Potable water system improvements proposed for inclusion into Long Beach Utilities Department's (LBUD) service area shall be designed in accordance with all of the following:

1. California Division of Drinking Water (DDW)
2. California Code of Regulations (CCR), Title 17
3. California Waterworks Standards - CCR, Title 22, Division 4, Chapter 16
4. American Water Works Association (AWWA) Standards
5. California Fire Code (CFC)
6. California Plumbing Code (CPC)
7. Standard Specifications for Public Works Construction (The "Greenbook")
8. LBUD's Water and Sewer Standard Drawings
9. LBUD Water and Sewer Specifications
10. LBUD's Design Criteria for Potable Water Distribution System

2.1 System Analysis

A hydraulic analysis study is required when a proposed development intensifies the land use from the existing development on the site, proposed development requires a general plan amendment to a more intense use, or required by LBUD. The hydraulic analysis is to ensure the potable water system can accommodate the proposed development, and if not, help identify needed improvements required for the development. The Developer is required to cover the costs associated with the hydraulic analysis/water modeling.

Water modeling shall be performed by LBUD where available at the cost of the Developer. LBUD will model at least two scenarios:

1. Existing Condition – using the calibrated LBUD model
2. Existing Condition with Proposed Development – to identify additional deficiencies created by the proposed development

The cost of modeling is dependent on the scope of the proposed project and an estimate shall be provided to the Developer by LBUD. Developer will deposit the estimated amount for the proposed hydraulic analysis study. LBUD will input the Developer's project parameters into the current water model to identify the project's impact to the potable water system.

The Developer will be responsible for the needed improvements to the water system at their own cost. As applicable, the Developer may request a reimbursement agreement to recover a portion of the costs from other developments that tie into the system and benefit from the improvements. Reimbursement agreements run a term of twenty years and are not guaranteed to be paid in full. For more information, refer to Section 303 – REIMBURSEMENT AGREEMENT of LBUD's Rules and Regulations.

2.2 Demands, Pressures, Pipeline Criteria

2.2.1 System Demand Criteria

LBUD's staff reserves the right to determine criteria for each potable water system based upon conditions that may exist for that particular location, anticipated level of development, planned use or other criteria. In general, however, potable water pipelines and appurtenances shall be sized to handle the highest demand on the system.

Developers shall provide supporting water demand calculations for the proposed development. Calculations shall be performed/reviewed and signed/stamped by a licensed professional engineer.

Potable Water Demands

In the absence of specific development and water use information, the potable water demands shall be determined using the demand factors and peaking factors shown in Table 2-1 and 2.2.

Table 2-1
Future Potable Water Demand Factors

Customer Use Sector	Future Potable Water Demand Factor[1]	Unit
Single Family Residential	199	gallons per household per day
Multi-Family Residential	131	gallons per household per day
Commercial	60	gallons per employee per day
Industrial	53	gallons per employee per day
Irrigation	1,416	gallons per account per day
Hotels	150	gallons per room per day

[1]Demand factors based on 2019 LBWD Water Resources Plan and 2020 Water Master Plan

Table 2-2
Peaking Factors

Demand Description	Peaking Factor[1]
Minimum Day	0.64
Average Day	1.00
Maximum Day	1.34
Peak Hour[2]	2.40

[1]Peaking factors based on 2020 Water Master Plan

[2]Peak hour factor is a system wide factor. If it is known that a specific development will generate a higher peak hour factor, it should be utilized for estimating peak demands.

Fire Flow Demands

The City of Long Beach Municipal Code, Chapter 18.48 Fire Code adopts the California Fire Code (CFC). The requirements in the CFC are specific to each building on a given parcel of land and based on several factors, including land use, building construction methods and materials, and whether or not automatic sprinklers are present. Design criteria for fire flow demands shall be based on the latest CFC requirements

(Appendix B, Table B105.1(1) and Table B105.1(2)) or Table 2-3, whichever is greater. The residual system pressure at the hydrant outlet shall be a minimum of 20 psi.

Table 2-3
Fire Flow and Fire Hydrant Location Criteria

Land Use	Flow (gpm)	Duration (hrs)[1]	Residual Pressure at Hydrant Outlet (psi)[1]	Minimum Number of Hydrants Required[2]	Average Spacing between Hydrants (ft)[2]	Maximum Distance From Hydrant to any Point on Lot Frontage (ft)[2]
Single Family Residential (CN)	1,500	2	20	1	500	250
Multi-Family Residential - Low Density (MFR-L)	2,500	2	20	3	450	225
Multi-Family Residential - Moderate Density (MFR-M)	3,000	3	20	3	400	225
Community Commercial (CC)	3,000	3	20	3	400	225
Downtown (DT)	3,500	4	20	4	350	210
Neighborhood Serving Center - Low Density (NSC-L)	3,000	3	20	3	400	225
Neighborhood Serving Center - Moderate Density (NSC-M)	3,500	4	20	4	350	210
Industrial (I)	4,000	4	20	4	350	210

Table 2-3 (continued)
Fire Flow and Fire Hydrant Location Criteria

Land Use	Flow (gpm)	Duration (hrs)[1]	Residual Pressure at Hydrant Outlet (psi)[1]	Minimum Number of Hydrants Required[2]	Average Spacing between Hydrants (ft)[2]	Maximum Distance From Hydrant to any Point on Lot Frontage (ft)[2]
Neo Industrial (NI)	4,000	4	20	4	350	210
Open Space (OS)	1,500	2	20	1	500	250
Regional Serving Facility (RSF)	4,000	4	20	4	350	210
Transit-Oriented Development - Low Density (TOD-L)	3,000	3	20	3	400	225
Transit-Oriented Development - Moderate Density (TOD-M)	3,500	4	20	4	350	210
Waterfront (WF)	3,500	4	20	4	350	210

[1] *Data Source: California Fire Code Appendix B Table B 105.1(1) and B105.2*

[2] *Data Source: California Fire Code Appendix C, Table C102.1*

Water pipelines shall be designed so that service pressures range between 40 psi to 80 psi. The minimum pressure shall be 40 psi during peak hour demand. Static pressures should not exceed 80 psi, except where system operating conditions and geographical conditions warrant a higher maximum pressure. In areas where pressures exceed 80 psi, the Uniform Plumbing Code requires customers to install "an approved type pressure regulator preceded by an adequate strainer" on their service connections to protect domestic plumbing and water heaters. A residual pressure of 20 psi must be maintained at the fire hydrant outlet in developed areas during maximum day plus fire flow conditions (California Code of Regulations (CCR), Title 22, Division 4, Chapter 16, Section 64602).

2.2.2 Pipeline Materials

Potable water pipelines and fire lines shall use the materials shown in Table 2-4. Exceptions to pipeline materials will be reviewed/approved by LBUD on a case by case basis.

Table 2-4
Pipeline Materials

Size	Material	Comments
Less than 4"	Copper	Only Service Laterals can be less than 4"
4" to 24"	Ductile Iron (Class 52) with Double Cement Mortar Lining	Only Service Laterals can be 4". See LBWD Specifications Section 33 05 31 for Joint Materials and Section 33 11 11 for Ductile Iron Pipe.
	Flanged Pipe Shall be Minimum Class 53	
Greater than 24"	Ductile Iron (Class 52) with Double Cement Mortar Lining or Cement Mortar Lined and Coated Steel Cylinder	See LBWD Specifications Section 33 05 31 for Joint Materials and Section 33 11 11 for Ductile Iron Pipe.
	Flanged Pipe Shall be Minimum Class 53	

The hydraulic analysis shall use the resulting internal pipe diameter for ductile iron pipe.

2.2.3 Pipeline Sizing Criteria

The minimum potable water pipeline diameter is 6-inches (inner diameter). Adequate fire flows must be provided at the required outlet pressure of 20 psi. Maximum velocity criteria must not be exceeded under maximum day plus fire flow conditions.

In commercial and industrial areas, the minimum pipeline diameter is 12-inches (inner diameter).

2.2.4 Pipeline Velocity Criteria

Water pipelines shall be designed with the maximum allowable velocity as follows:

5 ft/s at Average Day Demand

8 ft/s at Maximum Day Demand or Peak Hour Demand

10 ft/s at Maximum Day Demand plus Fire Flow Demand

2.2.5 Pipeline Hazen-Williams "C"

Water pipelines shall be designed using the following Hazen-Williams Coefficients shown in Table 2-5.

Table 2-5
Pipe Roughness Coefficients

Pipe Diameter	Pipe Roughness Coefficient		
	Ductile Iron, Steel, & AC Pipe	PVC Pipe	SCC Pipe
<= 4-inch	80	80	-
4-inch	100	120	-
6 inch	120	130	100
8-12 inch	130	140	100
16-24 inch	140	145	100
>=24 inch	145	155	115
>=42 inch	-	-	120

**Coefficients adopted from LBWD 2020 Water Distribution System Master Plan*

2.3 Pipeline Location

2.3.1 Pipeline Alignment

Unless otherwise approved by LBUD staff, all potable water pipelines shall be located a minimum of 5 feet from curb face. Location shall not interfere with other existing utilities and shall follow all established separation criteria.

Potable water pipelines to all service areas shall be looped to provide dual direction supply and system flexibility. Dead end mains are undesireable, but can be considered on a case-by-case basis.

See LBUD Water and Sewer Specification Section 33 11 11 for allowable joint deflections and minimum radii.

2.3.2 Pipeline Cover

The cover over the potable water pipelines shall be sufficient to provide protection of the potable water pipeline and for operation of the appurtenances. The depth shall be a minimum of 42-inches and a maximum of 72-inches from the top of the pipeline to the finished surface. LBUD staff may increase or decrease this required depth as necessary to cover non-standard conditions.

When minimum cover cannot be provided, concrete encasement or protective slab construction over the pipline may be substituted pending special approval by LBUD.

2.3.3 Pipeline Separation Criteria

Potable water pipelines shall be designed with the required separation from non-potable pipelines in accordance with California Waterworks Standards (California Code of Regulations (CCR), Title 22, Division 4, Chapter 16, Section 64572).

Potable water pipelines parallel to sanitary sewer pipelines shall be located a minimum of ten feet (outside to outside) horizontally and one foot (outside to outside) vertically (above) from the sanitary sewer pipeline.

Potable water pipelines parallel to a tertiary treated recycled water line or storm drain line shall be located a minimum of four feet (outside to outside) horizontally and one foot (outside to outside) vertically from the tertiary treated recycled water line or storm drain line

When crossing any other utilities, a minimum vertical clearance of 1 foot (above) shall be provided (outside to outside) and no connection joints shall be made withing 8 horizontal feet of the crossing, unless otherwise approved by LBUD and DDW.

If certain conditions call for the installation of pipelines with less separation than required by the regulations, an alternative may be proposed for approval by LBUD and DDW pursuant to CCR, Title 22, Section 64551.100:

§64551.100 Waivers and Alternatives

(a) A water system that proposes to use an alternative to a requirement in this chapter shall:

(1) Demonstrate to the State Board that the proposed alternative would provide at least the same level of protection to public health; and

(2) Obtain written approval from the State Board prior to implementation of the alternative.

2.3.4 Easements

Pipelines in easements or other areas that are not easily accessible should be avoided unless there is no other alternative. If an easement is needed, the minimum width of a water main easement shall be 20 feet, unless otherwise approved by LBUD.

A. Water Main Location in Easement - The water main shall be located on the centerline of the easement except where otherwise approved by LBUD.

B. Where Easements Follow Common Lot Lines - The full easement width shall be on one lot in such a manner that access to lines will not be obstructed by walls, trees or permanent improvements. Where this requirement cannot be met without interfering with existing buildings, easements may straddle lot lines, but the water line shall not be located on the lot lines.

C. Deeds for Easements - Deeds for easements shall provide for restrictions of permanent construction within the easement to provide ingress and egress for maintenance. A recent title report will be required prior to acceptance of the easement.

D. Dedication of Easements - Easements shall be provided as follows:

i. For subdivision tracts - the owners of land included within the subdivision shall offer to dedicate for public use the water main easements so designated on the final map. The form of dedication shall be as follows: “The Long Beach Water Department hereby accepts for public use all water main easements delineated and designated on the map, when said map is approved and recorded.”

ii. For other than subdivision tracts - easements for public water mains crossing private property shall occur by means of easement deeds in favor of LBUD on a form approved by LBUD.

For other than subdivision tracts - dedication of water main rights-of-way shall occur by means of deeds of conveyance to LBUD for all dedications other than those dedications created by subdivision tract maps on a form and as approved by LBUD.

2.4 Valves

2.4.1 General

Water pipeline valves shall be specified as follows:

- Potable water pipelines 12-inch diameter and smaller shall be resilient-seated gate valves in accordance with AWWA C509 latest edition and LBUD Specification 33 12 12.
- Potable water pipelines greater than 12-inch diameter shall have rubber seated butterfly valves in accordance with AWWA C504 latest edition and LBUD Specification 33 12 14.

Generally, water pipeline valves shall be located as follows. Actual valve spacing will be reviewed and approved by LBUD.

- Potable water pipelines shall have 3 isolation valves installed at every tee, unless otherwise approved by LBUD
- Potable water pipelines shall have 4 isolation valves installed at every cross, unless otherwise approved by LBUD
- Potable water pipelines shall have isolation valves and blow-off valves installed at the dead end of a water main or at the traverse of an easement
- Potable water pipeline valves shall be adequately spaced to provide pipeline isolation, repair, and maintenance. Spacing shall be determined by LBUD for each system to meet operational requirements.
- Potable water pipeline valves shall be placed in-line with extended property lines and not within traffic intersections.
- Potable water pipeline valves shall be located so that not more than two adjacent fire hydrants will be out of water due to one break in the distribution system. Distance between valves shall be per CFC requirements (Appendix C, Table C102.1) or Table 2-3, but shall not exceed 500 feet without approval from LBUD.

Valves shall be installed with valve can and cover as shown on LBUD Standard Drawing WDS-115, WDS-116, WDS-117, WDS-118 or WDS-119, whichever are applicable.

Pressure class rating of valves shall be the same as the potable water pipe on which the valve is to be installed (typically Class 150 or 250).

2.4.2 Air Release and Air Vacuum Valves

Air Release and Air Vacuum Valves shall be in accordance with LBUD Standard Drawing WDS-110 or WDS-212 and LBUD Specification 33 12 25. Air release and air vacuum valves shall be located at high points of potable water pipelines where air pockets may form, where necessary to prevent vacuums during draining operations, and at locations shown and/or established by LBUD. Minimize usage of air release valves by adjusting the slope of potable water mains to eliminate high points.

In phased developments, air release and air vacuum valves are often located at the end of the pipeline as dictated by the phasing plan. When additional phases are constructed, the air valves shall be removed unless it is still required.

Air release and air vacuum relief valves shall be sized appropriately based on the size of the mainline and to prevent excessive negative pressure in the pipeline in case of a pipe break. In no case shall the negative pressure exceed 3 psi or the maximum negative pressure allowed per manufactures publications or recommendations. The air velocity entering the air vacuum valve shall be limited to 10 feet per second under all conditions.

2.4.3 Blow-off Valves

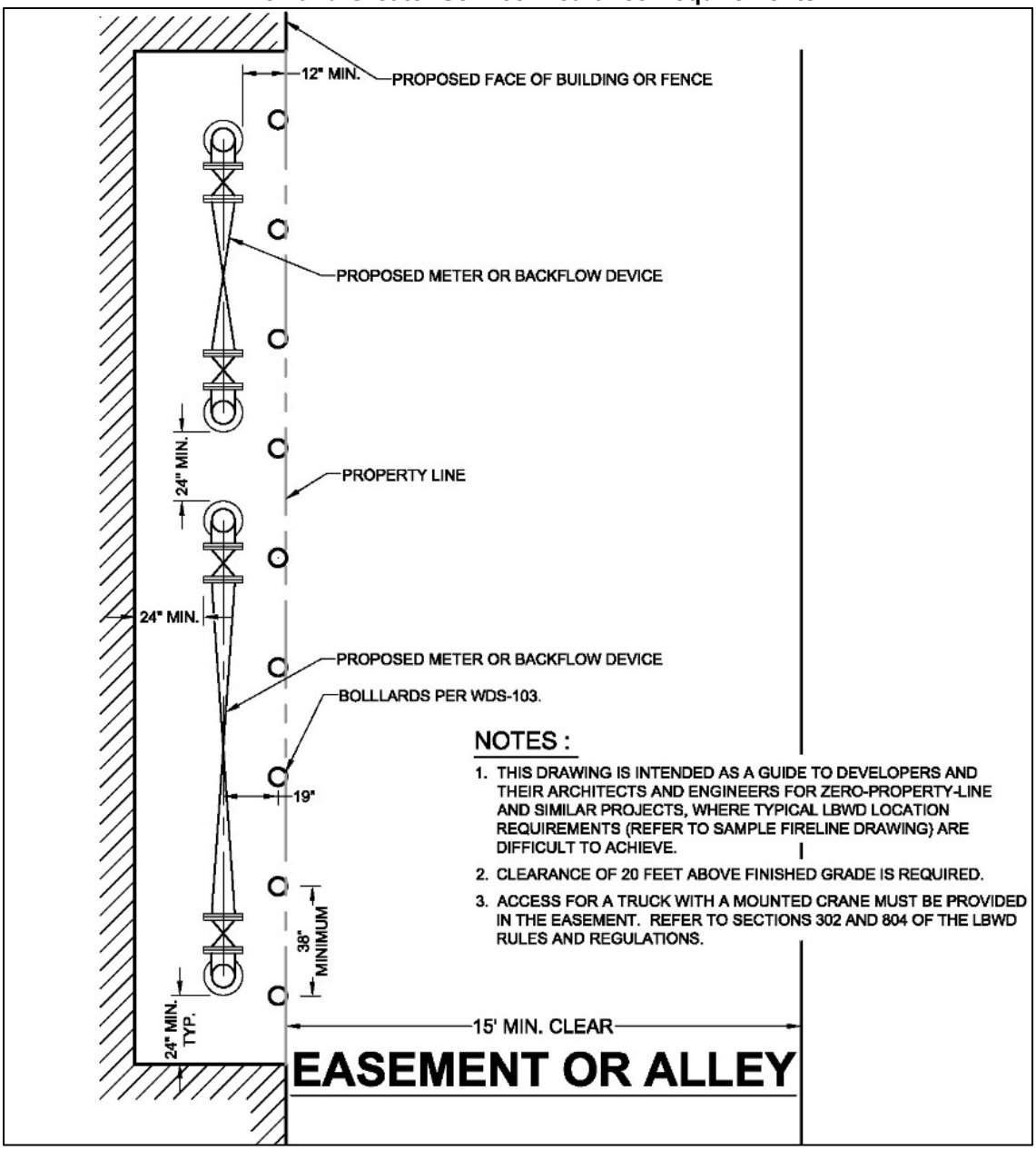
Blow-offs shall be in accordance with LBUD Standard Drawing WDS-112 or WDS-113.1 and LBUD Specification 33 12 21. Blow-offs shall be located at all low points of the pipeline and at all dead-end terminal points where sediment may collect. Minimum size of a permanent or temporary blow-off shall be 2” or as sized based on the applicable water pipeline size. Design class shall be compatible with the pipeline working

pressure. Blow-off shall be sized so that velocity is 2.5 feet per second or more in the mainline if flushed. Minimize usage of blow-off valves by adjusting the slope of potable water mains to eliminate low points.

2.5 Service Installations

Service pipelines and meters shall be in accordance with LBUD standard drawing WDS-001, WDS-002, WDS-004, WDS-006, or WDS-011. Service pipelines or meters that are 4" diameter or greater shall be in accordance with the following clearance requirements. Unless otherwise approved by LBUD, the upstream riser shall be within 5 feet of the property line.

Figure 2-1
4-inch and Greater Service Clearance Requirements



2.5.1 Service Pipeline and Meter Sizing

All service pipeline installations shall be copper tubing and have a minimum 1" diameter. Other materials may be considered per LBUD approval. Each meter shall have its own service connected to the pipeline. Services shall run at a 90-degree angle from the pipeline to the meter box. Service piplines shall be sized to minimize the losses from the mainline to the building being served water.

Water service pipelines 2" diameter and smaller shall be sized per the California Plumbing Code (CPC), latest edition. In cases where sizing per CPC is not applicable, it is advised that demand (in gallons per minute, gpm) at the water meter should not exceed the following Meter Size and Lateral Size Criteria shown in Table 2-6.

Table 2-6
Meter and Lateral Size Criteria

Lateral Diameter (inches)	Allowable Flow (gpm) for 8 fps	Allowable Flow (gpm) for 10 fps[1]
1	20	24
1.5	44	55
2	78	98
3	180	220
4	310	390
6	700	880
8	1250	1570
10	1960	2450
12	2820	3530

[1]Allowable flow for services with fire demand, refer to 2.2.4 for velocity criteria

2.5.2 Submeters for Each Individual Dwelling Unit in MultiFamily Residential Buildings

A submeter to measure the amount of water used by each individual residential dwelling unit is required for any project in Long Beach that includes new construction of multi-family residential building or mixed-use residential and commercial buildings.

2.5.3 Separate Meters for Residential and Commercial in Mixed-Use Buildings

Mixed-use residential and commercial sites must have a separate service connection dedicated solely to the residential units and a separate service connection dedicated solely to the commercial units. The private pipeline systems for residential and commercial uses must be independent of the other and not cross-connected.

2.5.4 Dedicated Irrigation Meters

Residential sites with landscapes over 5,000 square feet and for non-residential sites with landscapes over 1,000 square feet must have a dedicated irrigation service connection separate from the service connection for non-irrigation use. The private pipeline systems for irrigation and non-irrigation uses must be independent of the other and not cross-connected.

2.6 Backflow Prevention

Where LBUD's potable water system has the potential of becoming cross-connected to other water supplies or sources, an approved backflow prevention device is required by Title 17 of the California Code of Regulations, and shall be installed in accordance with LBUD's Standard Drawing WDS-015 and LBUD Secification 33 12 09. Backflow prevention assembly shall be made of low lead materials.

2.6.1 Location of Backflow Prevention Devices

Backflow prevention devices shall be located outside of the public right-of-way. Backflow prevention devices located indoors must provide drainage per the California Plumbing Code (CPC), latest edition adopted by the City of Long Beach (City). Plan check will be by the City's Development Services and LBUD.

If LBUD Backflow and Meter Shop personnel deem the device location(s) to be inaccessible, device certification testing must be performed by a Certified Backflow Prevention Device Tester contracted by the owner.

A reduced pressure principle backflow prevention device shall be located as close as practical to the owner's service connection or meter and shall be installed a minimum of twelve inches (12") above grade and not more than thirty-six (36") above grade measured from the bottom of the device and with a minimum of twelve inches (12") side clearance. (17 CA ADC § 7603)

2.7 Fire Hydrants

Fire hydrants shall be designed in accordance with LBUD Standard Drawing WDS-102, WDS-103, and WDS-130 (as applicable) and LBUD Specification 33 12 20. Fire hydrants shall be installed behind curb face at right angles to the potable water pipeline.

The hose and pumper nozzles required per LBUD Specification 33 12 20 are as follows:

1. Residential with dome cap
    a. One 4" Pumper Outlet
    b. One 2-1/2" Hose Outlet
    c. One 2-1/2" Dome Cap
    d. Nozzles shall have ANSI B26 standard fire hose threads
2. Commercial double steamer with dome cap
    a. Two 4" Pumper Outlets
    b. One 2-1/2" Hose Outlet
    c. One 2-1/2" Dome Cap
    d. Nozzles shall have ANSI B26 standard fire hose threads

The number of hydrants required and hydrant spacing shall be in accordance with California Fire Code, Appendix C, Table C102.1, which is based upon the fire flow requirement and shown in Table 2-7. In general, fire hydrants are located on the prolongation of the B.C. radial, on property line between lots or parcels, or at loctions selected by the Long Beach Fire Department.

Table 2-7
California Fire Code Table C102.1
Required Number and Spacing of Fire Hydrants

Fire-Flow Requirement (gpm)	Minimum Number of Hydrants Required	Average Spacing between Hydrants (ft)[a, b, c, f, g]	Maximum Distance From Hydrant to any Point on Lot Frontage (ft)[d, f, g]
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more[e]	200	150

[a] *Reduce by 100 feet for dead-end streets or roads*

[b] *Where streets are provided with median dividers that cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis*

[c] *Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.*

[d] *Reduce by 50 feet for dead-end streets or roads*

[e] *One hydrant for each 1,000 gallons per minute or fraction thereof*

[f] *A 50-percent spacing increase shall be permitted where building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 of the California Fire Code.*

[g] *A 25-percent spacing increase shall be permitted where building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2 or 903.3.1.3 of the California Fire Code or Section P2904 of the California Residential Code.*

2.8 Cathodic Protection

All new metallic water and recycled water mains shall be protected from corrosion using project specific design guidelines. Three level of protection are considered for every pipeline and include the following:

Level 1: Standard Installation

Level 2: Enhanced installation (including joint bonding, test stations)

Level 3: Specific corrosion control design (joint bonding, test stations, cathodic protection)

The decision process includes:

A. Pipe classification. Classification are primarily based on size, function and location of the pipelines. LBUD reserves the right to adjust the classification of individual pipelines at its own discretion.

a) Class 1 – All water and recycled water mains 16 inches in diameter or greater.

b) Class 2 – All water and recycled water mains 12 inches in diameter or greater. Any size pipeline where repair or taking the line out of service would require high repair costs such as underneath river and flood control channel crossings, pipe installed in encasements and Freeway / Highway crossings.

c) Class 3 – All water and recycled water mains less than 12 inches in diameter.

B. Soil evaluation. Soil samples shall be collected at the anticipated pipeline depth. Soil samples for Class 1 pipelines shall be taken at intervals of 500 linear feet along the anticipated alignment.

a) Type 1 – Severely corrosive and corrosive soil. Resistivity < 5000 ohm.cm

b) Type 2 – Moderately corrosive soil. Resistivity >5000 ohm.cm

C. Stray Currents. Stray current risks for all classes of pipelines shall be identified and evaluated by Consultant. Mitigation of stray current will be incorporated into the design of the proposed pipe.

D. Evaluation. Using the information collected in A, B, and C LBUD will determine the level of corrosion protection to be included in the pipeline design.

All pipelines Class 1 and Class 2 in severely corrosive soils (Type 1) will require a project specific corrosion protection design. Corrosion protection may include any of the following: joint bonding, test stations, cathodic protection, and stray current mitigation.

Class 2 pipelines in moderately corrosive soils (Type 2) and Class 3 pipelines in Type 1 soils will require enhanced installation includes: joint bonding, test stations, and stray current mitigation.

Class 3 pipelines in Type 2 soils will be installed in accordance with LBUD water installation requirements

In certain cases, LBUD may choose to specify a nonmetallic piping material in an application that would otherwise be built of ductile iron