COLLECTION AT CACTUS

SUBAREA MASTER PLAN

December 11, 2025

OWD WORK ORDER NO. D1218-090689

Submitted to
Otay Water District

COLLECTION AT CACTUS
SUBAREA MASTER PLAN

December 2025

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Per OWD Code of Ordinances 60.04, approval of SAMP is valid for up to two years.

TABLE OF CONTENTS

PAGE NO.

CHAPTER 1 INTRODUCTION 1-1
PURPOSE 1-1
SCOPE 1-1
PLANNING AREA 1-1

CHAPTER 2 PROPOSED LAND USE 2-1

CHAPTER 3 POTABLE WATER SYSTEM 3-1
PLANNING CRITERIA 3-1
POTABLE WATER DEMANDS 3-2
REGIONAL WATER FACILITY ANALYSIS 3-4
Regional Transmission Mains 3-5
Pump Stations 3-5
Reservoir Storage 3-5
RECOMMENDED ONSITE WATER SYSTEM 3-7
Preliminary Master Domestic Water Meter Sizes 3-9
Easements 3-10
Utility Separation 3-10
HYDRAULIC ANALYSES 3-11
POTABLE WATER SYSTEM
CAPITAL IMPROVEMENT PROGRAM 3-12

APPENDIX A **CONCEPTUAL SITE PLAN**

APPENDIX B **OTAY WATER DISTRICT PEAKING FACTOR CURVES**

APPENDIX C **COMPUTER MODELING OUTPUT**

LIST OF TABLES

PAGE NO.

TABLE 2-1 COLLECTION AT CACTUS SAMP SITE UTILIZATION SUMMARY TABLE 2-1

TABLE 3-1 POTABLE WATER SYSTEM CRITERIA 3-1

TABLE 3-2 POTABLE WATER UNIT DEMAND FACTORS 3-2

TABLE 3-3 COLLECTION AT CACTUS SAMP PROJECTED WATER DEMAND BY PLANNING AREA 3-3

TABLE 3-4 COLLECTION AT CACTUS SAMP PRELIMINARY DOMESTIC WATER MASTER METER SIZES 3-9

TABLE 3-5 COLLECTION AT CACTUS SAMP HYDRAULIC ANALYSIS RESULTS 3-11

TABLE 3-6 OTAY WATER DISTRICT CIP FACILITIES 3-12

LIST OF FIGURES

PAGE NO.

FIGURE 1-1 VICINITY MAP 1-2

FIGURE 3-1 EXISTING WATER FACILITIES 3-6

FIGURE 3-2 PROPOSED WATER SYSTEM 3-8

CHAPTER 1

INTRODUCTION

This document provides a Subarea Master Plan (SAMP) of potable water for the Collection at Cactus project. This report is prepared in accordance with Otay Water District (OWD) Code of Ordinances 60.04 and is valid for up to two years after the date of approval.

PURPOSE

The purpose of this Subarea Master Plan (SAMP) is to describe the planned regional facilities required to provide potable water service to the Collection at Cactus project. The potable water facilities described in this SAMP are compatible with the Otay Water District 2015 Water Facilities Master Plan Update and meet all District planning and design criteria.

SCOPE

The scope of work for the Collection at Cactus SAMP includes the following elements.

- Estimate potable water demands for Collection at Cactus.
- Identify regional water facilities.
- Recommend onsite and offsite facilities required to serve Collection at Cactus.
- Prepare and present hydraulic modeling to evaluate recommended water distribution system pipe sizing.

PLANNING AREA

The Collection at Cactus project is located in the Otay Mesa area of the City of San Diego, within the Central Village Specific Plan, on the northeast corner of Cactus Road and Airway Road. Figure 1-1 presents a location map for the project.

The project is located within the Otay Mesa Service Area of the Otay Water District which is served by the 870 Pressure Zone.

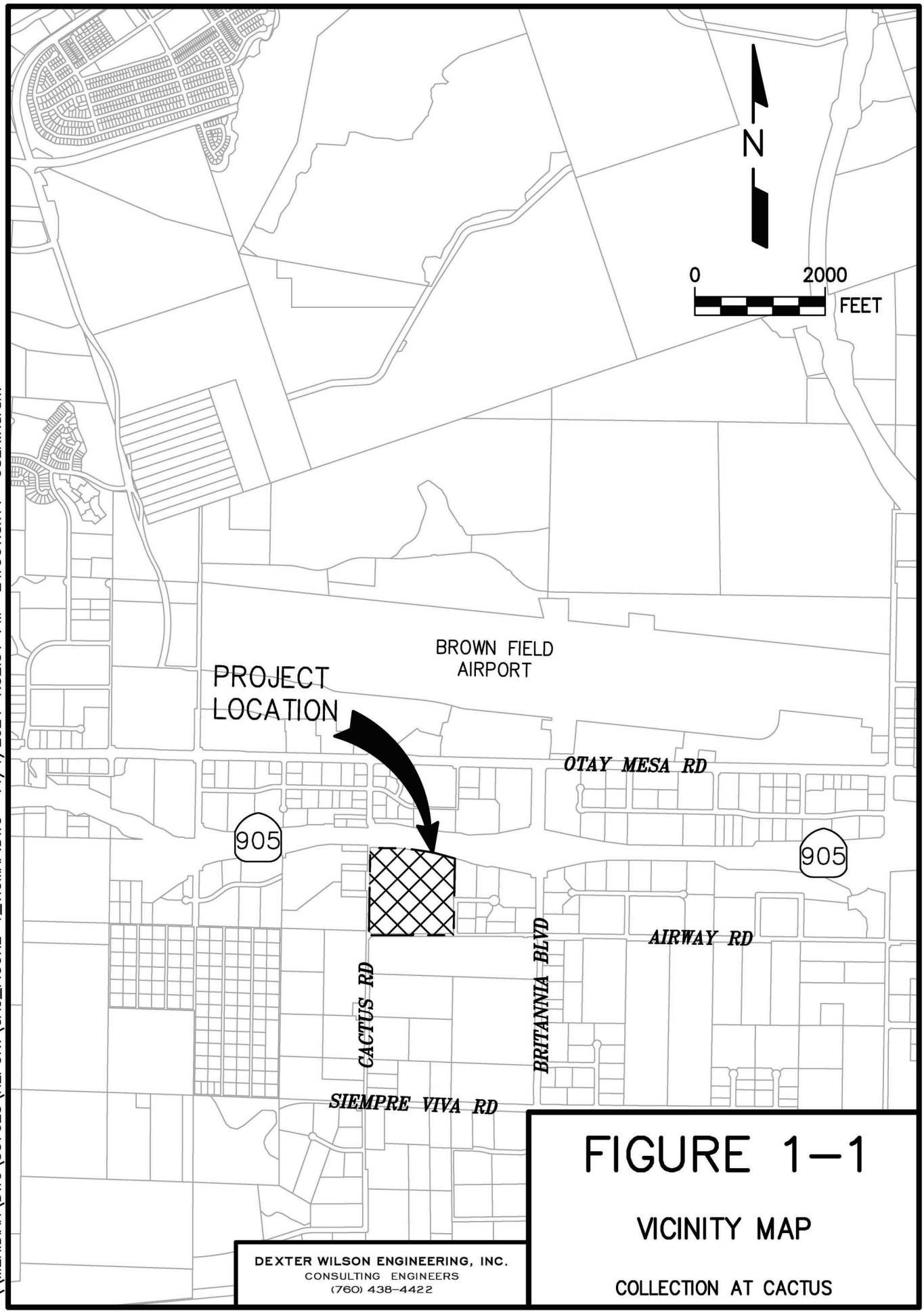

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FIGURE 1-1

VICINITY MAP

COLLECTION AT CACTUS

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CHAPTER 2

PROPOSED LAND USE

The Collection at Cactus project encompasses a total of approximately 39.6 gross acres and the existing property is currently vacant. The project is planned to include 985 multi-family residential units, 20,949 square feet of residential amenities, 3.5 acres of park area, and 243,162 square feet (5.58 acres) of irrigated landscape area. The remaining acreage is made up of public and private roads. A conceptual site plan showing the planning areas for the project is provided in Appendix A for reference. The proposed land uses for the project are summarized in Table 2-1.

TABLE 2-1
COLLECTION AT CACTUS SAMP
SITE UTILIZATION SUMMARY TABLE

Planning Area	Area, acres	Units	Unit Density, DU/ac
Multi-Family Residential (>10 DU/ac)			
10	5.49	145	26.4
11	8.41	324	38.5
12	8.89	342	38.5
13	6.46	174	26.9
Subtotal	**29.25**	**985**	
Park			
17	3.50	--	--
Subtotal	**3.50**	**--**	**--**
Irrigated Landscape Area			
Combined (All PAs)	5.58	--	--
Subtotal	**5.58**	**--**	**--**
TOTAL	**38.33**	**985**	

CHAPTER 3

POTABLE WATER SYSTEM

This chapter presents the planning criteria used to evaluate potable water demand projections and facility sizing requirements for Collection at Cactus. Based on these projections and criteria, the water facility requirements and hydraulic analyses are presented.

PLANNING CRITERIA

The District has established criteria to determine pressure zone boundaries and appropriate line sizing to serve new and existing developments. The criteria, as defined in the 2015 Water Facilities Master Plan, constitute minimum and maximum allowable pressures under certain demand conditions. Minimum pressure requirements are based on the water system supplying both peak hour domestic demands and maximum day demands plus firefighting operations. The maximum pressure limitations are established to protect residential and commercial plumbing as well as distribution piping and appurtenances. The criteria also provide pipeline limitations, such as maximum velocities and minimum line sizes. Table 3-1 lists the potable water planning criteria within the distribution system piping under specified operating conditions.

TABLE 3-1
POTABLE WATER SYSTEM CRITERIA

Item	Criteria
Minimum Static Pressure	65 psi
Maximum Static Pressure	200 psi
Minimum Pressure – Peak Hour Demands	40 psi
Minimum Pressure – Maximum Day Demands plus Fire	20 psi
Maximum Velocity – Maximum Day Demands plus Fire	10 fps
Maximum Velocity – Peak Hour	6 fps
Maximum Headloss per thousand feet	10 ft
Minimum Diameter	8-inch
Hazen-Williams C-factor (12-inch diameter or less)	120
Maximum Day Peak Factors	W.A.S. Figure 4-1-2
Peak Hour Peak Factors	W.A.S. Figure 4-1-1

The criteria presented in Table 3-1 were used to confirm that service from the 870 Zone will provide an acceptable water service to the project. Ground elevations on the project range from approximately 495 feet to 510 feet. With service from the 870 Zone, the Collection at Cactus project will have static pressures ranging from 155 psi to 162 psi, which is an acceptable range per the design criteria presented in Table 3-1. In order to protect private plumbing fixtures, all building connections with a static pressure greater than 80 psi must include a pressure regulator per the 2022 California Plumbing Code.

POTABLE WATER DEMANDS

Water demand factors were obtained from the Otay Water District 2015 Water Facilities Master Plan. Table 3-2 presents the Otay Water District's unit water demand factors pertinent to this study. Irrigation demand will be supplied by the potable water system as there are no recycled water supplies within the vicinity of the project.

TABLE 3-2
POTABLE WATER UNIT DEMAND FACTORS

Land Use	Unit Demand
Multi-Family Residential (>10 DU/ac)	200 gpd/DU
Park/Irrigation	1,900 gpd/ac

Table 3-3 represents the projected average annual potable water demand for Collection at Cactus by planning area. The demand projections were estimated by applying the unit demand factors to residential dwelling units (DUs) and non-residential gross acreage. The total estimated average day demand potable water use is 214,252 gpd (or 0.214 MGD or 149 gpm).

TABLE 3-3
COLLECTION AT CACTUS SAMP
PROJECTED WATER DEMAND BY PLANNING AREA

Planning Area	Land Use	Area, acres	Units	Demand Factor	Average Water Demand, gpd
10	Multi-Family Residential (>10 DU/ac)	5.49	145	200 gpd/DU	29,000
11	Multi-Family Residential (>10 DU/ac)	8.41	324	200 gpd/DU	64,800
12	Multi-Family Residential (>10 DU/ac)	8.89	342	200 gpd/DU	68,400
13	Multi-Family Residential (>10 DU/ac)	6.46	174	200 gpd/DU	34,800
17	Park	3.50	--	1,900 gpd/ac	6,650
Combined (All PAs)	Irrigated Landscape	5.58	--	1,900 gpd/ac	10,602
TOTAL		**38.33**	**985**		**214,252**

Maximum day demands and peak hour demands are computed by multiplying average annual demand by the appropriate peaking factors. Peaking factors of 2.8 for maximum day and 6.2 for peak hour were determined from the charts in Appendix B for Collection at Cactus. This results in a maximum day demand of 599,906 gpd (or 0.600 MGD or 417 gpm) and a peak hour demand of 1,328,362 gpd (or 1.328 MGD or 922 gpm) for the project.

The fire flow requirement for the project was estimated using Table 2-1 of the Otay Water District 2015 Water Facilities Master Plan. Per Table 2-1, the fire flow requirement for multi-family residential sites is 2,500 gpm for two hours. Actual fire flow requirements for the project will be determined by the fire department using the California Fire Code which uses building area and type of construction to determine a building's fire flow requirement; the fire flow requirement for multi-family residential sites may exceed 2,500 gpm based on these factors. Thus, the hydraulic modeling for this project analyzes 4,000 gpm fire flow scenarios. This will allow the Otay Water District to respond to fire flow requests for future multi-family residential sites where the fire flow requirement exceeds 2,500 gpm.

REGIONAL WATER FACILITY ANALYSIS

The 2015 Water Facilities Master Plan estimates future water demand for each pressure zone based on planned developments. Based on these demand projections, the 2015 Water Facilities Master Plan identifies regional facility improvements required to service future development. Included in Appendix C of the 2015 Water Facilities Master Plan is a map which presents anticipated future development within the Otay Water District. The Collection at Cactus project site is included on this map as a part of the Central Village development.

The Otay Water District has several connections to SDCWA Pipeline No. 4, which delivers filtered water from the Metropolitan Water District's filtration plant at Lake Skinner in Riverside County. SDCWA also provides filtered water from the Twin Oaks Treatment plant and provides water from the Carlsbad desalination project. The Otay Water District obtains filtered water from the R.M. Levy Water Treatment Plant in the Helix Water District via the Jamacha Road Pipeline. The Otay Water District has a connection to the City of San Diego's water system near the City of San Diego Otay Lake Water Filtration Plant. The City of San Diego and Otay Water District entered into an agreement in January 1999 for rights to receive 10 mgd from the existing capacity in the Otay Treatment Plant. When the City of San Diego's Lower Otay Filtration Plant is expanded in the future, the Otay Water District has a right to receive an additional 10 mgd from the treatment plant with financial participation.

Collection at Cactus will be served by the 870 Pressure Zone of the Otay Mesa Service Area of the Otay Water District. This area of the District is primarily supplied by SDCWA Aqueduct Connection Number 12 to the SDCWA Aqueduct via the 624 Zone. The 624 Zone gravity feeds to the 571-1 Reservoir, located on the northern end of the Otay Mesa Service Area, via a 30-inch Central Area/Otay Mesa Interconnect Pipeline. The 870 Zone is supplied by pumping water from the 571-1 Reservoir to the 870-1 Reservoir. The 571-1 Reservoir only serves as forebay and emergency storage for the 870 Zone system and provides no direct gravity service to customers. Water is pumped from the 571-1 Reservoir to the 870-1 Reservoir by the recently constructed 870-2 Pump Station.

Water supply is also provided through SDCWA Aqueduct Connection Number 13; however, the primary function of providing supply through this connection is to maintain water quality in the aqueduct. Water from this connection is delivered to the 624-3 Reservoir to boost chloramine disinfection residual, then gravity fed to the 571-1 Reservoir via the Central Area/Otay Mesa Interconnect Pipeline.

Regional Transmission Mains

Figure 3-1 presents a map showing the location of existing major water facilities in the vicinity of Collection at Cactus. There is an existing 10-inch 870 Zone water line west of the project in Cactus Road that connects to an existing 12-inch water line that crosses State Highway 905 near the northwest corner of the project. South of the project there is an existing 16-inch 870 Zone water line in Airway Road. East of the project there is an existing 12-inch 870 Zone water line in Continental Street that continues east in Colchester Court to Britannia Boulevard, where it connects to an existing 20-inch 870 Zone water line in Britannia Boulevard.

Pump Stations

The 870-2 Pump Station was recently constructed and replaced the Low Head Pump Station and the 870-1 Pump Station. The 870-2 Pump Station has a firm capacity of 14,000 gpm and pumps water directly from the 570-1 Reservoir to the 870-1 Reservoir. With the 870-2 Pump Station online, the Low Head and High Head Pump Stations function primarily as standby.

The District uses maximum daily demand to determine pumping capacity for a project. The 2015 Water Facilities Master Plan estimates a maximum day demand for this zone to be 4,313 gpm, leaving a surplus capacity of 9,687 gpm for the 870-2 Pump Station. The projected maximum daily demand for Collection at Cactus is 417 gpm. Therefore, there is currently adequate surplus pumping capacity to supply water to the Collection at Cactus project.

Reservoir Storage

The District uses a factor of 1.3 times maximum daily demand to determine storage requirements for a project. Based on the demand information provided previously, Collection at Cactus has a storage requirement of 779,878 gallons or 0.78 MG in the 870 Zone.

The 870 Zone has one existing storage reservoir, the 870-1 Reservoir, which is located just northeast of the East Mesa Reentry Facility near the north end of Alta Road. From this reservoir, transmission lines in Alta Road convey water to the Otay Mesa Service Area. The total existing storage of the 870-1 Reservoir is 11.0 MG and includes approximately 1.73 MG of existing surplus capacity per the 2015 Water Facilities Master Plan. Additional storage for the 870 Zone is planned for as a District Capital Improvement Program project (CIP No. P2228). The proposed 870-2 Reservoir will add an additional 3.4 MG of storage to the 870 Zone.

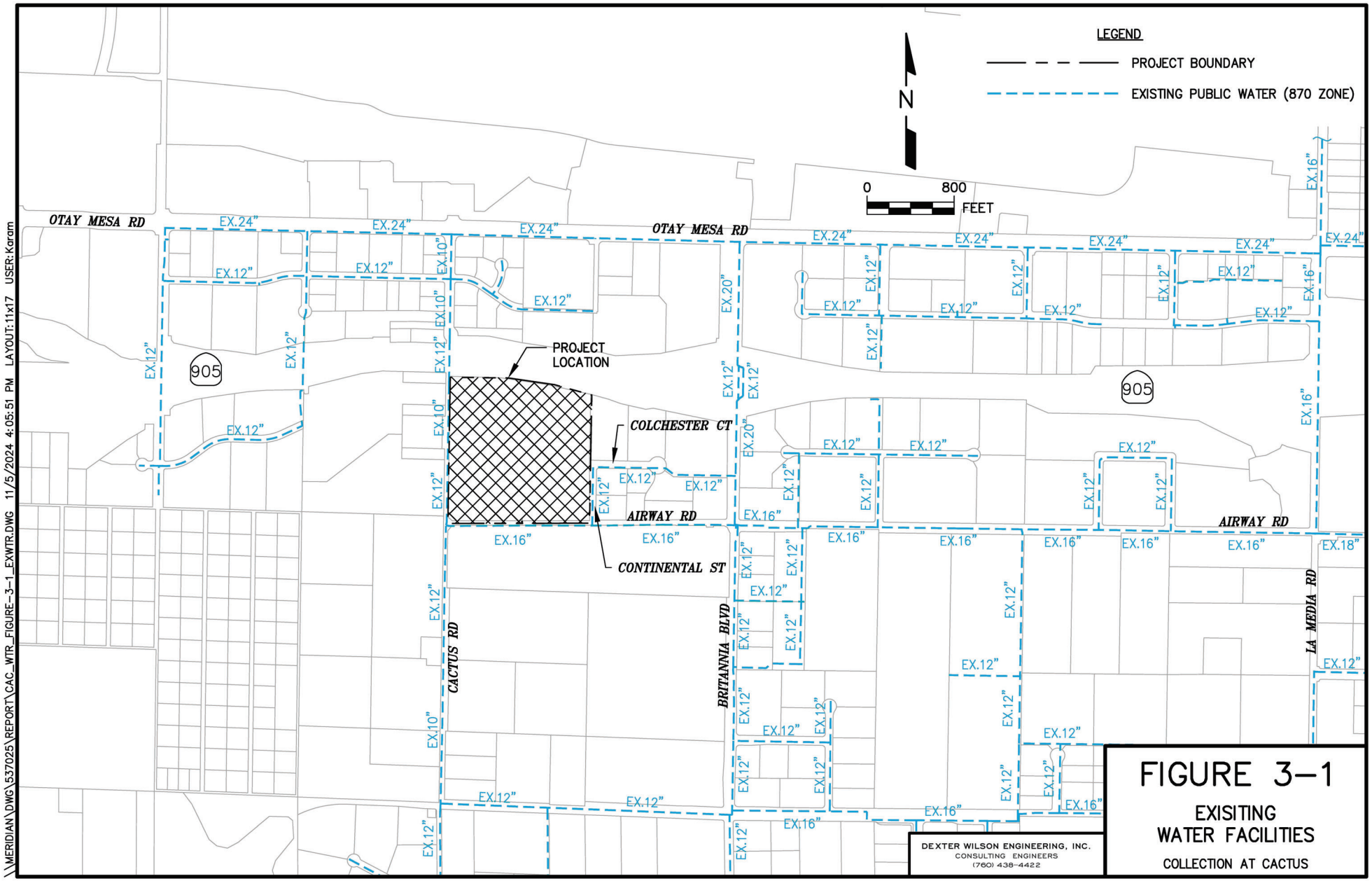

FIGURE 3–1

EXISITING WATER FACILITIES

COLLECTION AT CACTUS

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RECOMMENDED ONSITE WATER SYSTEM

The Collection at Cactus project can be provided water service by expanding the existing 870 Zone system. Figure 3-2 presents a map of the recommended public water facilities for the project.

As shown in Figure 3-2, new public water lines will be constructed within the public roads proposed for the project (Street 'D' and Park Way) and the existing 10-inch public water line in Cactus Road will be upgraded to a 12-inch diameter water line to provide water service to the project. A 12-inch public water line is proposed in Street 'D' and will connect to the existing 12-inch 870 Zone water line in Cactus Road and the existing 12-inch public water line in Continental Street. A 12-inch public water line is proposed in Park Way and will connect to the existing 16-inch 870 Zone water line in Airway Road and the proposed 12-inch 870 Zone water line in Street 'D'. As part of the public water system improvements for the project, four fire hydrants will be installed along the southern frontage of the project in Airway Road.

Private water systems are proposed for each planning area within the Collection at Cactus project. Each planning area will be metered independently, and the private water systems will be looped internally between the meters for each planning area. The project proposes water service connections to the public water lines in Street 'D', Park Way, and Continental Street. The anticipated points of connection for the private water systems are shown in Figure 3-2.

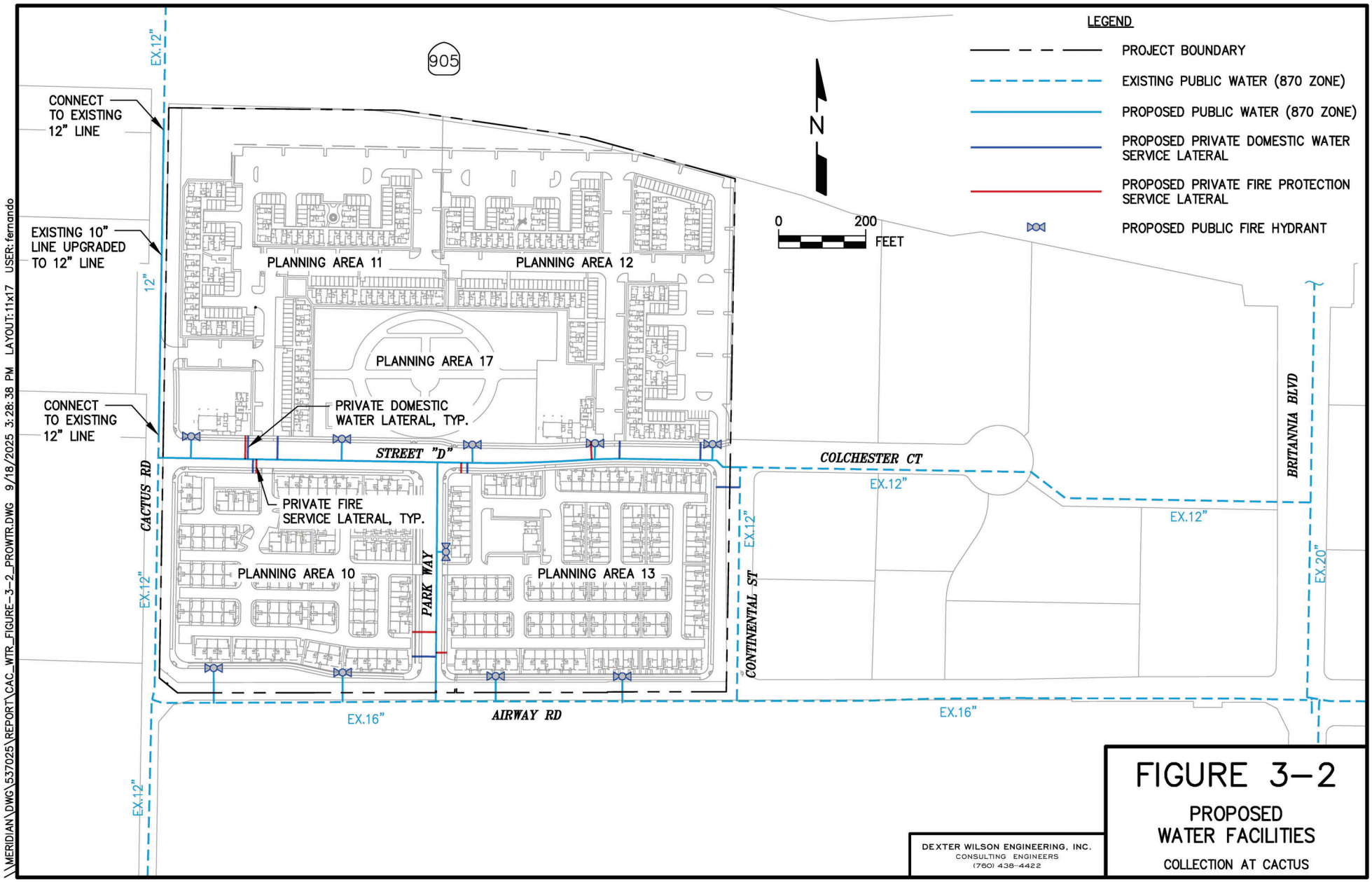

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FIGURE 3-2

PROPOSED WATER FACILITIES

COLLECTION AT CACTUS

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Preliminary Master Domestic Water Meter Sizes

Each residnetial planning area within the Collection at Cactus project will be served by master domestic water meters. The preliminary domestic water master meter sizes for each planning area were estimated based on the total number of water fixture units (WFUs) that will be supplied through the meter. Irrigation internal to the project is proposed to be connected separately and, therefore, are not accounted for in the master meter sizing.

Because architectural plans are not available for the project at this time, the WFU count for each planning area was estimated. The WFU estimates for each planning area are summarized in Table 3-4. Chart A-103.1 in the 2022 California Plumbing Code was used to convert the total WFU estimate for each planning area to a maximum expected demand. Chart A-103.1 provides demands for up to 3,000 Water Fixture Units. Therefore, the maximum expected demand for each planning area was extrapolated.

TABLE 3-4
COLLECTION AT CACTUS
PRELIMINARY DOMESTIC WATER MASTER METER SIZES

Planning Area	Estimated Water Fixture Unit Count	Maximum Expected Demand	Preliminary Master Meter Sizes[1]
10	4,330 WFUs	543 gpm	Two (2) 3" Meters
11	7,440 WFUs	777 gpm	Two (2) 3" Meters
12	8,250 WFUs	832 gpm	Three (3) 3" Meters
13	5,400 WFUs	629 gpm	Two (2) 3" Meters

1. Meter sizes shall be confirmed during final engineering for each planning area when architectural plans become available.

Easements

Placement of water lines in easements has been avoided. All proposed offsite public water lines for Collection at Cactus are proposed to be constructed in public right-of-way.

Utility Separation

The State Water Resources Control Board Division of Drinking Water has the responsibility of ensuring that potable water lines are located with adequate separation from recycled water and sewer lines. Any proposed installations that do not provide the required edge to edge clearance (as stipulated in the California Code of Regulations, Title 22, Division 4, Chapter 16, Section 64572) will require a waiver from the Division of Drinking Water with District concurrence. OWD will not sign off on a waiver for new construction within this project.

The required clearances for new potable water pipelines include a 10-foot horizontal separation and 1.0-foot vertical separation from raw sewage and recycled water lines. A clearance of 4.0 feet horizontally and 1.0 feet vertically is required between potable water and storm drain lines. All required clearances are from edge of pipe to edge of pipe. With no recycled water lines and only one potable water pressure zone, there are no issues anticipated in meeting utility separation requirements.

HYDRAULIC ANALYSES

The analysis for this project utilized the District's current InfoWater hydraulic model. The demands for the project were added to the system, along with the necessary public water system improvements.

The system was analyzed for available capacity to deliver maximum day demand plus fire and peak hour conditions. Table 3-5 presents a summary of these analyses, and detailed results are included in Appendix C. In all cases, the onsite pressures were above 40 psi for peak hour, and above 20 psi for maximum day demand plus fire flow. All velocities are within District design criteria. The results indicate that the proposed improvements are capable of supplying a fire flow of 4,000 gpm to the project.

TABLE 3-5
COLLECTION AT CACTUS SAMP
HYDRAULIC ANALYSIS RESULTS

Run No.	Scenario Description	Fire Department Requirements	
		Minimum Pressure	Maximum Velocity
1	Peak Hour	153.6 psi at Node F-010-0225	0.90 fps in Pipe P133
2	4,000 gpm Fire Flow split between Nodes N200 and N204	141.9 psi at Node N200	4.06 fps in Pipe F-010-0224_V-010-140
3	4,000 gpm Fire Flow split between Nodes N208 and N212	141.8 psi at Node F-010-0225	4.16 fps in Pipe F-010-0225_F-009-0058
4	4,000 gpm Fire Flow split between Nodes N108 and N116	142.1 psi at Node F-010-0225	4.84 fps in Pipe P101
5	4,000 gpm Fire Flow split between Nodes N124 and N128	141.9 psi at Node N220	7.20 fps in Pipe P133
6	4,000 gpm Fire Flow split between Nodes N132 and N148	142.2 psi at Node F-010-0225	6.33 fps in Pipe P153

POTABLE WATER SYSTEM CAPITAL IMPROVEMENT PROGRAM

The District requires a comparison of Capital Improvement Program pipe sizing to determine what the project would require by itself versus what pipe size is required by the Capital Improvement Program. Table 3-5 includes CIP facilities relevant to the project.

TABLE 3-6
OTAY WATER DISTRICT CIP FACILITIES

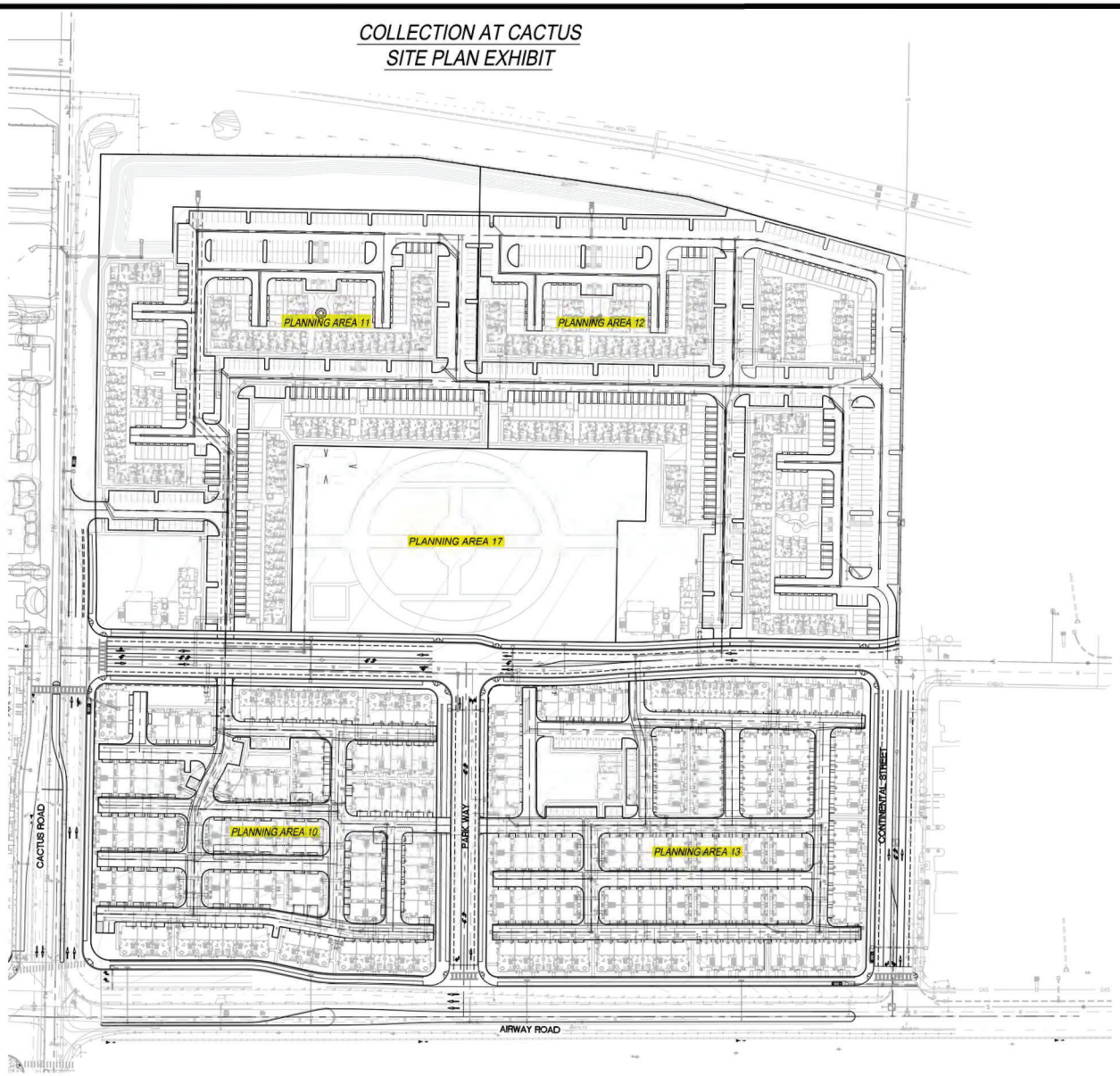
CIP Description	OWD CIP No.	CIP Diameter, In.	Project Diameter, In.
Reconnection of Water Services and Appurtenances along the 12-inch Pipeline Upgrade in Cactus Road	P2665	--	--

Based on Table 3-5, CIP No. P2665 is eligible for reimbursement. CIP No. P2665 is associated with the 12-inch pipeline upgrade in Cactus Road that is required of the project. CIP No. P2665 only addresses the reconnection of water service laterals and appurtenances along the new 12-inch pipeline and not the upgrade of the pipeline itself. Reimbursement will be addressed at the time of completion of construction and acceptance of the facilities by the District.

APPENDIX A

CONCEPTUAL SITE PLAN

COLLECTION AT CACTUS
SITE PLAN EXHIBIT



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APPENDIX B

OTAY WATER DISTRICT
PEAKING FACTOR CURVES

Figure 4-2. MDD Peaking Factor Curve

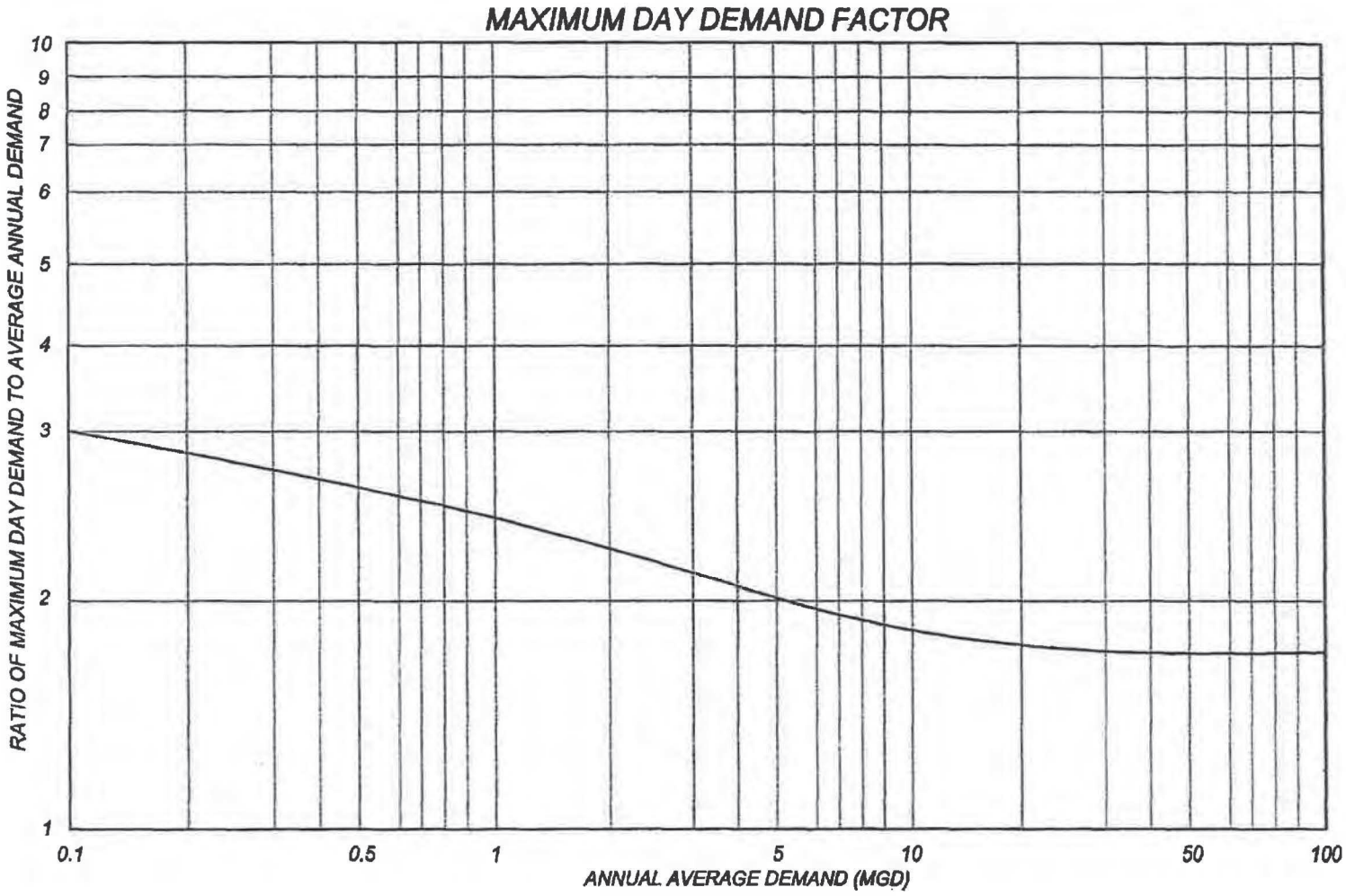
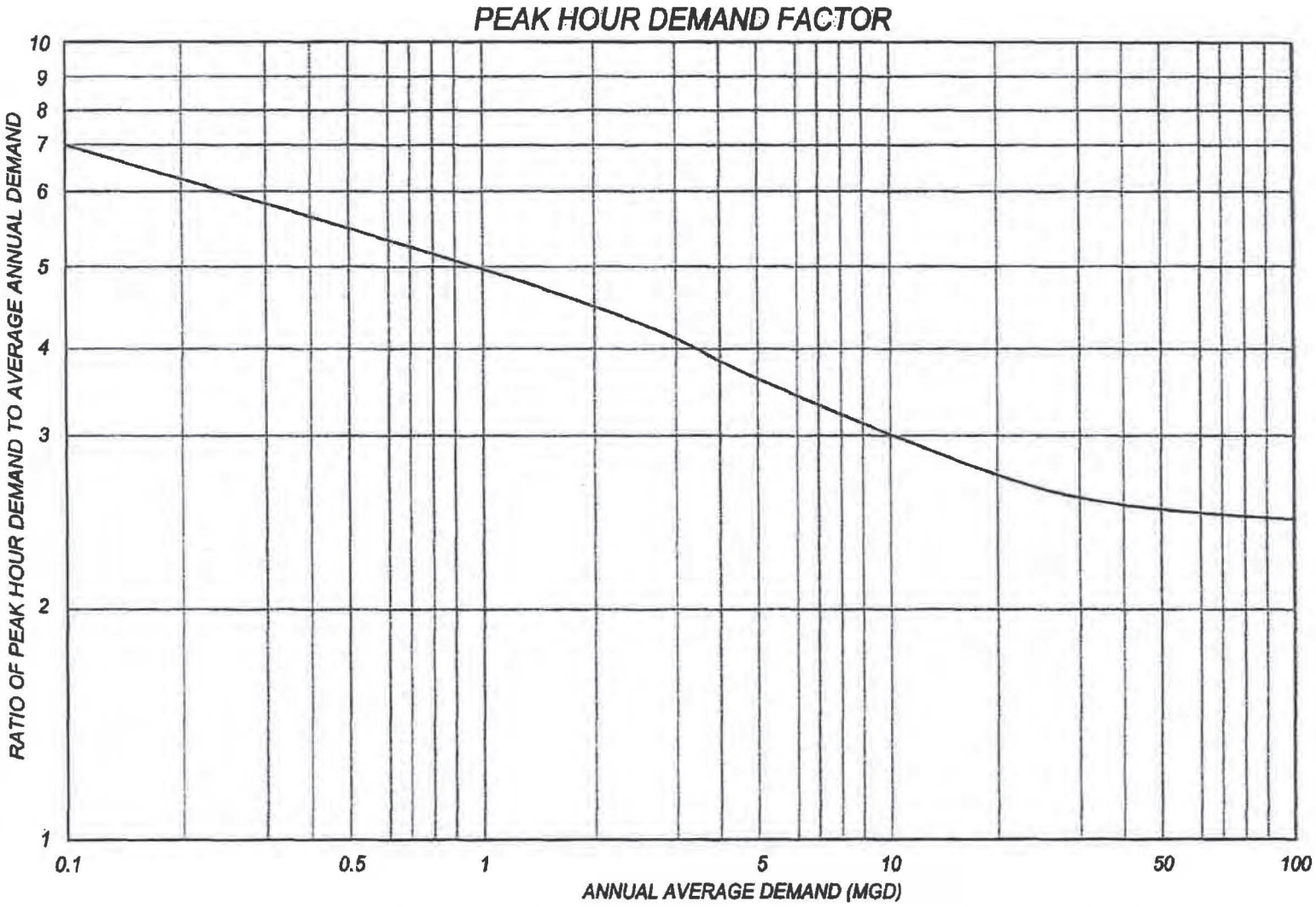


Figure 4-3. Peak Hour Peaking Curve



APPENDIX C

COMPUTER MODELING OUTPUT

Run No. 1: Peak Hour Demand
Node Report

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
F-009-0038	0.3	507.61	870.4	157.2
F-009-0058	0.0	509.7	870.4	156.3
F-009-0059	0.0	508.93	870.4	156.6
F-009-0060	0.0	509.25	870.4	156.5
F-010-0224	0.0	510.19	870.4	156.1
F-010-0225	0.0	516	870.4	153.6
F-010-0305	0.0	510.32	870.4	156.0
F-010-0306	80.7	510.26	870.4	156.0
F-010-0308	0.0	510.23	870.4	156.1
F-010-0312	0.0	510.33	870.4	156.0
F-010-0313	0.0	510.15	870.4	156.1
F-010-0314	0.0	509.93	870.4	156.2
F-010-0320	0.0	510.33	870.4	156.0
N100	68.1	510	870.4	156.2
N108	0.0	511	870.4	155.7
N112	28.6	507	870.3	157.4
N116	80.7	508	870.3	157.0
N124	153.0	510	870.3	156.1
N128	153.0	511	870.4	155.7
N132	0.0	505	870.3	158.3
N140	358.6	503	870.3	159.2
N148	0.0	502	870.4	159.6
N200	0.0	516	870.4	153.6
N204	0.0	514	870.4	154.4

Run No. 1: Peak Hour Demand
Pipe Report

ID	From Node	To Node	Length (ft)	Diameter (in)	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/k-ft)
F-009-0038_V-009-018	F-009-0038	V-009-018	24.2	12	-94.2	0.27	0.00	0.04
F-009-0055_F-009-0038	F-009-0055	N216	661.6	12	189.8	0.54	0.09	0.14
F-009-0058_F-009-0060	F-009-0058	F-009-0060	5.5	16	29.2	0.05	0.00	0.00
F-009-0060_V-009-019	F-009-0060	V-009-019	14.3	16	29.2	0.05	0.00	0.00
F-010-0224_V-010-140	F-010-0224	N204	261.2	16	269.1	0.43	0.01	0.05
F-010-0225_F-009-0058	N208	F-010-0225	213.5	16	-29.2	0.05	0.00	0.00
F-010-0305_F-010-0320	F-010-0305	N220	10.0	12	224.8	0.64	0.00	0.19
F-010-0306_F-010-0308	F-010-0306	F-010-0308	134.6	12	-174.1	0.49	0.02	0.12
F-010-0308_F-010-0312	F-010-0308	F-010-0312	20.1	12	-174.1	0.49	0.00	0.12
F-010-0312_F-010-0313	F-010-0312	F-010-0313	204.9	12	-174.1	0.49	0.02	0.12
F-010-0313_F-010-0314	F-010-0313	F-010-0314	120.6	12	-174.1	0.49	0.01	0.12
F-010-0314_V-010-196	F-010-0224	F-010-0314	1.5	16	174.1	0.28	0.00	0.00
F-010-0320_F-010-0306	F-010-0320	F-010-0306	15.2	12	-93.4	0.26	0.00	0.04
P101	F-010-0225	N100	102.6	12	239.9	0.68	0.02	0.21
P109	N108	N100	240.2	12	-171.8	0.49	0.03	0.11
P113	N108	N112	205.6	12	171.8	0.49	0.02	0.11
P117	N112	N116	74.3	12	68.3	0.19	0.00	0.02
P123	N116	N124	315.4	12	-12.3	0.03	0.00	0.00
P129	N124	N128	228.5	12	-165.3	0.47	0.02	0.10
P133	N128	N220	83.6	12	-318.2	0.90	0.03	0.35
P137	N112	N132	220.5	12	74.8	0.21	0.01	0.02
P141	N132	N140	209.3	12	74.8	0.21	0.01	0.02
P149	N140	N148	136.7	12	-283.8	0.80	0.04	0.29
P153	N148	N216	77.1	12	-283.8	0.80	0.02	0.29
P201	N200	F-010-0225	138.0	16	269.1	0.43	0.01	0.05
P205	N204	V-010-140	93.7	16	269.1	0.43	0.01	0.05
P209	N208	N212	296.0	16	29.2	0.05	0.00	0.00
P211	V-009-018	F-009-0059	0.4	12	-94.2	0.27	0.00	0.00

Run No. 2: 4,000 gpm Fire Flow split between Nodes N200 and N204
Node Report

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
F-009-0038	0.4	507.61	844.1	145.8
F-009-0058	0.0	509.7	844.1	144.9
F-009-0059	0.0	508.93	844.1	145.2
F-009-0060	0.0	509.25	844.1	145.1
F-010-0224	0.0	510.19	844.5	144.9
F-010-0225	0.0	516	843.7	142.0
F-010-0305	0.0	510.32	844.8	144.9
F-010-0306	36.4	510.26	844.7	144.9
F-010-0308	0.0	510.23	844.7	144.9
F-010-0312	0.0	510.33	844.7	144.9
F-010-0313	0.0	510.15	844.6	144.9
F-010-0314	0.0	509.93	844.5	145.0
F-010-0320	0.0	510.33	844.7	144.9
N100	30.8	510	843.8	144.6
N108	0.0	511	844.1	144.3
N112	12.9	507	844.3	146.1
N116	36.4	508	844.3	145.7
N124	69.1	510	844.5	144.9
N128	69.1	511	844.7	144.6
N132	0.0	505	844.3	147.0
N140	161.9	503	844.3	147.9
N148	0.0	502	844.4	148.4
N200	2,000.0	516	843.6	141.9

Run No. 2: 4,000 gpm Fire Flow split between Nodes N200 and N204
Pipe Report

ID	From Node	To Node	Length (ft)	Diameter (in)	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/k-ft)
F-009-0038_V-009-018	F-009-0038	V-009-018	24.2	12	442.2	1.25	0.02	0.65
F-009-0055_F-009-0038	F-009-0055	N216	661.6	12	805.8	2.29	1.30	1.97
F-009-0058_F-009-0060	F-009-0058	F-009-0060	5.5	16	-921.8	1.47	0.00	0.54
F-009-0060_V-009-019	F-009-0060	V-009-019	14.3	16	-921.8	1.47	0.01	0.54
F-010-0224_V-010-140	F-010-0224	N204	261.2	16	2,543.9	4.06	0.92	3.52
F-010-0225_F-009-0058	N208	F-010-0225	213.5	16	921.8	1.47	0.11	0.54
F-010-0305_F-010-0320	F-010-0305	N220	10.0	12	927.6	2.63	0.03	2.56
F-010-0306_F-010-0308	F-010-0306	F-010-0308	134.6	12	340.0	0.96	0.05	0.40
F-010-0308_F-010-0312	F-010-0308	F-010-0312	20.1	12	340.0	0.96	0.01	0.40
F-010-0312_F-010-0313	F-010-0312	F-010-0313	204.9	12	340.0	0.96	0.08	0.40
F-010-0313_F-010-0314	F-010-0313	F-010-0314	120.6	12	340.0	0.96	0.05	0.40
F-010-0314_V-010-196	F-010-0224	F-010-0314	1.5	16	-340.0	0.54	0.00	0.08
F-010-0320_F-010-0306	F-010-0320	F-010-0306	15.2	12	376.4	1.07	0.01	0.48
P101	F-010-0225	N100	102.6	12	-534.3	1.52	0.09	0.92
P109	N108	N100	240.2	12	565.1	1.60	0.25	1.02
P113	N108	N112	205.6	12	-565.1	1.60	0.21	1.02
P117	N112	N116	74.3	12	-376.6	1.07	0.04	0.48
P123	N116	N124	315.4	12	-413.1	1.17	0.18	0.57
P129	N124	N128	228.5	12	-482.1	1.37	0.17	0.76
P133	N128	N220	83.6	12	-551.2	1.56	0.08	0.98
P137	N112	N132	220.5	12	-201.4	0.57	0.03	0.15
P141	N132	N140	209.3	12	-201.4	0.57	0.03	0.15
P149	N140	N148	136.7	12	-363.3	1.03	0.06	0.45
P153	N148	N216	77.1	12	-363.3	1.03	0.03	0.45
P201	N200	F-010-0225	138.0	16	-1,456.1	2.32	0.17	1.25
P205	N204	V-010-140	93.7	16	543.9	0.87	0.02	0.20
P209	N208	N212	296.0	16	-921.8	1.47	0.16	0.54
P211	V-009-018	F-009-0059	0.4	12	442.2	1.25	0.00	0.65

Run No. 3: 4,000 gpm Fire Flow split between Nodes N208 and N212
Node Report

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
F-009-0038	0.4	507.61	842.6	145.2
F-009-0058	0.0	509.7	842.5	144.2
F-009-0059	0.0	508.93	842.6	144.6
F-009-0060	0.0	509.25	842.5	144.4
F-010-0224	0.0	510.19	845.0	145.1
F-010-0225	0.0	516	843.3	141.8
F-010-0305	0.0	510.32	845.0	145.0
F-010-0306	36.4	510.26	845.0	145.0
F-010-0308	0.0	510.23	845.0	145.0
F-010-0312	0.0	510.33	845.0	145.0
F-010-0313	0.0	510.15	845.0	145.1
F-010-0314	0.0	509.93	845.0	145.2
F-010-0320	0.0	510.33	845.0	145.0
N100	30.8	510	843.4	144.4
N108	0.0	511	843.6	144.1
N112	12.9	507	843.8	145.9
N116	36.4	508	843.9	145.5
N124	69.1	510	844.4	144.9
N128	69.1	511	844.8	144.6
N132	0.0	505	843.7	146.8
N140	161.9	503	843.7	147.6
N148	0.0	502	843.7	148.1
N200	0.0	516	843.6	142.0

Run No. 3: 4,000 gpm Fire Flow split between Nodes N208 and N212
Pipe Report

ID	From Node	To Node	Length (ft)	Diameter (in)	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/k-ft)
F-009-0038_V-009-018	F-009-0038	V-009-018	24.2	12	831.1	2.36	0.05	2.09
F-009-0055_F-009-0038	F-009-0055	N216	661.6	12	860.9	2.44	1.47	2.23
F-009-0058_F-009-0060	F-009-0058	F-009-0060	5.5	16	-1,392.0	2.22	0.01	1.15
F-009-0060_V-009-019	F-009-0060	V-009-019	14.3	16	-1,392.0	2.22	0.02	1.15
F-010-0224_V-010-140	F-010-0224	N204	261.2	16	2,105.2	3.36	0.65	2.48
F-010-0225_F-009-0058	N208	F-010-0225	213.5	16	-2,608.0	4.16	0.79	3.68
F-010-0305_F-010-0320	F-010-0305	N220	10.0	12	908.2	2.58	0.02	2.46
F-010-0306_F-010-0308	F-010-0306	F-010-0308	134.6	12	18.2	0.05	0.00	0.00
F-010-0308_F-010-0312	F-010-0308	F-010-0312	20.1	12	18.2	0.05	0.00	0.00
F-010-0312_F-010-0313	F-010-0312	F-010-0313	204.9	12	18.2	0.05	0.00	0.00
F-010-0313_F-010-0314	F-010-0313	F-010-0314	120.6	12	18.2	0.05	0.00	0.00
F-010-0314_V-010-196	F-010-0224	F-010-0314	1.5	16	-18.2	0.03	0.00	0.00
F-010-0320_F-010-0306	F-010-0320	F-010-0306	15.2	12	54.6	0.15	0.00	0.01
P101	F-010-0225	N100	102.6	12	-502.8	1.43	0.08	0.82
P109	N108	N100	240.2	12	533.6	1.51	0.22	0.92
P113	N108	N112	205.6	12	-533.6	1.51	0.19	0.92
P117	N112	N116	74.3	12	-679.1	1.93	0.11	1.44
P123	N116	N124	315.4	12	-715.5	2.03	0.50	1.58
P129	N124	N128	228.5	12	-784.6	2.23	0.43	1.88
P133	N128	N220	83.6	12	-853.7	2.42	0.18	2.19
P137	N112	N132	220.5	12	132.5	0.38	0.02	0.07
P141	N132	N140	209.3	12	132.5	0.38	0.01	0.07
P149	N140	N148	136.7	12	-29.4	0.08	0.00	0.00
P153	N148	N216	77.1	12	-29.4	0.08	0.00	0.00
P201	N200	F-010-0225	138.0	16	2,105.2	3.36	0.34	2.48
P205	N204	V-010-140	93.7	16	2,105.2	3.36	0.23	2.48
P209	N208	N212	296.0	16	608.0	0.97	0.07	0.25
P211	V-009-018	F-009-0059	0.4	12	831.1	2.36	0.00	2.09

Run No. 4: 4,000 gpm Fire Flow split between Nodes N108 and N116
Node Report

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
F-009-0038	0.4	507.61	843.9	145.7
F-009-0058	0.0	509.7	843.9	144.8
F-009-0059	0.0	508.93	843.9	145.2
F-009-0060	0.0	509.25	843.9	145.0
F-010-0224	0.0	510.19	844.9	145.0
F-010-0225	0.0	516	843.9	142.1
F-010-0305	0.0	510.32	844.5	144.8
F-010-0306	36.4	510.26	844.5	144.8
F-010-0308	0.0	510.23	844.6	144.9
F-010-0312	0.0	510.33	844.7	144.9
F-010-0313	0.0	510.15	844.8	145.0
F-010-0314	0.0	509.93	844.9	145.2
F-010-0320	0.0	510.33	844.5	144.8
N100	30.8	510	843.1	144.3
N108	2,000.0	511	841.3	143.1
N112	12.9	507	841.4	144.9
N116	2,036.4	508	841.2	144.4
N124	69.1	510	842.8	144.2
N128	69.1	511	844.0	144.3
N132	0.0	505	842.1	146.1
N140	161.9	503	842.8	147.2
N148	0.0	502	843.4	147.9
N200	0.0	516	844.1	142.2

Run No. 4: 4,000 gpm Fire Flow split between Nodes N108 and N116
Pipe Report

ID	From Node	To Node	Length (ft)	Diameter (in)	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/k-ft)
F-009-0038_V-009-018	F-009-0038	V-009-018	24.2	12	-362.8	1.03	0.01	0.45
F-009-0055_F-009-0038	F-009-0055	N216	661.6	12	862.3	2.45	1.48	2.23
F-009-0058_F-009-0060	F-009-0058	F-009-0060	5.5	16	-127.1	0.20	0.00	0.01
F-009-0060_V-009-019	F-009-0060	V-009-019	14.3	16	-127.1	0.20	0.00	0.01
F-010-0224_V-010-140	F-010-0224	N204	261.2	16	1,578.2	2.52	0.38	1.45
F-010-0225_F-009-0058	N208	F-010-0225	213.5	16	127.1	0.20	0.00	0.01
F-010-0305_F-010-0320	F-010-0305	N220	10.0	12	974.1	2.76	0.03	2.80
F-010-0306_F-010-0308	F-010-0306	F-010-0308	134.6	12	-512.6	1.45	0.11	0.85
F-010-0308_F-010-0312	F-010-0308	F-010-0312	20.1	12	-512.6	1.45	0.02	0.85
F-010-0312_F-010-0313	F-010-0312	F-010-0313	204.9	12	-512.6	1.45	0.17	0.85
F-010-0313_F-010-0314	F-010-0313	F-010-0314	120.6	12	-512.6	1.45	0.10	0.85
F-010-0314_V-010-196	F-010-0224	F-010-0314	1.5	16	512.6	0.82	0.00	0.18
F-010-0320_F-010-0306	F-010-0320	F-010-0306	15.2	12	-476.1	1.35	0.01	0.74
P101	F-010-0225	N100	102.6	12	1,705.2	4.84	0.81	7.90
P109	N108	N100	240.2	12	-1,674.4	4.75	1.83	7.64
P113	N108	N112	205.6	12	-325.6	0.92	0.08	0.37
P117	N112	N116	74.3	12	724.3	2.05	0.12	1.62
P123	N116	N124	315.4	12	-1,312.1	3.72	1.53	4.86
P129	N124	N128	228.5	12	-1,381.2	3.92	1.22	5.35
P133	N128	N220	83.6	12	-1,450.3	4.11	0.49	5.85
P137	N112	N132	220.5	12	-1,062.8	3.01	0.73	3.29
P141	N132	N140	209.3	12	-1,062.8	3.01	0.69	3.29
P149	N140	N148	136.7	12	-1,224.7	3.47	0.58	4.28
P153	N148	N216	77.1	12	-1,224.7	3.47	0.33	4.28
P201	N200	F-010-0225	138.0	16	1,578.2	2.52	0.20	1.45
P205	N204	V-010-140	93.7	16	1,578.2	2.52	0.14	1.45
P209	N208	N212	296.0	16	-127.1	0.20	0.00	0.01
P211	V-009-018	F-009-0059	0.4	12	-362.8	1.03	0.00	0.45

Run No. 5: 4,000 gpm Fire Flow split between Nodes N124 and N128
Node Report

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
F-009-0038	0.4	507.61	844.9	146.2
F-009-0058	0.0	509.7	844.9	145.3
F-009-0059	0.0	508.93	844.9	145.6
F-009-0060	0.0	509.25	844.9	145.5
F-010-0224	0.0	510.19	845.1	145.1
F-010-0225	0.0	516	844.9	142.5
F-010-0305	0.0	510.32	842.4	143.9
F-010-0306	36.4	510.26	842.6	144.0
F-010-0308	0.0	510.23	843.3	144.3
F-010-0312	0.0	510.33	843.4	144.3
F-010-0313	0.0	510.15	844.5	144.9
F-010-0314	0.0	509.93	845.1	145.2
F-010-0320	0.0	510.33	842.5	144.0
N100	30.8	510	844.6	145.0
N108	0.0	511	844.1	144.3
N112	12.9	507	843.6	145.8
N116	36.4	508	843.0	145.2
N124	2,069.1	510	840.8	143.3
N128	2,069.1	511	841.0	143.0
N132	0.0	505	844.0	146.9
N140	161.9	503	844.3	147.9
N148	0.0	502	844.7	148.5
N200	0.0	516	844.9	142.5

Run No. 5: 4,000 gpm Fire Flow split between Nodes N124 and N128
Pipe Report

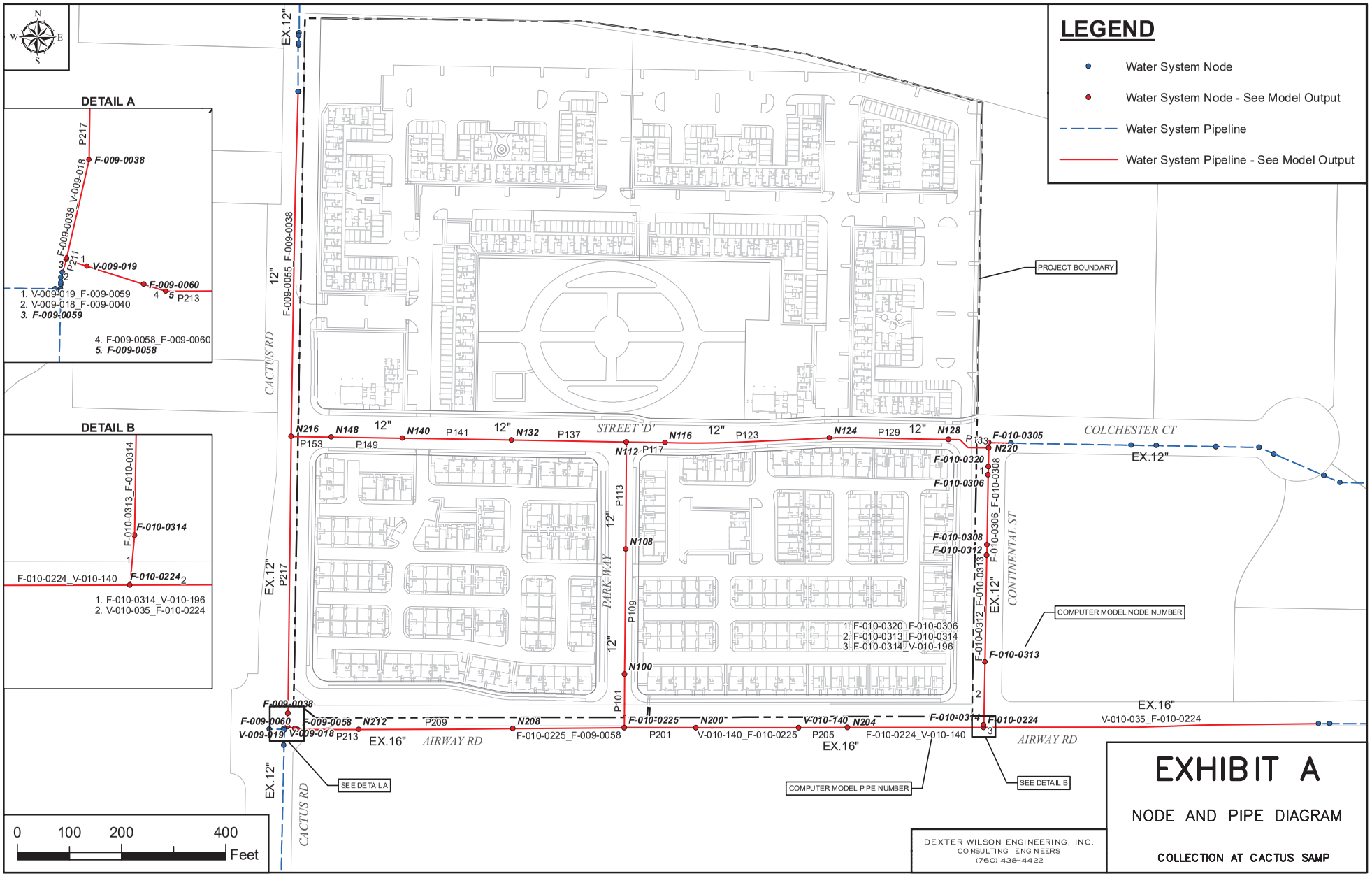
ID	From Node	To Node	Length (ft)	Diameter (in)	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/k-ft)
F-009-0038_V-009-018	F-009-0038	V-009-018	24.2	12	-153.0	0.43	0.00	0.09
F-009-0055_F-009-0038	F-009-0055	N216	661.6	12	768.9	2.18	1.20	1.81
F-009-0058_F-009-0060	F-009-0058	F-009-0060	5.5	16	-276.9	0.44	0.00	0.06
F-009-0060_V-009-019	F-009-0060	V-009-019	14.3	16	-276.9	0.44	0.00	0.06
F-010-0224_V-010-140	F-010-0224	N204	261.2	16	642.8	1.03	0.07	0.28
F-010-0225_F-009-0058	N208	F-010-0225	213.5	16	276.9	0.44	0.01	0.06
F-010-0305_F-010-0320	F-010-0305	N220	10.0	12	1,225.7	3.48	0.04	4.29
F-010-0306_F-010-0308	F-010-0306	F-010-0308	134.6	12	-1,349.7	3.83	0.69	5.12
F-010-0308_F-010-0312	F-010-0308	F-010-0312	20.1	12	-1,349.7	3.83	0.10	5.12
F-010-0312_F-010-0313	F-010-0312	F-010-0313	204.9	12	-1,349.7	3.83	1.05	5.12
F-010-0313_F-010-0314	F-010-0313	F-010-0314	120.6	12	-1,349.7	3.83	0.62	5.12
F-010-0314_V-010-196	F-010-0224	F-010-0314	1.5	16	1,349.7	2.15	0.00	1.09
F-010-0320_F-010-0306	F-010-0320	F-010-0306	15.2	12	-1,313.2	3.73	0.07	4.87
P101	F-010-0225	N100	102.6	12	919.7	2.61	0.26	2.52
P109	N108	N100	240.2	12	-888.9	2.52	0.57	2.36
P113	N108	N112	205.6	12	888.9	2.52	0.49	2.36
P117	N112	N116	74.3	12	1,635.7	4.64	0.54	7.31
P123	N116	N124	315.4	12	1,599.2	4.54	2.21	7.01
P129	N124	N128	228.5	12	-469.9	1.33	0.17	0.73
P133	N128	N220	83.6	12	-2,538.9	7.20	1.38	16.51
P137	N112	N132	220.5	12	-759.7	2.15	0.39	1.77
P141	N132	N140	209.3	12	-759.7	2.15	0.37	1.77
P149	N140	N148	136.7	12	-921.6	2.61	0.35	2.53
P153	N148	N216	77.1	12	-921.6	2.61	0.19	2.53
P201	N200	F-010-0225	138.0	16	642.8	1.03	0.04	0.28
P205	N204	V-010-140	93.7	16	642.8	1.03	0.03	0.28
P209	N208	N212	296.0	16	-276.9	0.44	0.02	0.06
P211	V-009-018	F-009-0059	0.4	12	-153.0	0.43	0.00	0.09

Run No. 6: 4,000 gpm Fire Flow split between Nodes N132 and N148
Node Report

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
F-009-0038	0.4	507.61	843.8	145.7
F-009-0058	0.0	509.7	843.9	144.8
F-009-0059	0.0	508.93	843.9	145.2
F-009-0060	0.0	509.25	843.9	145.0
F-010-0224	0.0	510.19	845.3	145.2
F-010-0225	0.0	516	844.2	142.2
F-010-0305	0.0	510.32	845.1	145.1
F-010-0306	36.4	510.26	845.1	145.1
F-010-0308	0.0	510.23	845.2	145.1
F-010-0312	0.0	510.33	845.2	145.1
F-010-0313	0.0	510.15	845.3	145.2
F-010-0314	0.0	509.93	845.3	145.3
F-010-0320	0.0	510.33	845.1	145.1
N100	30.8	510	843.9	144.7
N108	0.0	511	843.3	144.0
N112	12.9	507	842.7	145.5
N116	36.4	508	842.9	145.1
N124	69.1	510	843.9	144.7
N128	69.1	511	844.8	144.6

Run No. 6: 4,000 gpm Fire Flow split between Nodes N132 and N148
Pipe Report

ID	From Node	To Node	Length (ft)	Diameter (in)	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/k-ft)
F-009-0038_V-009-018	F-009-0038	V-009-018	24.2	12	-1,223.0	3.47	0.10	4.27
F-009-0055_F-009-0038	F-009-0055	N216	661.6	12	1,008.1	2.86	1.97	2.98
F-009-0058_F-009-0060	F-009-0058	F-009-0060	5.5	16	727.3	1.16	0.00	0.35
F-009-0060_V-009-019	F-009-0060	V-009-019	14.3	16	727.3	1.16	0.00	0.35
F-010-0224_V-010-140	F-010-0224	N204	261.2	16	1,691.8	2.70	0.43	1.65
F-010-0225_F-009-0058	N208	F-010-0225	213.5	16	-727.3	1.16	0.07	0.35
F-010-0305_F-010-0320	F-010-0305	N220	10.0	12	902.2	2.56	0.02	2.43
F-010-0306_F-010-0308	F-010-0306	F-010-0308	134.6	12	-319.2	0.91	0.05	0.35
F-010-0308_F-010-0312	F-010-0308	F-010-0312	20.1	12	-319.2	0.91	0.01	0.35
F-010-0312_F-010-0313	F-010-0312	F-010-0313	204.9	12	-319.2	0.91	0.07	0.35
F-010-0313_F-010-0314	F-010-0313	F-010-0314	120.6	12	-319.2	0.91	0.04	0.35
F-010-0314_V-010-196	F-010-0224	F-010-0314	1.5	16	319.2	0.51	0.00	0.08
F-010-0320_F-010-0306	F-010-0320	F-010-0306	15.2	12	-282.8	0.80	0.00	0.28
P101	F-010-0225	N100	102.6	12	964.5	2.74	0.28	2.75
P109	N108	N100	240.2	12	-933.7	2.65	0.62	2.59
P113	N108	N112	205.6	12	933.7	2.65	0.53	2.59
P117	N112	N116	74.3	12	-1,010.5	2.87	0.22	3.00
P123	N116	N124	315.4	12	-1,046.9	2.97	1.01	3.20
P129	N124	N128	228.5	12	-1,116.0	3.17	0.82	3.60
P133	N128	N220	83.6	12	-1,185.0	3.36	0.34	4.03
P137	N112	N132	220.5	12	1,931.2	5.48	2.19	9.95
P141	N132	N140	209.3	12	-68.8	0.20	0.00	0.02



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