DEXTER WILSON ENGINEERING, INC.

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CONSULTING ENGINEERS

WATER SERVICE ANALYSIS FOR THE BUNKER HILL REVERE PHASE 2 PROJECT IN THE CITY OF SAN DIEGO

July 9, 2025

2234 FARADAY AVENUE • CARLSBAD, CA • (760) 438-4422

WATER SERVICE ANALYSIS FOR THE BUNKER HILL REVERE PHASE 2 PROJECT IN THE CITY OF SAN DIEGO

July 9, 2025

7-9-2025

Prepared by:
Dexter Wilson Engineering, Inc.
2234 Faraday Avenue
Carlsbad, CA 92008
(760) 438-4422

Job No. 1198-001

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DEXTER WILSON ENGINEERING, INC.

DEXTER S. WILSON, P.E.
ANDREW M. OVEN, P.E.
NATALIE J. FRASCHETTI, P.E.
STEVEN J. HENDERSON, P.E.
FERNANDO FREGOSO, P.E.
KATHLEEN H. NOEL, P.E.
WILLIAM W. TODD, P.E.

July 9, 2025 1198-001

Bunker Hill Lofts, LLC
703 16th Street, Ste. 200
San Diego, CA 92101

Attention: Evan Gerber, Principal

Subject: Water Service Analysis for the Bunker Hill Revere Phase 2 Project in the City of San Diego

Introduction

This report provides a public water study for the Bunker Hill Revere Phase 2 project in the City of San Diego. The project proposes 20 multi-family residential units on an approximate quarter acre site located in the Pacific Beach community of the City along Bunker Hill Street between Revere Avenue and Mission Bay Drive. The project site currently consists of a surface parking lot which will be redeveloped with the proposed project.

Topography of the buildable portion of the site is generally flat. The project will be connecting its private onsite water system(s) to the existing 6-inch public water line in Bunker Hill Street along the northern frontage of the project. Figure 1 provides a Vicinity Map for the project.

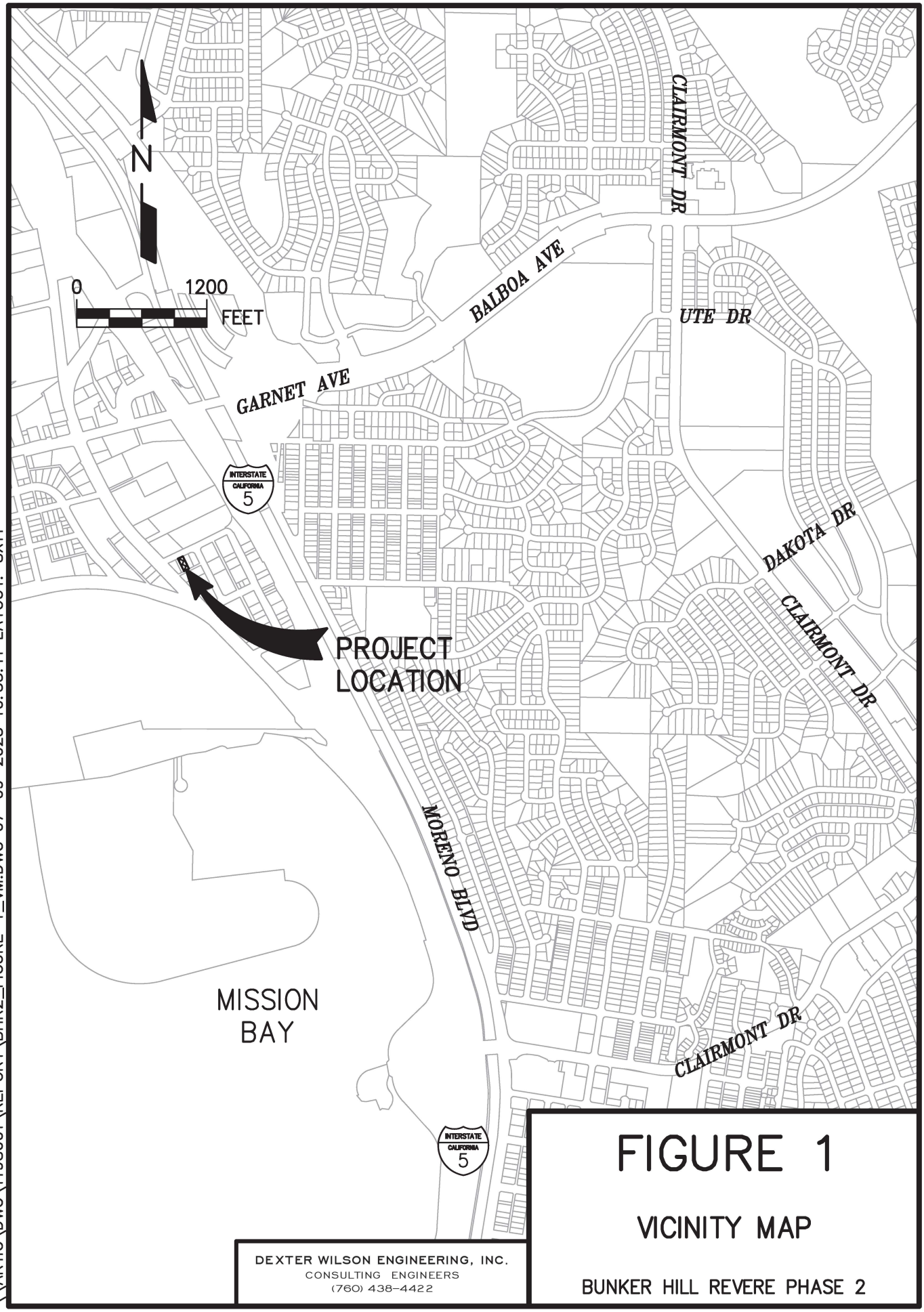

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FIGURE 1

VICINITY MAP

BUNKER HILL REVERE PHASE 2

Purpose of Study

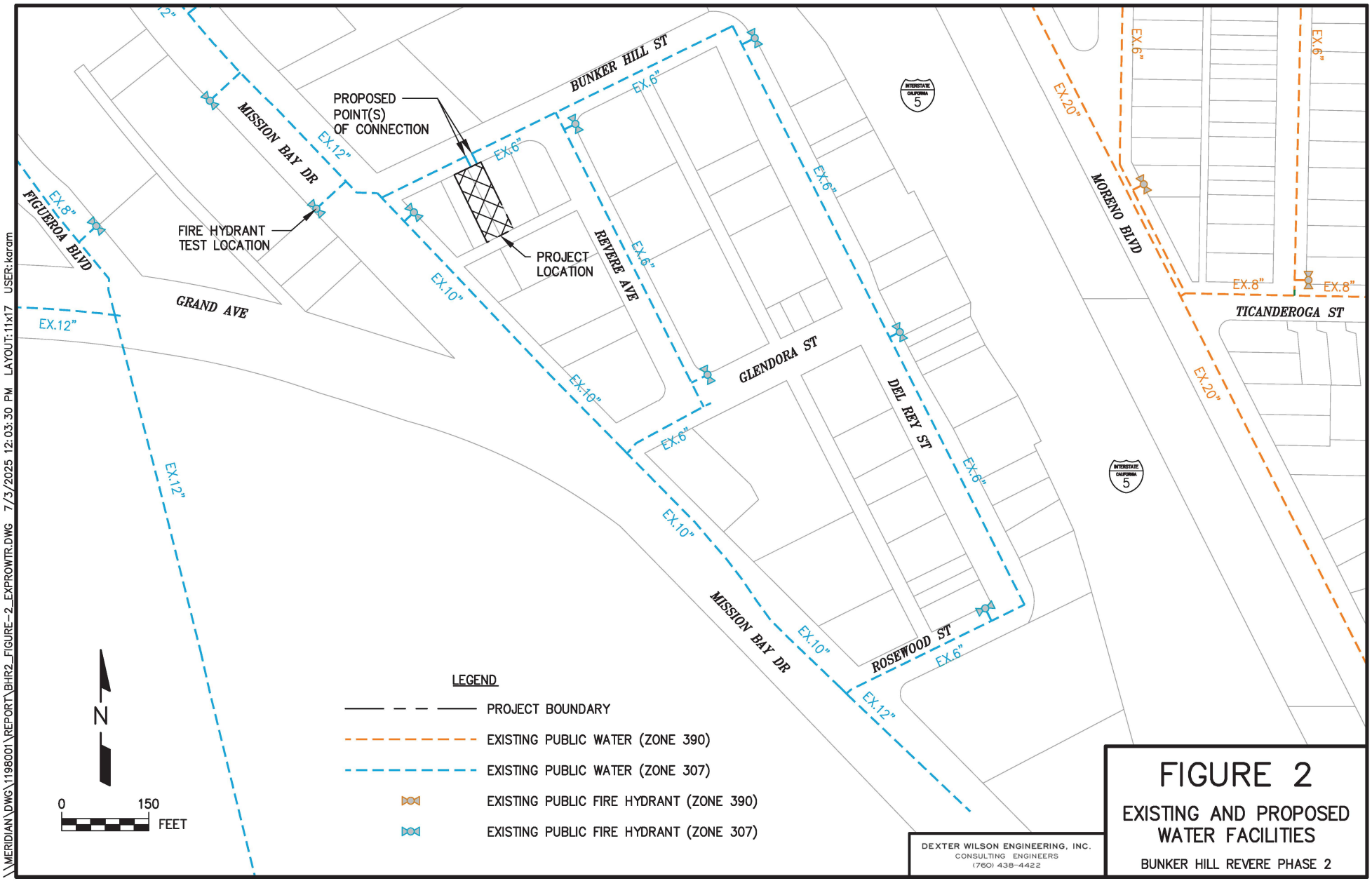
The purpose of this study is to confirm the adequacy of the existing public water system and provide recommended water system improvements for the Bunker Hill Revere Phase 2 project if needed. This report will verify that the public improvements comply with the Water Facility Design Guidelines and Standards of the City of San Diego.

The onsite water facilities for the project are proposed to be private. These facilities will be designed in accordance with the City's design standards and will be analyzed in a separate study/report.

Study Area

The study area for this report is the boundary of the Bunker Hill Revere Phase 2 project. The extent of the existing public water system which was incorporated into the analysis of the project site was based on the existing Pacific Beach 307 Zone distribution system that serves the area. The adjacent water mains were assessed by a hydrant flow test performed by the City in the area of the project. This was performed to ensure that the dynamics of the existing water system were analyzed sufficiently without modeling the entire pressure zone.

Figure 2 presents the existing and proposed water facilities in the project area as well as the location of the hydrant flow test. Detailed information regarding the hydrant flow test is included in Appendix A.



\\MERIDIAN\DWG\1198001\REPORT\BHR2_FIGURE-2_EXPROWTR.DWG 7/3/2025 12:03:30 PM LAYOUT:11x17 USER:karam

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FIGURE 2

EXISTING AND PROPOSED WATER FACILITIES

BUNKER HILL REVERE PHASE 2

Bunker Hill Revere Phase 2 Project Water Demands

The water demands were developed in accordance with the Water Facility Design Guidelines and Standards of the City of San Diego. Multi-family residential water demand is estimated based on density and a unit water demand of 150 gpd/person. The project proposes 20 residential units over a quarter acre which equals a density of 80 units per acre. Table 2-1 in the Water Facility Design Guidelines and Standards indicates that 80 units per acre falls in the range of approximately 2.2 persons per dwelling unit. A dwelling unit density of 2.2 persons per dwelling unit and a unit water demand of 150 gpd/person results in a water demand of 330 gpd per multi-family dwelling unit for this project.

Table 1 presents the projected potable water demand for the project.

TABLE 1
BUNKER HILL REVERE PHASE 2 PROJECT
POTABLE WATER DEMAND

Land Use	Quantity	Demand Factor	Average Water Use
Multi-Family Residential	20 units	330 gpd/unit	6,600 gpd

From the Water Facility Design Guidelines and Standards of the City of San Diego, Figure 2-2, the maximum day demand to average annual demand ratio is approximately 1.3 based on the RM multi-family residential peaking curve, resulting in an estimated maximum day demand in the pressure zone of 8,580 gpd (6 gpm).

From the Water Facility Design Guidelines and Standards of the City of San Diego, Figure 2-1, the peak hour demand to average annual demand ratio is approximately 2.3 x 1.5 based on the RM multi-family residential peaking curve, resulting in an estimated peak hour demand of 22,770 gpd (16 gpm).

Appendix B of this report presents the reference and backup data for determining these peaking factors.

City of San Diego Design Criteria

The Water Facility Design Guidelines and Standards of the City of San Diego was used to analyze the existing water system. A summary of the design criteria from the Water Facility Design Guidelines and Standards is presented as Table 2.

TABLE 2
CITY OF SAN DIEGO
WATER FACILITY DESIGN CRITERIA

Criteria	Design Requirement
Minimum Static Pressure	65 psi
Maximum Static Pressure	120 psi
Maximum Pressure Drop – Peak Hour	25 psi
Minimum Pressure – Peak Hour	40 psi
Minimum Pressure – Max Day plus Fire	20 psi
Maximum Pipeline Velocity (Fire Flow)[1]	15 fps

[1] Section 3.3.1.5

Static Pressures

Maximum static pressures within the project are calculated based on the Pacific Beach 307 Water Service Pressure Zone. The pad elevation for the proposed building will be approximately 20 feet. Using the maximum potential hydraulic grade line of 307 feet, maximum static pressure within the project site will be approximately 124 psi.

Existing and Proposed Water System

There are existing public water facilities directly adjacent to the project site that are part of the Pacific Beach 307 Zone. There is an existing 307 Zone 6-inch diameter public water line in Bunker Hill Street adjacent to the project. The project will be connecting its private onsite water system(s) to this existing adjacent public water line. Figure 2 shows the existing and proposed water facilities in the vicinity of the project.

The sizing and final design of the private water facilities will be under a separate report/study once final architectural plans, water fixture units, and final onsite water layouts are determined for the project. A preliminary analysis and discussion of the private water facilities for the project is included below.

Preliminary Private Domestic Meter Sizing

Architectural Plans or official Water Meter Data Cards are not available at this stage of development. It can be assumed that for a Multi-Family Residential product with a maximum of two/three bedrooms, there can be approximately 25 Water Fixture Units (WFUs) per unit.

The project has 20 units proposed with an assumed total WFU count of 500. Using Chart A 103.1 (1), the corresponding flow rate is extrapolated to be 125 gpm per City standards. Meter sizing in the City of San Diego uses 80% of the maximum capacity of the 2015 AWWA Standards for Water Meter Capacities. This suggests that the required meter will be a 2-inch meter. This recommendation will be confirmed when the Plumbing Plans are completed.

Fire Flow Requirement

The worst-case fire flow requirement for the project site was estimated based on the 2022 California Fire Code. The fire code takes into account building area and construction type. The worst-case fire flow requirement per the 2022 California Fire Code is 3,250 gpm for the least restrictive type of construction (Type V-B) building at 13,456 square feet. After the reduction of 50% of the required fire flow due to having an NFPA approved fire sprinkler system, the expected worst-case fire flow requirement for the project site would be 1,625 gpm.

An excerpt from the 2022 California Fire Code pertaining to fire flow requirements and project information on building area and construction type is shown in Appendix C.

Water System Computer Model and Analysis

Appendix A presents the hydrant flow test data performed by the City. The available pressure under an expected fire flow requirement of 1,625 gpm was extrapolated from the hydrant flow tests through the utilization of an additional spreadsheet calculation. That spreadsheet calculation is included in Appendix A as well. Results from the hydrant flow test show a residual pressure of approximately 99 psi at the 1,625 gpm expected fire flow requirement for the project at the hydrant flow test location (Bunker Hill Street and Mission Bay Drive intersection).

Hydraulic analysis using the KYPIPE computer software program developed by the University of Kentucky determined pressure and velocity results throughout the existing public water system. This computer software utilizes the Hazen-Williams equation for determining headloss in pipes. The Hazen-Williams "C" value used for all pipe sizes in our analysis is 120.

Appendix D presents the computer modeling results and Exhibit A at the back of this report presents the corresponding Node and Pipe Diagram. The cases modeled were average day demand, peak hour demand, and maximum day demand plus fire flow of 1,625 gpm.

The peak hour demand is being met with a minimum residual pressure of 113 psi at the project site. Residual pressures remain above 105 psi throughout the existing public water system that was modeled.

The expected fire flow requirement of 1,625 gpm plus maximum day demand is being met with a minimum residual pressure of 87 psi at the project's point of connection and a maximum pipeline velocity of 9.4 feet per second (fps) in the existing public water system. Residual pressures remain above 81 psi throughout the existing public water system that was modeled.

The results of the computer hydraulic analyses for the Bunker Hill Revere Phase 2 project indicate that the existing public water system can provide sufficient flow and pressure for its domestic and fire protection service needs.

Conclusions and Recommendations

The following conclusions and recommendations are summarized based on the water system and analysis prepared for the proposed Bunker Hill Revere Phase 2 project.

1. The project will be supplied from the Pacific Beach 307 Zone system.

2. Maximum static pressure within the project site will be approximately 124 psi.

3. Figure 2 presents the existing water system surrounding the project.

4. A maximum day demand plus expected 1,625 gpm fire flow scenario can be met at the project site with existing piping with all residual pressures greater than the 20 psi minimum requirement. The hydrant flow tests performed by the City in the project vicinity, and headloss in the distribution piping around the project, show residual pressures of approximately 80 psi under an expected 1,625 gpm fire flow at the project site.

5. The project will be connecting its private onsite water system(s) to the existing public water line in Bunker Hill Street along the north frontage of the project.

6. No offsite water system improvements are needed for the Bunker Hill Revere Phase 2 project in order to meet the fire flow and residual domestic pressure requirements at the site.

7. Peak hour demand is met at a residual pressure of 113 psi at the project site.

8. The recommended material specification for all new potable water lines is AWWA C900 PVC DR18 Class 235 or copper pipe Type K for drinking water use.

9. Based on the estimated plumbing fixture schedule from the initial development package, the proposed water meter will be a 2-inch meter.

10. The final sizing of private water lines and water meters to serve the building will be determined by the Building Department based on the Water Meter Data Card information provided for each building service.

11. If any water lines to be constructed by this development are metallic, a California Licensed Corrosion Engineer will be required to perform a soil corrosivity study and to design a Corrosion Control System. Control

If you have any questions regarding the information or conclusions and recommendations presented in this report, please do not hesitate to contact the undersigned.

Dexter Wilson Engineering, Inc.

Steven Henderson, P.E.

SH:cf

Attachments

APPENDIX A

CITY OF SAN DIEGO
HYDRANT FLOW TEST INFORMATION

City of San Diego
Development Services
Attention: **Hydrant Flow Request**
1222 First Ave., MS-401
San Diego, CA 92101
(619) 446-5000

Hydrant Flow Request

FORM
DS-160
October 2016

Fill out the information below completely for all sprinkler system flow requests, including NFPA 13, 13D and 13R systems. E-mail form to: DSDHydrantFlow@sandiego.gov, or mail request to the above address.

Please print or type legibly.

Company Requesting Hydrant Flow:
Dexter Wilson Engineering, Inc.

Telephone No:	Fax No:	E-mail Address:
760-438-4422	760-438-0173	steven@dwilsoneng.com

Project Number for the Building Permits:
N/A

Location of Hydrants:
Corner of Mission Bay Drive and Bunker Hill Street

Cross Street:	City:	State:	ZIP Code:
Mission Bay Dr. / Bunker Hill St.	San Diego	CA	92109

FOR CITY USE ONLY

Facility Sequence Number: (FSN): 520795

Static: 102.99 PSI

Elevation: 17 FEET

Pitot: - - - PSI

Residual: 89.92 PSI

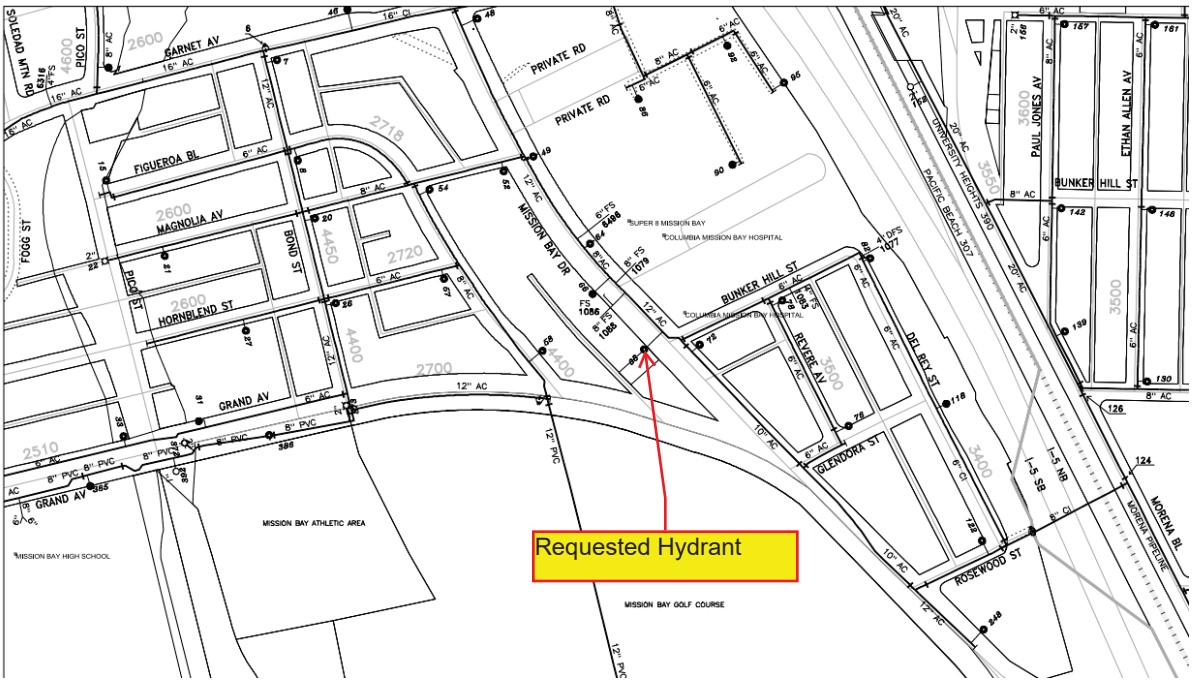
Date: 6/5/2025

Flow: 1,551.16 GPM

Researched in database by: Eduardo Wells

The information provided above is based upon a water model. It is the contractor's responsibility to confirm the available static pressure at the system point of connection. If a discrepancy is noticed at that time, notify DSDHydrantFlow@sandiego.gov as soon as possible.

Please draw an accurate map for fire hydrant data



Fire Hydrant Flow Test Date 6/5/2025

Input Fire Flow Test Results			**Modified Fire Flow Test Results**[1]		
Static Pressure	103	PSI	Static Pressure	114.4	PSI
Residual Pressure	89	PSI	Residual Pressure	100.4	PSI
Hydrant Flow	1551	GPM	Hydrant Flow	1551	GPM

Acutal Hydrant Elevation	17	Feet	HGL	281.1 Feet
Fire Flow Test Results Elevation	17	Feet	HGL	281.1 Feet

Equation $\Delta H = k Q^{1.85}$

k = 4.04326E-05

Extrapolated Calculations

Q, gpm	Residual Pressure	Available HGL
500	112.7 psi	277.2 ft
1000	108.2 psi	266.8 ft
1500	101.3 psi	250.8 ft
1625	99.2 psi	245.9 ft
2000	92.0 psi	229.4 ft
2500	80.6 psi	203.0 ft
3000	67.0 psi	171.6 ft
3500	51.3 psi	135.5 ft
4000	33.7 psi	94.7 ft
4500	14.0 psi	49.3 ft

Residual Pressure, psi	Available Flow, gpm
0 psi	4,829
10 psi	4,596
20 psi	4,353
30 psi	4,097
40 psi	3,827
50 psi	3,540
60 psi	3,232
70 psi	2,896
80 psi	2,523
90 psi	2,096
100 psi	1,577
110 psi	834
120 psi	Residual Pressure Exceeds Static Pressure

1. Static pressure increased by 10% to remove safety factor associated with fire sprinkler design. See City of San Diego Department Instruction 180.

APPENDIX B

CITY OF SAN DIEGO DESIGN CRITERIA

Chapter 2

WATER DEMANDS AND SERVICE CRITERIA

2.1 General

This chapter outlines planning procedures to estimate water demands and fire flows. Water system service requirements are also defined in terms of water pressure and reservoir storage.

2.2 Service Area

The DESIGN CONSULTANT defines the project's service area and identifies the pressure zones in which it is located. The Senior Civil Engineer in charge of either Water Planning or new development approves the service area boundaries.

2.3 Land Use and Residential Population

The DESIGN CONSULTANT develops present and future land use maps for the service area to define the following land use categories: residential (by zone in accordance with **Table 2-1**), central business district, commercial and institutional, parks, hospitals, hotels, industrial, office, and schools.

The DESIGN CONSULTANT estimates the residential population in the service area based on present and future allowable land use. Unless more accurate population density estimates are available, the residential population in the service area is estimated based on the figures presented in **Table 2-1**.

Table 2-1
Residential Population Density

Zone	Dwelling Unit Density (dwelling unit/ net acre)	Unit Density (persons/ dwelling unit)	Population Density (persons/ net acre)
AR-1-1	0.1	3.5	0.4
AR-1-1	0.2	3.5	0.7
AR-1-2	1	3.5	3.5
RS-1-1/RS-1-8	1	3.5	3.5
RS-1-2/RS-1-9	2	3.5	7.0
RS-1-4/RS-1-11	4	3.5	14

Zone	Dwelling Unit Density (dwelling unit/ net acre)	Unit Density (persons/ dwelling unit)	Population Density (persons/ net acre)
RS-1-7/RS-1-14	9	3.5	32
RM-1-1	14	3.2	45
RM-2-5	29	3.0	87
RM-3-7	43	2.6	112
RM-3-9	73	2.2	161
RM-4-10	109	1.8	196
RM-4-11	218	1.5	327

Dwelling unit density in **Table 2-1** is based on net area. The net area is measured in acres, and is 80% of the gross area for each residential zone.

2.4 Average Annual Water Demands

For most projects, average annual water demands are determined based on the unit water demand criteria presented in **Table 2-2**.

Table 2-2
Unit Water Demands

Land Use Category	Unit Water Demand
Residential	150 gallons/person-day
Central Business District	6000 gallons/net acre-day
Commercial and Institutional	5000 gallons/net acre-day
Fully Landscaped Park	4000 gallons/net acre-day
Hospitals	22500 gallons/net acre-day
Hotels	6555 gallons/net acre-day
Industrial	6250 gallons/net acre-day
Office	5730 gallons/net acre-day
Schools	4680 gallons/net acre-day

Average annual water demands are calculated as the sum of: (1) the residential water demand, and (2) other water demands for each land use category as follows:

Residential Water Demand (gallons/day) = Residential Population x 150 gallons/person-day

Other Water Demand (gallons/day) = Land Use Area by Category (net acres) x Unit Water Demand for Each Land Use Category (gallons/net acre-day)

Average Annual Water Demand (gallons/day) = Residential Water Demand + Other Water Demands

On some projects, particularly large residential developments, using the unit water demands in **Table 2-2** may generate unrealistically high estimates of water requirements. For these large projects, the DESIGN CONSULTANT or developer may request that the Senior Civil Engineer consider an alternative approach, making use of the City's water demand distribution data developed for macroscale planning purposes. Similarly, the Senior Civil Engineer may also consider alternative unit water demand estimates for specific land use types where such estimates are based on detailed demand evaluations. Recent projects of similar size, nearby location and similar character may be used for comparative demand analysis.

2.5 Peak Water Demands

Unless the project involves a large development that calls for an alternative approach, peak hour and maximum day water demands are estimated using the peaking factors presented in **Figures 2-1 and 2-2**. Peaking day factors correspond to the zones identified in the Public Utilities Department Water System HGL Zones.

Peak water demands are estimated as follows:

Peak Hour Demand = Average Annual Water Demand * Peak Day Factor * 1.5

Maximum Day Demand = Average Annual Water Demand * Peak Day Factor

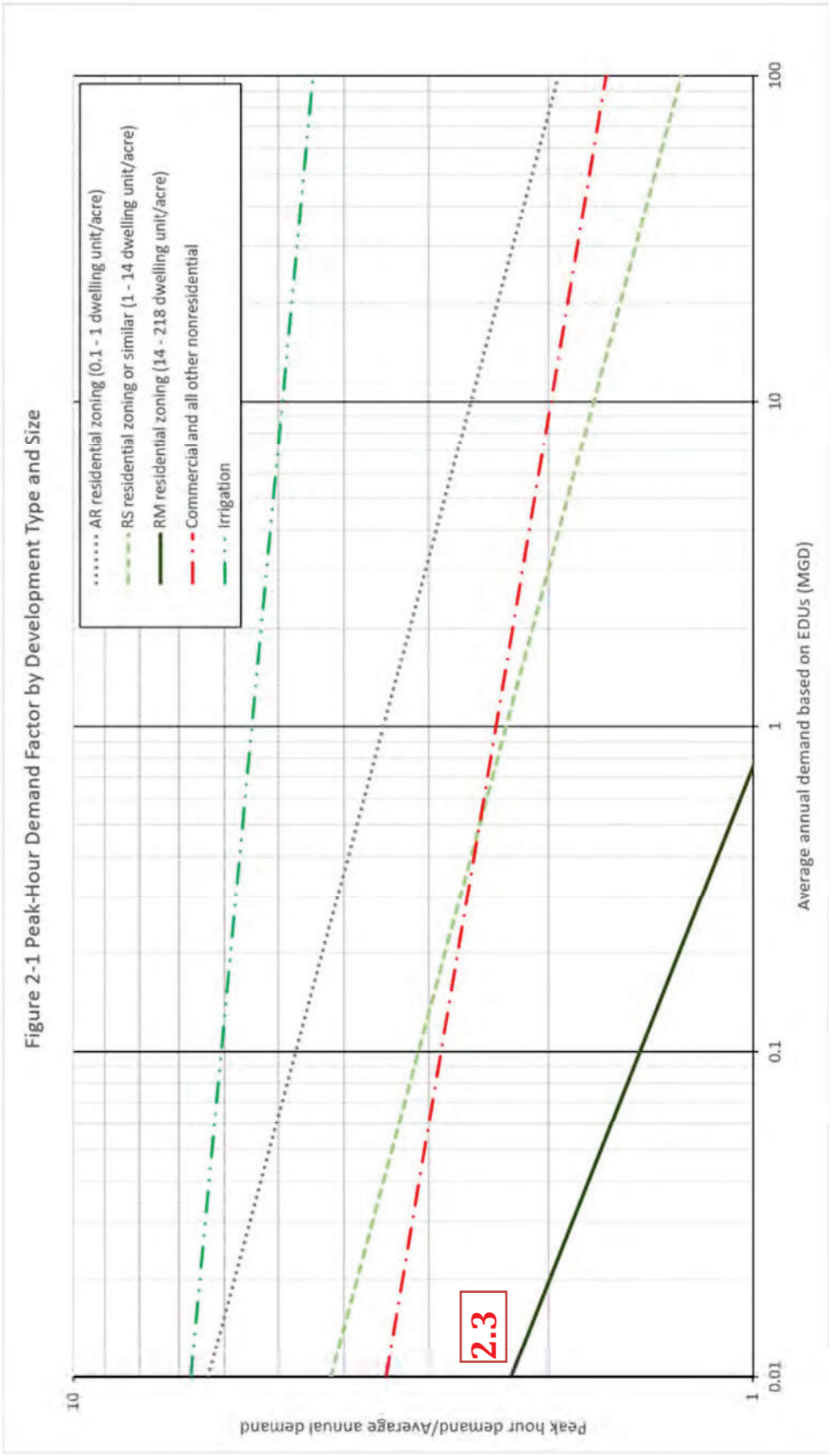


Figure 2-1 Peak-Hour Demand Factor by Development Type and Size

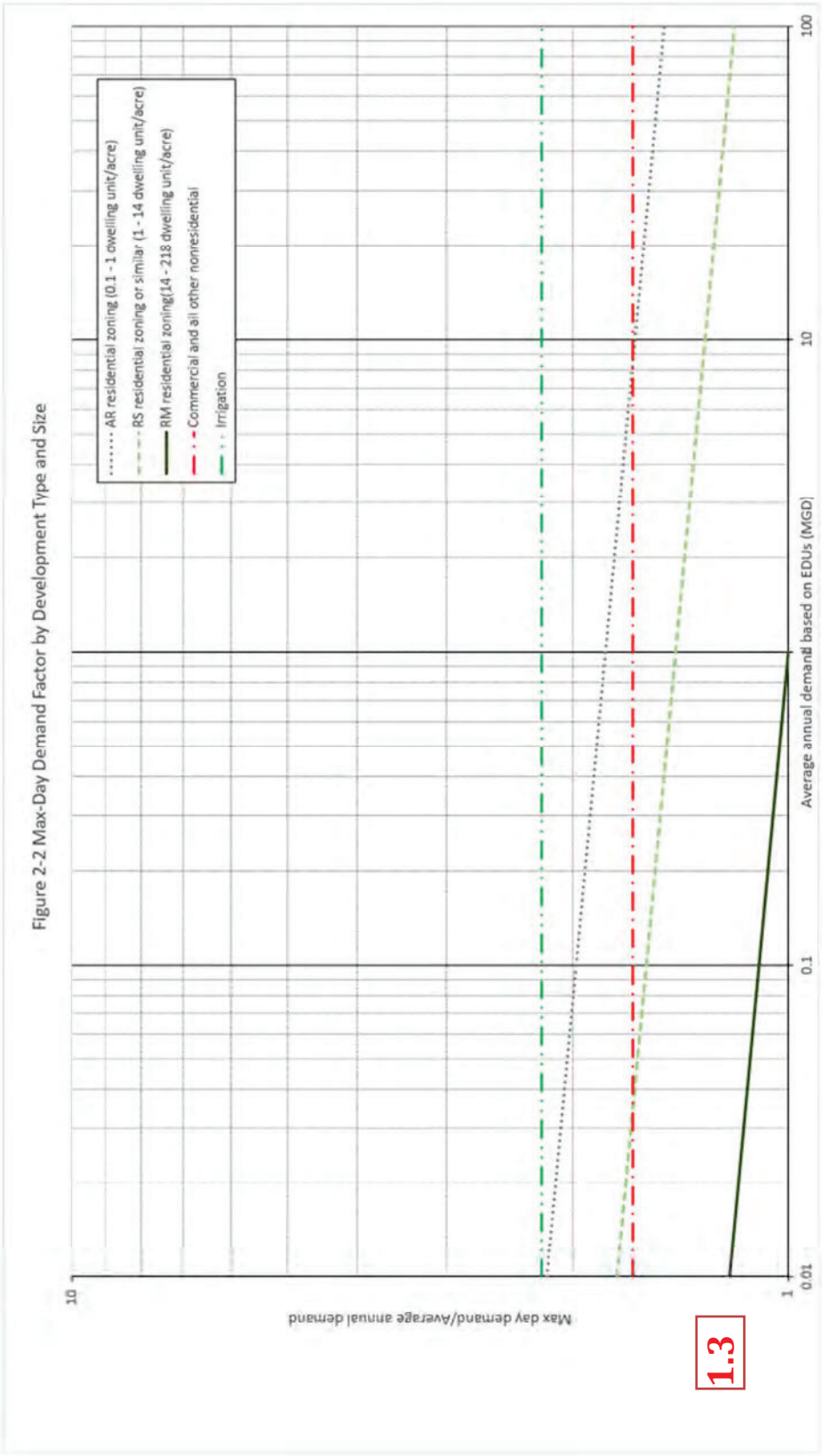


Figure 2-2 Max-Day Demand Factor by Development Type and Size

2.6 Fire Demands

The DESIGN CONSULTANT shall use the minimum required fire demands for design shown in **Table 2-3**. The fire flow duration for planning purposes is at least five hours. Note that the values in **Table 2-3** are the minimum design criteria for public infrastructure. Privately owned facilities shall follow the guidelines described in Appendix B of the California Fire Code (CFC).

Table 2-3
Fire Demands for Design Purposes

Development Type	Fire Demand (gpm)
Single family residential up to Fourplexes	1,500
Condominiums and apartments	3,000
Commercial	4,000
Industrial	6,000

Should application of the CFC Appendix B result in figures lower than those shown in **Table 2-3**, the firm or Civil Engineer, in consultation with the fire department, CIP City Project Manager may approve the CFC figures on a case-by-case basis following submittal of supporting calculations. In no case shall the approved fire flow rate and flow duration be less than the flow rate and duration values required by Appendix B of the CFC based on the anticipated or proposed type of building construction and total building floor area.

The required fire demand must be supplied from public and private on-site fire hydrants located as required by CFC Appendix C.

2.7 Pressure Criteria

2.7.1 Design Pressures

Water systems must be designed to provide the minimum residual pressures under:

- Maximum day demands plus fire demand conditions, or
- Peak hour demand conditions.

In analyzing the supply to a pressure zone, the minimum hydraulic grade line elevation available from the water source is used, a level that typically occurs during dry weather conditions. A water supply source is defined as a treatment plant clearwell, flow control facility, pump station, pressure regulating station or reservoir. Supply sources occur at discrete points in a system of

water mains and control both flow and pressure at the supply point. Water mains are not supply sources but rather conveyance facilities. The maximum static pressure in gravity systems is determined from reservoir overflow elevations and/or the discharge control setting on pressure reducing valves, whichever is greater. The maximum static pressure in pumped systems is determined from reservoir overflow elevations or pump shutoff levels, whichever is greater. There are two important pressure criteria used in water system design: Domestic Pressure and Fire Pressure. For systems supplying only domestic demand, only the Domestic Pressure criteria will apply. Similarly, for systems providing only fire demand, only the Fire Pressure criteria will apply. Systems supplying both types of demand, both criteria will apply and must be independently checked.

2.7.2 Domestic Pressure Criteria

The domestic pressure criteria for water system design are shown in **Figure 2-3**. Every water main in each pressure zone must be capable of supplying a minimum static pressure of 65 psi. Domestic pressures must fall no more than 25 psi below the static pressure, and residual water main pressure must be at least 40 psi. Domestic pressures are determined in the distribution system pipelines, excluding losses through service connections and building plumbing, and are measured relative to adjacent building pad elevations.

When analyzing a system with one source of supply out of service, domestic pressures may fall more than 25 psi below static pressure, but the domestic pressure shall not fall below 40 psi.

2.7.3 Pressure Requirements During Fires

For the simulation of fire conditions, a minimum operating pressure of 20 psi is required at the fire hydrant locations.. The residual pressure is determined given the fire demand among one or more hydrants and with the simultaneous water consumption occurring at the maximum day demand. The hydrants considered in this simulation must be sufficiently near to the fire location to be classified as "available" to that location as defined by the California Fire Code.

For water systems with available storage, the residual pressures in the distribution system during a fire are maintained given the following conditions:

- The water level in the storage facility at the time of the fire is at or near the minimum operating level
- The prescribed fire duration set by the California Fire Code, occurring under maximum day conditions.

2.8 System Reliability

Water systems must be designed to meet the operating pressure criteria with one critical source

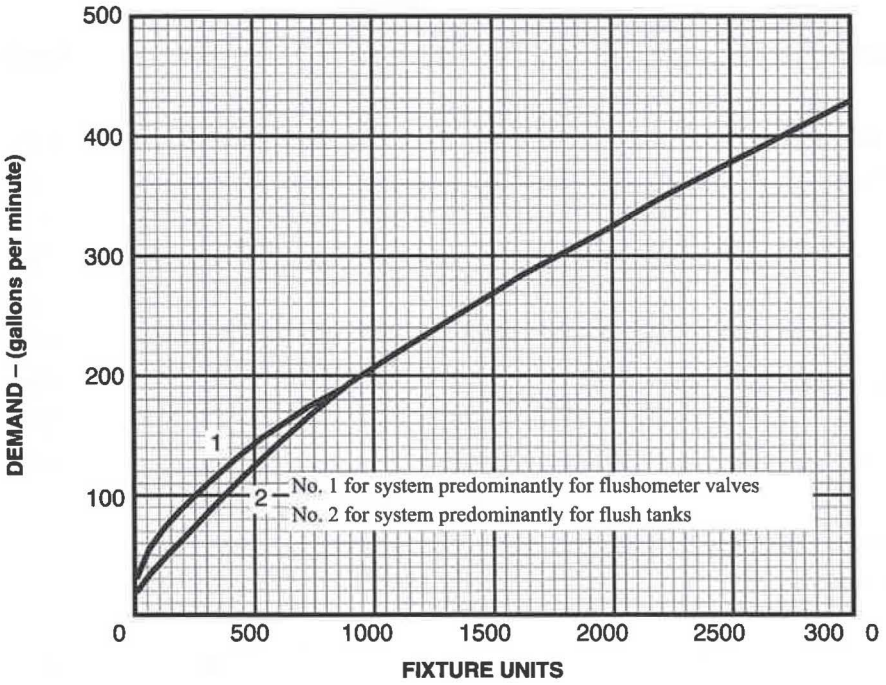
out of service. Water mains must be designed so that no more than one, average-sized city block (approximately 30 homes) is out of service at any time, and no more than two fire hydrants (excluding fire services) are on a dead end or are out of service at any time. These provisions do not apply under earthquake conditions.

Water mains serving more than two hydrants or more than 30 homes must be looped, fed from two sources, or provided with a reservoir of sufficient capacity to supply the emergency needs (contingency and fire storage) as described below in **subsection 2.9**.

All water mains relied upon for looping and source redundancy shall be in separate streets. Dual mains in the same street or alignment require the DESIGN ENGINEER to prepare a request for deviation using the format of ATTACHMENT 1, which is included as a part of this document. Where dual mains are relied upon for looping or source redundancy, the mains shall be spaced at least 10 feet apart from outer edge to outer edge.

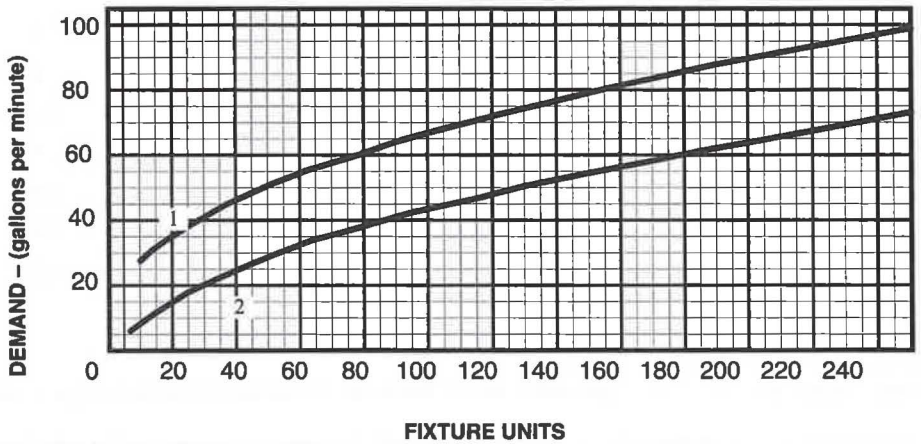
For City CIP work in already-built-out areas, where looping of mains or connection to two sources of supply is not feasible, water mains may be constructed require the DESIGN ENGINEER to prepare a request for deviation using the format of ATTACHMENT 1, which is included as a part of this document. Additional design considerations shall be made to minimize the chance of pipe breakage, such as use of a higher class of pipe.

CHART A 103.1(1)
ESTIMATE CURVES FOR DEMAND LOAD



For SI units: 1 gallon per minute = 0.06 L/s

CHART A 103.1(2)
ENLARGED SCALE DEMAND LOAD



For SI units: 1 gallon per minute = 0.06 L/s

2015 AWWA Standards for Water Meter Capacities

Meter Size	City of San Diego 1973 AWWA Table		2015 AWWA Standards	
	Max Capacity per AWWA (gpm)	City Uses 80% of Max Capacity (gpm)	Max Capacity per AWWA (gpm)	City Uses 80% of Max Capacity (gpm)
Displacement Type Meters - AWWA C700-15				
5/8 x 3/4	20	16	20	16
3/4	30	24	30	24
1	50	40	50	40
1-1/2	100	80	100	80
2	160	128	160	128
Compound Type Meters - AWWA C702-15				
3	320	250	350	280
4	500	400	600	480
6	1,000	800	1,350	1,080
8	1,600	1,280	1,600	1,280
Turbine Type Meters - AWWA C701-15 Class II				
3	350	280	435	348
4	600	480	750	600
6	1,250	1,000	1,600	1,280
8			2,800	2,240
10			4,200	3,360
12			5,300	4,240
16			7,800	6,240
20			12,000	9,600

August 23, 2016

Notes:

1. Most large water meters are Compound Type Meters.
2. Installation of a Turbine meter requires approval from the Water Systems Technician Supervisor.

APPENDIX C

2022 CALIFORNIA FIRE CODE EXCERPT

SEWER & WATER- BUNKER HILL STREET & REVERE AVENUE

Fire Demands for design Purposes = Condominiums and apartments = TYPE V-B= 1,625 GPM

PER CALIFORNIA FIRE CODE 2022 APPENDIX B FIRE FLOW REQUIREMENTS FOR BUILDING

TOTAL FLOOR AREA (ALL FLOORS OF THE BUILDING) = 13,456 SQFT.

TYPE V-B

TOTAL DURATION 3 HOURS

PER TABLE B105.1(2)

FIRE FLOW = 3,250 GPM

PER TABLE B105.1(1)

USE ½ VALUE IN TABLE B105.1(2)

THEREFORE:

REDUCE FIRE FLOW = 3,250 GPM X 0.5 = 1,625 GPM

SEE ATTACHED TABLE B105.1 (1) & (2)

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: *Appendix B provides a tool for the use of jurisdictions in establishing a policy for determining fire-flow requirements in accordance with Section 507.3. The determination of required fire flow is not an exact science, but having some level of information provides a consistent way of choosing the appropriate fire flow for buildings throughout a jurisdiction. The primary tool used in this appendix is a table that presents fire flow based on construction type and building area based on the correlation of the Insurance Services Office (ISO) method and the construction types used in the* International Building Code®.

SECTION B101
GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102
DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire code official is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall be not more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the fire code official is authorized to utilize NFPA 1142.

SECTION B104
FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the exterior walls, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings that are separated by fire walls without openings, constructed in accordance with the *California Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration requirements for one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration for buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(2) and B105.2.

Exception: ***[SFM]*** *Group B, S-2 and U occupancies having a floor area not exceeding 1,000 square feet, primarily constructed of noncombustible exterior walls with wood or steel roof framing, having a Class A roof assembly, with uses limited to the following or similar uses:*

1. *California State Parks buildings of an accessory nature (restrooms).*
2. *Safety roadside rest areas, (SRRA), public restrooms.*
3. *Truck inspection facilities, (TIF), CHP office space and vehicle inspection bays.*
4. *Sand/salt storage buildings, storage of sand and salt.*

TABLE B105.1(1)
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0–3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0–3,600	Section 903.3.1.3 of the *California Fire Code* or Section *313.3* of the *California Residential Code*	500	$^1/_2$
3,601 and greater	Section 903.3.1.3 of the *California Fire Code* or Section *313.3* of the *California Residential Code*	$^1/_2$ value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0–22,700	0–12,700	0–8,200	0–5,900	0–3,600	1,500	2
22,701–30,200	12,701–17,000	8,201–10,900	5,901–7,900	3,601–4,800	1,750	
30,201–38,700	17,001–21,800	10,901–12,900	7,901–9,800	4,801–6,200	2,000	
38,701–48,300	21,801–24,200	12,901–17,400	9,801–12,600	6,201–7,700	2,250	
48,301–59,000	24,201–33,200	17,401–21,300	12,601–15,400	7,701–9,400	2,500	
59,001–70,900	33,201–39,700	21,301–25,500	15,401–18,400	9,401–11,300	2,750	
70,901–83,700	39,701–47,100	25,501–30,100	18,401–21,800	11,301–13,400	3,000	3
83,701–97,700	47,101–54,900	30,101–35,200	21,801–25,900	13,401–15,600	3,250	
97,701–112,700	54,901–63,400	35,201–40,600	25,901–29,300	15,601–18,000	3,500	
112,701–128,700	63,401–72,400	40,601–46,400	29,301–33,500	18,001–20,600	3,750	
128,701–145,900	72,401–82,100	46,401–52,500	33,501–37,900	20,601–23,300	4,000	4
145,901–164,200	82,101–92,400	52,501–59,100	37,901–42,700	23,301–26,300	4,250	
164,201–183,400	92,401–103,100	59,101–66,000	42,701–47,700	26,301–29,300	4,500	
183,401–203,700	103,101–114,600	66,001–73,300	47,701–53,000	29,301–32,600	4,750	
203,701–225,200	114,601–126,700	73,301–81,100	53,001–58,600	32,601–36,000	5,000	
225,201–247,700	126,701–139,400	81,101–89,200	58,601–65,400	36,001–39,600	5,250	
247,701–271,200	139,401–152,600	89,201–97,700	65,401–70,600	39,601–43,400	5,500	
271,201–295,900	152,601–166,500	97,701–106,500	70,601–77,000	43,401–47,400	5,750	
295,901–Greater	166,501–Greater	106,501–115,800	77,001–83,700	47,401–51,500	6,000	
—	—	115,801–125,500	83,701–90,600	51,501–55,700	6,250	
—	—	125,501–135,500	90,601–97,900	55,701–60,200	6,500	
—	—	135,501–145,800	97,901–106,800	60,201–64,800	6,750	
—	—	145,801–156,700	106,801–113,200	64,801–69,600	7,000	
—	—	156,701–167,900	113,201–121,300	69,601–74,600	7,250	
—	—	167,901–179,400	121,301–129,600	74,601–79,800	7,500	
—	—	179,401–191,400	129,601–138,300	79,801–85,100	7,750	
—	—	191,401–Greater	138,301–Greater	85,101–Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *California Building Code*.

b. Measured at 20 psi residual pressure.

TABLE B105.2
REQUIRED FIRE FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the *California Fire Code*	25% of the value in Table B105.1(2)[a]	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the *California Fire Code*	25% of the value in Table B105.1(2)[b]	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire flow shall be not less than 1,000 gallons per minute.

b. The reduced fire flow shall be not less than 1,500 gallons per minute.

B105.3 Water supply for buildings equipped with an automatic sprinkler system. For buildings equipped with an approved automatic sprinkler system, the water supply shall be capable of providing the greater of:

1. The automatic sprinkler system demand, including hose stream allowance.
2. The required fire flow.

SECTION B106
REFERENCED STANDARDS

B106.1 General. See Table B106.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE B106.1
REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
CBC—22	*California Building Code*	B104.2
CRC—22	*California Residential Code*	Table B105.1(1)
NFPA 1142—17	*Standard on Water Supplies for Suburban and Rural Fire Fighting*	B103.3

APPENDIX D

COMPUTER MODELING OUTPUT

NODE AND PIPE DIAGRAM REFERENCE:

Exhibit A

The following conditions were modeled:

0. Average Day Demand
1. Peak Hour Demand
2. Maximum Day Demand plus 1,625 gpm Fire Flow at Node 2

Project: Bunker Hill Revere Phase 2
Date:7/3/2025
Job Number: 1198-001

Scenario: Average Day Demand

Node No.	Node El. Ft.	HGL Zone Ft. (Static)*	Static P psi	Model Run P, psi	Delta P from Static
J-1	17	307	125.6	114.4	11.2
J-2	20	307	124.4	113.1	11.3
J-3	13	307	127.4	116.1	11.3
J-4	15	307	126.5	115.3	11.2
J-5	29	307	120.5	109.2	11.3
J-6	16	307	126.1	114.8	11.3
J-7	38	307	116.6	105.3	11.3
J-8	24	307	122.6	111.4	11.2
J-9	17	307	125.6	114.4	11.2

Project: Bunker Hill Revere Phase 2
Date:7/3/2025
Job Number: 1198-001

Scenario: Peak Hour Demand

Node No.	Node El. Ft.	HGL Zone Ft. (Static)*	Static P psi	Model Run P, psi	Delta P from Static
J-1	17	307	125.6	114.4	11.2
J-2	20	307	124.4	113.1	11.3
J-3	13	307	127.4	116.1	11.3
J-4	15	307	126.5	115.3	11.3
J-5	29	307	120.5	109.2	11.3
J-6	16	307	126.1	114.8	11.3
J-7	38	307	116.6	105.3	11.3
J-8	24	307	122.6	111.4	11.3
J-9	17	307	125.6	114.4	11.2

Project: Bunker Hill Revere Phase 2
Date:7/3/2025
Job Number: 1198-001

Scenario: Maximum Day Demand plus 1,625 gpm Fire Flow at Node 2

Node No.	Node El. Ft.	HGL Zone Ft. (Static)*	Static P psi	Model Run P, psi
J-1	17	307	125.6	98.5
J-2	20	307	124.4	88.0
J-3	13	307	127.4	98.7
J-4	15	307	126.5	98.0
J-5	29	307	120.5	88.0
J-6	16	307	126.1	98.5
J-7	38	307	116.6	81.7
J-8	24	307	122.6	92.5
J-9	17	307	125.6	95.3

Project: Bunker Hill Revere Phase 2
Date:7/3/2025
Job Number: 1198-001

Scenario: Average Day Demand

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run Velocity (fps)
1	12	5	0.01
2	10	-0.94	0
3	6	-0.94	0.01
4	6	1.53	0.02
5	6	2.53	0.03
6	10	-2.47	0.01
7	10	-2.47	0.01
8	6	-0.94	0.01
9	6	-0.94	0.01
10	6	1.53	0.02
11	6	-0.94	0.01

Project: Bunker Hill Revere Phase 2
Date:7/3/2025
Job Number: 1198-001

Scenario: Peak Hour Demand

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run Velocity (fps)
1	12	17.5	0.05
2	10	-3.29	0.01
3	6	-3.29	0.04
4	6	5.37	0.06
5	6	8.84	0.1
6	10	-8.66	0.04
7	10	-8.66	0.04
8	6	-3.29	0.04
9	6	-3.29	0.04
10	6	5.37	0.06
11	6	-3.29	0.04

Project: Bunker Hill Revere Phase 2
Date:7/3/2025
Job Number: 1198-001

Scenario: Maximum Day Demand plus 1,625 gpm Fire Flow at Node 2

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run Velocity (fps)
1	12	1635	4.64
2	10	-307.32	1.26
3	6	-307.32	3.49
4	6	501.38	5.69
5	6	826.3	9.38
6	10	-808.7	3.3
7	10	-808.7	3.3
8	6	-307.32	3.49
9	6	-307.32	3.49
10	6	501.38	5.69
11	6	-307.32	3.49

```
* * * * * * * * * * * * *  K Y P I P E  * * * * * * * * * * * * *
*                                                                 *
*  Pipe Network Modeling Software                                 *
*                                                                 *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)                     *
*  Version: 12.009b  03-25-2024                                   *
*  Company:  DEXWIL        Serial #:  580753                      *
*  Interface:  Classic                                            *
*   Licensed for Pipe2018                                         *
*                                                                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Date & Time: Wed Jul 02 17:33:18 2025

Master File : \\meridian\eng\1198001\bunker hill revere phase 2 ky pipe july 2025.KYP\bunker hill revere phase 2 ky pipe july 2025.P2K

SUMMARY OF ORIGINAL DATA

UNITS SPECIFIED

FLOWRATE ..... = gallons/minute
HEAD (HGL) ..... = feet
PRESSURE ..... = psig

PIPELINE DATA

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-1	Hyd Test	J-1	60.00	12.00	120.0000	0.00
P-2	J-3	J-4	620.00	10.00	120.0000	0.00
P-3	J-2	J-7	350.00	6.00	120.0000	0.00
P-4	J-4	J-9	180.00	6.00	120.0000	0.00
P-5	J-1	J-2	350.00	6.00	120.0000	0.00
P-6	J-4	J-6	430.00	10.00	120.0000	0.00
P-7	J-6	J-1	180.00	10.00	120.0000	0.00
P-8	J-7	J-5	570.00	6.00	120.0000	0.00
P-9	J-8	J-3	340.00	6.00	120.0000	0.00
P-10	J-9	J-2	580.00	6.00	120.0000	0.00
P-11	J-5	J-8	570.00	6.00	120.0000	0.00

PUMP/LOSS ELEMENT DATA

THERE IS A DEVICE AT NODE Hyd Test DESCRIBED BY THE FOLLOWING DATA: (ID= 1)

HEAD (ft)	FLOWRATE (gpm)	EFFICIENCY (%)
281.00	0.00	75.00 (Default)
277.00	500.00	75.00 (Default)
266.00	1000.00	75.00 (Default)
250.00	1500.00	75.00 (Default)
229.00	2000.00	75.00 (Default)
171.00	3000.00	75.00 (Default)

N O D E D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
Hyd Test		0.00	0.00	
J-1		0.00	17.00	
J-2		5.00	20.00	
J-3		0.00	13.00	
J-4		0.00	15.00	
J-5		0.00	29.00	
J-6		0.00	16.00	
J-7		0.00	38.00	
J-8		0.00	24.00	
J-9		0.00	17.00	

O U T P U T O P T I O N D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
MAXIMUM AND MINIMUM PRESSURES = 3
MAXIMUM AND MINIMUM VELOCITIES = 3

S Y S T E M C O N F I G U R A T I O N

NUMBER OF PIPES .....(P) = 11
NUMBER OF END NODES .....(J) = 9
NUMBER OF PRIMARY LOOPS .....(L) = 2
NUMBER OF SUPPLY NODES .....(F) = 1
NUMBER OF SUPPLY ZONES .....(Z) = 1

==========

Case: 0

RESULTS OBTAINED AFTER 13 TRIALS: ACCURACY = 0.67909E-06

AVERAGE DAY DEMAND

S I M U L A T I O N D E S C R I P T I O N (L A B E L)

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-1	Hyd Test	J-1	5.00	0.00	0.00	0.01	0.00	0.00
P-2	J-3	J-4	-0.94	0.00	0.00	0.00	0.00	0.00
P-3	J-2	J-7	-0.94	0.00	0.00	0.01	0.00	0.00
P-4	J-4	J-9	1.53	0.00	0.00	0.02	0.00	0.00
P-5	J-1	J-2	2.53	0.00	0.00	0.03	0.00	0.00
P-6	J-4	J-6	-2.47	0.00	0.00	0.01	0.00	0.00
P-7	J-6	J-1	-2.47	0.00	0.00	0.01	0.00	0.00
P-8	J-7	J-5	-0.94	0.00	0.00	0.01	0.00	0.00
P-9	J-8	J-3	-0.94	0.00	0.00	0.01	0.00	0.00
P-10	J-9	J-2	1.53	0.00	0.00	0.02	0.00	0.00
P-11	J-5	J-8	-0.94	0.00	0.00	0.01	0.00	0.00

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft	EFFIC- ENCY %	USEFUL POWER Hp	INCREMTL COST $	TOTAL COST $	#PUMPS PARALLEL	#PUMPS SERIES	NPSH Avail. ft	Case
Hyd Test	5.00	0.00	281.00	281.0	75.00	0.	0.0	0.0	**	**	33.2	0.0000

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
Hyd Test		0.00	281.00			
J-1		0.00	281.00	17.00	264.00	114.40
J-2		5.00	281.00	20.00	261.00	113.10
J-3		0.00	281.00	13.00	268.00	116.13
J-4		0.00	281.00	15.00	266.00	115.27
J-5		0.00	281.00	29.00	252.00	109.20
J-6		0.00	281.00	16.00	265.00	114.83
J-7		0.00	281.00	38.00	243.00	105.30
J-8		0.00	281.00	24.00	257.00	111.37
J-9		0.00	281.00	17.00	264.00	114.40

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
J-3	116.13	J-7	105.30
J-4	115.27	J-5	109.20
J-6	114.83	J-8	111.37

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
P-5	0.03	P-2	0.00
P-4	0.02	P-6	0.01
P-10	0.02	P-7	0.01

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
Hyd Test	5.00	

NET SYSTEM INFLOW = 5.00
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 5.00

==========

Case: 1

C H A N G E S F O R N E X T S I M U L A T I O N (Change Number = 1)

Peak Hour Demand

JUNCTION DEMANDS CHANGED - PLEASE SEE RESULTS TABLE

RESULTS OBTAINED AFTER 3 TRIALS: ACCURACY = 0.40225E-07

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-1	Hyd Test	J-1	17.50	0.00	0.00	0.05	0.00	0.00
P-2	J-3	J-4	-3.29	0.00	0.00	0.01	0.00	0.00
P-3	J-2	J-7	-3.29	0.00	0.00	0.04	0.00	0.00
P-4	J-4	J-9	5.37	0.00	0.00	0.06	0.01	0.01
P-5	J-1	J-2	8.84	0.00	0.00	0.10	0.01	0.01
P-6	J-4	J-6	-8.66	0.00	0.00	0.04	0.00	0.00
P-7	J-6	J-1	-8.66	0.00	0.00	0.04	0.00	0.00
P-8	J-7	J-5	-3.29	0.00	0.00	0.04	0.00	0.00
P-9	J-8	J-3	-3.29	0.00	0.00	0.04	0.00	0.00
P-10	J-9	J-2	5.37	0.00	0.00	0.06	0.01	0.01
P-11	J-5	J-8	-3.29	0.00	0.00	0.04	0.00	0.00

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft	EFFIC- ENCY %	USEFUL POWER Hp	INCREMTL COST $	TOTAL COST $	#PUMPS PARALLEL	#PUMPS SERIES	NPSH Avail. ft	Case
Hyd Test	17.50	0.00	280.99	281.0	75.00	1.	0.0	0.0	**	**	33.2	1.0000

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
Hyd Test		0.00	280.99			
J-1		0.00	280.99	17.00	263.99	114.40
J-2		17.50(3.50)	280.99	20.00	260.99	113.10
J-3		0.00	280.99	13.00	267.99	116.13
J-4		0.00	280.99	15.00	265.99	115.26
J-5		0.00	280.99	29.00	251.99	109.20
J-6		0.00	280.99	16.00	264.99	114.83
J-7		0.00	280.99	38.00	242.99	105.30
J-8		0.00	280.99	24.00	256.99	111.36
J-9		0.00	280.99	17.00	263.99	114.40

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
J-3	116.13	J-7	105.30
J-4	115.26	J-5	109.20
J-6	114.83	J-8	111.36

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
P-5	0.10	P-2	0.01
P-4	0.06	P-6	0.04
P-10	0.06	P-7	0.04

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
Hyd Test	17.50	

NET SYSTEM INFLOW = 17.50
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 17.50

==========

Case: 2

C H A N G E S F O R N E X T S I M U L A T I O N (Change Number = 2)

Maximum Day Demand plus 1,625 gpm Fire Flow at Node 2

JUNCTION DEMANDS CHANGED - PLEASE SEE RESULTS TABLE

RESULTS OBTAINED AFTER 3 TRIALS: ACCURACY = 0.12319E-06

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-1	Hyd Test	J-1	1635.00	0.44	0.00	4.64	7.31	7.31
P-2	J-3	J-4	-307.32	0.50	0.00	1.26	0.80	0.80
P-3	J-2	J-7	-307.32	3.39	0.00	3.49	9.67	9.67
P-4	J-4	J-9	501.38	4.31	0.00	5.69	23.95	23.95
P-5	J-1	J-2	826.30	21.14	0.00	9.38	60.40	60.40
P-6	J-4	J-6	-808.70	2.07	0.00	3.30	4.82	4.82
P-7	J-6	J-1	-808.70	0.87	0.00	3.30	4.82	4.82
P-8	J-7	J-5	-307.32	5.51	0.00	3.49	9.67	9.67
P-9	J-8	J-3	-307.32	3.29	0.00	3.49	9.67	9.67
P-10	J-9	J-2	501.38	13.89	0.00	5.69	23.95	23.95
P-11	J-5	J-8	-307.32	5.51	0.00	3.49	9.67	9.67

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft	EFFIC- ENCY %	USEFUL POWER Hp	INCREMTL COST $	TOTAL COST $	#PUMPS PARALLEL	#PUMPS SERIES	NPSH Avail. ft	Case
Hyd Test	1635.00	0.00	244.64	244.6	75.00	101.	0.1	0.1	**	**	33.2	2.0000

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
Hyd Test		0.00	244.64			
J-1		0.00	244.20	17.00	227.20	98.45
J-2		1635.00(**)	223.06	20.00	203.06	87.99
J-3		0.00	240.76	13.00	227.76	98.69
J-4		0.00	241.26	15.00	226.26	98.04
J-5		0.00	231.96	29.00	202.96	87.95
J-6		0.00	243.33	16.00	227.33	98.51
J-7		0.00	226.44	38.00	188.44	81.66
J-8		0.00	237.47	24.00	213.47	92.50
J-9		0.00	236.95	17.00	219.95	95.31

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
J-3	98.69	J-7	81.66
J-6	98.51	J-5	87.95
J-1	98.45	J-2	87.99

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
P-5	9.38	P-2	1.26
P-4	5.69	P-6	3.30
P-10	5.69	P-7	3.30

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
Hyd Test	1635.00	

NET SYSTEM INFLOW = 1635.00
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 1635.00

***** HYDRAULIC ANALYSIS COMPLETED *****

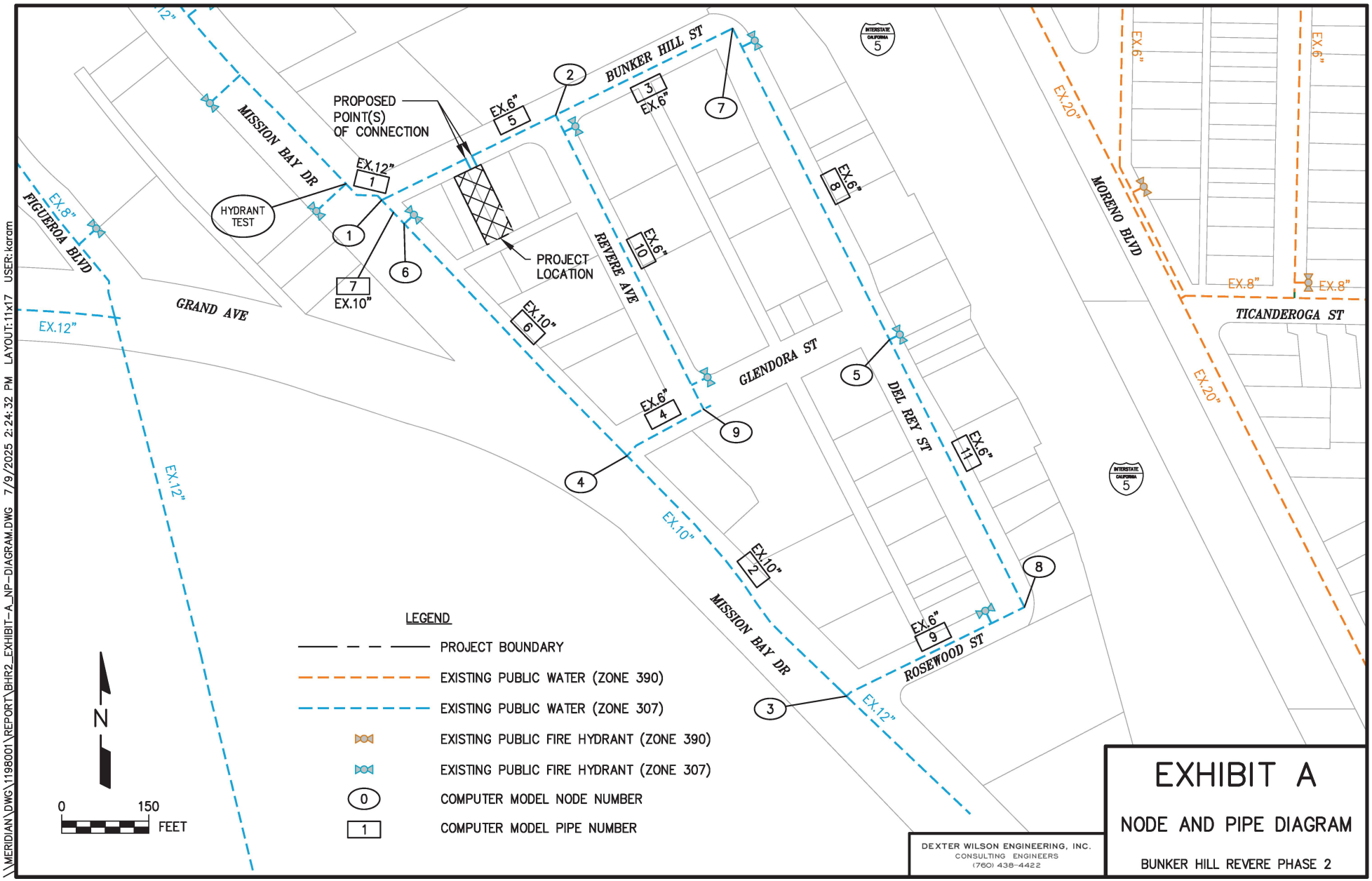


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EXHIBIT A

NODE AND PIPE DIAGRAM

BUNKER HILL REVERE PHASE 2

DEXTER WILSON ENGINEERING, INC.
CONSULTING ENGINEERS
(760) 438-4422