions

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To: Del Paso Manor Water District, Mr. Adam Coyan, General Manager

From: Alicia Brundage, PE, Project Manager

Reviewed By: Ligaya Kohagura, PE

Subject: 2021 Amendment to the DPMWD 2009 Water Master Plan - **DRAFT**

Date: May 21, 2021

Section 1: Executive Summary

1.1 Purpose

This technical memorandum (TM) represents an amendment (2021 Amendment) to the District's 2009 Water Master Plan (2009 WMP) to document data, policies, projects, and strategies that have been completed or updated in the intervening 11 years and provides a roadmap for reaching new policy and vision goals. This 2021 Amendment updates specific aspects of the 2009 WMP as follows:

- Water demands and planning criteria.
- Water supply and wells.
- Hydraulic modeling utilizing updated system flow criteria to determine pipe and hydrant deficiencies.
- Identification of near term (0-5 years) prioritized projects to address the most significant deficiencies.
- Longer-term recommendations for additional studies and projects.

This 2021 Amendment does not commit the ratepayer to any specific discretionary action in order to implement policy goals. Updates to the 2009 WMP are presented in this TM, which is organized similarly to the 2009 WMP. The TM includes references to the 2009 WMP where appropriate, for convenience.

In addition to updating the data and facilities to represent current conditions, this 2021 Amendment presents a preliminary Capital Improvement Plan (CIP) for near-term system improvements to supplement the longer-range improvements in the 2009 WMP. There are significant liabilities facing the District in maintaining a high quality, reliable water supply and level of service. These liabilities are addressed by the recommended CIP.

1.2 Water Demands and Planning Criteria

The water use over the past two decades has reduced significantly due to ongoing drought conservation measures. It is expected that some conservation measures that were required during the extended drought periods have remained in use even when there is no longer a drought. The updated evaluation of water demands resulted in the following findings:

- The calculated average for the District is 2.56 persons per household. Using the staff reported number of 1,798 residential connections, the estimated population for the District of roughly 4,600 persons.
- The District reports that there are currently 1,798 residential connections and 100 commercial connections, which indicates that 95% of the District's connections are residential.
- In comparing the only recent overlapping data of well production and commercial meter reading from April 2020 through July 2020, it is estimated that the residential water use of 768,816 gpd represented approximately 49% of all water delivered while commercial/industrial/institutional represented 51%. The largest single water use account was the cooling towers at AT&T.
- Usage metering is limited to commercial and mutli-family residential connection. Commercial metering does not separate irrigation demands, making it difficult to quantify implementation of outdoor water use conservation policies.
- Based on historical well production data from January 2014 thru July 2020, the Average Day Demand (ADD) is estimated at 698 gpm.
- The reduction in ADD water demand, despite a slight increase in population, can be attributed to continuing water conservation efforts and public awareness for drought potential. Based on the District's updated population of 4,600 persons, the estimated residential per capita water demand is 218 gpcd.
- Using the available well supply data (and previously noted 10% unaccounted for water losses), the estimated Maximum Day Demand (MDD) is 1,396 gpm for the years 2014-2019.
- For commercial customers, the largest user is the AT&T Telephone Service Center, which is located in the northwest of the service area. The hydraulic model considered a demand of 3,500 gpm for a 4-hour duration, driven by fire flow requirements at this location.
- As the State of California continues to take a hard look at water use, sustainability, climate change, and requires a more active approach in determining local water use patterns, the District is likely to be statutorily exempt from some requirements due to its small size but can expect increasing pressure to increase water conservation. Water conservation should continue to be a key element of managing the District's water supply.

1.3 Water Supply and Wells

The water supply and well evaluation contained in the 2009 WMP was updated with new information provided by the District including the results of a State Water Resources Control Board (SWRCB) inspection conducted in 2019. During the period since 2009, two wells were abandoned, two wells were developed and equipped as replacements, one well has been taken offline indefinitely due to contamination, another was placed on standby due to high contaminant levels, and one well is being monitored for rising contaminant levels.

Per California Waterworks Standards (Title 22, Chapter 16), community water systems using only groundwater shall be capable of meeting MDD with the highest-capacity source off-line. Currently, the District's well system firm capacity (with Well 9 on standby) is 3,075 gpm, which is greater than the updated MDD of 1,396 gpm. So, the District meets this waterworks standard. Additionally, a system without a storage tank should be capable of meeting MDD plus the maximum Fire Flow (FF) demand, which is the AT&T facility's FF demand of 3,500 gpm, with the

largest well out of service. Based on these conditions, the District's system does not currently meet this additional requirement.

In 2008, the District completed a Conjunctive Use Plan to evaluate alternatives for developing a surface water use program and participating in groundwater wheeling with neighboring districts to bring more surface water into the District and to offset groundwater pumping during wet years. Implementation of this plan has not progressed as of the date of this 2021 Amendment.

1.4 Facilities Replacement Planning and Implementation

Hydraulic modeling utilizing updated system flow criteria was performed to determine pipe and hydrant deficiencies and identify near-term capital improvement projects. The evaluation and identification of near-term CIP projects to address identified deficiencies is summarized in Table 1-1, below.

Table 1-1: Near Term CIP Summary

Project Priority	Description	Need Addressed	Estimated Planning-Level Implementation Cost[1]
1	Install New Fire Hydrant on 12" Main	High fire flow at AT&T	$16,000
2	Pipe Replacement Projects 2-10 (see Note 2)	Hydrant flow deficiency	$580,000
3	Install New Water Supply Well(s) Totaling 1,800 gpm Additional Flow	MDD+FF deficiency, improve system pressures, improve supply reliability	$3,100,000
4	Install 260kW, 480VAC NG outdoor genset at Well 9 with sound enclosure; replace MTS with ATS	Provide redundancy and reliability to the system	$450,000
5	Install 15 Additional Fire Hydrants	Achieve compliance with 500 ft max hydrant spacing	$240,000
NP	Install 8" PRV Station and Intertie to SSWD (see Note 3)	Connect supplemental water source for pressure support	$220,000

Notes:
1. Rounded to two significant figures.
2. Pipe replacement projects can be implemented individually or in smaller groups. Refer to prioritization in Attachment C, Cost Detail, for recommended order of implementation. Order is set based on level of existing fire flow deficiency addressed by the corresponding upgrade.
3. The District should first evaluate impacts to residential metering and fluoridation requirements as stated herein prior to implementing this project.
4. Genset cost excludes the cost of bringing gas onsite, but there is a gas line in the street on the other side of the water main (approximate added cost of $10,000 for gas service installation).

Section 2: Introduction

2.1 Purpose of the 2021 Amendment to the 2009 Water Master Plan

The Del Paso Manor Water District (District) has long been committed to providing a safe and reliable water supply while, at the same time, maintaining low water rates. The 2009 Water System Master Plan (Master Plan) was the first District Master Plan to address the District's planning strategies and to develop projects to address aging infrastructure and changing water supply concerns. This 2021 Amendment to the DPMWD 2009 Water Master Plan (2021 Amendment) is not intended to be a full master planning effort but a documentation of data, policies, projects, and strategies that have been completed or updated in the intervening 11 years and provides a roadmap for reaching new policy and vision goals. This 2021 Amendment updates specific aspects of the 2009 WMP as follows:

- Water demands and planning criteria
- Water supply and wells
- Hydraulic modeling utilizing updated system flow criteria to determine pipe and hydrant deficiencies
- Identification of near term (0-5 years) prioritized projects to address the most significant deficiencies
- Longer-term recommendations for additional studies and projects

This 2021 Amendment does not commit the ratepayer to any specific discretionary action in order to implement policy goals. Updates to the 2009 WMP are presented in this TM organized similarly to the 2009 WMP, for convenience.

Limited updated data was available regarding well condition and customer demands. Where data was not provided or was limited, the team made inferences based on knowledge of other nearby water districts and recent experiences on similar water system planning.

2.2 Background

The District is located in the Arden area of unincorporated Sacramento County, northeast of the City of Sacramento, as shown in the vicinity and location maps provided in Figures 1 and 2. The District service area is approximately 1.3 square miles and the District provides drinking water to approximately 1,800 residential, commercial, and institutional customers. The District is bounded on all sides by Sacramento Suburban Water District (SSWD), a large water purveyor in the Sacramento region. Figure 3 provides a map of the region and the Districts location relative to neighboring water purveyors.

The District is fully built-out and is facing an increasing infrastructure liability as the aging pipelines and wells reach the end of their useful life. The District's water system is comprised of buried water mains, eight (8) groundwater wells, and individual service connections, and has generally been in continuous service for over 65 years. Figure 4 provides the location of each of the existing District wells and approximate locations and diameters of existing buried water distribution pipelines. The District's elected Board of Directors, recognizing that the aging system and water supply reliability impact water service, commissioned this update to the 2009 Water Master Plan. Over the next 5 to 30 years, the infrastructure needs will continue to rise as more older facilities fail. This update will provide the roadmap for distributing available funding.

FIGURE 1
DEL PASO MANOR WATER DISTRICT
WATER MASTER PLAN UPDATE
VICINITY MAP

HydroScience

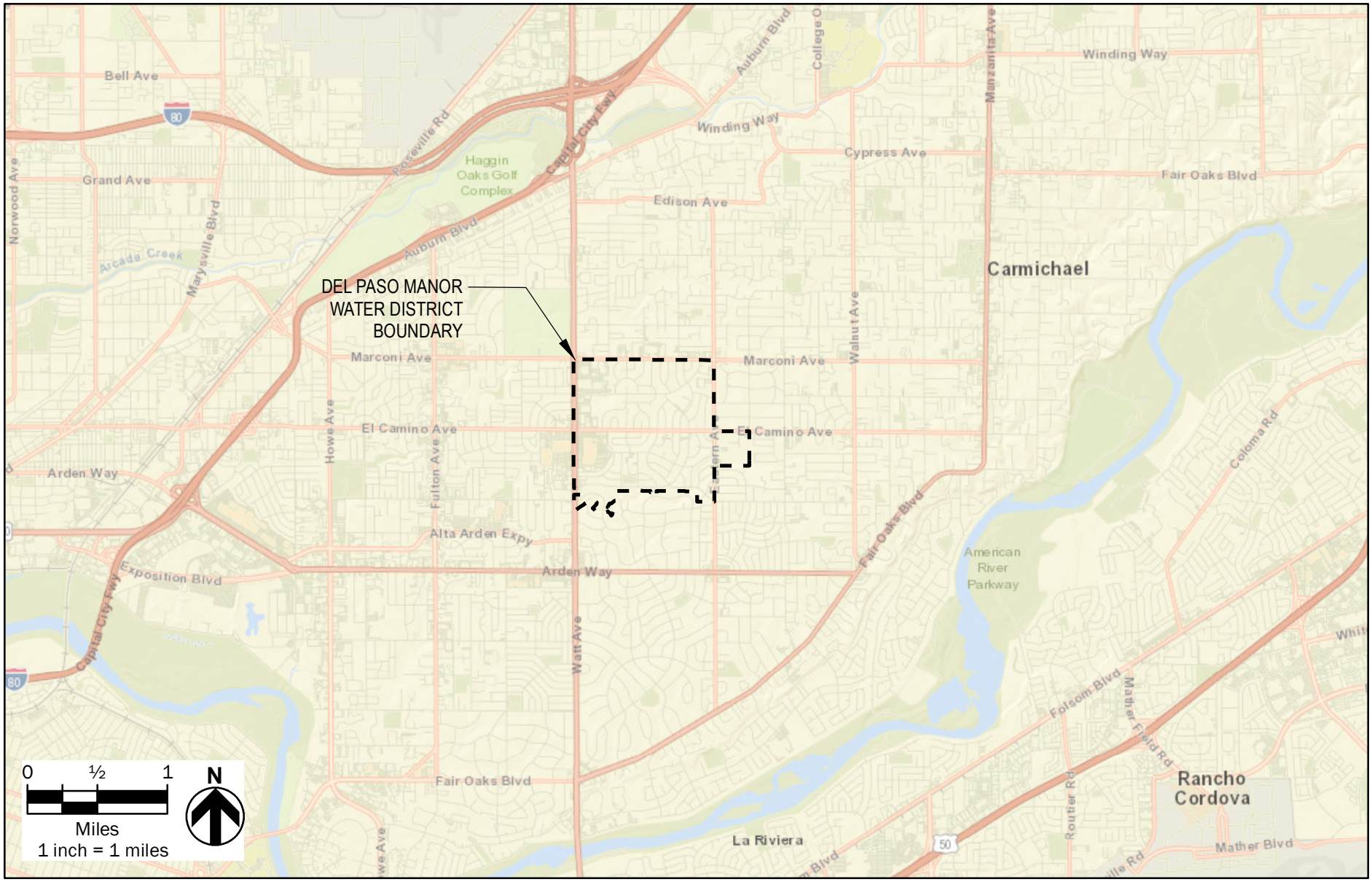


FIGURE 2
DEL PASO MANOR WATER DISTRICT
WATER MASTER PLAN UPDATE
LOCATION MAP

HydroScience

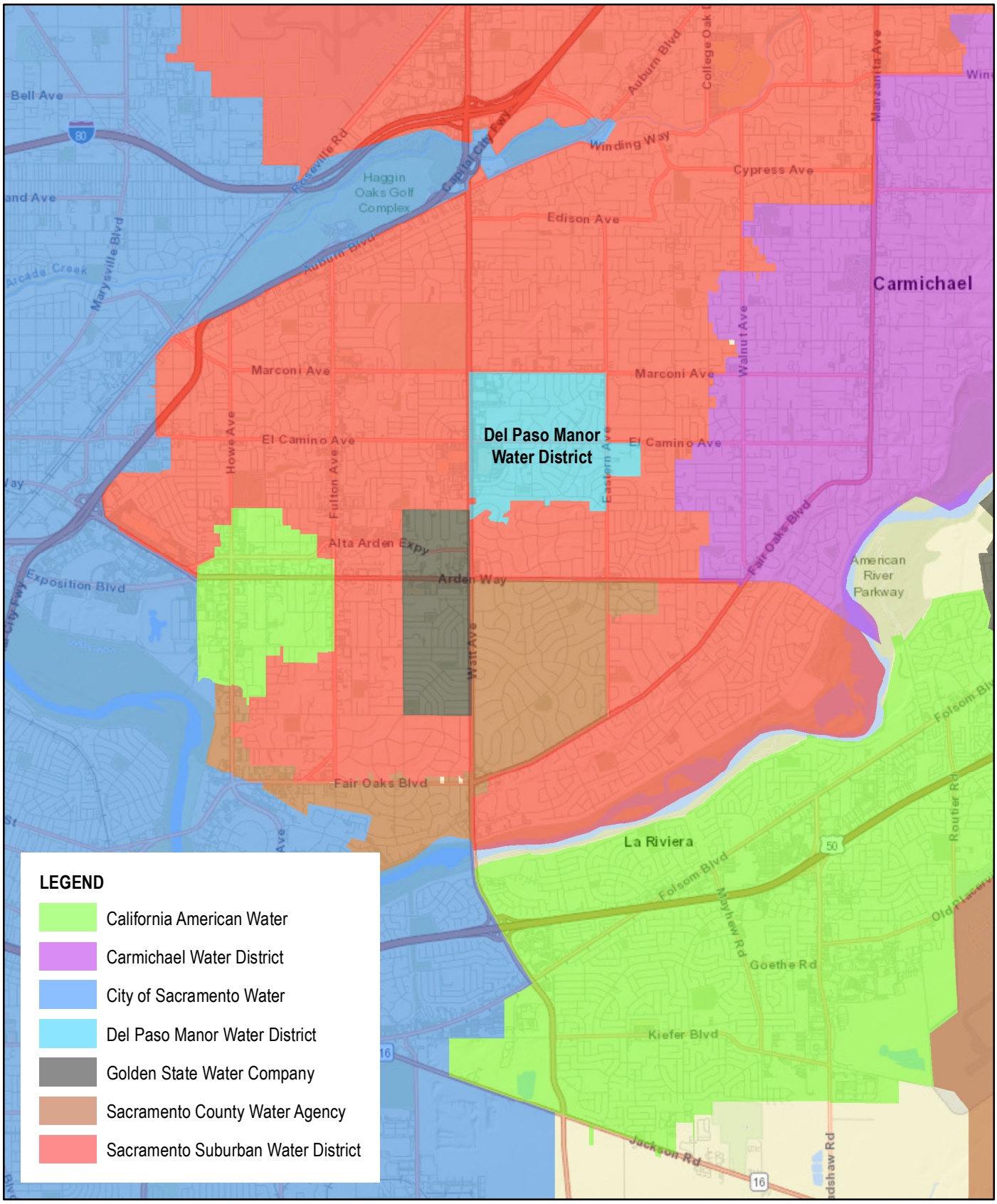


FIGURE 3
DEL PASO MANOR WATER DISTRICT
WATER MASTER PLAN UPDATE
ADJACENT WATER DISTRICTS

HydroScience

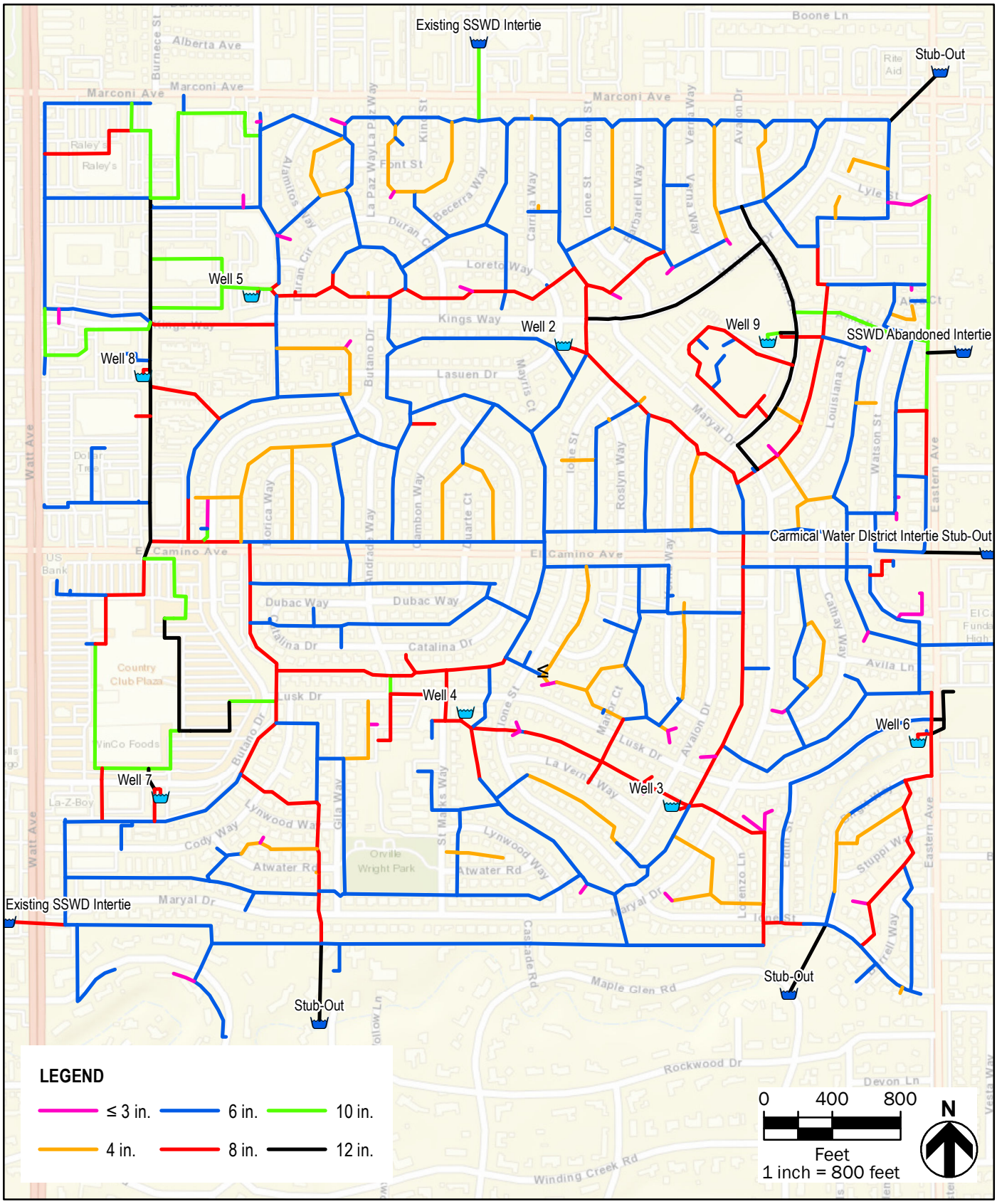


FIGURE 4
DEL PASO MANOR WATER DISTRICT
WATER MASTER PLAN UPDATE
DISTRICT FACILITIES MAP

HydroScience

Section 3: Water Demands and Planning Criteria

This section provides updates to the water demands and planning criteria that were previously addressed by Section 3 of the 2009 WMP.

3.1 Introduction

The District is designated as a "Small Water District" and therefore does not meet the California threshold of an "Urban Water Supplier". Since it neither serves more than 3,000 urban connections nor provides more than 3,000 acre-feet of water annually, the District is not subject to State of California Assembly Bill AB-2572, which would require metering of all municipal (residential and commercial) connections by January 1, 2025.

The District reports that its number of connections has remained stable since the previous master plan due to the service area being built-out.

3.2 Population and Growth

The District is not expected to experience significant population growth or demographic changes. The District has one elementary school, one high school and a commercial district, however the majority of service connections are residential. The land use change most anticipated is redevelopment of commercial properties with potentially different water needs. This should be accommodated in the record-keeping process moving forward so these potential changes can be considered during the evaluation of demand in subsequent master planning efforts.

The District encompasses a small geographic area within an unincorporated portion of Sacramento County whose population is not measured and reported through the usual sources for determining population and growth. Because population in the District area is not measured directly, this report determines the District's population growth by investigating Census Designated Places (CDP) within the northern unincorporated areas of Sacramento that exhibit similar socio-economic and geographical characteristics. Table 3-1 below shows the CDP areas used in the 2009 Master Plan and provides updated 2019 population and housing unit density for each CDP. The table below indicates that the Foothill Farms and the Gold River CDPs experienced significant growth indicating that the CDPs still had open tracts of land available for development. The District service area does not incorporate such tracks of developable land. therefore, Foothill Farms and Gold River CDPs were discounted in the estimate calculation of the population per household in the District's service area. As projected in the 2009 Master Plan, the increase in estimated population per household is minor and can be attributed to the area's demographics slowly changing from older single or two person residences to younger two to four person residences. This trend is expected to continue slowly. As shown in the table below, the calculated average for the District is 2.56 persons per household. Using the staff reported number of 1,798 residential connections the estimated population for the District of roughly 4,600 persons.

Table 3-1: Population and Housing Unit Density

Geographic Area	Housing Units per square mile	Population per square mile	Population per Household	Change since 2000
Arden Arcade CDP	2,521.2	5,778.9	2.29	+0.15
Carmichael CDP	2,052.2	4,774.4	2.33	---
Citrus Heights City	2,486.0	6,153.0	2.48	+0.04
Fair Oaks CDP	1,222.4	2,873.3	2.35	-0.09
Foothill Farms CDP	3,036.9	8,543.1	2.81	+0.26
Florin CDP	1,823.3	5,466.1	3.00	+0.12
Gold River CDP	1,336.9	2,899.2	2.17	-0.28
La Riviera CDP	2,606.1	6,022.2	2.31	+0.02
Orangevale CDP	1,199.7	3,028.2	2.52	-0.12
Rio Linda CDP	518.1	1,652.4	3.19	+0.28
Del Paso Manor WD Estimated Population/Household Density			**2.56 4,600 persons**	**+0.06**

US Census 2019 American Community Survey 5-Year Estimates

3.3 Water Use

The District provided historical well production data from January 2014 thru July 2020 which was used to estimate system demands (Table 3-2). Based on typical water system data, we assumed that 10% of the water produced at the wells is unaccounted for water loss and the remaining 90% of water supply volume is the District demand.

Table 3-2: Annual Well Production and ADD Estimate

Year	Well Production	Well Production	Average Day Demand (ADD)
2014[1]	1,447 AFY	1.29 MGD	897 gpm
2015	941 AFY	0.84 MGD	585 gpm
2016	1,113 AFY	0.99 MGD	690 gpm
2017	1,111 AFY	0.99 MGD	689 gpm
2018	1,100 AFY	0.98 MGD	682 gpm
2019	1,037 AFY	0.93 MGD	643 gpm
2020[1]	1,125 AFY	1.00 MGD	698 gpm
AVERAGE	**1,125 AFY**	**1.00 MGD**	**698 gpm**

Notes:
1. Well production data for 2014 and 2020 available only for January thru September and January thru July, respectively. Usage totals were averaged over available months and projected for the total year.

The District reports that there are currently 1,798 residential connections and 100 commercial connections which indicates that 95% of the District's connections are residential. No additional breakdown of this information was available.

It is assumed that the customer service type breakdown (residential vs commercial) has not changed significantly since the 2009 Water Master Plan, since the water system has been built-out for a long period of time. Historical demand and water customer data for the period of 2009 to April 2020 was not available to confirm this.

In comparing the only recent overlapping data of well production and commercial meter reading from April 2020 through July 2020, it is estimated that the residential water use of 768,816 gpd represented approximately 49% of all water delivered while commercial/industrial/institutional represented 51%. The largest single water use account was the cooling towers at AT&T.

The District remains largely unmetered. Commercial and multi-family residential connections are metered while single-family residential services remain unmetered. The commercial metered connections do not generally have separate irrigation meters installed making it difficult to quantify implementation of outdoor water use conservation policies. Currently, there are no plans to implement a meter installation program within the District.

3.4 Water Demand Criteria

Hydraulic Modeling. The District's hydraulic model was updated and used to evaluate the system for compliance with water system standards and design criteria. A detailed explanation of the hydraulic modeling evaluations and results are provided in Attachment A.

Average Day Demand (ADD). The 2021 Amendment updated the Districts system demands based on available data. The District's Average Day Demand (ADD) estimates were provided in Table 3-2. The 2009 Water Master Plan, relying on historical groundwater production records from 1998 through 2007, reported an ADD of 1.50 MGD. The District's current ADD is estimated as the average of estimated water demands from 2014 through 2020. As shown in Table 3-2, the District's current ADD is estimated as 697 gpm (1.00 MGD). The reduction in ADD water demand, despite a slight increase in population, can be attributed to continuing water conservation efforts and public awareness for drought potential. As discussed in Section 3-2, the District's updated population is 4,600. Therefore, the estimated residential per capita water demand is 218 gpcd. This estimated water use per capita is primarily used to determine whether conservation measures are having an impact on water use practices.

Maximum Day Demand (MDD). MDD represents peak water use during summer months (June through August). Using the available well supply data (and previously noted 10% unaccounted for water losses), the estimated MDD is 1,396 gpm for the years 2014-2019.

Peak Hour Demand (PHD). PHD represents the peak hourly use hour during a maximum demand day. Hourly well production data was unavailable at the time of this analysis. The existing hydraulic model used for the 2009 Master Plan used a diurnal curve indicating a peak hour factor of 1.8 times MDD. No additional information on hourly well production was available. Therefore, using the estimated MDD of 1,396, the estimated PHD is 2,513 gpm.

Peaking Factors. Water peaking factors are necessary to predict fluctuations in water demands throughout the year. This allows the District to identify possible deficiencies during high use events. Considering the estimated ADD of 698 gpm and MDD of 1,172 gpm, the calculated MDD peaking factor is 1.7. To provide a conservative analysis, an MDD peaking factor of 2 times ADD

is recommended. Table 3-3 summarizes the recommended updated peaking factors for this analysis and the associated demands.

Table 3-3: Summary of Water Demands and Peaking Factors

Demand Type	Peaking Factor	Demands
Annual Average Day (ADD)	1.0	1,125 AFY (698 gpm)
Maximum Day Demand (MDD)	2.0 x ADD	2,250 AFY (1,396 gpm)
Peak Hour Demand (PHD)	1.8 x MDD	4,052 AFY (2,513 gpm)

Fire Flow Requirements. The District remains in the Sacramento Metropolitan Fire Department (SFMD) service area. For residential customers, the hydraulic model considered a fire flow demand of 1,500 gpm for a 2-hour duration. For commercial customers, the largest user is the AT&T Telephone Service Center, which is located in the northwest of the service area. The hydraulic model considered a demand of 3,500 gpm for a 4-hour duration.

Non-residential, commercial, industrial and park demands represented approximately 50% of all water use during the 4 months of 2020 for which records were available. This represents a very small data set. Based on the data available, the AT&T center's cooling tower is typically the largest single commercial water use. In addition to the small data set in summer of 2020, the months data was provide also coincide with the beginning months of a historic pandemic period where stay-at-home orders were enforced in Sacramento County. Schools, restaurants, department stores, and other business deemed "non-essential" were shuttered and many residents of Sacramento County were sheltered at their residences. The lack of data prior to the pandemic impacts the usefulness of the analysis to predict trends and forecast future needs.

3.5 Water Conservation

While the 2009 Master Plan was written just after a multi-year drought period, this 2021 Amendment is being prepared at the early stages of another drought period. California's water reservoirs are expected to reach record lows by the end of the summer 2021. Significant conservation measures are likely to be placed on larger districts along with restrictions on the use of their surface water sources. These measures will result in increased pumping from the area's groundwater aquifers including the one relied upon by the District. The increased groundwater pumping, although not quantified in this report, may have significant impact to groundwater levels and water quality available to the District.

As the State of California continues to take a hard look at water use, sustainability, climate change and requires a more active approach in determining local water use patterns, the District is likely to be statutorily exempt from some requirements due to its small size but can expect increasing pressure to increase water conservation. Water conservation should continue to be a key element of managing the District's water supply.

3.6 Water System Standards and Design Criteria

The water system standards presented in this section are based on standard water distribution system operating criteria. Minimum pressure criteria were established in accordance with

California Waterworks Standards Section 64602. System pressure in the distribution system must operate within the required minimum and maximum range. Maximum velocity criteria are required to minimize head loss in the distribution mains. Pressure, velocity, and additional water system design criteria is provided in Table 3-4.

Table 3-4: Water System Criteria

Pressure	Criteria
Average water system pressure	50 psi
Minimum water system pressure under PHD	40 psi
Minimum water system pressure under MDD	40 psi
Minimum residual pressure under MDD+FF with Largest Supply Out of Service	20 psi
Maximum water system pressure	80 psi
Velocity	**Criteria**
Maximum velocity under ADD	3 fps
Maximum velocity under MDD	5 fps
Maximum velocity under PHD	7 fps
Target velocity under MDD+FF	10 fps
Maximum velocity under MDD+FF	13 fps
Other Design Criteria	**Criteria**
Hazen-Williams Roughness Coefficient	130
Maximum fire hydrant spacing	500 feet
Minimum pipe diameter for looped system	8 inch
Pipe diameter for dead-end runs	6 inch

Section 4: Water Supply and Wells

This section provides updates to the evaluation of existing water supply, water supply deficiencies, and approaches to address those deficiencies. These planning elements were previously addressed by Sections 4 and 5 of the 2009 WMP.

4.1 Groundwater Supply

The District remains an active member of regional groundwater planning organizations and initiatives, including the Sacramento Groundwater Authority (SGA) and the Regional Water Authority (RWA). There are several documents published by these organizations since the 2009 Master Plan which can be found at the web locations below.

- SGA Water Accounting Framework Phase III Effort Final, 2010 (https://www.sgah2o.org/wp-content/uploads/2016/06/WAF-PhaseIII-Final-9-28-10.pdf)

- SGA Groundwater Management Plan, Sacramento County, North Basin, 2014 (https://www.sgah2o.org/wp-content/uploads/2016/06/GMP_SGA_2014_Final.pdf)
- SGA Basin Management Report – 2016 Update (https://www.sgah2o.org/wp-content/uploads/2017/01/pub-bmreport-2015.pdf)
- RWA Regional Water Reliability Plan – May 2019 (https://rwah2o.org/wp-content/uploads/2019/05/RWRP_May2019b.pdf)

These documents indicate that the North Basin is in recovery and water levels, although still low, are rebounding. Continued pumping by the District will not impact the status of the groundwater basin. There is a potential for perchloroethylene (PCE) contamination in the northwest corner of the District stemming from the migration of the known contamination plume from the area formerly known as McClellan Air Base. More information regarding this plume and its migration can be found in the documents listed above.

The District currently maintains eight (8) well to supply the District's water distribution system. Since the 2009 Master Plan was published, Well Nos. 1 and 6 were abandoned and Well Nos. 6B and 9 were developed and equipped as replacements, respectively. Currently, Well No. 8 has been taken offline indefinitely due to exceedances of the maximum contaminant level (MCL) for PCE. Well No. 5, which is in the same general vicinity, is being monitored to ensure that it is not impacted by the PCE plume migration.

The State Water Resources Control Board (SWRCB) performed an inspection of the District system on December 4, 2019 and issued the 2019 Compliance Inspection Report (2019 Inspection). A copy of this report is included in Attachment B. According to this inspection report, the Well No. 3 status was changed from Active to Standby due to exceedances of the MCL for 1,2,3 Trichloropropane (TCP). Additional testing will be required in order to apply for a change in status back to Active.

Well production capacity as provided by the District and documented in the SWRCB 2019 Inspection are shown in the following Table 4-1. The locations of the District wells are shown in Figure 5. Further details on recent well history and the SWRCB 2019 Inspection are provided in Section 5.

Per California Waterworks Standards (Title 22, Chapter 16), community water systems using only groundwater shall be capable of meeting MDD with the highest-capacity source off-line. Currently, the District's well system firm capacity (with Well 9 on standby) is 3,075 gpm, which is greater than the updated MDD of 1,396 gpm. Therefore, the District meets this waterworks standard.

Since the District does not have any storage tanks in their distribution system, the District's well system's firm capacity should also be capable of meeting MDD + FF demand or 4,896 gpm (based on fire flow of 3,500 gpm at AT&T Telephone Service Center). Based on this best practice, the District has a well pumping deficit of 1,821 gpm. To meet this MDD+FF condition, new source(s) and/or improvement to existing sources may be needed.

Table 4-1: Groundwater Supply and Active Pumping Capacity

Well No	Year Built	Age In Years	Active Pumping Capacity	Well Status / Comments
2	1948	72	375 gpm	Video inspection scheduled for 2021
3	1949	71	--	Permitted Use is Standby, 1,2,3 TCP MCL Exceeded
4	1951	69	475 gpm	Video inspection scheduled for 2021
5	1955	67	450 gpm	
6B	2014	6	1,100 gpm	Primary well with standby generator, Used during low winter demands (down to 100 gpm)
7	1956	64	675 gpm	
8	1977	43	--	PCE detected. Well Offline. Expected complete loss
9	2011	9	1,500 gpm	Primary well, New Generator scheduled for 2021 installation
Total Capacity			**4,575 gpm**	PHD=2,513 gpm
Firm Capacity			**3,075 gpm**	MDD = 1,396 gpm, MDD+FF=4,896 gpm

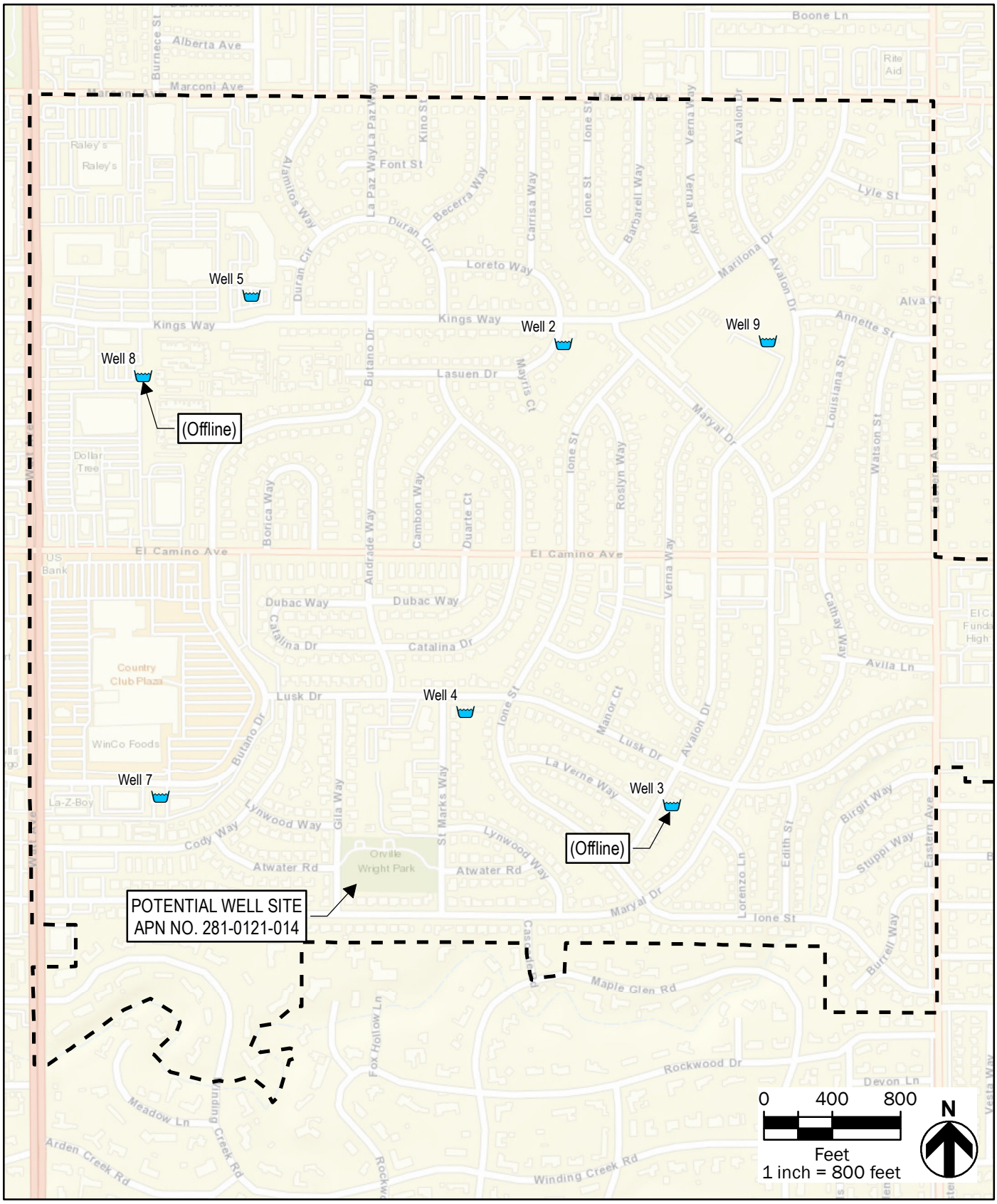


FIGURE 5
DEL PASO MANOR WATER DISTRICT
WATER MASTER PLAN UPDATE
FUTURE WELL SITES

HydroScience

4.2 Surface Water Supply

In 2008, the District completed a Conjunctive Use Plan to evaluate alternatives for developing a surface water use program and participating in groundwater wheeling with neighboring districts to bring more surface water into the District and to offset groundwater pumping during wet years.

The District continues to have a 1968 agreement with the City of Sacramento that establishes conditions for transfer of up to 6.8 cubic feet per second or 2,460 acre-feet annually to the District through the City's Area D water service area. The District also has a Mutual Aid and Assistance Agreement Between with Sacramento Suburban Water District (SSWD Mutual Aid Agreement), dated January 11, 2011, extended through September 30, 2020, allowing the transfer of water in the event of an emergency and the providing of support staff on a regular and ongoing basis. The District has two interties with SSWD for water transfer. Each intertie is outfitted with manually operated valves. Outfitting the interties with automated valves would allow the interties to open in emergency situations where pressure in the vicinity of the intertie drops below a setpoint. Prior to any decision regarding the installation of automated valves, it is recommended the District investigate whether the action would subsequently require the installation of residential water meters or the fluoridation of the water system.

Based on information provided for this update, no progress has been made in taking the next steps as outlined in the Conjunctive Use Plan.

Section 5: Facilities Replacement Planning and Implementation

This section provides selected updates to the assessment of existing facilities, planning for replacement and augmentation of facilities, a focused near term (0-5 years) prioritized CIP for the proposed projects, and recommendation for future studies, projects, and other actions. These planning elements were previously addressed by Sections 6 and 9 of the 2009 WMP.

5.1 Water Main and Hydrant Existing Condition and Capacities

The pipe network is a looped system of mostly small diameter (2-inch to 12-inch) transite, PVC, steel, and ductile iron pipe located mostly in backyards. As noted elsewhere in this TM, the District's system is more than 75 years old and, as indicated in the SWRCB 2019 Inspection Report, the distribution system is "suffering from age and wear and may be in need of increased maintenance". When compared to two other water systems (located in close proximity to the District in 2018), the District was found to have experienced nine times the number of leaks and breaks as the other systems. An annual program of main replacement will be necessary for the District to maintain system reliability.

The system includes approximately 3,000 linear feet of 3-inch or less pipe in the system at 39 locations, which do not meet the minimum water main diameter (4-inches) requirements specified in Title 22 of the California Code of Regulations (CCR). A significant portion of these non-compliant mains are small dead-end extensions located in cul-de-sacs and at the edge of the District boundary.

The District utilizes a single pressure zone with the distribution system pressure maintained by hydropneumatic tanks at well sites throughout the system. Pressure is operationally maintained at 46 psi to 56 psi via well sources triggered by pressure switches at the pressure tanks.

The hydraulic model was used to evaluate the sufficiency of the water system to meet defined criteria (MDD, FF) under certain constraints (flow, pressure and velocity). The model shows that the system is capable of meeting MDD with the largest source removed, however low pressures are experienced (less than 40 psi) in the northeast quadrant of the District as indicated in Figure A4 of Attachment A. Additionally, evaluation of the model for MDD+FF with the largest source removed identified a number of fire hydrant flow deficiencies as indicated in Figure A6 of Attachment A.

The District maintains a network of fire hydrants connected to the system. California Fire Code Section C102 (Table C102.1) requires that fire hydrants be spaced an average of 500 feet apart in residential water distribution systems. Due to the District being mainly comprised of "backyard mains" rather than pipelines within street rights-of-way, this average spacing has not been accomplished. The system map was studied to determine locations where hydrant spacing maximums are not currently met and identify locations where:

- a fire hydrant can be served from a minimum 8-inch pipeline or at the intersection of three or more 6-inch pipelines, and
- is able to be placed within the public right-of-way.

Fifteen (15) locations were identified where the noted criteria is met for providing fire hydrant infill to the system.

Descriptions of the projects associated with correcting the noted deficiencies are provided in Section 5.3 below. Total costs associated with these projects are provided Table 5-1 and a breakdown cost estimate is provided in Appendix C.

5.2 Existing Well Ages and Condition

This subsection provides available updated information about existing condition and operating status of each of the wells since the 2009 WMP.

The SWRCB 2019 Inspection Report documented a series of planned projects that the District had indicated would be implemented as near-term projects:

- Well 2 - Pulling the pump and TV examination of well casing was to be scheduled for Jan 2020. Had positive coliform tests last 2 quarters of 2019.
- Well 3 - Chemical feed system was to be repaired in December 2019.
- Well 5 - Well was scheduled for video inspection in 2018/2019 but was postponed .
- Well 7 - necessary corrections were identified during inspection and new SCADA and PLC were in design at the time of the report and expected to be completed in Spring of 2020.
- Well 8 - Install rebuilt right angle drive for service during power outages.
- 2018 rate increase included budgets for inspections of Well 4 and 9 in 2020/2021; site paving and tank inspections in 2021/2022 and inspection of Well 6B in 2022/2023.

Of the projects listed above, the Well 2 well casing inspection project has not been completed. The Well 3 chemical feed system repairs were completed, but this well was placed in standby permit status due to contamination issues (see below).

The inspection report also noted the recent removal and replacement of 205-feet of 4-inch Transite with 6-inch ductile iron pipe (DIP).

The District provided for this update the following current status of each of the existing wells:

- Well No. 1 – Well has been abandoned, all facilities pulled and backfilled.
- Well No. 2 – Video inspection postponed until after the 2021 summer demands.
- Well No. 3 – Currently offline and on standby due to test samples showing TCP contaminant.
- Well No. 4 – Currently video inspection postponed until after the 2021 summer demands.
- Well No. 5 – No reported changes.
- Well No. 6 and 6B – Well No. 6 was replaced by Well No. 6B. The Well No. 6B generator transfer switch failed during power outage in 2020 and has since been repaired.
- Well No. 7 – No reported changes.

- Well No. 8 – SWRCB 2019 Permit and Inspection Report indicated 1,2,3 TCP was detected and had failed bacteriological testing. The well was switched to quarterly monitoring; however, due to the presence of 1,2,3 TCP this well has subsequently been removed from service indefinitely.
- Well No. 9 – This is a new well installed since the 2009 Master Plan. The SWRQCB 2019 Permit and Inspection Report set the design capacity at 1,500 gpm.

The resulting capacity and system redundancy based on these changes was previously summarized in Table 4-1.

5.3 Water Main, Hydrant, and Well Improvements

As a long-term goal, HydroScience recommends that the District plan to implement the distribution (water main) improvement system goals established in the 2009 WMP to extent feasible, which is to replace older failing backyard mains with upsized and well-looped 6-inch or greater diameter pipeline network. For near-term distribution piping improvements, this 2021 Amendment focuses on identifying high-priority improvements that address the following specific deficiencies:

- Pipe upgrades to address pressure, velocity, and flow deficiencies under normal operations and the design maximum condition of MDD+FF with the largest well source out of service.
- Hydrant upgrades to meet required fire flow demand and regulatory spacing requirements.

Coupled with the need to address distribution pipe network deficiencies is the need to provide sufficient well supply to meet MDD+FF with the largest well out of service. As documented in Section 4.1 and Table 4-1, there is currently a supply deficiency in meeting this condition, with the capacity shortfall estimated at 1,821 gpm. The near-term recommended CIP project to address this well pumping deficiency is to install one or two new groundwater wells in a non-contaminated area to supply the system with this additional flow. Associated with this project is the need to improve any distribution piping between that new well location and the largest fire flow demand at AT&T.

Attachment A details the modeling run that was performed to test addition of a new 1,821 gpm well source to the system. The selected well site location for this model run was at Orville Wright Park.

Alternatives to installation of a single new well source at Orville Wright Park that should be evaluated before implementation of a water supply improvement project include:

- Construction of two or more smaller wells to provide equal or greater additional flow. More than one well is preferred to avoid establishing a larger maximum sized well than the existing maximum sized well (currently Well 9 at 1,500 gpm) that would need to be assumed to be offline during a MDD+FF event for the purpose of redundancy analysis.
- Construction of one new well and rehabilitation/improvements to one or more existing wells to provide a total increase to source capacity of at least 1,821 gpm. This alternative should be based on condition assessment results that show the existing well is in sufficiently fair condition for rehabilitation. Available condition assessment information was not available to sufficiently evaluate this alternative.

- Construction of a storage tank and booster pump station sized to meet maximum fire flow demand of 3,500 gpm at AT&T, in lieu of sizing the well supply to meet this flow.

For simplicity, this 2021 Amendment establishes the construction of a single new 1,821 gpm well in the CIP as a placeholder for any of these improvement options. A future study should further evaluate these options in consideration of District goals and priorities and select a best-value option for implementation.

The SWRCB Inspection Report and District documentation indicated a number of condition issues that should be addressed either as ongoing maintenance projects or as part of a comprehensive well rehabilitation or replacement project. The more significant items include:

- Well 5 – Inspect and repair casing hole.
- Wells 3 and 5 – Increase pedestal height to at least 18-inches to reduce the risk of contamination.

Other near-term priority pipe network and fire hydrant improvements to address water system standards and design criteria (see Section 3.7) resulting from updated hydraulic model runs (see Attachment A) are summarized below:

- Install New Fire Hydrant on 12" Main at AT&T: Location 1 is situated in the north-western portion of the District at the AT&T Call Center where the required fire flow of 3,500 gpm cannot be supplied. This location includes the installation of one fire hydrant serviced from the 12-inch main located near the existing fire hydrant H-11P which will increase the available fire flow from 1,229 gpm to 2,125 gpm.
- Pipe Replacement Projects: The District model was evaluated for Maximum Day Demand plus a 1,500 gpm Fire Flow for 2 hours. The results of that evaluation can be found in Attachment A, Figure A5. The hydrants found to be deficit are shown in red with the available fire flow in gallons per minute provided under the hydrant label. The System Upgrades Project contains nine (9) discreet locations where minor system improvements will result in all hydrants being capable of meeting the 1,500 gpm fire flow demand.
- Generator at Well 9: Install a generator at the well site with automatic transfer switch to provide backup power during a utility outage.
- Install 15 Additional Fire Hydrants: Install new fire hydrants to resolve the spacing issue previously discussed.
- Install 8" PRV Station: Installation of two automated PRV valves set to open the SSWD interconnections if the pressure in the District drops below the setpoint.

5.4 Capital Improvement Recommendations

Near-term prioritized CIP projects to address immediate and critical deficiencies is addressed in this subsection. Refer to the 2009 WMP for longer-term recommendations related to replacing transite pipe, relocating mains from backyards to streets, rehabilitating or replacing existing wells that are beyond their remaining useful lives, and implementing alternative supplies. The recommendations presented herein, coupled with the recommendations in the 2009 WMP, are made in consideration of the District's established policy of performing capital improvement

projects as funding allows with a focus on hydraulically critical regions first and condition/age second.

Descriptions of the planned capital improvement projects are given in Table 5-1 below, with priorities. A detailed cost estimate for each project is provided in Attachment C.

Table 5-1: Near Term CIP Summary

Project Priority	Description	Need Addressed	Estimated Planning-Level Implementation Cost[1]
1	Install New Fire Hydrant on 12" Main	High fire flow at AT&T	$16,000
2	Pipe Replacement Projects 2-10 (see Note 2)	Hydrant flow deficiency	$580,000
3	Install New Water Supply Well(s) Totaling 1,800 gpm Additional Flow	MDD+FF deficiency, improve system pressures, improve supply reliability	$3,100,000
4	Install 260kW, 480VAC NG outdoor genset at Well 9 with sound enclosure; replace MTS with ATS	Provide redundancy and reliability to the system	$450,000
5	Install 15 Additional Fire Hydrants	Achieve compliance with 500 ft max hydrant spacing	$240,000
NP	Install 8" PRV Station and Intertie to SSWD (see Note 3)	Connect supplemental water source for pressure support	$220,000

Notes:
1. Rounded to two significant figures.
2. Pipe replacement projects can be implemented individually or in smaller groups. Refer to prioritization in Attachment C, Cost Detail, for recommended order of implementation. Order is set based on level of existing fire flow deficiency addressed by the corresponding upgrade.
3. The District should first evaluate potential impacts to residential metering and fluoridation requirements, as stated herein, prior to implementing this project.
4. Genset cost excludes the cost of bringing natural gas onsite. If there is a natural gas pipeline in the street near the water main, the approximate added cost is $10,000 for the natural gas service extension).

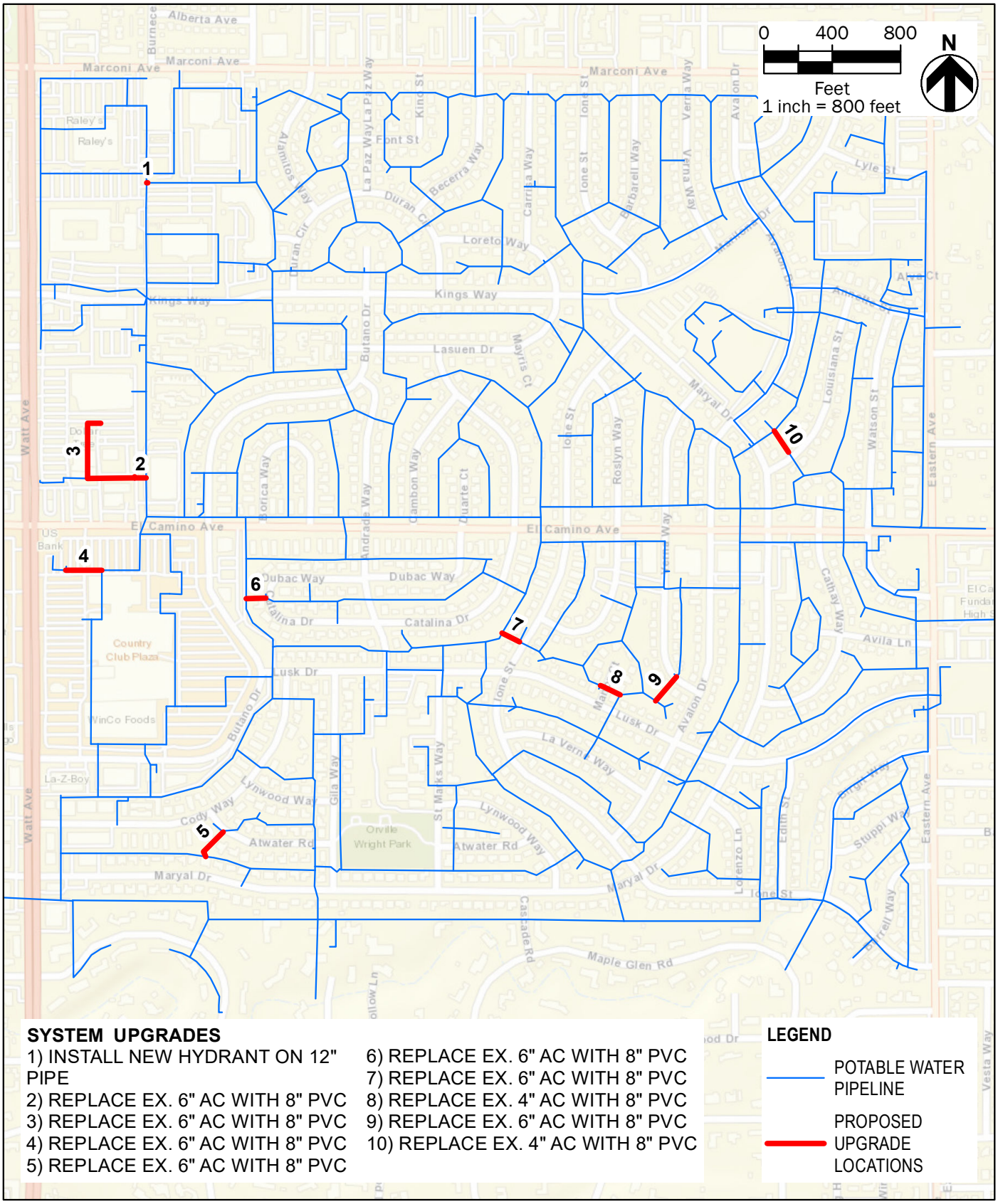
5.5 Other Recommendations

The following are some additional near-term recommendations to improve District's operations and business strategies, which would ensure continued sustainability.

- **Record Keeping**. Since the District residential areas are built-out, the commercial properties have greatest potential impacts to the District's water demands and operations. Commercial properties are also currently metered. Therefore, the District's new accounting system may be improved, if not currently available, to maintain electronic records of water consumption from existing meters. This electronic record-keeping process will provide improved water use information for future evaluations and subsequent master planning efforts.
- **Conjunctive Use Plan**. The 2009 WMP included a significant analysis of developing water for implementation of a Conjunctive Use Plan. The 2021 Amendment did not include a comprehensive review of the current potential for implementing a conjunctive use plan. District staff discussed the following potential for future conjunctive use evaluations:

  - If surface water use is considered beyond emergency use, we recommended the District investigate whether this operational change may require the installation of residential water meters or the fluoridation of the water system.
  - Due to changes in regional surface water strategies, continue vetting opportunities to participate in conjunctive use arrangements.

- **Regional Planning**. Maintain active participation in SGA and RWA.



SYSTEM UPGRADES

1) INSTALL NEW HYDRANT ON 12" PIPE
2) REPLACE EX. 6" AC WITH 8" PVC
3) REPLACE EX. 6" AC WITH 8" PVC
4) REPLACE EX. 6" AC WITH 8" PVC
5) REPLACE EX. 6" AC WITH 8" PVC
6) REPLACE EX. 6" AC WITH 8" PVC
7) REPLACE EX. 6" AC WITH 8" PVC
8) REPLACE EX. 4" AC WITH 8" PVC
9) REPLACE EX. 6" AC WITH 8" PVC
10) REPLACE EX. 4" AC WITH 8" PVC

LEGEND

POTABLE WATER PIPELINE

PROPOSED UPGRADE LOCATIONS

FIGURE 6
DEL PASO MANOR WATER DISTRICT
WATER MASTER PLAN UPDATE
SYSTEM UPGRADE LOCATIONS

HydroScience

ATTACHMENT A
Hydraulic Model Update

Attachment A: Hydraulic Modeling

The existing District potable water model was updated with changes since the 2009 Master Plan to determine system capacity under peak demand conditions and identify deficiencies. The service area was modeled as a single pressure zone and system.

Provided below is a discussion of the hydraulic model updates and analysis performed.

A.1 Model Development

The District potable water model was initially developed in 2014 using Bentley OpenFlows WaterGEMS software. Baseline water demands for existing conditions were estimated based on the water demand analysis presented in the previous section and updated in the model.

Development and analysis of the hydraulic model was based on the data received and the resulting data allocation. Data used for the development of the existing condition hydraulic model were as follows:

- Well 9 Yard Pipe Calcs (.xls)
- Well 9 Flow Calculations (.xls)
- DPM Well 9 Record Set (.pdf)
- Del Paso Manor Water District Master Plan 2009 (.pdf)
- City of Sacramento – Fire Sprinkler Systems Requirements (.pdf)
- Meter Read Consumption (.pdf)
- Western States Fire Protection Co. Fire Flow Test Results (.pdf)
- Hydraulic Modeling Workshop_v51 FINAL (.pdf)
- Distribution System As-Builts (.pdf)
- Fire Flow Analysis Summary – DISTRICT MP KJ (.pdf)
- DISTRICT Surface Water Utilization Road Map (.pdf)
- LEAK LOG – MASTER (.xlsx)
- Response to District Water Model and Fire Flow Analysis – DISTRICT MP KJ (.pdf)
- State Water Resources Control Board – DISTRICT 2019 Inspection Report (.pdf)
- Well Production (2019-2020) (.xlsx)
- Well Production 2014 to current (.xlsx)
- Well pumping capacity 2019 (.docx)

A.2 Modeling Scenarios

The District service area was analyzed for existing conditions using the data provided. The scenarios analyzed are discussed below:

- **Maximum Day Demand (MDD) – Normal Operations:** This analysis identifies deficiencies in the system simulating maximum day demands under normal system supply operations.
- **Maximum Day Demand (MDD) – Largest Source Removed:** This analysis identifies deficiencies in the system simulating maximum day demands with the largest supply source (Well 9) removed.
- **Maximum Day Demand + Fire Flow (MDD+FF) – Normal Operations:** This analysis identifies deficiencies within the system when simulating maximum day demands under normal operations and a related fire flow event concurrently. Fire flow is simulated at existing hydrants in the system and fire flow rates are determined by the most conservative land use type at the respective hydrant.
- **Maximum Day Demand + Fire Flow (MDD+FF) – Largest Source Removed:** This analysis identifies deficiencies within the system simulating maximum day demands and a concurrent fire flow event with the largest supply source (Well 9) removed.
- **Maximum Day Demand + Fire Flow (MDD+FF) – Largest Source Removed – With System Upgrades and New Well #10:** This analysis tests whether fire flow at hydrants is met simulating maximum day demands and a related fire flow event occurring concurrently with the largest supply source (Well 9) removed and after the addition of new Well #10 and implementation of recommended pipe improvements.

A.3 Hydraulic Modeling Results

The entire District service area was modeled and evaluated based on the flow, velocity and pressure performance criteria limits presented in Table 3-4. The results are discussed below.

System-wide Conditions with Normal Operations

MDD: The system was modeled with normal operations under a maximum day demand scenario and analyzed as a 24-hour extended period simulation. This type of simulation allows for the analysis of the peak hour demand while also observing system operations throughout a simulated maximum day. The system was able to stay below the maximum velocity criteria. During the peak hour (05:00 AM) some pressures in the system fall below the minimum pressure threshold of 40 psi. Pressure ranges for this deficiency is approximately 38 – 51 psi (see **Figure A3).**

MDD+FF: The system was modeled with normal operations under a maximum day demand plus fire flow scenario. This type of simulation is a 2-hour period providing an iterative analysis at each hydrant while systematically increasing the fire flows. Fire hydrant flows are reported as the maximum flow recorded prior to any of the constraints of pressure (>20 psi) or velocity (<13 fps) being exceeded. During MDD+FF conditions, the system exhibited fire hydrant flow deficiencies. Eleven of thirty-three hydrants did not meet required fire flow demand (3,500 gpm at H-11P and 1,500 gpm all others) while staying within the established criteria (see **Figure A5)**. Nine of the eleven violations are due to velocity restrictions in the adjacent pipelines.

System-wide Conditions with Largest Source Removed

MDD: The system was modeled with the largest supply source (Well/Pump 9) removed. The system was able to meet the maximum velocity criteria. During the peak hour (05:00 AM), some

pressures in the system fall below the minimum pressure threshold of 40 psi. Pressures throughout the system were approximately 4 psi lower than with MDD under normal operations simulation. Pressure ranges for this deficiency is approximately 34 – 48 psi (see **Figure A4)**.

MDD+FF: The system was modeled with the largest supply source (Well/Pump 9) removed under a maximum day demand plus fire flow scenario. This type of simulation is a 2-hour period providing an iterative analysis at each hydrant while systematically increasing the fire flows. Fire hydrant flows are reported as the maximum flow recorded prior to any of the constraints of pressure (>20 psi) or velocity (<13 fps) being exceeded. During MDD+FF conditions, the system exhibited fire hydrant flow deficiencies results similar to those with normal operations. Ten of thirty-three hydrants did not meet fire flow demand (3,500 gpm at H-11P and 1,500 gpm all others) while staying within the established criteria (see **Figure A6)**. There is one hydrant, J453, that did not satisfy fire flow demand with normal operations but improved with Pump 9 off. Hydrant J453 experienced velocity violations with normal operations that were not violated when Pump 9 was removed.

MDD+FF – With System Upgrades and New Well #10: The system was modeled during MDD+FF conditions with the largest supply source removed and following system upgrades and the addition of a new Well #10 (rated for 1,800 gpm). The results indicate that all hydrants including the new hydrant at AT&T satisfy all fire flow conditions (see **Figure A7)**.

A.4 Summary of Results

Table A-1 provides a summary of the results of the hydraulic analyses. Results shown are based on the results as they relate to the performance criteria limits provided in Table 3-4.

Performance Criteria		**Meets Criteria?**	
Pressure		**Current Conditions**	**After CIP Implementation**
Minimum water system pressure under PHD	40 psi	No	No
Minimum water system pressure under MDD	40 psi	No	No
Minimum residual pressure under MDD+FF with Largest Supply Out of Service	20 psi	No	Yes
Maximum water system pressure	80 psi	Yes	Yes
Velocity		**Current Conditions**	**After CIP Implementation**
Maximum velocity under MDD	5 fps	Yes	Yes
Maximum velocity under PHD	7 fps	Yes	Yes
Maximum velocity under MDD+FF	13 fpsi	No	Yes
Other Design Criteria		**Current Conditions**	**After CIP Implementation**
Hazen-Williams Roughness Coefficient	130	N/A	N/A
Maximum fire hydrant spacing	500 feet	No	No[3]
Minimum pipe diameter for looped system	8 inch	No	No
Pipe diameter for dead-end runs	6 inch	No	Yes

A.5 Detailed Modeling Results

Figures depicting model results output and model output tables follow.

ATTACHMENT A:

DEL PASO MANOR WATER DISTRICT – WATER DISTRIBUTION SYSTEM MODELING RESULTS

FIGURES **PAGE**

TABLES

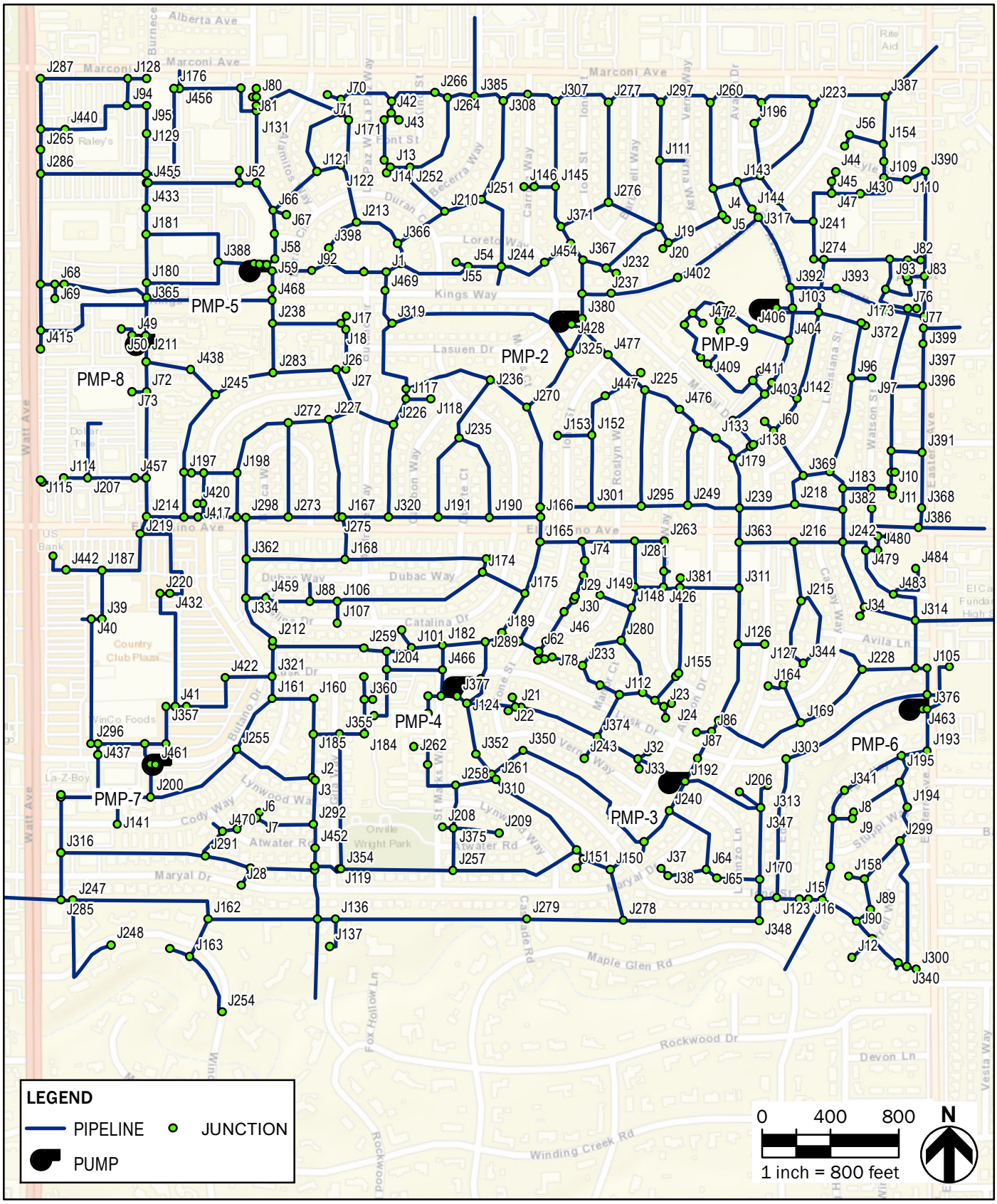


FIGURE A1
DEL PASO MANOR WATER DISTRIBUTION SYSTEM
JUNCTION LABELS

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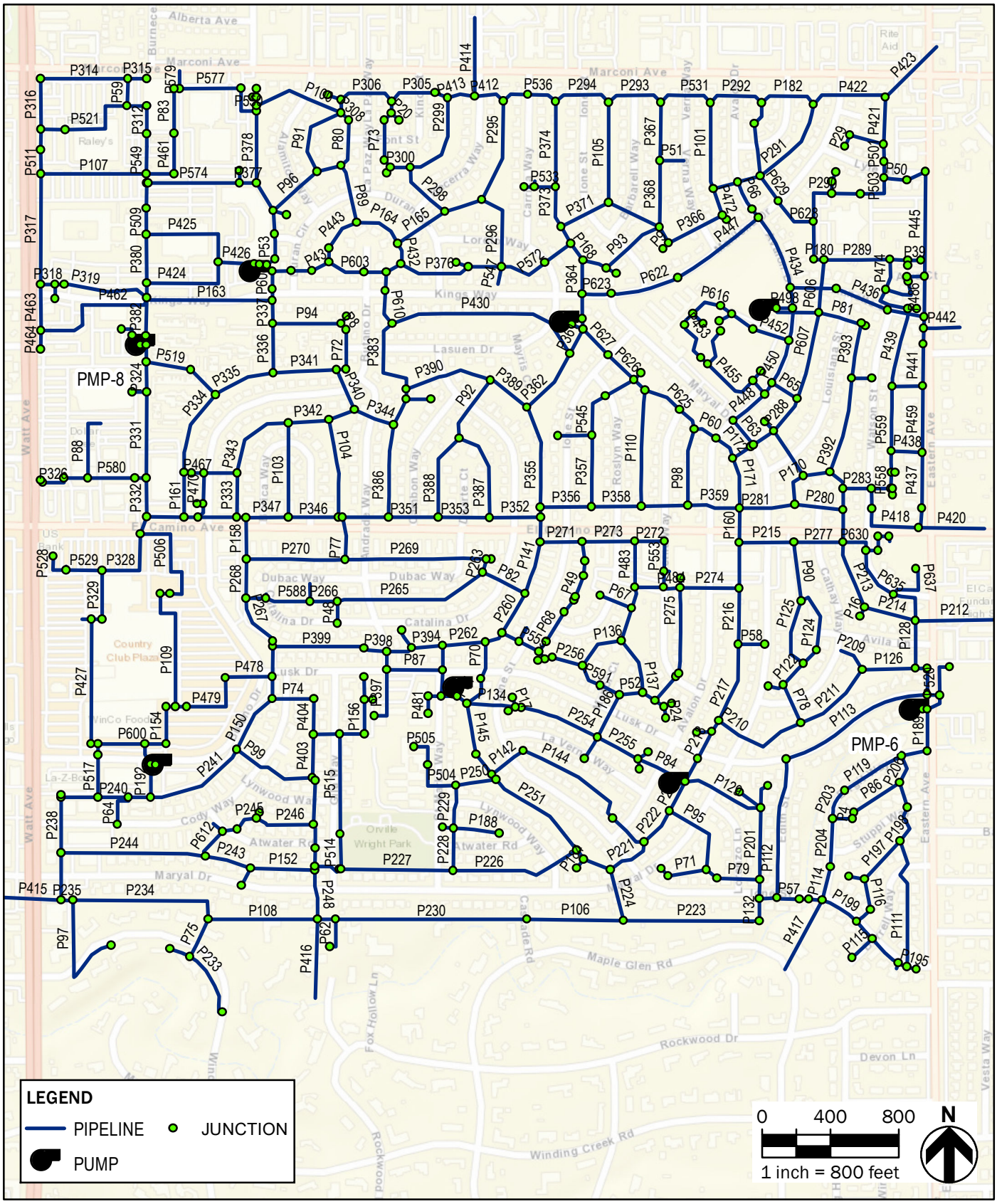
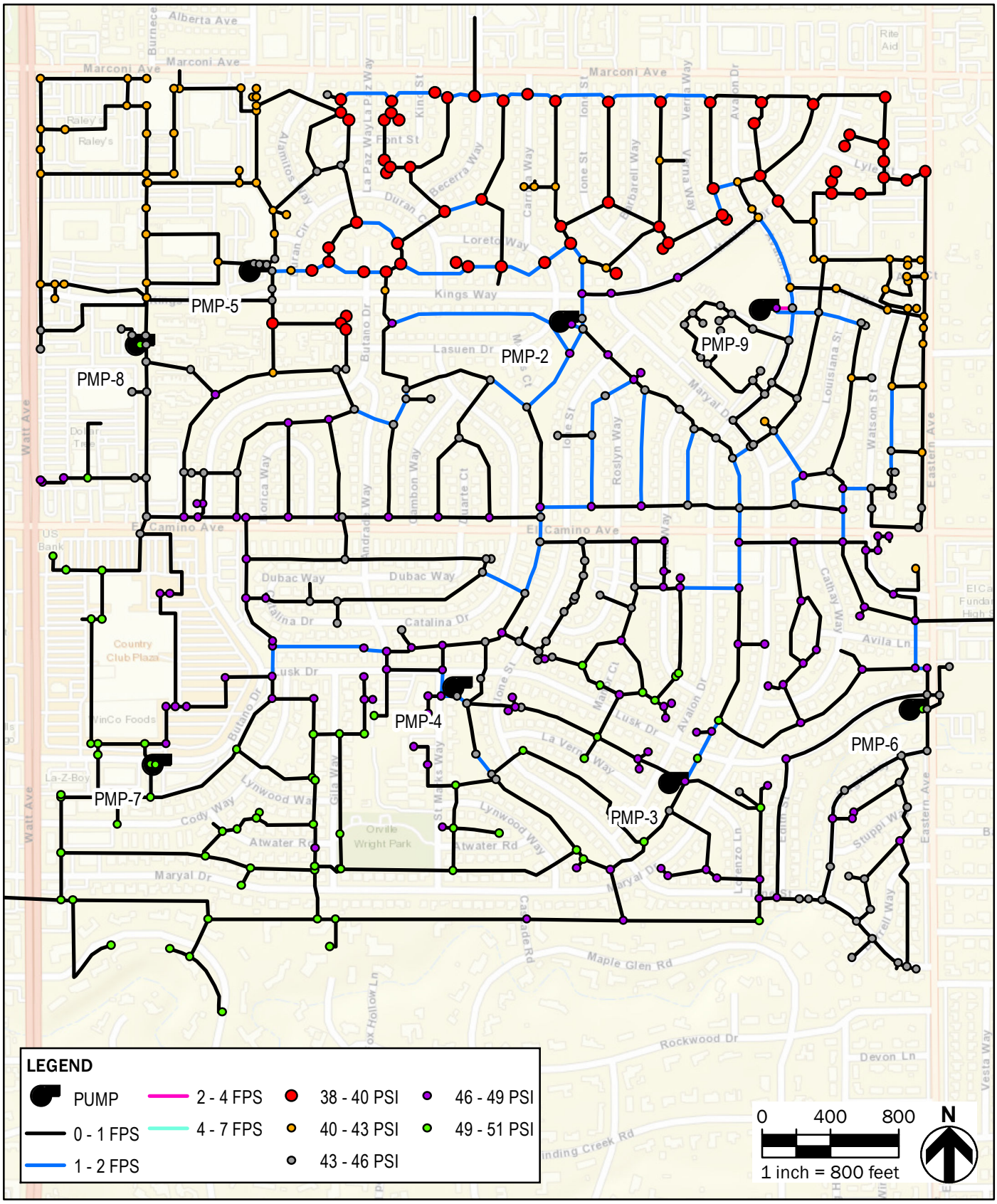


FIGURE A2
DEL PASO MANOR WATER DISTRIBUTION SYSTEM
PIPE LABELS

HydroScience



HydroScience

FIGURE A3
DEL PASO MANOR WATER DISTRIBUTION SYSTEM
MDD MIN. PRES. AND MAX. VEL. - NORMAL OPERATIONS

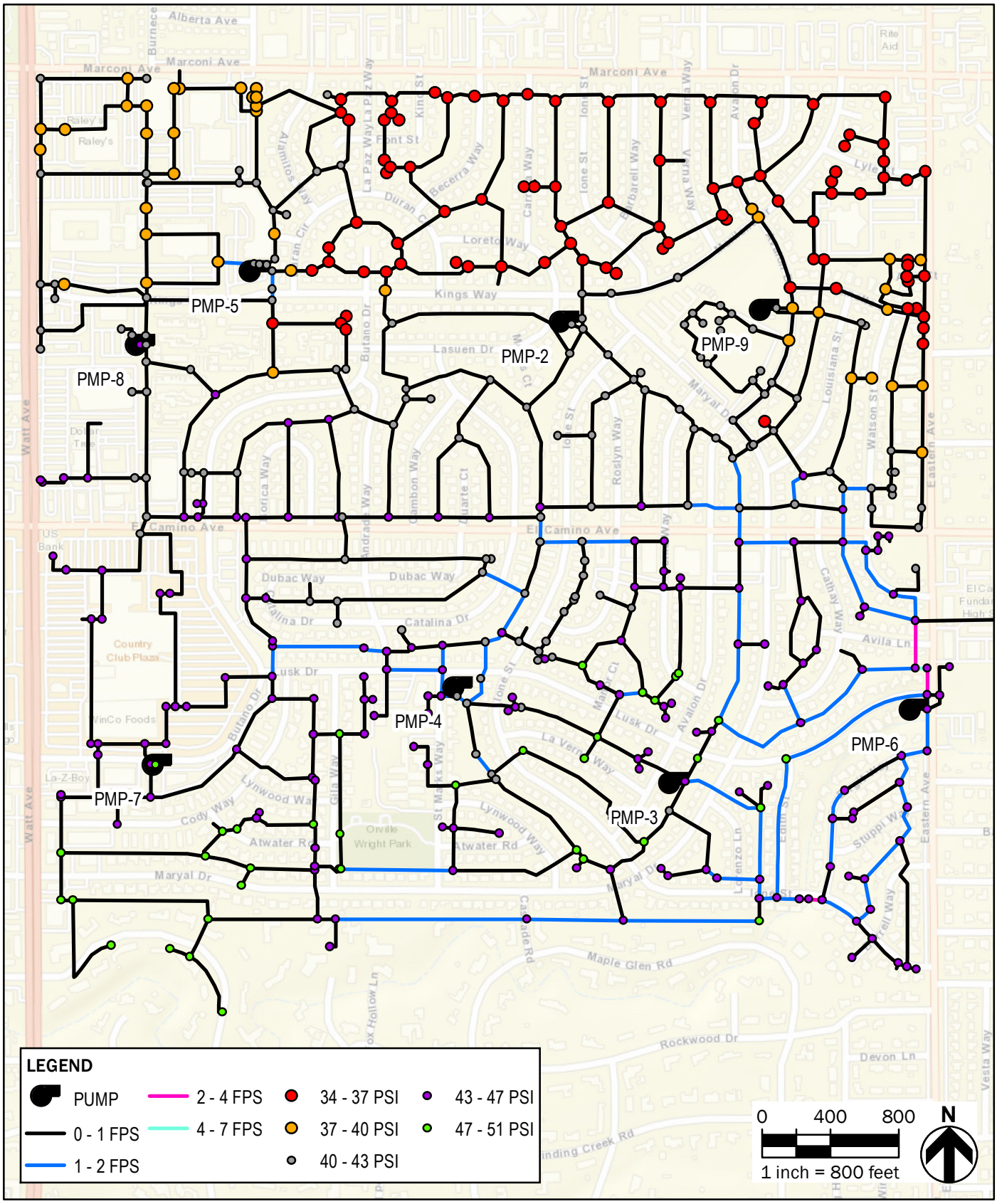


FIGURE A4
DEL PASO MANOR WATER DISTRIBUTION SYSTEM
MDD MIN. PRES. AND MAX. VEL. - PUMP 9 OFF

HydroScience

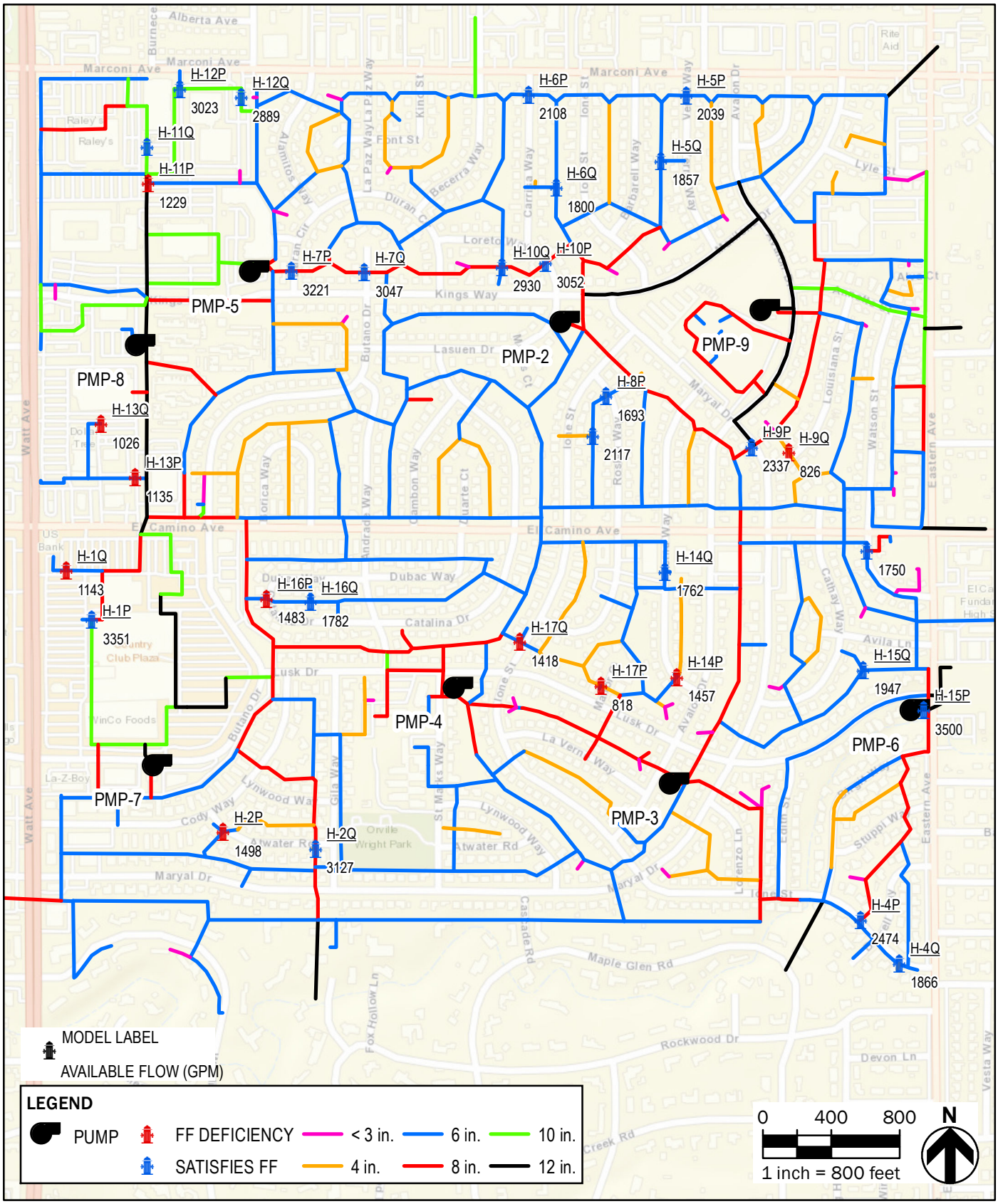


FIGURE A5
DEL PASO MANOR WATER DISTRIBUTION SYSTEM
MDD+FF AVAILABLE FIRE FLOW - NORMAL OPERATIONS

HydroScience

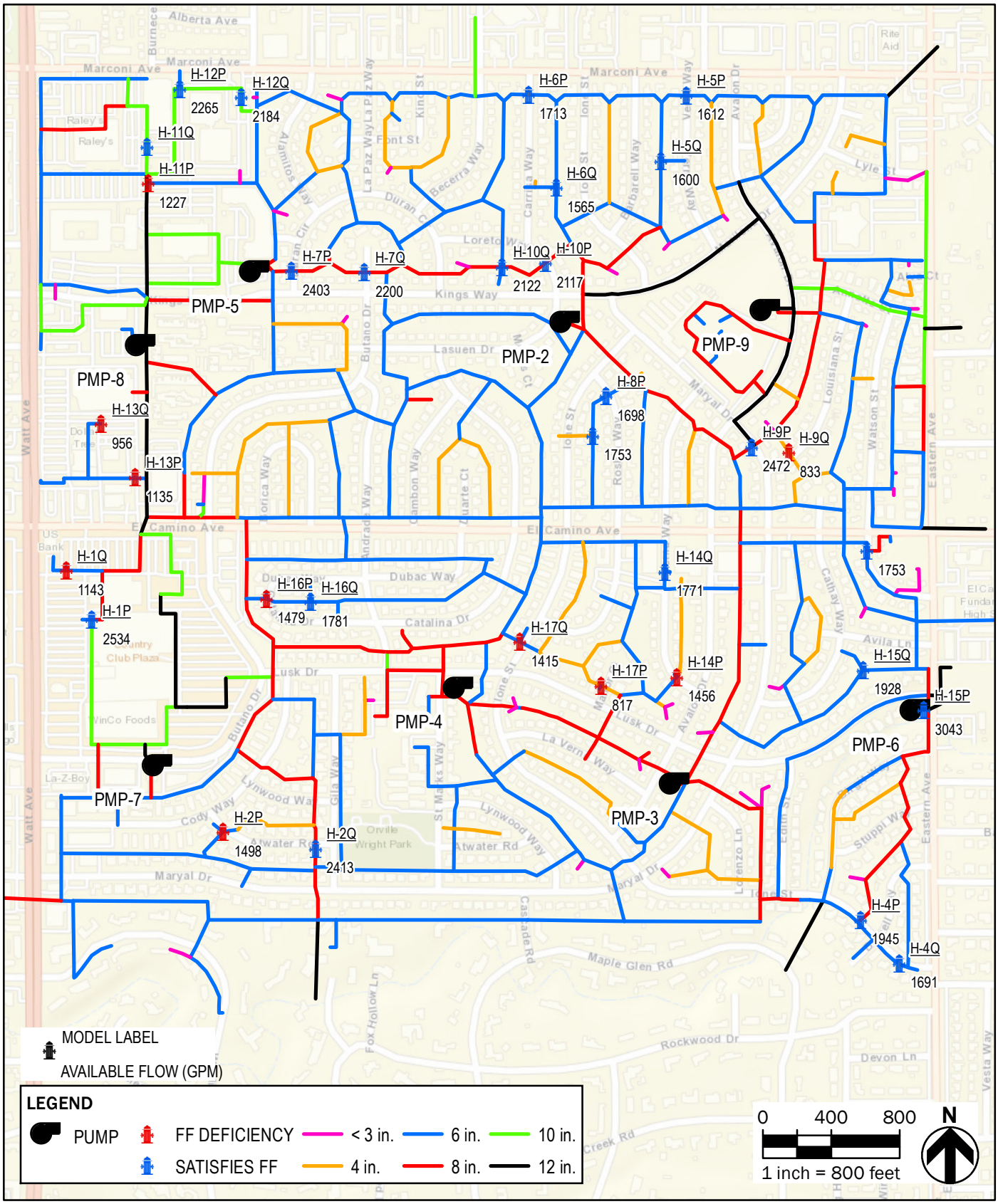


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FIGURE A6
DEL PASO MANOR WATER DISTRIBUTION SYSTEM
MDD+FF AVAILABLE FIRE FLOW - PUMP 9 OFF

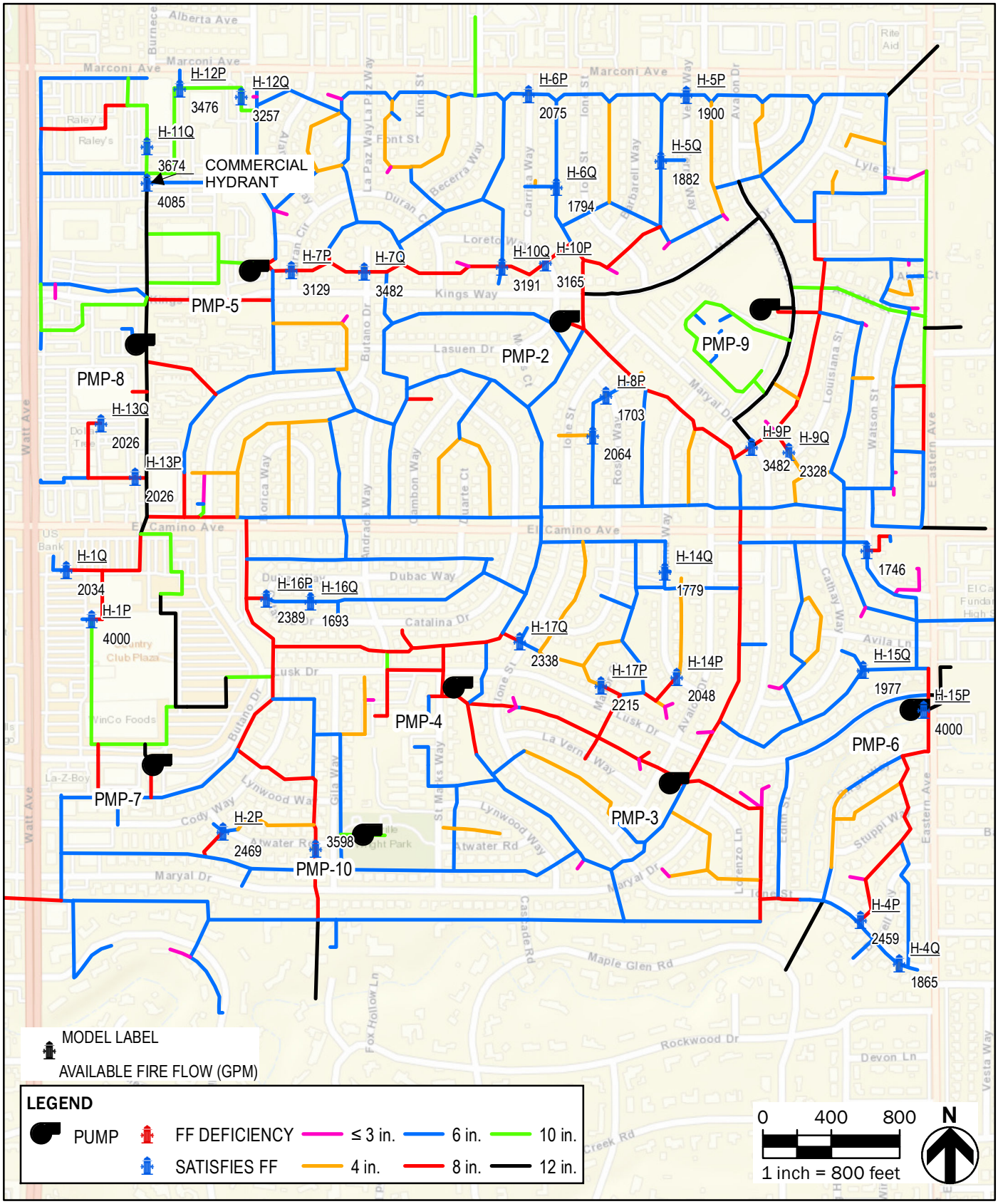

FIGURE A7
DEL PASO WATER DISTRIBUTION SYSTEM
MDD+FF AVAILABLE FIRE FLOW - PUMP 9 OFF - WITH SYSTEM UPGRADES

HydroScience

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J1	86	3	187	44	176	39
J2	62	3	187	54	176	49
J3	62	3	187	54	176	49
J4	90	3	187	42	179	38
J5	88	3	187	43	179	39
J6	62	3	187	54	175	49
J7	62	3	187	54	175	49
J8	68	3	187	51	176	47
J9	68	3	187	51	176	47
J10	74	3	187	49	179	45
J11	73	4	187	49	179	46
J12	71	3	187	50	176	46
J13	86	3	187	44	176	39
J14	86	3	187	44	176	39
J15	71	3	187	50	176	46
J16	71	3	187	50	176	46
J17	87	3	187	43	176	38
J18	87	3	187	43	175	38
J19	87	3	187	43	179	40
J20	87	3	187	43	179	40
J21	70	3	187	51	177	46
J22	70	3	187	51	177	46
J23	70	3	187	51	177	46
J24	70	3	187	51	177	46
J25	87	3	187	43	175	38
J26	70	3	187	51	176	46
J27	70	3	187	51	176	46
J28	60	3	187	55	175	50
J29	76	3	187	48	177	44
J30	76	3	187	48	177	44
J31	60	3	187	55	175	50
J32	70	3	187	51	177	46
J33	70	3	187	51	177	46
J34	70	3	187	51	177	46
J35	70	3	187	51	177	46
J36	70	3	187	51	177	46
J37	68	3	187	51	176	47
J38	68	3	187	51	176	47
J39	62	3	187	54	175	49
J40	62	3	187	54	175	49
J41	64	3	187	53	175	48
J42	87	3	187	43	176	39
J43	86	3	187	44	176	39
J44	90	3	187	42	179	39
J45	90	3	187	42	179	39
J46	76	3	187	48	177	44
J47	90	3	187	42	179	39
J48	68	3	187	52	177	47
J49	74	3	187	49	175	44
J50	74	3	187	49	175	44
J51	68	3	187	52	177	47
J52	76	3	187	48	175	43
J53	76	3	187	48	175	43
J54	86	3	187	44	177	39
J55	86	3	187	44	177	39
J56	90	3	187	42	179	39
J57	90	3	187	42	179	39
J58	76	3	187	48	176	43
J59	76	3	187	48	176	43
J60	76	3	187	48	180	45

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J61	85	3	187	44	180	41
J62	72	3	187	50	177	45
J63	74	3	187	49	177	44
J64	68	3	187	52	176	47
J65	68	3	187	51	176	47
J66	76	3	187	48	175	43
J67	76	3	187	48	175	43
J68	76	3	187	48	175	43
J69	76	3	187	48	175	43
J70	86	3	187	44	176	39
J71	76	3	187	48	176	43
J72	74	3	187	49	175	44
J73	74	3	187	49	175	44
J74	74	3	187	49	177	44
J75	74	3	187	49	177	44
J76	85	3	187	44	179	41
J77	85	3	187	44	179	41
J78	74	3	187	49	177	44
J79	74	3	187	49	177	44
J80	78	3	187	47	175	42
J81	78	3	187	47	175	42
J82	85	3	187	44	179	41
J83	82	3	187	45	179	42
J84	78	3	187	47	175	42
J85	78	3	187	47	175	42
J86	64	3	187	53	177	49
J87	64	3	187	53	177	49
J88	72	3	187	50	176	45
J89	74	3	187	49	176	44
J90	74	3	187	49	176	44
J91	72	3	187	50	177	45
J92	85	3	187	44	176	39
J93	82	3	187	45	179	42
J94	80	3	187	46	175	41
J95	80	3	187	46	175	41
J96	82	3	187	45	179	42
J97	78	3	187	47	179	44
J98	85	3	187	44	176	39
J99	85	3	187	44	176	39
J100	68	3	187	51	176	47
J101	70	3	187	51	177	46
J102	72	3	187	50	177	45
J103	78	3	187	47	180	44
J104	71	3	187	50	180	47
J105	70	3	187	51	176	46
J106	72	3	187	50	176	45
J107	72	3	187	50	176	45
J108	80	3	187	46	175	41
J109	90	3	187	42	179	39
J110	90	3	187	42	179	39
J111	85	3	187	44	179	40
J112	64	3	187	53	177	49
J113	62	3	187	54	177	50
J114	68	3	187	51	175	46
J115	68	3	187	51	175	46
J116	80	3	187	46	176	41
J117	72	3	187	50	176	45
J118	73	3	187	49	176	45
J119	60	3	187	55	176	50
J120	62	3	187	54	176	49

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J121	76	3	187	48	176	43
J122	76	3	187	48	176	43
J123	66	3	187	52	176	48
J124	72	3	187	50	177	45
J125	65	3	188	53	177	48
J126	70	3	187	51	177	46
J127	70	3	187	51	177	46
J128	78	3	187	47	175	42
J129	78	3	187	47	175	42
J130	80	3	187	46	175	41
J131	80	3	187	46	175	41
J132	80	3	187	46	175	41
J133	76	3	187	48	179	45
J134	76	3	187	48	179	45
J135	72	3	187	50	177	45
J136	62	3	187	54	176	49
J137	61	3	187	54	176	50
J138	76	3	187	48	180	45
J139	75	3	187	49	180	45
J140	62	3	187	54	175	49
J141	62	3	187	54	175	49
J142	76	3	187	48	180	45
J143	84	3	187	45	179	41
J144	82	3	187	45	179	42
J145	85	3	187	44	178	40
J146	85	3	187	44	178	40
J147	74	3	187	49	176	44
J148	72	3	187	50	177	45
J149	72	3	187	50	177	45
J150	64	3	187	53	176	49
J151	64	3	187	53	176	49
J152	75	3	187	49	178	45
J153	75	3	187	49	178	45
J154	90	3	187	42	179	39
J155	62	3	187	54	177	50
J156	74	3	187	49	175	44
J157	62	3	187	54	176	49
J158	74	3	187	49	176	44
J159	85	3	187	44	176	40
J160	65	3	187	53	176	48
J161	64	3	187	53	176	48
J162	60	3	187	55	175	50
J163	60	3	187	55	175	50
J164	70	3	187	51	177	46
J165	72	3	187	50	177	45
J166	72	3	187	50	177	45
J167	70	3	187	51	176	46
J168	70	3	187	51	176	46
J169	66	3	187	52	177	48
J170	64	3	187	53	176	49
J171	86	3	187	44	176	39
J172	70	13	187	51	177	46
J173	76	3	187	48	179	45
J174	72	3	187	50	176	45
J175	72	3	187	50	176	45
J176	78	3	187	47	175	42
J177	90	3	187	42	179	39
J178	90	3	187	42	179	39
J179	75	3	187	49	179	45
J180	78	3	187	47	175	42

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J181	78	3	187	47	175	42
J182	70	3	187	51	177	46
J183	72	3	187	50	179	46
J184	62	3	187	54	175	49
J185	62	3	187	54	176	49
J186	62	3	187	54	175	49
J187	62	3	187	54	175	49
J188	70	3	187	51	177	46
J189	70	3	187	51	177	46
J190	68	3	187	52	177	47
J191	68	3	187	51	176	47
J192	70	3	187	51	177	46
J193	70	3	187	51	176	46
J194	72	3	187	50	176	45
J195	72	3	187	50	176	45
J196	90	3	187	42	179	39
J197	70	3	187	51	175	46
J198	70	3	187	51	176	46
J199	62	3	187	54	175	49
J200	62	3	187	54	175	49
J201	62	3	187	54	175	49
J202	64	3	187	53	175	48
J203	72	3	187	50	176	45
J204	68	3	187	52	176	47
J205	72	3	187	50	177	45
J206	72	3	187	50	176	45
J207	62	3	187	54	175	49
J208	64	3	187	53	176	49
J209	62	3	187	54	176	49
J210	86	3	187	44	176	39
J211	74	3	187	49	175	44
J212	64	3	187	53	176	48
J213	86	3	187	44	176	39
J214	74	3	187	49	175	44
J215	68	3	187	52	177	47
J216	68	3	187	52	177	47
J217	74	3	187	49	179	45
J218	72	3	187	50	178	46
J219	72	3	187	50	175	45
J220	64	3	187	53	175	48
J221	74	3	187	49	179	45
J222	74	3	187	49	179	46
J223	90	3	187	42	179	39
J224	86	3	187	44	176	39
J225	73	3	187	49	179	46
J226	73	3	187	49	176	45
J227	68	3	187	51	176	47
J228	68	3	187	51	177	47
J229	66	3	187	52	176	48
J230	62	3	187	54	176	50
J231	73	3	187	49	179	46
J232	86	3	187	44	178	40
J233	62	3	187	54	177	50
J234	86	3	187	44	179	40
J235	72	3	187	50	177	45
J236	74	3	187	49	177	44
J237	86	3	187	44	179	40
J238	86	3	187	44	175	39
J239	73	3	187	49	178	45
J240	73	3	187	49	176	45

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J241	86	3	187	44	179	40
J242	68	3	187	52	177	47
J243	62	3	187	54	177	50
J244	86	3	187	44	177	39
J245	68	3	187	51	175	46
J246	72	3	187	50	175	45
J247	60	3	187	55	175	50
J248	60	3	187	55	175	50
J249	73	3	187	49	178	46
J250	74	3	187	49	175	44
J251	86	3	187	44	177	39
J252	86	3	187	44	176	39
J253	60	3	187	55	175	50
J254	60	3	187	55	175	50
J255	62	3	187	54	176	49
J256	74	3	187	49	176	44
J257	62	3	187	54	176	49
J258	62	3	187	54	176	49
J259	64	3	187	53	176	49
J260	90	3	187	42	179	39
J261	72	3	187	50	176	45
J262	64	3	187	53	176	49
J263	70	3	187	51	177	46
J264	86	3	187	44	176	39
J265	78	3	187	47	175	42
J266	86	3	187	44	176	39
J267	68	3	187	52	177	47
J268	72	3	187	50	179	46
J269	72	3	187	50	179	46
J270	72	3	187	50	177	45
J271	72	3	187	50	176	45
J272	68	3	187	51	176	47
J273	68	3	187	51	176	47
J274	84	3	187	45	179	41
J275	68	3	187	51	176	47
J276	86	3	187	44	178	40
J277	86	3	187	44	178	40
J278	63	3	187	54	176	49
J279	64	3	187	53	176	48
J280	68	3	187	52	177	47
J281	68	3	187	52	177	47
J282	86	3	187	44	176	39
J283	78	3	187	47	175	42
J284	62	3	187	54	175	49
J285	60	3	187	55	175	50
J286	76	3	187	48	175	43
J287	76	3	187	48	175	43
J288	76	3	187	48	175	43
J289	72	3	187	50	177	45
J290	62	3	187	54	176	49
J291	60	3	187	55	175	50
J292	60	3	187	55	176	50
J293	76	3	187	48	175	43
J294	76	3	187	48	175	43
J295	70	3	187	51	178	47
J296	62	3	187	54	175	49
J297	90	3	187	42	179	38
J298	64	3	187	53	176	48
J299	68	3	187	51	176	47
J300	74	3	187	49	176	44

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J301	70	3	187	51	178	47
J302	64	3	187	53	176	48
J303	64	3	187	53	176	49
J304	62	3	187	54	177	50
J305	62	3	187	54	177	50
J306	72	3	187	50	176	45
J307	86	3	187	44	178	40
J308	86	3	187	44	177	39
J309	60	3	187	55	176	50
J310	72	3	187	50	176	45
J311	68	3	187	52	177	47
J312	84	3	187	45	180	41
J313	68	3	187	51	176	47
J314	68	3	187	51	177	47
J315	74	3	187	49	176	44
J316	60	3	187	55	175	50
J317	82	3	187	45	179	42
J318	70	3	187	51	179	47
J319	70	3	187	51	176	46
J320	68	3	187	51	176	47
J321	66	3	187	52	176	47
J322	60	3	187	55	176	50
J323	70	3	187	51	176	46
J324	64	3	187	53	175	48
J325	70	3	187	51	178	47
J326	76	3	187	48	175	43
J327	74	3	187	49	179	45
J328	85	3	187	44	179	41
J329	66	3	187	52	176	47
J330	76	3	187	48	175	43
J331	62	3	187	54	175	49
J332	60	3	187	55	176	50
J333	72	3	187	50	176	45
J334	64	3	187	53	176	48
J335	72	3	187	50	176	45
J336	74	3	187	49	179	45
J337	70	3	187	51	177	46
J338	90	3	187	42	179	39
J339	72	3	187	50	176	45
J340	74	3	187	49	176	44
J341	72	3	187	50	176	45
J342	66	3	187	52	176	48
J343	68	3	187	52	177	47
J344	68	3	187	52	177	47
J345	68	3	187	52	177	47
J346	68	3	187	51	177	47
J347	62	3	187	54	176	50
J348	62	3	187	54	176	49
J349	62	3	187	54	177	50
J350	62	3	187	54	176	50
J351	62	3	187	54	176	50
J352	72	3	187	50	177	45
J353	64	3	188	53	177	49
J354	60	3	187	55	176	50
J355	60	3	187	55	176	50
J356	60	3	187	55	175	50
J357	64	3	187	53	175	48
J358	64	3	187	53	175	48
J359	64	3	187	53	175	48
J360	64	3	187	53	175	48

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J361	64	3	187	53	175	48
J362	64	3	187	53	176	48
J363	68	3	187	52	177	47
J364	76	3	187	48	175	43
J365	76	3	187	48	175	43
J366	86	3	187	44	176	39
J367	86	3	187	44	179	40
J368	74	3	187	49	179	46
J369	70	3	187	51	179	47
J370	86	3	187	44	178	40
J371	86	3	187	44	178	40
J372	76	3	187	48	179	45
J373	85	3	187	44	179	41
J374	62	3	187	54	177	50
J375	62	3	187	54	176	49
J376	72	3	187	50	176	45
J377	72	3	188	50	177	45
J378	62	3	187	54	175	49
J379	72	3	187	50	175	45
J380	73	3	187	49	179	46
J381	68	3	187	52	177	47
J382	70	3	187	51	178	47
J383	76	3	187	48	180	45
J384	74	3	187	49	176	44
J385	86	3	187	44	177	39
J386	74	3	187	49	179	45
J387	90	3	187	42	179	39
J388	78	3	187	47	175	42
J389	72	3	187	50	176	45
J390	91	3	187	42	179	38
J391	80	3	187	46	179	43
J392	84	3	187	45	180	41
J393	85	3	187	44	180	41
J394	83	3	187	45	180	42
J395	80.2	3	187	46	179	43
J396	83	3	187	45	179	42
J397	86	3	187	44	179	40
J398	86.7	3	187	43	176	39
J399	86.6	3	187	44	179	40
J400	85	3	187	44	179	41
J401	86	3	187	44	179	40
J402	70	3	187	51	179	47
J403	75.8	3	187	48	180	45
J404	77.2	3	187	48	180	44
J405	76	3	187	48	180	45
J406	76	3	187	48	180	45
J407	76	3	187	48	180	45
J408	76	3	187	48	180	45
J409	76	21	187	48	180	45
J410	76	3	187	48	180	45
J411	76	3	187	48	180	45
J412	76	3	187	48	180	45
J413	78	3	187	47	175	42
J414	75	3	187	48	175	43
J415	75	3	187	48	175	43
J416	70	3	187	51	176	46
J417	64	3	187	53	175	48
J418	70	3	187	51	176	46
J419	66	3	187	52	175	47
J420	66	3	187	52	175	47

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J421	83.3	3	187	45	179	42
J422	65.2	3	187	53	175	48
J423	64	3	187	53	175	48
J424	64	3	188	53	177	49
J425	70.7	3	187	50	177	46
J426	68.6	3	187	51	177	47
J427	86.9	3	187	43	179	40
J428	72	3	188	50	179	47
J429	90	2	187	42	179	39
J430	90	3	187	42	179	39
J431	63.2	9	187	54	176	49
J432	64	7	187	53	175	48
J433	77	156	187	48	175	43
J434	77.1	8	187	47	175	43
J435	74	13	187	49	175	44
J436	60	10	187	55	176	50
J437	62	19	187	54	175	49
J438	69.7	45	187	51	175	46
J439	72	43	187	50	176	45
J440	78.4	0	187	47	175	42
J441	74	0	187	49	176	44
J442	62	0	187	54	175	49
J443	85	0	187	44	178	40
J444	86	0	187	44	177	40
J445	86	0	187	44	176	39
J446	80.3	0	187	46	176	41
J447	73.2	0	187	49	179	46
J448	69.1	0	187	51	177	47
J449	72.9	0	187	50	177	45
J450	75	5	187	49	179	45
J451	75	0	187	49	179	45
J452	62.8	0	187	54	176	49
J453	75.9	0	187	48	180	45
J454	86	0	187	44	178	40
J455	76	0	187	48	175	43
J456	78.2	0	187	47	175	42
J457	71.7	0	187	50	175	45
J458	62	0	187	54	177	50
J459	66.5	0	187	52	176	47
J460	63.1	0	187	54	177	49
J461	60	0	187	55	175	50
J462	61	0	187	54	175	50
J463	60	0	187	55	176	50
J464	62	0	187	54	175	49
J465	86	0	187	44	176	39
J466	68	0	187	52	177	47
J467	78	0	187	47	180	44
J468	76	0	187	48	175	43
J469	80.5	0	187	46	176	41
J470	60	0	187	55	175	50
J471	76	0	187	48	180	45
J472	76	0	187	48	180	45
J473	76	0	187	48	180	45
J474	76	0	187	48	180	45
J475	70	0	187	51	179	47
J476	75	0	187	49	179	45
J477	72.5	0	187	50	179	46
J478	88.4	0	187	43	179	39
J479	68	0	187	52	177	47
J480	68	0	187	52	177	47

TABLE 1

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J481	68	0	187	52	177	47
J482	68	0	187	52	177	47
J483	68	0	187	52	177	47
J484	79	0	187	47	177	42

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P1	8	12	0.08	0.005	ACP
P2	2	4	0.46	0.692	ACP
P3	2	4	0.46	0.693	ACP
P4	4	4	0.09	0.016	ACP
P5	2	6	0.64	1.3	ACP
P6	2	4	0.46	0.693	ACP
P7	6	33	0.37	0.152	DI
P8	4	15	0.39	0.236	ACP
P9	2	4	0.46	0.693	ACP
P10	2	4	0.46	0.693	ACP
P11	2	4	0.46	0.693	ACP
P12	2	4	0.46	0.692	ACP
P13	4	24	0.62	0.549	ACP
P14	4	24	0.6	0.516	ACP
P15	2	4	0.46	0.692	ACP
P16	2	4	0.46	0.692	ACP
P17	2	4	0.46	0.693	ACP
P18	2	4	0.46	0.693	ACP
P19	8	24	0.15	0.016	PVC
P20	6	4	0.05	0.003	ACP
P21	4	4	0.11	0.024	ACP
P22	4	20	0.52	0.398	ACP
P23	4	9	0.23	0.085	ACP
P24	2	4	0.46	0.692	ACP
P25	6	4	0.05	0.003	ACP
P26	8	4	0.03	0.001	ACP
P27	2	4	0.46	0.692	ACP
P28	2	4	0.46	0.693	ACP
P29	4	4	0.11	0.024	ACP
P30	2	4	0.46	0.693	ACP
P31	4	20	0.51	0.384	ACP
P32	4	8	0.2	0.068	ACP
P33	2	4	0.46	0.693	ACP
P34	2	4	0.46	0.693	ACP
P35	2	4	0.46	0.693	ACP
P36	8	4	0.03	0.001	ACP
P37	4	30	0.76	0.795	ACP
P38	2	4	0.46	0.693	ACP
P39	6	4	0.05	0.003	ACP
P40	2	4	0.46	0.692	ACP
P41	6	0	0	0	ACP
P42	4	33	0.84	0.954	ACP
P43	8	223	1.42	1.544	ACP
P44	10	19	0.08	0.004	ACP
P45	4	4	0.11	0.024	ACP
P46	4	4	0.11	0.021	ACP
P47	8	4	0.03	0.001	ACP
P48	6	4	0.05	0.003	ACP
P49	4	27	0.68	0.648	ACP

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P50	2	2	0.25	0.27	DI
P51	6	0	0	0	ACP
P52	6	42	0.47	0.205	ACP
P53	6	46	0.52	0.288	DI
P54	8	4	0.03	0.001	ACP
P55	6	43	0.48	0.249	DI
P56	4	35	0.89	1.077	ACP
P57	8	37	0.24	0.041	ACP
P58	6	4	0.05	0.003	ACP
P59	10	11	0.05	0.002	ACP
P60	8	149	0.95	0.535	ACP
P61	6	77	0.88	0.648	ACP
P62	6	4	0.05	0.003	PVC
P63	12	309	0.88	0.333	DI
P64	6	4	0.05	0.003	ACP
P65	4	27	0.7	0.681	ACP
P66	12	157	0.44	0.095	DI
P67	6	4	0.05	0.003	ACP
P68	4	18	0.46	0.32	ACP
P69	4	9	0.23	0.085	ACP
P70	6	73	0.83	0.58	ACP
P71	4	9	0.23	0.085	ACP
P72	4	20	0.51	0.378	ACP
P73	4	22	0.56	0.452	ACP
P74	6	16	0.18	0.036	ACP
P75	6	13	0.15	0.025	ACP
P76	6	129	1.47	1.676	ACP
P77	6	37	0.42	0.169	ACP
P78	6	72	0.82	0.574	ACP
P79	4	11	0.28	0.125	ACP
P80	6	28	0.32	0.098	ACP
P81	6	96	1.08	0.96	ACP
P82	6	114	1.3	1.334	ACP
P83	10	45	0.18	0.019	ACP
P84	8	74	0.48	0.149	ACP
P85	4	27	0.7	0.679	ACP
P86	4	7	0.17	0.05	ACP
P87	8	133	0.85	0.436	ACP
P88	6	0	0	0	ACP
P89	6	67	0.76	0.498	ACP
P90	6	88	1	0.821	ACP
P91	4	17	0.44	0.289	ACP
P92	6	37	0.43	0.169	ACP
P93	8	27	0.17	0.031	ACP
P94	4	7	0.17	0.048	ACP
P95	4	14	0.35	0.186	ACP
P96	6	49	0.56	0.28	ACP
P97	6	4	0.05	0.003	ACP
P98	4	49	1.25	2.006	ACP

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P99	8	16	0.1	0.009	ACP
P100	6	87	0.98	0.799	ACP
P101	4	24	0.62	0.745	ACP
P102	4	4	0.11	0.024	ACP
P103	4	4	0.1	0.019	ACP
P104	6	16	0.18	0.04	DI
P105	4	9	0.24	0.096	ACP
P106	6	63	0.71	0.438	ACP
P107	6	3	0.03	0.001	ACP
P108	6	28	0.32	0.102	ACP
P109	12	65	0.19	0.014	PVC
P110	6	105	1.19	1.147	ACP
P111	6	10	0.11	0.014	ACP
P112	6	21	0.24	0.059	ACP
P113	6	24	0.28	0.076	ACP
P114	6	7	0.08	0.008	ACP
P115	6	4	0.05	0.003	ACP
P116	8	21	0.13	0.014	ACP
P117	2	4	0.46	0.692	ACP
P118	8	69	0.44	0.129	ACP
P119	6	13	0.15	0.025	ACP
P120	8	41	0.26	0.05	ACP
P121	2	4	0.46	0.693	ACP
P122	6	79	0.89	0.668	ACP
P123	4	18	0.45	0.305	ACP
P124	4	21	0.53	0.411	ACP
P125	6	64	0.73	0.456	ACP
P126	6	38	0.43	0.172	ACP
P127	6	152	1.73	2.271	ACP
P128	6	127	1.44	1.627	ACP
P129	8	100	0.64	0.258	ACP
P130	2	4	0.46	0.693	ACP
P131	2	4	0.46	0.693	ACP
P132	8	44	0.28	0.057	ACP
P133	8	176	1.12	0.731	ACP
P134	8	132	0.84	0.43	ACP
P135	6	126	1.43	1.61	ACP
P136	4	16	0.42	0.265	ACP
P137	6	35	0.39	0.147	ACP
P138	4	12	0.3	0.146	ACP
P139	6	17	0.19	0.04	ACP
P140	4	13	0.34	0.181	ACP
P141	6	100	1.14	1.049	ACP
P142	6	17	0.19	0.038	ACP
P143	6	14	0.16	0.031	DI
P144	4	15	0.38	0.222	ACP
P145	8	141	0.9	0.488	ACP
P146	8	9	0.06	0.003	ACP
P147	6	47	0.53	0.259	ACP

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P148	4	18	0.46	0.358	DI
P149	6	11	0.12	0.017	ACP
P150	8	34	0.22	0.034	ACP
P151	6	4	0.05	0.003	ACP
P152	6	29	0.33	0.105	ACP
P153	10	67	0.27	0.036	PVC
P154	10	62	0.25	0.031	PVC
P155	12	137	0.39	0.063	ACP
P156	4	13	0.34	0.181	ACP
P157	2	4	0.46	0.693	ACP
P158	8	85	0.55	0.192	ACP
P159	8	274	1.75	1.66	ACP
P160	8	321	2.05	2.581	DI
P161	8	30	0.19	0.028	ACP
P162	8	78	0.5	0.163	ACP
P163	8	69	0.44	0.129	ACP
P164	6	105	1.2	1.15	ACP
P165	6	71	0.8	0.551	ACP
P166	8	36	0.23	0.039	ACP
P167	2	4	0.46	0.693	ACP
P168	8	290	1.85	2.995	Steel
P169	4	4	0.1	0.028	ACP
P170	4	49	1.24	3.215	ACP
P171	6	189	2.14	4.611	ACP
P172	8	152	0.97	0.555	ACP
P173	8	90	0.58	0.212	ACP
P174	6	8	0.09	0.017	Steel
P175	2	4	0.46	0.693	ACP
P176	2	4	0.46	0.692	ACP
P177	2	4	0.46	0.693	ACP
P178	6	13	0.15	0.025	ACP
P179	8	84	0.54	0.187	ACP
P180	8	89	0.57	0.206	ACP
P181	4	23	0.58	0.489	ACP
P182	6	57	0.64	0.364	ACP
P183	6	41	0.47	0.204	ACP
P184	2	4	0.46	0.692	ACP
P185	8	4	0.03	0.001	ACP
P186	8	41	0.26	0.048	ACP
P187	4	4	0.11	0.024	ACP
P188	4	4	0.11	0.024	ACP
P189	8	72	0.46	0.14	ACP
P190	8	327	2.09	2.31	ACP
P191	8	266	1.7	1.577	ACP
P192	8	9	0.06	0.003	PVC
P193	12	4	0.01	0	PVC
P194	8	184	1.17	1.082	ACP
P195	6	4	0.05	0.003	ACP
P196	6	12	0.13	0.019	ACP

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P197	8	27	0.17	0.023	ACP
P198	8	40	0.25	0.047	ACP
P199	6	17	0.19	0.037	ACP
P200	6	28	0.32	0.1	ACP
P201	8	87	0.55	0.198	ACP
P202	8	78	0.5	0.163	ACP
P203	4	10	0.26	0.109	ACP
P204	4	8	0.19	0.063	ACP
P205	8	43	0.27	0.054	ACP
P206	8	53	0.34	0.078	ACP
P207	8	75	0.48	0.151	ACP
P208	8	149	0.95	0.539	ACP
P209	6	0	0	0	ACP
P210	6	38	0.43	0.175	ACP
P211	6	42	0.48	0.212	ACP
P212	6	19	0.21	0.046	ACP
P213	6	78	0.88	0.651	ACP
P214	6	71	0.81	0.558	ACP
P215	6	51	0.58	0.299	ACP
P216	8	156	1	0.588	ACP
P217	8	150	0.96	0.546	ACP
P218	8	179	1.14	0.755	ACP
P219	8	185	1.18	0.804	ACP
P220	6	77	0.87	0.637	ACP
P221	6	57	0.65	0.371	ACP
P222	6	59	0.66	0.387	ACP
P223	6	41	0.47	0.204	ACP
P224	6	33	0.38	0.134	ACP
P225	6	35	0.4	0.151	ACP
P226	6	46	0.52	0.249	ACP
P227	6	84	0.96	0.759	ACP
P228	6	43	0.48	0.215	ACP
P229	6	56	0.64	0.356	ACP
P230	6	58	0.66	0.382	ACP
P231	6	49	0.56	0.281	ACP
P232	3	4	0.2	0.096	ACP
P233	6	4	0.05	0.003	ACP
P234	6	11	0.12	0.016	ACP
P235	6	5	0.05	0.004	ACP
P236	6	8	0.09	0.01	ACP
P237	6	4	0.05	0.004	ACP
P238	6	10	0.11	0.013	ACP
P239	6	16	0.18	0.038	DI
P240	6	7	0.08	0.01	DI
P241	6	28	0.32	0.115	DI
P242	6	15	0.17	0.035	DI
P243	6	20	0.23	0.053	ACP
P244	6	14	0.16	0.027	ACP
P245	4	3	0.07	0.01	ACP

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P246	4	12	0.3	0.143	ACP
P247	8	9	0.06	0.003	ACP
P248	8	16	0.1	0.009	ACP
P249	8	17	0.11	0.01	ACP
P250	6	78	0.89	0.662	ACP
P251	6	41	0.47	0.203	ACP
P252	6	121	1.37	1.474	ACP
P253	6	137	1.55	1.869	ACP
P254	8	125	0.79	0.386	ACP
P255	8	80	0.51	0.17	ACP
P256	4	13	0.32	0.164	ACP
P257	2	10	0.98	2.867	ACP
P258	2	4	0.46	0.692	ACP
P259	6	54	0.62	0.389	DI
P260	6	79	0.9	0.68	ACP
P261	8	115	0.74	0.334	ACP
P262	8	53	0.34	0.08	ACP
P263	6	57	0.65	0.371	ACP
P264	6	4	0.05	0.003	ACP
P265	6	53	0.6	0.317	ACP
P266	6	44	0.49	0.224	ACP
P267	8	36	0.23	0.044	DI
P268	8	47	0.3	0.074	DI
P269	6	48	0.55	0.271	ACP
P270	6	47	0.54	0.261	ACP
P271	6	26	0.29	0.085	ACP
P272	6	26	0.29	0.085	ACP
P273	6	27	0.31	0.095	ACP
P274	6	114	1.3	1.338	ACP
P275	4	25	0.65	0.595	ACP
P276	4	4	0.11	0.024	ACP
P277	6	47	0.53	0.258	ACP
P278	6	70	0.8	0.472	PVC
P279	6	199	2.26	3.746	ACP
P280	6	12	0.14	0.034	Steel
P281	6	56	0.63	0.572	Steel
P282	6	11	0.12	0.018	ACP
P283	6	140	1.59	1.948	ACP
P284	6	73	0.83	0.583	ACP
P285	6	213	2.41	4.217	ACP
P286	6	76	0.86	0.846	ACP
P287	8	23	0.15	0.023	ACP
P288	8	76	0.48	0.21	ACP
P289	6	48	0.54	0.265	ACP
P290	6	53	0.6	0.317	ACP
P291	6	49	0.56	0.282	ACP
P292	6	75	0.85	0.612	ACP
P293	6	91	1.03	0.869	ACP
P294	6	96	1.09	1.309	ACP

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P295	6	31	0.36	0.167	ACP
P296	6	79	0.89	0.67	ACP
P297	6	105	1.19	1.137	ACP
P298	6	35	0.4	0.15	ACP
P299	4	6	0.16	0.043	ACP
P300	4	35	0.9	1.092	ACP
P301	4	26	0.67	0.637	ACP
P302	4	18	0.47	0.321	ACP
P303	4	12	0.31	0.149	ACP
P304	6	93	1.06	0.915	ACP
P305	6	89	1.01	0.836	ACP
P306	6	94	1.07	0.931	ACP
P307	6	88	1	0.821	ACP
P308	6	23	0.27	0.071	ACP
P309	6	74	0.84	0.598	ACP
P310	6	13	0.15	0.029	DI
P311	6	4	0.05	0.004	DI
P312	10	24	0.1	0.006	ACP
P313	12	13	0.04	0.001	ACP
P314	6	2	0.02	0.001	ACP
P315	6	4	0.05	0.003	ACP
P316	6	2	0.03	0.001	ACP
P317	6	22	0.24	0.061	ACP
P318	6	2	0.02	0.001	ACP
P319	6	13	0.14	0.023	ACP
P320	6	8	0.09	0.01	ACP
P321	6	9	0.1	0.012	ACP
P322	12	88	0.25	0.028	ACP
P323	12	85	0.24	0.026	ACP
P324	12	95	0.27	0.033	ACP
P325	6	13	0.15	0.025	ACP
P326	6	9	0.1	0.012	ACP
P327	6	4	0.05	0.003	ACP
P328	8	22	0.14	0.018	ACP
P329	8	22	0.14	0.018	ACP
P330	12	61	0.17	0.014	ACP
P331	12	104	0.3	0.038	ACP
P332	12	126	0.36	0.055	ACP
P333	4	2	0.06	0.009	DI
P334	6	26	0.29	0.085	ACP
P335	6	41	0.47	0.204	ACP
P336	6	13	0.15	0.024	ACP
P337	6	15	0.17	0.031	ACP
P338	8	43	0.27	0.054	ACP
P339	8	155	0.99	0.578	ACP
P340	6	87	0.99	0.804	ACP
P341	6	58	0.66	0.382	ACP
P342	4	19	0.48	0.396	DI
P343	4	17	0.44	0.334	DI

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P344	6	100	1.13	1.033	ACP
P345	6	30	0.34	0.111	ACP
P346	6	53	0.6	0.377	DI
P347	6	46	0.52	0.288	DI
P348	6	127	1.44	1.884	DI
P349	6	73	0.83	0.674	DI
P350	6	82	0.93	0.835	DI
P351	6	88	1	0.954	DI
P352	6	70	0.79	0.619	DI
P353	6	71	0.81	0.647	DI
P354	6	176	2	4.845	Steel
P355	6	24	0.27	0.116	Steel
P356	6	156	1.77	3.855	Steel
P357	6	90	1.03	1.085	ACP
P358	6	69	0.78	0.842	Steel
P359	6	80	0.9	1.11	Steel
P360	6	34	0.38	0.226	Steel
P361	6	231	2.62	7.988	Steel
P362	6	124	1.4	2.513	Steel
P363	8	182	1.16	1.062	ACP
P364	8	330	2.11	3.197	ACP
P365	6	52	0.59	0.308	ACP
P366	6	61	0.69	0.411	ACP
P367	6	12	0.14	0.029	ACP
P368	6	9	0.1	0.017	ACP
P369	6	54	0.61	0.332	ACP
P370	6	98	1.11	1.008	ACP
P371	6	56	0.63	0.351	ACP
P372	6	69	0.79	0.724	ACP
P373	6	59	0.67	0.647	Steel
P374	6	51	0.57	0.479	Steel
P375	8	194	1.24	1.191	ACP
P376	8	185	1.18	1.091	ACP
P377	6	11	0.12	0.018	ACP
P378	6	20	0.23	0.054	ACP
P379	6	9	0.1	0.012	ACP
P380	12	154	0.44	0.079	ACP
P381	12	86	0.25	0.027	ACP
P382	12	75	0.21	0.021	ACP
P383	6	60	0.68	0.407	ACP
P384	6	114	1.29	1.319	ACP
P385	6	107	1.22	1.189	ACP
P386	6	13	0.14	0.023	ACP
P387	4	13	0.34	0.18	ACP
P388	4	21	0.54	0.422	ACP
P389	6	108	1.23	1.203	ACP
P390	6	72	0.82	0.565	ACP
P391	12	161	0.46	0.1	DI
P392	6	79	0.9	0.924	ACP

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P393	6	87	0.98	0.801	ACP
P394	8	114	0.73	0.33	ACP
P395	8	106	0.67	0.284	ACP
P396	10	124	0.51	0.129	ACP
P397	8	4	0.03	0.001	ACP
P398	8	225	1.44	1.155	ACP
P399	8	221	1.41	1.113	ACP
P400	8	34	0.22	0.041	DI
P401	8	54	0.35	0.095	DI
P402	8	204	1.3	1.116	DI
P403	6	4	0.05	0.003	ACP
P404	6	13	0.15	0.024	ACP
P405	8	0	0	0	DI
P406	99	0	0	0	DI
P407	99	598	0.02	0	DI
P408	8	0	0	0	DI
P409	8	0	0	0	DI
P410	8	439	2.8	3.976	DI
P411	8	0	0	0	DI
P412	6	107	1.21	1.177	ACP
P413	6	102	1.16	1.088	ACP
P414	10	(N/A)	(N/A)	(N/A)	DI
P415	8	(N/A)	(N/A)	(N/A)	DI
P416	12	(N/A)	(N/A)	(N/A)	DI
P417	12	(N/A)	(N/A)	(N/A)	DI
P418	6	73	0.83	0.511	PVC
P419	6	76	0.87	0.552	PVC
P420	12	(N/A)	(N/A)	(N/A)	DI
P421	6	18	0.21	0.045	ACP
P422	6	15	0.17	0.032	ACP
P423	12	(N/A)	(N/A)	(N/A)	DI
P424	10	81	0.33	0.095	Steel
P425	10	88	0.36	0.11	Steel
P426	10	165	0.68	0.358	Steel
P427	10	27	0.11	0.007	PVC
P428	12	0	0	0	DI
P429	12	67	0.19	0.017	DI
P430	6	109	1.24	1.233	ACP
P431	8	146	0.93	0.708	ACP
P432	6	45	0.51	0.235	ACP
P433	12	667	1.89	1.388	DI
P434	12	445	1.26	0.656	DI
P435	10	217	0.89	0.365	DI
P436	10	213	0.87	0.351	DI
P437	6	80	0.91	0.608	PVC
P438	6	4	0.05	0.003	PVC
P439	6	16	0.18	0.036	ACP
P440	8	81	0.52	0.176	DI
P441	10	175	0.72	0.245	DI

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P442	12	(N/A)	(N/A)	(N/A)	DI
P443	6	38	0.44	0.177	ACP
P444	10	180	0.73	0.257	DI
P445	10	11	0.04	0.001	DI
P446	6	4	0.05	0.003	DI
P447	12	305	0.87	0.327	DI
P448	12	313	0.89	0.342	DI
P449	12	301	0.85	0.319	DI
P450	12	333	0.95	0.384	DI
P451	12	415	1.18	0.578	DI
P452	8	78	0.5	0.141	PVC
P453	8	64	0.41	0.099	PVC
P454	8	60	0.38	0.087	PVC
P455	8	33	0.21	0.029	PVC
P456	8	27	0.17	0.019	PVC
P457	8	4	0.03	0.001	PVC
P458	6	4	0.05	0.003	PVC
P459	8	89	0.57	0.209	DI
P460	10	38	0.16	0.015	DI
P461	10	41	0.17	0.017	DI
P462	10	36	0.15	0.013	DI
P463	10	27	0.11	0.008	DI
P464	6	4	0.05	0.003	DI
P465	8	123	0.79	0.379	ACP
P466	8	113	0.72	0.322	ACP
P467	4	4	0.11	0.024	ACP
P468	4	12	0.3	0.145	ACP
P469	10	6	0.02	0.001	DI
P470	2	4	0.37	0.323	DI
P471	6	4	0.05	0.003	DI
P472	4	69	1.77	3.823	DI
P473	2	6	0.66	1.384	DI
P474	6	30	0.34	0.112	ACP
P475	6	22	0.25	0.065	ACP
P476	4	4	0.11	0.024	DI
P477	8	288	1.84	2.109	DI
P478	10	145	0.59	0.173	ACP
P479	12	141	0.4	0.067	ACP
P480	4	4	0.11	0.024	ACP
P481	6	4	0.05	0.003	DI
P482	6	60	0.69	0.475	DI
P483	6	15	0.17	0.037	DI
P484	6	83	0.94	0.736	ACP
P485	6	51	0.58	0.297	DI
P486	10	20	0.08	0.004	DI
P487	10	184	0.75	0.269	DI
P488	10	209	0.85	0.338	DI
P489	8	439	2.8	3.976	DI
P490	8	435	2.77	3.901	DI

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P491	8	439	2.8	3.976	DI
P492	8	0	0	0	DI
P493	8	0	0	0	DI
P494	8	598	3.82	7.055	DI
P495	8	598	3.82	7.055	DI
P496	8	0	0	0	DI
P497	8	0	0	0	DI
P498	12	1087	3.08	2.957	ACP
P499	10	1379	5.63	11.171	DI
P500	6	32	0.37	0.13	ACP
P501	6	30	0.34	0.109	ACP
P502	6	39	0.45	0.184	ACP
P503	6	35	0.4	0.148	ACP
P504	6	18	0.2	0.043	ACP
P505	6	4	0.05	0.003	ACP
P506	10	50	0.21	0.024	ACP
P507	10	61	0.25	0.035	ACP
P508	12	16	0.04	0.001	ACP
P509	12	237	0.67	0.176	ACP
P510	6	3	0.03	0.001	ACP
P511	6	15	0.17	0.03	ACP
P512	10	188	0.77	0.279	ACP
P513	10	169	0.69	0.228	ACP
P514	6	33	0.37	0.115	PVC
P515	6	18	0.21	0.039	PVC
P516	8	45	0.28	0.05	PVC
P517	8	25	0.16	0.017	PVC
P518	8	63	0.4	0.109	ACP
P519	8	5	0.03	0.001	ACP
P520	12	63	0.18	0.015	DI
P521	8	4	0.03	0.001	PVC
P522	8	4	0.03	0.001	PVC
P523	6	3	0.04	0.002	ACP
P524	6	3	0.04	0.002	ACP
P525	4	0	0	0	DI
P526	8	18	0.11	0.012	DI
P527	8	18	0.11	0.013	DI
P528	6	4	0.05	0.004	DI
P529	6	4	0.05	0.004	DI
P530	6	0	0	0	DI
P531	6	95	1.08	1.288	ACP
P532	6	95	1.08	1.288	ACP
P533	6	4	0.05	0.005	ACP
P534	6	4	0.05	0.003	ACP
P535	4	0	0	0	ACP
P536	6	142	1.61	2.71	ACP
P537	6	142	1.61	2.711	ACP
P538	8	193	1.23	1.187	ACP
P539	4	0	0	0	DI

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P540	8	218	1.39	1.091	ACP
P541	8	218	1.39	1.091	ACP
P542	4	4	0.11	0.027	ACP
P543	4	4	0.11	0.032	ACP
P544	6	97	1.1	1.227	ACP
P545	6	97	1.1	1.227	ACP
P546	4	52	1.31	3.575	ACP
P547	6	0	0	0	DI
P548	10	28	0.12	0.009	ACP
P549	10	28	0.12	0.008	ACP
P550	10	51	0.21	0.029	DI
P551	10	51	0.21	0.029	DI
P552	6	29	0.33	0.105	ACP
P553	6	29	0.33	0.105	ACP
P554	6	0	0	0	DI
P555	6	34	0.38	0.163	DI
P556	6	34	0.38	0.163	DI
P557	6	0	0	0	DI
P558	6	84	0.95	0.748	ACP
P559	6	89	1.01	0.842	ACP
P560	2	7	0.72	1.6	ACP
P561	8	21	0.13	0.014	ACP
P562	8	21	0.13	0.014	ACP
P563	4	0	0	0	ACP
P564	6	0	0	0	DI
P565	4	0	0	0	DI
P566	8	0	0	0	DI
P567	4	0	0	0	DI
P568	8	320	2.04	2.566	ACP
P569	8	320	2.04	2.566	ACP
P570	6	0	0	0	DI
P571	8	277	1.77	2.308	ACP
P572	8	277	1.77	2.308	ACP
P573	6	0	0	0	DI
P574	6	5	0.05	0.004	ACP
P575	6	5	0.05	0.004	ACP
P576	6	0	0	0	DI
P577	10	48	0.19	0.022	ACP
P578	10	48	0.19	0.022	ACP
P579	6	0	0	0	DI
P580	6	18	0.2	0.043	ACP
P581	6	18	0.2	0.043	ACP
P582	6	0	0	0	DI
P583	6	22	0.25	0.065	ACP
P584	6	22	0.25	0.065	ACP
P585	6	0	0	0	DI
P586	8	0	0	0	DI
P587	6	0	0	0	DI
P588	6	39	0.44	0.184	ACP

TABLE 1

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P589	6	39	0.44	0.184	ACP
P590	6	0	0	0	DI
P591	4	6	0.16	0.044	ACP
P592	4	6	0.16	0.044	ACP
P593	6	0	0	0	DI
P594	8	0	0	0	DI
P595	8	0	0	0	DI
P596	8	0	0	0	DI
P597	8	0	0	0	DI
P598	10	1379	5.63	11.171	DI
P599	8	0	0	0	DI
P600	10	58	0.24	0.027	PVC
P601	10	30	0.12	0.008	PVC
P602	8	35	0.23	0.037	ACP
P603	8	193	1.23	0.871	ACP
P604	8	120	0.77	0.36	ACP
P605	8	253	1.62	1.433	ACP
P606	8	141	0.9	0.485	ACP
P607	8	53	0.34	0.092	ACP
P608	6	69	0.79	0.531	ACP
P609	6	69	0.79	0.531	ACP
P610	6	62	0.71	0.433	ACP
P611	6	62	0.71	0.433	ACP
P612	6	3	0.04	0.002	ACP
P613	6	3	0.04	0.002	ACP
P614	6	0	0	0	DI
P615	4	52	1.31	2.199	DI
P616	8	69	0.44	0.112	PVC
P617	8	69	0.44	0.112	PVC
P618	6	0	0	0	DI
P619	8	73	0.47	0.126	PVC
P620	8	73	0.47	0.126	PVC
P621	6	0	0	0	DI
P622	12	302	0.86	0.321	DI
P623	12	302	0.86	0.321	DI
P624	8	117	0.75	0.401	DI
P625	8	117	0.75	0.401	DI
P626	8	138	0.88	0.469	ACP
P627	8	138	0.88	0.468	ACP
P628	6	36	0.41	0.156	ACP
P629	6	36	0.41	0.156	ACP
P630	6	72	0.81	0.564	ACP
P631	8	0	0	0	DI
P632	8	0	0	0	DI
P633	8	0	0	0	DI
P634	6	0	0	0	DI
P635	6	72	0.81	0.564	ACP
P636	6	72	0.81	0.564	ACP
P637	1	0	0	0	PVC

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J1	86	3	178	40	169	36
J2	62	3	178	50	169	46
J3	62	3	178	50	169	46
J4	90	3	178	38	169	34
J5	88	3	178	39	169	35
J6	62	3	178	50	169	46
J7	62	3	178	50	169	46
J8	68	3	178	48	176	47
J9	68	3	178	48	176	47
J10	74	3	178	45	169	41
J11	73	4	178	45	169	42
J12	71	3	178	46	175	45
J13	86	3	178	40	169	36
J14	86	3	178	40	169	36
J15	71	3	178	46	173	44
J16	71	3	178	46	174	44
J17	87	3	178	39	169	35
J18	87	3	178	39	169	35
J19	87	3	178	39	169	36
J20	87	3	178	39	169	36
J21	70	3	178	47	171	44
J22	70	3	178	47	171	44
J23	70	3	178	47	171	44
J24	70	3	178	47	171	44
J25	87	3	178	39	169	35
J26	70	3	178	47	169	43
J27	70	3	178	47	169	43
J28	60	3	178	51	169	47
J29	76	3	178	44	170	41
J30	76	3	178	44	170	41
J31	60	3	178	51	169	47
J32	70	3	178	47	171	44
J33	70	3	178	47	171	44
J34	70	3	178	47	172	44
J35	70	3	178	47	172	44
J36	70	3	178	47	171	44
J37	68	3	178	48	172	45
J38	68	3	178	48	172	45
J39	62	3	178	50	169	46
J40	62	3	178	50	169	46
J41	64	3	178	49	169	46
J42	87	3	178	39	169	35
J43	86	3	178	40	169	36
J44	90	3	178	38	169	34
J45	90	3	178	38	169	34
J46	76	3	178	44	170	41
J47	90	3	178	38	169	34
J48	68	3	178	48	171	44
J49	74	3	178	45	169	41
J50	74	3	178	45	169	41
J51	68	3	178	48	171	45
J52	76	3	178	44	169	40
J53	76	3	178	44	169	40
J54	86	3	178	40	169	36
J55	86	3	178	40	169	36

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J56	90	3	178	38	169	34
J57	90	3	178	38	169	34
J58	76	3	178	44	169	40
J59	76	3	178	44	169	40
J60	76	3	178	44	169	40
J61	85	3	178	40	169	36
J62	72	3	178	46	170	43
J63	74	3	178	45	170	42
J64	68	3	178	48	172	45
J65	68	3	178	48	172	45
J66	76	3	178	44	169	40
J67	76	3	178	44	169	40
J68	76	3	178	44	169	40
J69	76	3	178	44	169	40
J70	86	3	178	40	169	36
J71	76	3	178	44	169	40
J72	74	3	178	45	169	41
J73	74	3	178	45	169	41
J74	74	3	178	45	170	42
J75	74	3	178	45	170	42
J76	85	3	178	40	169	36
J77	85	3	178	40	169	36
J78	74	3	178	45	171	42
J79	74	3	178	45	170	42
J80	78	3	178	43	169	39
J81	78	3	178	43	169	39
J82	85	3	178	40	169	36
J83	82	3	178	41	169	38
J84	78	3	178	43	169	39
J85	78	3	178	43	169	39
J86	64	3	178	49	171	46
J87	64	3	178	49	171	46
J88	72	3	178	46	169	42
J89	74	3	178	45	175	44
J90	74	3	178	45	175	44
J91	72	3	178	46	170	42
J92	85	3	178	40	169	36
J93	82	3	178	41	169	38
J94	80	3	178	42	169	38
J95	80	3	178	42	169	38
J96	82	3	178	41	169	38
J97	78	3	178	43	169	40
J98	85	3	178	40	169	36
J99	85	3	178	40	169	36
J100	68	3	178	48	176	47
J101	70	3	178	47	170	43
J102	72	3	178	46	170	43
J103	78	3	178	43	169	39
J104	71	3	178	46	169	43
J105	70	3	178	47	176	46
J106	72	3	178	46	169	42
J107	72	3	178	46	169	42
J108	80	3	178	42	169	38
J109	90	3	178	38	169	34
J110	90	3	178	38	169	34

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J111	85	3	178	40	169	36
J112	64	3	178	49	171	46
J113	62	3	178	50	171	47
J114	68	3	178	47	169	44
J115	68	3	178	47	169	44
J116	80	3	178	42	169	38
J117	72	3	178	46	169	42
J118	73	3	178	45	169	42
J119	60	3	178	51	169	47
J120	62	3	178	50	169	46
J121	76	3	178	44	169	40
J122	76	3	178	44	169	40
J123	66	3	178	48	173	46
J124	72	3	179	46	171	43
J125	65	3	179	49	171	46
J126	70	3	178	47	171	44
J127	70	3	178	47	171	44
J128	78	3	178	43	169	39
J129	78	3	178	43	169	39
J130	80	3	178	42	169	38
J131	80	3	178	42	169	38
J132	80	3	178	42	169	38
J133	76	3	178	44	169	40
J134	76	3	178	44	169	40
J135	72	3	178	46	171	43
J136	62	3	178	50	169	47
J137	61	3	178	51	169	47
J138	76	3	178	44	169	40
J139	75	3	178	44	169	41
J140	62	3	178	50	169	46
J141	62	3	178	50	169	46
J142	76	3	178	44	169	40
J143	84	3	178	41	169	37
J144	82	3	178	41	169	38
J145	85	3	178	40	169	36
J146	85	3	178	40	169	36
J147	74	3	178	45	175	44
J148	72	3	178	46	171	43
J149	72	3	178	46	171	43
J150	64	3	178	49	171	46
J151	64	3	178	49	171	46
J152	75	3	178	44	169	41
J153	75	3	178	44	169	41
J154	90	3	178	38	169	34
J155	62	3	178	50	171	47
J156	74	3	178	45	169	41
J157	62	3	178	50	169	46
J158	74	3	178	45	175	44
J159	85	3	178	40	169	36
J160	65	3	178	49	169	45
J161	64	3	178	49	169	46
J162	60	3	178	51	169	47
J163	60	3	178	51	169	47
J164	70	3	178	47	171	44
J165	72	3	178	46	170	42

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J166	72	3	178	46	170	42
J167	70	3	178	47	169	43
J168	70	3	178	47	169	43
J169	66	3	178	48	172	46
J170	64	3	178	49	172	47
J171	86	3	178	40	169	36
J172	70	13	178	47	172	44
J173	76	3	178	44	169	40
J174	72	3	178	46	170	42
J175	72	3	178	46	170	42
J176	78	3	178	43	169	39
J177	90	3	178	38	169	34
J178	90	3	178	38	169	34
J179	75	3	178	44	169	41
J180	78	3	178	43	169	39
J181	78	3	178	43	169	39
J182	70	3	178	47	171	44
J183	72	3	178	46	170	42
J184	62	3	178	50	169	46
J185	62	3	178	50	169	46
J186	62	3	178	50	169	46
J187	62	3	178	50	169	46
J188	70	3	178	47	170	43
J189	70	3	178	47	170	43
J190	68	3	178	47	169	44
J191	68	3	178	47	169	44
J192	70	3	178	47	171	44
J193	70	3	178	47	177	46
J194	72	3	178	46	176	45
J195	72	3	178	46	176	45
J196	90	3	178	38	169	34
J197	70	3	178	47	169	43
J198	70	3	178	47	169	43
J199	62	3	178	50	169	46
J200	62	3	178	50	169	46
J201	62	3	178	50	169	46
J202	64	3	178	49	169	45
J203	72	3	178	46	176	45
J204	68	3	178	48	170	44
J205	72	3	178	46	171	43
J206	72	3	178	46	172	43
J207	62	3	178	50	169	46
J208	64	3	178	49	171	46
J209	62	3	178	50	171	47
J210	86	3	178	40	169	36
J211	74	3	178	45	169	41
J212	64	3	178	49	169	46
J213	86	3	178	40	169	36
J214	74	3	178	45	169	41
J215	68	3	178	48	171	45
J216	68	3	178	48	171	45
J217	74	3	178	45	170	41
J218	72	3	178	46	170	42
J219	72	3	178	46	169	42
J220	64	3	178	49	169	45

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J221	74	3	178	45	169	41
J222	74	3	178	45	169	41
J223	90	3	178	38	169	34
J224	86	3	178	40	169	36
J225	73	3	178	45	169	42
J226	73	3	178	45	169	42
J227	68	3	178	47	169	44
J228	68	3	178	48	173	46
J229	66	3	178	49	170	45
J230	62	3	178	50	170	47
J231	73	3	178	45	169	42
J232	86	3	178	40	169	36
J233	62	3	178	50	171	47
J234	86	3	178	40	169	36
J235	72	3	178	46	169	42
J236	74	3	178	45	169	41
J237	86	3	178	40	169	36
J238	86	3	178	40	169	36
J239	73	3	178	45	170	42
J240	73	3	178	45	171	43
J241	86	3	178	40	169	36
J242	68	3	178	48	171	45
J243	62	3	178	50	171	47
J244	86	3	178	40	169	36
J245	68	3	178	47	169	44
J246	72	3	178	46	169	42
J247	60	3	178	51	169	47
J248	60	3	178	51	169	47
J249	73	3	178	45	170	42
J250	74	3	178	45	169	41
J251	86	3	178	40	169	36
J252	86	3	178	40	169	36
J253	60	3	178	51	169	47
J254	60	3	178	51	169	47
J255	62	3	178	50	169	46
J256	74	3	178	45	175	44
J257	62	3	178	50	171	47
J258	62	3	178	50	171	47
J259	64	3	178	49	170	46
J260	90	3	178	38	169	34
J261	72	3	178	46	171	43
J262	64	3	178	49	171	46
J263	70	3	178	47	170	43
J264	86	3	178	40	169	36
J265	78	3	178	43	169	39
J266	86	3	178	40	169	36
J267	68	3	178	48	171	44
J268	72	3	178	46	169	42
J269	72	3	178	46	169	42
J270	72	3	178	46	169	42
J271	72	3	178	46	169	42
J272	68	3	178	47	169	44
J273	68	3	178	47	169	44
J274	84	3	178	41	169	37
J275	68	3	178	47	169	44

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J276	86	3	178	40	169	36
J277	86	3	178	40	169	36
J278	63	3	178	50	171	47
J279	64	3	178	49	171	46
J280	68	3	178	48	171	44
J281	68	3	178	48	170	44
J282	86	3	178	40	169	36
J283	78	3	178	43	169	39
J284	62	3	178	50	169	46
J285	60	3	178	51	169	47
J286	76	3	178	44	169	40
J287	76	3	178	44	169	40
J288	76	3	178	44	169	40
J289	72	3	178	46	171	43
J290	62	3	178	50	169	46
J291	60	3	178	51	169	47
J292	60	3	178	51	169	47
J293	76	3	178	44	169	40
J294	76	3	178	44	169	40
J295	70	3	178	47	169	43
J296	62	3	178	50	169	46
J297	90	3	178	38	169	34
J298	64	3	178	49	169	46
J299	68	3	178	48	176	47
J300	74	3	178	45	175	44
J301	70	3	178	47	169	43
J302	64	3	178	49	169	45
J303	64	3	178	49	175	48
J304	62	3	178	50	171	47
J305	62	3	178	50	171	47
J306	72	3	178	46	177	45
J307	86	3	178	40	169	36
J308	86	3	178	40	169	36
J309	60	3	178	51	171	48
J310	72	3	178	46	171	43
J311	68	3	178	48	171	44
J312	84	3	178	41	169	37
J313	68	3	178	48	172	45
J314	68	3	178	48	172	45
J315	74	3	178	45	174	43
J316	60	3	178	51	169	47
J317	82	3	178	41	169	38
J318	70	3	178	47	169	43
J319	70	3	178	47	169	43
J320	68	3	178	47	169	44
J321	66	3	178	48	169	45
J322	60	3	178	51	171	48
J323	70	3	178	47	169	43
J324	64	3	178	49	169	45
J325	70	3	178	47	169	43
J326	76	3	178	44	169	40
J327	74	3	178	45	169	41
J328	85	3	178	40	169	36
J329	66	3	178	48	169	45
J330	76	3	178	44	169	40

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J331	62	3	178	50	169	46
J332	60	3	178	51	171	48
J333	72	3	178	46	170	42
J334	64	3	178	49	169	46
J335	72	3	178	46	170	42
J336	74	3	178	45	169	41
J337	70	3	178	47	169	43
J338	90	3	178	38	169	34
J339	72	3	178	46	174	44
J340	74	3	178	45	175	44
J341	72	3	178	46	176	45
J342	66	3	178	48	173	46
J343	68	3	178	48	171	45
J344	68	3	178	48	171	45
J345	68	3	178	48	171	45
J346	68	3	178	48	175	46
J347	62	3	178	50	172	48
J348	62	3	178	50	172	48
J349	62	3	178	50	171	47
J350	62	3	178	50	171	47
J351	62	3	178	50	171	47
J352	72	3	178	46	171	43
J353	64	3	179	50	171	46
J354	60	3	178	51	169	47
J355	60	3	178	51	169	47
J356	60	3	178	51	169	47
J357	64	3	178	49	169	46
J358	64	3	178	49	169	46
J359	64	3	178	49	169	46
J360	64	3	178	49	169	46
J361	64	3	178	49	169	46
J362	64	3	178	49	169	46
J363	68	3	178	48	170	44
J364	76	3	178	44	169	40
J365	76	3	178	44	169	40
J366	86	3	178	40	169	36
J367	86	3	178	40	169	36
J368	74	3	178	45	169	41
J369	70	3	178	47	170	43
J370	86	3	178	40	169	36
J371	86	3	178	40	169	36
J372	76	3	178	44	169	40
J373	85	3	178	40	169	36
J374	62	3	178	50	171	47
J375	62	3	178	50	171	47
J376	72	3	178	46	177	46
J377	72	3	179	46	171	43
J378	62	3	178	50	169	46
J379	72	3	178	46	169	42
J380	73	3	178	45	169	42
J381	68	3	178	48	171	44
J382	70	3	178	47	170	43
J383	76	3	178	44	169	40
J384	74	3	178	45	169	41
J385	86	3	178	40	169	36

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J386	74	3	178	45	169	41
J387	90	3	178	38	169	34
J388	78	3	178	43	169	39
J389	72	3	178	46	177	45
J390	91	3	178	37	169	34
J391	80	3	178	42	169	39
J392	84	3	178	41	169	37
J393	85	3	178	40	169	36
J394	83	3	178	41	169	37
J395	80	3	178	42	169	39
J396	83	3	178	41	169	37
J397	86	3	178	40	169	36
J398	87	3	178	39	169	36
J399	87	3	178	39	169	36
J400	85	3	178	40	169	36
J401	86	3	178	40	169	36
J402	70	3	178	47	169	43
J403	76	3	178	44	169	40
J404	77	3	178	43	169	40
J405	76	3	178	44	169	40
J406	76	3	178	44	169	40
J407	76	3	178	44	169	40
J408	76	3	178	44	169	40
J409	76	21	178	44	169	40
J410	76	3	178	44	169	40
J411	76	3	178	44	169	40
J412	76	3	178	44	169	40
J413	78	3	178	43	169	39
J414	75	3	178	44	169	41
J415	75	3	178	44	169	41
J416	70	3	178	47	169	43
J417	64	3	178	49	169	45
J418	70	3	178	47	169	43
J419	66	3	178	48	169	45
J420	66	3	178	48	169	45
J421	83	3	178	41	169	37
J422	65	3	178	49	169	45
J423	64	3	178	49	169	46
J424	64	3	179	50	171	46
J425	71	3	178	46	171	43
J426	69	3	178	47	171	44
J427	87	3	178	39	169	36
J428	72	3	178	46	169	42
J429	90	2	178	38	169	34
J430	90	3	178	38	169	34
J431	63	9	178	50	171	47
J432	64	7	178	49	169	45
J433	77	156	178	44	169	40
J434	77	8	178	44	169	40
J435	74	13	178	45	169	41
J436	60	10	178	51	169	47
J437	62	19	178	50	169	46
J438	70	45	178	47	169	43
J439	72	43	178	46	177	45
J440	78	0	178	43	169	39

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (Maximum) (ft)	Pressure (Maximum) (psi)	Hydraulic Grade (Minimum) (ft)	Pressure (Minimum) (psi)
J441	74	0	178	45	175	44
J442	62	0	178	50	169	46
J443	85	0	178	40	169	36
J444	86	0	178	40	169	36
J445	86	0	178	40	169	36
J446	80	0	178	42	169	38
J447	73	0	178	45	169	42
J448	69	0	178	47	170	44
J449	73	0	178	46	170	42
J450	75	5	178	44	169	41
J451	75	0	178	44	169	41
J452	63	0	178	50	169	46
J453	76	0	178	44	169	40
J454	86	0	178	40	169	36
J455	76	0	178	44	169	40
J456	78	0	178	43	169	39
J457	72	0	178	46	169	42
J458	62	0	178	50	171	47
J459	67	0	178	48	169	45
J460	63	0	178	50	171	47
J461	60	0	178	51	169	47
J462	61	0	178	50	169	47
J463	60	0	178	51	178	51
J464	62	0	178	50	169	46
J465	86	0	178	40	169	36
J466	68	0	178	48	171	44
J467	78	0	178	43	169	39
J468	76	0	178	44	169	40
J469	81	0	178	42	169	38
J470	60	0	178	51	169	47
J471	76	0	178	44	169	40
J472	76	0	178	44	169	40
J473	76	0	178	44	169	40
J474	76	0	178	44	169	40
J475	70	0	178	47	169	43
J476	75	0	178	44	169	41
J477	73	0	178	46	169	42
J478	88	0	178	39	169	35
J479	68	0	178	48	171	45
J480	68	0	178	48	171	45
J481	68	0	178	48	171	45
J482	68	0	178	48	171	45
J483	68	0	178	48	172	45
J484	79	0	178	43	172	40

TABLE 2

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P1	8	59	0.38	0.097	ACP
P2	2	4	0.46	0.693	ACP
P3	2	4	0.46	0.692	ACP
P4	4	29	0.75	0.773	ACP
P5	2	6	0.64	1.3	ACP
P6	2	4	0.46	0.693	ACP
P7	6	286	3.25	8.47	DI
P8	4	13	0.33	0.166	ACP
P9	2	4	0.46	0.692	ACP
P10	2	4	0.46	0.692	ACP
P11	2	4	0.46	0.693	ACP
P12	2	4	0.46	0.692	ACP
P13	4	19	0.48	0.344	ACP
P14	4	21	0.53	0.408	ACP
P15	2	4	0.46	0.693	ACP
P16	2	4	0.46	0.693	ACP
P17	2	4	0.46	0.692	ACP
P18	2	4	0.46	0.693	ACP
P19	8	68	0.44	0.11	PVC
P20	6	4	0.05	0.003	ACP
P21	4	4	0.11	0.024	ACP
P22	4	24	0.61	0.528	ACP
P23	4	9	0.23	0.085	ACP
P24	2	4	0.46	0.693	ACP
P25	6	4	0.05	0.003	ACP
P26	8	4	0.03	0.001	ACP
P27	2	4	0.46	0.693	ACP
P28	2	4	0.46	0.693	ACP
P29	4	4	0.11	0.024	ACP
P30	2	4	0.46	0.693	ACP
P31	4	31	0.8	0.884	ACP
P32	4	45	1.14	1.679	ACP
P33	2	4	0.46	0.692	ACP
P34	2	4	0.46	0.693	ACP
P35	2	4	0.46	0.693	ACP
P36	8	4	0.03	0.001	ACP
P37	4	18	0.45	0.299	ACP
P38	2	4	0.46	0.692	ACP
P39	6	4	0.05	0.003	ACP
P40	2	4	0.46	0.692	ACP
P41	6	0	0	0	ACP
P42	4	16	0.41	0.257	ACP
P43	8	148	0.95	0.725	ACP
P44	10	18	0.08	0.004	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P45	4	4	0.11	0.024	ACP
P46	4	26	0.66	0.621	ACP
P47	8	4	0.03	0.001	ACP
P48	6	4	0.05	0.003	ACP
P49	4	19	0.48	0.344	ACP
P50	2	1	0.1	0.053	DI
P51	6	0	0	0	ACP
P52	6	101	1.14	1.059	ACP
P53	6	62	0.7	0.493	DI
P54	8	4	0.03	0.001	ACP
P55	6	68	0.77	0.591	DI
P56	4	31	0.8	0.879	ACP
P57	8	283	1.81	1.763	ACP
P58	6	4	0.05	0.003	ACP
P59	10	11	0.04	0.001	ACP
P60	8	28	0.18	0.024	ACP
P61	6	125	1.42	1.575	ACP
P62	6	4	0.05	0.003	PVC
P63	12	118	0.34	0.056	DI
P64	6	4	0.05	0.003	ACP
P65	4	7	0.18	0.056	ACP
P66	12	59	0.17	0.016	DI
P67	6	4	0.05	0.003	ACP
P68	4	27	0.69	0.667	ACP
P69	4	9	0.23	0.085	ACP
P70	6	122	1.38	1.504	ACP
P71	4	9	0.23	0.085	ACP
P72	4	16	0.4	0.248	ACP
P73	4	5	0.14	0.033	ACP
P74	6	24	0.28	0.076	ACP
P75	6	13	0.15	0.025	ACP
P76	6	143	1.62	2.011	ACP
P77	6	49	0.55	0.275	ACP
P78	6	93	1.06	0.913	ACP
P79	4	48	1.23	1.949	ACP
P80	6	43	0.49	0.222	ACP
P81	6	46	0.52	0.248	ACP
P82	6	104	1.18	1.119	ACP
P83	10	25	0.1	0.007	ACP
P84	8	104	0.66	0.276	ACP
P85	4	11	0.27	0.119	ACP
P86	4	34	0.86	1.005	ACP
P87	8	161	1.03	0.619	ACP
P88	6	0	0	0	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P89	6	26	0.3	0.089	ACP
P90	6	78	0.88	0.652	ACP
P91	4	21	0.54	0.429	ACP
P92	6	19	0.21	0.047	ACP
P93	8	25	0.16	0.026	ACP
P94	4	11	0.29	0.131	ACP
P95	4	35	0.9	1.089	ACP
P96	6	57	0.65	0.37	ACP
P97	6	4	0.05	0.003	ACP
P98	4	29	0.73	0.746	ACP
P99	8	51	0.33	0.074	ACP
P100	6	25	0.28	0.08	ACP
P101	4	8	0.22	0.105	ACP
P102	4	4	0.11	0.024	ACP
P103	4	11	0.29	0.134	ACP
P104	6	32	0.37	0.148	DI
P105	4	4	0.09	0.017	ACP
P106	6	97	1.1	0.988	ACP
P107	6	5	0.06	0.004	ACP
P108	6	36	0.41	0.158	ACP
P109	12	136	0.39	0.055	PVC
P110	6	43	0.49	0.222	ACP
P111	6	62	0.7	0.43	ACP
P112	6	147	1.67	2.13	ACP
P113	6	150	1.7	2.213	ACP
P114	6	78	0.89	0.664	ACP
P115	6	4	0.05	0.003	ACP
P116	8	173	1.1	0.706	ACP
P117	2	4	0.46	0.692	ACP
P118	8	360	2.3	2.748	ACP
P119	6	65	0.73	0.464	ACP
P120	8	427	2.72	3.776	ACP
P121	2	4	0.46	0.693	ACP
P122	6	87	0.99	0.804	ACP
P123	4	22	0.56	0.45	ACP
P124	4	19	0.48	0.34	ACP
P125	6	62	0.7	0.429	ACP
P126	6	196	2.22	3.628	ACP
P127	6	493	5.6	20.025	ACP
P128	6	294	3.34	7.683	ACP
P129	8	228	1.46	1.184	ACP
P130	2	4	0.46	0.693	ACP
P131	2	4	0.46	0.693	ACP
P132	8	136	0.87	0.451	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P133	8	92	0.58	0.218	ACP
P134	8	145	0.92	0.51	ACP
P135	6	141	1.6	1.964	ACP
P136	4	15	0.37	0.212	ACP
P137	6	59	0.67	0.395	ACP
P138	4	14	0.36	0.197	ACP
P139	6	42	0.48	0.209	ACP
P140	4	13	0.34	0.181	ACP
P141	6	47	0.53	0.256	ACP
P142	6	18	0.2	0.043	ACP
P143	6	17	0.19	0.043	DI
P144	4	16	0.42	0.266	ACP
P145	8	117	0.75	0.345	ACP
P146	8	9	0.06	0.003	ACP
P147	6	71	0.81	0.553	ACP
P148	4	18	0.46	0.358	DI
P149	6	26	0.29	0.083	ACP
P150	8	21	0.13	0.014	ACP
P151	6	4	0.05	0.003	ACP
P152	6	34	0.39	0.145	ACP
P153	10	57	0.23	0.027	PVC
P154	10	52	0.21	0.023	PVC
P155	12	189	0.54	0.116	ACP
P156	4	13	0.34	0.181	ACP
P157	2	4	0.46	0.693	ACP
P158	8	116	0.74	0.339	ACP
P159	8	135	0.86	0.446	ACP
P160	8	254	1.62	1.674	DI
P161	8	46	0.29	0.061	ACP
P162	8	45	0.29	0.058	ACP
P163	8	68	0.43	0.125	ACP
P164	6	39	0.44	0.183	ACP
P165	6	41	0.46	0.196	ACP
P166	8	34	0.22	0.034	ACP
P167	2	4	0.46	0.693	ACP
P168	8	86	0.55	0.314	Steel
P169	4	3	0.07	0.015	ACP
P170	4	40	1.01	2.19	ACP
P171	6	143	1.62	2.742	ACP
P172	8	25	0.16	0.02	ACP
P173	8	70	0.45	0.132	ACP
P174	6	23	0.26	0.11	Steel
P175	2	4	0.46	0.693	ACP
P176	2	4	0.46	0.692	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P177	2	4	0.46	0.693	ACP
P178	6	13	0.15	0.025	ACP
P179	8	43	0.27	0.053	ACP
P180	8	46	0.29	0.061	ACP
P181	4	8	0.19	0.063	ACP
P182	6	17	0.19	0.037	ACP
P183	6	71	0.81	0.555	ACP
P184	2	4	0.46	0.693	ACP
P185	8	4	0.03	0.001	ACP
P186	8	134	0.86	0.444	ACP
P187	4	4	0.11	0.023	ACP
P188	4	4	0.11	0.024	ACP
P189	8	364	2.32	2.812	ACP
P190	8	339	2.17	2.469	ACP
P191	8	349	2.23	2.601	ACP
P192	8	9	0.06	0.003	PVC
P193	12	4	0.01	0	PVC
P194	8	79	0.51	0.229	ACP
P195	6	4	0.05	0.003	ACP
P196	6	48	0.54	0.267	ACP
P197	8	181	1.16	0.775	ACP
P198	8	248	1.58	1.38	ACP
P199	6	214	2.43	4.261	ACP
P200	6	289	3.28	7.45	ACP
P201	8	238	1.52	1.275	ACP
P202	8	288	1.84	1.824	ACP
P203	4	60	1.54	2.93	ACP
P204	4	81	2.08	5.143	ACP
P205	8	252	1.61	1.426	ACP
P206	8	291	1.85	1.852	ACP
P207	8	712	4.54	9.725	ACP
P208	8	496	3.17	4.989	ACP
P209	6	0	0	0	ACP
P210	6	97	1.1	0.982	ACP
P211	6	193	2.19	3.523	ACP
P212	6	19	0.21	0.046	ACP
P213	6	138	1.56	1.881	ACP
P214	6	144	1.63	2.041	ACP
P215	6	122	1.39	1.513	ACP
P216	8	170	1.08	0.685	ACP
P217	8	176	1.12	0.732	ACP
P218	8	89	0.57	0.205	ACP
P219	8	83	0.53	0.184	ACP
P220	6	30	0.34	0.112	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P221	6	42	0.48	0.209	ACP
P222	6	62	0.7	0.426	ACP
P223	6	132	1.5	1.756	ACP
P224	6	35	0.39	0.146	ACP
P225	6	65	0.74	0.469	ACP
P226	6	69	0.78	0.525	ACP
P227	6	125	1.42	1.58	ACP
P228	6	59	0.67	0.395	ACP
P229	6	69	0.78	0.518	ACP
P230	6	94	1.07	0.931	ACP
P231	6	88	1	0.821	ACP
P232	3	4	0.2	0.096	ACP
P233	6	4	0.05	0.003	ACP
P234	6	24	0.27	0.073	ACP
P235	6	18	0.2	0.042	ACP
P236	6	15	0.16	0.029	ACP
P237	6	4	0.05	0.004	ACP
P238	6	38	0.43	0.173	ACP
P239	6	32	0.36	0.145	DI
P240	6	21	0.24	0.068	DI
P241	6	37	0.42	0.188	DI
P242	6	27	0.31	0.11	DI
P243	6	28	0.32	0.101	ACP
P244	6	27	0.3	0.089	ACP
P245	4	4	0.11	0.023	ACP
P246	4	11	0.29	0.134	ACP
P247	8	62	0.4	0.107	ACP
P248	8	49	0.31	0.068	ACP
P249	8	11	0.07	0.004	ACP
P250	6	84	0.95	0.754	ACP
P251	6	45	0.51	0.234	ACP
P252	6	97	1.1	0.979	ACP
P253	6	116	1.31	1.37	ACP
P254	8	139	0.89	0.475	ACP
P255	8	95	0.61	0.233	ACP
P256	4	17	0.42	0.271	ACP
P257	2	14	1.38	5.411	ACP
P258	2	4	0.46	0.692	ACP
P259	6	67	0.76	0.574	DI
P260	6	147	1.67	2.13	ACP
P261	8	176	1.12	0.731	ACP
P262	8	70	0.45	0.133	ACP
P263	6	61	0.7	0.423	ACP
P264	6	4	0.05	0.004	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P265	6	39	0.45	0.185	ACP
P266	6	33	0.38	0.135	ACP
P267	8	89	0.57	0.239	DI
P268	8	116	0.74	0.391	DI
P269	6	55	0.63	0.348	ACP
P270	6	7	0.08	0.008	ACP
P271	6	106	1.2	1.153	ACP
P272	6	44	0.5	0.232	ACP
P273	6	97	1.1	0.989	ACP
P274	6	36	0.41	0.16	ACP
P275	4	23	0.59	0.496	ACP
P276	4	4	0.11	0.024	ACP
P277	6	50	0.56	0.284	ACP
P278	6	55	0.63	0.302	PVC
P279	6	221	2.51	4.529	ACP
P280	6	30	0.34	0.179	Steel
P281	6	20	0.22	0.082	Steel
P282	6	11	0.12	0.017	ACP
P283	6	126	1.43	1.597	ACP
P284	6	68	0.77	0.506	ACP
P285	6	188	2.14	3.365	ACP
P286	6	59	0.67	0.54	ACP
P287	8	15	0.1	0.011	ACP
P288	8	39	0.25	0.062	ACP
P289	6	14	0.16	0.028	ACP
P290	6	27	0.31	0.094	ACP
P291	6	21	0.24	0.06	ACP
P292	6	21	0.24	0.058	ACP
P293	6	26	0.3	0.088	ACP
P294	6	27	0.3	0.125	ACP
P295	6	16	0.19	0.05	ACP
P296	6	25	0.28	0.08	ACP
P297	6	24	0.28	0.076	ACP
P298	6	22	0.25	0.065	ACP
P299	4	4	0.11	0.023	ACP
P300	4	15	0.37	0.212	ACP
P301	4	8	0.21	0.077	ACP
P302	4	6	0.16	0.043	ACP
P303	4	13	0.34	0.181	ACP
P304	6	29	0.33	0.104	ACP
P305	6	26	0.29	0.084	ACP
P306	6	38	0.43	0.175	ACP
P307	6	44	0.5	0.23	ACP
P308	6	39	0.44	0.182	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P309	6	13	0.14	0.023	ACP
P310	6	13	0.15	0.029	DI
P311	6	4	0.05	0.004	DI
P312	10	23	0.09	0.006	ACP
P313	12	58	0.17	0.013	ACP
P314	6	2	0.02	0.001	ACP
P315	6	4	0.05	0.003	ACP
P316	6	3	0.03	0.001	ACP
P317	6	24	0.28	0.076	ACP
P318	6	1	0.01	0	ACP
P319	6	13	0.15	0.025	ACP
P320	6	9	0.1	0.012	ACP
P321	6	9	0.1	0.012	ACP
P322	12	200	0.57	0.128	ACP
P323	12	197	0.56	0.125	ACP
P324	12	202	0.57	0.131	ACP
P325	6	13	0.15	0.025	ACP
P326	6	9	0.1	0.012	ACP
P327	6	4	0.05	0.003	ACP
P328	8	59	0.38	0.112	ACP
P329	8	65	0.42	0.135	ACP
P330	12	182	0.52	0.108	ACP
P331	12	208	0.59	0.138	ACP
P332	12	223	0.63	0.158	ACP
P333	4	7	0.18	0.064	DI
P334	6	43	0.49	0.219	ACP
P335	6	25	0.29	0.082	ACP
P336	6	33	0.38	0.137	ACP
P337	6	48	0.54	0.264	ACP
P338	8	66	0.42	0.119	ACP
P339	8	275	1.75	1.667	ACP
P340	6	62	0.7	0.429	ACP
P341	6	40	0.45	0.19	ACP
P342	4	4	0.11	0.027	DI
P343	4	5	0.13	0.036	DI
P344	6	32	0.37	0.129	ACP
P345	6	33	0.37	0.131	ACP
P346	6	12	0.14	0.025	DI
P347	6	15	0.17	0.037	DI
P348	6	111	1.26	1.464	DI
P349	6	48	0.54	0.305	DI
P350	6	18	0.21	0.051	DI
P351	6	40	0.46	0.223	DI
P352	6	68	0.77	0.594	DI

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P353	6	50	0.57	0.334	DI
P354	6	71	0.81	0.907	Steel
P355	6	47	0.53	0.414	Steel
P356	6	37	0.41	0.263	Steel
P357	6	36	0.4	0.193	ACP
P358	6	17	0.19	0.064	Steel
P359	6	95	1.08	1.551	Steel
P360	6	63	0.72	0.731	Steel
P361	6	46	0.52	0.399	Steel
P362	6	26	0.29	0.139	Steel
P363	8	75	0.48	0.205	ACP
P364	8	114	0.73	0.449	ACP
P365	6	18	0.2	0.042	ACP
P366	6	16	0.18	0.035	ACP
P367	6	6	0.06	0.007	ACP
P368	6	10	0.11	0.02	ACP
P369	6	32	0.36	0.124	ACP
P370	6	34	0.38	0.139	ACP
P371	6	14	0.15	0.026	ACP
P372	6	20	0.23	0.072	ACP
P373	6	20	0.23	0.09	Steel
P374	6	14	0.16	0.046	Steel
P375	8	57	0.36	0.123	ACP
P376	8	63	0.4	0.148	ACP
P377	6	5	0.06	0.004	ACP
P378	6	10	0.11	0.013	ACP
P379	6	9	0.1	0.012	ACP
P380	12	150	0.42	0.075	ACP
P381	12	163	0.46	0.088	ACP
P382	12	187	0.53	0.114	ACP
P383	6	31	0.35	0.118	ACP
P384	6	17	0.19	0.038	ACP
P385	6	23	0.26	0.068	ACP
P386	6	35	0.4	0.15	ACP
P387	4	15	0.39	0.227	ACP
P388	4	7	0.17	0.05	ACP
P389	6	25	0.28	0.079	ACP
P390	6	40	0.46	0.195	ACP
P391	12	62	0.18	0.017	DI
P392	6	58	0.66	0.524	ACP
P393	6	52	0.59	0.313	ACP
P394	8	119	0.76	0.353	ACP
P395	8	113	0.72	0.32	ACP
P396	10	155	0.63	0.194	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P397	8	4	0.03	0.001	ACP
P398	8	264	1.69	1.552	ACP
P399	8	261	1.67	1.519	ACP
P400	8	92	0.59	0.255	DI
P401	8	34	0.22	0.041	DI
P402	8	166	1.06	0.762	DI
P403	6	5	0.06	0.005	ACP
P404	6	27	0.31	0.094	ACP
P405	8	0	0	0	DI
P406	99	0	0	0	DI
P407	99	628	0.03	0	DI
P408	8	0	0	0	DI
P409	8	709	4.53	9.664	DI
P410	8	0	0	0	DI
P411	8	1080	6.89	21.066	DI
P412	6	32	0.37	0.13	ACP
P413	6	29	0.33	0.108	ACP
P414	10	(N/A)	(N/A)	(N/A)	DI
P415	8	(N/A)	(N/A)	(N/A)	DI
P416	12	(N/A)	(N/A)	(N/A)	DI
P417	12	(N/A)	(N/A)	(N/A)	DI
P418	6	52	0.59	0.271	PVC
P419	6	49	0.56	0.242	PVC
P420	12	(N/A)	(N/A)	(N/A)	DI
P421	6	12	0.13	0.02	ACP
P422	6	16	0.18	0.036	ACP
P423	12	(N/A)	(N/A)	(N/A)	DI
P424	10	167	0.68	0.363	Steel
P425	10	169	0.69	0.371	Steel
P426	10	340	1.39	1.358	Steel
P427	10	71	0.29	0.04	PVC
P428	12	0	0	0	DI
P429	12	67	0.19	0.017	DI
P430	6	33	0.37	0.132	ACP
P431	8	76	0.49	0.212	ACP
P432	6	30	0.34	0.11	ACP
P433	12	88	0.25	0.033	DI
P434	12	119	0.34	0.057	DI
P435	10	34	0.14	0.012	DI
P436	10	37	0.15	0.014	DI
P437	6	46	0.52	0.215	PVC
P438	6	4	0.05	0.003	PVC
P439	6	23	0.26	0.066	ACP
P440	8	27	0.17	0.022	DI

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P441	10	63	0.26	0.037	DI
P442	12	(N/A)	(N/A)	(N/A)	DI
P443	6	52	0.59	0.307	ACP
P444	10	60	0.25	0.034	DI
P445	10	8	0.03	0.001	DI
P446	6	4	0.05	0.003	DI
P447	12	62	0.18	0.017	DI
P448	12	115	0.33	0.054	DI
P449	12	78	0.22	0.026	DI
P450	12	82	0.23	0.029	DI
P451	12	70	0.2	0.021	DI
P452	8	22	0.14	0.014	PVC
P453	8	9	0.06	0.003	PVC
P454	8	5	0.03	0.001	PVC
P455	8	30	0.19	0.025	PVC
P456	8	39	0.25	0.039	PVC
P457	8	4	0.03	0.001	PVC
P458	6	4	0.05	0.003	PVC
P459	8	40	0.25	0.046	DI
P460	10	31	0.13	0.01	DI
P461	10	28	0.12	0.008	DI
P462	10	38	0.15	0.014	DI
P463	10	29	0.12	0.009	DI
P464	6	4	0.05	0.003	DI
P465	8	101	0.65	0.263	ACP
P466	8	94	0.6	0.229	ACP
P467	4	4	0.11	0.024	ACP
P468	4	8	0.21	0.074	ACP
P469	10	10	0.04	0.001	DI
P470	2	2	0.21	0.17	DI
P471	6	4	0.05	0.003	DI
P472	4	22	0.57	0.462	DI
P473	2	4	0.42	0.597	DI
P474	6	10	0.12	0.015	ACP
P475	6	16	0.19	0.037	ACP
P476	4	4	0.11	0.024	DI
P477	8	24	0.15	0.021	DI
P478	10	196	0.8	0.3	ACP
P479	12	192	0.55	0.12	ACP
P480	4	4	0.11	0.024	ACP
P481	6	4	0.05	0.003	DI
P482	6	61	0.69	0.48	DI
P483	6	56	0.63	0.412	DI
P484	6	49	0.55	0.277	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P485	6	21	0.24	0.059	DI
P486	10	17	0.07	0.003	DI
P487	10	57	0.23	0.031	DI
P488	10	41	0.17	0.016	DI
P489	8	0	0	0	DI
P490	8	4	0.03	0.001	DI
P491	8	0	0	0	DI
P492	8	0	0	0	DI
P493	8	0	0	0	DI
P494	8	628	4.01	7.724	DI
P495	8	628	4.01	7.724	DI
P496	8	709	4.53	9.663	DI
P497	8	709	4.53	9.664	DI
P498	12	21	0.06	0.002	ACP
P499	10	0	0	0	DI
P500	6	13	0.14	0.023	ACP
P501	6	11	0.12	0.016	ACP
P502	6	18	0.2	0.042	ACP
P503	6	15	0.17	0.03	ACP
P504	6	18	0.2	0.043	ACP
P505	6	4	0.05	0.003	ACP
P506	10	126	0.51	0.132	ACP
P507	10	133	0.54	0.147	ACP
P508	12	76	0.21	0.021	ACP
P509	12	302	0.86	0.276	ACP
P510	6	5	0.05	0.004	ACP
P511	6	16	0.18	0.034	ACP
P512	10	345	1.41	0.859	ACP
P513	10	365	1.49	0.951	ACP
P514	6	51	0.58	0.262	PVC
P515	6	41	0.47	0.174	PVC
P516	8	35	0.22	0.032	PVC
P517	8	50	0.32	0.062	PVC
P518	8	46	0.3	0.062	ACP
P519	8	34	0.22	0.035	ACP
P520	12	63	0.18	0.015	DI
P521	8	3	0.02	0	PVC
P522	8	3	0.02	0	PVC
P523	6	54	0.61	0.335	ACP
P524	6	54	0.61	0.335	ACP
P525	4	0	0	0	DI
P526	8	169	1.08	0.787	DI
P527	8	169	1.08	0.787	DI
P528	6	4	0.05	0.004	DI

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P529	6	4	0.05	0.004	DI
P530	6	0	0	0	DI
P531	6	26	0.3	0.12	ACP
P532	6	26	0.3	0.121	ACP
P533	6	4	0.05	0.005	ACP
P534	6	4	0.05	0.003	ACP
P535	4	0	0	0	ACP
P536	6	38	0.43	0.237	ACP
P537	6	38	0.43	0.237	ACP
P538	8	97	0.62	0.331	ACP
P539	4	0	0	0	DI
P540	8	153	0.97	0.562	ACP
P541	8	153	0.97	0.562	ACP
P542	4	4	0.11	0.027	ACP
P543	4	4	0.11	0.032	ACP
P544	6	29	0.33	0.135	ACP
P545	6	29	0.33	0.135	ACP
P546	4	34	0.88	1.683	ACP
P547	6	0	0	0	DI
P548	10	27	0.11	0.008	ACP
P549	10	27	0.11	0.008	ACP
P550	10	19	0.08	0.005	DI
P551	10	19	0.08	0.005	DI
P552	6	47	0.54	0.262	ACP
P553	6	47	0.54	0.263	ACP
P554	6	0	0	0	DI
P555	6	44	0.5	0.265	DI
P556	6	44	0.5	0.265	DI
P557	6	0	0	0	DI
P558	6	57	0.65	0.37	ACP
P559	6	52	0.59	0.313	ACP
P560	2	7	0.72	1.599	ACP
P561	8	76	0.48	0.154	ACP
P562	8	76	0.48	0.154	ACP
P563	4	0	0	0	ACP
P564	6	0	0	0	DI
P565	4	0	0	0	DI
P566	8	0	0	0	DI
P567	4	0	0	0	DI
P568	8	132	0.84	0.501	ACP
P569	8	132	0.84	0.501	ACP
P570	6	0	0	0	DI
P571	8	72	0.46	0.193	ACP
P572	8	72	0.46	0.193	ACP

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P573	6	0	0	0	DI
P574	6	13	0.14	0.023	ACP
P575	6	13	0.14	0.024	ACP
P576	6	0	0	0	DI
P577	10	22	0.09	0.005	ACP
P578	10	22	0.09	0.006	ACP
P579	6	0	0	0	DI
P580	6	18	0.2	0.043	ACP
P581	6	18	0.2	0.043	ACP
P582	6	0	0	0	DI
P583	6	26	0.3	0.087	ACP
P584	6	26	0.3	0.087	ACP
P585	6	0	0	0	DI
P586	8	1080	6.89	21.066	DI
P587	6	0	0	0	DI
P588	6	30	0.34	0.113	ACP
P589	6	30	0.34	0.113	ACP
P590	6	0	0	0	DI
P591	4	30	0.78	0.831	ACP
P592	4	30	0.78	0.831	ACP
P593	6	0	0	0	DI
P594	8	0	0	0	DI
P595	8	0	0	0	DI
P596	8	0	0	0	DI
P597	8	0	0	0	DI
P598	10	0	0	0	DI
P599	8	1080	6.89	21.066	DI
P600	10	48	0.2	0.019	PVC
P601	10	74	0.3	0.044	PVC
P602	8	56	0.36	0.088	ACP
P603	8	97	0.62	0.243	ACP
P604	8	179	1.14	0.755	ACP
P605	8	340	2.17	2.475	ACP
P606	8	51	0.33	0.074	ACP
P607	8	29	0.19	0.03	ACP
P608	6	118	1.33	1.406	ACP
P609	6	118	1.33	1.406	ACP
P610	6	60	0.69	0.411	ACP
P611	6	60	0.69	0.411	ACP
P612	6	2	0.03	0.001	ACP
P613	6	2	0.03	0.001	ACP
P614	6	0	0	0	DI
P615	4	34	0.88	1.035	DI
P616	8	13	0.09	0.005	PVC

TABLE 2

Label	Diam. (in)	Flow (Max.) (gpm)	Vel. (Max.) (fps)	Headloss Gradient (ft/1000ft)	Material
P617	8	13	0.09	0.005	PVC
P618	6	0	0	0	DI
P619	8	18	0.11	0.009	PVC
P620	8	18	0.11	0.009	PVC
P621	6	0	0	0	DI
P622	12	65	0.19	0.019	DI
P623	12	65	0.19	0.019	DI
P624	8	30	0.19	0.031	DI
P625	8	30	0.19	0.031	DI
P626	8	93	0.59	0.225	ACP
P627	8	93	0.59	0.225	ACP
P628	6	13	0.14	0.023	ACP
P629	6	13	0.14	0.023	ACP
P630	6	134	1.52	1.801	ACP
P631	8	0	0	0	DI
P632	8	0	0	0	DI
P633	8	0	0	0	DI
P634	6	0	0	0	DI
P635	6	134	1.52	1.801	ACP
P636	6	134	1.52	1.801	ACP
P637	1	0	0	0	PVC

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Resid. @ Total Flow Needed) (psi)	Vel. of Max. Pipe (fps)	Satisfies Fire Flow Constraints?
H-11P	1500	1229	38	13	FALSE
H-13P	1500	1135	44	13	FALSE
H-13Q	1500	1026	-3	12	FALSE
H-14P	1500	1457	33	13	FALSE
H-16P	1500	1483	46	13	FALSE
H-17P	1500	818	19	13	FALSE
H-17Q	1500	1418	35	13	FALSE
H-1Q	1500	1143	34	13	FALSE
H-2P	1500	1498	35	13	FALSE
H-9Q	1500	826	17	13	FALSE
DUTCH BRO HYDRANT	1500	1750	44	13	TRUE
H-10P	1500	3052	36	11	TRUE
H-10Q	1500	2930	36	8	TRUE
H-11Q	1500	3248	38	12	TRUE
H-12P	1500	3023	36	8	TRUE
H-12Q	1500	2889	35	8	TRUE
H-14Q	1500	1762	39	13	TRUE
H-15P	1500	3500	51	11	TRUE
H-15Q	1500	1947	44	13	TRUE
H-16Q	1500	1782	38	13	TRUE
H-1P	1500	3351	43	8	TRUE
H-2Q	1500	3127	42	11	TRUE
H-4P	1500	2474	38	13	TRUE
H-4Q	1500	1866	29	13	TRUE
H-5P	1500	2039	27	12	TRUE
H-5Q	1500	1857	27	11	TRUE
H-6P	1500	2108	29	12	TRUE
H-6Q	1500	1800	26	12	TRUE
H-7P	1500	3221	37	13	TRUE
H-7Q	1500	3047	35	10	TRUE
H-8P	1500	1693	36	13	TRUE
H-8Q	1500	2117	32	12	TRUE
H-9P	1500	2337	43	13	TRUE

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Resid. @ Total Flow Needed) (psi)	Vel. of Max. Pipe (fps)	Satisfies Fire Flow Constraints?
H-11P	1500	1227	38	13	FALSE
H-13P	1500	1135	44	13	FALSE
H-13Q	1500	1026	-3	12	FALSE
H-14P	1500	1456	30	13	FALSE
H-16P	1500	1479	37	13	FALSE
H-17P	1500	817	17	13	FALSE
H-17Q	1500	1415	34	13	FALSE
H-1Q	1500	1143	26	13	FALSE
H-2P	1500	1498	26	13	FALSE
H-9Q	1500	826	17	13	FALSE
DUTCH BRO HYDRANT	1500	1753	36	13	TRUE
H-10P	1500	2117	32	8	TRUE
H-10Q	1500	2122	32	8	TRUE
H-11Q	1500	3248	38	12	TRUE
H-12P	1500	2265	35	9	TRUE
H-12Q	1500	2889	35	8	TRUE
H-14Q	1500	1771	36	13	TRUE
H-15P	1500	3043	49	12	TRUE
H-15Q	1500	1928	36	13	TRUE
H-16Q	1500	1781	29	13	TRUE
H-1P	1500	2534	42	9	TRUE
H-2Q	1500	2413	41	9	TRUE
H-4P	1500	2474	38	13	TRUE
H-4Q	1500	1691	27	12	TRUE
H-5P	1500	2039	27	12	TRUE
H-5Q	1500	1600	23	9	TRUE
H-6P	1500	1713	25	10	TRUE
H-6Q	1500	1565	22	11	TRUE
H-7P	1500	2403	36	10	TRUE
H-7Q	1500	2200	33	8	TRUE
H-8P	1500	1698	32	13	TRUE
H-8Q	1500	1753	28	10	TRUE
H-9P	1500	2472	38	9	TRUE

Notes	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Resid. @ Total Flow Needed) (psi)	Vel. of Max Pipe (fps)	Satisfies Fire Flow Constraints?
DUTCH BRO HYDRANT	1500	1746	39.3	12.99	TRUE
H-10P	1500	3165	38.1	11.38	TRUE
H-10Q	1500	3191	38.3	8.41	TRUE
H-11P	3500	4085	29.2	9.52	TRUE
H-11Q	1500	3674	45.5	13	TRUE
H-12P	1500	3476	49.4	9.67	TRUE
H-12Q	1500	3257	48	8.63	TRUE
H-13P	1500	2026	48.4	13	TRUE
H-13Q	1500	2026	35.3	13	TRUE
H-14P	1500	2048	42.4	13	TRUE
H-14Q	1500	1779	40.8	12.99	TRUE
H-15P	1500	4000	51.1	6.04	TRUE
H-15Q	1500	1977	38.9	13.01	TRUE
H-16P	1500	2389	49.4	12.99	TRUE
H-16Q	1500	1693	39.4	13	TRUE
H-17P	1500	2215	45.9	13.01	TRUE
H-17Q	1500	2338	44.1	13	TRUE
H-1P	1500	4000	52.4	10.49	TRUE
H-1Q	1500	2034	47.7	13	TRUE
H-2P	1500	2469	42.4	12.68	TRUE
H-2Q	1500	3598	52.6	13	TRUE
H-4P	1500	2459	38	13.01	TRUE
H-4Q	1500	1865	29.5	13	TRUE
H-5P	1500	1900	28.3	11.66	TRUE
H-5Q	1500	1882	28.4	11.05	TRUE
H-6P	1500	2075	31.4	12.27	TRUE
H-6Q	1500	1794	27.6	12.2	TRUE
H-7P	1500	3129	44.9	13	TRUE
H-7Q	1500	3482	39.5	11.14	TRUE
H-8P	1500	1703	37.2	13	TRUE
H-8Q	1500	2064	33.1	12.01	TRUE
H-9P	1500	3482	43.6	13	TRUE
H-9Q	1500	2328	42	13	TRUE

ATTACHMENT B
SWRQB 2019 Inspection Report

State Water Resources Control Board

January 28, 2020

PWS No. 3410007

Ken Ingle
Operator
Del Paso Manor County Water District
1817 Maryal Drive, Suite 300
Sacramento, CA 95864

2019 COMPLIANCE INSPECTION OF THE DEL PASO MANOR COUNTY WATER DISTRICT PUBLIC WATER SYSTEM (PWS No. 3410007)

On December 4, 2019, Michael Tolin of the California State Water Resources Control Board Division of Drinking Water, accompanied by you inspected the Del Paso Manor County Water District domestic water system (PWS No. 3410007).

Attached to this letter you will find a copy of the Compliance Inspection Report that documents inspection findings. **Please review the enclosed report and respond to the items listed in both the report and the Compliance Inspection Findings section (Appendix A) by the indicated response deadlines.**

If you have any questions, or if we can be of any assistance, please do not hesitate to contact Michael Tolin at (916) 552-9995, or by email at Michael.tolin@waterboards.ca.gov.

Sincerely,

Ali R. Rezvani, P.E.
Sacramento District Engineer
Division of Drinking Water
STATE WATER RESOURCES CONTROL BOARD

cc: Michael Tolin, P.E. – Associate Sanitary Engineer, DDW, SWRCB

State Water Resources Control Board
Division of Drinking Water
Compliance Inspection Report / Sanitary Survey

Purveyor: Del Paso Manor County Water District (Del Paso) **System Number:** 3410007
Person(s) Contacted/Title(s): Ken Ingle, Operations and Maintenance Technician
District Engineer: Ali R. Rezvani, P.E.
Reviewing Engineer: Michael Tolin, P.E. **Inspection Date(s):** December 4, 2019
Last Inspection/Inspector: October 3, 2017, Austin Peterson, P.E.

EXECUTIVE SUMMARY

MCL Exceedances:

Has the water system had a water quality exceedance since the last inspection (Yes/No): Yes
Has the water system had an operational failure since the last inspection (Yes/No): Yes
If the water system had a water quality exceedance or an operational failure since the last inspection, has DDW issued enforcement actions (Yes/No): No.

Enforcement Actions Since the Last Inspection:

Date	Number	Reason	Resolved (Yes/No)	Comments

Short discussion: According to the 2018 electronic Annual Report, Del Paso Manor WD received 11 complaints about a recorded water outage (see table 22).

Permit:

Is the water system permit up-to-date (Yes/No): Yes
Does the water system have pending permit or permit amendment(s) application with DDW (Yes/No): No
If the water system needs new permit(s) or permit amendment(s), has water system submitted an application to DDW (Yes/No): No

Pending Permits:

Application Date	Number	Type	Reason	Documents Received (Yes/No)	Comments

Short discussion:

Improvements:

Does the water system have on-going or future planned improvement projects (Yes/No): Unknown
If the water system has on-going or future planned improvement projects, do they need a permit from DDW (Yes/No): Unknown

Improvement Plans:

Project Name	Permit Required (Yes/No)	Waiver Required (Yes/No)	Comments

Short discussion: Reportedly, the DPMWD Board is reviewing the July 24, 2009, Master Plan and completing amendments to the plan. DPMWD shall provide DDW with an estimated date when the Board will complete the amendments to the Master Plan.

Noted Deficiencies:
Has the water system responded to previously noted deficiencies (Yes/No): Yes

Did the inspection reveal new deficiencies (Yes/No): Yes
Short discussion:

Recommendations and Important Issues:

Are there any recommendations or important issues (Yes/No): Yes
Short discussion:

A. INTRODUCTION

1. Permit Status

Full Permit: Permit No. 77-035, issued on June 27, 1977
Permit Amendment(s): Permit Amendment No. 01-09-05-PER-004, issued on May 25, 2005, to add Well 8 as an approved source of supply. Permit Amendment No. 01-09-11-PER-009 (the permit amendment number was later modified to be Permit Amendment 01-09-11-PER-014), was issued June 21, 2011, to inactivate Well 1 and add Well 9.

Table 1 - Permit Summary

Permit Number	Permit Type	Permit Date	Comments
Unknown	Full	March 29, 1957	Five wells supplying drinking water to 1,410 service connections.
77-035	Full	June 27, 1977	Permitted Wells 1, 2, 3, 4, 5, 6 (chlorinated) and 7, five pressure tanks and one interconnection with Arcade County Water District.
01-09-05-PER-004	A	May 25, 2005	Added Well 8. In service since 1978.
01-09-11-PER-014	A	June 21, 2011	Replaced Well 1 with new Well 9
01-09-14-PER-012	A	May 30, 2014	Removed Well 6 and added Well 6B.
01-09-18-PER-012	A	June 6, 2018	Changed Well 3 to a standby source.

Public Water System Classification: Community Water System
Permit Condition Compliance: Permit conditions are complied with.

Permit Conditions for 01-09-05-PER-004:

a) Well No. 8 shall be disinfected at all times.

b) The District shall continue quarterly monitoring for total and fecal coliform bacteria of the raw water produced by Well No. 8. The test results shall be reported by the 10th day of the month following the sampling month. If these organisms are detected in any of the samples collected pursuant to this condition, the District shall notify the Department (now State Water Resources Control Board, Division of Drinking Water) and shall follow up on the detections in a manner prescribed by the Department. The District shall report any detections of fecal coliform and/or e. coli bacteria to the Department (now State Water Resources Control Board, Division of Drinking Water) within 24 hours after being notified of the results.

c) The District shall submit to the Department (now State Water Resources Control Board, Division of Drinking Water) an Annual Report on the status and condition of the system as directed by the Department.

Permit Conditions for 01-09-11-PER-014:

a) Prior to placing Well No. 9 in service, DPMC shall disinfect, flush, and sample the facility and interconnecting pipeline per Section 64580 and Section 64583, Title 22 of the California Code of Regulations (CCR) of the CDPH's (now State Water Resources Control Board, Division of Drinking Water) Water Works Standards and the American Water Works Association (AWWA) standards;

b) Prior to connecting Well No. 9 to the distribution system, DPMC shall provide evidence to CDPH (now State Water Resources Control Board, Division of Drinking Water) that the water quality, including total coliform and E. coli laboratory results, are absent;

c) DPMC shall conduct routine monitoring of raw and treated water at the new well site and treatment facility per state and federal drinking water regulations. Well No. 9 routing sampling shall be integrated into the long-term monitoring schedule for DPMC. Quarterly total coliform and E. coli testing shall be conducted during the first year of operation at Well No. 9 – Raw (3410007-015). Annual VOC sampling shall be conducted at Well No. 9 - Raw (3410007-015);

d) Well No. 9 and treatment system shall only be operated up to the flow rate of 1,500 gallons per minute;

e) Wellhead treatment shall be operating when Well No. 9 is active and supplying water to the DPMC distribution system.

Permit Conditions for 01-09-14-PER-012:

a) The District shall comply with all the requirements set forth in the California Safe Drinking Water Act, California Health and Safety Code and any regulations, standards or orders adopted thereunder.

b) The following water sources are approved for domestic water supply use:

Table 2 - Domestic Water Supply Sources to be Permitted

Sources	Type	PS Code	Status
Well 2	Groundwater	3410007-002	Active
Well 3	Groundwater	3410007-003	Active
Well 4	Groundwater	3410007-004	Active
Well 5	Groundwater	3410007-005	Active
Well 7	Groundwater	3410007-007	Active
Well 8	Groundwater	3410007-008	Active
Well 9	Groundwater	3410007-009	Active
Well 6B	Groundwater	3410007-017	Active

c) No changes, additions, or modifications shall be made to the sources, treatment processes, and reservoirs as permitted unless an amended water supply permit has been obtained from the Department (now State Water Resources Control Board, Division of Drinking Water).

d) All personnel who operate the treatment and distribution system facilities shall be certified in accordance with Article 2, Chapter 13, Title 22, California Code of Regulations. The District's distribution system is classified as a D2 system and as such, the minimum certification requirement of Chief Operator is D3 and the minimum certification of Shift Operator is D2.

e) All materials, including well appurtenances, in contact with drinking water must be tested and certified as meeting the specification of ANSI/NSF Standard 60 or 61. This requirement shall be met under testing conducted by a product certification organization accredited for this purpose by the American National Standards Institute.

f) The District shall operate the water system in its entirety in accordance with the most recent Operation and Maintenance Plan reviewed by the Department (now State Water Resources Control Board, Division of Drinking Water).

g) The District shall develop and submit an updated Operations and Maintenance Plan that includes, at minimum, description of current facilities, standard operations, routine maintenance, routine and compliance monitoring, contingency, and reporting/notification plans.

h) The District shall continue to submit to the Department (now State Water Resources Control Board, Division of Drinking Water) an Annual Report on the status and condition of the system as directed by the Department (now State Water Resources Control Board, Division of Drinking Water).

Permit Conditions for 01-09-18-PER-012:

a) The Water System shall comply with all the requirements set forth in the California Safe Drinking Water Act, California Health and Safety Code and any regulations, standards or orders adopted thereunder.

b) The status of the following source codes have been changed from "Active" to "Standby":

Table 3 - Source(s) changed from "Active" to "Standby"

Sources	Type	PS Code	Status
Well 3 - Raw	Groundwater	3410007-003	Standby
Well 3 - Treated	Groundwater	3410007-014	Standby

c) The Water System shall operate the water system in its entirety in accordance with the most recent Operation and Maintenance Plan reviewed and approved by the Division.

d) The Water System shall apply and secure a water supply permit prior to putting Well 3 - Raw (PS Code 3410007-003) back into service as an "Active" source.

e) The Water System shall operate and monitor the water quality of the Well 3 - Raw (PS Code 3410007-003) in accordance with Section 64414, Article 2, Chapter 15, Division 4, Title 22 of the CCR.

f) The Water System shall monitor the bacteriological raw water quality of Well 3 - Raw (PS Code 3410007-003) once every calendar quarter.

g) The Water System disinfect the raw water produced by Well 3 - Raw (PS Code 3410007-003) prior to distribution and use.

Discussion and Appraisal: The Domestic Water Supply Permit for Del Paso Manor County Water District (Del Paso) is current. All known active sources except for interties are permitted.

2. System Changes

Changes Since Last Annual Inspection: Removal 205-feet of 4-inch Transite pipeline and replacement with 6-in DIP pipeline.

Planned Future Changes: None reported on the 2018 electronic Annual Report. After the inspection, the Operator submitted an email with a list of planned projects. The following is a list projects that are currently planned:

- Well 8 – Odell Pumps will install the rebuilt right angle drive necessary for running the well during a power outage.
- Well 2 – the operator is working with contractors to finalize costs and work on scheduling the pulling of the pump, tv examination of the well casing and any repairs required. This will start in January 2020. Since there have been positive coliform results (absent of E. Coli) for the last two quarters, the contractors and staff will look for possible cause and solutions at that time.
- Well 3 – parts are on order for the chemical feed system and repairs should be completed by the end of December 2019.
- Well 7 – corrections identified during inspection will be made once temporary help is obtained. SCADA and PLC have been ordered and are in the engineering/design stage. Completing by spring of 2020.

- Well 5 – This well was scheduled to be pulled and the hole in the casing assessed this fiscal year 2018/2019 but well 8 has pushed back the schedule to pull Well 2 and has used up more of their O&M budget and so Well 5 may have to be moved to the 2019/2020 budget.
- Our 2018 rate increase called for Wells 4 and 9 to be pulled and assessed in fiscal year 2020/2021, site paving and tank inspections in FY 2021/2022 and pull and assess Well 6b in FY 2022/2023.
- Reportedly at this time, the water system does not have any Master Plan projects planned.

3. Enforcement History

Discussion and Appraisal: There have been no enforcement actions since Del Paso failed the total coliform MCL in June 2006.

4. Consumer and Production Data

Available Historic Data: As reported by Del Paso in the Annual Reports to the Division.

Table 4 - Water System Historic Data

Year	Connections (Total/metered)	Pop. Served	Water Use (MG) Maximum Month MG	Month	Total (year)	Max. Daily Demand (MG) [A]	Peak Hourly Demand (gpm and gpm/sc) [B]
2005	1,787 (87)	4,458	85.9	August	539.7	4.2	4,300/ 2.4
2006	1,788 (83)	4,458	83.1	August	538.8	4.0	4,200/ 2.3
2007	1,795 (92)	4,458	72.4	August	533.7	3.5	3,600/ 2.0
2008	1,795 (92)	4,458	72.4	August	533.7	3.5	3,600/ 2.0
2009	1,797 (95)	4,458	71.3	August	490.1	3.5	3,600/ 2.0
2010	1,797 (95)	4,458	73.6	August	459.1	3.6	3,700/ 2.1
2011	1,797 (95)	4,458	89.1	Sept	465.1	4.5	4,600/ 2.6
2012	1,797 (95)	4,458	92.3	August	488.3	4.5	4,700/ 2.6
2013	1,702 (97)	4,458	69.2	July	511.9	3.3	3,500/ 2.0
2014	1,697 (96)	4,520	58.6	July	405.8	2.8	3,000/ 1.7
2015	1,793 (98)	4,520	45.0	July	342.6	2.2	2,300/ 1.3
2016	1,794 (99)	4,520	55.3	Sept	367.7	1.5	1,600/ 0.9
2017	1,795 (101)	4,520	61.0	August	403.8	2.1	2,200/ 1.2
2018	1,795 (101)	4,520	57.2	August	399.5	1.7	1,700/ 1.0
Avg.			72.4		473.0	3.4	

Notes: A Maximum Daily Demand is estimated from maximum monthly usage and a factor of 1.5
B Peak Hourly Demand is estimated using a peaking factor of 1.5 (Section 64554). Service connection=sc.

Discussion and Appraisal: The reported number of service connections and population served has remained consistent over the years. The Del Paso water system is reportedly at build-out and surrounded by other water systems. Water production has fluctuated up and down with no drastic changes in recent years. Water use went down as a result of the drought in 2014 and 2015 and appears to have gone up slightly in 2016 as compared to 2015. Time will tell what the new normal water demand will be going forward. In all likelihood, some water use habits (such as sweeping driveways as opposed to washing them down) that came out of the drought will remain. Also, drought tolerant landscaping likely replaced more water intensive landscaping during the drought ultimately keeping future peak demands lower than in the past.

B. SOURCES

1. Approved Sources:

Current approved sources are Wells 2-9 as permitted in the full permit 77-035 and subsequent amendments. The SCADA system is solely used for monitoring.

Table 5 - Drinking Water Sources

Sources	Status	Capacity (gpm)	Comments
Well 2 (3410007-002)	Active	600	Constructed in 1948. Located in a residential area protected by a locked wood and chain-link fenced perimeter. The site is protected by a locked chain link fence. Raw sampling tap is located off the air release valve. Chlorine is injected at well effluent line downstream of check-valve and delivers water to an onsite pressure tank. Electrical hook up for portable generator. Site has SCADA equipment.
Well 3 (341007-003)	Standby	675	Constructed in 1949. Located in a residential area protected by a locked wood and chain-link fenced perimeter. Pedestal is low and should be raised during the next well rehabilitation. Raw sampling tap is located off the air release valve. Chlorine is injected at well discharge line downstream of check-valve immediately before delivering water to an onsite pressure tank. Site has SCADA equipment. use somewhere else
Well 4 (3410007-004)	Active	550	Constructed in 1951. Located in a residential area protected by a locked wood and chain-link fenced perimeter. Raw sampling tap is located on the well discharge line near the air release valve. Chlorine is injected into the onsite pressure tank. Electrical hook up for portable generator. Site has SCADA equipment.
Well 5 (3410007-005)	Active	525	Constructed in 1955. Located in a commercial parking lot with brick-fenced perimeter. Pedestal is low and should be raised during the next well rehabilitation. Raw sampling tap is located downstream of the check valve and chlorine injection quill. Water is delivered to the onsite pressure tank. Site has SCADA equipment. The hydropneumatic tank drain valve had a small leak.
Well 7 (3410007-007) VFD	Active	675	Constructed in 1956. Located in a locked subsurface vault in a commercial parking lot. Pedestal is low with a sump pump within the vault to prevent flooding. Water is delivered directly to the distribution system. Well is reportedly last in the operations schedule, rarely being used. Next due for rehabilitation or replacement.
Well 8 (3410007-008) VFD	Active	1,100	Constructed in 1977. Located in a commercial parking lot with locked chain-link fenced perimeter. Pedestal appears in good condition and seems to have adequate seals with motor base. Raw water sampling tap was relocated to upstream of the chlorine injection quill. Water is delivered directly to the distribution system. The motor is run by a variable frequency drive and there is SCADA equipment on site.
Well 9 (3410007-015) VFD	Active	400-1,500	Constructed in 2010. Located in a school yard brick building protected by an iron fenced perimeter. Pedestal is in good condition. Raw sampling tap is located on the well discharge line near the air release valve. Chlorine is injected downstream of the check valve into the well discharge line which feeds directly to the distribution system. The motor is run by a variable frequency drive and there is SCADA equipment on site.

Well 6B (3410007-017) VFD	Active	1,100	Constructed in 2013. Located at the former main office near Eastern and Lusk Ave. Disinfection facilities in same building. The sample tap is by the air release valve. Drilled 2013. Total depth is 510 feet; perforated from 120 to 320 ft beneath ground surface. Air gap pump to waste to storm drain. Lead well checked 5d/wk. VFD on pump. Natural gas generator onsite. Site has SCADA equipment.
Interties			
Annette and Eastern (Sac Suburban)	Active	-	Reconnected in 2015. The connection is now an 8-inch connection.
Becerra and Marconi (Sac Suburban)	Active	-	
Watt and Maryal (Sac Suburban)	Active	-	
Total		6,725	

Discussion and Appraisal: **All of the well sites are inside fenced enclosures and/or in buildings. Two of the sites that are enclosed within buildings. The remaining well sources do not have secured valve controller wheels. This is a potential tampering hazard. The control wheels should be locked, removed, or secured by some other suitable means to avoid tampering of the water system valves and possible damage to the water system facilities.**

Reportedly, there is a casing hole in Well 5. It is unclear as to how severe the damage to the casing is. As a result, it is unclear if the well is in danger of imminent failure. Given the fact that the well has an estimated age of 64 years, it may be subject to a failure much like Well 6. As a result, there is a concern that five of the water system's eight drinking water sources with a total estimated flow of 3,025 gpm, have an estimated age of at least 63 years. In addition, Well 8 (42 years) was out-of-service for repair at the time of the inspection. Well 8 has an estimated flow rate of 1,100 gpm.

Wells 3 and 5 have pedestals less than 18-inches in height. These have been noted in the previous inspection reports and need to be corrected the next time the respective well receives maintenance.

2. **Interties:** Del Paso currently operates three interties with Sacramento Suburban Water District (PWS No. 3410001) as outlined in the table above. No use of the interties has been reported in several years.

3. **Summary of Raw Water Bacteriological Sampling:** Del Paso is required to sample raw water sources (before disinfection) on a quarterly basis. Bacteriological monitoring results have been submitted quarterly for the sources in service during the time of sampling. The Division has been notified that Well 2 has received positive monitoring results for total coliform bacteria on August 8, August 14, and December 4, 2019. On August 14, 2019, the Operator mentioned that the well has never been inspected and that oil build-up may be contributing to the bacteriological results. According to the current General Manager, an inspection of the well has been scheduled for the well. The Division concurs with the water system's suspicion of the possibility that food grade oil build-up might be a contributor to the bacteriological detections in the raw water.

4. **Drought Preparedness**

Has a "*Water Supply Contingency Plan*" been prepared: X Yes ___ No Other Shortage Plan

Surface Water Supplies

Contracted Supplies (all likely water reductions): ___ Yes ___ No Other n/a

Natural Supplies (Historical drought conditions): X Yes ___ No Other ___

Ground Water Supplies

Well Pumping Capacity (flow-rate monitoring): X Yes ___ No Other ___

Ground-water Levels (sounding/manometry): X Yes ___ No Other via SCADA on Wells 6B, 8, and 9; annually at other wells

Storage

Daily Max Demand Tank Levels (daily record): ___ Yes ___ No Other n/a

***Intertie evaluation* (connection to a neighbor):** X Yes ___ No Other ___

***Water Conservation* (restrictions on unneeded use):** X Yes ___ No Other ___

Discussion and Appraisal: With the exception of well 8, all wells appear to be operational, maintained, and are secure from intrusion. Given a reported hole in Well 5, the structural integrity of the well is unclear without further investigation.
Wells are monitored or operated via Del Paso's SCADA system and programmable logic controllers. All sounding tubes and air vents (with the exception of one at Well 4) are properly capped or screened. Wells are oil-lubed with food grade oil stored at each well site. Wells 2, 3, 4, and 5 have to pump to waste through the hydropneumatic tank at each site; other wells pump to waste directly to the storm drain.

C. TREATMENT

1. Disinfection

Process Description: All wells except for Well 7 consist of chlorination units which inject 12.5% sodium hypochlorite solution into the well discharge line or onsite pressure tank. Dosage is based on residual results within the vicinity of the well's distribution system. Daily records are kept onsite and periodically transferred to office records. Some wells have flow pacing with the VFDs and others are constant feed.

Facilities Description: Disinfection facilities at Wells 2, 3, 4 and 5 consist of small lockable enclosures with a barrel supply tank and a 5 gallon per day (gpd) peristaltic chemical feed pump. Injection quills are either at the well discharge line just upstream of the tank or on the actual tank near the raw influent feed line. Well 8 is equipped with a pair of two 5 gpd peristaltic chemical feed pumps for flowrate variance. Both chemical feed pumps at Well 8 supply a common injection quill at the well discharge line which feeds into the distribution system. Well 6B and 9 disinfection facilities are located in a separate room within the masonry brick building of the well. Chlorine injection is provided using 0.7 gallon per hour (gph) peristaltic pumps.

Continuous disinfection provided: X Yes ___ No Other ___
Chlorination data sheet on file: ___ Yes ___ No Other resubmit
Provisions for emergency chlorination provided: X Yes ___ No Other ___

a. Chemical Data

Table 6 - Disinfection Chemical Data

Location	Chemicals used	Typical Residual (mg/L)	Chemical Manufacturer	ANSI/NSF Standard 60 Approval	Mixing provided
Wells	Sodium Hypochlorite (12.5% NaOCl)	0.4-0.8	Multi-Chlor	Yes	In-line or tank rollover turbulence.

b. Control System

Primary Control Method: X Flow Switches ___ Manual Other ___
Backup Control Method: X Manual ___ Level Switches Other ___

Discussion and Appraisal: Disinfection facilities are kept secure by locked housing and protected within the well sites. Enclosures are clean and free of debris with no visible spills or hazards present within them. However, all of the enclosures have varying degrees of corrosion present. Dosage pumps operate based on power switches connected to the well motors with no alarms if operational issues should arise. There is a backup dosing pump w/auto switchover for Well 8 and this is pending for Well 9.

D. DISTRIBUTION SYSTEM

1. Distribution System Information

Distribution system classification: D2 based on Table 64413.3-A (Pop served between 1,001 and 10,000)
Distribution system maps on file: X Yes ___ No Other ___
Distribution system data sheets on file: X Yes ___ No Other ___

2. Construction Practices

Facilities constructed to meet Waterworks Standards: X Yes ___ No Other ___
Water/Sewer Separation: X Yes ___ No Other ___
Lead pipes, joints, or solder used: ___ Yes X No Other ___

3. Pressure Zones

Table 7 - Distribution System Pressure Zone Summary

Pressure Zone Name	Pressure Range (psi)	Water Sources	Storage Capacity	No. of Conn.	Comments
Main	46-56	All Wells	n/a	1,795	

Discussion and Appraisal: The Del Paso Mano WD water system began as a series of developments in the post-world war II period. Much of the distribution system and well sources were constructed in the 1940's and 1950's. Age and wear may cause significant degradation of the water system infrastructure. At the time of the previous inspection, Del Paso was planning a number of main relocation projects to upgrade the distribution system as well as add meter connections in the front yards. It is unclear if the water system will be able to continue the system upgrades. Del Paso consists of a single pressure zone maintained by the hydropneumatic pressure tanks at well sites throughout the distribution system. The minimum reported operating pressure experienced by the distribution system has been 45 psi. Pressure is operationally maintained at 46-56 psi via well sources triggered by pressure switches at the pressure tanks. Leaks and repairs are attended to as they arise, and the current Master Plan calls for the replacement of aging infrastructure. Proposed distribution system improvements include the replacement of old steel distribution mains, relocation of service lines within easements and continual installation of meter setters. Now that the water system only has one Operator on staff, it is hoped that the water system can continue to upgrade the aging water system facilities.

4. WATER MAINS AND SERVICE CONNECTIONS

California Code of Regulations, Title 22, Chapter 16, Article 4: Materials and Installation of Water Mains and Appurtenances

Water Mains: Del Paso distribution pipe summary is tabulated in Table 7.

Table 8 - Summary of Water Mains

Material	Size (Inches)	Length Installed (ft)	Amount (%)	Condition
PVC	8-12	7,400	7	
AC	4-6	62,500	57	
AC	10-12	17,750	16	
Welded steel	4-6	15,400	14	
DIP	6-12	6,034	6	Excellent. Added 2010-2016
HDPE	**2**	**350**	**<1**	**Installed 2015-2016**
Total		109,400	100	

Water Main and Service Connection Leak History: Del Paso reportedly investigated 70 service connection breaks/leaks, 9 main line breaks/leaks, and 11 water outages during 2018. Most service connection issues were on the customer side of the service connection and attributed to corrosion, age and tree root intrusion. The main line leaks were caused by corrosion, age, tree roots, and contract damage. The distribution system experienced a significant number of leaks. The water system was compared to two neighboring water systems. One was slightly smaller in size and the other was approximately twice the size of Del Paso Manor WD. Del Paso Manor experienced nine times the number of leaks and breaks as the other two water systems during 2018. In addition, Del Paso Manor WD experienced 11 water system pressure failures during 2018. The infrastructure is aging and should be systematically replaced to spread the costs out over time.

Discussion and Appraisal: Reportedly, the water mains are functional although Del Paso is planning on replacing backyard mains with mains located in the front of the structure. **However, after reviewing the last ten years of water system problems (2009-20018 EAR's) in the system seem to indicate that the system is suffering from age, wear, and may be in need of increased maintenance.**

Based on the information provided in the table above, 350 linear feet of 2-inch diameter HDPE pipe does not the minimum water main diameter (4-inches) requirements specified in Section 64573, Article 4, Chapter 16, Division 4, Title 22 of California Code of Regulations (CCR).

E. SYSTEM CAPACITY APPRAISAL

Total available source and storage capacity: Sources: 6,725 gpm

Storage: none at this time

Estimate of required source capacity (Peaking factor method)

Maximum Production: Production is based on the eight (8) operational wells producing water for the distribution system.

Total Current Available Source Capacity: 6,725 gpm

Maximum Day Demand (MDD): Based on production data available in the past ten years, the highest maximum day demand occurred in 2012 at 4.5 MGD (3,130 gpm).

Does the Water System have the Source Capacity to meet the system's MDD: Yes

Estimated Peak Hourly Demand (PHD = 1.5xMDD): 4,700 gpm

PHD x 4: 0.75 MG **Emergency Storage Capacity:** None

Emergency Storage Capacity exceed PHD x 4: No

Discussion and Appraisal: According to Section 64554, Article 2, Chapter 16, Division 4, Title 22 of the CCR, at all times, a public water system's water source(s) shall have the capacity to meet the system's maximum day demand and for systems with 1,000 or more service connections, the system shall be able to meet four hours of peak hourly demand with source capacity, storage capacity, and/or emergency source connections. Del Paso must maintain their wells operational and in service to meet maximum day demands. Del Paso has no storage capacity as the pressure vessels primarily provide system pressure and are not considered storage per Water Works Standards.

According to Section 64554(c), Article 2, Chapter 16, Division 4, Title 22 of the CCR, community water systems using only groundwater shall have a minimum of two approved sources before being granted an initial permit. The system shall be capable of meeting MDD with the highest-capacity source off line. Del Paso's source capacity with the largest source offline (Well 9) is 7.5 MGD (5,225 gpm). In 2012, the MDD was 4.5 MGD. The Water System is therefore in compliance with this section of the regulations.

F. FINISHED WATER STORAGE

Facilities: No dedicated water storage facilities exist for Del Paso. Four hydropneumatic pressure tanks are located at Wells 2, 3, 4 and 5. However, the Division does no recognize hydropneumatic tanks as water storage.

Reservoir data sheets on file:	X	Yes	___	No	Other	(pressure vessels)
Source/storage capacity meets Waterworks Standards:	___	Yes	X	No	Other	see Sec. E
Reservoir design meets Waterworks Standards:	X	Yes	___	No	Other	(pressure vessels)

Discussion and Appraisal: Tanks visually appear to be in good condition and maintained clear of rust with recent paint overlays. Tanks were last inspected in July of 2013 by a third-party company which provided recommendations for maintenance. Tank sites are protected as part of the well site and free of physical hazards besides nearby trees but not within alarming proximity.

G. PUMPS, PUMP FACILITIES and CONTROLS

1. Pumps and Pump Facilities

Table 9 - Pump Facilities Summary

Location	Active/ Standby	Drive Type	Capacity (gpm)	Power (hp)	Lube Type	Comments
Well 2 Pedestal	active	vertical turbine	600	50	oil	Mobile auxiliary power available onsite.
Well 3 Pedestal	standby	vertical turbine	675	60	oil	
Well 4 Pedestal	active	vertical turbine	550	50	oil	Transfer switch installed for mobile unit (mobile unit housed at Well 2)
Well 5 Pedestal	active	vertical turbine	525	50	oil	
Well 7 Vault	active	vertical turbine	675	50	oil	
Well 8 Pedestal	active	vertical turbine	1,100	100	oil	Auxiliary power available onsite.
Well 9 Pedestal	active	vertical turbine	1,500	150	oil	
Well 6B Pedestal	active	vertical turbine	1,100		oil	Auxiliary power available onsite.

Discussion and Appraisal: Well pumps are properly protected and kept clear of any immediate sanitary hazards. As noted in Table 4, some low pedestals or vault housings may subject the motors to increased risks of flooding. Food-grade oil that is kept onsite is locked in an enclosure or building. The distribution system is reportedly served by 2 separate electrical grids. It should be noted that part of the design of the mobile backup power facilities considered providing power supply to both grids when one or the other fails.

2. Controls

a. Control System

Primary Control Method: ___ SCADA X Manual Other ___
Backup Control Method: ___ Manual X Level Switches Other (pressure switches)

b. Alarms

Alarm set points are adequate: X Yes ___ No Other ___

Alarm Testing Frequency: unknown
Discussion and Appraisal: The Del Paso SCADA system sends immediate notifications in case of any well failures to personnel. No further alarms or automatic notifications are known to be used by Del Paso. SCADA system is used primarily for supervisory purposes with only limited control of facilities. Del Paso personnel are actively at the well sites for physical monitoring and control of the facilities as necessary on a daily basis.

H. MONITORING, REPORTING and DATA VERIFICATION

1. Bacteriological Monitoring

Program Description: Routine samples are taken by Del Paso personnel (either the Field Manager or O&M Technician) then submitted to the certified laboratory for analysis. Del Paso currently has four dedicated sampling taps throughout the distribution system of which they rotate for bacteriological sampling.

Bacteriological Sample Siting Plan (BSSP)
Copy received by Division: X Yes ___ No Other ___
Plan reviewed for approval: X Yes ___ No Other ___

Sampler: Del Paso certified personnel or certified laboratory
Laboratory: BSK Sacramento Microbiology **Phone:** (916) 853-9293
Factor controlling sample size: ___ Population X Service Connections
Number of samples required: 6 per month **Number of samples taken:** 7 per month
Raw water sampling frequency: Quarterly
Reports submitted late (after 10th of the month): no
MCL violations: None since 2006

Discussion and Appraisal: Summary and lab results are regularly received by the Division by the 10th of the month. Samples are spread out during the month and rotated from the four available sampling taps. No recent MCL exceedances have occurred for Del Paso. The last BSSP was submitted to the Division in 9/2015. While Del Paso takes the required number of samples per month (6 per month minimum), the BSSP states the sampling frequency as "Weekly". At the time of the next BSSP submittal, the sampling frequency should be changed to accurately reflect the 6 per month minimum requirement.

2. Chemical Monitoring

Program Description: The Del Paso system is monitored according to the requirements in Chapter 15, Division 4, Title 22 of California Code of Regulations. Chemical sampling is performed by Del Paso personnel and sent to the BSK laboratory in Sacramento. A summary of monitoring results and frequencies is provided below. The operational status of Well 3 on was changed from an Active to a Standby drinking water source on June 6, 2018.

a. **Inorganic Chemicals:** Del Paso source water inorganic chemical monitoring is up to date. As initiated in the previous inspection report, the monitoring frequency of all the wells with the exception of Well 6B is every 9 years per Section 64432(m). Any further monitoring would be at the discretion of the water system.

Table 10 – Inorganic Chemicals Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	9-year	9-year	2019-08-07	2028-08-07	None	
Well 3	9-year	None	2016-08-22	2025-08-22	None	Standby
Well 4	9-year	9-year	2019-08-06	2028-08-06	None	
Well 5	9-year	9-year	2019-08-06	2028-08-06	None	
Well 6B	3-year	None	2019-08-06	2022-08-06	None	
Well 7	9-year	9-year	2019-08-06	2028-08-06	None	
Well 8	9-year	9-year	2019-08-13	2028-08-13	None	
Well 9	9-year	9-year	2019-08-07	2028-08-07	None	

Discussion and Appraisal: Del Paso monitoring for inorganic standards is up to date. Nearly all the inorganic chemicals were non-detect during the last sample cycle. Arsenic is present in all the wells, except for Well 6B, at around 2 to 3 ug/L. The water quality sampling results taken when Well 6B was drilled have now been uploaded to the Division's electronic database. After reviewing the sampling results, Well 6B qualifies for three-year monitoring.

b. **Secondary Drinking Water Standards:** Del Paso monitoring for secondary standards is up-to-date. The current monitoring frequency is every 9 years per Section 64449(f), Article 16, Chapter 15, Division 4, Title 22 of the CCR. Any further monitoring would be at the discretion of the water system.

Table 11 - Secondary Drinking Water Standards Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	9-year	9-year	2019-08-07	2028-08-07 All else	Iron	Quarterly iron sampling required RAA=582.5 ug/L
Well 3	9-year	none	2016-08-22	2025-08-22	Iron	RAA=582.5 ug/L Standby
Well 4	9-year	9-year	2019-08-06	2028-08-06 All else	Iron	Quarterly iron sampling required RAA=782.5 ug/L

Well 5	9-year	9-year	2019-08-06	2028-08-06 All else	Iron	Quarterly iron sampling required RAA=1,142.5 ug/L
Well 6B	3-year	None	2019-08-06	2022-08-06	None	
Well 7	9-year	9-year	2019-08-06	2028-08-06	None	
Well 8	9-year	9-year	2019-08-13	2028-08-13	None	
Well 9	9-year	9-year	2019-08-07	2028-08-07	None	

Discussion and Appraisal: The monitoring results from 08/2016 for iron indicate that wells 2, 3, 4, and 5 exceed the MCL established in Table 64449-A. In accordance with Section 64449(c), Article 16, Chapter 15, Division 4, Title 22 of the CCR, quarterly iron sampling shall be initiated for these wells except for well 3 which is now permitted as a standby drinking water source.

Methyl-Tert-Butyl-Ether (MTBE) was last sampled on 06/2010 for wells 4, 7, 8, and 9. This chemical shall be sampled in 2019. There are no records in the database that indicate Well 6B has ever been sampled for MTBE. Del Paso should work with their laboratory to get the sampling data submitted to the Division's electronic database.

c. **Radiological (Table 64442):** No changes to the sample frequency of every 9 years for gross alpha per Section 64442(d)(4) is necessary pending the latest sample results.

Table 12 - Gross Alpha (GA) Radiological Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	9-year	None	2015-11-18	2024-11-18	None	
Well 3	9-year	None	2015-11-18	2024-11-18	None	Standby
Well 4	9-year	None	2015-11-18	2024-11-18	None	
Well 5	9-year	None	2015-11-18	2024-11-18	None	
Well 6B	9-year	None	2019-02-25	2019-02-25	None	
Well 7	9-year	None	2015-11-18	2024-11-18	None	
Well 8	9-year	None	2015-11-18	2024-11-18	None	
Well 9	9-year	None	2015-11-18	2024-11-18	None	

Discussion and Appraisal: Radiological monitoring for the District's wells is required once per compliance cycle (every 9 years). After reviewing the current monitoring data for Well 6B, the source qualifies for reduced radiological monitoring. Well 6B shall be monitored at least once every 9-year monitoring cycle.

d. **Regulated Volatile Organic Chemicals (VOCs):** No VOCs were detected in the last round of sampling. Any further monitoring would be at the discretion of the water system.

Table 13 - Volatile Organic Chemical Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	3-year	None	2019-08-07	2022-08-07	None	
Well 3	3-year	None	2016-08-22	2025-08-22	None	Standby
Well 4	3-year	None	2019-08-06	2022-08-06	None	
Well 5	3-year	None	2019-08-06	2022-08-06	None	
Well 6B	3-year	None	2019-08-06	2022-08-06	None	
Well 7	3-year	None	2019-08-06	2022-08-06	None	
Well 8	3-year	None	2019-08-13	2022-08-13	None	
Well 9	3-year	None	2019-08-07	2022-08-07	None	

Discussion and Appraisal: All monitoring in the electronic database for Well 6B is current. The Division has reviewed the monitoring data for Well 6B. Well 6B, qualifies for triennial monitoring for VOC's.

e. **Regulated Synthetic Organic Chemicals (SOCs):** Sufficient monitoring has been performed, with no SOCs detected, to justify reducing the frequency to every 3 years per Section 64445.1(b)(1). Any further monitoring would be at the discretion of the water system.

Table 14 – Synthetic Organic Chemical Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	3-year	3-year	2019-08-07	2022-08-07	None	
Well 3	9-year	none	2016-08-22	2025-08-22	1,2,3 TCP	Standby *1,2,3 TCP 0.018 ug/L*
Well 4	3-year	3-year	2019-08-06	2022-08-06	None	
Well 5	3-year	3-year	2019-08-06	2022-08-06	None	
Well 6B	3-year	3-year	2019-08-06	2022-08-06	None	
Well 7	3-year	3-year	2019-08-06	2022-08-06	None	
Well 8	3-year	3-year	2019-08-13	2022-08-13	None	
Well 9	3-year	3-year	2019-08-07	2022-08-07	None	

Discussion and Appraisal:

f. **Nitrate/Nitrite:** Monitoring is current. No changes to the sample frequencies of annual and triennial for nitrate and nitrite, respectively.

Table 15 – Nitrate Chemical Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	Annual	None	2019-08-07	2020-08-07	None	
Well 3	Annual	None	2018-09-11	See below	None	Standby
Well 4	Annual	None	2019-08-06	2020-08-06	None	
Well 5	Annual	None	2019-08-06	2020-08-06	None	
Well 6B	Annual	None	2019-08-06	2020-08-06	None	
Well 7	Annual	None	2019-08-06	2020-08-06	None	
Well 8	Annual	None	2019-08-13	2020-08-13	None	
Well 9	Annual	None	2019-08-07	2020-08-07	None	

Discussion and Appraisal: Well 3 is a standby drinking water source. The well must be monitored prior to operation.

Table 16 – Nitrite Chemical Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	3-year	None	2019-08-07	2022-08-07	None	
Well 3	3-year	None	2016-08-22	See below	None	Standby
Well 4	3-year	None	2019-08-06	2022-08-06	None	
Well 5	3-year	None	2019-08-06	2022-08-06	None	
Well 6B	3-year	None	2019-08-06	2022-08-06	None	
Well 7	3-year	None	2019-08-06	2022-08-06	None	
Well 8	3-year	None	2019-08-13	2022-08-13	None	
Well 9	3-year	None	2019-08-07	2022-08-07	None	

Discussion and Appraisal: Well 3 is a standby drinking water source. The well must be monitored prior to operation.

g. **Asbestos monitoring:** Monitoring is due now based on the latest records in the Division's electronic database.

Table 17 - Asbestos Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	9-year	None	2014-03-26	2023-03-26	None	
Well 3	9-year	None	2014-03-26	2023-03-26	None	
Well 4	9-year	None	2014-03-26	2023-03-26	None	
Well 5	9-year	None	2014-03-26	2023-03-26	None	
Well 6B	9-year	None	2019-08-06	2028-08-06	None	
Well 7	9-year	None	2019-02-25	2028-02-25	None	
Well 8	9-year	None	2018-06-21	2027-06-21	None	
Well 9	9-year	None	2014-03-26	2023-03-26	None	

Discussion and Appraisal: Asbestos was last sampled in 2014. Each source should be sampled again at this time. Additionally, one sample should be taken from the distribution system per Section 64432.2(3), Article 4, Chapter 15, Division 4, Title 22 of the CCR due to the fact that 73 percent of the distribution system is constructed with AC pipe. According to a telephone conversation with Del Paso on December 28, 2017, more recent asbestos data is available. Del Paso shall work with their laboratory to get the sampling data submitted to the Division's electronic database.

h. **Perchlorate monitoring:** Per Section 644323.3(c)(1) the frequency of perchlorate monitoring cannot be reduced to less than once every 3 years for a groundwater system. Perchlorate monitoring is due in 2019.

Table 18 - Perchlorate Monitoring Summary

Well Source	Frequency	Waivers	Last Monitoring Date	Next Monitoring Date	MCL Violations	Comments
Well 2	3-year	None	2019-08-07	2020-08-07	None	
Well 3	9-year	None	2016-08-22	See below	None	Standby
Well 4	3-year	None	2019-08-06	2022-08-06	None	
Well 5	3-year	None	2019-08-06	2022-08-06	None	
Well 6B	3-year	None	2019-08-06	2022-08-06	None	
Well 7	3-year	None	2019-08-06	2022-08-06	None	
Well 8	3-year	None	2019-08-13	2022-08-13	None	
Well 9	3-year	None	2019-08-07	2022-08-07	None	

Discussion and Appraisal: Well 3 is a standby drinking water source. The well must be monitored prior to operation.

3. Disinfection Byproducts Monitoring

a. Stage 1 D/DBP Rule

Program Description and Date: According to the monitoring plan dated March 10, 2005, Del Paso is on a reduced monitoring schedule for disinfection byproducts and standard monitoring for disinfectant residual. Total trihalomethanes and haloacetic acid monitoring is done at four sites throughout the distribution system on a triennial basis. Disinfectant residual monitoring is done on a monthly basis paired with the coliform bacteriological monitoring due for compliance on a quarterly basis.

Table 19 - Disinfection Byproduct Monitoring Summary

Date Sampled	Average (µg/L) TTHM	Average (µg/L) HAA5	Maximum Result (µg/L) TTHM	Maximum Result (µg/L) HAA5	Comments
9/27/2004	ND	1.6	ND	2.2	
8/17/2007	ND	ND	ND	ND	
4/24/2009	ND	ND	ND	ND	
3/14/2014	ND	ND	ND	ND	
6/28/2014	ND	ND	ND	ND	
8/21/2014	ND	ND	ND	ND	
7/10/2017	ND	ND	ND	ND	
Due in 2020					

Discussion and Appraisal: Disinfection byproduct formation has not been an issue in the Del Paso distribution system as evident in the historical monitoring results. Monitoring for byproducts is on a reduced schedule. Monitoring for residuals is done monthly and submitted to the Division for quarterly compliance. The next round of TTHM/HAA5 sampling is due in 2020.

b. **Stage 2 D/DBP Rule**

Schedule: 4 **Consecutive Systems:** none

Discussion and Appraisal: Del Paso is currently on a 40/30 waiver approved January 22, 2008. No further monitoring is required beyond Stage 1 sampling while under the 40/30 waiver.

4. Lead and Copper Rule Monitoring

Program Description and Date: Del Paso sends a letter and sampling kit to the identified residences which have historically participated in the lead and copper program. Instructions on the letter outline the sampling time and identification procedures. Of the original forty sites, only twenty are currently asked to sample every nine years. A testing report/summary is produced by Del Paso and supplied to the Division for review which contains sampling results.

Sampling Plan

Copy received by Division: X Yes ___ No Other ___

Plan reviewed for approval for approval: X Yes ___ No Other ___

Number of samples required: 20 **Number of samples taken:** 20

AL Exceedances: none

Table 20 - Lead and Copper Tap Sampling Summary

Round	Date	No. Samples	90% Lead (µg/L)	90% Copper (µg/L)
A1	11/6/1992	40	1.1	140
A2	4/29/1993	20	ND	119
A3	6/29/1994	20	3	150
T1	6/24/1997	20	2	170
T2	7/3/2000	20	2.5	140
T3	6/16/2004	20	3	120
T4	7/30/2013	20	ND	120
T5	9/27/2016	20	ND	160
T6	6/28/2019	20	ND	250

Discussion and Appraisal: Lead and copper monitoring was erroneously reduced to a nine-year schedule between 2004 and 2013. Del Paso is required to monitor for lead and copper at the reduced number of sites (twenty) every three years pursuant to Title 22, Chapter 15, Section 64675.5(a)(1) of the CCR. The next monitoring is due between June 1 and September 30, 2022.

5. Consumer Confidence Report

Send Date/Anticipated Send Date: Unknown
Copy received by Division: X Yes ___ No Other ___
Certification received by Division: ___ Yes X No Other ___
Discussion and Appraisal: The CCR was received at the time of the Inspection. There is no record on file of the certification form being submitted to the Division. Reportedly, the previous General Manager of the water system retired prior to the submission of the report and someone else sent the CCR to the customers. The date of the submission was not documented.

I. SYSTEM MANAGEMENT AND OPERATION

1. Operator Certification

a. **Distribution operator certification requirements:** D2 Chief Operator; D1 Shift Operator

b. **Treatment operator certification requirements:** N/A (No water treatment other that disinfection in system)

Discussion and Appraisal: Currently, there is only one certified operator on staff at this time. Ken Ingle is the designated Chief Operator for the water system. The water system needs at least one designated Shift Operator. It would appear that the water system is understaffed at the time of the inspection.

2. Operations and Maintenance

a. **Operations & Maintenance Plan**

Copy received by Division: X Yes ___ No Other ___
Plan reviewed for approval for approval: ___ Yes ___ No Other unknown

b. **Valve Exercising & Maintenance Program**

Program Description: According to the valve exercising program (as reported by Del Paso), valves are exercised by Del Paso personnel on a regular basis with about a third of valves being done on an annual basis. Every three years, all valves should have been exercised and the cycle would be initiated again. A total of 98 were exercised in 2018. At the time of the Inspection, 69 valves were reportedly exercised. It was reported that two valves failed (one seized open and other was closed), and one valve was replaced. Given the fact that the water system has only one operator on staff, Del Paso Manor WD appears to be behind schedule for the 2019 year on the three-year cycle.
Approximate number of valves: 275 **Exercising frequency:** Every three years.
Adequacy of valve locations: The locations of valves may be adequate. However, the age and/or functionality of the valves in the system may lead to future difficulties.

c. **Distribution System Flushing Program**

Program Description: reportedly, dead-ends with blow-offs are normally flushed by Del Paso personnel on a regular basis with about a third of dead-ends being flushed on an annual basis (as reported by Del Paso). According to the 2018 electronic Annual Report, only 9 were flushed. At the time of the inspection, it was reported that only one dead end was flushed for the entire 2019 calendar year.
Approximate number of dead ends: 42 **Percent with flushing valves:** 45% (19)
Flushing frequency: Every three years.
Discussion and Appraisal: Valve exercising and dead-end flushing for Del Paso seems to be behind schedule. No issues were reported with the maintenance programs. Due to operational and/or staffing limitations, it would appear that the water system may be falling behind in maintenance and system upkeep.

d. **Water Main Disinfection Plan**

Program Description: Outlined in the Master Plan (dated July 24, 2009).
Compliance with AWWA C-651 standard: X Yes ___ No Other ___

e. **Customer Complaint Program**

Program Description: Complaints are received by Del Paso Office Manager and forwarded to the Chief Operator for investigation and response.

Table 21 - 2018 Customer Complaint Summary

Type	Number	Reported to DDW	Comments
Taste and Odor	1	0	Chlorine smell complaint. Upon investigation, all chlorine levels were normal.
Color	1	0	Upon investigation, we determined the "cloudy" water was from entrained air in the line. It dissipated after setting for about one minute.
Turbidity	0	0	
Visible Organisms	0	0	
Pressure (High/Low)	1	0	Upon investigation, static and residual pressures were within normal range.
Water Outages	0	0	
Illnesses	0	0	
Other	0	0	
Total	**3**	**0**	All were investigated.

f. **Distribution System Problems**

Program Description: The field personnel investigate all distribution system problems and address and/or make repairs as needed. Summary of distribution system problems, as reported in the 2018 Annual Report, is tabulated below.

The number of system and service connection breaks were compared to other nearby water systems of similar size and type. Del Paso Manor WD has a long history of significantly more service connection breaks and main breaks than other water systems of similar type and similar size. A comparison of water system main and service connection breaks was made with two neighboring water systems (California America Arden and Sacramento County Water Agency Arden Park Vista) with water quality, age, and with similar types of water usage (mostly residential with some commercial connections). A spreadsheet with the data is included in the appendix of this report. The Division is concerned about the condition of the distribution system, as well as, the water system well sources also mentioned in this report. The Division has reviewed the last ten years of electronic Annual Reports and found that the water system received an average of 21.9 service connection breaks and 7.4 main breaks each year.

Also, the system has 11 complaints for a recorded water outage according to the last electronic Annual Report. According to the Annual Report, the outage was not reported to the Division at the time. The water system shall notify DDW of any unplanned water outages affecting 100 service connections or more.

Table 22 - Summary of Distribution Problems

Type	Number			Comments
	Received	Investigated	Reported to DDW	
Service Connection Breaks / Leaks	18	70	0	Eighteen were the District's responsibility and were caused by corrosion, age, tree roots, or struck by contractors. Eight of the ones investigated were not leaks. The remaining 44 were the customer's responsibility and were caused by the same.
Main Breaks / Leaks	9	9	0	Caused by corrosion, age, tree roots, or struck by contractor. All were repaired.
Water Outages	11	11	0	Eleven calls with one emergency main repair that required water to be turned off in area without notice.
Boil Water Orders	0	0	0	
Total	**38**	**90**	0	

g. Cross-Connection Control Program

Program Description: Del Paso's cross connection program was adopted from the 1987 Sacramento County Plan. Plan was submitted to the Division on October 13, 2008. According to the 2018 electronic Annual Report, the last cross-connection control survey was completed on September 13, 2018.

Cross-connection control specialist: None at the time of the inspection

Certification No.: _____ **Telephone:** _____

Copy received by Division: X Yes ___ No Other _____

Program reviewed for approval: X Yes ___ No Other _____

Table 23 - Cross-Connection Control Device Summary

Year	Total Devices	Air Gaps	Newly Installed	Number Tested	Number Failed	Number Replaced or Repaired
2009	109	0	1	106	4	5
2010	107	0	0	106	3	2
2011	105	0	1	103	6	4
2012	108	0	3	106	8	12
2013	108	0	0	108	5	4
2014	110	0	2	110	8	8
2015	110	0	2	109	8	8
2016	113	0	2	113	9	9
2017	115	0	0	115	5	5
2018	118	0	3	118	8	9

Discussion and Appraisal: Device summaries have been as reported in the Annual Report to the Division. **The cross-connection control program and associated surveys were conducted by Richard Bolton. Mr. Bolton is no longer employed by the water system. Reportedly, Del Paso Manor WD has contracted these services out to Sacramento County. Del Paso Manor WD needs to provide the Division with the name(s), contact information, the certifying agency, and certification number(s) of the person(s) providing this service to Del Paso Manor WD.**

3. Emergency Response Program

a. Emergency Notification Plan (ENP):

Plan Date: December 4, 2019
Copy received by Division: X Yes ___ No Other ___
ENP reviewed for approval: X Yes ___ No Other ___

b. Emergency Response Plan (ERP):

Plan Date: July 6, 2017
Copy received by Division: X Yes ___ No Other ___
ERP reviewed for approval: X Yes ___ No Other revised

Discussion and Appraisal: Emergency Notification and Response Plans have been received and reviewed by the Division for filing.

5. CLIMATE CHANGE VULNERABILITY ASSESSMENT

a. Fire:

Is Defensive Space of 100-feet (California Public Resources Code 4291) maintained around all structures owned, operated, and managed by the Community Water System? ___ Yes X No

Discussion and Appraisal: The water system should be aware of the value of establishing defensive spaces an all areas should be cleared of material that could either cause fire or become fuel for a natural fire to the greatest extent possible.

b. Flooding:

Has the water system had a history of flooding? ___Yes X No
Are any of the drinking water facilities owned, operated, and managed by the Community Water System vulnerable to flooding? ___Yes X No

Discussion and Appraisal: None of the facilities were at risk of flooding.

c. Drought:

Has the water system had any history of drought related shortages and/or outages? ___ Yes X No
Is water system prepared for drought related shortages or outages? (Interties, backup supply, increased storage, etc.) X Yes ___ No
Discussion and Appraisal: There are mitigation measures for drought(s) and water conservation measures established relating to drought water use. In addition, there are several water system interties with Sacramento Suburban Water District if needed.

d. Backup Power

Is backup power available via portable generators or permanent generators? X Yes ___ No
If liquid fuel is used, is it properly contained and stored away from the drinking water supply sources?
X Yes ___ No
Is backup generator tested on a routine schedule? X Yes ___ No

Discussion and Appraisal: Well 6B is equipped with a backup generator and there are emergency generator connectors at wells 2 and 4. The water system has an emergency interconnection with Sacramento Suburban Water District at three locations.

J. OVERALL SYSTEM APPRAISAL

Given the fact that the Del Paso Manor County Water District water system has only a single certified operator on staff, it is well operated. Del Paso's only certified Operator regularly monitors the system facilities to ensure

Summary of Environmental Compliance Concerns

The following represents a partial list of concerns by well site that do not appear to have been adequately addressed or correctly reported to regulatory agencies, customers, or both. Compliance concerns that pertain to one or more facilities or the system overall are also discussed. It is important to note that compliance with regulatory requirements is ultimately the responsibility of the permit holder of the Public Water System (PWS).

WELL 2

The monitoring result from a sample collected at Well 2 in February 2018 shows iron was detected (440 µg/L), thereby exceeding the secondary maximum contaminant level (MCL) of 300 µg/L. Unless usage of the source is discontinued, according to Title 22, Division 4, Chapter 15, Article 16, §64449(c)(2 and 3), the exceedance triggers quarterly monitoring for three quarters. Compliance with the secondary MCL is determined by averaging the initial sample result with the next three quarterly sample results. If a violation has occurred (the average of the four consecutive quarterly samples exceeds the secondary MCL), the PWS is required to notify DDW by the 10th day of the following month within which the sample result is reported by the laboratory. It is unclear if the requisite reporting to DDW occurred. The following is a summary of iron sampling results reported to date from Well 2.

DATE	IRON (µg/L)	COMMENTS
2/28/2018	440	Previous result = 700 µg/L (8/18/2016)
5/11/2018	290	
8/7/2018	530	
12/11/2018	660	Four quarter average = 480 µg/L[1] Secondary MCL = 300 µg/L
3/13/2019	720	
6/19/2019	950	
8/7/2019	< 100	2019 running annual average = 583 µg/L
2/11/2020	< 100	

1. Notification required to DDW by January 10, 2019.

needed to be reported to DDW

DEC 2019 46

WELL 3

As was the case at Well 2 in 2018, the monitoring result from a sample collected at Well 3 in 2018 shows iron was detected (940 µg/L) significantly above the 300 µg/L Secondary MCL. However, 1,2,3-Trichloropropane (1,2,3-TCP) was previously detected in August 2017 and May 2018 at concentrations of 18 and 33 nanograms per liter (ng/L), respectively. Both results are well over the 1,2,3,-TCP Primary MCL of 5 ng/L. It appears as though DPMWD elected not to perform the voluntary Confirmation Sampling for 1,2,3-TCP in accordance within the seven-day window following laboratory notification, as specified in Title 22, Division 4, Chapter 15, Article 5.5, §64445.1(c)(1). According to the 2019 DDW CIR, it wasn't until June 6, 2018, that the permitted status of Well 3 was changed from Active to Standby. While any usage of Well 3 at this time is unadvisable, the permitted status as a Standby source limits its usage to short-term emergencies. Title 22, Division 4, Chapter 15, Article 2, §64414(c) states the following, "A Standby source shall

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be used only for short-term emergencies of five consecutive days or less, and for less than a total of fifteen calendar days a year."

The nitrate sample was probably collected to meet Standby well monitoring requirements. It is unclear why additional 1,2,3-TCP samples, or the iron sample discussed above were collected in 2018. It is also unclear where the water produced during those and the nitrate sampling events was discharged. Serving the water to the public without specific authorization from DDW may put customer's health at risk and result in DPMWD receiving a notice of violation from DDW with a requirement to notify the public. Water discharged to the storm drain system would be a violation of the Clean Water Act. Water produced from any additional sampling performed at Well 3 would require containerization and discharge to the sanitary sewer. A temporary discharge permit from the Sacramento Regional County Sanitation District (SRCSD) is required prior to any discharge to the sewer. The following lists the most recent monitoring reported to DDW for Well 3.

CONTAMINANT	DATE	RESULT	COMMENTS
1,2,3-TCP	8/29/2017	18 ng/L	Primary MCL = 5 ng/L
1,2,3-TCP	5/11/2018	33 ng/L	
Nitrate	9/11/2018	2.6 mg/L	
1,2,3-TCP	12/11/2018	18 ng/L	
Iron	12/11/2018	940 µg/L	Secondary MCL = 300 µg/L

WELL 4

Similar to Wells 2 and 3, Well 4 showed an iron Secondary MCL exceedance (420 µg/L) in 2018. It is unclear why quarterly monitoring for iron was initiated in 2018 as the most recent iron sample collected before that was in August 2016 (440 µg/L). Regardless, as indicated in the discussion for Well 2, compliance with the secondary MCL is determined by averaging the initial sample result (that exceeds the MCL) with the next three quarterly sample results. If a violation has occurred (the average of the four consecutive quarterly samples exceeds the Secondary MCL), the PWS is required to notify DDW by the 10th day of the following month within which the sample result is reported by the laboratory. It is unclear if the requisite reporting to DDW occurred. The following is a summary of iron sampling results reported to date from Well 4.

DATE	IRON (µg/L)	COMMENTS
2/28/2018	180	
5/11/2018	420	First exceedance, Secondary MCL = 300 µg/L
8/7/2018	810	
12/11/2018	650	
3/13/2019	1600	Four quarter average = 870 µg/L[1]
6/19/2019	880	
8/6/2019	< 100	2019 running annual average = 783 µg/L
2/11/2020	< 100	

1 Notification to DDW required by April 10, 2019.

WELL 5

Similar to Wells 2, 3 and 4, Well 5 showed a Secondary MCL exceedance (490 µg/L) for iron in 2018. It is unclear why quarterly monitoring for iron was initiated in 2018 as the most recent iron monitoring before that was in August 2016 (@ 410 µg/L). Regardless, as indicated in the

discussion for the previous wells, compliance with the secondary MCL is determined by averaging the initial sample result (that exceeds the MCL) with the next three quarterly sample results. If a violation has occurred (the average of the four consecutive quarterly samples exceeds the secondary MCL), the PWS is required to notify DDW by the 10th day of the following month within which the sample result is reported by the laboratory. It is unclear if the requisite notification to DDW occurred. The following is a summary of iron sampling results reported to date from Well 5.

DATE	IRON (µg/L)	COMMENTS
2/28/2018	110	
5/11/2018	490	First exceedance, Secondary MCL = 300 µg/L
8/7/2018	400	
12/11/2018	960	
3/13/2019	2000	Four quarter average = 963 µg/L[1]
6/19/2019	1200	
8/6/2019	410	2019 running annual average = 1143 µg/L
2/11/2020	900	

1. Notification to DDW required by April 10, 2019.

WELLS 6B and 7

Based on a review of recent water quality data in DDW's database, there are no apparent water quality concerns associated with Wells 6B or 7.

WELL 8

The monitoring result from a sample collected at Well 8 on August 13, 2019, shows tetrachloroethylene (PCE) was detected at a concentration of 13 µg/L, thereby exceeding the Primary MCL of 5 µg/L. According to Title 22, Division 4, Chapter 15, Article 5.5, §64445.1(c)(5), notification to DDW is required within 48 hours from receipt of the laboratory report. Unless usage of the source is discontinued, §64445.1(c) allows the water supplier to collect one or two additional samples within seven days of laboratory reporting to confirm the initial result. If the result is confirmed, §64445.1(c)(5)(A) requires that monthly sampling be performed for six months. It further indicates that if the average of the initial result and the six monthly results exceeds the MCL, the system is in violation of the MCL. Based on the available data, it does not appear that the notification to DDW, optional confirmation sampling, or required monthly sampling were performed.

Because available data indicates that the water from Well 8 exceeds the primary MCL for PCE, water pumped from the well cannot be pumped into the distribution system or into the storm drain system. As indicated in the discussion for Well 3, serving the water to the public without specific authorization from DDW may put customer's health at risk and result in DPMWD receiving a notice of violation from DDW with a requirement to notify the public. Water discharged to the storm drain system would be a violation of the Clean Water Act. Water produced from any additional sampling performed at Well 8 would require containerization and discharge to the sanitary sewer. A temporary discharge permit from the SRCSD is required prior to any discharge to the sewer.

A recently received laboratory report indicates that DPMWD staff collected a sample on February 11, 2020, for analysis of PCE and total petroleum hydrocarbons – diesel range (TPH-D). The PCE result (1.3 µg/L) came back significantly less than that of the sample collected in August 2019.

No TPH-D was detected. It is unclear why the PCE or TPH-D sample was collected or what the results are intended to represent. According to the laboratory report, the DDW engineer was forwarded a copy of the report; however, the results are not currently in DDW's database. The following table shows notable water quality data from Well 8 since 2016.

CONTAMINANT	DATE	RESULT	COMMENTS
PCE	6/21/2016	1 µg/L	This result triggers quarterly monitoring. Not done
PCE	8/13/2019	13 µg/L	This result triggered 48 hour notification to DDW and quarterly monitoring. Not done
Hexavalent Chromium	8/14/2019	8.8 µg/L	Unclear why this sample was collected. The MCL was rescinded on Sep 11, 2017. The result is well above historic results (4.1 - 4.2 µg/L)
PCE	2/11/2020	1.3 µg/L	Unclear why this sample was collected or what it is intended to represent
TPH-D	2/11/2020	< 50 µg/L	Unclear why this sample was collected or what it is intended to represent

WELL 9

Similar to Wells 2, 3, 4, and 5, Well 9 showed a Secondary MCL exceedance (430 µg/L) for iron in 2018. However, unlike the other wells, no quarterly monitoring for iron was performed. Based on the information available in DDW's database, only one other iron sample has been collected at Well 9 to date (August 7, 2019, < 100 µg/L). Regardless, as indicated in the discussion for the previous wells, compliance with the secondary MCL is determined by averaging the initial sample result with the next three quarterly sample results. If a violation has occurred (the average of the four consecutive quarterly samples exceeds the secondary MCL), DDW is required to notified by the 10th day of the following month within which sample result is reported. It is unclear why the quarterly monitoring was not conducted at Well 9.

ALL SITES

Environmental compliance concerns for the system overall and each individual well site not discussed previously include:

- Discharges to waters of the U.S.
- Storing amounts of hazardous materials greater than or equal to Reportable Quantities
- Operation of emergency generators
- Information required in the Consumer Confidence Report

NPDES Discharges

All point source discharges to Waters of the U.S. require a National Pollutant Discharge Elimination System (NPDES) permit. The State Water Resources Control Board (SWRCB) has an NPDES permit for water purveyors that specifically covers the various discharges performed in the day-to-day operation of drinking water systems. It is unknown if DPMWD has a valid NPDES permit.

If DPMWD does not have an NPDES permit, its small size allows it to apply for one discussed above, or an individual, system-specific low-threat NPDES permit. Depending on the type of NPDES permit chosen by DPMWD, the issuing agency is either the SWRCB or the Regional Water Quality Control Board. Fines associated in excess of $10,000 for unpermitted discharges or violations of NPDES permit conditions (including violations of the Clean Water Act) are not uncommon.

Hazardous Materials Requirements

Hazardous Materials Business Plans (HMBPs) are required for any business, utility, government agency, etc. that uses, stores, or has containerized volume to store hazardous materials at or above "Reportable Quantities." Reportable Quantities are as follows: for liquids (55 gallons), for solids (500 pounds), and for compressed gases (200 cubic feet). HMBPs are site-specific; therefore, DPMWD is required to have a HMBP for each of its facilities that stores (or has the available volume to store) Reportable Quantities of hazardous materials. DPMWD has Reportable Quantities of hazardous materials at several facilities; however, none of them have HMBPs.

Upon receipt and approval of an HMBP, the local permitting agency (Sacramento County Environmental Management Department [SCEMD]) issues an invoice for an annual Hazardous Materials Permit (HMP). The following are DPMWD facilities that require HMBPs/HMPs: Every DPMWD well site or facility with a sodium hypochlorite tank having a capacity greater than or equal to 55 gallons, Well 2 (diesel fuel tank of emergency generator), Well 8 (propane fuel tank for emergency generator). Facilities with more than eight 60-pound bags of concrete or asphalt patch must also be included in the HMBP. SCEMD typically refers cases involving significant hazardous materials violations to the District Attorney.

Air Quality Requirements

The California Air Resources Board (CARB) has specific requirements for the operation of emergency generators. The Sacramento Metropolitan Air Quality Management District (SMAQMD) is the local agency that administers CARB regulations (in addition to their own) via a permitting process. DPMWD has a natural gas emergency generator at Well 6B in addition to two other generators discussed above. However, only the propane and natural gas-powered generators have SMAQMD permits. The diesel-powered generator at Well 2 is unpermitted. SMAQMD penalties resulting from operating an emergency generator without a permit or violating a permit condition typically range from $10,000 to $20,000.

Customer Water Quality Reporting

The Consumer Confidence Report (CCR) is required to be prepared by the PWS and delivered to customers every year by July 1. The CCR guidance lists basic requirements about reporting water quality data, most notably: if a well was used to provide water to customers, the laboratory data must be included. If it was not used to provide water, the laboratory data should not be included. Other specific requirements address: reporting MCL violations, what data to include, presenting data, labelling columns in the data tables, how to calculate averages, report ranges, etc. Those requirements also state that PWSs must include additional information about MCL violations. The 2018 DPMWD has problems in all those categories. Significant among them are that the DPMWD 2018 CCR does not accurately calculate the range of 1,2,3-TCP detections (ND

– 33 ng/L), or the average amount detected. In fact, based on the "1,2,3-TCP Update" in the 2018 CCR, the data from Well 3 should not have been included in the table. In addition, the DPMWD 2018 CCR does not include correct or specific information required about the secondary MCL iron violations at Wells 2, 4, 5, and 9. Because of various reasons, including insufficient and improper monitoring at some wells, those violations and the PCE violation at Well 8 must be reported in DPMWD's 2019 CCR for any of those wells that were used to provide water to customers in 2019.

Summary

The preceding summary discusses some of the water quality and environmental compliance concerns in the DPMWD observed by SSWD Environmental Compliance staff. At this time, it is unclear why DDW staff did not initiate enforcement of the drinking water regulations cited in the discussions of the individual well sites. The Executive Summary of DDW's 2019 Compliance Inspection Report (2019 CIR) indicates there have been water quality exceedances and new deficiencies since the last inspection but does not elaborate. The Chemical Monitoring section of the 2019 CIR lists four Secondary Maximum Contaminant Level (Secondary MCL) violations for iron. They are at Wells 2, 3, 4, and 5. It is also unclear why the 2019 CIR does not address the 13 µg/L PCE result from the sample collected at Well 8 in August 2019. Based on the available data, no Confirmation Sampling was performed in accordance with the regulations following the initial detections of 1,2,3-TCP at Well 3, or PCE at Well 8. Furthermore, there is no indication that the requisite monthly sampling was performed following the initial detections. In response to the iron violations, DDW may do one or more of the following: require treatment, require removal of the well(s) from service, or grant a waiver if customers deem the water quality acceptable.

The presentation of data and the reporting inaccuracies in DPMWD's 2018 CCR do not adhere to DDW's CCR guidance. As discussed previously, a review of the data indicates there were reportable MCL violations for iron at Wells 2, 4, 5, and 9 (Well 3 was re-permitted as Standby) that should have been included and discussed in the 2018 CCR. Inaccuracies involving reporting and data presentation also affect DPMWD's customers. One of the primary purposes of the CCR is to accurately convey information about water quality to customers. Inaccurate and incomplete information may provide customers with a false sense of security. It may also make them less willing to increase funding to address problems that they do not know exist. Furthermore, serving water in excess of a Primary MCL increases the risk of litigation by customers who may believe they have been harmed.

Regardless of the responsive actions by DDW, compliance with drinking water requirements remains the responsibility of the agency holding the water supply permit. It is not DDW's function or responsibility to operate the PWS in accordance with State and Federal drinking water regulations. It is important to note that DDW does not provide comprehensive daily oversight of PWSs. PWS management and staff are responsible for the maintenance and operation of the system. The PWS is also responsible to know what other environmental compliance requirements pertain to the operation of the system. Not having the requisite NPDES permit, HMPs, SMAQMD permits, and any other permits that may be required has the potential to:

- Put the PWS in violation of Local, State, or Federal regulations
- Endanger employees, customers, or the environment
- Expose the PWS to significant financial penalties
- Lose the trust and confidence of customers

ATTACHMENT C
CIP Cost Estimates

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS				HydroScience Engineers
Del Paso Manor Water District Water Master Plan Update 475-001	**Pipe Replacement Projects 2-10**	BY: ARP LCK	SHEET:	
			DATE:	5/18/2021

ITEM DESCRIPTION: (INCLUDE SPECIFICATION REFERENCE IF POSSIBLE)		QUANTITY NUMBER	QUANTITY UNIT	MATERIAL AND LABOR UNIT COST	MATERIAL AND LABOR TOTAL
General					
	Mobilization/Demobilization	1	LS	$20,000	$20,000
	Bonds and Insurance	1	LS	$10,000	$10,000
	Start up and Testing	1	LS	$7,000	$7,000
System Upgrades by Location					
2	Replace ex 6" dia AC pipe w/ 8" PVC	74	LF	$130	$9,620
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	180		$9	$1,620
3	Replace ex 6" dia AC pipe w/ 8" PVC	739	LF	$130	$96,070
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	1,770	SF	$9	$15,930
4	Replace ex 6" dia DI pipe w/ 8" PVC	209	LF	$130	$27,170
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	500	SF	$9	$4,500
5	Replace ex 6" dia AC pipe w/ 8" PVC	194	LF	$130	$25,220
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	470	SF	$9	$4,230
6	Replace ex 6" dia AC pipe w/ 8" PVC	117	LF	$130	$15,210
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	280	SF	$9	$2,520
7	Replace ex 6" dia DI pipe w/ 8" PVC	114	LF	$130	$14,820
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	270	SF	$9	$2,430
8	Replace ex 4" dia AC pipe w/ 8" PVC	126	LF	$130	$16,380
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	300	SF	$9	$2,700
9	Replace ex 6" dia AC pipe w/ 8" PVC	186	LF	$130	$24,180
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	450	SF	$9	$4,050
10	Replace ex 4" dia DI pipe w/ 8" PVC	149	LF	$130	$19,370
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	360	SF	$9	$3,240
SUBTOTAL					**$371,000**
Engineering		10%			$40,000

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS			HydroScience Engineers
Del Paso Manor Water District Water Master Plan Update 475-001	**Pipe Replacement Projects 2-10**	BY: ARP LCK	SHEET: DATE: 5/18/2021

ITEM DESCRIPTION: (INCLUDE SPECIFICATION REFERENCE IF POSSIBLE)		QUANTITY		MATERIAL AND LABOR	
		NUMBER	UNIT	UNIT COST	TOTAL
Environmental, Permits		5%			$20,000
Contractor Overhead and Profit		15%			$60,000
Estimating Contingency		25%			$90,000
TOTAL PROBABLE CONSTRUCTION COST					**$581,000**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS			HydroScience Engineers
Del Paso Manor Water District Water Master Plan Update 475-001	**Fire Hydrant Upgrade at AT&T**	BY: ARP LCK	SHEET: DATE: 5/18/2021

	ITEM DESCRIPTION: (INCLUDE SPECIFICATION REFERENCE IF POSSIBLE)	QUANTITY NUMBER	QUANTITY UNIT	MATERIAL AND LABOR UNIT COST	MATERIAL AND LABOR TOTAL
Fire Hydrant Upgrade at AT&T					
1	Install new Fire Hydrant with lateral and valves	15	EA	$5,000	$75,000
	Tie-in	15	LS	$5,000	$75,000
	Pavement replacement	300	SF	$9	$2,700
SUBTOTAL					**$152,700**
Engineering		10%			$15,300
Contractor Overhead and Profit		15%			$23,000
Environmental, Permits		5%			$7,600
Estimating Contingency		25%			$38,200
TOTAL PROBABLE CONSTRUCTION COST					**$236,800**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS			HydroScience Engineers
Del Paso Manor Water District Water Master Plan Update 475-001	**Install 15 Additional Fire Hydrants**	BY: ARP LCK	SHEET: DATE: 5/18/2021

	ITEM DESCRIPTION: (INCLUDE SPECIFICATION REFERENCE IF POSSIBLE)	QUANTITY NUMBER	QUANTITY UNIT	MATERIAL AND LABOR UNIT COST	MATERIAL AND LABOR TOTAL
Fire Hydrant Installations - Resolve 500' Spacing Deficiency					
1	Install new Fire Hydrant with lateral and valves	1	EA	$5,000	$5,000
	Tie-in	1	LS	$5,000	$5,000
	Pavement replacement	20	SF	$9	$180
SUBTOTAL					**$10,200**
Engineering		10%			$1,000
Contractor Overhead and Profit		15%			$2,000
Environmental, Permits		5%			$500
Estimating Contingency		25%			$2,600
TOTAL PROBABLE CONSTRUCTION COST					**$16,300**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS			HydroScience Engineers	
Del Paso Manor Water District Water Master Plan Update 475-001	**Install 8" PRV Station and Intertie to SSWD**	BY: ARP LCK	SHEET: DATE: 5/18/2021	
ITEM DESCRIPTION: (INCLUDE SPECIFICATION REFERENCE IF POSSIBLE)		QUANTITY NUMBER	 UNIT	MATERIAL AND LABOR UNIT COST	 TOTAL
PRV Station					
8" Pressure Reducing Valve station, precast vault, tie-ins		2	LS	$70,000	$140,000
SUBTOTAL					**$140,000**
Engineering		10%			$10,000
Contractor Overhead and Profit		15%			$21,000
Environmental, Permits		5%			$10,000
Estimating Contingency		25%			$40,000
TOTAL PROBABLE CONSTRUCTION COST					**$221,000**

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS			HydroScience Engineers
Del Paso Manor Water District Water Master Plan Update 475-001	**New Well Development and Equipping Construction**	BY: ARP LCK	SHEET: DATE: 5/18/2021

ITEM DESCRIPTION: (INCLUDE SPECIFICATION REFERENCE IF POSSIBLE)		QUANTITY		MATERIAL AND LABOR	
		NUMBER	UNIT	UNIT COST	TOTAL
General					
	Mobilization/Demobilization	1	LS	$90,000	$90,000
	Bonds and Insurance	1	LS	$70,000	$70,000
	Start up and Testing	1	LS	$37,000	$37,000
				Subtotal	**$197,000**
Well Development					
	Drill pilot hole and borehole	1	LS	$100,000	$100,000
	Furnish casing, screen and seal	1	LS	$80,000	$80,000
	Gravel pack, testing and misc	1	LS	$90,000	$90,000
				Subtotal	**$270,000**
Well Site, Housing, and Equipping					
	Site Demolition, Clearing, Grubbing and Grading	1	LS	$90,000	$90,000
	Site Fill	1	LS	$70,000	$70,000
	Fencing	1	LS	$40,000	$40,000
	Pump and Above-ground Piping *(capacity ~ 1100gpm)*	1	LS	$140,000	$140,000
	Below-ground piping and Tie-ins	1	LS	$85,000	$85,000
	Well house slab and structural	1	LS	$250,000	$250,000
	Paint, sealing, HVAC, Plumbing	1	LS	$140,000	$140,000
	Standby Generator	1	LS	$225,000	$225,000
	Electrical wiring, lighting, panels	1	LS	$250,000	$250,000
	MCC, Control panels and PLC	1	LS	$200,000	$200,000
	Instrumentation and Programming	1	LS	$70,000	$70,000
				Subtotal	**$1,560,000**
SUBTOTAL					**$2,027,000**
Engineering		10%			$200,000
Environmental, Permits		5%			$100,000
Contractor Overhead and Profit		15%			$300,000
Estimating Contingency		25%			$510,000

TOTAL PROBABLE CONSTRUCTION COST	**$3,137,000**

Kennedy/Jenks Consultants

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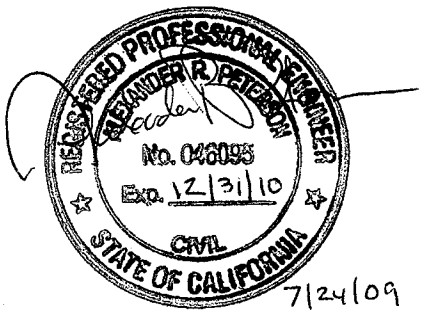
Del Paso Manor Water District Master Plan

24 July 2009



Prepared for

Del Paso Manor Water District
4268 Lusk Drive
Sacramento, California 95864

K/J Project No. 0870017*00

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Section 1: Executive Summary

1.1 Introduction and Purpose of Master Plan

The Del Paso Manor Water District (District) has long been committed to providing a safe and reliable water supply, while at the same time maintaining low water rates. This Water System Master Plan is the first District master plan and documents planning strategies developed to address aging infrastructure and changing water supply pressures. This Master Plan has been prepared as a working document capturing engineering evaluations and recommendations while also allowing for adaptation as conditions and policy changes.

This Water System Master Plan documents the Del Paso Manor Water District policy regarding policy, vision and direction for the District and does not commit the rate-payers to a specific discretionary action to implement the policy goals. Evaluation of funding and rate impacts, California Environmental Quality Act (CEQA) review, and possibly construction implementation will flow from the vision of this Master Plan and reflect the next steps in the process of renewing the infrastructure of the District.

1.2 Master Planning Process and Documents Prepared

The District is located in the Arden area of unincorporated Sacramento County serving approximately 1.3 square miles, 1,800 residential, commercial, and institutional customers with an estimated average water usage of 1,680 acre feet per year over the last 10 years. The District is fully built-out and there is no growth area available.

The District's water system is comprised of buried water mains, eight (8) groundwater supply wells, and individual service connections, and has generally been in continuous service for over 50 years. There is an increasing infrastructure liability as the aging pipelines and wells reach the end of their useful life over the next 5 to 30 years. The District's elected Board of Directors, recognizing that the aging system and water supply reliability impact water service reliability, commissioned this Water System Master Plan.

The Master Plan focuses on a 25-year horizon with specific recommendations developed for the 5-, 10-, and 25-year milestones. This Master Plan was prepared building on a series of technical memoranda documenting the detailed evaluations for review and discussion with the District management and Board. The evaluation, findings and recommendations of the Technical Memoranda (TMs) are presented in this Master Plan and the TMs provided as appendices under separate cover.

The Master Plan includes a detailed Planned System Maintenance schedule for replacement of facilities similar to what has traditionally been titled a Capital Improvement Plan. Given that the District is fully developed, there are no true capital improvements needed for the current use. There are, however, significant liabilities facing the District in maintaining high quality water supply and level of service and the liabilities are addressed with the PSM plan.

1.3 Executive Summary

This Executive Summary provide a brief overview of the evaluation undertaken, key findings and recommendations. Additional discussion and date are provided in the body of this Master Plan and in the Technical Memoranda provided as appendices under separate cover.

1.3.1 Water Demands and Planning Criteria

The existing water use in the District was evaluated with the following findings:

- The District has a mixture of residential (94.3% of services), multi-housing (0.6% of services), commercial (3.7% of services) and institutional, irrigation and fire protection (1.3% of services) customers.
- The water demand is disproportionately skewed towards the non-residential water customers with 44% of the annual water being used by non-residential accounts.
- The District records indicate a 24% reduction in system water use over the period 2004 to 2007. The estimated per capita water use in 2004 was 227 gallons per capita per day (gpcd) and in 2007 was estimated at 173 gpcd.
- The District average 10-year water use is estimated to be below similar communities in the Sacramento area and was assumed to increase to match similar communities.

The water demands in the District are shown in Table 1 and are dominated by a small number of non-residential customers with a regional benefit. Conservation will be encouraged with these large water users as part of managing the Districts resources. The District has large landscape lots and water use reductions will require changes in customer landscape practices.

Table 1: Peak Demands and Factors

Demand Period	Water Demand		Peaking Factor	Basis for Calculation
Average Day	1.50 MGD	1,042 gpm	1.0	District Records (1998 – 2007)
Maximum Month Daily Average	2.93 MGD	2,035 gpm	1.95	Maximum monthly demand from the last 10 years of supply operation divided by number of days where maximum monthly demand occurred
Maximum Day Demand	4.40 MGD	3,056 gpm	2.93	Max Month Daily Average Demand times 1.5 peaking factor
Peak Hour Demand	6.60 MGD	4,580 gpm	4.40	Estimated Max Day Demand times 1.5 peaking factor divided by 24 hours

1.3.2 Water Supply Planning

The District is 100% groundwater and the groundwater basin in not in overdraft. The District maintains eight existing wells with an installed capacity capable of meeting maximum day demand (with single largest well off line), peak hour demand and a maximum day demand with a residential fire flow. The existing system supply is insufficient to meet a maximum day demand and the single largest fire flow of 3,500 gallons per minute without low pressure conditions in the system. The initial phase planned system improvements include a new well to address this shortfall.

The District has an agreement with the City of Sacramento to make available sufficient surface water to meet the District water supply needs. The District does not have facilities or approvals to use this water at this time. Obtaining approvals for surface water use will trigger installation of water meters within the District.

1.3.3 Conjunctive Use Planning

Conjunctive use is the balancing of surface water and groundwater to maximize the benefits of both. Two options for conjunctive use were evaluated. One option is the use of City of Sacramento surface water supplies either directly or wheeled through Sacramento Suburban Water District and the second option is the use of surface water diverted at the Carmichael Water District Bajamont Water Treatment Plant. This second option provides for a beneficial water supply plan for both the Carmichael Water District (CWD) and Del Paso Manor Water District with a joint project option to pump groundwater back to CWD in the event they have lost surface water supply due to drought or groundwater supply due to contamination.

The recommendation is to continue to investigate the joint CWD water supply project while maintaining the City surface water supply agreement.

1.3.4 Facilities Replacement Planning

The facilities replacement plan is presented in detail and provided for five new wells and a complete reconstruction of all pipelines. The planned replacement was evaluated using a hydraulic model and confirmed system pipe and supply capacity to fully support existing water use and fire flow criteria.

1.3.5 Organizational Structure and Management Planning

The District currently employs four full-time and one part-time employee to operate the system. The District maintains agreements with neighboring agencies for assistance in the event of an emergency and maintains annual contracts with water and water well contractors for on-call response as needed.

The proposed planned system maintenance, addition of metering, additional conservation requirements and increased distribution and treatment operator coverage will require additional staffing in the future. Two approaches to addressing possible future staffing needs are provided.

1.3.6 Meter Retrofit Planning

The District is a small water agency and does not currently fall under recent legislation regarding mandatory water metering. The District has agreed through the Water Forum process to begin metering at such time a discretionary surface water supply decision is required.

This Master Plan recommends proceeding with installation of new services, meter boxes and meter idlers concurrent with the pipeline

1.3.7 Planned System Maintenance

The planned system maintenance (PSM) schedule is presented in detail with summary cost estimate tables, project descriptions and project time table. The work is presented in four year periods with the initial effort including a new well and system electrical improvements. The work includes wells, pipes, meters, and the CWD conjunctive use project and provides for full replacement of the system with conjunctive use and meters by the end of the planning period.

The existing distribution system is primarily in the backyards of the residential area and this Master Plan recommends relocating the system to the public right of way as part of replacing the aging pipe network.

1.3.7.1 Summary Estimated Cost and Phasing

The detailed breakdown and development of cost estimates for the projects is provided in the body of this Master Plan. The summary of the estimated cost and planned system maintenance phasing is provided in Table 2.

Table 2: Cost Summary for Planned System Maintenance 2010-2030 (Meter Installation by 2025)

PSM Phase	Scheduled	Baseline	Optional	Total
1	2010-2014	$4,393,400	$0	$4,393,400
2	2014-2018	$4,928,200	$1,147,000	$6,075,200
3	2018-2022	$2,438,400	$2,184,800	$4,624,200
4	2022-2026	$6,910,100	$5,628,300	$12,538,400
5	2026-2030	$1,744,300	$617,400	$2,361,700
Estimated Cost				$29,992,900
Total Cost Rounded to:				$29,993,000

Section 2: Introduction

Del Paso Manor neighborhood is a well maintained quiet post World War II residential and commercial development in the unincorporated Arden/Arcade are of Sacrament County whose water system has served it well since first delivering water in the late 1940's.

2.1 Purpose of the Water Master Plan

The Del Paso Manor Water District (District) has long been committed to providing a safe and reliable water supply, while at the same time maintaining low water rates. This Water System Master Plan is the first District master plan and documents planning strategies developed to address aging infrastructure and changing water supply pressures. This Master Plan has been prepared as a working document capturing engineering evaluations and recommendations while also allowing for adaptation as conditions and policy changes.

This Water System Master Plan documents the Del Paso Manor Water District policy regarding policy, vision and direction for the District and does not commit the rate-payers to a specific discretionary action to implement the policy goals. Evaluation of funding and rate impacts, California Environmental Quality Act (CEQA) review, and possibly construction implementation will flow from the vision of this Master Plan and reflect the next steps in the process of renewing the infrastructure of the District.

2.2 Background

The District is located in the Arden area of unincorporated Sacramento County, northeast of the City of Sacramento, as shown in the vicinity and location maps provided in Figures 1 and 2. The District service area is approximately 1.3 square miles and the District provides drinking water to approximately 1,800 residential, commercial, and institutional customers. The District is bounded on all sides by Sacramento Suburban Water District (SSWD), a large water purveyor in the Sacramento region that was formed in 2002 by the merger of the former Arden and Northridge Water Districts. Figure 3 provides a map of the region and the District's location relative to neighboring water purveyors.

The District is fully built-out and is facing an increasing infrastructure liability as the aging pipelines and wells reach the end of their useful life over the next 5 to 30 years. The District's water system is comprised of buried water mains, eight (8) groundwater supply wells, and individual service connections, and has generally been in continuous service for over 50 years. Figure 4 provides the location of each of the existing District wells, and approximate locations and diameters of existing buried water distribution pipelines. The District's elected Board of Directors, recognizing that the aging system and water supply reliability impact water service reliability, commissioned this Water System Master Plan.

Kennedy/Jenks Consultants (Kennedy/Jenks) specializes in water system master planning, infrastructure planning, water resources planning, as well as design and practical application of engineered solutions for safe and reliable systems and has prepared this Master Plan. The Master Plan will focus on a 25-year horizon with specific recommendations developed for the 5-, 10-, and 25-year milestones. The Plans will consider infrastructure replacement beyond the

25-year period for pipelines and groundwater wells, as appropriate, and provide general recommendations for the longer-term issues.

2.3 Scope of Work

This Master Plan was prepared building on a series of technical memoranda documenting the evaluation of conjunctive use water supply strategies and facilities replacement planning. In addition, facility management review for future District staffing needs and metering installation planning were developed through meetings with the staff.

The Master Plan includes a detailed Planned System Maintenance (PSM) schedule for replacement of facilities similar to what has traditionally been titled a Capital Improvement Plan. Given that the District is fully developed, there are no capital improvements associated with growth or development and instead the investment of capital is to maintain the system as needed for the current use. The significant liabilities facing the District in maintaining high quality water supply and level of service and the liabilities are addressed with the PSM plan.

2.4 Acknowledgements

The team and Kennedy/Jenks wishes to acknowledge the efforts and input of the following Del Paso Manor Staff and Elected Board for their participation in the work, consideration of the issues and leadership and charting the future for the District.

Del Paso Manor Water District – Board of Directors

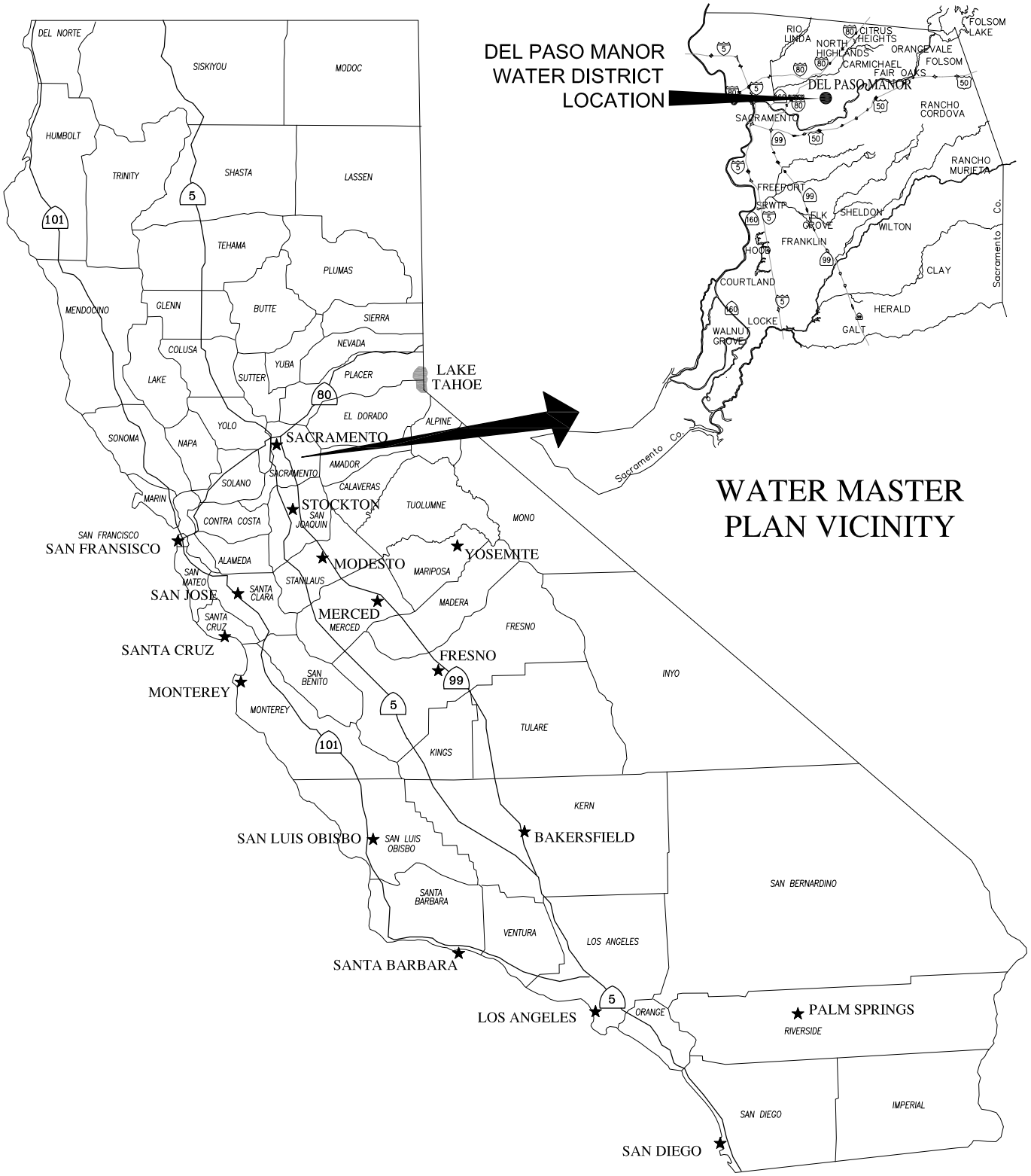
Richard Allen, President
John Downing, Vice President
Michael Clohossey, Director
Philip Ripplinger, Director
Roy Wilson, Director

Del Paso Manor Water District – Administration and Staff

Debra Sedwick, General Manager
Richard Bolton, Field Manager
Lori Hensley, Office Assistant
Ken Ingle, Operation and Maintenance Technician

In addition, we would like to acknowledge the efforts of the Kennedy/Jenks team as follows:

Sean Maguire, P.E., Project Engineer
Sherly Rosilela, EIT, Staff Technical Support
Alex Peterson, P.E., Project Manager



Kennedy/Jenks Consultants

DEL PASO MANOR WATER DISTRICT
SACRAMENTO, CALIFORNIA
MASTER PLAN

DISTRICT VICINITY MAP

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FIGURE 1

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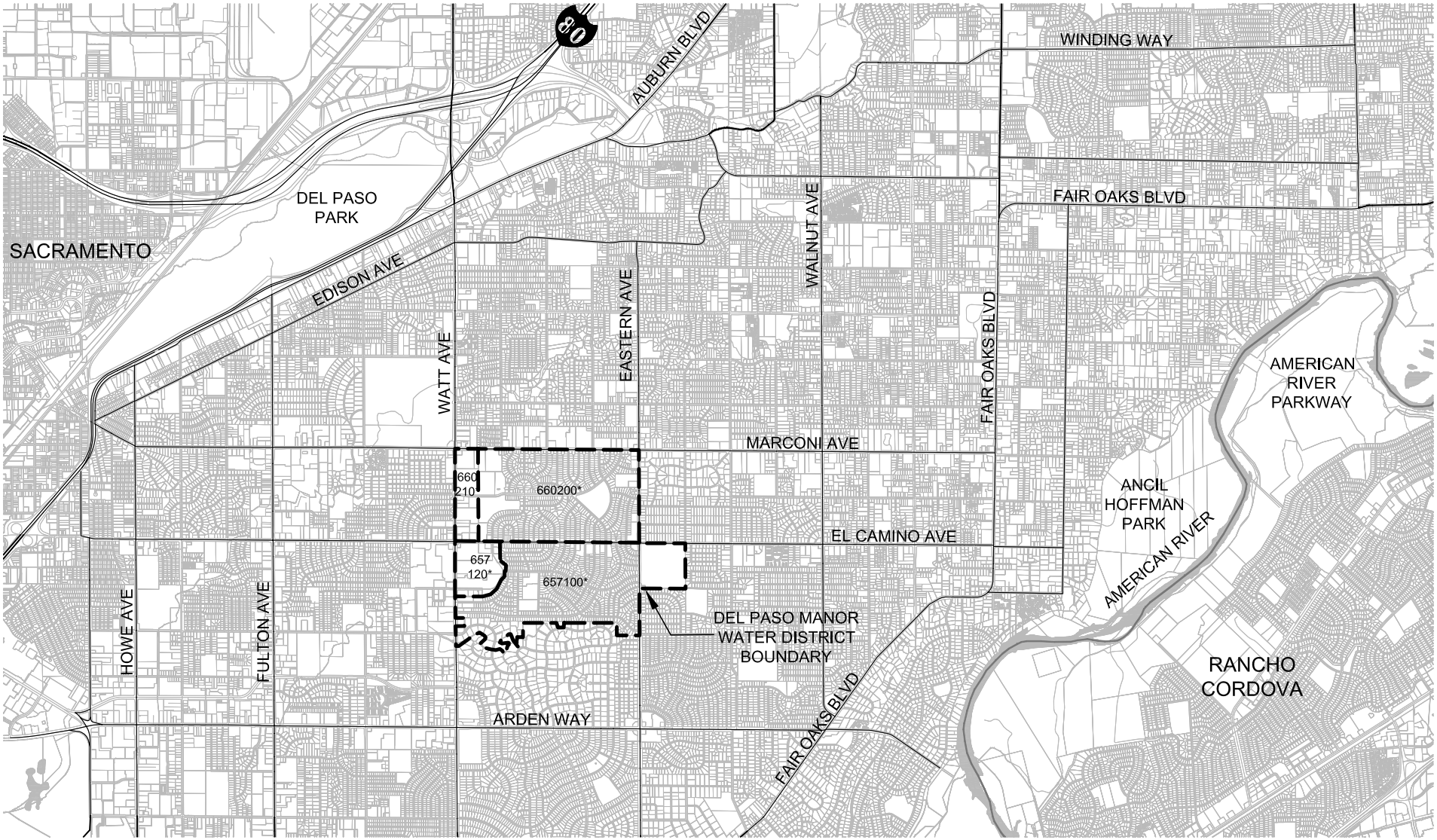

*NOTE: SACRAMENTO AREA COUNCIL OF GOVERNMENT MINOR ZONES BOUNDARIES SHOWN WERE USED FOR POPULATION AND GROWTH PROJECTION.

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DEL PASO MANOR WATER DISTRICT
SACRAMENTO, CALIFORNIA
MASTER PLAN

DISTRICT LOCATION MAP

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FIGURE 2

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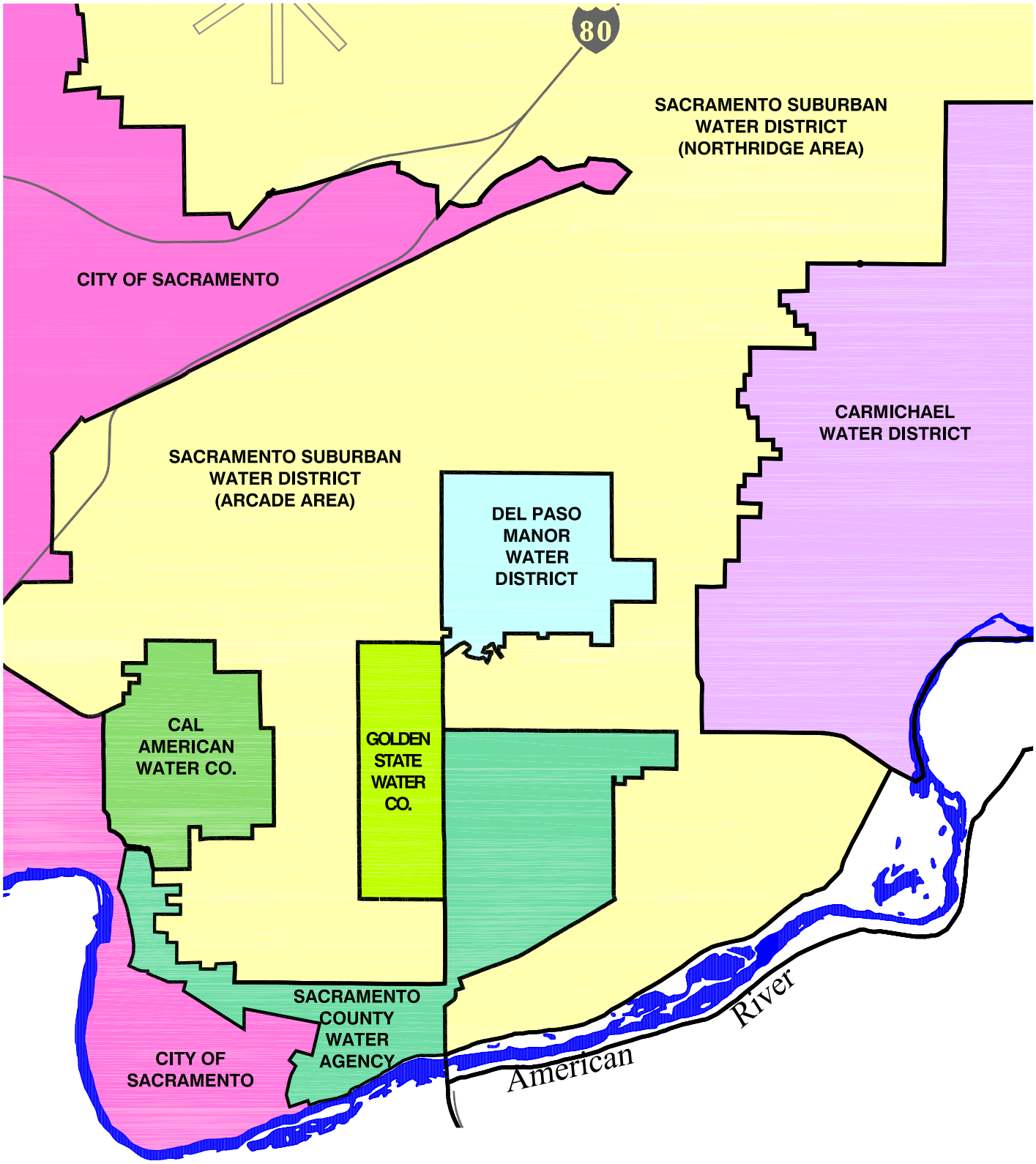

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DEL PASO MANOR WATER DISTRICT
SACRAMENTO, CALIFORNIA
MASTER PLAN

ADJACENT WATER DISTRICTS

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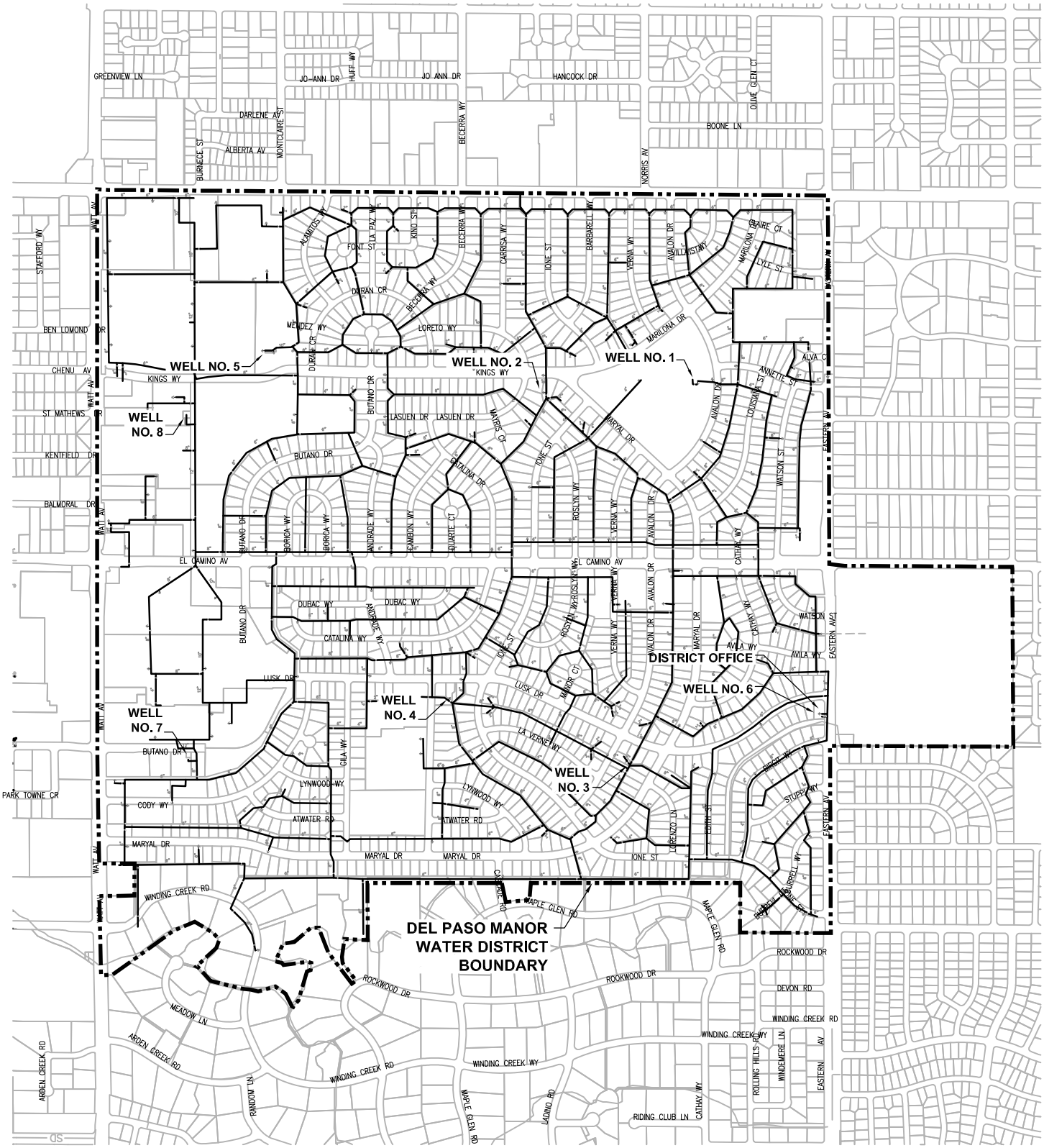
FIGURE 3



Kennedy/Jenks Consultants

DEL PASO MANOR WATER DISTRICT
SACRAMENTO, CALIFORNIA
MASTER PLAN

DISTRICT SERVICE AREA BOUNDARY

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FIGURE 4

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Section 3: Water Demands and Planning Criteria

The District customers have benefited from low cost and abundant water supply supporting park like suburban landscapes and continuous commercial water consumption practices that are trending to be inconsistent with state conservation policies, presenting challenges for the District in maintaining the high level of service, low cost and consistent regulatory policy compliance.

3.1 Introduction

This section presents the District historical water demands and planning criteria that will be used for planning of water supply and distribution system improvements.

3.2 Population and Growth

In order to estimate the population and residential units within the District service area was obtained from two data sources: The Sacramento Area Council of Governments (SACOG) Regional Data Center and the US Census Bureau. With the District already at its build out capacity, the population is expected to remain steady for the next 25 years. The following population estimate data was used to prepare per capita water use estimates.

The District boundaries concur with four (4) minor zone boundaries 657100, 657120, 660200, and 660210 in the SACOG Regional Analysis District 9 Arden Arcade. The SACOG minor zones are shown in Figure 2. The SACOG data from 1995 – 2001 shows a general zero growth across the minor zone boundaries, which confirms that the District service area has been fully developed and reached build out. Table 3 shows estimated population and housing units for minor zones within District Boundaries and tabulated estimate of population per housing unit. The estimated 2.2 persons per household using the SACOG data is low for similar land use and density in Sacramento County and we assumed would trend upward during the planning period of the Master Plan.

Table 3: Population and Housing Estimates and Tabulated Density [a]

Minor Zone	Estimated Population	Housing Units
660200	2,421	1,188
660210	49	20
657100	2,520	1,043
657120	0	0
Total	4,990	2,251
Estimated Population/Housing Unit [b]		**2.22**

(a) Based on SACOG. Population and Housing for Sacramento County, by Minor Zone: 2002
(b) Rounded to nearest 0.01 unit

The data in Table 4 shows the population and housing unit density for the geographic area as prepared by the US Census Bureau national census data 2000. Population and housing unit density projections for several Census Data Places (CDP) in Sacramento County were reviewed to develop an average for similar land use and development density.

The CDPs shown in the table below were selected based on their similar socio-economic and geographical characteristics with the District.

Table 4: Population and Housing Units Density

Geographic Area	Housing Units Per Square Mile	Population Per Square Mile	Population Per Household
Arden Arcade CDP	5084.9	2373.3	2.14
Carmichael CDP	4622.2	1987	2.33
Citrus Heights City	5929.3	2432.3	2.44
Fair Oaks CDP	2832.7	1159.2	2.44
Foothill Farms CDP	7528.2	2950.6	2.55
Florin CDP	4896.1	1700.8	2.88
Gold River CDP	3011.1	1229.1	2.45
La Riviera CDP	5649.1	2467.9	2.29
Orangevale CDP	2663.5	1007.2	2.64
Rio Linda CDP	1911.2	656.7	2.91
Del Paso Manor WD estimated Population/Household			**2.51**

(a) Based on US Census Bureau GCTPH1. Population, Housing Units, Area, and Density: 2000

Nine out of the ten (10) similar census data areas indicated higher population per household than Del Paso Manor. The District, although fully built out, could experience an increasing trend with water use due to increasing population per household. The future District persons per dwelling projection assumes the residential neighborhoods will tend to see a transition from older single and two person residential profile to three to four person per household families. For this reason the composite value of 2.51 persons per household is used for future water projections and reflects a potential increase of 13 percent.

Existing water use values have been reviewed based on the estimated 2.22 persons per household discussed above.

3.3 Water Use

This section presents historical water use and the development projected District water demands based on existing water use patterns.

3.3.1 Historical Annual Water Use

The annual historical District water demands and average gallons per capita day (gpcd) usage for 1998 - 2007 are provided in Table 5 based on groundwater supply well production records. Since the District does not have water meters installed at each connection to provide a full account of actual water demand, water supply data as provided in Section 3.2.1 is assumed to be equal to water demand. Typically there is a loss factor resulting from leaking pipes or illicit connections that causes actual customer demand to be lower than the supplied flow. Since the District is at a build out condition, the average day demand used for calculating Maximum Day and Peak Hour demand is 1.50 MGD.

Table 5: Historical Water Use 1998 - 2007

	Annual Water Use		
Year	**Acre-Feet**	**Million gallons per day (MGD)**	**Average Day Demand (gpm)**
1998	1,545	1.38	958
1999	1,794	1.60	1,111
2000	1,801	1.61	1,118
2001	1,793	1.60	1,111
2002	1,693	1.51	1,049
2003	1,476	1.32	917
2004	1,747	1.56	1,083
2005	1,657	1.48	1,028
2006	1,654	1.48	1,028
2007	1,638	1.46	1,014
Average	**1,680**	**1.50**	

Based on the historic water use the Average Day Demand is estimated to be 1.50 MGD (1,042 gpm) with an annual total water use of approximately 1,680 acre-feet.

3.3.2 Water Use and Customer Service Type

Water use calculations are reported several different ways depending on the intended use of the estimates. For example, in a land use planning document a generalized water duty by land use type might be used to estimate long range water demands associated with a county General Plan update. In this example you could expect to see a water duty for residential, multifamily residential, commercial, industrial, park, etc. Water districts however do not govern over land use and commonly assess water demands based on the existing community development profile lumping together the residential and all the services, business, professional, recreational, industrial and public water use as a composite of the water needed to support a given population. The future projects are then based on estimates of population growth with the assumption that the corresponding services, employment and recreation needed to support the standard of living associated with growth will result in similar water use. Sacramento County for example used a blanket 3 acre feet per acre water use estimate regardless of land use for many years in estimating long term water needs.

Water use and water conservation are becoming much more closely reviewed as limited water resources and escalating storage, treatment and conveyance costs push for greater management of our water resources.

The District annual water use is estimated at 1,680 acre-feet and the population is approximately 4,990 persons. Dividing total water used by total population served produces a water use number of 300 gallons per capita per day (gpcd) as an average day water use. This however ignores the impact of high water use types that include for the District two regional resources, County Club Plaza Mall and the AT&T western US telephone switching center. Backing out all the non-single family and duplex water use results in a lower per capita water use of 208 gpcd for purely the residential customer.

The United States Geologic Survey (USGS) *Circular 1268 Estimated Use of Water in the United States in 2000* compiled statewide water use values for public water supplies. USGS defined the Public Supply as follows.

> *Public supply refers to water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum of 15 connections. Public-supply water may be delivered to users for domestic, commercial, industrial, or thermoelectric-power purposes. Some public-supply water may be delivered to other public suppliers or used in the processes of water and wastewater treatment. Public-supply water is used for such public services (public uses) as pools, parks, and public buildings; or be unaccounted for (losses) because of system leaks or such non-metered services as firefighting or the flushing of water lines.*

The USGS 2000 water use numbers provide the basis for our calculating an estimated California statewide average, weighted by population, of 203 gpcd for the public water supply.

Table 6 provides a summary of selected counties and calculated per capita water use using the USGS Circular 1268 data.

The District composite water use number of 300 gpcd appears high when compared to the statewide average of 203 gpcd and the county by county number shows above. However, the relative contribution of water use from the regional mall and western US call center equipment cooling towers must be taken into account in considering realistic conservation opportunities and goals.

Table 6: Residential Water Use 2004 - 2007

County Name	Water Use – Public Supplied (gpcd)	Percent of Total Water Used in California
Sacramento County	261	5%
Placer County	267	1%
Yolo County	299	1%
San Francisco County	109	1%
San Diego County	185	7%
San Bernardino County	273	6%
Orange County	190	8%
Los Angeles County	185	26%
Riverside County	294	7%

The following sections present a further review of District water use by customer type.

3.3.2.1 Customer Service Type

Water use varies by customer type, class and practice. The District's largest customers include AT&T, schools and parks and reflect <1% (14 services) of the service connections consume approximately 44 percent (730 acre feet per year). The summary below breaks out water use based on District meter data by customer type. Residential single family and duplex service type is metered and the values are estimated.

The District has approximately 1,796 total water service connections reflecting all classes of service. The District service profile breakdown is as follows:

- 1,611 connections (94.4%) Residential Use
- 92 (0.6%) Multi-Housing Use (81 flat rate and 11 metered)
- 69 (3.7%) Commercial Use
- 24 (1.3%) combinations of institutional, irrigation, and fire protection

The estimated water use per connection type is presented in the following sections.

3.3.2.2 Residential

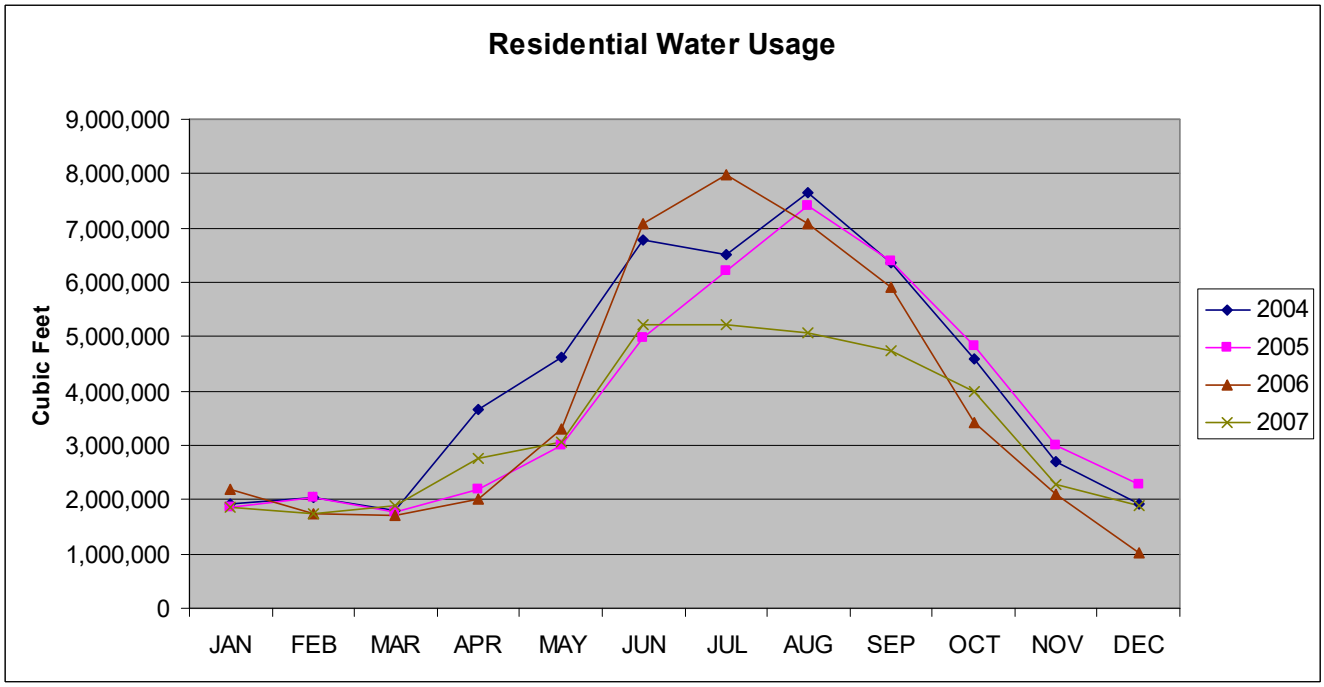
The population served within the District is estimated at 4,990 occupying 2,251 housing units. The total number of housing units includes apartments, duplex and single family accounts. The total metered water use was used as the starting point for developing the estimates below by backing out non-residential water use and apartment water use figures.

The non-metered water use was adjusted for a 10% unaccounted for water loss prior to assigning the remaining unmetered production for single family and duplex unit water consumption. The estimated single family and duplex unit water use is presented in Table 7 below.

Table 7: Residential Water Use 2004 - 2007

Description	2004	2005	2006	2007
Residential Water Use (gpd)	891,860.4	787,791.6	772,455.3	677,732.8
Number of Residential Accounts: SFR	1,611	1,611	1,611	1,611
Number of Residential Accounts: Duplex	81	81	81	81
Total Number of Households	1,773	1,773	1,773	1,773
Residential Water Use (gallons/household)	503.0	444.3	435.7	382.3
Average Population (persons/household)	2.21	2.21	2.21	2.21
Residential Water Use (gpcd)	227	201	197	173

The estimated water use in gallons per capita per day (gpcd) value is often used to compare water use of different agencies. The District records indicate a declining per capita water use over the period from 2004 to 2007 of almost 24% (54 gpcd). The review of the monthly data presented below shows a marked decline in summer water use for 2007 that is uncharacteristic of the typical demand pattern for the District and we have disregarded the 2007 water use numbers in estimating the average per capita water demand.



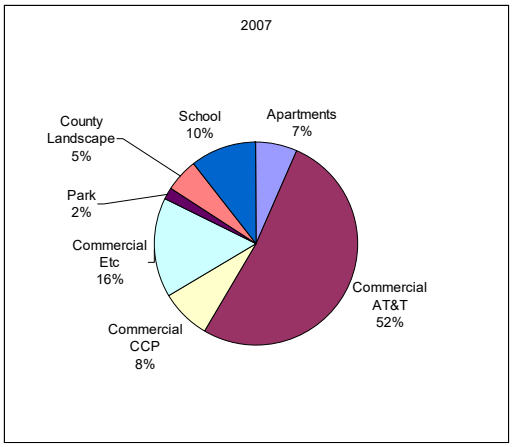
The estimated average per capita water demand is 208 gallons per capita per day based on estimated water use for the period 2004 through 2006.

3.3.2.3 Non-residential, Commercial and Institutional/Parks

The commercial water use is predominantly serving cooling tower equipment operated by AT&T for cooling of their telephone service centers. The summer maximum month water use for AT&T complex is approximately a 460 gpm contribution to Maximum Day Demand. The winter demand goes a low as 12 gpm in January- February when evaporative cooling demands are down. For the purposes of estimating water demand for this master plan we have assumed an average annual water use of 300 acre feet per year and a Maximum Day Demand of 460 gpm.

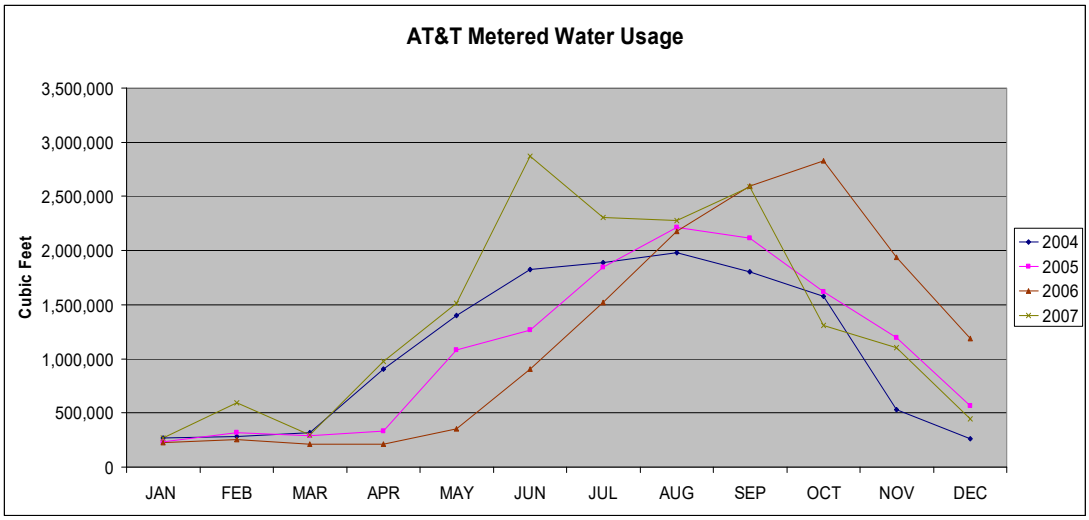
The chart below presents an overview of the non-residential water distribution within the District for 2007.

Historically institutional and park water use come from three schools and one park. The County of Sacramento added two metered accounts starting in 2006 for the Watt Ave Beautification project median landscape irrigation. District water use records indicate 88 acre-feet per year and an increase starting in 2006 of approximately 12 acre-feet per year for the County project. The estimated total for this class is 100 acre-feet per year. This equates to approximately 62 gpm average day demand.



The estimated maximum day water demand from non-residential demands is 522 gallons per minute (460 gpm AT&T plus 62 gpm institutional and park demand.) The total estimated maximum day demand is estimated at 3,056 gpm. The non-residential demand reflects approximately 17 percent of the instantaneous water demand during a maximum day use condition.

The annual water use from non-residential demands is approximately 44% of the total water used in the District. The annual water use, measured in cubic feet per month in the graph below, shows how water use increases from March through December and produces a high total annual water. This seasonal water use corresponds to the increased equipment load needed for the AT&T cooling towers.



3.3.3 Water Meters

The District has meters installed at approximately 90% of its commercial accounts, one park, and three schools. Private residences are not currently metered and it is the Goal of the District to install meters at each District service connection by 2030, or sooner depending on the District's potential future agreements with surface water providers.

The Water Forum agreement includes requirements for the District when discretionary approval is required for new or expanded surface water supplies. In this case, the District would be required to annually retrofit 3.3%-5% of the total number of unmetered residential connections and read and bill in accordance with the Water Forum Conservation Element.

The existing District water lines are located along the back lot lines and are generally inaccessible without entry into the individual residential yards. The existing back lot pipelines are fifty plus years old and the PSM recommendations include replacement of these pipeline with new pipelines in the front right of way by the meter deadline of 2030. It is therefore recommended that the installation of meters in the backyards be avoided and that meter setters be installed with the pipeline replacement projects. Upon completion of the pipeline replacement projects the entire District can be converted to a metered district with the installation of all meters at once. The installation will coincide with the start of conversion to a commodity based water rate.

3.4 Water Demand Criteria

The following provides an evaluation and determination of water use date for determination of water supply needs. The demand criteria is based on historic water use within the District and with similar water agencies in Sacramento County.

3.4.1 Demand Projections

Water demands fluctuate throughout the year and day with changes in weather, landscape irrigation practices, and other activities. For this reason, water demands under varying conditions are calculated to provide the basis for the District's water supply and distribution system capacity.

The key water demand periods used for planning purposes are as follows:

- Average Day Demand: The average of total water consumption over a year. For the District, the Average Day Demand over the past ten years is 1.5 MGD.
- Maximum Day Demand: The highest daily demand in a one year period. This demand period typically occurs during hot summer weather.
- Peak Hour Demand: The average water use during the highest hour of use in the year. Peak hour demand may or may not occur on the same day of Maximum Day Demand.

The peak factors used in this Master Plan are developed further in Section 3.4.4.

3.4.2 Fire Protection, Jurisdiction and Estimated Fire Flow Criteria

This section of the Master Plan addresses the existing District water system flow capacity and provides a source capacity targets for planning future water system Planned System Maintenance projects.

The existing District water system is used by the Sacramento Metropolitan Fire Department (SMFD) for water supply during testing and when responding to a structure fire within the District. The District requirements for water supply are defined in Title 22 of the California Code of Regulations (CCR) Chapter 16 California Water Works Standards. Title 22 does not require a public water system to provide fire flow as a minimum condition of service. Fire protection requirements for building permit approvals is in the jurisdiction of the SMFD and the not the District.

The SMFD conducts periodic fire hydrant testing in the District including high demand locations such as Country Club Plaza. The SMFD has not advised the District of any deficiencies with the existing system providing a level of service consistent with SMFD expectations. Title 22, although not requiring a minimum supply for fire flow, does stipulate a minimum operating pressure of 20 pounds per square inch, including under a fire flow condition.

Review of existing SMFD records by the District identified a 3,500 gpm fire demand for the 3540 Kings Way AT&T Building and was the maximum value discovered during the review. Kennedy/Jenks review of the residential demand resulted in a range from 1,500 gpm for the

bulk of the District's neighborhoods and 2,750 gpm for the larger residential homes in the Winding Creek area of the District. Based on this research, 3,500 gpm has been used as the maximum fire flow demand that can be expected and this have been included in the minimum source capacity calculations of this Master Plan. The planned system replacement will result in a water supply and system capable of meeting or exceeding the fire flow criteria presented above.

3.4.3 Unaccounted-for Water

Unaccounted-for water is the difference between water production and the metered demand. A portion of this water may be from system leaks. Underground leaks could be located in lines, service lines, residential meter boxes, valves, and they are usually associated with excessive pressures, ground settlement, improper installation, or improper materials. According to American Water Works (AWWA) Water Audit and Leak Detection Guidebook, water losses other than leakage can generally be attributed to hydrant flushing of pipelines for O&M purposes, fire hydrant flows for fire fighting, construction practices, illegal connections, malfunctioning distribution system controls, reservoir seepage and leakage, and theft.

In a Municipal Leak Detection Program Loss Reduction document prepared for the state of California Department of Water Resources, Office of Water Conservation, it is estimated that the average unaccounted-for water in the State of California is 9.5 percent.

Currently, water usage is accounted for by metering the District's largest water users: commercial, multi-family residential, and park/landscaping accounts. Once the residential water use is metered as discussed in earlier section of this document, the District will be able to more accurately track the losses throughout the system.

For purposes of the Water Master Plan, unaccounted-for water usage has not been included in the average day water demands and per capita water usage.

3.4.4 Peaking Factors

The water system peaking factors were calculated based on the District's average historical water use from 1998 – 2007 using the provisions provided in the current edition of the Title 22 California Code of Regulations Chapter 16 California Waterworks Standards §64554 (Waterworks Standards). The Waterworks Standards prescribes methods to be used for calculating peaking factors when daily or monthly data is available. The calculated water demands are shown in Table 8. With the District reaching its build out capacity, it is anticipated that the District water demands will undergo little or no change.

Table 8: Peak Demands and Factors

Demand Period	Water Demand		Peaking Factor	Basis for Calculation
Average Day	1.50 MGD	1,042 gpm	1.0	District Records (1998 – 2007)
Maximum Month Daily Average	2.93 MGD	2,035 gpm	1.95	Maximum monthly demand from the last 10 years of supply operation divided by number of days where maximum monthly demand occurred
Maximum Day Demand	4.40 MGD	3,056 gpm	2.93	Max Month Daily Average Demand times 1.5 peaking factor
Peak Hour Demand	6.60 MGD	4,580 gpm	4.40	Estimated Max Day Demand times 1.5 peaking factor divided by 24 hours

3.5 Water Conservation

Water conservation requirements continue to change in California. Water use restrictions for dry years have been in place for water suppliers relying on surface water. The District relies solely on groundwater for supply and is not subject to surface water conservation requirements. The District Conservation regulation document provides for guidelines as follows:

- When outside watering is required, residents or businesses with odd address numbers may water only on Tuesdays, Thursdays, or Saturdays. Even numbers may water only on Wednesdays, Fridays, or Sundays. Watering on Mondays is prohibited.
- Open hoses are not permitted. Automatic shut-off nozzles are required.
- Car washing may be done only with a bucket. Rinsing may be done with a hose equipped with a shut-off nozzle.
- Washing down of sidewalks, driveways, parking lot, or other paved surfaces is prohibited.
- All swimming pools, ponds, fountains and evaporative coolers shall be equipped with recirculating pumps.

The existing policy provides for the District Board implementing, by resolution, some or all of the above conservation requirements.

Enforcement includes oral warning for the first offense, written violation notice for the second offense and citation for the third offense. Citation penalties may include a fine, a requirement for meter installation, and/or termination of water services as determined by the General Manager.

Future baseline non-conservation water use goals may approach or exceed twenty percent (20%) in the coming years as the State of California continues to take a harder look at water use sustainability, climate change and pursues an active role in local water use patterns. The District

can expect to be exempt from some requirements due to the size of the District but can expect increasing pressure to reduce water use over time. Water conservation should continue to be a key element of managing the District supply.

3.6 Reliability and Redundancy

Water system reliability and redundancy are generally defined by the California Code of Regulations, Title 22 Water System Standards to include the following:

- The system must have sufficient supply capacity to meet the Maximum Day Demand (MDD).
- A Community water systems using only groundwater shall have a minimum of two approved sources before being granted an initial permit and the system shall be capable of meeting MDD with the highest-capacity source off line.

The District currently operates 8 wells with a pumping capacity of 4,275 gpm with the largest well offline. The MDD is approximately 3,056 gpm. The District meets the minimum required water source capacity as identified above. The existing well condition and capacity is discussed further in Section 4.

The peak hour demand (PHD) exceeds the MDD and water systems can meet this daily peak usage through additional supply pumping capacity or through storage. In addition, emergency and fire protection water supplies can be provided using additional supply pumping capacity of storage. The District relies on additional supply through well capacity to meet peak hour demand. Use of peaking wells avoids the need for surface tanks and booster pumping capacity within the District. The PHD is estimated at 4,580 gpm and with the installed pumping capacity of 5,375 gpm the District meets the PHD.

Fire protection water demand ranges from a low based on typical residential criteria of 1,500 gpm to the higher commercial and multifamily fire flow of 3,500 gpm. The District supply may not be sufficient to provide fire protection supply in excess of 2,500 gpm.

Hydropneumatic tanks are designed to maintain system pressure and do not provide significant storage. A 5,000 gallon District hydropneumatic tank volume provides approximately 1,650 gallons net storage when full and there are 5 tanks for a net maximum stored volume of less than 10,000 gallons. Although five (5) wells are equipped with hydropneumatic tanks this onsite volume of water is minimal and is not considered storage. A typical minimum storage volume a similar district would be calculated as follows:

- 880,000 Gallons Peak Equalization based on 20% of the Maximum Day Demand, and
- 960,000 Gallons Fire Protection Supply based on 4,000 gpm for 4 hours, and
- 1,100,000 Gallons Emergency Supply for reliability.

The estimated minimum storage for a similar district without well capacity to exceed the MDD would be 3 million gallons.

An additional element of redundancy that improves reliability is access to alternative power supply of mechanical engine drivers to continue operating the wells during a power outage. The District maintains two backup systems as follows:

- Natural Gas Engine Drive Well Nos. 6 and 8, and
- Portable electrical generator capable of starting Well No. 2 or 4.

Based on the backup systems the District has approximately 2,700 gpm and should be able to maintain system water pressure in the event of an extended regional power outage. Additional redundancy exists in the electrical grid due to the three substation circuits serving the District. Historical power outages rarely extend to more than two (2) substations servicing the District at any given time.

3.7 Water System Standards and Design Criteria

The water system design criteria presented in this section are recommended to maintain a high level of service and to ensure adequate flow and pressure characteristics throughout the distribution system. Ongoing efforts to manage system hydraulics will help to minimize operation and maintenance activities and costs. The minimum recommended design standards for the water distribution system include the following:

- Design all piping, valves and appurtenances for a minimum pressure of 150 pounds per square inch (psi). This will allow for the system to accommodate normal operating pressures and transient surges.
- Design or select water system materials and components to meet or exceed American Water Works Association (AWWA) standards.
- Loop the distribution system to the greatest extent practical to avoid dead end pipes. Where dead ends are unavoidable, such as on some dead end streets, a minimum water main line size of 6 inches be used to reduce system residence time in the dead end line.
- The minimum distribution system pipe loop diameter should be 8-inch to help ensure that minimum fire flows to hydrants are achievable.
- Design water mains so that the velocities under average day, maximum day, and peak hour conditions are less than 3 fps, 5 fps and 7 fps, respectively. This will reduce damage to pipe linings and valves and minimize excessive head loss. Ultimately, this will help preserve the life of the pipeline and will contribute to lower maintenance costs.
- Design pipes for a target velocity under a fire flow of 10 foot per second and a maximum velocity under maximum day plus fire flow of 13 foot per second.
- Size all mains to limit head loss to three feet per 1,000 feet of length under average day conditions per AWWA recommendations. This is based on an analysis of optimum pipe sizes for lowest total cost of pipeline and pumping costs.

Table 9 summarizes additional distribution system design criteria. The pressure values presented are consistent with existing operating conditions. Friction coefficient values decline with pipe age and it is reasonable to assume that the existing system is operating at between 110 to 120 “C” value for the asbestos pipe and perhaps 90 to 110 “C” value for the steel lines. Steel lines tend to accumulate deposits and the combination of reduced inside diameter from accumulations and increased roughness results in the lower “C” value estimate.

Table 9: Water Distribution System Design Criteria

Item	Criteria
Hazen-Williams “C” factor (Friction Coefficient)	130 for all new pipes
Average water system pressure	50 psi
Minimum water system pressure under peak hour water demand conditions	40 psi
Minimum water system pressure under maximum day water demand conditions	40 psi
Minimum water system pressure under maximum day plus fire water demand conditions	20 psi
Maximum water system pressure	80 psi

Section 4: Water Supply Planning

4.1 Introduction

This section provides documentation of the water supply availability in the District, and provides recommendations for new supply.

4.2 Groundwater Supply

The District currently maintains eight (8) wells to meet all of the District water demands. The District has been pumping on average 1,680 acre-feet per year using Wells 1 and 8 as lead producers. Wells 2, 3 and 4 provide peaking demand and Wells 6 and 7 are the last wells to come on line to meet system demand.

The District is a member of the Sacramento Groundwater Authority (SGA) and Regional Water Authority (RWA) and active participant in regional and groundwater basin planning efforts. The aquifer utilized as the pumping resource by the District is identified by SGA/RWA as not being in overdraft and there are no indications that continued pumping by the District at approximately 1,680 acre-feet per year is unsustainable.

The locations of the District wells are shown in Figure 5. Table 10 below provides a summary of the estimated capacity of the District's wells based on the original installed pump design operating point and current operating observations from District staff.

Table 10: Well Production Capacity Summary

Well No.	Pumping Capacity
1	500 gpm
2	460 gpm
3	580 gpm
4	500 gpm
5[(a)]	460 gpm
6	1,100 gpm
7	675 gpm
8	1,100 gpm
Total Capacity	5,375 gpm
Total Capacity with Redundancy[(b)]	4,275 gpm

(a) Well No. 5 is the last well to come on line.
(b) Redundancy is total system capacity with largest District well (1,100 gpm) offline.

4.3 Surface Water Supply

The District and the City of Sacramento (City) executed an agreement in 1968 establishing conditions for transfer of up to 6.8 cubic feet per second, or 2,460 acre-feet annually of the City's surface water supply to the District through the Area D water service area. This maximum delivery flow is 3,048 gpm and is equivalent to the District MDD of 3,056 gpm. The City has planned for supplying Area D with surface water through their Fairbairn Water Treatment Plant and 54-inch diameter Howe Avenue transmission main.

The District completed a Conjunctive Use Plan evaluating alternatives for developing a surface water supply and participating in groundwater wheeling with neighboring districts in September 2008. The initial findings of the evaluation are the basis for preliminary implementation cost estimates presented in Section 5 of this report.

4.3.1 Interties with Other Districts

The District is active in the water supplier community participating in the Regional Water Authority, Sacramento Groundwater Authority and Water Forum and successor activities. The District has two (2) existing interties and multiple locations for potential interties with Sacramento Suburban Water District (SSWD) and has participated in planning additional connections associated with new pipeline installations by SSWD.

4.3.1.1 Mutual Aid Agreements

The District maintains Mutual Aid Agreements with SSWD and the Carmichael Water District to provide technical and emergency support as part of providing redundancy in District resources to address unforeseen events.

4.3.1.2 Surface Water Supply Agreements

The District and the City of Sacramento executed an agreement over 40 years ago allocating City surface water supply for District use in the future. The specifics of this agreement are discussed in greater detail in the Conjunctive Use Plan.

4.4 Findings and Recommendations

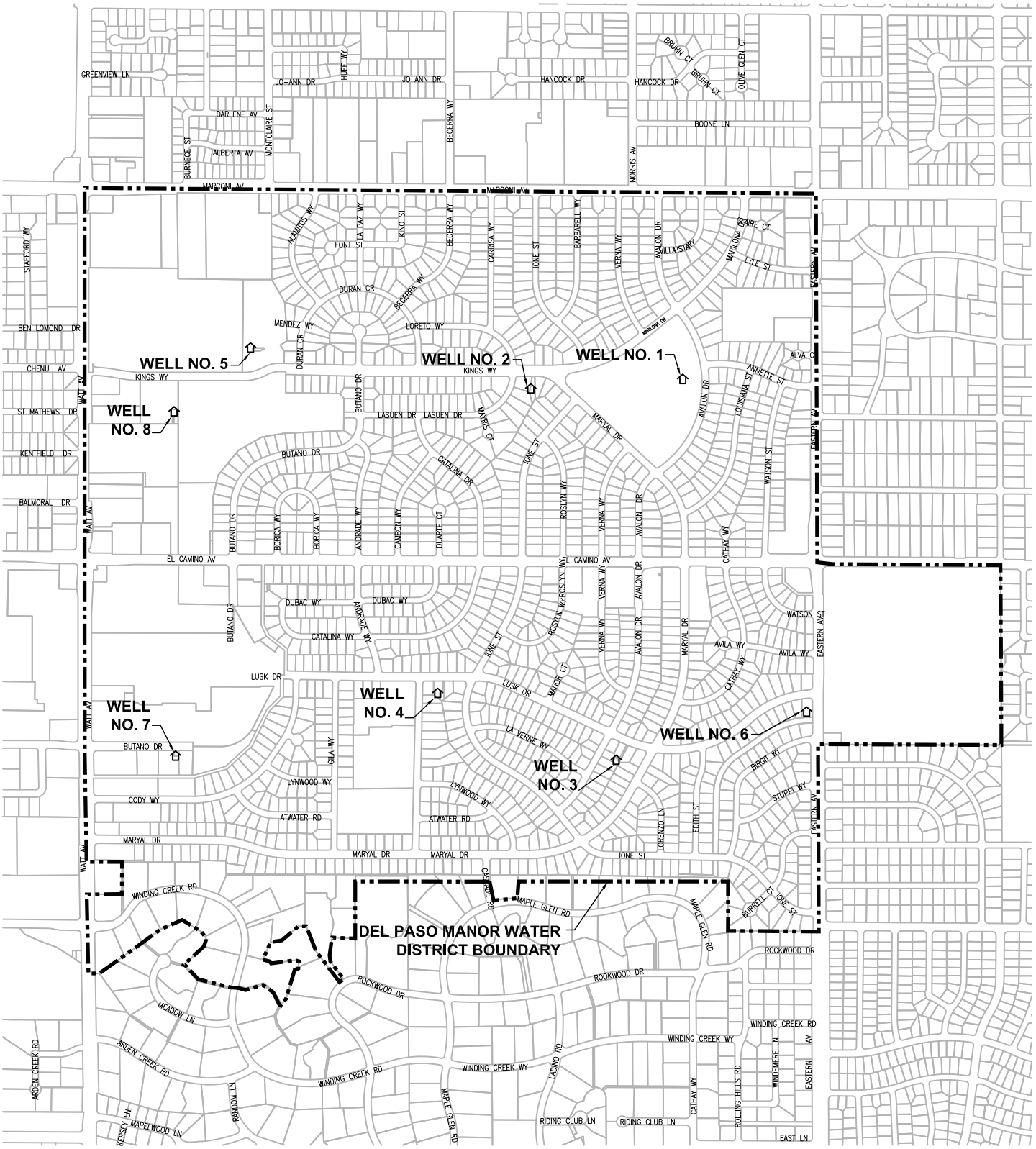
The District is capable of meeting system demands for all normal operating conditions. Although the District relies solely on groundwater, indications are that the groundwater basin is not in overdraft and the continued water use at the historic extractions is a sustainable operating practice.

Table 11 provides a summary of the water supply availability with associated demand conditions. The water system demand criteria is discussed further in Section 3.4 and Table 8.

Table 11: Water Supply Availability

Demand Condition	Demand (gpm)	Water Availability (gpm)	Surplus or <Deficit> (gpm)
Average Day	1,042	5,375	4,333
Maximum Day[(a)]	3,056	4,275	1,219
Maximum Day Plus Fire [(b)]	6,556	5,375	<1,181>
Peak Hour	4,580	5,375	<795>

(a) Maximum Day supply assumes the single largest well offline as shown in Table 10.
(b) Maximum Day plus Fire flow demand are based on a maximum fire flow demand of 3,500 gallons per minute for a minimum for four hours.



Kennedy/Jenks Consultants

DEL PASO MANOR WATER DISTRICT
SACRAMENTO, CALIFORNIA
MASTER PLAN

EXISTING WELL SITES

K/J 0870017.00
APRIL 2009

FIGURE 5

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Section 5: Conjunctive Use

5.1 Introduction

Kennedy/Jenks has provided the District with a Conjunctive Use Plan to present recommendations for implementing a conjunctive use program, whereby the District will continue to utilize its groundwater resources and supplement with imported surface water, either through existing or new contract mechanisms to help accomplish the following objectives:

- Enhance water supply reliability and redundancy for District customers by maintaining both groundwater and surface water source supplies.
- Participate in regional management efforts to ensure the continued sustainability of the groundwater basin.

The Conjunctive Use Plan includes a discussion of the many factors that impact local and regional groundwater resources, and consideration of their potential implications on the District. The discussion includes a summary of efforts to manage historical declining groundwater elevations and migrating groundwater contamination plumes, and partnering agreements that have moved the Sacramento region towards implementation of a managed conjunctive use effort to ensure a sustainable water supply.

After the groundwater resources setting, a focused review of the District's conjunctive use considerations is provided including the following:

- Survey of potential surface water/groundwater use ratios and justification for each case.
- Comparison of several potential surface water supply alternatives to import surface water from neighboring water purveyors (including the City of Sacramento, Sacramento Suburban Water District, and Carmichael Water District).
- Alternatives for infrastructure improvements that would be required to import surface water into the District, depending on the surface water supply alternative that is selected.

5.2 Findings Summary

The following presents a list of findings presented in the Conjunctive Use Plan:

<u>District Water Supply</u>

1. The District desires to provide a safe and reliable drinking water supply to its customers.
2. The District's average annual water demand is approximately 1,680 acre-feet/year.
3. The District's existing source capacity is dependant on 8 groundwater wells ranging in age from 30 years to in excess of 60 years old.

Groundwater Resources

1. The sustainable yield of the aquifer, as estimated by the Water Forum is 131,000 acre-feet per year. Historical groundwater pumping in the north Sacramento groundwater basin has ranged between 80,000 to 100,000 acre-feet per year.

2. Recent conjunctive use efforts (by SSWD to import PCWA surface water and CWD's Bajamont WTP) has decreased groundwater pumping and appears to have contributed to the stabilization of regional groundwater elevations.

3. Groundwater quality is threatened by both regional groundwater contaminant plumes to the west and east of the District as well as localized historical and ongoing potential contaminating activities (PCAs).

4. The District has participated in regional efforts, including the Sacramento Groundwater Authority and Water Forums to establish measures to ensure reliable water supplies region-wide. For this reason, the District would like to participate in conjunctive use efforts and import surface water to balance groundwater pumping.

5. The District has committed to implementing Water Forum Best Management Practices for water conservation.

Conjunctive Use Planning

1. The District does not have an established conjunctive use numerical goal.

2. In 2004, SGA staff proposed a conjunctive use allocation. The proposal was not successful in getting adopted, however it identified a possible conjunctive use goal of 300 acre-feet/year for the District.

3. Surface water may be more readily available in the winter, non-peak water demand months. Approximate average District water demand during the period between October and April is 640 acre-feet per year.

4. There are several possible groundwater banking opportunities if the District imports surface water. Opportunities include in-lieu groundwater recharge as well as aquifer storage and recovery.

Surface Water Alternatives

1. The District has access to surface water through a 1968 agreement with the City of Sacramento for up to 2,460 acre-feet per year of the City's Area "D" water.

2. There are several alternatives available to the District for importing Area "D" water into the District. Options include diverting and treating the water at the City of Sacramento and conveying the water through the City through SSWD to the District or diverting and treating the Area "D" water at Carmichael Water District and transferring the water directly from CWD to the District.

3. SSWD's north service area surface water from PCWA does not include the District in its Place of Use.

4. See Tables in Section 4 for additional detailed findings on surface water alternatives.

Interconnections

1. There are currently two recommended interconnection options for the District: construct an intertie with SSWD or CWD.

2. SSWD has built pipelines through and adjacent to the District, and as a result, an intertie would require only a metering station and short pipeline to connect to the District's distribution system.

3. An intertie with CWD would require an approximately 3,000 linear foot pipeline, metering station and pump station.

4. A permanent interconnection to SSWD would require the District to install fluoridation on its groundwater supply. A permanent interconnection with CWD would not require fluoridation.

5.3 Recommendations Summary

Following is a list of the recommendations that have been provided in the Conjunctive Use plan:

Section 2: Conjunctive Use Setting

1. The District should continue to participate in the Water Forum Successor Effort and support the agreement among the member agencies, and work cooperatively in solving the remaining water resources challenges being addressed in the Water Forum. It is also recommended that the District review and confirm it is implementing its BMP commitments, and develop a plan to complete any outstanding elements.

2. The District should continue its active role in the SGA and support the implementation of the regional management of the groundwater resources to achieve the goals defined in the Water Forum Agreement.

3. The District become more active in its role in the RWA and support the implementation of the regional management of the water resources to achieve District objectives the goals defined in the Water Forum Agreement.

4. The District should monitor and participate in the upcoming and subsequent future efforts to update the Integrated Regional Water Management Plan, and seek funding opportunities for conjunctive use and water management improvements.

5. The District should continue to participate in efforts to collectively manage and protect the North Area Groundwater basin from an overdraft condition.

6. The District should have a contingency surface water supply resource in place, and maintain mutual aid agreements with neighboring purveyors to offset lost groundwater supply resulting from contamination and other emergency conditions.

7. The District should be diligent about monitoring regional contaminant plume remediation, and work collaboratively with neighboring agencies to help ensure that the necessary measures are implemented to contain and remediate the plumes to the extent feasible. One possible avenue could be participation in the SGA's groundwater contamination task force.

8. Continue to monitor potential localized contaminating activities and implement wellhead protection measures as warranted.

Section 3: Conjunctive Use Goals

1. Establish an interim conjunctive use baseline goal of 300 acre-feet/year. Confirm goal would be in accordance with Water Forum Agreement groundwater management commitments pending future determination of conjunctive use objectives by the Water Forum Successor Effort or SGA Water Accounting Framework.

2. Any new surface water interties with neighboring water districts and infrastructure improvements should be sized to accommodate at minimum a 50/50 conjunctive use split.

3. Evaluate potential rate impacts for varying levels and sources of surface water through preparation of a rate study.

4. The District should continue to implement Water Forum Agreement demand conservation measures as warranted. Investigate means for measurable demand reduction as a component of the District's conjunctive use efforts.

5. It is recommended the District continue to explore participation in a groundwater banking program, either through the SGA efforts or a partnership with a neighboring agency.

6. Evaluate participation in local or regional groundwater banking partnerships. Monitor progress of SGA's Water Accounting Framework and proposals for a model groundwater banking program.

Section 4: Surface Water Supply Alternatives

1. The District should continue to explore opportunities to develop agreements with either the City of Sacramento and SSWD (for transmission) or CWD to import Area "D" surface water. Considerations should include the reliability of the water supply sources, required institutional arrangements and regulatory approvals, and evaluation of the annual costs of the water transfer and any capital improvement requirements.

Section 5: Surface Water Supply Infrastructure Improvements

1. For a surface water supply intertie with SSWD, provide a minimum 12-inch connection at the existing intertie stubout of SSWD's existing 24-inch pipeline near Maryal Drive and Gila Way.

2. For a surface water supply intertie with CWD, provide a 12-inch interconnection near the intersection of Eastern Avenue and Lusk Drive.

3. Interconnection locations should be finalized once the surface water alternative is selected. It is recommended that a new intertie should be constructed to connect to a new 12-inch distribution system "backbone" located within the District. Specific intertie location recommendations will be refined after completion of the draft Facilities Replacement Plan.

5.4 Direction Based on Board Review

The District Board review of the summaries above resulted in the direction to prioritize the process as follows:

- Begin Negotiations with Carmichael Water District for implementation of using surplus winter surface water treatment plant capacity at the Bajamont membrane plant. This would include resolution of the beneficial use of the 600 gpm remediated groundwater discharge to the American River at the Bajamont site as an offsetting flow allowing consideration for diversion of City of Sacramento water at the Carmichael Water District point of diversion using the existing river infiltration facilities.

- Begin Negotiations with the City of Sacramento to obtain support for the approach and to proceed with obtaining the regulatory water supply and diversion approvals needed to allow diversion of City surface water supplies at the Carmichael Water District point of diversion.

- Explore additional well construction potential within the District as a secondary water supply for Carmichael Water District to use in periods of low river flow and in the event the GenCorp/Aerojet groundwater contamination plume impacts existing Carmichael groundwater production.

The effort to bring the use of surface water to the District using this approach will be a multi-year process. The estimated costs of these alternatives are discussed in the Conjunctive Use Technical Memorandum and are opinions as to the order of magnitude of cost. Additional detail, discussions and planning are recommended as part of refining the costs as the negotiations and process moves forward.

Section 6: Facilities Replacement Planning

6.1 Introduction

All facilities wear out and need to be replaced over time. The useful period of service for equipment varies with the process, maintenance, and service conditions. For example, a submersible well pump will typically not last as long an aboveground vertical turbine well pump. Small equipment wears out faster than larger equipment, fixed assets such as wells and tanks last longer than equipment with moving parts such as pumps.

This evaluation includes consideration of the current overall age and condition of the District's groundwater facilities, pipes, and tanks. This section provides a summary of the existing state (capacity and condition) of the District's groundwater supply production capacity and recommendations for supplementing and replacement of the supply sources. Pipeline assets are reviewed and recommendations to replace provided.

6.2 Production Capacity Considerations

The District currently relies on eight existing groundwater wells to meet water demands. In a condition with the highest capacity production well offline, it appears that the District is able to meet Maximum Day demand as required by the California Waterworks Standards, but would not be able to meet Maximum Day plus Fire demand, and would marginally not be able to meet Peak Hour demands. Because Maximum Day plus Fire is the highest demand period criteria, it is the controlling factor.

6.3 Existing Well Ages and Condition

All of the existing wells exceed a typical well useful life expectancy of 30 to 50 years. While the useful life expectancy is not a steadfast time period, it does serve as a general indicator for when one may expect to begin to see signs of wear and failure of the well. Typical signs may include pumping sand, diminished water production, casing or screen collapse, and pump and motor failure. Specific well replacement recommendations, detailed well site investigations, and other considerations are provided in the separate Draft Facilities Replacement Plan document.

Table 12: Well Age and Current Production Capacity Summary

Well No.	Year Built	Age in Years	Projected Useful Life	Remaining Useful Life	Notes
1	1946	62	30	<32>	Recent inspection and in fair condition
2	1948	60	30	<30>	No recent inspection
3	1949	59	30	<29>	No recent inspection
4	1951	57	30	<27>	No recent inspection
5	1953	55	30	<25>	Recent inspection – poor condition and now out of service
6	1956	52	30	<22>	No recent inspection
7	1956	52	30	<22>	No recent inspection
8	1977	31	30	1	Recent inspection and in good condition

The following is an assessment of Well Nos. 1 – 8. The well assessment is based on evaluation of the District's record of pump test reports for Well Nos. 1 – 8. The oldest and newest available data for standing water level, drawdown, discharge head, and efficiency were reviewed and tabulated to capture the change in groundwater level, well's performance by specific capacity, and impact to well motor over time.

The well pump motor horsepower required estimates presented below are based on observed well drawdown data and reflect the impact of declining groundwater tables over the last 50 years since the majority of the well pumps were installed. These estimates are for predicting stress on the electrical elements of the motor and possible impacts to reliability of equipment under increased operating loads. The estimated motor load assumes a low 70% motor/pump efficiency value associated with the older motors.

6.3.1 Well No. 1

Well No. 1, built in 1946, has a 12-inch diameter casing constructed to a total depth 500 feet. The well was initially pump tested at 1,200 gpm with a 62 feet drawdown during pumping. Well No. 1 is equipped to provide 500 gpm and is the second lead system supply well following lead well, Well No. 8.

- Recorded Static Water Level – The 1946 static water level was not recorded but first water identified at 55 feet. The driller reported 1,200 gpm at 62 feet of drawdown demonstrating a high specific capacity. Pump test report data from 1956 shows a recorded static water level of 64.60 ft and data from 2000 recorded a static water level is 118 ft below the pump discharge level. This indicates a 53.4 foot decline in the water table at this well site.

- Recorded Specific Capacity - Pump test report dated 1956 shows a recorded specific capacity of 68.10 gallons per minute per foot of drawdown (gpm/ft). Pump testing in 2000 documented a specific capacity of 42.30 gpm/ft.

- Change in Specific Capacity - Between 1956 and 2000 data, specific capacity decreased by 37.9%. Data shows a generally consistent declining trend.

- Impact to Motor/Pump - According to pump test data recorded in 1956, total HP required to pump at 500 gpm well capacity is 37.73 HP. In 2000, the total HP increased to 50.93 HP. Assuming that Well No. 1 pump has a built in service factor of 5% to a service capacity of 52.5 HP, the Well No. 1 pump exceeds the name plate horsepower but does not exceed the service capacity as of 2000.

- This well has been equipped with a variable frequency drive (VFD) for reduced flow at start up to reduce drawing sand through the wall slots. The VFD allows the well pump to match demands in the vicinity by speed up and slowing down based on system demand. This has resulted in a consistent system pressure in the northeast District area.

This well was serviced in 2007 with the casing hole bailed to total depth and video inspected. The video review showed considerable cascading metal scale and a mottled surface characteristic of generally uniform corrosion across the surface of the casing. The well casing perforations were consistent with a mills knife with visible enlargement of the slots. Increased sand production has been observed, consistent with the slot enlargement.

6.3.2 Well No. 2

Well No. 2 was constructed in 1948 with maximum pumping capacity of 460 gpm.

- Recorded Static Water Level – Well measurements in 1959 recorded a static water level of 59.80 ft below the pump discharge level. Data in 2000 documented a water table decreased by 64.70 ft and the recorded static water level was 124.50 ft below the pump discharge level. This indicates a 59.8 foot decline in the water table at this site.

- Recorded Specific Capacity - Pump test report data from 1959 documents a specific capacity of 62.70 gpm/ft while data from 2000 shows a decrease to 33.30 gpm/ft.

- Change in Specific Capacity - Between 1959 and 2000 data, specific capacity decreased by 46.9%. Data shows a generally consistent declining trend.

- Impact to Motor/Pump - According to pump test data recorded in 1959, total HP required to pump at 460 gpm well capacity is 36.07 HP. In 2000, the total HP increased to 51.64 HP. Assuming that Well No. 2 pump has a built in service factor of 5% to a service capacity of 52.5 HP, the Well No. 2 pump exceeds the name plate horsepower capacity but does not exceed the service capacity as of 2000.

6.3.3 Well No. 3

Well No. 3 was constructed in 1949 with maximum pumping capacity of 580 gpm.

- Recorded Static Water Level – Well measurements in 1956 recorded a static water level of 50.40 ft below the pump discharge level. In 2000, the water table decreased by 64.60 ft and the recorded static water level was 115 ft below the pump discharge level.

- Recorded Specific Capacity - Pump test report dated 1956 shows a recorded specific capacity of 41.50 gpm/ft. In 2000 the specific capacity had decreased to 29.70 gpm/ft.

- Change in Specific Capacity - Between 1956 and 2000 data, specific capacity decreased by 28.4%. Data shows a generally consistent declining trend.

- Impact to Motor/Pump - According to pump test data recorded in 1956, total HP required to pump at 580 gpm well capacity is 40.62 HP. In 2000, the total HP increased to 56.45 HP. Assuming that Well No. 3 pump has a built in service factor of 5% to a service capacity of 52.5 HP, the Well No. 3 pump exceeds both of the name plate horsepower and the service factor as of 2000.

6.3.4 Well No. 4

Well No. 4 was constructed in 1951 with maximum pumping capacity of 500 gpm.

- Recorded Static Water Level – Measurements in 1956 shows a recorded static water level of 57.70 ft below the pump discharge level. In pump test report dated 1999, the water table decreased by 62.30 ft and the recorded static water level is 120 ft below the pump discharge level.

- Recorded Specific Capacity - Pump test report dated 1956 shows a recorded specific capacity of 64.70 gpm/ft. In pump test report dated 1999, the specific capacity increased to 85.70 gpm/ft.

- Change in Specific Capacity - Between 1956 and 1999 data, specific capacity increased by 32.5%. Data shows a generally increasing trend.

- Impact to Motor/Pump - According to pump test data recorded in 1956, total HP required to pump at 500 gpm well capacity is 38.90 HP. In 2000, the total HP increased to 54.84 HP. Assuming that Well No. 4 pump has a built in service factor of 5% to a service capacity of 52.5 HP, the Well No. 4 pump exceeds the name plate horsepower and service factor as of 1999.

6.3.5 Well No. 5

Well No. 5 was constructed in 1953 with maximum pumping capacity of 460 gpm.

- Recorded Static Water Level – Measurements in 1961 shows a recorded static water level of 67.60 ft below the pump discharge level. In pump test report dated 1999, the

water table decreased by 47.70 ft and the recorded static water level is 115.30 ft below the pump discharge level.

- Recorded Specific Capacity – A pump test report dated 1961 shows a recorded specific capacity of 67.60 gpm/ft. In pump test report dated 1999, the specific capacity increased to 115.30 gpm/ft.

- Change in Specific Capacity - Between 1956 and 1999 data, specific capacity increased by 70.6%. Data shows a generally consistent increasing trend.

- Impact to Motor/Pump - According to pump test data recorded in 1961, total HP required to pump at 460 gpm well capacity is 34.83 HP. In 1999, the total HP increased to 38.64 HP. Assuming that Well No. 5 pump has a built in service factor of 5% to a service capacity of 52.5 HP, the Well No. 5 pump is within the name plate horsepower as of 1999.

This well was serviced in 2009 with the casing hole video inspected. The video review showed considerable cascading metal scale and a mottled surface characteristic of generally uniform corrosion across the surface of the casing. The casing corrosion appears to have completely deteriorated the casing wall in several areas and the well contractor servicing the well advised that casing collapse was a possibility during cleaning. The well casing perforations were consistent with a mills knife with visible enlargement of the slots. Increased sand production has been observed, consistent with the slot enlargement and holes in the casing.

This well pump and electrical panel also require upgrading to place it back into reliable service and the District weighed the cost of completing the service, estimated at $60,000 to $80,000, with the risk and return. It is recommended that the District invest in a replacement well for Well No. 5 and not proceed with rehabilitation of the existing well.

6.3.6 Well No. 6

Well No. 6 was constructed in 1956 with maximum pumping capacity of 1100 gpm.

- Recorded Static Water Level – Measurements in 1961 shows a recorded static water level of 55.60 ft below the pump discharge level. In pump test report dated 1976, the water table decreased by 21.50 ft and the recorded static water level is 77.10 ft below the pump discharge level. More recent pumping water levels were not available.

- Recorded Specific Capacity – Pump test report dated 1961 shows a recorded specific capacity of 67.80 gpm/ft. In pump test report dated 1976, the specific capacity increased to 91.20 gpm/ft. No more recent test data was available.

- Change in Specific Capacity – Between 1961 and 1976 data, specific capacity increased by 34.5%. Data shows a generally consistent increasing trend contrary to regional trends and typical well performance profiles over time.

- Impact to Motor/Pump – This well is driven by a gas engine drive and no determination as to the drive ability to meet full capacity was made.

6.3.7 Well No. 7

Well No. 7 was constructed in 1956 with maximum pumping capacity of 675 gpm.

- Recorded Static Water Level – Measurements in 1961 shows a recorded static water level of 50.50 ft below the pump discharge level. In a 1997 pump test report the water table decreased by 42.50 ft and the recorded static water level is 93 ft below the pump discharge level.

- Recorded Specific Capacity – Pump test report dated 1961 shows a recorded specific capacity of 98.70 gpm/ft. In pump test report dated 1997, the specific capacity increased to 115.90 gpm/ft.

- Change in Specific Capacity – Between 1961 and 1976 data, specific capacity increased by 17.4%. Data shows a generally consistent increasing trend contrary to regional trends and typical well performance profiles over time.

- Impact to Motor/Pump – According to pump test data recorded in 1961, total HP required to pump at 675 gpm well capacity is 49.02 HP. In 1997, the total HP increased to 56.04 HP. Assuming that Well No. 7 pump has a built in service factor of 5% to a service capacity of 52.5 HP, the Well No. 7 pump exceeds the name plate horsepower and service capacities as of 1997.

6.3.8 Well No. 8

Well No. 8 was constructed in 1977 with maximum pumping capacity of 1100 gpm. Well No. 8 is the District's lead well and was recently upgraded to include a new VFD and electrical switchgear. The existing motor was not replaced and may be at risk from heat buildup under the VFD operating conditions. An enclosure and evaporative cooler has been added around the motor to address the heat buildup at this site.

- Recorded Static Water Level – Measurements in 1980 documented a recorded static water level of 86.75 ft below the pump discharge level. In a pump test report dated 2000, the water table decreased by 27.05 ft and the recorded static water level is 113.80 ft below the pump discharge level.

- Recorded Specific Capacity – Pump test report dated 1980 shows a recorded specific capacity of 39 gpm/ft. In pump test report dated 2000, the specific capacity decreased to 24.20 gpm/ft.

- Change in Specific Capacity – Between 1980 and 2000 data, specific capacity decreased by 37.9%. Data shows a generally consistent declining trend.

- Impact to Motor/Pump – According to pump test data recorded in 1980, total HP required to pump at 1100 gpm well capacity is 101 HP exceeding the pump rated capacity of 100 HP but within the motor service factor allowance for operation at up to 5% over the rated horsepower. Additional pump test data in 1998 indicated the motor drawing 115 HP and exceeding the motor service factor. The District has been operating an additional well to maintain Well No. 8 within acceptable operating ranges but a replacement with a larger motor may be required should the existing

motor fail. If the electrical service is upgraded this site should be considered for a 125 HP motor.

6.3.9 Groundwater Summary and Recommendations

6.3.9.1 Data Availability

Changes in specific capacity are not uniformly comparable for all eight wells due to sporadic data availability. Well Nos. 1, 2, 3, 4, 7, and 8 has data available from within the first 5 years of the well construction to District's latest available test data in 2000. Pump test data for Well No. 5 is unavailable for its first 5 years of operation.

6.3.9.2 Summary

Static water level decreased as observed on all well sites; however, changes in specific capacity for each well varies in trend. Well Nos. 1, 2, 3, and 8 exhibit more than 25% percent decrease in specific capacity, with Well No. 2 exhibits the highest decrease at 47%. Well Nos. 4, 5, 6, and 7 exhibits more than 15% increase in specific capacity, with Well No. 5 exhibits the highest increase at 70%.

Decreased static water level contributes to the total pumping head required for each well. Out of the eight (8) well motors, the following were observed:

- Well motors for Well Nos. 1 – 7 were adequately sized to accommodate the well maximum pumping capacity as exhibited in each of the 7 wells' earliest available pump test report.
    - Well Nos. 5 and 6 motors remained adequate to accommodate each well's maximum pumping capacity.
    - Well Nos. 1 and 2 motors exceeded the rated motor capacity at maximum pumping, although it is still below the service capacity.
    - Well Nos. 3, 4, and 7 motors were no longer adequate to handle each well's maximum pumping capacity.

Well No. 8 was the latest well built within the District and remained as the District's lead well to date. According to its earliest documented pump test report, required power to support maximum pumping is greater than the rated capacity of the well motor but is within the service factor. The latest pump test report shows Well No. 8 motor currently operating at a maximum pumping load on the motor that is exceeding both rated and service capacities.

6.3.9.3 Recommendations

The following recommendations are provided for operations/maintenance of the wells.

1. The District has not performed a pump test report in the last eight (8) years. Considering the ages of the well facilities, a current pump test report should be performed for all eight (8) wells to correctly capture the current well conditions. SMUD no longer provides this service and the District will need to hire a contractor to conduct this testing. The testing

should document static water level, pumping water level, flow volume, power draw and include a calculation of efficiency and well yield specific capacity in gallons per minute per foot of drawdown.

2. Well motor load at Well No. 8 exceeding the service factor could result in excessive motor heating and failure during peak usage periods. Calibrating the system wells to increase system pressure during peak periods will result in Well No. 8 operating within the normal power draw operating range.

    - Continue running an extra well to meet District's daily water demand to keep Well No. 8 operating within acceptable motor loads.

    - Replace existing motor and install a larger motor.

3. Well Nos. 3, 4, and 7 motors have reached the same condition with static water levels decreasing.

    - Monitor well motor load and output and track specific capacity against current measured well yield. The current specific capacity of each well is presented below and is based on the most recent pump efficiency testing where static water level, well drawdown and pump discharge flow and pressure were measured.

	Well No. 1	Well No. 2	Well No. 3	Well No. 4	Well No. 5	Well No. 6	Well No. 7	Well No. 8
Baseline Specific Capacity	60	60	40	60	65	68	100	40

Units are in gallons per minute per foot of water level drawdown in the well and indicate well capacity. Higher numbers reflect higher capacity.

Well cleaning and swabbing may be warranted if the structural condition of the well is suitable. An aquifer pump test is recommended following any well rehabilitation and should include the following steps:

1. Allow well to recover for 24 hours minimum prior to starting test
2. Measure static water level
3. Pump well for 24 hours, measure pumping rate at start of test
4. Measure well pumping rate at end of 24 hours
5. Measure pumping water level at end of 24 hour test

6.4 Groundwater Well Replacement Program

It is recommended that the District implement a program to replace its entire groundwater supply to continue to ensure a reliable drinking water supply. Construction of five (5) new wells at 1,500 gpm each will provide the District with 7,500 gpm of pumping capacity to meet system demands and fire flow. Select existing District wells could be placed in standby operation as redundant water supply sources. The remaining wells would be demolished in accordance with California Department of Water Resources standards.

6.4.1 Replacement Groundwater Supply

Due to the relatively high aquifer yield potential of a new well, it is expected that the District will be able to achieve a 1,500 gpm per well capacity. Through discussion with District staff, there are four (4) preliminary locations selected for future well sites as shown on Figure 6. A typical new well site layout is as shown on Figure 7.

6.5 Pipeline Replacement Planning

The District buried assets are also reaching the upper end of the typical lifecycle with the steel pipe in the northeastern District are most at risk of increasing failure. The balance of the District residential service area is asbestos cement (AC) pipe located in backyards. Although the backyard pipe is protected from traffic loads and other utility construction, AC is subject to damage and failure from tree root loading. Mature trees can either crush the pipe or pull it out of the ground if the tree falls over. Based on the existing age and condition it is reasonable to expect that the District will see increasing leaks and pipe failures over the next 15 years at which point significant replacement will need to be implemented. This forecast is consistent with the observations made by SSWD and one of the drivers behind their pipe replacement program.

A second consideration as to when to begin the pipe replacement program is that the District system is comprised of a well looped 6-inch diameter network. This system includes multiple small water supply wells that are integrated in the distribution system made up of small pipe diameter networks. Increasing well capacity and planning for a possible surface water single point of entry to the system will required a larger backbone distribution system. A computerized hydraulic model was developed to test the proposed water system and wells for meeting peak demands and fire flow requirements. The results of the hydraulic modeling are included in the appendix under separate cover.

This larger diameter system is proposed as 8-inch and 12-inch pipelines forming a single main loop tying into the existing 6-inch system to maintain service through existing residential connections. This approach will allow for relocation over several years of the distribution system from the back lot to the front public right of way consistent with District policy for new pipelines. Ultimately, the water services will be converted from back lot to front yard and meters installed. As discussed later in this Master Plan, meter setters could be installed at the time the pipes are replaced and actual meters installed system wide at one time. Conversion to a metered rate would occur at one time for residential customers and delay the capital outlay for the meters.

Meters are an additional driver as to timing for the pipeline replacement. Installation of meters in the backyards will require radio read meter or access by District staff to read the meters. The meters will ultimately end up in the front yards as the pipeline replacement is completed. We

have developed the replacement plan using the 2030 metering deadline as the completion date for full abandonment of back lot pipelines. This assumption provides a conservative approach to the planning impacts of both metering and pipeline replacement.

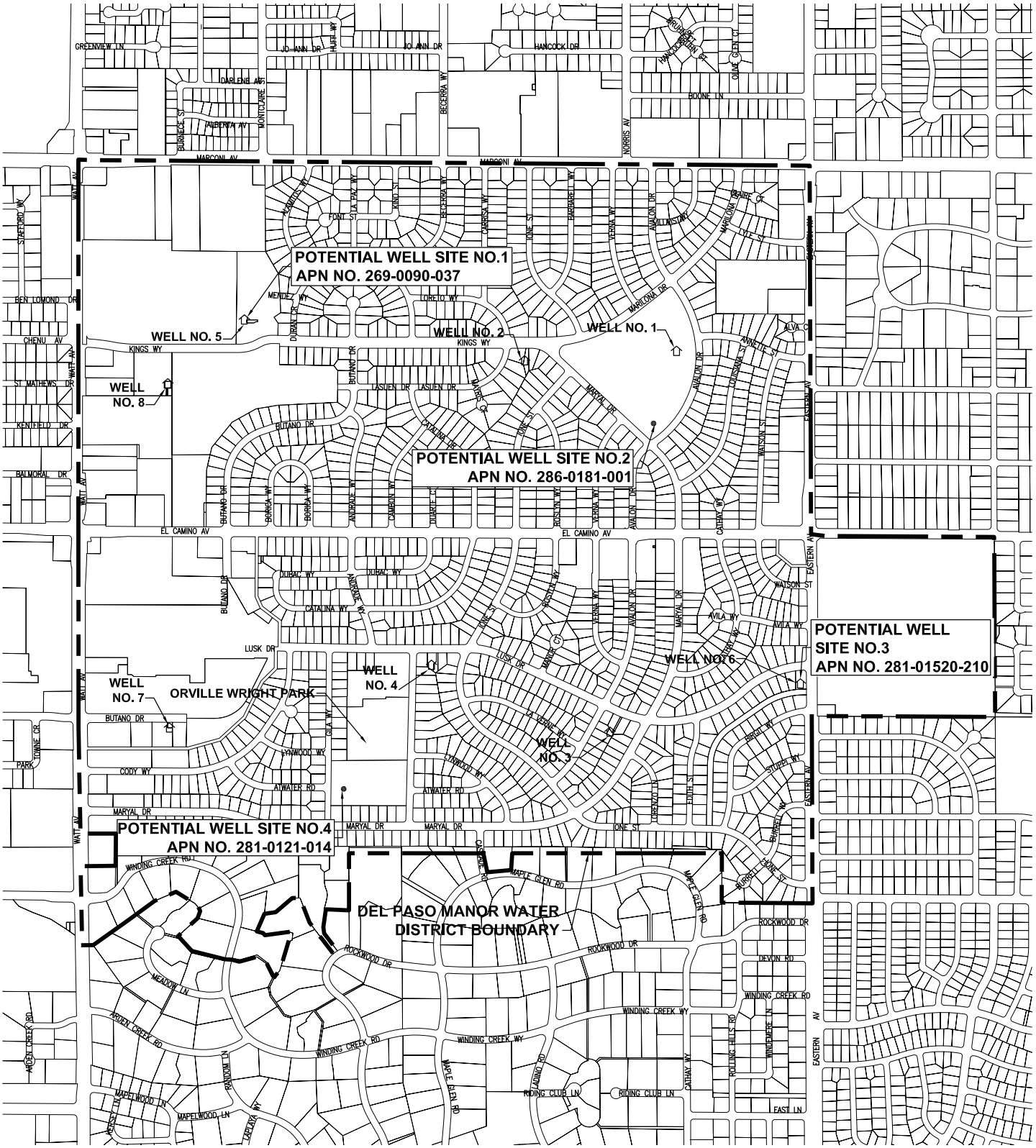
6.6 Corporation Yard and Office Building

The existing District office building and corporation yard is located on a residential lot on the east side of the District. The site also includes Well No. 6. Future District staffing and maintenance efforts for meters will require additional work space and a possible expansion of the District's building. Unfortunately the existing site is too small to accommodate a new well, possible CWD joint conjunctive use pump station and the expanded Office and Corporation Yard.

The District should monitor properties for sale and consider purchasing a new site for a joint use or single use facility. The options for joint use and single use facility are generally as follows:

- New Office and Corporation Yard site with existing site used for replacement Well No. 6 and CWD joint conjunctive use pump station.

- New site for replacement Well No. 6 and CWD joint conjunctive use pump station and new site for Office and Corporation Yard. New Office/Corporation Yard site could also provide property for a replacement well.



Kennedy/Jenks Consultants

DEL PASO MANOR WATER DISTRICT
SACRAMENTO, CALIFORNIA
MASTER PLAN

FUTURE WELL SITES

K/J 0870017.00
JUNE 2009

FIGURE 6

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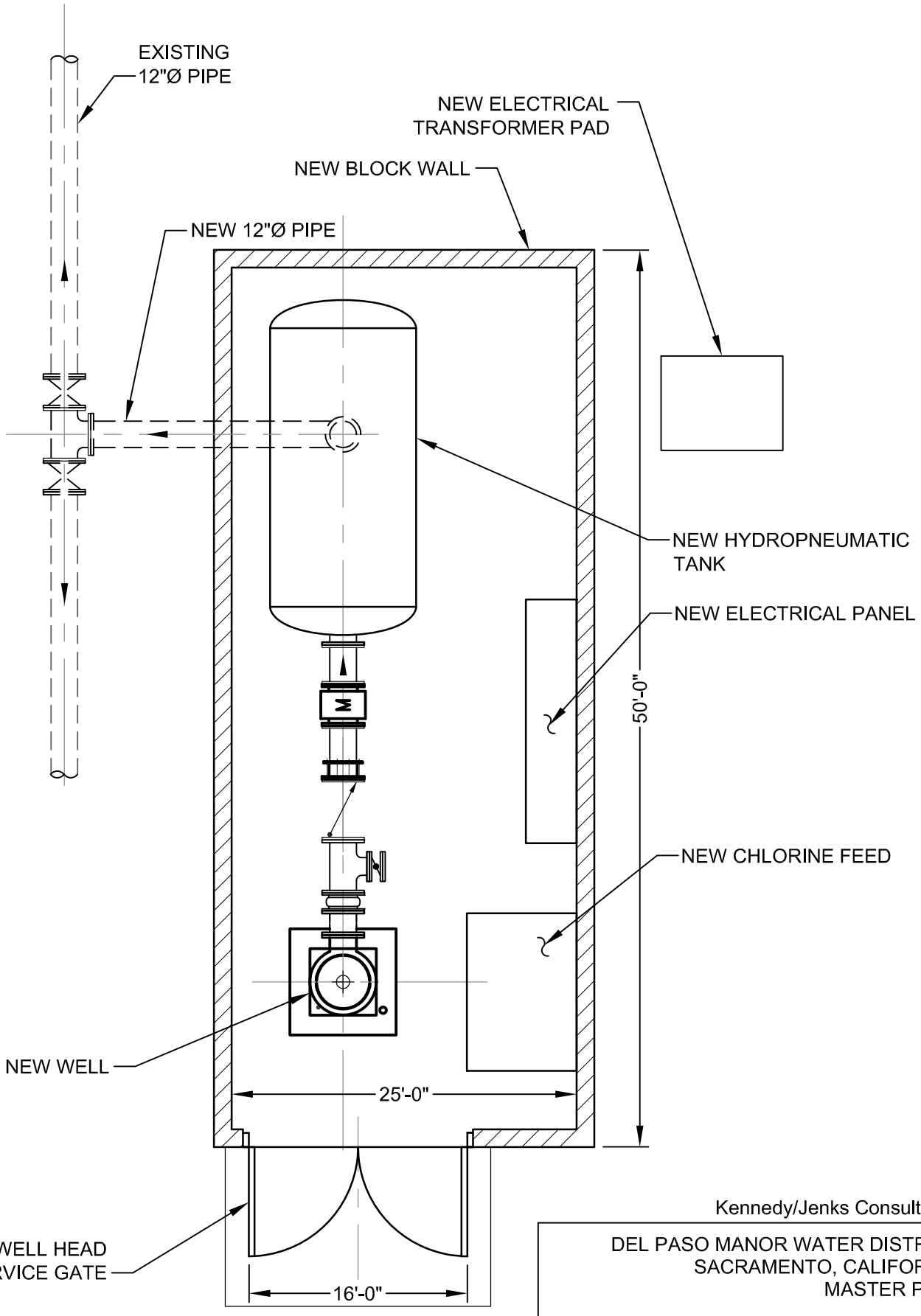

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Kennedy/Jenks Consultants

DEL PASO MANOR WATER DISTRICT
SACRAMENTO, CALIFORNIA
MASTER PLAN

TYPICAL NEW WELL SITE LAYOUT

K/J 0870017.00
APRIL 2009

FIGURE 7

Section 7: Facilities Management Planning

7.1 Introduction

This section discusses the organization of the District, operation and maintenance responsibilities, and general practices of the District and provides a general management plan.

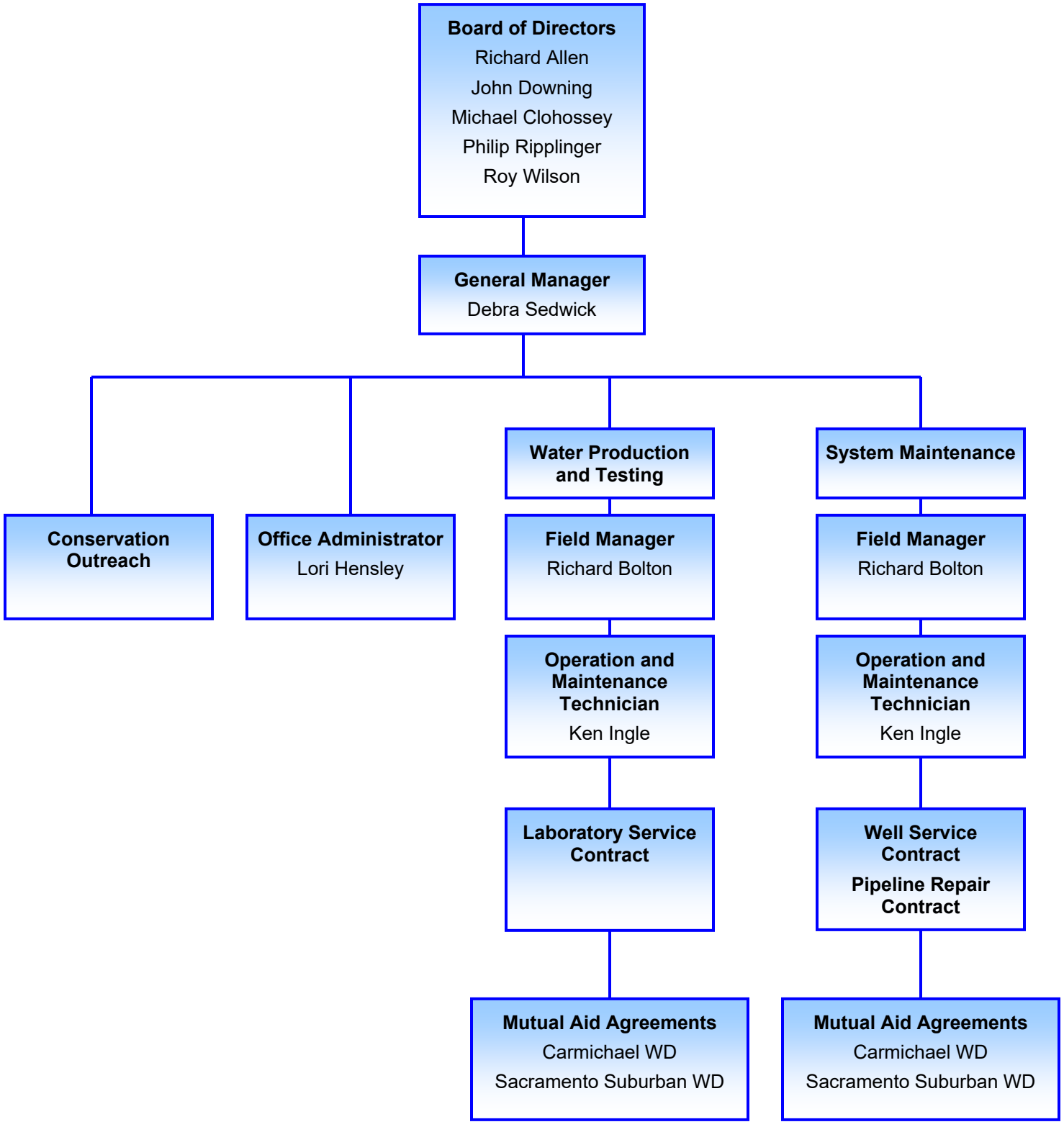
7.2 District Organizational Structure

Del Paso Manor Water District is a public agency governed by an elected five member Board of Directors. The Board is elected at large within the District service area. The District is a small water agency with a service area of approximately 1 square mile and under 3000 customers providing less than 3000 acre feet of water annually. As such the District does not meet the definition of an Urban Water Supplier under the California Water Code Section 10617, exempting it from many of the water resource management legislation of the State of California. The minimum agency size threshold helps to avoid placing a disproportionate cost for meeting planning, conservation and management activities on small agencies.

The District performs four principle activities including management and administration; water production and testing; system maintenance; and conservation outreach. The District currently employs four (4) individuals.

Figure 8 reflects the current Organization Chart.

Figure 8: District Current Organizational Chart



7.2.1 Management and Administration Activities

The management and administration activities are provided by the General Manager and Office Administrator providing the labor effort needed to keep the District operating including customer service (billing and collection), processing accounts payable, District business accounting, Board support, administrative support, as well as answering the telephones, preparing and filing regulatory compliance reports and maintaining customer outreach. Project/staff management also participate and represent the District customer interests in regional planning through the Water Forum, Regional Water Authority, Sacramento Groundwater Authority, and Sacramento Area Water Works Association. The staff also maintains outreach and provides community service through activities with the Del Paso Manor Homeowners Association and San Juan School District.

The key positions of the General Manager and Office Administrator are discussed below:

- General Manager – This person is responsible for all aspects of the District operation and is the key liaison between the elected Board and the District staff. The General Manager is responsible for implementing Board actions and policies and for providing outreach to the community as a visible representative of the organization. The General Manager is responsible for the daily operational decisions and is responsible for regulatory compliance monitoring, capital projects management, labor negotiations, and maintaining the people and resources needed to continues providing safe and reliable services on a daily basis. The General Manager is responsible for development of the annual budget alternatives following the direction of the Board of Directors.

- Office Administrator – This person is responsible for the administration of District accounts, payroll and purchasing processing and acts as the primary customer service representative. In addition, supports all the activities of the General Manager and employees of the District including, support of Administrative activities, document reproduction, emergency dispatch, and public outreach.

7.2.2 Water Production and Testing

The water production and testing staff provides for the groundwater pumping and testing of the District's water supply. District facilities include all District wells, well pumps and system interties with Sacramento Suburban Water District. State Certification as a Water Distribution Operator, Water Treatment Operator, and specialized training is required for the lead responsibilities of these activities for the District.

The existing District staff positions conducting these activities are as follows:

- Field Manager – This person is responsible for maintaining adequate water pressure in the system under all demand conditions and monitoring and maintaining water quality and testing demonstrating compliance with the Drinking Water Standards. This person is responsible for maintaining the mechanical aspects of equipment ranging from small chemical feed pumps through multiphase variable frequency drive pumps providing thousands of gallons per minute of supply. This person maintains District production and operations reports and plans and schedules maintenance

activities. This person is also responsible for emergency response planning and coordination of those activities needed to maintain a safe and reliable water supply.

- Operations and Maintenance Field Technician – This person supports all activities of the Field Manager and must be familiar with all production facilities, operation practices and procedures.

These people are responsible for preventative maintenance for all mechanical, electrical, chemical feed and control systems within the District. They also conduct the distribution system-flushing program, valve exercising, system monitoring and compliance with the California Department of Public Health (CDPH) water quality testing programs under the District Water Supply Permit.

The staff activities support the following four areas: maintenance, water quality, chemicals, and control.

Maintenance

Maintenance includes the electrical and electrical control system, chemical storage and feed equipment, and mechanical equipment, such as pump maintenance.

Electrical and electrical control system maintenance includes cleaning contacts; tightening connections; measuring voltage and amperage loads; and replacing starters, relays, circuit breakers and fuses.

Chemical feed equipment maintenance includes cleaning the pump Internals and solution lines; replacing diaphragms; and checking valves, chemical solution lines and injection point devices.

Mechanical equipment maintenance includes oil and filter changes; charging system check and replacement; efficiencies testing; bearing replacement; cleaning of Y strainers and diaphragms; and speed, travel and pressure adjustment for control valves.

Water Quality

Water quality is broken out into the following sub-categories: Distribution water quality testing, groundwater testing, flushing program, and water quality calls.

- Distribution water quality testing includes sampling at the wells and within the system for chlorine residual, coliform bacteria and periodic sampling for lead and copper at various locations in the District.

- Groundwater testing includes sampling for constituents and contaminants such as VOC, IOC, Gross Alpha, SOC, Gen. Mineral, Physical, Nitrate, Nitrite, Phase 2/5, Perchlorate, and MTBE, as well as other regulated and unregulated parameters required by law and as directed by CDPH.

- Flushing program includes flushing dead-end mains to reduce sedimentation and taste and odor complaints. This effort includes valve exercising and inspection as opportunities allow.

- Water quality calls – includes investigating water quality issues reported by customers.

Chemicals

Activities include ordering, receiving, loading and delivery of sodium hypochlorite to all sites; operation of feed systems; testing, training and emergency response planning.

Control System and Testing

The water system has a single chart recorder that monitors water pressure. The recorder is manually read. System alarms and automated emergency contact and reporting are not currently part of the District capabilities.

7.2.3 System Maintenance

The activities for system maintenance include all buried infrastructure providing transmission and distribution for delivery of water throughout the District. These activities include the inspection of all new construction, replacement and repair of water mains, fire hydrants, water services, meters, and valves. In addition, these people are responsible for inspection of all potential cross-connections and to administer the corrections on those cross-connections.

This activity includes responding to Underground Service Alerts calls for locating the buried water facilities, and maintaining the District water system maps.

The System Maintenance activities the following key Roles:

- Field Manager – This person is responsible for assignments of resources, project scheduling, training, inventory, equipment fleet and maintaining the corporation yard. This person is also responsible for the District record drawing files, contractor submittal review and comments, construction inspection support, and inspection records. In addition, this position coordinates plan checking, fire flow analysis requests and responds to requests for information by developers regarding the District facilities and physical connection requirements.

- Operations and Maintenance Field Technician – This person supports the activities of the Field Manager.

7.2.4 Conservation Outreach

The District maintains a part-time water conservation outreach person who travels the District during high water use periods contacting customers where water waste appears to be occurring. This person is responsible for informing the customer of the importance of avoiding water waste, of District water conservation policies currently in force and consequences for continued water waste.

7.3 Future Water District Organizational Structure and Management Plan

The District staffing provides for assignment of multiple activities to the four full-time employees and one part-time employee for conservation outreach duties. This approach has worked well for several years and will continue to work well; however, the following changes will impact the District staffing:

- District will be undertaking an increased Planned System Maintenance program for system wide replacement of the aging infrastructure resulting in a need for additional resources. This effort could result in an additional workload as follows:
    - 2010 – 2014: Up to 1/8 time senior manager requirement for managing PSM Program development, funding investigations, Proposition 218 rate considerations, and managing project design, bidding, construction, and startup.
    - 2014 to 2018: Up to 1/2 time senior manager requirement for managing PSM Program development, funding investigations, 218 rate considerations, and managing project design, bidding, construction, and startup.
    - 2018 to 2022 up to 1/2 time senior manager requirement for managing PSM Program development, funding investigations, Proposition 218 rate considerations, and managing project design, bidding, construction, and startup.
    - 2022 to 2026 up to 3/4 time senior manager requirement for managing PSM Program development, funding investigations, Proposition 218 rate considerations, and managing project design, bidding, construction, and startup.
    - 2026 to 2030 up to 1/8 time senior manager requirement for managing PSM Program development, funding investigations, Proposition 218 rate considerations, and managing project design, bidding, construction, and startup.
- Modernization to add computerized Supervisory Control and Data Acquisition (SCADA) would not require additional manpower but would require training for the Water Production Field Position in the system operation and in operator control programming. No additional staff recommended however a training budget should be considered.
- Changes in State laws may reach to the small water system providers and require additional labor effort for the following items:
    - Water Conservation BMPs – The District is not required based on its size to under take many of the BMPs. However, if a voluntary implementation of some or all of the BMPs is undertaken, there will need to be additional staffing. It is recommended that a 1/8 to 1/4 time person could manage this activity.
    - Certifications – Additional training and maintenance of Distribution Certifications need to be tracked and maintained. No additional staff is recommend, however a training budget should be considered.

- Chemical Feed System – Fluoridation may become a requirement should the District choose to practice Conjunctive Use. Subsequently, there will be additional operation and maintenance work load related with the fluoridation program. This work will require daily inspection and maintenance at each well adding up to 2 hours per week per site. This could result in between 1/4 and 1/2 time additional field staff.

- Changing Groundwater Quality – If the groundwater quality declines and treatment is required, the District will need to add a Grade 2 Water Treatment Plant Operator. It is recommended for this scenario that the District considers adding a new position and separating production from distribution field work.

- Meter Reading, Calibration, Maintenance, and Monthly Commodity Billing – This will result in a 1/2 time person associated with the meters and a part-time office administrator assistant to process monthly billing using the meter data. Use of auto/reading meters may reduce the meter reading work load, however a minimum number of re-reads, manual reads, and field checks are typically required as part of the normal billing quality control and in response to customer inquiries.

These changes may result in some reorganization and the need for additional staffing as reflected in the possible future organization chart shown in Figure 9 and Figure 10. Figure 9 reflects adding resources with no change to the existing organizational structure. Figure 10 reflects a revised structure adding and Assistant General Manager and maintaining the existing structure below the new manager role.

Figure 9: Proposed District Organizational Chart – Approach 1

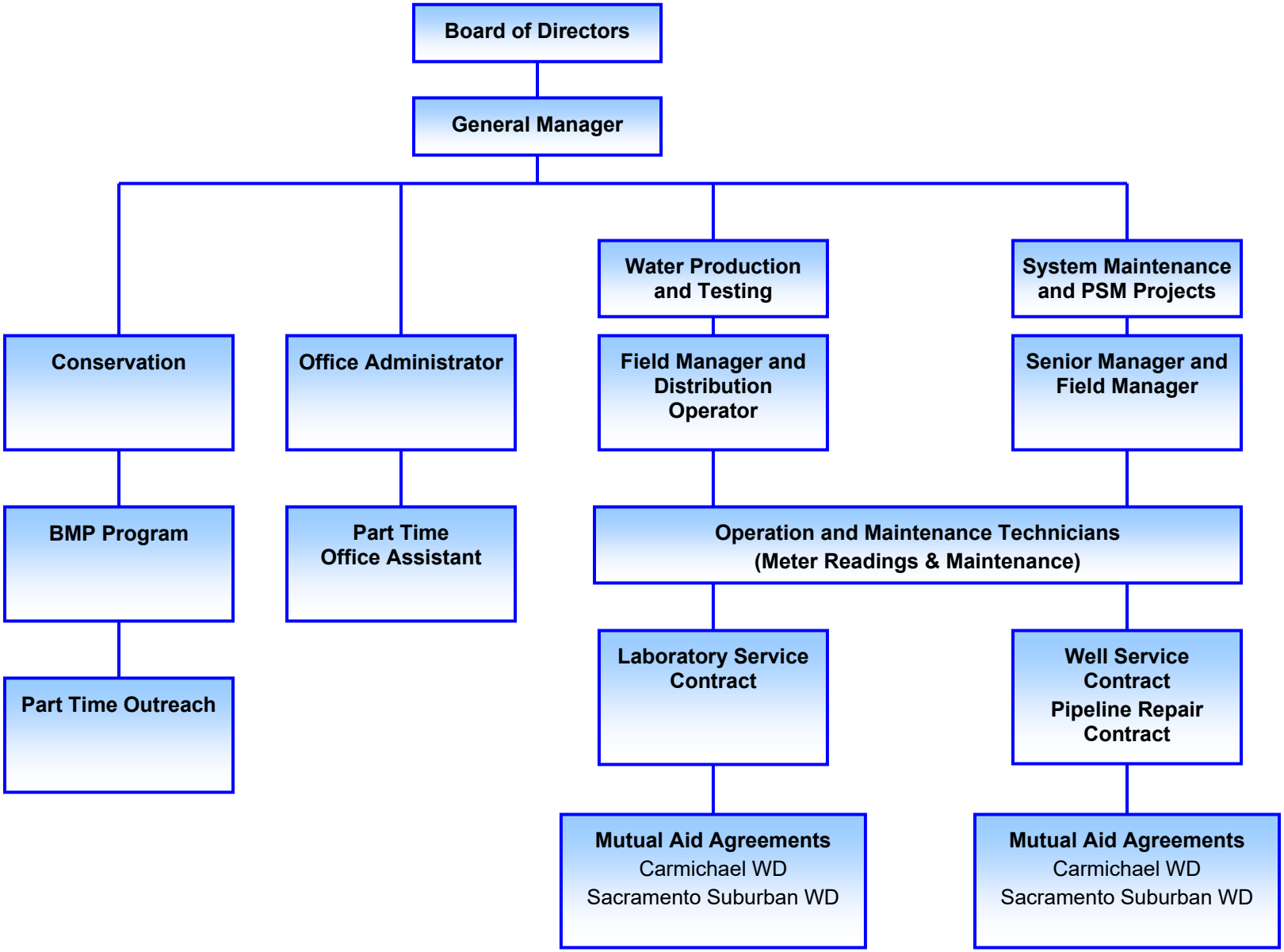
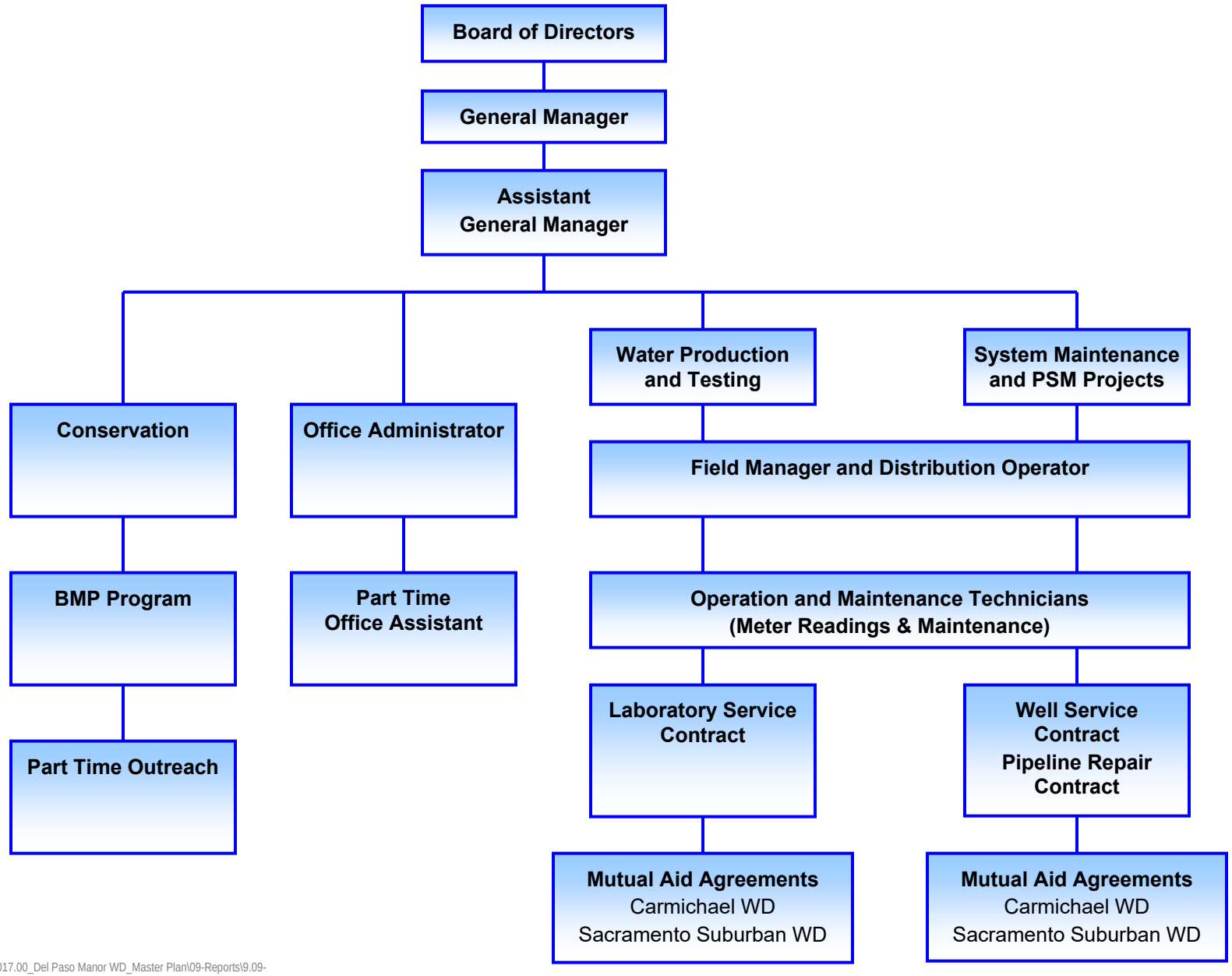


Figure 10: Proposed District Organizational Chart – Approach 2



Section 8: Meter Retrofit Planning

8.1 Introduction and Background

This Water Conservation and Meter Retrofit Plan reviews existing Del Paso Manor Water District (District) commitments for metering the District water system and frames the existing ongoing changes is local and state programs to encourage and enforce metering and billing using a metered rate.

The Metering Plan Technical Memorandum includes review of the following documents and are provided in Appendix 2:

- Assembly Bill No. 2572 Water Meters; Water Code Section 10617; Draft Water Forum Agreement – Water Conservation Element, 14 May 2009
- Del Paso Manor Water District (DPMWD) Water Forum Agreement and DPMWD Water Conservation Plan, January 2000 Appendix J
- Memorandum of Understanding Regarding Urban Water Conservation in California, California Urban Water Conservation Council, 10 December 2008
- California Urban Water Conservation Council – Best Management Practices (BMPs), 10 December 2008
- California Urban Water Conservation Council – BMP Cost-Effectiveness Workshop, June 2009
- Assembly Bill No. 1420 (AB 1420) Water Demand Management Measures: Water Management Grant or Loan Funds; AB 1420 Frequently Asked Questions; AB 1420 Self-Certification Statement Forms; Public Workshop Notes, AB 1420 Compliance/Eligibility Requirements, June 2009

The District is a signatory to the Water Forum Memorandum of Understanding (MOU), a member of the Regional Water Authority and participating in ongoing discussions with the Water Forum regarding updating the January 2000 MOU. This effort is part of an ongoing commitment to responsible management of the District and regional solutions to water supply planning.

8.2 Water Metering Commitments

Presented below is a summary of existing water metering commitments, current draft updated commitments and current state laws relating to water metering.

Existing Water Forum Best Management Practice 4 (BMP 4) Residential Meter Retrofit

The District Water Forum Purveyor Specific Water Conservation Plan (Appendix B) Best Management Practice 4 (BMP 4) Residential Meter Retrofit provides for the following commitment.

> "It is recognized that Del Paso Manor Water District is a relatively smaller water purveyor currently relying totally on groundwater and will not realize immediate water supply benefits from participating in the Water Forum Agreement. Therefore until such time as Del Paso Manor Water District needs discretionary approvals for new or expanded surface water supplies, an active voluntary meter retrofit with incentives is acceptable. Nothing in the Water Forum Agreement prevents purveyors from deciding to undertake a more rapid meter retrofit program.
>
> "At such time as Del Paso Manor Water District needs discretionary approvals for new or expanded surface water supplies it agrees to annually retrofit at least 3.3% - 5% of the total number of unmetered residential connections and read and bill as set for the in Appendix D of the Water Forum Agreement.
>
> "If in the future Del Paso Manor Water District receives benefits from another agency's conjunctive use program, it agrees to discuss its meter retrofit program with the Water Forum Successor Effort."

The District has 1692 (1611 single family and 81 duplex housing) services that are unmetered. The existing commitment is to install 56 to 85 meters per year as part of pursuing a discretionary approval for new or expanded surface water supplies. It is reasonable to assume that this commitment will be triggered by the following surface water supplies actions if undertaken by the District:

- Proceeding with City of Sacramento surface water deliveries whether directly, or through Sacramento Suburban Water District.
- Proceeding with a Point of Diversion effort for City of Sacramento surface water to be treated and wheeled through Carmichael Water District.
- Proceeding with a joint District and Carmichael Water District conjunctive use project for beneficial use of the remediated groundwater discharging at the Bajamont Water Treatment Plant.

The annual cost of installing 85 residential meters in 2009 construction dollars is approximately $100,000. This assumes retrofit to the existing pipelines using a service tap, corporation stop, 1-inch copper service, curb stop, meter box, meter, customer service shutoff valve and limited customer service retrofit. The District would be fully metered by 2030 if it proceeded at a rate of 5% (85) meters per year starting in 2010.

Assembly Bill 2572 and Water Forum Successor Effort

AB 2572 established requirements for Urban Water Suppliers to be fully metered by the year 2025 and begin billing all metered services within one seasonal year of having installed a water meter. An Urban Water Supplier under the California Water Code Section 10617 is any supplier serving more than 3,000 customers, or supplying more than 3,000 acre-feet per year of water. The District does not fall under the definition of an Urban Water Supplier and is therefore AB 2572 does not pertain to the District.

The Water Forum successor effort is negotiating an update Water Conservation Element and released a draft Water Conservation Element 14 May 2009 (Appendix A) that includes that same working as the original agreement (see above) for the District commitment to 3.3% - 5% triggered by the need for discretionary approvals for new of expanded surface water.

Assembly Bill 1420, California Urban Water Conservation Council Best Management Practices

The Water Forum draft update process is embracing the California Urban Water Conservation Council (CUWCC) Memorandum of Understanding (Appendix C) and the 10 December 2008 Best Management Practices while maintaining flexibility for unmetered members such as the District. Specifically, there is a Pre-Determined Deferral for Meter-Based BMPs that accepts the January 2000 Appendix J (Appendix B) schedule. As stated above, Water Forum Appendix J does not require the District to meter until a discretionary surface water approval is needed.

The CUWCC MOU provides advantages to local larger water purveyors in preparing Urban Water Management Plans. The District does not exceed the minimum size threshold requiring an Urban Water Management Plan. Although alignment with the CUWCC approach and goals are recommended, the District should refrain from committing to accelerating meter installation until the distribution system replacement approach and timing is fully determined.

AB 1420 further tightens water conservation accountability to state grant and bond funding opportunities for Urban Water Suppliers. AB 1420 does not appear to change the California Water Code Section 10617 definition of an Urban Water Supplier and therefore the District does not meet the minimum size threshold to require compliance with AB 1420. This is important because AB 1420 ties back to the CUWCC BMPs and metering.

At this time, based on the evaluation above, it appears that the District is under no obligation to proceed with installation of water meters until such time as a surface water need is acted upon. The District Master Plan is providing recommendations on system-wide pipeline replacement from the back lot line to the street and metering the system in a phased approach at that time. This approach is discussed further in the following sections, but, appears consistent with existing meter installation obligation commitments.

8.3 Current Meter Retrofit Status

The District is partially metered with 95 metered accounts as show in Table 13. There are six (6) accounts that are non-residential that are currently on a flat rate as shown in Table 14 and are assumed to not be metered. There are also four (4) stand-by fire protection accounts that are not metered and are billed at as-needed basis. No residential water meters have been installed in the District.

Table 13: Water Meter Accounts Summary

Type	No. of Accounts
Multi-Family	11
Commercial	64
Institutional	5
Irrigation	15
TOTAL	95

Table 14: Commercial Flat Rate Accounts

Account No.	Customer	Service Size
50004	Eastern Mini Market	1”
50005	SI Investment Trust	8” FP, (5) 1”, 2”
50038	Phuong Ngo	5/8”
50055	Sam Co Systems	1”, 6” FP
50070	Ben Davis Enterprises	1½”
50112	Eastern Manor Care Home	1”, 4” FP

8.4 Meter Installation Options

The District has adopted a policy to proceed with relocation of the water mains from the backyards to the street frontage at such time as the pipelines have reached the end of their useful life. Concurrent with the need to address the aging pipelines is the desire to proceed with installing water meters. The Master Plan provides a Planned System Maintenance program for both replacing the pipes, retrofitting water services during pipe replacements, and installing meters.

The District has expressed targeting a 2025 completion year for all meter installation. The District can choose from the following installation approaches:

1. Annual meter installation of approximately 113 meters per year starting in 2010. This would result in installing meters to existing backyard services and the later relocation of

meters with the planned pipeline system replacement. The estimated annual cost would be approximately $135,000. Under this option the meters would be installed as the work proceeded and there would be a phased conversion from flat rate to a metered rate on an annual schedule.

2. Installation of meters concurrent with the Planned System Maintenance pipeline replacement projects starting in 2010 and continuing through 2025. Installation of meter setters would proceed concurrently with pipe replacement and all meters are installed in 2025. Meters would be installed at one time and the entire District residential customer group converted to a metered rate at one time. The cost of metering will be reduced from approximately $1,200 per meter installation to approximately $700 per installation. This represents a savings of 47% or $1,200,000 over preceding with the installation of meters annually and in backyards.

8.5 Findings and Recommendations

The findings of this review are that the District has the option to postpone installing meters until such time as the law changes or there is a need for surface water use within the District. The District would face an annual cost of approximately $100,000 for installing 5% (85) of the total unmetered per year at that time and this would require 20 years to complete should a surface water use be needed.

The District could proceed with installation of meters in advance of the pipeline at a cost of approximately $135,000 per year and be complete by 2025. This approach would require relocating meters to the front yards when the pipelines are relocated from the backyard easements to the public right of way.

The District could proceed with installing meters as they replace the pipelines at a cost savings of approximately 47% or $1,200,000 over the life of the projects.

It is recommended that the District proceed with the concurrent pipeline and meter replacement/retrofit program. Installation of meters as an annual element of the pipeline replacement plan could be reconsidered as the pipeline projects are completed.

Section 9: Planned System Maintenance

9.1 Introduction

Kennedy/Jenks has discussed with the District a Facilities Replacement Plan, which includes the evaluation of District water demands and condition assessment of production and distribution facilities. The District currently practices a sufficient day-to-day maintenance practices. Assets are identified as generally in a good working condition but are currently at or exceeding their useful lives. It is reasonably assumed that replacements of production and distribution facilities are necessary by the end of 2030. The system-wide District assets replacements will be executed as Planned System Maintenance (PSM) projects. The PSM projects will be executed through five (5) phases of four (4) year durations.

In addition to production and distribution facilities, the District acknowledged the necessity to modernize the District facilities to bring the District to a standard industry practices, this includes work associated with upgrading electrical facilities at all existing production facilities, installation of computerized supervisory control and data acquisition (SCADA) system, and building new District office and corporation yard. The PSM will also include efforts to meet all residential meters installation by 2025.

Elements of the PSM can be categorized into the following:

1. Production facilities
2. Buried infrastructures
3. Modernization of operation and maintenance
4. Programmatic element, i.e. metering.

9.2 Planning and Phasing Recommendations

Scope of PSM projects outlined in this section reflects revisions made according to inputs and discussions with District staff. Work associated in the PSM planning for each phase is generally grouped into two different types of efforts:

1. Baseline efforts are triggered by aging production facilities. Systematically, existing production facilities will be abandoned and replaced along associated installation of a typically 12” diameter backbone piping that connects through the District’s quadrants. Priorities are placed first on hydraulically critical regions of the District and age second.
2. Optional efforts address the District’s goal to achieve full residential meter installation by 2025. The distribution facilities replacement includes mainly pipelines with diameters smaller than 12”.

The PSM Summary and Phasing are as presented in the following subsections:

9.2.1 Summary of PSM

An approach for planning a PSM project is shown in Table 15 below. Conditions for each individual project will most likely varying, however, it is recommended for the District to research or complete the following activities in the process of decision making.

Table 15: Typical Construction Projects Preparation

Year	Activities
1	Planning, Right of Way, Funding, Preliminary Design
2	Funding, CEQA, Design
3	Funding, Bidding, Construction
4	Construction, Facilities Start-Up

Summary of cost with related phases and components for the PSM project is provided with description of work for each phase as shown in Table 16 and Table 17.

Table 16: Planned System Maintenance Project Description

Project	Description of Work
1A	Demolish (E) Well No. 5; Construct (N) Well No. 5.
1B	Electrical upgrade for Well Nos. 1–8; Demolish (E) Well No. 7.
1C	Install (N) 2,610 LF of 12” pipelines and appurtenances; Retrofit 46 water service connections to front yards and install meter setters.
1D	Intertie with Carmichael Water District: (N) 3,000 LF of 12” intertie pipelines and appurtenances, meter station, and booster pump station.
2A	Demolish (E) Well No. 1; Construct (N) Well No. 1 and new pump station building; Demolish (E) Well No. 6.
2B	Construct/Purchase (N) 3,600 SF District Office.
2C	Install (N) 5,200 LF of 12” pipeline and appurtenances; Retrofit 96 water service connections to front yards and install meter setters.
2D	Install (N) 900 LF of 12” pipeline, (N) 17,230 LF of 8” pipeline, (N) 300 LF of 6” pipelines and appurtenances; Retrofit 341 water service connections to front yards and install meter setters.
3A	Construct (N) Well No. 6.
3B	Install (N) 4,900 LF of 12” pipeline and appurtenances; Retrofit 84 water service connections to front yards and install meter setters.
3C	Install (N) 14,040 LF of 8” pipeline, (N) 1350 LF of 6” pipelines and appurtenances; Retrofit 262 water service connections to front yards and install meter setters.
4A	Demolish (E) Well No. 2; Demolish (E) Well No. 3; Demolish (E) Well No. 4; Construct (N) Well near Country Club Plaza area.
4B	Install (N) 6,880 LF of 12” pipeline, (N) 35,500 LF of 8” pipeline, (N) 1,550 LF of 6” pipelines and appurtenances; Retrofit 407 water service connections to front yards and install meter setters.
4C	Install (N) 4,500 LF of 12” pipeline, (N) 20,000 LF of 8” pipeline, (N) 100 LF of 6” pipelines and appurtenances; Retrofit 381 water service connections to front yards and install meter setters; Retrofit existing 75 water service at front yards and install meter setters.
4D	Install 1,692 water meters.
5A	Demolish (E) Well No. 8; Construct (N) Well at an undetermined site
5B	Install (N) 4,500 LF of 12” pipelines and appurtenances.

Table 17: Planned System Maintenance Summary of Cost by Phase

Phase	Period	Project	Baseline / Optional	Wells	Pipelines	Pipelines (Meter Installation)	Facilities	Conjunctive Use	Total Cost
1	2010-2014	1A	Baseline	$1,617,000	-	-	-	-	$1,617,000
		1B	Baseline	$451,000	-	-	-	-	$451,000
		1C	Baseline	-	$453,000	-	-	-	$453,000
		1D	Baseline	-	-	-	-	$831,000	$831,000
2	2014-2018	2A	Baseline	$1,925,000	-	-	-	-	$1,925,000
		2B	Baseline	-	-	-	$1,700,000	-	$1,700,000
		2C	Baseline	-	$956,000	-	-	-	$956,000
		2D	Optional	-	-	$1,147,000	-	-	$1,147,000
3	2018-2022	3A	Baseline	$1,562,000	-	-	-	-	$1,562,000
		3B	Baseline	-	$878,000	-	-	-	$878,000
		3C	Optional	-	-	$2,185,000	-	-	$2,185,000
4	2022-2026	4A	Baseline	$1,756,000	-	-	-	-	$1,756,000
		4B	Baseline	-	$5,154,000	-	-	-	$5,154,000
		4C	Optional	-	-	$3,401,000	-	-	$3,401,000
		4D	Optional	-	-	$1,880,000	-	-	$1,880,000
5	2026-2030	5A	Baseline	$1,744,000	-	-	-	-	$1,744,000
		5B	Optional	-	$617,000	-	-	-	$617,000

9.2.2 PSM Phase 1: 2010-2014

Phase 1 is scheduled for 2010 – 2014. The District has expressed the need for addressing priority improvements on facilities that requires immediate attention. In this case, replacement of Well No. 5 and electrical facilities upgrade for Well Nos. 1 – 8. District's Well No. 5 operation has reprioritized to be called last due in the well operation lineup. A downhole well video inspection was performed in February 2009 validates that Well No. 5 replacement is imminent. The well feeds AT&T demands, the District's single largest commercial user. Electrical facilities upgrade for Well Nos. 1 – 8 are necessary to bring the facilities to current industry and safety standards. Backbone pipeline installed in association with new Well No. 5 hydraulically connects north westerly portion of the District with the north easterly portion of the District. An intertie with Carmichael Water District is included in this Phase to address the implementation of Conjunctive Use as discussed in Section 5 of this Master Plan. The work for PSM Phase 1 is as shown on Figure 11. Discussion and summary of cost for PSM Phase 1 is included in Section 9.3.

Recommended baseline work includes the following:

Production Facilities

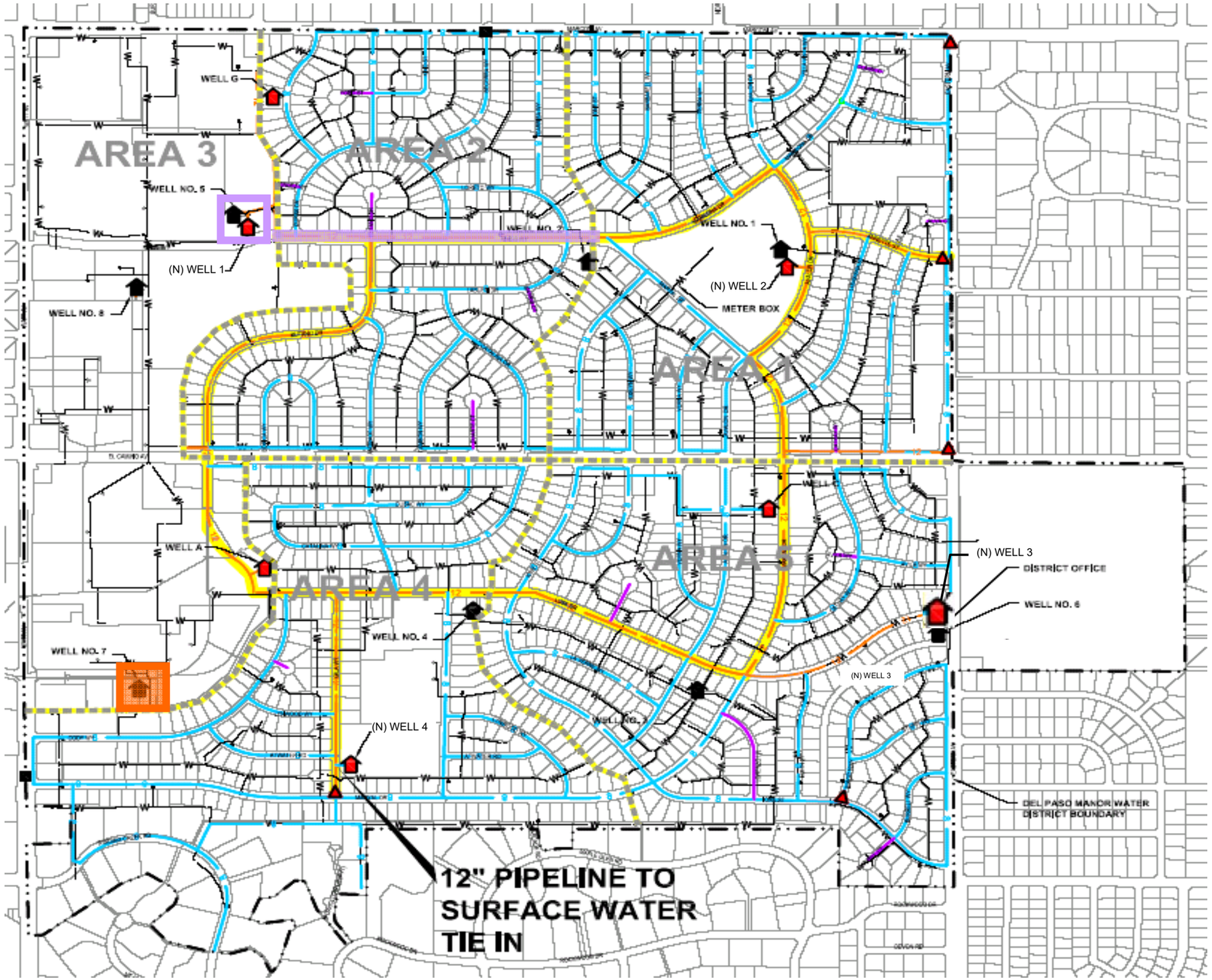
1. Demolish (E) Well No. 5
2. Construct (N) Well No. 5
3. Upgrade electrical facilities Well Nos. 1–8
4. SCADA installation
5. Demolish (E) Well No. 7

Distribution Facilities

1. Install (N) 2,610 LF of 12" pipeline and appurtenances
2. Retrofit 46 water service connections to front yard and install meter setters

Conjunctive Use

1. Intertie with Carmichael Water District: Install (N) 3,000 LF of 12" pipeline and appurtenances, meter station, and booster pump station



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SACRAMENTO, CALIFORNIA
MASTER PLAN

WATER SYSTEM PSM 2010-2014

K/J 0870017.00
APRIL 2009
FIGURE 11

9.2.3 PSM Phase 2: 2014-2018

Phase 2 is scheduled for 2014-2018. The District's Well No. 1 is the District's oldest lead well. The District's Well No. 6 is the only natural gas fueled engine located inside a vault to the rear of District office building. Demolition of Well No. 6 will concurrently take place with moving the District office to a new location. Extension of the backbone pipeline installed in association with new Well No. 1 hydraulically connects north easterly portion of the District with the south easterly portion of the District. The optional efforts related to installation of new distribution facilities begin to take place on this phase. The work for PSM Phase 2 is as shown on Figure 12. Discussion and summary of cost for PSM Phase 2 is included in Section 9.3.

Recommended baseline work includes the following:

Production Facilities

1. Demolish (E) Well No. 1
2. Construct (N) Well No. 1
3. Demolish (E) Well No. 6

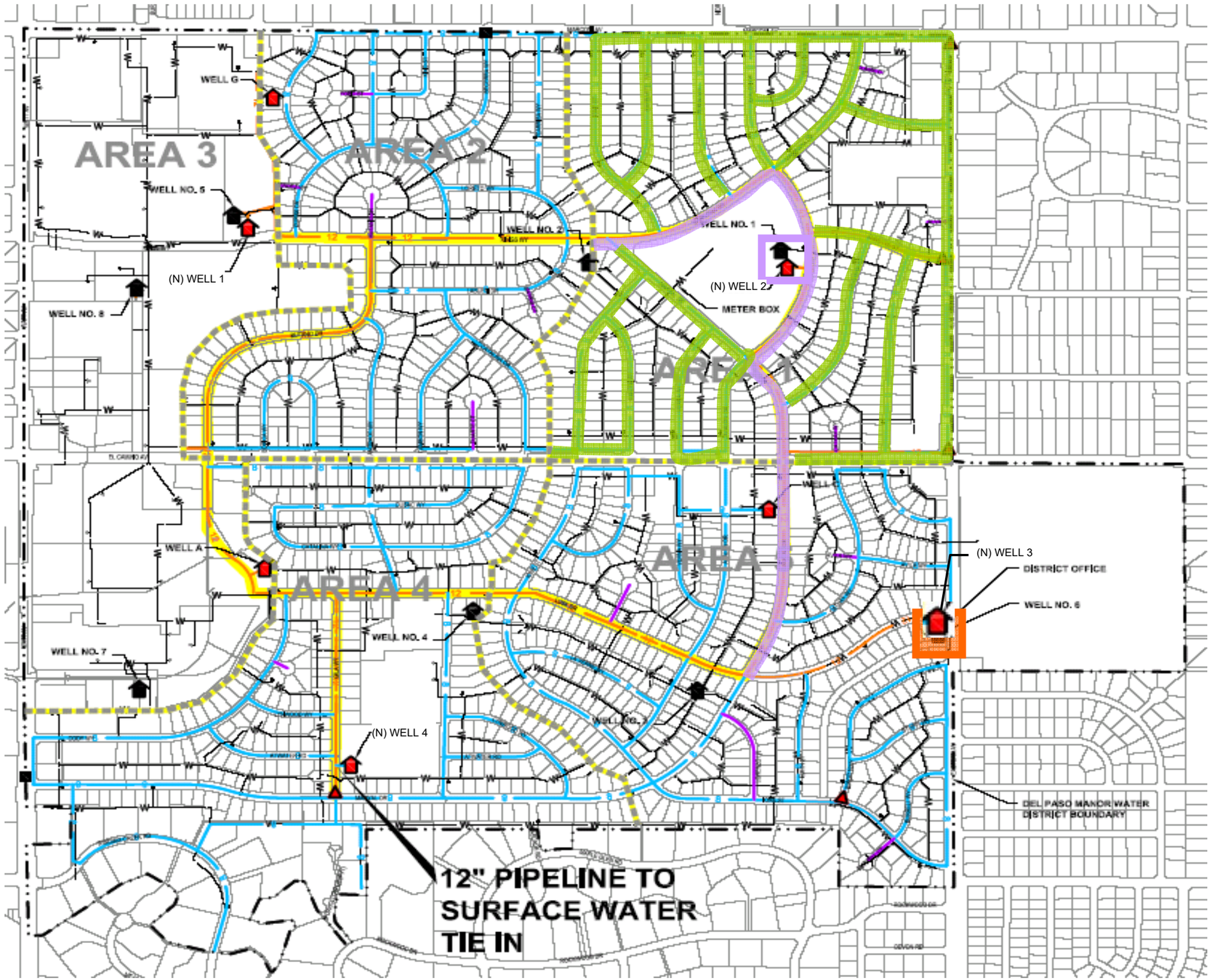
Distribution Facilities

1. Install (N) 5,200 LF of 12" pipeline and appurtenances
2. Retrofit 96 water service connections to front yards
3. Construct/Purchase (N) 3,600 SF District Office

Recommended optional work, driven by meter installation includes the following:

Distribution Facilities

1. Install (N) 900 LF of 12" pipeline, (N) 17,230 LF of 8" pipeline, (N) 300 LF of 6" pipelines and appurtenances
2. Retrofit 341 water service connections to front yards



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WATER SYSTEM PSM 2014-2018

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FIGURE 12

9.2.4 PSM Phase 3: 2018-2022

Phase 3 is scheduled for 2018-2022. The production facilities replacement continues with construction of new Well No. 6. The extension of the backbone pipeline installed in association with new Well No. 6 hydraulically connects south easterly portion of the District with the south westerly portion of the District. The work for PSM Phase 3 is as shown on Figure 13. Discussion and summary of cost for PSM Phase 3 is included in Section 9.3.

Recommended baseline work includes the following:

Production Facilities

1. Construct (N) Well No. 6

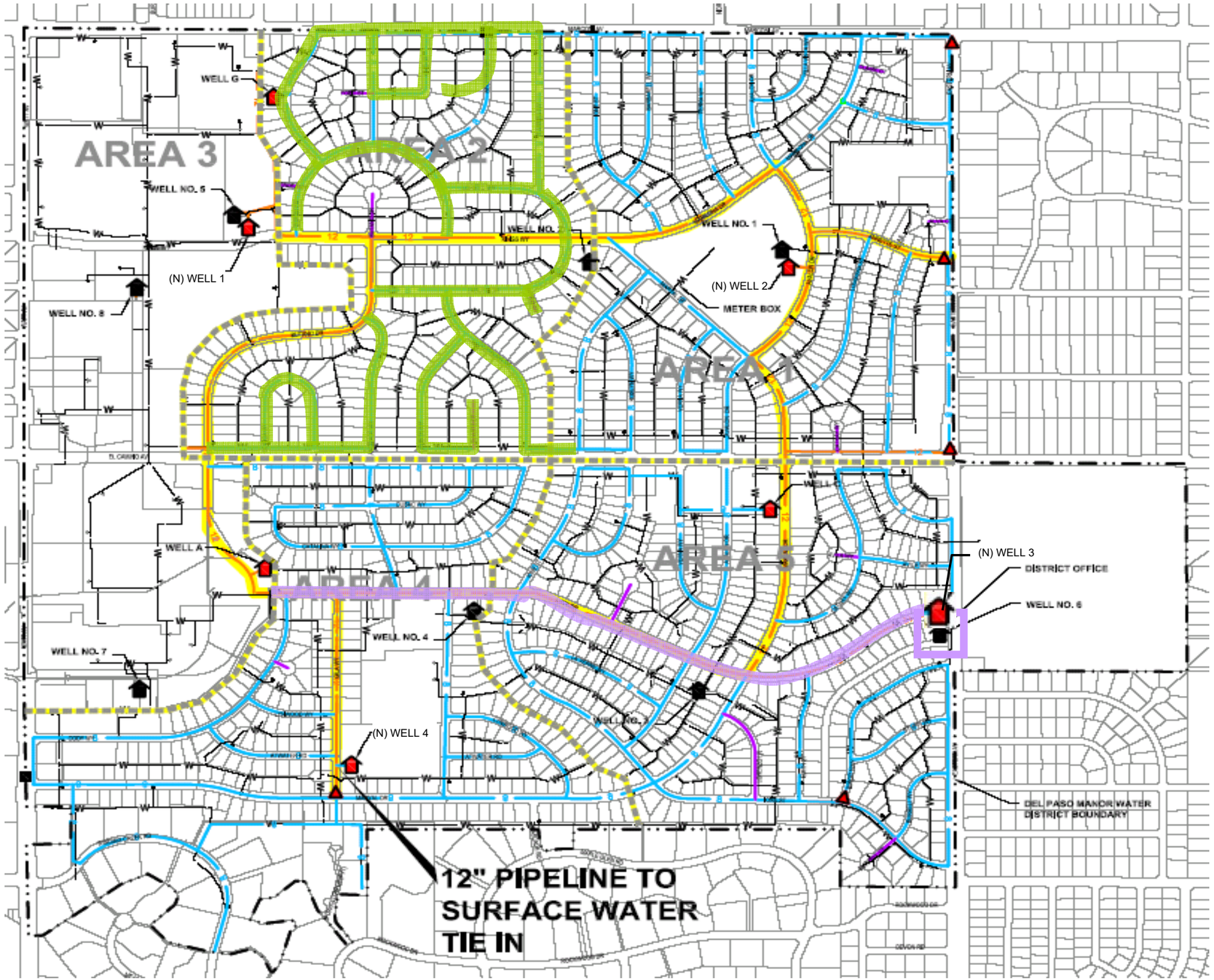
Distribution Facilities

1. Install (N) 4,900 LF of 12” pipeline and appurtenances
2. Retrofit 84 water service connections to front yards

Recommended optional work, driven by meter installation includes the following:

Distribution Facilities

1. Install (N) 14,040 LF of 8” pipeline, (N) 1350 LF of 6” pipelines and appurtenances
2. Retrofit 262 water service connections to front yards



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WATER SYSTEM PSM 2018-2022

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FIGURE 13

9.2.5 PSM Phase 4: 2022-2026

Phase 4 is scheduled for 2022-2026. The production facilities replacement continues with demolition of Well Nos. 2, 3, and 4 and construction of a new well at a site near the Country Club commercial area. The extension of the backbone pipeline installed in association with the new well hydraulically connects south westerly portion of the District with the north westerly portion of the District. Non backbone pipelines are included in the baseline to help meeting deadline for meter installation. Work for PSM Phase 4 is as shown on Figure 14. Discussion and summary of cost for PSM Phase 4 is included in Section 9.3.

Recommended baseline work includes the following:

Production Facilities

1. Demolish (E) Well No. 2
2. Demolish (E) Well No. 3
3. Demolish (E) Well No. 4
4. Construct (N) Well at Country Club site

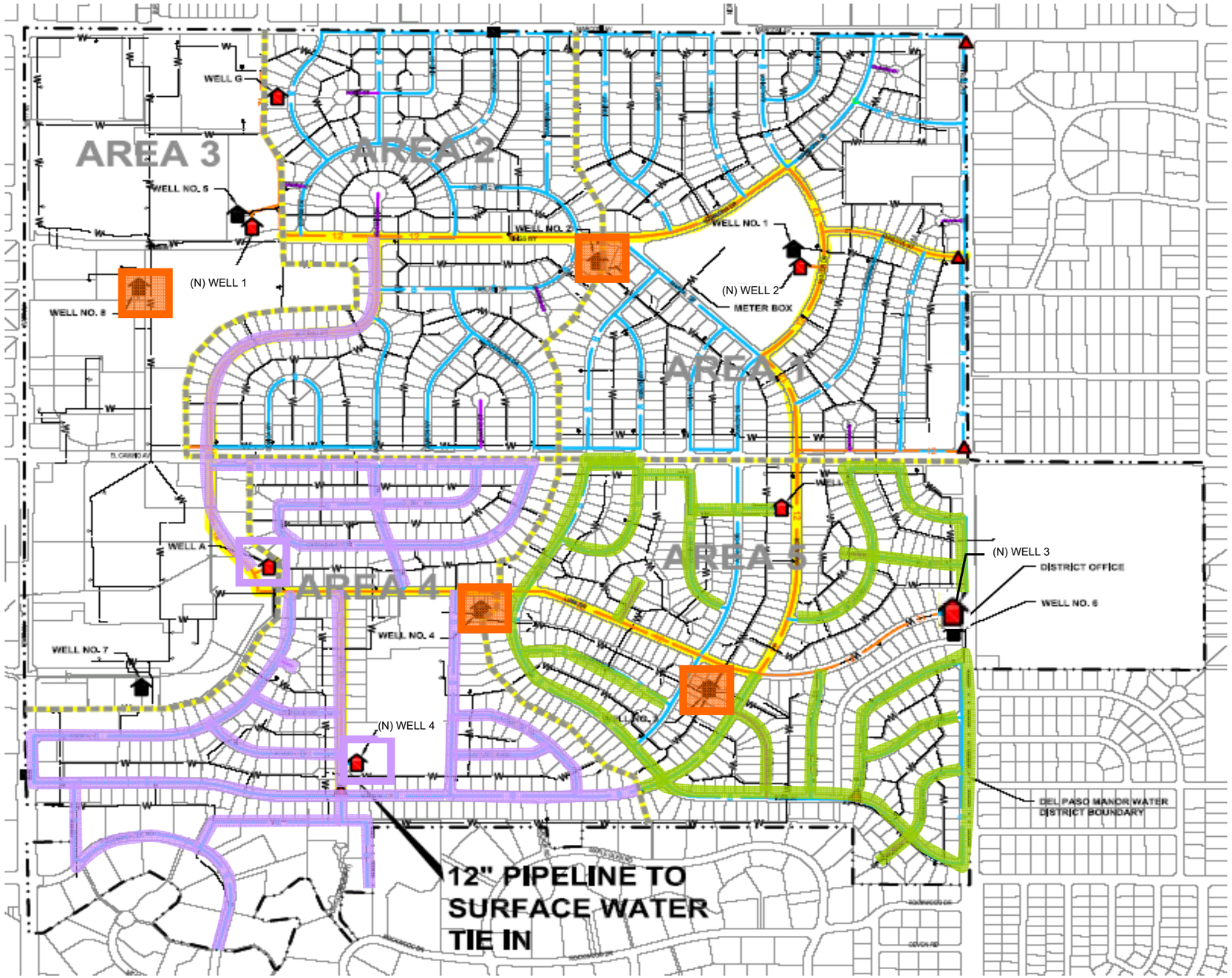
Distribution Facilities

1. Install (N) 6,880 LF of 12” pipeline, (N) 35,500 LF of 8” pipeline, (N) 1,550 LF of 6” pipelines and appurtenances
2. Retrofit 407 water service connections to front yards

Recommended optional work, driven by meter installation includes the following:

Distribution Facilities

1. Install (N) 4,500 LF of 12” pipeline, (N) 20,000 LF of 8” pipeline, (N) 100 LF of 6” pipelines and appurtenances
2. Retrofit 381 water service connections to front yards
3. Retrofit existing 75 water service at front yards
4. Install 1692 water meters



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SACRAMENTO, CALIFORNIA
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WATER SYSTEM PSM 2022-2026

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FIGURE 14

9.2.6 PSM Phase 5: 2026-2030

Phase 5 is scheduled for 2026-2030. The production facilities replacement finishes with demolition of Well 8 and construction of a new well at a site that is not yet determined. At this time, all the backbone pipeline has been installed to accommodate full capacity of the District's new wells. A distribution facility replacement for a segment in the commercial area is included as optional work. The work for PSM Phase 5 is as shown on Figure 15. Discussion and summary of cost for PSM Phase 5 is included in Section 9.3.

Recommended baseline work includes the following:

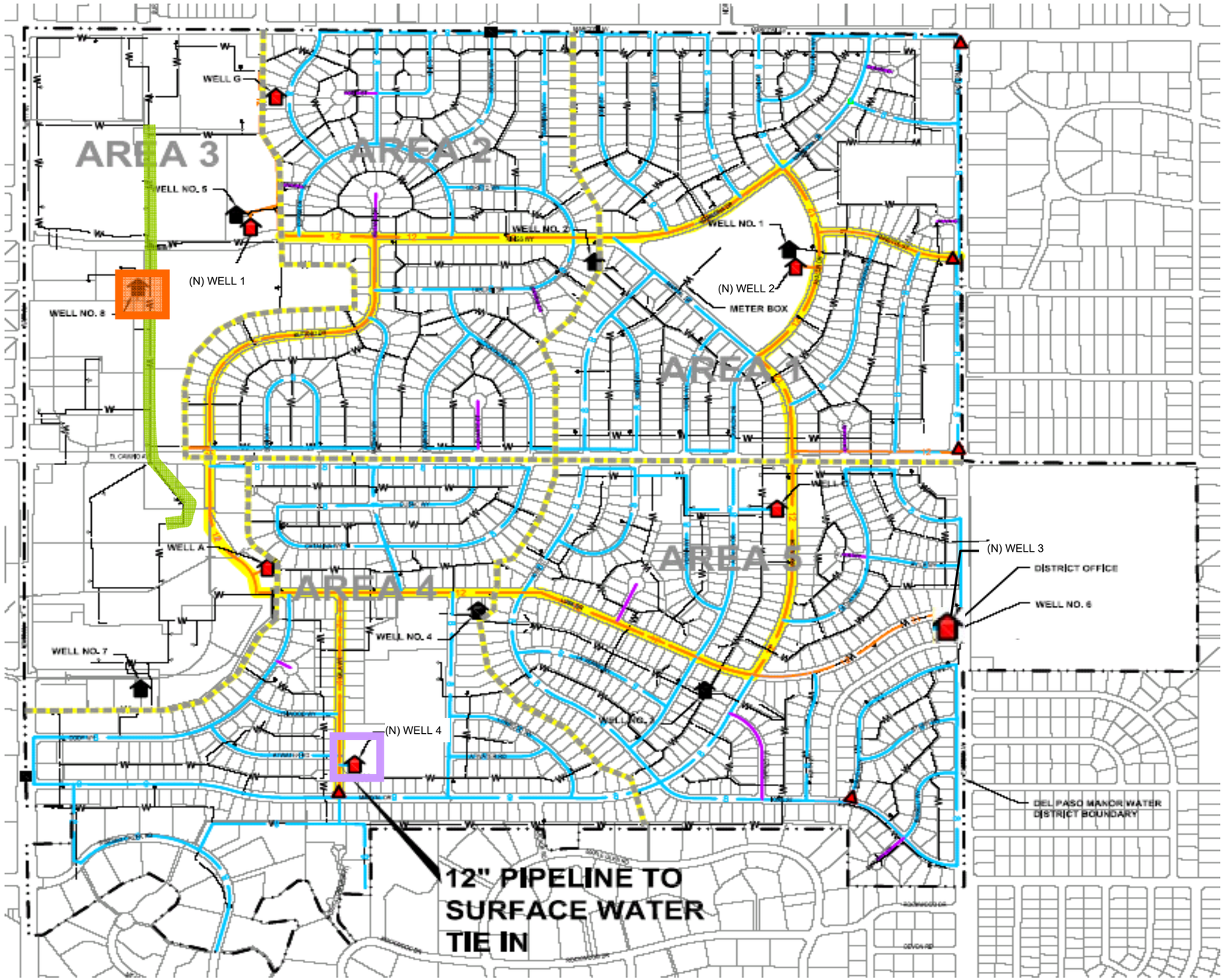
Production Facilities

1. Demolish (E) Well 8
2. Construct (N) Well at a site to be determined

Recommended optional work includes the following:

Distribution Facilities

1. Install (N) 4,500 LF of 12" pipelines and appurtenances



BASELINE, NEW BASELINE, DEMO OPTIONAL

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WATER SYSTEM PSM 2026-2030

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FIGURE 15

9.3 Cost Estimate

The cost estimates were prepared using prior construction bids, current materials pricing, estimating guides, and engineering judgment. The costs are opinion of probable cost and reflect a conceptual level of accuracy. The estimates include a 25 percent contingency for unforeseen conditions, a 10 percent cost for engineering, administrative, and legal costs, a 1 percent cost for environmental review. In this case, it is assumed that District's Planned System Maintenance projects qualify for CEQA Categorical Exemption. Opinions of cost are in current 2009 dollars and are based on Engineering News Records for West Coast Cities - San Francisco Index of 9757.

The estimated new well construction costs include new well drilling and associated improvements, such as site work, mechanical, electrical and instrumentation. The estimated new pipeline cost is per lineal foot of trench installed. The appurtenances include blow-off assembly, fire hydrants, connection to existing distribution system, and abandonment of existing pipeline. Land costs for new wells are included at an estimated $250,000 per site and may vary based on actual sites.

Total cost for PSM Phases 1 – 5 in current 2009 is approximately $28.3 M. The Cost Summary is shown by phase, schedule, and baseline and optional costs. Optional costs reflect costs of distribution pipelines that are driven by District wide completion of service retrofits and meter setters installation for all residential meters installed by 2025. Cost estimate is prepared to reflect options of completing meter installation as an optional effort in phase 4 (2022-2026). The breakdown of cost estimate by individual projects is also included as example of potential staging completion of each PSM phase.

A cost impact calculation was prepared assuming a 4 ½ percent interest rate over 30 years allocated by estimated water use. The estimate provides a monthly residential service cost associated with each PSM phase.

Del Paso Manor Water District
Planned System Maintenace
2010-2030
Meter Installation by 2025
Cost Summary

PSM Phase	Scheduled	Baseline	Optional	Total
1	2010 - 2014	$4,393,400	$0	$4,393,400
2	2014 - 2018	$4,928,200	$1,147,000	$6,075,200
3	2018 - 2022	$2,439,400	$2,184,800	$4,624,200
4	2022 - 2026	$6,910,100	$5,628,300	$12,538,400
5	2026 - 2030	$1,744,300	$617,400	$2,361,700
Estimated Cost				$ 29,992,900
		Rounded to:		**$ 29,993,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 1- Summary
2010-2014

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Demolish (E) Well 5	1	LS	$ 50,000.00	$ 50,000.00
Construct (N) Well 5	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Block Wall	140	LF	$ 104.00	$ 14,560.00
Well Electrical Upgrade/SCADA	1	LS	$ 250,000.00	$ 250,000.00
Demolish (E) Well 7	1	LS	$ 75,000.00	$ 75,000.00
PIPELINES				
12" Piping	2610	LF	$ 87.22	$ 227,640.00
8" Piping		LF	$ -	$ -
6" Piping		LF	$ -	$ -
Appurtenances [a]	1	LS	$ 20,000.00	$ 20,000.00
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	46	EA	$ 1,700.00	$ 78,200.00
Service Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -
CONJUNCTIVE USE				
Carmichael WD Intertie				
Pipeline and System Intertie	1	EA	$ 360,624.00	$ 360,624.00
Booster Pump Station	1	EA	$ 237,600.00	$ 237,600.00
Additional Environmental	1	LS	$ 250,000.00	$ 250,000.00
Land/Right of Way				
Well 5	1	LS	$ 250,000.00	$ 250,000.00
CWD Intertie	1	LS	$ 250,000.00	$ 250,000.00

Subtotal		$ 3,163,624.00
Contingencies	25%	$ 790,906.00
Subtotal		$ 3,954,530.00
Engineering, Admin, and Legal	10%	$ 395,453.00
Subtotal		$ 4,349,983.00
Environmental (Categorical Exemption)	1%	$ 43,499.83
Estimated Cost		$ 4,393,482.83

Rounded to: $ 4,393,400.00

Economic Impacts	
Outlay 2014	$ 4,393,400.00
Annual Cost Factor 30 years @ 4.5% (0.0614)	$ 269,754.76
Cost per Acre Foot Water/Year	$ 160.57
Cost per Single Family ResidentialMonth	$ 7.28

Del Paso Manor Water District
Planned System Maintenance
Phase 1
2010-2014
Project 1A

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Demolish (E) Well 5	1	LS	$ 50,000.00	$ 50,000.00
Construct (N) Well 5	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Block Wall	140	LF	$ 104.00	$ 14,560.00

Subtotal		$ 1,164,560.00
Contingencies	25%	$ 291,140.00
Subtotal		$ 1,455,700.00
Engineering, Admin, and Legal	10%	$ 145,570.00
Subtotal		$ 1,601,270.00
Environmental (Categorical Exemption)	1%	$ 16,012.70
Estimated Cost		$ 1,617,282.70

Rounded to: $ 1,617,000.00

Del Paso Manor Water District
Planned System Maintenance
Phase 1
2010-2014
Project 1B

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Well Electrical Upgrade/SCADA	1	LS	$ 250,000.00	$ 250,000.00
Demolish (E) Well 7	1	LS	$ 75,000.00	$ 75,000.00
Subtotal				$ 325,000.00
Contingencies			25%	$ 81,250.00
Subtotal				$ 406,250.00
Engineering, Admin, and Legal			10%	$ 40,625.00
Subtotal				$ 446,875.00
Environmental (Categorical Exemption)			1%	$ 4,468.75
Estimated Cost				$ 451,343.75
		Rounded to:		**$ 451,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 1
2010-2014
Project 1C

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
PIPELINES				
12" Piping	2610	LF	$ 87.22	$ 227,640.00
8" Piping		LF	$ -	$ -
6" Piping		LF	$ -	$ -
Appurtenances [a]	1	LS	$ 20,000.00	$ 20,000.00
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	46	EA	$ 1,700.00	$ 78,200.00
Service Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -

Subtotal		$ 325,840.00
Contingencies	25%	$ 81,460.00
Subtotal		$ 407,300.00
Engineering, Admin, and Legal	10%	$ 40,730.00
Subtotal		$ 448,030.00
Environmental (Categorical Exemption)	1%	$ 4,480.30
Estimated Cost		$ 452,510.30

Rounded to:	**$ 453,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 1
2010-2014
Project 1D

Project Element	Quantity	Unit	Unit Cost	Extension
CONJUNCTIVE USE				
Carmichael WD Intertie				
Pipeline and System Intertie	1	EA	$ 360,624.00	$ 360,624.00
Booster Pump Station	1	EA	$ 237,600.00	$ 237,600.00
Additional Environmental	1	LS	$ 250,000.00	$ 250,000.00

Subtotal		$ 848,224.00
Contingencies	25%	$ 212,056.00
Subtotal		$ 1,060,280.00
Engineering, Admin, and Legal	10%	$ 106,028.00
Subtotal		$ 1,166,308.00
Environmental (Categorical Exemption)	1%	$ 11,663.08
Estimated Cost		$ 1,177,971.08

Rounded to: $ 1,178,000.00

Del Paso Manor Water District
Planned System Maintenance
Phase 2 - Summary
2014-2018

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Demolish (E) Well 1	1	LS	$ 90,000.00	$ 90,000.00
Construct (N) Well 1	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Pump Station Building	1	LS	$ 106,000.00	$ 106,000.00
Demolish (E) Well 6	1	LS	$ 90,000.00	$ 90,000.00
PIPELINES				
12" Piping	5200	LF	$ 87.46	$ 454,800.00
8" Piping		LF	$ -	$ -
6" Piping		LF	$ -	$ -
Appurtenances [a]	1	LS	$ 70,350.83	$ 70,350.83
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	96	EA	$ 1,700.00	$ 163,482.01
Service Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -
NEW DISTRICT OFFICE				
Building Acquisition	3600	SF	$ 250.00	$ 900,000.00
Tenant Improvement	3600	SF	$ 90.00	$ 324,000.00
Land/Right of Way				
Well 1	1	LS	$ 250,000.00	$ 250,000.00
METER INSTALLATION EFFORT				
PIPELINES				
12" Piping	900	LF	$ 88.00	$ 79,200.00
8" Piping	17230	LF	$ 57.90	$ 57.90
6" Piping	300	LF	$ 46.00	$ 46.00
Appurtenances	1	LS	$ 167,249.17	$ 167,249.17
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	341	EA	$ 1,700.00	$ 579,417.99
Service Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -
Subtotal				$ 4,374,603.90
Contingencies			25%	$ 1,093,650.98
Subtotal				$ 5,468,254.88
Engineering, Admin, and Legal			10%	$ 546,825.49
Subtotal				$ 6,015,080.37
Environmental (Categorical Exemption)			1%	$ 60,150.80
Estimated Cost				$ 6,075,231.17
			Rounded to:	**$ 6,075,200.00**

Economic Impacts	
Outlay 2014	$ 6,075,200.00
Annual Cost Factor 30 years @ 4.5% (0.0614)	$ 373,017.28
Cost per Acre Foot Water/Year	$ 222.03
Cost per Single Family ResidentialMonth	$ 10.07

Del Paso Manor Water District
Planned System Maintenance
Phase 2
2014-2018
Project 2A

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Demolish (E) Well 1	1	LS	$ 90,000.00	$ 90,000.00
Construct (N) Well 1	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Pump Station Building	1	LS	$ 106,000.00	$ 106,000.00
Demolish (E) Well 6	1	LS	$ 90,000.00	$ 90,000.00

Subtotal		$ 1,386,000.00
Contingencies	25%	$ 346,500.00
Subtotal		$ 1,732,500.00
Engineering, Admin, and Legal	10%	$ 173,250.00
Subtotal		$ 1,905,750.00
Environmental (Categorical Exemption)	1%	$ 19,057.50
Estimated Cost		$ 1,924,807.50

Rounded to:	**$ 1,925,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 2
2014-2018
Project 2B

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
NEW DISTRICT OFFICE				
Building Acquisition	3600	SF	$ 250.00	$ 900,000.00
Tenant Improvement	3600	SF	$ 90.00	$ 324,000.00
Subtotal				$ 1,224,000.00
Contingencies			25%	$ 306,000.00
Subtotal				$ 1,530,000.00
Engineering, Admin, and Legal			10%	$ 153,000.00
Subtotal				$ 1,683,000.00
Environmental (Categorical Exemption)			1%	$ 16,830.00
Estimated Cost				$ 1,699,830.00
		Rounded to:		**$ 1,700,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 2
2014-2018
Project 2C

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
PIPELINES				
12" Piping	5200	LF	$ 87.46	$ 454,800.00
8" Piping		LF	$ -	$ -
6" Piping		LF	$ -	$ -
Appurtenances [a]	1	LS	$ 70,350.83	$ 70,350.83
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	96	EA	$ 1,700.00	$ 163,482.01
Service Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -

Subtotal		$ 688,632.84
Contingencies	25%	$ 172,158.21
Subtotal		$ 860,791.05
Engineering, Admin, and Legal	10%	$ 86,079.10
Subtotal		$ 946,870.15
Environmental (Categorical Exemption)	1%	$ 9,468.70
Estimated Cost		$ 956,338.86

Rounded to:	**$ 956,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 2
2014-2018
Project 2D

Project Element	Quantity	Unit	Unit Cost	Extension
METER INSTALLATION EFFORT				
PIPELINES				
12" Piping	900	LF	$ 88.00	$ 79,200.00
8" Piping	17230	LF	$ 57.90	$ 57.90
6" Piping	300	LF	$ 46.00	$ 46.00
Appurtenances [a]	1	LS	$ 167,249.17	$ 167,249.17
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	341	EA	$ 1,700.00	$ 579,417.99
Service Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -

Subtotal		$ 825,971.06
Contingencies	25%	$ 206,492.77
Subtotal		$ 1,032,463.83
Engineering, Admin, and Legal	10%	$ 103,246.38
Subtotal		$ 1,135,710.21
Environmental (Categorical Exemption)	1%	$ 11,357.10
Estimated Cost		$ 1,147,067.32

Rounded to:	**$ 1,147,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 3 - Summary
2018-2022

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Construct (N) Well 6	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Block Wall	140	LF	$ 104.00	$ 14,560.00
Landscape	1	LS	$ 10,000.00	$ 10,000.00
PIPELINES				
12" Piping	4900	LF	$ 85.96	$ 421,200.00
8" Piping	0	LF	$ -	$ -
6" Piping	0	LF	$ -	$ -
Appurtenances [a]	1	LS	$ 68,763.43	$ 68,763.43
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	84	EA	$ 1,700.00	$ 142,049.29
Services Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -
METER INSTALLATION EFFORT				
PIPELINES				
12" Piping	0	LF	$ -	$ -
8" Piping	14040	LF	$ 57.88	$ 812,640.00
6" Piping	1350	LF	$ 43.33	$ 58,500.00
Appurtenances [a]	1	LS	$ 125,636.57	$ 125,636.57
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
AC Pipe Removal	1300	LF	$ 34.00	$ 44,200.00
Trenchless Installation	1300	LF	$ 66.25	$ 86,125.00
SERVICES				
Service Retrofit to Front Yard	262	EA	$ 1,700.00	$ 446,150.71
Services Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -

Subtotal		$ 3,329,825.00
Contingencies	25%	$ 832,456.25
Subtotal		$ 4,162,281.25
Engineering, Admin, and Legal	10%	$ 416,228.13
Subtotal		$ 4,578,509.38
Environmental (Categorical Exemption)	1%	$ 45,785.09
Estimated Cost		$ 4,624,294.47

Rounded to:	**$ 4,624,200.00**

Economic Impacts	
Outlay 2014	$ 4,624,200.00
Annual Cost Factor 30 years @ 4.5% (0.0614)	$ 283,925.88
Cost per Acre Foot Water/Year	$ 169.00
Cost per Single Family ResidentialMonth	$ 7.66

Del Paso Manor Water District
Planned System Maintenance
Phase 3
2018-2022
Project 3A

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Construct (N) Well 6	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Block Wall	140	LF	$ 104.00	$ 14,560.00
Landscape	1	LS	$ 10,000.00	$ 10,000.00
Subtotal				**$ 1,124,560.00**
Contingencies			25%	$ 281,140.00
Subtotal				$ 1,405,700.00
Engineering, Admin, and Legal			10%	$ 140,570.00
Subtotal				$ 1,546,270.00
Environmental (Categorical Exemption)			1%	$ 15,462.70
Estimated Cost				$ 1,561,732.70
		Rounded to:		**$ 1,562,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 3
2018-2022
Project 3B

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
PIPELINES				
12" Piping	4900	LF	$ 85.96	$ 421,200.00
8" Piping	0	LF	$ -	$ -
6" Piping	0	LF	$ -	$ -
Appurtenances [a]	1	LS	$ 68,763.43	$ 68,763.43
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	84	EA	$ 1,700.00	$ 142,049.29
Services Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -

Subtotal		**$ 632,012.72**
Contingencies	25%	$ 158,003.18
Subtotal		$ 790,015.89
Engineering, Admin, and Legal	10%	$ 79,001.59
Subtotal		$ 869,017.48
Environmental (Categorical Exemption)	1%	$ 8,690.17
Estimated Cost		$ 877,707.66

Rounded to:	**$ 878,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 3
2018-2022
Project 3C

Project Element	Quantity	Unit	Unit Cost	Extension
METER INSTALLATION EFFORT				
PIPELINES				
12" Piping	0	LF	$ -	$ -
8" Piping	14040	LF	$ 57.88	$ 812,640.00
6" Piping	1350	LF	$ 43.33	$ 58,500.00
Appurtenances [a]	1	LS	$ 125,636.57	$ 125,636.57
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
AC Pipe Removal	1300	LF	$ 34.00	$ 44,200.00
Trenchless Installation	1300	LF	$ 66.25	$ 86,125.00
SERVICES				
Service Retrofit to Front Yard	262.441597	EA	$ 1,700.00	$ 446,150.71
Services Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -

Subtotal		**$ 1,573,252.28**
Contingencies	25%	$ 393,313.07
Subtotal		$ 1,966,565.36
Engineering, Admin, and Legal	10%	$ 196,656.54
Subtotal		$ 2,163,221.89
Environmental (Categorical Exemption)	1%	$ 21,632.22
Estimated Cost		$ 2,184,854.11

Rounded to:	**$ 2,185,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 4 - Summary
2022-2026

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Demolish/Abandon (E) Well 2	1	LS	$ 50,000.00	$ 50,000.00
Demolish/Abandon (E) Well 3	1	LS	$ 50,000.00	$ 50,000.00
Demolish/Abandon (E) Well 4	1	LS	$ 50,000.00	$ 50,000.00
Construct (N) Well near Country Club	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Block Wall	140	LF	$ 104.00	$ 14,560.00
PIPELINES				
12" Piping	6880	LF	$ 86.44	$ 594,720.00
8" Piping	35500	LF	$ 56.81	$ 2,016,800.00
6" Piping	1550	LF	$ 43.55	$ 67,500.00
Appurtenances [a]	1	LS	$ 340,310.17	$ 340,310.17
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	407	EA	$ 1,700.00	$ 691,900.00
Services Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -
METER INSTALLATION EFFORT				
PIPELINES				
12" Piping	4500	LF	$ 87.20	$ 392,400.00
8" Piping	20000	LF	$ 56.96	$ 1,139,200.00
6" Piping	100	LF	$ 48.00	$ 4,800.00
Appurtenances [a]	1	LS	$ 175,089.83	$ 175,089.83
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	381	EA	$ 1,700.00	$ 647,700.00
Services Existing Front Yard	75	EA	$ 1,200.00	$ 90,000.00
Meters	1692	EA	$ 800.00	$ 1,353,600.00
Land/Right of Way				
Well 4	1	LS	$ 250,000.00	$ 250,000.00

Subtotal		$ 9,028,580.00
Contingencies	25%	$ 2,257,145.00
Subtotal		$ 11,285,725.00
Engineering, Admin, and Legal	10%	$ 1,128,572.50
Subtotal		$ 12,414,297.50
Environmental (Categorical Exemption)	1%	$ 124,142.98
Estimated Cost		$ 12,538,440.48
Rounded to:		**$ 12,538,400.00**

Economic Impacts	
Outlay 2014	$ 12,538,400.00
Annual Cost Factor 30 years @ 4.5% (0.0614)	$ 769,857.76
Cost per Acre Foot Water/Year	$ 458.25
Cost per Single Family ResidentialMonth	$ 20.77

Del Paso Manor Water District
Planned System Maintenance
Phase 4
2022-2026
Project 4A

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Demolish/Abandon (E) Well 2	1	LS	$ 50,000.00	$ 50,000.00
Demolish/Abandon (E) Well 3	1	LS	$ 50,000.00	$ 50,000.00
Demolish/Abandon (E) Well 4	1	LS	$ 50,000.00	$ 50,000.00
Construct (N) Well near Country Club	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Block Wall	140	LF	$ 104.00	$ 14,560.00

Subtotal		$ 1,264,560.00
Contingencies	25%	$ 316,140.00
Subtotal		$ 1,580,700.00
Engineering, Admin, and Legal	10%	$ 158,070.00
Subtotal		$ 1,738,770.00
Environmental (Categorical Exemption)	1%	$ 17,387.70
Estimated Cost		$ 1,756,157.70

Rounded to:	**$ 1,756,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 4
2022-2026
Project 4B

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
12" Piping	6880	LF	$ 86.44	$ 594,720.00
8" Piping	35500	LF	$ 56.81	$ 2,016,800.00
6" Piping	1550	LF	$ 43.55	$ 67,500.00
Appurtenances [a]	1	LS	$ 340,310.17	$ 340,310.17
a] Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	407	EA	$ 1,700.00	$ 691,900.00
Services Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -

Subtotal		$ 3,711,230.17
Contingencies	25%	$ 927,807.54
Subtotal		$ 4,639,037.71
Engineering, Admin, and Legal	10%	$ 463,903.77
Subtotal		$ 5,102,941.48
Environmental (Categorical Exemption)	1%	$ 51,029.41
Estimated Cost		$ 5,153,970.90
Rounded to:		**$ 5,154,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 4
2022-2026
Project 4C

Project Element	Quantity	Unit	Unit Cost	Extension
METER INSTALLATION EFFORT				
PIPELINES				
12" Piping	4500	LF	$ 87.20	$ 392,400.00
8" Piping	20000	LF	$ 56.96	$ 1,139,200.00
6" Piping	100	LF	$ 48.00	$ 4,800.00
Appurtenances [a]	1	LS	$ 175,089.83	$ 175,089.83
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	381	EA	$ 1,700.00	$ 647,700.00
Services Existing Front Yard	75	EA	$ 1,200.00	$ 90,000.00

Subtotal		$ 2,449,189.83
Contingencies	25%	$ 612,297.46
Subtotal		$ 3,061,487.29
Engineering, Admin, and Legal	10%	$ 306,148.73
Subtotal		$ 3,367,636.02
Environmental (Categorical Exemption)	1%	$ 33,676.36
Estimated Cost		$ 3,401,312.38
Rounded to:		**$ 3,401,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 4
2022-2026
Project 4D

Project Element	Quantity	Unit	Unit Cost	Extension
METER INSTALLATION EFFORT				
SERVICES				
Meters	1692	EA	$ 800.00	$ 1,353,600.00
Subtotal				$ 1,353,600.00
Contingencies			25%	$ 338,400.00
Subtotal				$ 1,692,000.00
Engineering, Admin, and Legal			10%	$ 169,200.00
Subtotal				$ 1,861,200.00
Environmental (Categorical Exemption)			1%	$ 18,612.00
Estimated Cost				$ 1,879,812.00
		Rounded to:		**$ 1,880,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 5 Summary
2026-2030

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Demolish (E) Well 8	1	LS	$ 50,000.00	$ 50,000.00
(N) Well at an undetermined site	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Pump Station Building	1	LS	$ 106,000.00	$ 106,000.00
PIPELINES				
12" Piping	0	LF	$ -	$ -
8" Piping	0	LF	$ -	$ -
6" Piping	0	LF	$ -	$ -
Appurtenances [a]	0	LS	$ -	$ -
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				
SERVICES				
Service Retrofit to Front Yard	0	EA	$ 1,700.00	$ -
Service Existing Front Yard	0	EA	$ 1,200.00	$ -
Meters	0	EA	$ 800.00	$ -
METER INSTALLATION EFFORT				
PIPELINES				
12" Piping	4500	LF	$ 84.00	$ 378,000.00
Appurtenances [a]	1	LS	$ 66,600.00	$ 66,600.00
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				

Subtotal		$ 1,700,600.00
Contingencies	25%	$ 425,150.00
Subtotal		$ 2,125,750.00
Engineering, Admin, and Legal	10%	$ 212,575.00
Subtotal		$ 2,338,325.00
Environmental (Categorical Exemption)	1%	$ 23,383.25
Estimated Cost		$ 2,361,708.25
Rounded to:		**$ 2,361,700.00**

Economic Impacts	
Outlay 2014	$ 2,361,700.00
Annual Cost Factor 30 years @ 4.5% (0.0614)	$ 145,008.38
Cost per Acre Foot Water/Year	$ 86.31
Cost per Single Family ResidentialMonth	$ 3.91

Del Paso Manor Water District
Planned System Maintenance
Phase 5
2026-2030
Project 5A

Project Element	Quantity	Unit	Unit Cost	Extension
BASELINE EFFORT				
WELLS				
Demolish (E) Well 8	1	LS	$ 50,000.00	$ 50,000.00
(N) Well at an undetermined site	1	LS	$ 1,100,000.00	$ 1,100,000.00
(N) Pump Station Building	1	LS	$ 106,000.00	$ 106,000.00
Subtotal				$ 1,256,000.00
Contingencies			25%	$ 314,000.00
Subtotal				$ 1,570,000.00
Engineering, Admin, and Legal			10%	$ 157,000.00
Subtotal				$ 1,727,000.00
Environmental (Categorical Exemption)			1%	$ 17,270.00
Estimated Cost				$ 1,744,270.00
		Rounded to:		**$ 1,744,000.00**

Del Paso Manor Water District
Planned System Maintenance
Phase 5
2026-2030
Project 5B

Project Element	Quantity	Unit	Unit Cost	Extension
METER INSTALLATION EFFORT				
PIPELINES				
12" Piping	4500	LF	$ 84.00	$ 378,000.00
Appurtenances [a]	1	LS	$ 66,600.00	$ 66,600.00
a| Appurtenances include valves, fire hydrants, blow off assemblies and fittings				

Subtotal		$ 444,600.00
Contingencies	25%	$ 111,150.00
Subtotal		$ 555,750.00
Engineering, Admin, and Legal	10%	$ 55,575.00
Subtotal		$ 611,325.00
Environmental (Categorical Exemption)	1%	$ 6,113.25
Estimated Cost		$ 617,438.25

Rounded to: $ 617,000.00