



STANDARD SPECIFICATIONS FOR CONSTRUCTION OF SANITARY SEWER MAINS

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City of Hayward
Department of Public Works & Utilities
777 B Street, Hayward, CA 94541

www.hayward-ca.gov/your-government/departments/engineering-division

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PART 1: GENERAL REQUIREMENTS

1.01 SCOPE

These Sewer Specifications cover the installation of polyvinyl chloride (PVC), ductile iron pipe (DIP) with lining suitable for wastewater applications, and high density polyethylene (HDPE) sanitary sewer mains and appurtenances to be installed by the Applicant with materials provided by the Applicant. Vitrified clay pipe (VCP) is not allowed on the City's sanitary sewer collection system unless approved by the City Engineer.

Pipe installations under these Sewer Specifications are generally limited to pipe diameters of 12 inches or less. For pipe installations greater than 12 inches in diameter, the City may provide additional specifications and requirements.

1.02 DEFINITIONS AND TERMS

Wherever in these Sewer Specifications, the Standard Specifications, or the Standard Details, the following definitions and terms are used, the intent and meaning shall be interpreted as follows:

ANSI: American National Standards Institute. www.ansi.org

Applicant: Any individual, firm, company, corporation, developer, or contractor that applies for a connection or for improvements affecting the City's sanitary sewer and/or water system.

ASTM: American Society for Testing and Materials. www.astm.org

AWWA: American Water Works Association. www.awwa.org

Backwater Valve: Any approved check valve or other approved device to prevent the flow of wastewater from the public sewer into the building. Also called a Backflow Preventer (for sewer). Refer to Standard Detail SD-314.

Building: Any structure erected for the support, shelter, and enclosure of persons, animals, or movable property of any kind.

Building Court: 2 or more buildings containing 4 or more dwelling units or 2 or more commercial and/or industrial buildings on premises or parcel under one ownership and to remain under one ownership.

1.02 DEFINITIONS AND TERMS (continued)

Building Court House Sewer: The extension from the building drain to the building court main sewer and shall be located within the building lot boundaries. Also called a sewer lateral.

Building Court Main Sewer: The extension from the building court house sewer to a public sewer or other place of disposal. Refer to Standard Detail SD-301. Also called a common lateral, shared lateral, common private main or shared private main.

Building Drain, House Drain or Main Drain: That part of the lowest piping of a drainage system which received the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys it to the building sewer beginning two (2) feet outside the building wall that faces the public sewer. (It is the portion of sewer piping that is inside the house.)

Building Sewer or House Sewer: The extension from the house drain to the public sewer or other place of disposal, which is not less than two (2) feet from any building or structure foundation or footing that faces the public sewer. (Refer to Standard Detail SD-312. Also called a sewer lateral.)

City: City of Hayward, California **www.hayward-ca.gov**

Cal OSHA: California Occupational Safety & Health Administration. **www.dir.ca.gov/dosh**

Caltrans: State of California Department of Transportation. **www.dot.ca.gov**

Cleanout: A pipe rising from the Building Sewer to the ground surface with a removable cap or plug. It is used to access the sewer pipe to free blockages.

Department: Department of Public Works & Utilities of the City of Hayward, California

Development Review Specialist (DRS): A City Public Works & Utilities Department employee who, by definition, is an authorized agent of the Director of Public Works. The DRS assesses fees for connection to the City's water distribution system and discharge wastewater into the City's sanitary sewer collection system, processes water and sewer service applications, and provides work orders to City water field crew for installation.

1.02 DEFINITIONS AND TERMS (continued)

Director: The Director of the Public Works & Utilities Department of the City of Hayward acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them. On all questions regarding applications, permits, design, layout, location, conditions of approval, and acceptance of work, the decisions of the Director shall be final and binding upon all parties. The Director of Public Works may perform duties of City Engineer.

Drainage Piping or Drainage System: All piping within public or private premises which convey wastewater, or other liquid wastes, to a point of disposal, but shall not include the mains, laterals, manholes, and pipe encasements of the public sewer system.

Dwelling Unit: A building or portion of a building arranged, intended or designed to be occupied by not more than one family, a congregate residence for 10 or fewer people, and having facilities for sleeping, eating, cooking and sanitary purposes, independent of another dwelling or dwellings.

Engineer: The Director of Public Works/City Engineer, the Deputy Director of Public Works/Assistant City Engineer, the Assistant Director of Public Works & Utilities, or their designee, who by definition, are authorized agents of the Director of Public Works. The Engineer may act either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them. On all questions concerning the acceptability or classification of materials, the execution of the work, and conflicting interests of Contractors performing related work, the decisions of the Engineer shall be final and binding upon all parties.

Equivalent Dwelling Unit: A measure of the size of a proposed development based on its projected water usage. For residential developments, this number is equal to the number of dwelling units. For non-residential developments, this number represents the number of single-family dwelling units that would produce the same peak day flow rate. The water use of a single-family home to be used for this calculation shall be based on the water use factor for future single-family homes, as defined in the latest edition of the City's Water Master Plan.

1.02 DEFINITIONS AND TERMS (continued)

Grease Interceptor: A receptacle designed to collect and retain grease and fatty substances normally found in kitchen, food processing, or similar wastes. An interceptor is a vault with a minimum capacity of 500 gallons that is located on the exterior of a building. The vault includes a minimum of two compartments, and flow between each compartment is through a 90° fitting designed for grease retention. The capacity of the interceptor provides adequate residence time so that the wastewater has time to cool, allowing any remaining grease not collected by the traps time to congeal and rise to the surface where it accumulates until the interceptor is cleaned. Grease interceptors should be cleaned at least once each month.

Grease Trap: Similar to an interceptor, a trap is a small reservoir built into wastewater piping a short distance from the grease producing area. Baffles in the reservoir retain the wastewater long enough for the grease to congeal and rise to the surface where it accumulates until the trap is cleaned. Grease traps may need to be cleaned twice per month or more frequently.

Hayward Municipal Sewer System: All of the property, heretofore or hereafter constructed and/or owned by the City of Hayward, involved in the collection and treatment of wastewater. It includes land, pipelines, appurtenances, pumping stations, treatment works, and general properties. Also known as Sanitary Sewer System or Sanitary Sewer Collection System.

House Drain: See Building Drain.

House Sewer: See Building Sewer.

Insanitary: A condition which is contrary to sanitary principles or is injurious to health.

Inspector: A City inspector, who by definition, is an authorized agent of the Director and Engineer.

Main Drain: See Building Drain.

Outside Sewer: Sewer lines and facilities owned by City lying outside the City limits.

Plans: Project plans that have been approved and signed by the Director of Public Works and are marked "Approved for Construction."

1.02 DEFINITIONS AND TERMS (continued)

Public Sewer: Any sewer which is part of the Hayward municipal sewer system, including any sewer main within any public street or sanitary sewer easement and any outside sewer.

Regulations: The Wastewater Discharge Regulations of the City of Hayward contained in Appendix "A" of Chapter 11, Article 3 of the Hayward Municipal Code, "Sanitary Sewer System."

Service Sewer: A shallow (typically ≤ 10 feet) Sewer Main that collects wastewater from Building Sewers and conveys wastewater to a parallel and deeper Sewer Main.

Sewer Main: A sewer in a public street or easement maintained and operated by the City that collects wastewater from Building Sewers (sewer laterals) and Building Court Main Sewers and conveys wastewater to a Sewer Trunk.

Sewer Specifications: This document.

Sewer Trunk: A sewer pipeline that collects wastewater from smaller local Sewer Mains in a large area. Sewer trunks are large-diameter pipeline.

Soils Engineer: A licensed civil or geotechnical engineer who is qualified in the field of geotechnical engineering and soil mechanics.

Special Provisions: The special provisions are specific clauses setting forth conditions or requirements peculiar to the work and supplementary to the Standard Specifications.

Standard Dimension Ratio (SDR): The ratio of the outside diameter of the pipe divided by the minimum wall thickness.

Standard Plans: The Standard Plans of the State of California Department of Transportation (latest revision), and the Standard Details of the City of Hayward (latest revision). The Standard Details of the City of Hayward shall govern over both the State of California Department of Transportation Standard Plans and Standard Specifications.

Standard Specifications: The Standard Specifications, State of California Department of Transportation, latest revision.

1.02 DEFINITIONS AND TERMS (continued)

Surveyor: A City surveyor who, by definition, is an authorized agent of the Director and Engineer.

Water Pollution Source Control (WPSC): Operates the City's industrial wastewater pretreatment program and administers regulations affecting businesses that discharge industrial wastewater into the City's sanitary sewer system. The WPSC also administers the City's Stormwater Management and Urban Runoff Control Program to reduce pollution of San Francisco Bay caused by urban activities. Staff coordinate activities performed by outside agencies and other City operating divisions, and perform inspections associated with the industrial and illicit discharge.

Water Resource Recovery Facility (WRRF): A City facility for treating wastewater from residential, commercial, and industrial users through a series of treatment processes. WRRF was formerly known as Water Pollution Control Facility (WPCF). In addition, the City has a recycled water treatment facility located at WRRF to produce disinfected tertiary recycled water.

1.03 CITY SERVICE CONTACTS

CONTACT	DESCRIPTION OF SERVICE
Development Services Development Services Dept. (510) 583-4005	Encroachment permits for work in City right-of-way or easements.
Permit Center Development Services Dept. - Building Division (510) 583-4005	Building permits and inspections (non-Public Works).
Construction Inspection Public Works & Utilities Dept. - Engineering Division (510) 583-4730	Inspections of Public Works projects and utilities improvements.
Development Review Specialist Public Works & Utilities Dept. - Utilities Division (510) 583-4722	Water and sewer service applications, connections and fees, and work orders for City water field crews.
Survey & Right-Of-Way Public Works & Utilities Dept. - Engineering Division (510) 583-4730	Construction staking requirements, monuments, and elevation information.
Utilities Operation and Maintenance Manager Public Works & Utilities Dept. - Utilities Division (510) 881-7901 (510) 881-7902 (Administrative Staff)	Oversee the City's water distribution and sanitary sewer collection system operation and maintenance.

1.03 CITY SERVICE CONTACTS (continued)

CONTACT	DESCRIPTION OF SERVICE
Utilities Field Services Manager Public Works & Utilities Dept. - Utilities Division (510) 881-7949 (510) 881-7933 (Administrative Staff)	City's water distribution operation, maintenance, service connections, and meter installations.
Wastewater Collections System Manager Public Works & Utilities Dept. - Utilities Division (510) 881-7970 (510) 881-7902 (Administrative Staff)	City's sanitary sewer collection system operation, maintenance, and video inspection or closed-circuit television (CCTV) of City-owned sewer pipelines.
Water Pollution Source Control Administrator Public Works & Utilities Dept. – Environmental Services Division (510) 881-7900	Water pollution prevention and investigation of illicit discharge or dumping.

1.04 CITY STANDARDS AND CODES

The City's currently adopted State of California, Department of Transportation (Caltrans) Standard Plans and Specifications and the City of Hayward Standard Details form a part of these Sewer Specifications and shall be followed in the construction and installation of sanitary sewer mains and services by the Applicant. Wherever in the Standard Specifications the word "Contractor" is used, it shall mean Applicant. Any and all provisions in the Standard Specifications regarding compensation of the Contractor by the City and provisions of like import, are not applicable to work performed by an Applicant.

In case of conflict between these Sewer Specifications and the Standard Specifications, the general requirements in these Sewer Specifications shall govern.

All sewer installations and services within the City of Hayward shall comply with the minimum separation requirements set forth in the California Code of Regulations Title 22 Division 4 Chapter 16 Article 4 (refer to Section 1.10 of these Sewer Specifications).

In addition, see Chapter 11, Article 3 of the Hayward Municipal Code, "Sanitary Sewer System". Excerpts of the Municipal Code are presented and referenced below. A copy of the Hayward Municipal Code is available online at:

https://library.municode.com/ca/hayward/codes/municipal_code

Section 11-3.201 Duty To Connect To Municipal Sewer. "The owner of any property ... which abuts on any street, alley or right of way in which there is located a public sanitary sewer of the City, is hereby required at the owner's expense to ... connect ... directly with said public sewer...Properties that connect to the City system will be required to pay all connection charges in effect at the time of connection."

Section 11-3.251 Application For Construction Permit. "At the time that a construction permit is issued, the applicant shall pay the established permit fee."

Section 11-3.252 To Whom Construction Permits May Be Issued. "No sewerage work for which a construction permit is required shall be commenced until a construction permit to do such work shall have first been obtained."

Section 11-3.311 New Materials And Methods Of Construction. "The provisions of this Article are not intended to prevent the use of any material or method of construction not specifically prescribed herein, provided any such alternate has been approved and its use authorized by the ... Engineer."

1.04 CITY STANDARDS AND CODES (continued)

Section 11-3.361, Cleanouts. "Cleanouts shall be placed in every building sewer at the connection with the building drain and shall be installed at uniform intervals not to exceed one hundred (100) feet."

Section 11-3.362, Back Water Protection. "If the lowest fixture or outlet in any building is below the rim elevation of the nearest manhole, cleanout, or riser upstream from the connection to the public sewer, a backwater valve or overflow device of an approved type shall be installed in the building sewer." Refer to Standard Detail SD-314.

Section 11-3.500, Extension of Sewer Main Facilities. "Sewer main facilities may be extended by an applicant in accordance with plans and specifications approved by the ... Engineer. The applicant shall deposit an amount which when added to any previous deposits on the same application is equal to all estimated inspection costs. Engineering costs plus an administrative charge equal to three percent (3%) of the total cost of installation shall be deposited before applicant begins such work."

Section 11-3.503, Applicant to File Surety Bond. "In the event the applicant installs sewer main extension facilities, the applicant shall furnish the City a surety company bond in an amount equal to at least one-half of the ... Engineer's estimate of the installation costs to guarantee faithful performance by the applicant, and a surety company bond in an equal amount to guarantee claims of persons employed by applicant and claims of persons who furnish materials, supplies and implements used by applicant on such work."

Section 11-3.504, Sewer Main Extension Facilities – Bill of Sale. "When sewer main extension facilities are installed and upon the execution and delivery by applicant of a good and sufficient bill of sale of said facilities to the City of Hayward, sewer service shall be furnished to applicant's property."

1.05 DRAWINGS

1. STANDARD PLANS: The Caltrans Standard Plans and the Standard Details of the City of Hayward, latest revisions, form a part of these Sewer Specifications and shall be followed in the installation of sanitary sewer mains and services. The Standard Details shall govern over both the State of California Department of Transportation Standard Plans and Standard Specifications.
2. PROJECT DRAWINGS OR PLANS: Drawings showing the size and location of the mains to be installed and other pertinent details shall be provided by the Applicant for each project, and the approved Plans will become a part of these Sewer Specifications. Abbreviations and symbols shown on the Drawings shall be per on Standard Details SD-100 and SD-101 respectively
3. CONFLICTS: In case of conflict between the approved Project Drawings and these Sewer Specifications, including the Standard Plans and Specifications, then notify the Engineer of Record and the City Engineer. Conflicts shall be resolved as determined by the City Engineer.

1.06 CHANGES

If, during the progress of the work, changes in design, material, or location are deemed necessary for proper construction of the work, the City reserves the right to make such changes. The increase or decrease in cost of material and construction caused by such changes shall be borne by the Applicant.

1.07 PERMITS, RIGHT OF WAY AND LICENSES

1. PERMITS: The Applicant shall obtain all necessary permits for doing work and copies of the permits shall be provided to the Engineer. In the case where the requirements of a permit differ from those of the City Standards, the more stringent requirements shall apply. Where a pipeline location is not public property, a right-of-way satisfactory to the City shall be obtained at the Applicant's expense, and the title shall be vested in the City.

An encroachment permit is required whenever work or an activity is to be performed within City easements or right-of-way. For additional information regarding Public Works Encroachment Permits, refer to the City's website at:

<https://www.hayward-ca.gov/services/permits/encroachment-permit>

2. CITY BUSINESS LICENSE: Any business operating within the City is required to possess a valid City Business License. The Applicant shall verify that any consultant, contractor or subcontractor performing work on their behalf possesses a valid City Business License and shall furnish satisfactory proof to the Engineer upon request. For additional information regarding City Business Licenses, contact the Revenue Division at (510) 583-4622 or refer to the City's website at: **<https://www.hayward-ca.gov/documents/business-license-application-hayward-based-business>**
3. CONTRACTOR'S LICENSE: The Applicant or their agent performing the work shall possess such State and local licenses as are required by law and shall furnish satisfactory proof to the Engineer upon request that such licenses are in effect during the entire period of construction.

1.08 SUBMITTALS & REQUEST FOR INFORMATION

Prior to delivery of materials to the job site, the Applicant shall furnish to the Engineer a complete list of materials by manufacturer and model number for approval and certificates of compliance where applicable. Prior to submitting these materials to the City, the Applicant's engineer shall review and approve all submittals. Refer to Appendix A City of Hayward Sewer System Approved Materials. The Applicant shall allow at least **10 business days** for the City to review submittals or Requests for Information (RFI). Approval by the Engineer shall not constitute a waiver of any portion of these Water Specifications.

1.09 INSPECTION

All work performed under this project shall be subject to thorough inspection to ensure full compliance with these Sewer Specifications. The Engineer shall have access to all parts of the work at all times. Work or material that does not conform to these Sewer Specifications may be rejected at any stage of the work. The Applicant shall remove and rebuild at their own expense any part of the work that the Engineer determines has been improperly executed.

Public Works inspections must be requested at least 24 hours in advance. For inspections on public streets and utilities (sanitary sewer, storm drains, etc.), contact the Public Works Supervising Construction Inspector in the Engineering & Transportation Division at 510-583-4730. For inspections associated with encroachment permits, refer to the approved permit for inspection requirements.

For inspections on private utilities, the Building Inspection Division can be contacted at 510-583-4140. For additional information, refer to the City's website at:

<https://www.hayward-ca.gov/your-government/departments/building-division>

Work under these Sewer Specifications can be performed on Monday through Friday, excluding weekends and holidays. Refer to Section 3.05, "Maintaining Traffic," Table 1 of these Sewer Specifications for a list of holidays observed by the City; these holidays are subject to change without notice. Requests to perform work or inspections on weekends or holidays shall be submitted during normal work hours at a minimum of three full working days (72 hours) prior to the beginning of the work.

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS

All new public sanitary sewer mains and building court main sewers shall be designed to comply with these Sewer Specifications and shall be located and installed to the lines and grades shown and the approved Plans.

1. SIZING AND SLOPE: Sewer mains shall be sized to serve the entire tributary area at buildout densities conforming to the General Plan. Large developments may be required to provide collection system calculations or perform a wastewater model run, so that their impact can be accurately assessed.

When designing or analyzing a sewer system, Manning's Formula shall be used (additional analyses, such as Froude Number, may also be performed). The minimum Manning's Roughness coefficient, n , shall be 0.013 for any new sewer main, regardless of the pipe material (a higher value can be used). $n \geq 0.015$ should be used when analyzing existing sewers.

- a. The minimum pipe diameter size of all sanitary sewer mains is 8 inches.
- b. All sanitary sewer mains shall be designed and constructed at a uniform grade (constant slope) between manholes and cleanouts.
- c. Building Court Main Sewer:
 - i. A Building Court Main Sewer serving up to 10 dwelling units shall have an absolute* minimum slope of 0.0060 ft/ft (0.60%).
 - ii. A Building Court Main Sewer serving more than 10 dwelling units shall have an absolute* minimum pipe slope of 0.0040 ft/ft (0.40%).
 - iii. It is recommended that these sewers be designed at a minimum slope of 1.25 times the absolute minimum pipe slope, to make allowances for adjustments during construction.

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

- d. Public sewer mains up to 15" pipe diameter shall be designed to achieve a minimum flow velocity of 2 feet per second (fps) when the pipe is less than 50% (half) full. The table below lists the standard* minimum slope and the absolute* minimum slope for various pipe sizes, and the flow quantity when the pipe is half full.

For trenchless installation methods, the minimum design slope shall be based on the accuracy/tolerance of the method and equipment used, such that it is feasible to install the sewer without exceeding the minimum slope limits. For example, say a mini-horizontal directional drill (HDD) has an accuracy/tolerance of $\pm 12''$ in 600' of bore, which for a manhole spacing of 400' is equivalent to $\pm 0.167\%$. Then the minimum (flattest) slope this mini-HDD could install a 10" pipe at is 0.417% ($0.417\% - 0.167\% = 0.25\%$). Refer to Section 3.03, "Alignment and Slope", of these Sewer Specifications for additional information.

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

Minimum Pipe Slopes For Public Sanitary Sewer Mains

Manning Roughness Coefficient, $n = 0.0130$

Pipe Diameter Size (inch)	Standard* Minimum Slope ft/ft (% slope)	Flow Quantity at Std. Min. Slope (gpm)	Absolute * Minimum Slope ft/ft (% slope)	Flow Quantity at Abs Min, Slope (gpm)	Flow Depth as % of Pipe Size
8	0.0050 (0.50%)	194.0	0.0035 (0.35%)	162.4	50
10	0.0035 (0.35%)	293.9	0.0025 (0.25%)	248.4	50
12	0.0025 (0.25%)	403.5	0.0020 (0.20%)	360.9	50
15	0.0020 (0.20%)	653.3	0.0015 (0.15%)	565.8	50

*Use of the "absolute" minimum slope will require specific approval by the Engineer and survey of pipe crown prior to covering the pipe with backfill. Trenchless installation methods must be designed at a slope steeper than or equal to the "standard" slope. (The difference between the "standard" and "absolute" values is a safety factor of 1.2 to 1.5.)

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

- e. The design flow velocity of any sewer shall not exceed 15 feet per second (fps). Drop manholes may be used to break the steep slopes and to limit velocities in the sewer pipes between manholes. Drop manholes shall be exterior drop unless specifically authorized by the Engineer. Where drop manholes are impracticable for reduction of high velocity flow, additional design features will be required. These conditions may include, but are not limited to, use of PVC, ductile iron, or other abrasion resistant pipe material or coating; mechanical or restrained joints; trench dams and drainage measures to prevent buildup of hydrostatic pressure in trenches; and any additional measures required by the Engineer.

The table below lists the maximum slope by pipe size at which 15 fps is achieved and the flow quantity when the pipe is half full.

Maximum Pipe Slopes For Public Sanitary Sewer Mains

Manning Roughness Coefficient, $n = 0.0130$

Pipe Diameter (inch)	Maximum Slope, ft/ft (% slope)	Flow Quantity at Max Slope (gpm)	Flow Depth as % of Pipe Size
8	0.1832 (18.32%)	1,174.6	50
10	0.1365 (13.65%)	1,835.6	50
12	0.1073 (10.73%)	2,643.2	50
15	0.0800 (8.00%)	4,131.9	50

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

2. DEPTH OF COVER

- a. Building court mains and sewer mains shall be designed and installed at elevations which will provide a minimum of 4 feet of cover measured from the top of the pipe barrel to the established street grade or the surface of the permanent improvement (i.e., finished grade).
- b. The depth of a sewer shall be limited to a maximum of 12 feet unless otherwise approved in writing by the Engineer. In addition, the maximum depth of any sewer pipe shall not exceed the manufacturer's recommended maximum depth and loading limit for the specific type, class and size of pipe. Request for approval of sewers deeper than 12 feet shall include a sewer alignment and profile study showing that no other way of providing a sewer at a depth of 12 feet or less is feasible.
- c. Where building sewers (laterals) connect to a sewer main, the maximum cover of the sewer main shall be limited to 9 feet, plus or minus one (± 1) foot, measured from the top of the pipe barrel to the finished surface grade. If the Sewer Main must be constructed deeper than the above limit, a shallow "service sewer" that runs roughly parallel (in plan view) to the deeper sewer main can be used, and the Service Sewer shall discharge to the deeper sewer main via a manhole. As an alternative to the parallel shallow service and deep sewer main, a lift station may be used.

3. ALIGNMENT: In general, building court mains and sewer mains in straight street sections shall be designed to run parallel to the street centerline. All sanitary sewer mains shall be:

- a. Designed with a straight alignment (no curves) between manholes and cleanouts.
- b. A minimum of 5 feet or as determined by the Applicant for the specific project (whichever clearance is greater) from all structures, building overhangs, gutters, property lines, and edge of easements.
- c. A minimum of 3 feet from all monuments and lip of gutter.

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

In addition, the alignment shall be designed such that any 48-inch manhole is centered a minimum of 3 feet from the lip of gutter, and any 60-inch manhole is centered a minimum of 4 feet from the lip of gutter.

In curved streets, the public sanitary sewer main shall be aligned on one side of the street centerline to allow installation of other facilities without using transverse crossings and such that no part of the sewer main is less than one (<1) foot from the lip of gutter.

Horizontal and/or vertical curves in gravity sanitary sewer mains are not allowed

4. RESERVED

5. CRITERIA FOR THE SEPARATION OF WATER MAINS, SANITARY SEWER, STORM DRAIN, AND OTHER UTILITY PIPELINES

California Code of Regulations Title 22 Division 4 Chapter 16 Article 4 sets the minimum separation requirements between water mains and sanitary sewer, storm drain, and recycled water pipelines. The City's minimum separation requirements are as follows:

a. Basic Separation Standards

- i. **Parallel Construction.** The separation between potable water mains and sanitary sewer and recycled water pipelines shall be a minimum of 10 feet horizontally. The separation between potable water mains and storm drain pipelines shall be a minimum of 5 feet horizontally, measured from the nearest edges of the facilities.
- ii. **Perpendicular Construction (Crossing).** Water mains shall be at least 1 foot vertically above sanitary sewer, storm drain, and recycled water pipelines, measured from the nearest edges of the facilities. Refer to Standard Detail SD-224, "Ductile Iron Drop."

The vertical separation shall be a minimum of 12 inches, measured from the outer diameter of the pipe to the outer diameter of the pipe between water mains and other utilities. Refer to Standard Detail SD-303, "Sewer Construction in the Vicinity of Other Utilities."

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

- iii. **Common Trench.** Water mains and sanitary sewer and storm drain, or recycled water pipelines shall not be installed in the same trench.
 - iv. Refer to the City's Recycled Water Specifications for additional separation requirements between recycled water mains and other utility pipelines.
 - v. Local conditions may create a situation where there is no alternative but to install water mains, sanitary sewer or storm drain pipelines at a distance less than that which is required by the Basic Separation Standards above. In such cases, the Alternative Criteria for Construction (Item 2 below) shall be followed, subject to the Special Provisions (Item 3 below).
- b. Alternative Criteria for Construction: The construction criteria for water mains, sanitary sewer or storm drain pipelines where the Basic Separation Standards cannot be attained are detailed below in Case 1 and 2, and illustrated in Figures 1 and 2. There are two standard situations encountered:

CASE 1: New Sanitary Sewer or Storm Drain & New or Existing Water Main.

The Alternative Construction Criteria shall apply to the sanitary sewer and/or storm drain pipelines.

CASE 2: New Water Main & Existing Sanitary Sewer or Storm Drain.

The Alternative Construction Criteria may apply to the water main, sanitary sewer, and/or storm drain pipelines.

The Alternative Construction Criteria shall also apply to service laterals that cross above a potable water main, but not to service laterals that cross below a potable water main.

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

- c. Special Provisions: The Basic Separation Standards are applicable under normal conditions for sewers, storm drains, and water mains. More stringent requirements may be necessary if adverse conditions, such as high groundwater, exist.
- i. **Low Pressure Water Mains.** Sanitary sewer and storm drain pipelines shall not be installed within ($<$) 25 feet horizontally of a low head (≤ 5 psi) water main.
 - ii. **Pressure Testing of Pipelines.** New water mains, sanitary sewer, and storm drain pipelines shall be pressure tested, where the pipelines must be located ten (≤ 10) feet apart or less.
 - iii. **Maintain Support of Existing Pipelines.** Measures must be taken during the excavation and installation of water mains, sanitary sewer, or storm drain pipelines to prevent, or at least minimize, disturbance to existing mains or pipelines (i.e., shoring and/or bracing). Disturbance of the supporting base material of a main or pipeline could result in the pipeline's eventual failure.
 - iv. **Corrosive Conditions.** Special consideration shall be given to the selection of pipe materials if corrosive conditions are likely to exist. These conditions may be due to soil type and/or the nature of the fluid conveyed in the conduit, such as a septic wastewater which produces corrosive hydrogen sulfide.
 - v. **Force Mains (Sanitary Sewer and Storm Drain).**
 - 1. Force mains shall comply with the Basic Separation Standards above.
 - 2. When a force main must cross a water main, the crossing shall be perpendicular (90°) or as close to perpendicular as is practical. The force main shall be at least 12 inches below the water main. In no instance shall a force main be installed above a water main
 - 3. When a new force main crosses under an existing water main, all portions of the force main within 10 feet horizontally of the water main shall be enclosed within a continuous sleeve or casing pipe.
 - 4. When a new water main crosses over an existing force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating. In no instance shall a water main be installed below a force main.

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

- d. Separation Waiver Request Process: Prior to construction, the Applicant's licensed professional engineer shall prepare and submit the waiver information package in accordance with the requirements of the California State Water Resources Control Board's Division of Drinking Water (DDW) to the City for review.

The Applicant shall account for DDW review timeline during project planning, as receiving responses to waivers can take months and could impact the project schedule. The waiver information package shall include the following, but not limited to:

- i. Alternative Analysis: Provide a detailed evaluation of all exhausted design alternatives, including a formal statement confirming that encroachment into the DDW separation criteria is unavoidable.
- ii. Mitigation & Public Health: Demonstrate that the project design minimizes encroachment to the greatest extent possible and incorporates sufficient mitigation measures to protect public health.
- iii. Variance Request: Explicitly request the required variance(s) and clearly identify all variance locations on the plans.
- iv. Stamped and signed by a licensed Civil Engineer.

The City may request additional information during the process. Following City review, the City will submit the waiver request package to DDW and will notify the Applicant of any subsequent actions or requirements upon receipt of DDW's response.

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

CASE 1 - NEW SANITARY SEWER OR STORM DRAIN PIPELINE

(See Figure 1 and Appendix B for Reference Standards)

Zone	Special Construction Requirements
P	PARALLEL or CROSSING: Zone P is a PROHIBITED zone. Water mains and sanitary sewer or storm drain pipelines shall never be installed within six (≤ 6) inches vertically and/or within one (≤ 1) foot horizontally of each other.
A	PARALLEL: Installation of new sanitary sewer or storm drain pipeline in Zone A parallel to existing water main is not allowed unless approved by the Director of Public Works and requires a waiver from the California State Water Resources Control Board's Division of Drinking Water (DDW). ¹
B	PARALLEL: Requires a waiver from DDW.¹ A new sanitary sewer or storm drain pipeline to be installed parallel to an existing water main and in Zone B shall be constructed of: 1. Fusible AWWA C900 PVC DR 14 (green color pipe for sewer). 2. Thermo-fusion welded (Butt fusion) HDPE pipe, minimum SDR-17. 3. Ductile Iron Pipe: standard asphaltic coating on the exterior, and Protecto 401™ ceramic epoxy lining by U.S. Pipe on the interior, or approved equal 4. Reinforced Concrete Pressure Pipe with compression joints per AWWA C302 (<i>Not for sanitary sewer. For storm drain only</i>).

¹ For the Separation Waiver Request Process, see Section 1.10.5.d of these Sewer Specifications

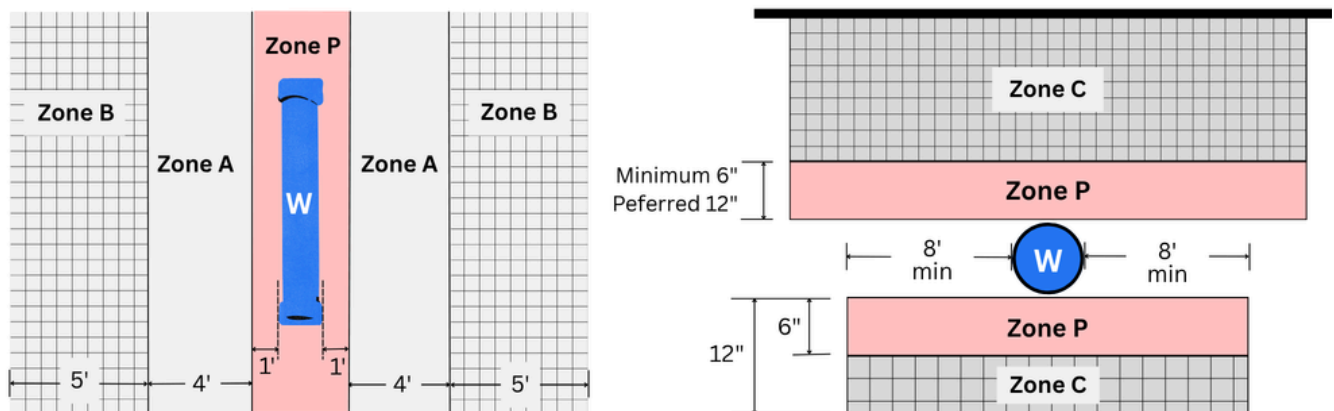
1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

CASE 1 - NEW SANITARY SEWER OR STORM DRAIN PIPELINE

(See Figure 1 and Appendix B for Reference Standards)

Zone	Special Construction Requirements
C	CROSSING: Requires a waiver from DDW.¹ A new sanitary sewer or storm drain pipeline to be installed crossing an existing water main and in Zone C shall be constructed of: 1. A continuous section of AWWA C900 PVC DR 14 (green color pipe for sewer), centered over the pipe being crossed. 2. Thermo-fusion welded (Butt fusion) HDPE pipe, minimum SDR-17. 3. A continuous section of Ductile Iron Pipe: standard asphaltic coating on the exterior, and Protecto 401™ ceramic epoxy lining by U.S. Pipe on the interior, or approved equal. 4. A continuous section of Reinforced Concrete Pressure Pipe with compression joints (per AWWA C302), centered over the pipe being crossed (<i>For storm drain only</i>).

¹ For the Separation Waiver Request Process, see Section 1.10.5.d of these Sewer Specifications



Case 1 - Figure 1

Sanitary Sewer or Storm Drain Pipeline
Parallel or Crossing Water Main

1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

CASE 2 - NEW WATER MAIN

(See Figure 2 and Appendix B for Reference Standards)

Zone	Special Construction Requirements
P	PARALLEL or CROSSING: Zone P is a PROHIBITED zone. Water mains and sanitary sewer or storm drain pipelines shall never be installed within six (≤ 6) inches vertically and/or within one (≤ 1) foot horizontally of each other.
A	PARALLEL: Installation of new sanitary sewer or storm drain pipeline in Zone A parallel to existing water main is not allowed unless approved by the Director of Public Works and requires a waiver from the California State Water Resources Control Board's Division of Drinking Water (DDW). ¹
B	PARALLEL: Requires a waiver from DDW.¹ Existing sanitary sewer or storm drain pipeline parallel to a new water main and does not meet the requirements of Case 1 - Zone B: The new water main shall be constructed of: 1. Ductile Iron Pipe per standard C150/A21.50-02 2. AWWA C900 PVC DR 14 (blue color pipe for water).

¹ For the Separation Waiver Request Process, see Section 1.10.5.d of these Sewer Specifications

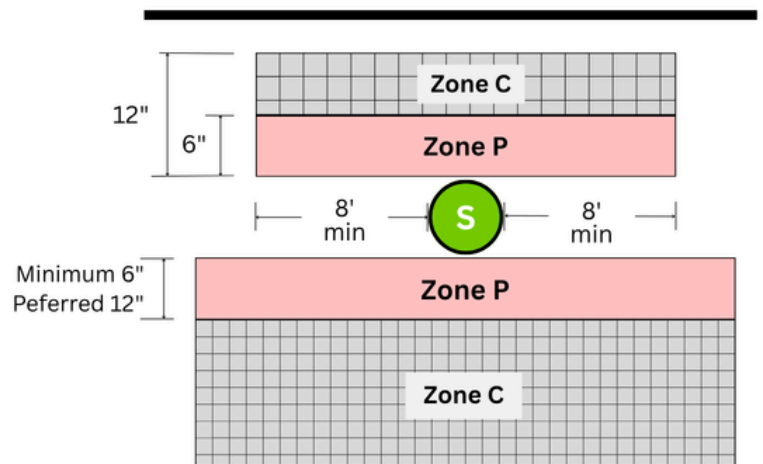
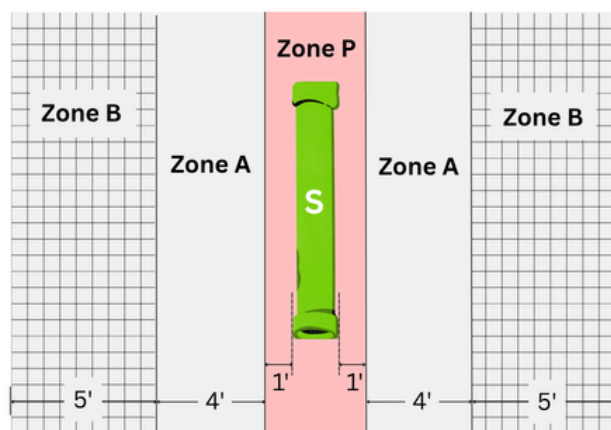
1.10 DESIGN AND LOCATION OF SEWER MAINS AND BUILDING COURT MAINS (continued)

CASE 2 - NEW WATER MAIN

(See Figure 2 and Appendix B for Reference Standards)

Zone	Special Construction Requirements
C	CROSSING: Requires a waiver from DDW.¹ Existing sanitary sewer or storm drain pipeline crossing a new water main and sewer pipe does not meet the requirements for Case 1 - Zone C: The new water main shall have no joints within a minimum of eight feet from either side of the sanitary sewer or storm drain pipeline and shall be constructed of the same materials specified for Case 2 - Zone B, above.

¹ For the Separation Waiver Request Process, see Section 1.10.5.d of these Sewer Specifications



Case 2 - Figure 2

Water Main Parallel or Crossing
Sanitary Sewer or Storm Drain Pipeline

1.11 DESIGN AND LOCATION OF BUILDING SEWERS/HOUSE SEWERS

All Building Sewers/House Sewers (Sewer Laterals) shall be designed to comply with these Sewer Specifications and shall be located and installed to the lines and grades shown and the approved Plans. A separate and independent Building Sewer shall be provided for every building. Exceptions to the "Separate Sewers" rule are detailed in Section 11-3.351 of Chapter 11, Article 3 of the Hayward Municipal Code.

Building Court House Sewers shall meet the requirements for Building Sewers/House Sewers.

1. SIZING, SLOPE, AND MATERIAL: All Building Sewers shall be sized according to the requirements of the California Plumbing Code. Subject to the approval of the Engineer, the minimum size for Building Sewers is 4 inches. All sanitary sewers shall be designed at a uniform grade (constant slope) between cleanouts. The table below lists the absolute minimum and maximum slopes for Building Sewers/House Sewers, and the flow quantity when the pipe is half full. It is recommended that Building Sewers be designed at a minimum slope of 1.25 times the absolute minimum pipe slope, to make allowances for adjustments during construction. Building sewers (sewer laterals) shall be PVC or HDPE, unless approved by the Engineer.

Minimum Pipe Slope for Building Sewers, House Sewers, Building Court House Sewers and Sewer Laterals

Manning Roughness Coefficient, $\eta = 0.0130$

Pipe Diameter (inch)	Absolute Minimum Slope ft/ft (% slope)	Max. Flow Cap. at Min. Slope (gpm)	Maximum Slope ft/ft (% slope)	Max. Flow Cap. at Max. Slope (gpm)	Flow Depth as % of Pipe Size
4	0.0208 (2.08%)	134.6	0.2035 (20.35%)	195.9	50
6	0.0142 (1.42%)	152.0	0.1191 (11.95%)	440.6	50

1.11 DESIGN AND LOCATION OF BUILDING SEWERS/HOUSE SEWERS (continued)

2. DEPTH OF COVER: Whenever possible, the Building Sewer shall be brought to the building at an elevation below the lowest floor being served. The Building Sewer shall be laid at a uniform grade (constant slope), and the depth shall be sufficient to afford a minimum of 30 inches of cover for non-metallic pipe and 24 inches for metallic pipe, within the lot boundaries.

The top of the Building Sewer pipe at the point of connection shall be at the same or at a higher elevation than the top of the public sewer pipe.

The portion of the Building Sewer in the street shall be at right angles to the right-of-way lines and at least 3 feet below the top-of-curb grade. In the situation where it is necessary to install a Building Sewer in the street at less than three (<3) feet below the top-of-curb grade, the Building Sewer must be covered with at least six (≥6) inches of concrete, or it must be constructed of ductile iron pipe. Where it is necessary to increase the slope of the Building Sewer to connect to the Sewer Main, one change in slope not to exceed 45° (½ bend) is permitted with the written approval of the Engineer. Refer to Standard Detail SD-312, "House Sewer" (*Sewer Lateral Connection*).

3. ALIGNMENT: The Building Sewer shall be laid in a straight alignment and at an adequate distance from a building foundation. **No Building Sewer shall be laid parallel and within the soil bearing area of the footing of any bearing wall,** which might be weakened thereby. Where direct alignment is not practical, one change in alignment not to exceed 22-½ ° may be made in the portion of the Building Sewer within the lot boundaries without additional cleanouts. Any additional changes in alignment shall be served by a cleanout (refer to Standard Detail SD-313, "House Sewer").
4. CLEANOUTS: Cleanouts shall not be located in streets and shall not be used on public sewer mains. Cleanouts shall be installed at the following locations on Building Sewers (sewer laterals):
- a. At any change in alignment.
 - b. At the connection with the building drain.
 - c. At uniform intervals not to exceed 100 feet.

1.11 DESIGN AND LOCATION OF BUILDING SEWERS/HOUSE SEWERS (continued)

5. BACKWATER VALVES: If the lowest fixture or outlet in any building is below the rim elevation of the nearest manhole, cleanout, or riser upstream from the connection to the public sewer, a backwater valve or overflow device of an approved type shall be installed in the building sewer (refer to Standard Detail SD-314, "Backflow Preventer").
6. SEPARATION CRITERIA: Building Sewers shall conform to the following separation requirements:
 - a. Parallel Construction: The minimum separation between Building Sewer pipelines and publicly-owned water service pipelines of 2 inch diameter or less, including water meters, shall be a minimum of 5 feet horizontally measured from the nearest edges of the facilities. The minimum separation between Building Sewer pipelines and publicly-owned water service pipelines greater than 2 inch diameter shall be a minimum of 10 feet horizontally measured from the nearest edges of the facilities.
 - b. Perpendicular Construction (Crossing): Building Sewer pipelines shall be at least 12 inches below water service pipes and any underground water pipes where these pipelines must cross, measured from the nearest edges of the facilities.
 - c. Common Trench: Building Sewer and building drainage piping shall not be run or laid in the same trench with water service pipes or any underground water pipes.
 - d. Alternative Criteria for Construction: Local conditions, such as available space, limited slope, existing structures, etc., may create a situation where there is no alternative but to install water service, Building Sewer and/or building drain lines at a distance less than that which is required above. In such cases, the Engineer will require alternative piping materials be used to prevent insanitary conditions.
7. Sewer Lateral Couplings: Couplings for sanitary sewer laterals shall be made with the appropriate stop, repair, or mechanical/compression coupling as detailed in Section 2.06, "Couplings and Reducers," of these Sewer Specifications.

1.12 DESIGN AND LOCATION OF SEWER MANHOLES AND INDUSTRIAL WASTE MONITORING STRUCTURE

1. MANHOLES: Manholes shall be installed per the following requirements and at the following locations on Building Court Main Sewers and public sewers:
 - a. For pipe diameters less than 15 inches, a standard 48-inch diameter manhole shall be used. Refer to Standard Detail SD-304 Sheet 1 of 2, "Precast Concentric Sanitary Sewer Manhole".
 - b. For pipe diameters of 15 inches or greater, a standard 60-inch diameter manhole shall be used. Refer to Standard Detail SD-304 Sheet 2 of 2, "Precast Concentric Sanitary Sewer Manhole".
 - c. Manhole frame, cover, and pan shall be per Standard Detail SD-307, "Manhole Frame, Cover, and Pan."
 - d. Sewer manholes located in unimproved areas (e.g., unpaved areas, easements, or landscaped areas) shall include a concrete maintenance pad extending a minimum 2 feet from the edge of the manhole frame in all directions.
 - e. At the connection of a Building Court Main Sewer to the public sewer.
 - f. At any change in direction or grade.
 - g. At intervals not to exceed 400 feet.
 - h. At the upstream end of the pipeline.
 - i. Where two sewer lines converge that are both 6 inches diameter or greater, the connection shall be made at a manhole.
 - j. When connecting a new sewer pipe to an existing manhole, a new manhole shall be constructed if the diameter of the new pipe exceeds that of the existing sewer pipe by more than 2 inches

1.12 DESIGN AND LOCATION OF SEWER MANHOLES AND INDUSTRIAL WASTE MONITORING STRUCTURE (continued)

k. Residential sanitary sewer laterals of 4 inches diameter or less shall not connect directly to manholes. The point of connection shall be made directly to the sewer pipeline and at a minimum of five (5) feet away from the nearest manhole. See Note 5 above for additional requirements.

l. Cleanouts and risers are not allowed in the public sanitary sewer system; manholes shall be constructed instead.

2. INDUSTRIAL WASTE MONITORING STRUCTURES: Industrial waste monitoring structures shall be installed per Standard Detail SD-309, "Industrial Waste Monitoring Structure." The monitoring structure shall be situated on the user's premises and not obstructed by landscaping, equipment, or parked vehicles, or in the way of oncoming traffic. The aggregate flow from the business operations, excluding domestic waste, shall be discharged through the SD-309 monitoring structure. In the event of a multi-tenant building, the monitoring structure shall be installed on each tenant's dedicated sanitary sewer line and not comeingle with other tenant's waste and domestic waste.

1.13 CONNECTIONS TO EXISTING SEWER MAINS

Connections to the existing sanitary sewer mains shall be constructed at the locations shown on the approved Plans. The Applicant shall perform all work necessary to complete the connection at Applicant's expense. Refer to Part 3 "Installation" of these Sewer Specifications for detailed sewer installation and connection requirements.

Connections of new sewer main pipe to existing sewer main pipe shall be made with the appropriate stop, repair, or mechanical/compression coupling as detailed in Section 2.06, "Couplings and Reducers," of these Sewer Specifications.

Existing sanitary sewer manholes, which are affected by the new vertical alignment of the new sanitary sewer pipe shall be replaced or reconstructed with the manhole base channelized for the connection of the new pipe(s), as required by the Engineer (refer to Section 3.19, "Sanitary Sewer Manhole Repair," of these Sewer Specifications). Applicant may elect to replace the existing sanitary sewer manholes that the Engineer has indicated must be reconstructed with new standard precast concentric manholes, frames and covers. Refer to Section 3.18, "Sanitary Sewer Manhole Construction," of these Sewer Specifications for detailed construction requirements.

1.13 CONNECTIONS TO EXISTING SEWER MAINS (continued)

1. Wastewater Flow Control: All existing sanitary sewer flows shall be accommodated throughout construction. All work shall be done without interruption of service or inconvenience to the public at all times. It shall be the Applicant's responsibility to maintain sewer flows through the project site at all times. Applicant shall schedule and coordinate the work to avoid any interference with normal operation of the sewer. A bypass plan shall be submitted and approved by the City. Refer to Section 3.04, "Wastewater Flow Control (Bypass Pumping)," of these Sewer Specifications for detailed wastewater flow control requirements.
2. Debris Protection: Debris protection shall be provided by installing false manhole bottoms, or other acceptable methods approved by the Engineer, to keep debris and foreign materials from entering the sewer system and shall be required for all existing sanitary sewer manholes within the project limits. False bottoms shall be removed within 3 calendar days after completion of paving in the presence of a City public works inspector or representative. The false bottom shall be adequately sized to prevent debris from entering the sewer system and shall not obstruct flow at any time.

If any debris or foreign materials enter the sewer system due to Applicant's operations, the Applicant shall clean and flush and CCTV the affected pipelines at their expense and in the presence of a City public works inspector or representative. If the Applicant is unable to clean and flush the pipelines, City crews and equipment can be used at the Applicant's expense.

3. Cleaning and Testing: Refer to Section 3.21, "Cleaning and Testing of Sanitary Sewer Mains," of these Sewer Specifications for requirements prior to wastewater discharge to the newly installed sewer system.

1.14 SANITARY SEWER EASEMENT (SSE)

When easements are required for public sanitary sewer facilities, the Applicant shall dedicate a public Sanitary Sewer Easement (SSE) to the City at no cost. The SSE shall include rights of ingress and egress for the purpose of construction, reconstruction, maintenance, and repair of public sewer facilities (sewer mains and manholes). If the public sewer facilities are located within a private roadway, then the entire roadway shall be a SSE. Otherwise, the required minimum easement width shall be determined in accordance with Table 1 below. The final location and width of the easement shall be subject to the approval of the Director of Public Works.

All SSE shall meet the following requirement, but not limited to:

- Roadways shall be paved to allow all-weather access, ensuring safe and efficient entry for operation and maintenance activities.
- Accessible at all times. Gate codes shall be provided. No vehicles parked within the easement. No facilities, overhangs, or structures are present within the easement.
- Provide the minimum required width per Table 1 below to accommodate equipment and the largest service truck for maintenance of the sanitary sewer facilities within the easement.

Facilities and improvements such as, but are not limited to, structures, storage shed, stormwater retention/treatment facilities, deep rooted landscaping, trees, retaining walls, dumpsters, and garbage bins are not allowed within the SSE. The entire “air space” above-ground and over the SSE shall be clear of any facilities and improvements.

Table 1: The minimum required width for a City of Hayward Sanitary Sewer Easement is based on pipe diameter and pipe depth, as outlined below.

Pipe Diameter (inch)	Depth (feet, finished grade to invert)	Easement Width (feet)
≤ 12	≤ 9	15
≤ 12	> 9	20
> 12	Any depth	20

1.15 SANITARY SEWER IMPACT EVALUATION

A sanitary sewer system impact evaluation will be required for all projects including 50 or more equivalent dwelling units. For projects with less than 50 equivalent dwelling units, the need for a sanitary sewer impact evaluation will be determined on a case-by-case basis by the Director of Public Works or their designee. The City will manage the preparation of the evaluation. The Applicant shall be responsible for all costs associated with the evaluation as well as the design and construction of any necessary improvements identified in the City's sanitary sewer collection system to accommodate the project and/or as determined by the Director of Public Works or their designee. The recommendations from the evaluation shall be implemented in the project's sanitary sewer improvement plans. Please refer to the City's latest Master Fee Schedule for the deposit amount.

1.16 GUARANTEE

The Applicant hereby guarantees all the following:

1. Any work performed by the Applicant shall be performed in a manner approved by the Engineer.
2. The Applicant shall provide the City submittals for review. Refer to Section 1.08, "Submittals," of these Sewer Specifications.
3. Any material furnished by the Applicant shall be materials listed upon the City's "Sewer System Approved Materials" list (included in Appendix A).
4. Both the work and materials shall fully comply with the requirements of these Sewer Specifications.
5. The completed sewer mains, manholes, and appurtenances shall be in accordance with the requirements of these Sewer Specifications.

The Applicant hereby agrees to promptly reinstall, at their own expense, any part of the sewer main, manhole, or any appurtenance that has not been installed in accordance with these Sewer Specifications.

1.16 GUARANTEE (continued)

The City has sole responsibility for making repairs to the pipeline once it is placed in service. The Applicant further agrees that if, within a period of one (1) year after written final acceptance of any portion of the work done under the project, any part of said pipelines or other structures furnished and installed or constructed by them, has developed leakage or fails to fulfill any of the requirements of these Sewer Specifications, or should the pavement or ground surface over the trench be damaged due to settlement of the backfill or due to poor material and/or workmanship, the Applicant shall reimburse the City for all costs of said repairs (including overhead costs to be determined at the time of work).

The Applicant shall be responsible for the full expense incidental to making good any and all of the above guarantees and agreements. The above guarantees and agreements are covenants, the performance of which shall be binding upon the Applicant and their sureties.

1.17 CLEANUP OF SITE

During the progress of the work, the Applicant shall keep the sites in a neat and sanitary condition and shall leave them so at the conclusion of the work. The Applicant shall dispose of refuse as often as directed by the City, so that at no time shall there be any accumulation of rubbish and excess materials. In the event that known contaminants are encountered during the installation of a sewer main, manhole, or appurtenances, the Applicant shall provide and carry out a remediation plan at their own expense. Refer to Section 3.06, "Dust Control and Storm Drain Pollution Prevention," of these Sewer Specifications for additional requirements.

1.18 STAGING AREA

The Applicant shall make their own arrangements for a staging area for the temporary stockpiling of material and equipment storage. The Applicant shall not be allowed to use public streets or property for such purposes.

Prior to using any property as a staging area, the Applicant shall submit to the Engineer a written release from the property owner absolving the City of any and all responsibility in connection with the use of such property in accordance with Section 5-1.20B(4), "Contractor-Property Owner Agreement," of the Standard Specifications. Refer to Section 1.18, "Responsibility of the Applicant," of these Sewer Specifications for additional requirements.

1.19 RESONSIBILITY OF THE APPLICANT

The Applicant shall protect, restore, or cause to be restored all damaged property, including sidewalks; curbs and gutters; pipes; conduits; gas, water and other services; meter boxes; sewers; monuments; stakes; trees; shrubs and other plantings; and other public or private property to a condition as good as it was when they entered upon the work.

The Applicant shall provide and maintain such fences, barricades, signs, warning lights, traffic control and flaggers as may be required to provide safety against accidents to the public. The maximum spacing between the warning lights is less than or equal to fifty (≤ 50) feet along the length of the trench where it is adjacent to or within the boundaries of a thoroughfare. No material or other obstruction shall be placed within fifteen (≤ 15) feet of fire hydrants. No construction material, equipment, or other material shall be left overnight within the City right-of-way or easement. No construction equipment, tools, or any other materials shall be stored on private property and/or planter areas during working hours that are not directly within the work area.

Convenient access to driveways, houses, and buildings along the line of work shall be maintained at all times. Temporary approaches to, and crossings of, intersecting streets shall be provided and kept in good condition.

If any improvements or facilities such as, but are not limited to, fencing, walls, landscaping, etc., need to be removed from private property or within the City right-of-way or easement to complete the work, appropriate temporary facilities shall be provided and maintained throughout construction to ensure safety. The Applicant is responsible for restoring the affected area to its original condition or better upon completion of the work.

All safety orders, rules, and recommendations of the Division of Industrial Safety of the Department of Industrial Relations of the State of California applicable to the work to be performed under this contract shall be obeyed and enforced by the Applicant. The Applicant shall comply with all applicable City regulations, to include the current CAL-OSHA Standards.

The Applicant's/Contractor's attention is directed to Section 5-1.17, "Character of Workers," of the Caltrans 2018 Standard Specifications. Under this section, the City Engineer or their designee, has the authority to require the Contractor to immediately remove, from the project, any worker whom the Engineer determines to be incompetent, disorderly, or acting improperly. No such worker shall be re-employed on the work without prior approval of the City Engineer.

The City right-of-way shall be used only as needed for active construction. No equipment, materials, or debris may remain in the right-of-way outside of working hours.

PART 2: MATERIALS

2.01 GENERAL

All materials shall be new. Material shall be covered and stored off the ground in a clean and tidy environment. During installation, pipe ends shall be covered at the end of each work shift. The materials and joints specified in these Sewer Standards are the minimum approved standards that shall be used.

All materials used and all joints made in or entering the construction of sanitary sewer systems or parts thereof shall be watertight and free from defects. All materials used shall be of adequate strength and durability and of such design as providing a substantial watertight system free from irregularities in flow lines. All joints and connections shall be made gas-tight and water-tight. Cement joints will not be permitted.

The City Engineer or their designee may require sewer pipelines to be constructed with seismic design features on a case-by-case basis. Sewer pipelines that cross or are located within the vicinity of earthquake zones, such as the Alquist Priolo Fault Zone, shall incorporate seismic design features. The City Engineer or their designee may provide additional specifications and requirements for earthquake-resistant pipe materials and installation.

2.02 POLYVINYL CHLORIDE PIPE AND FITTINGS

Polyvinyl chloride (PVC) pipe, fittings, couplings, and joints shall meet the requirements of ASTM D3034 for sizes 4 inch to 15 inch. PVC pipe for sewer mains shall be green color.

1. SDR 26 shall be used to a maximum depth of 14 feet or as recommended by the manufacture, whichever is less.
2. C900 PVC DR 14 (green color pipe for sewer) shall be used to a maximum depth of 24 feet or as recommended by the manufacture, whichever is less.
3. For depths deeper than 24 feet, a specific pipe material analysis and design by the Applicant's engineer shall be required and submitted to the City.
4. PVC pipes and fittings shall have proper markings, which shall remain legible during normal handling, storage and installation. The markings shall clearly identify the manufacturer's name, nominal pipe size, standard dimension ratio or dimension ratio, product type, and standard specification designation.

2.02 POLYVINYL CHLORIDE PIPE AND FITTINGS (continued)

5. Gaskets shall meet the requirements of ASTM F477, and gasketed fittings shall meet the requirements of ASTM F1336. Joints shall be of the bell-and-spigot type and meet the requirements of ASTM D3212.
6. PVC pipes shall be by Diamond Plastics, JM Eagle, Vinyltech, or approved equal.
7. For AWWA C900 or C905 PVC pipe, DR 14 (green color pipe for sewer) shall be used.

A Certificate of Compliance with all provisions of these Sewer Specifications shall be furnished by the manufacturer for all pipe furnished.

2.03 VITRIFIED CLAY PIPE

Vitrified clay pipe (VCP) **is not allowed** on the City's sanitary sewer system unless approved by the City Engineer.

2.04 DUCTILE IRON PIPE AND FITTINGS

Ductile iron pipe (DIP) and fittings shall conform to AWWA C150/A21.50 and AWWA C151/A21.51.

1. DIP and fittings shall be polyethylene lined and seal coated in conformance to AWWA C104/-A21.4.
2. Standard asphaltic coating on the exterior, and Protecto 401™ ceramic epoxy lining by U.S. Pipe on the interior, or approved equal.
3. Thickness Class shall be Number 50 for pipe diameter of 6 inches through 36 inches and Number 51 for pipe diameter of 4 inch (4 inch pipe is for sewer laterals only).
4. All ductile iron pipe shall be polywrapped with black 8 mil thick polyethylene (refer to Section 2.10, "Protection from Corrosion," of these Sewer Specifications). If the pipe is cut to fit the required length, the exposed cut area of the pipe shall be coated with a minimum of 1 mil of bituminous material. Polywrap shall be V-Bio Polyethylene Encasement or approved equal.

2.04 DUCTILE IRON PIPE AND FITTINGS (continued)

5. Ductile iron pipe shall be U.S. Pipe, McWane Ductile, American DIP, or approved equal.
6. The outside coating shall be a minimum of 1 mil of bituminous paint conforming to AWWA C151/A21.51. Prior to lining, the exterior and interior of the spigot end, including the spigot face, shall be coated with a minimum of 8 mils of epoxy. Before lining the inside of the socket, including a portion of the gasket cavity and a portion of the pipe barrel, shall be coated with a minimum of 8 mils of epoxy.
7. Fittings shall be ductile iron, at least Class 54 thickness, and in conformance with AWWA C110/A21.10 or AWWA C153/A21.53 if compact fittings are to be used. Mechanical joints shall conform to AWWA C111/A21.11.
8. Each length of ductile iron pipe and fitting used shall be stamped or indelibly marked with the weight or grade thereof and the manufacturer's mark or name.

A Certificate of Compliance with all provisions of these Sewer Specifications shall be furnished by the manufacturer for all pipe and fittings furnished.

2.05 HIGH DENSITY POLYETHYLENE PIPE

High density polyethylene (HDPE) sewer pipe for trench, bursting and trenchless installations, shall be colored white or light gray, minimum SDR 17 Extra High Molecular Weight, High Density Polyethylene PE 4170, Type III, Grade P34, Cell Class PE345434C, D or E.

1. SDR 17 and PE 4170 shall be used to a maximum depth of twenty (20) feet.
2. For depths deeper than 20 feet, a specific pipe material analysis and design by the Applicant's engineer shall be required and submitted to the City.
3. Pipe shall have a co-extruded inner wall that is white or light in color. All pipes shall conform to ASTM D3350 and ASTM F714. HDPE pipe shall be Camcore™ by WL Plastics, Plexvue™ by Driscoplex, LightView™ by PolyPipe, or approved equal.
4. HDPE sewer pipe for sliplining shall be the same as above, except it shall be SDR 26 minimum.

2.05 HIGH DENSITY POLYETHYLENE PIPE (continued)

HDPE to HDPE pipe connections shall be butt fusion welded prior to installation. Where a mechanical coupling must be used (i.e., repair, final connection, connection to dissimilar pipe material), an internal stainless steel stiffener sleeve that is expanded hydraulically to create an interference fit with the pipe must also be used.

HDPE pipes shall have proper markings which shall remain legible during normal handling, storage and installation. The markings shall clearly identify the manufacturer's name, nominal pipe size, standard dimension ratio or dimension ratio, product type and standard specification designation.

A Certificate of Compliance with all provisions of these Sewer Specifications shall be furnished and signed by an authorized agent of the manufacturer. The date that the pipe was manufactured shall be included in the certification. A report on test results shall be furnished if requested by the City. Refer to Section 3.14, "Installing High Density Polyethylene Pipe By Trenchless Methods," of these Sewer Specifications for field fusion qualifications and certification requirements.

All materials used in the manufacture of the pipe shall meet the requirements for Type III, Class B, Category 5, Grade P34 material as described in ASTM D1248. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material for the pipe. Pipe shall be homogeneous throughout and free of:

1. Serious abrasion, cutting or gouging of the outside surface extending to more than ten (10) percent of the wall thickness in depth;
2. Visible cracks;
3. Kinking caused by excessive or abrupt bending;
4. Flattening;
5. Holes;
6. Blisters; and
7. Foreign inclusions or other injurious defects. The pipe shall be uniform in color (with the exception of the liner), opacity, density, and other physical properties. The average outside diameter and wall thickness of pipe and fittings shall be in accordance with ASTM D2122.

2.06 COUPLINGS AND REDUCERS

Connections where the bell end of the pipe has been removed or where a new sewer main pipe is to be connected to existing sewer main pipe shall be made with the appropriate stop, repair or mechanical/compression coupling, or an approved equal, as detailed below. Couplings shall only be used and installed in accordance with the manufacturer's recommendations. All couplings shall be marked with the nominal size, product type and manufacturer's name/mark.

1. VITRIFIED CLAY PIPE (VCP): For connecting VCP to VCP, a shielded coupling consisting of two (2) 300 series stainless steel worm drive clamps, two (2) or four (4) surgical grade 316 stainless steel Nut and Bolt clamps, and a heavy duty 301 series stainless steel shield, over a molded one-piece elastomeric sealing gasket. Couplings shall meet ASTM C425. The coupling shall be a "Flex-Seal Adjustable Repair Coupling (ARC)" by Mission Rubber Company or approved equal.
2. POLYVINYL CHLORIDE (PVC): For connecting PVC to PVC, a heavy wall gasketed PVC stop coupling of the same SDR as the pipe and conforming to ASTM D3034 and ASTM F1336 shall be used. The stop coupling shall be IPEX / Multi Fittings Coupling or approved equal.
3. DUCTILE IRON PIPE AND DISSIMILAR PIPE MATERIALS: For connecting Ductile Iron Pipe and dissimilar pipe materials an adjustable repair coupling with a stainless steel sheer ring and conforming to ASTM C425 and ASTM C1173 shall be used. The adjustable repair coupling shall be by Romac 501 or approved equal.

2.06 COUPLINGS AND REDUCERS (continued)

Pipe ends shall be cut square prior to installing a coupling. When a coupling does not have a "stop" rib for the ends of the pipes to butt against (i.e., a repair or closure coupling), the pipe ends must be marked at a distance equal to half the width of the coupling to ensure proper installation. During post-installation inspection, the gap between a pipe end and a stop rib shall not exceed ½-inch at any point around the joint. If the coupling does not have a stop rib, the gap between pipe ends shall not exceed ¾-inch at any point around the joint. Additional measures to secure the coupling to the pipes (i.e., a mechanically restrained joint) may also be required as determined by the Engineer.

Where reducers are necessary and approved for connections to existing pipelines, reducers shall be eccentric type manufactured of approved pipe material. Coupling connections shall not be made to a reducer, and reducing couplings will not be allowed. Reducers will only be allowed for special situations as determined necessary by the Engineer.

2.07 SANITARY SEWER MANHOLES

Concrete for special manhole structures shall conform to Section 90-2, "Minor Concrete," of the Standard Specifications. Reinforcing steel for special manhole structures shall conform to Section 52, "Reinforcement," of the Standard Specifications.

Standard manholes shall be per Standard Detail SD-304, "Precast Concentric Sanitary Sewer Manhole", ASTM C478, and the following requirements.

Manhole base shall be constructed using cast-in-place Class 'B' concrete placed over a minimum of 6 inches of compacted aggregate base or crushed rock. Concrete shall be cured for no less than 7 days after being placed. After concrete has cured, stacking of manhole components on cast-in-place bases can commence. Duration may be modified with the quick set upon approval by the City Engineer. Reinforcing steel shall have a minimum cross-sectional area of three-tenths (≥ 0.30) square inches per foot in both directions.

Sanitary sewer manholes shall not have any steps. The top and bottom of all manhole sections shall be parallel. Joints shall be tongue-and-groove type. The Portland cement used in the precast sections shall conform to ASTM C150, Type II.

2.07 SANITARY SEWER MANHOLES (continued)

Cones shall be manufactured of the same materials, strength and quality requirements as the straight sections. The cones shall be concentric and shall have a maximum height of 3 feet.

Precast manhole sections shall be joined using preformed plastic gaskets conforming to Federal Specification SS-S-00210A, "Sealing Compound, Preformed Plastic for Pipe Joints," and sized in accordance with the recommendations of the manufacturer of the precast sections. Gaskets shall be KentSeal No. 2 by Hamilton Kent Manufacturing Co., Ram-Nek by K.T. Snyder Co., or approved equal.

Mortar shall be standard premixed mortar conforming to ASTM C387 or proportion 1 part Portland cement to 2 parts clean, well-graded sand which will pass a 1/8-inch screen. Admixtures may be used but shall not exceed the following percentages by weight of cement: Hydrated Lime, 10%; Diatomaceous earth or other inert materials, 5%.

The throat of the manhole, including grade rings and frame, shall not exceed eighteen (≤18) inches.

The manhole frame, cover, and pan shall be per Standard Detail SD-307, "Manhole Frame, Cover, and Pan." Castings shall be tough, close-grained gray iron, free from all defects, and shall conform to ASTM A48, Class 30B. Bearing surfaces shall be planed or ground to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

Sewer manholes located in unimproved areas (e.g., unpaved areas, easements, or landscaped areas) shall include a concrete maintenance pad extending a minimum 2 feet from the edge of the manhole frame in all directions.

Drop assemblies shall be constructed per Sheet 1 of Standard Detail SD-306, "Sanitary Sewer Drop Connection."

All plastic pipe connections to manholes and stubouts shall have a rubber waterstop tightly banded to the pipe and cast into the manhole base. Banding material shall be stainless steel or other corrosion resistant material.

Pipe for stubouts shall be the same sewer pipe as approved and furnished for the project, unless otherwise indicated on the approved Plans. Each stubout will require a rubber gasketed watertight plug similar to the gasketed joints of the sewer pipe being used or an expandable type of standard sewer plug.

2.08 SEWER LATERAL CLEANOUT RISER

Each cleanout shall consist of a wye of the same material as the building sewer in which it is installed and fitted with a watertight removal plug of the same material as the building sewer pipe. The cleanout shall consist of an extension from the cleanout wye to the ground surface and fitted with a cap/plug. The top of the cap/plug shall be a minimum of 2 inches below the subgrade and a minimum of 4 inches below the top of the cleanout box. Refer to Standard Detail SD-313, "House Sewer," for additional requirements.

2.09 BACKWATER AND GATE VALVES

Backwater valves (also called backflow preventers) shall have cast iron bodies, with bearing parts of non-corrosive metal or material, be so constructed as to ensure a positive mechanical seal and remain closed except when discharging wastes, such as a ball-type polyethylene backflow preventer. Backwater valves shall be so designed as not to cause a restriction of flow or deposit of solids. The backwater valve shall be installed in a round precast concrete valve box with a perforated cover. Valve box and access cover shall be installed in an approved manner to be readily accessible at all times. Refer to Standard Detail SD-314, "Backflow Preventer," for installation requirements.

Gate valves, when used on sanitary sewer work, shall be fullway-type with working parts of non-corrosive metal. Valves 4 inches or more in diameter shall have cast iron bodies, and valves smaller than 4 inches may have either cast iron or brass bodies. All valve boxes and covers installed in easements or right-of-way shall be Chisty G-5 Traffic Valve Box or approved equal, per Standard Detail SD-205, "Valve Installation." Note that for sewers, the covers shall have "S" or "SEWER" cast on or engraved into the top, and thrust blocks may not be required (as determined by the Engineer).

2.10 PROTECTION FROM CORROSION

Corrosion protection shall meet the requirements of these Sewer Specifications and as shown on the Plans. **Where corrosion protection requirements for directly buried ferrous metal have not been shown on the Plans or specified in detail, a mastic or tape coating shall be applied.**

The determination of the type of coating to be applied in each instance shall be reserved to the Engineer. Ferrous metal items to be protected shall include, but not be limited to, valves, fittings, service lines, reinforcing steel, anchor rods, flexible couplings, bolts, and nuts, flanges, saddles, tapping sleeves, hydrant buries, and plugged end and blow off assemblies. **Mastic and tape coated ferrous metal shall also be protected with polywrap.**

All copper piping or any copper or brass part shall not be permitted to contact steel or cast iron pipe at any point. If contact is unavoidable, the copper or brass part shall be mastic or tape coated. All cast iron, steel or other ferrous metal shall be insulated from any concrete structure, such as footings, anchor blocks, encasements or structure walls using mastic, tape coating or other specified coating system extending a minimum of six (≥6) inches beyond the concrete. All coatings shall be continuous, unbroken, and pinhole free. Protective coatings shall only be applied over a properly prepared surface.

1. POLYWRAP (Polyethylene Protective Wrapping)

- a. General purpose adhesive tape shall be 2 inches wide by minimum 10 mils thick, Scotchrap No. 50, Tapecoat CT, Protecto Wrap No. 200, or approved equal.
- b. Polywrap shall conform to AWWA C105/A21.5 for Type 1, Class C (black), Grade E1, and shall be V-Bio Polyethylene Encasement or approved equal. Minimum tube sizes are listed below:

2.10 PROTECTION FROM CORROSION (continued)

Polywrap Flat Tube Width (inches)

Pipe Diameter Size (inch)	Ductile Iron Pipe with Bell & Spigot Joints	Ductile Iron Pipe with Mechanical Joints
4	14	16
6	17	20
8	21	24
10	25	27
12	29	30

2. MASTIC COATING: Protective mastic coating shall be a coal tar synthetic resin solvent release, cold applied coating. The mastic coating shall be Protecto Wrap CA 1200 Mastic or approved equal.
3. TAPE COATING PRIMER: Primer for tape coating shall be Protecto Wrap No. 1170, or approved equal.

2.11 TRENCH SECTIONS

Materials for trench sections shall be per Standard Detail SD-125, "Permit and Subdivision Trench Sections," and per these Sewer Specifications.

1. ASPHALT CONCRETE: Asphalt concrete (AC) for pavement replacement shall be Type A and shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these Sewer Specifications. AC shall be produced from commercial quality virgin asphalt and aggregates and shall conform to the following requirements:
 - a. Asphalt concrete shall be produced at a central mixing plant.
 - b. Aggregate shall conform to the ½ inch maximum, medium grading specified in Section 39 of the Standard Specifications, except that ¾ inch maximum medium grading may be used below the top 0.15 feet (i.e., final lift).
 - c. **Temporary pavement shall be maintained at all times until final paving is completed.** Temporary pavement shall consist of asphalt concrete conforming to the requirements herein or cutback asphalt concrete consisting of a mixture of cutback asphalt and minimum sized aggregate as specified by the Engineer.
Cutback asphalt concrete installed in trenches from October through April shall be maintained at all times. Contractor shall monitor these locations and perform repairs as needed to ensure structural integrity.
2. AGGREGATE BASE: Aggregate Base (AB) shall be ¾ inch maximum Class 2 and shall conform to the provisions in Section 26, "Aggregate Bases," of the Standard Specifications and these Sewer Specifications.
3. QUARRY FINES and DRAIN ROCK: Aggregate for quarry fines and drain rock shall conform to the requirements per Standard Detail SD-125, "Permit and Subdivision Trench Sections," Sheet 2 of 3.
4. TRENCH TAPE: Trench tape shall be a minimum of 2 inches wide, green with white lettering, and shall carry the following inscription: "CAUTION BURIED SEWER LINE BELOW." Trench tape shall be Calpico, Allen Systems, or approved equal.

2.12 PORTLAND CEMENT CONCRETE

Materials for Portland cement concrete shall conform to the provisions in Section 90, "Concrete," of the Standard Specifications.

The concrete Classes A, B, C, and D specified in the City of Hayward Standard Details are defined as follows:

- Class A Concrete (6-sack-mix) shall contain not less than 564 pounds of cementitious material per cubic yard. (Typical for Precast Concrete Manhole sections)
- Class B Concrete (5-sack-mix) shall contain not less than 470 pounds of cementitious material per cubic yard. (Typical for Valve Boxes and Manholes)
- Class C Concrete (4-sack-mix) shall contain not less than 376 pounds of cementitious material per cubic yard. (Typical for Thrust, Reaction, and Support Blocks)
- Class D Concrete (7-sack-mix) shall contain not less than 658 pounds of cementitious material per cubic yard.

Materials for minor concrete shall conform to the requirements of Section 90-2, "Minor Concrete," of the Standard Specifications and these Sewer Specifications.

Reinforcing steel shall be Grade 40 or better and shall conform to Section 52, "Reinforcement," of the Standard Specifications.

2.13 SIDEWALK AND CURB AND GUTTER RESTORATION

Where existing sidewalk or curb and gutter are damaged by the installation of sewer facilities, appurtenances, or other construction activities, the Applicant shall replace them per Standard Detail SD-107, "Concrete Construction Special Provisions," and SD-108, "Sidewalk, Curb and Gutter, Island Curb, and Curb Ramp Sections."

Base rock material shall consist of Class 2 Aggregate Base per Section 2.11, "Trench Sections," of these Sewer Specifications and shall be a minimum of 4 inches thick unless otherwise noted on the approved plans.

2.13 SIDEWALK AND CURB AND GUTTER RESTORATION (continued)

Concrete for sidewalk shall be Class B, containing not less than 470 pounds of Portland cement per cubic yard, and shall conform to Section 90, "Concrete," of the Standard Specifications. Refer to Section 2.12, "Portland Cement Concrete," of these Sewer Specifications for additional requirements. In addition, concrete shall contain 1 pound of lamp black per cubic yard. All concrete repairs shall extend to the nearest score line or control/expansion joint.

2.14 MICROSURFACING

Microsurfacing shall be per Section 37-3 of the Standard Specifications and per the City of Hayward Public Works Engineering specifications, which will be provided by the City as a supplement to these Sewer Specifications. Also refer to Standard Detail SD-126, "Pavement Mitigation For Streets On Moratorium."

In case of conflict between the Standard Specifications and the City of Hayward Public Works Engineering specifications, the City of Hayward Public Works Engineering specifications shall govern for microsurfacing. The City may require the Applicant to provide material submittals for review and approval prior to microsurfacing. Slurry seal shall not be used within the City.

2.15 MARKER POSTS

Marker posts shall be per Standard Detail SD-222, "Facility References" and shall be placed at the locations shown on the approved Plans except where location can be marked on curbs.

PART 3: INSTALLATION

3.01 GENERAL

All new sewer mains shall be in conformance with these Sewer Specifications and shall be installed to the lines and grades shown and the approved Plans. The alignment and elevation of the sewer main and appurtenances shall be established in the field by the Applicant either by measurements from curb and gutter or by surveying based upon and conforming to the approved Plans.

All materials shall be new. Material shall be covered and stored off the ground in a clean and tidy environment. Pipe ends shall be covered at the end of the work shift during installation

The location of manholes, valves, and other appurtenances to be installed shall be clearly referenced by offset stakes or by marking the curb. All installed appurtenances shall be protected from damage. Operating nuts (in the valve pots) of valves controlling live lines shall be accessible and operational at all times.

Connections of a new sewer main pipe to an existing sewer main pipe shall be made with the appropriate couplings, as detailed previously in Section 2.06, "Couplings and Reducers," of these Sewer Specifications. When a coupling does not have a "stop" rib for the ends of the pipes to butt against, the pipe ends must be marked at a distance equal to half the width of the coupling to ensure proper installation. Refer to Section 1.13, "Connections To Existing Sewer Mains," of these Sewer Specifications for requirements for work in the vicinity of existing sewer mains.

The sanitary sewer pipe shall be installed without interruption of service or inconvenience to the public at all times. Existing flow of wastewater shall be rerouted during construction by the Applicant using satisfactory bypass facilities at their expense and with the approval of the Engineer. Temporary rerouting of wastewater flow shall be done in a safe and sanitary manner without creating health and safety problems, and without allowing sand, silt, rock, or any debris to enter the system. Use of storm drains, gutters, or the pipe trench for wastewater flow is strictly forbidden. The Applicant shall be held responsible for any damages resulting from rerouting the wastewater and from the use of any bypass facilities in rerouting the wastewater. Refer to Section 3.04, "Wastewater Flow Control (Bypass Pumping)," of these Sewer Specifications for detailed wastewater flow control requirements.

The Applicant is specifically cautioned as to the possibility of empty pipeline floating due to flooding of the trench by ground water, rain water or backfill consolidation. For this reason, "jetting" for backfill consolidation will not be allowed.

3.01 GENERAL (continued)

Should any pipe sections be flooded by water in the trench, that reach of pipeline shall be removed, any damaged pipe repaired, the trench re-excavated, de-watered, and the pipe reinstalled at the Applicant's expense.

The interior of the pipe shall be kept free from dirt and debris as the pipe laying progresses. Care shall be taken to make certain that the pipe, after proper cleaning, remains clean. **Open ends shall be plugged watertight when work is stopped, or for any other reason work is left unattended.** All openings in the pipeline shall be kept covered or plugged at all times.

Existing manholes shall be protected from debris by installation of false bottoms, or other acceptable methods approved by the Engineer. Refer to Section 1.13.B Debris Protection of these Sewer Specifications for false bottoms requirements.

Pipe shall be inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be rejected, at the sole discretion of the Engineer. Any corrective work shall be approved by the Engineer and shall be at no cost to the City.

Pipe shall be laid up-grade with the bell (socket or collar) ends of the pipe up-grade. The pipe ends shall be marked to indicate insertion stop position and to ensure that pipe is inserted into pipe or fitting bells to this mark. If full entry is not achieved, the joint shall be disassembled, cleaned and lubricated, and reassembled.

The spigot end of the pipe shall be lubricated with lubricant recommended by the pipe manufacturer. No other lubricant shall be used. The spigot end of a pipe shall be inserted into the bell end of another pipe so that it contacts the ring. The pipe sections should then be aligned and the spigot end pushed into bell end of the other pipe using methods recommended by the manufacturer.

Pipe shall be laid with uniform bearing under the full length of the barrel of the pipe. Suitable excavation shall be made to receive the socket or collar, which shall not bear upon the subgrade or bedding.

All excavations required to be made for the installation of a sanitary sewer system, or part thereof, inside or outside of a building, shall be kept open until the piping has been inspected and preliminarily approved. (Final approval occurs after successful completion of backfilling, testing and video inspection.)

3.01 GENERAL (continued)

If any sanitary sewer system or part thereof is covered or concealed before being regularly inspected and preliminarily approved, it shall be exposed upon the direction of the Engineer at no cost to the City.

When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Applicant shall excavate for, and expose, the existing improvement before laying pipe or conduit. The Engineer shall be provided with adequate notification and opportunity to inspect the existing pipe or conduit before connection is made. Any adjustments in line or grade which may be necessary to accomplish the intent of the Plans shall be made at no extra cost to the City.

Applicant shall reconnect all existing service laterals and intercepted operational sewer mains.

3.02 GRADING AND CURB AND GUTTER

Prior to installing a sanitary sewer main, earthwork and rough grading shall be completed and cut sheets of pipeline construction staking shall have been approved by the City. The pavement subgrade shall be acceptable to the City, or Alameda County if work is located in the unincorporated area, and curbs and gutters shall have been constructed. For construction staking requirements, contact the survey section in the Engineering and Transportation Division at 510-583-4730 .

Installation of a sewer main prior to curb and gutter construction may be considered for approval by the Engineer if the Applicant submits written verification to the Engineer that all the following conditions are met and are available for inspection:

1. The street area has been rough graded to the extent that the sanitary sewer main shall have a cover from the finished grade to the top of pipe per the approved Plans.
2. Construction survey stakes have been placed indicating curb grade and alignment, water main alignment and cuts for excavation for the water main in accordance with City requirements.

3.02 GRADING AND CURB AND GUTTER (continued)

3. Cut sheets indicating the elevation of the streets, curbs and the water main have been submitted to the City Survey Section and approved by the Engineer.
4. The alignment and grade of the street area are in accordance with the improvement plans approved by the City.
5. The main and appurtenances shall be located in accordance with Section 1.10, "Design and Location of Sewer Mains and Building Court Mains," of these Sewer Specifications.
6. The Applicant agrees to promptly relocate the main and appurtenances at their own expense should the street grade or alignment be changed for any reason after the main is installed.

3.03 ALIGNMENT AND SLOPE

All pipes shall be laid and maintained to the lines and grades per the approved Plans.

1. Open Trench Installation: For pipes installed by open trench methods, the allowed variance from the designed location and elevation of the pipe end at a manhole shall not be greater than three (≤ 3) inches horizontally (0.06%) and two (≤ 2) inches vertically (0.04%), while still maintaining the minimum required positive slope of the pipe. The maximum allowed variance from the design slope is $\pm 0.05\%$. At no point shall the slope be permitted to drop less than the minimum slope specified in Sections 1.10 and 1.11 of these Sewer Specifications, or the design slope per the approved Plans, whichever is less.

If the approved Plans indicate the pipe is to be laid at or less than the "absolute" minimum slope specified in Sections 1.10 and 1.11 of these Sewer Specifications, the elevation and the slope of the crown of the installed pipe shall be surveyed every fifteen (≤ 15) feet to verify that the design slope or absolute minimum slope limit, whichever is less, is not exceeded. The results of the survey shall be submitted to the Engineer for approval on a weekly basis at a minimum.

3.03 ALIGNMENT AND SLOPE (continued)

Trenchless Installation: For pipes installed by trenchless methods, the allowable variance from the design locations and elevations shall not be greater than the accuracy/tolerance of the trenchless method used. Any installation method with an accuracy/tolerance greater than 0.2% shall be pre-approved in writing by the Engineer. In addition, the minimum slope of the pipe to be installed shall be based on the accuracy/tolerance of the trenchless method and equipment used. For example, if a Mini-Horizontal Directional Drill (HDD) has an accuracy/tolerance of $\pm 12"$ in 600' of bore ($= \pm 0.167\%$), then the minimum (flattest) design slope for a 10" pipe installed by this Mini-HDD is 0.417% ($- 0.167 = 0.250$).

The table below lists various trenchless installation methods and their typical properties (Note that the use of a method listed below should not be considered as "pre-approved" nor should the use any method not listed be considered as "prohibited"):

Various Trenchless Methods

Trenchless Method	Bore Diameter (inch)	Max Length (feet)	Typical Casing and Pipe Material	Typical Accuracy/Tolerance
Jack & Bore (Auger Boring)	4 to 60	600	Steel Casing, any Carrier Pipe	$\pm 1\%$ of Bore Length ± 12 inches if Steered
Compaction (Push, Rotary or Percussion)	≤ 12	40 to 60	Any	Not Accurate
Pipe Ramming	2 to 55	200	Steel Casing, any Carrier Pipe	Not Accurate
Horizontal Directional Drill (HDD); Mini-HDD	12 to 60 2 to 12	2000 600	Steel, HDPE, PVC	$\pm 1\%$ of Bore Length ± 6 inches to ± 12 inches
Microtunneling	≥ 8	750	Any	± 1 inch Horizontal ± 1.5 inches Vertical

3.03 ALIGNMENT AND SLOPE (continued)

Trenchless Method	Bore Diameter (inch)	Max Length (feet)	Typical Casing and Pipe Material	Typical Accuracy/ Tolerance
Pipe Jacking	≥ 48	1600	Continuous Circumference Shield	±3 inches Horizontal ±2 inches Vertical
Utility Trenching (Tunnel Boring Machine)	≥ 48	Any	Segmented Circumference Shield	±1 inch

2. Connecting to Existing Building Sewers: Applicant shall make any necessary adjustments to the slope of the new pipe (i.e., raise or lower it) when connecting to existing Building Sewers (laterals) such that positive flow and minimum slopes are maintained in both the new sewer pipe and existing lateral. If the required adjustment to the new pipe exceeds the limits specified herein, the Applicant shall relay or replace up to five (≤5) feet of a sewer lateral at their expense and at no cost to the City or owner of the sewer lateral (if not the Applicant). These adjustments shall be documented, including a scaled sketch or plan, and submitted to the Engineer.

3. Other Utilities: Sewer mains shall not be run or laid in the same trench with water mains or service lines. Where a sanitary sewer or storm drain line parallels the path of a water main, standard horizontal separation shall be a minimum of ten (≥10) feet for sewers and five (≥5) feet for storm drains. Where these standard separation requirements cannot be met, the horizontal separation and pipe materials shall be constructed in accordance with the requirements in Section 1.10-E of these Sewer Specifications.

Where a sanitary sewer or storm drain line crosses the path of a water main, the standard vertical separation shall be a minimum of 12 inches with the water main located above the other utility. Where the standard separation requirement cannot be met, the vertical separation and pipe materials shall be constructed in accordance with the requirements in Section 1.10-E of these Sewer Specifications and per Standard Detail SD-224, "Ductile Iron Drop" and SD-303, "Sewer Construction in the Vicinity of Other Utilities."

3.04 WASTEWATER FLOW CONTROL (BYPASS PUMPING)

The existing sewers are currently and continuously receiving and conveying wastewater (sewage), and those functions shall not be interrupted except as specified herein. The Contractor shall coordinate the work to avoid any interference with normal operation. Contractor shall immediately correct any undesirable conditions, which result from bypassing or other operations.

Contractor shall provide labor, equipment, materials, and supervision to temporarily control flow around the Contractor's work during construction. Contractor shall not interrupt the functions of the existing sewers or cause sewer backups and is responsible for penalties and expenses in the event that their operations cause any violation of the City's discharge permit or in the event their operations result in any sewage spills.

It shall be the Contractor's responsibility to always maintain the sewer flows through the project site. A bypass shall be made by plugging existing manholes upstream of the Contractor's work and pumping the sewage to manholes downstream of the Contractor's work. Pumps and bypass piping shall be adequately sized to handle the flows to be bypassed without surcharging the system. Pumping system shall be sized for normal to peak conditions. Contractor shall monitor the level in the upstream manhole at all times to prevent system surcharging.

The bypassing plan and system shall be subject to approval by the Engineer. The pump, equipment, and bypass piping shall be in good working condition at all times. If the City determines whether any component is inadequate or not in proper condition, the Contractor shall immediately replace or repair it. Failure to comply may result in a work stoppage until the issue is resolved. If the Contractor is found to be in noncompliance with the required specifications, the City reserves the right to halt construction activities until all deficiencies are corrected to the satisfaction of the City.

Bypass pumping shall be done in a manner that will not damage private or public property or create a nuisance. At no time shall a private lateral be used for bypass purposes. The pumped sewage shall be in an enclosed pipe or hose that is adequately protected from traffic and/or pedestrians and shall be redirected into the sanitary sewer system. A temporary tank of adequate capacity may also be proposed for bypass pump discharge. Discharging sewage on private property, gutters, streets, sidewalks, or into storm sewers is prohibited. The Contractor shall be liable for all damages or fines (including fines imposed on the City as a result, of the Contractor's operations) associated with this work. After the work is completed, flow shall be restored to original conditions, and temporary facilities shall be removed.

3.04 WASTEWATER FLOW CONTROL (BYPASS PUMPING) (continued)

The Applicant shall submit a plan showing the size and layout of pumps and temporary pipelines. The layout shall also show how facilities will be protected during use. Applicant shall submit calculations and/or specifications showing the selected pumps are capable of pumping the anticipated flow. Calculations shall be stamped and signed by a Civil or Mechanical Engineer licensed in the State of California. Applicant shall submit catalog data for the pump controls and audible alarms and for generators. Applicant shall submit an emergency response plan to be followed in the event of a failure of the bypass pumping system.

The Contractor shall provide at least 5 business days advance notice to the Engineer of the location and schedule of flow control. Contractor shall set up and test the bypass operation and demonstrate proper operation a minimum of 72-hours prior to disrupting flows in section to be bypassed.

Wastewater shall not be allowed to escape or leak from the sewer system or from any bypass facilities at any time. Any leak, overflow or spill shall be documented and reported to the Engineer. Any leak or spill on the order of 1,000 gallons or more shall immediately be reported to the Engineer, Utilities Operation and Maintenance Manager at 510-881-7901 and to Water Pollution Source Control at 510-881-7900.

The Contractor shall clean and repair, at no cost to the City, any damage that may result from their negligence, inadequate or improper installation, maintenance and operation of bypassing and flow control system including mechanical or electrical failure.

The Contractor shall coordinate sewer bypass and flow interruptions with the City at least 15 business days in advance and with the property owners and businesses at least 72 hours and again at 24 hours prior to disruption.

3.05 MAINTAINING TRAFFIC

Attention is directed to Section 7-1.03, "Public Convenience;" Section 7-1.04, "Public Safety;" and Section 12, "Temporary Traffic Control Devices," of the Standard Specifications. Nothing in these Sewer Specifications shall be construed as relieving the Applicant from their responsibility.

1. STANDARD REQUIREMENTS

- a. Traffic Control Plans shall be submitted to the City Engineering & Transportation Department at least 20 business days in advance for review. For work on arterial streets, intersections, or bus routes, site-specific Traffic Control Plans are required. No detours shall be allowed.
- b. "No Parking" signs shall be posted at no greater than 50 foot intervals at least 72 hours prior to effective time of parking restriction. Contractor shall clearly indicate on the signs the day, date(s), and hours that "No Parking" is necessary.
- c. Temporary "No Parking" signs cannot be reused. New signs shall be posted for any schedule changes.
- d. Adequate traffic warning and control devices shall be provided and maintained by the Applicant during the contract period, in accordance with the current "Manual of Traffic Controls for Construction and Maintenance Work Zones," issued by the State Department of Transportation. When inadequate traffic warning and control devices have been installed, the City will require the Contractor to take appropriate measures to provide whatever facilities are deemed necessary to ensure proper traffic safety.
- e. Flaggers are mandatory at locations where equipment is intermittently blocking a traffic lane, or where only one lane is available for two-directional traffic. One flagger is required for each direction of traffic affected where only one lane is available for over 100 feet, or when required by the Engineer. Additional flaggers are required at intermediate uncontrolled intersections. When less than 20 feet of street width is available for two-directional traffic, one lane control shall be imposed with appropriate flaggers. Flaggers shall wear appropriate personal protective equipment and be able to communicate by radio with each other at all times. Flaggers shall be clearly visible to approaching traffic at all times.

3.05 MAINTAINING TRAFFIC (continued)

- f. Personal vehicles of the Applicant's employees shall not be parked on the traveled way at any time, including any section closed to public traffic. When entering or leaving roadways carrying public traffic, the Applicant's equipment, whether empty or loaded, shall in all cases yield to public traffic. Safe and convenient pedestrian access shall be provided, at all times.
- g. Applicant shall cooperate with local authorities related to handling traffic through the area and shall make their own arrangements related to keeping the working area clear of parked vehicles.
- h. Police services for traffic control are available upon request and shall be coordinated through the City of Hayward Police Department, Traffic Division, at 510-293-7011, 48 hours in advance. If excessive traffic congestion occurs at any time during the period of project construction due to the neglect of the contractor to provide adequate controls, the Engineer shall arrange the services of the Police Department. The traffic control services of the Police Department shall be at the Applicant 's expense.
- i. On all streets, the full width of the traveled way shall be open for use by public traffic on Saturdays, Sundays, holidays (refer to Table 1 below), after 4:00 p.m. on Fridays, and when construction operations are not actively in progress. Any exceptions will be described in the "Special Requirements" of this Section.
- j. In the event that the traffic control plan is determined to be ineffective, the Contractor shall resubmit a new traffic control plan for the Engineer's review and approval.
- k. Holidays mentioned above are listed in Table 1 below. These holidays are subject to change without notice.

3.05 MAINTAINING TRAFFIC (continued)

Table 1: Holidays observed by the City of Hayward

Holiday	Date
New Year's Day	January 1
Dr. Martin Luther King Jr. Day	3rd Monday in January
Lincoln's Birthday	February 12
Presidents' Day	3rd Monday in February
Cesar Chavez Day	March 31
Memorial Day	Last Monday in May
Juneteenth	June 19
Independence Day	July 4
Labor Day	1st Monday in September
Admissions Day	September 9
Indigenous Peoples' Day	2nd Monday in October
Veterans Day	November 11
Thanksgiving Day	4th Thursday in November
Friday after Thanksgiving Day	Friday following 4th Thursday in November

3.05 MAINTAINING TRAFFIC (continued)

Table 1: Holidays observed by the City of Hayward

Holiday	Date
Christmas Eve	December 24
Christmas Day	December 25
New Year's Eve	New Year's Eve December 31

1. SPECIAL REQUIREMENTS

- a. Traffic control for lane closure shall conform to the details per the State Standard Plans T-11, T-12, T-13, and T-14.
- b. A minimum of one (1) traffic lane, not less than ten (≥ 10) feet wide, shall be maintained in all areas. If only one (1) lane is available for two-way traffic, appropriate flagmen shall be used as specified in this section of these Sewer Specifications.
- c. Safe and convenient pedestrian access shall be provided at all times.
- d. Applicant shall install and maintain all construction signs conforming to State of California Standards and as directed by the Engineer.
- e. Applicant shall place new striping in kind for lane lines and pavement markings that have been removed by excavation.

3.06 DUST CONTROL AND STORM DRAIN POLLUTION PREVENTION

1. DUST CONTROL: Applicant shall implement dust control measures conforming to the provisions in Section 10-5, "Dust Control," of the Standard Specifications.
2. STORM DRAIN POLLUTION PREVENTION: Applicant shall comply with the requirements of Chapter 11, Article 5 of the Hayward Municipal Code, "Stormwater Management and Urban Runoff Control."
 - a. "Where best management practice guidelines or requirements have been adopted by any federal, State of California, regional, and/or City agency, for any activity, operation, or facility which may cause or contribute to stormwater pollution or contamination, illicit discharges, and/or discharge of non-stormwater to the stormwater system, every person undertaking such activity or operation, or owning or operating such facility, shall comply with such guidelines or requirements."
3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day or at a frequency noted by the City Engineer or City Forces. The use of dry power sweeping is prohibited.
4. The Contractor shall begin cleanup operations at least one hour before the end of each day's work, clean all paved portions of the project and paved streets leading from the project that have dust-producing materials or debris deposited upon them.

In addition, the Contractor shall provide continuous cleanup and debris/dust control at all times. Daily cleaning activities shall employ the use of a street sweeper capable of spraying for dust control and vacuuming and removing all debris from City streets. All cleaning activities shall be concluded by the end of the working hours.

3.07 WATERING (CONSTRUCTION WATER METER)

Watering shall conform to the provisions in Section 10-6, "Watering," of the Standard Specifications, except that no compensation for water supply shall be considered.

The Applicant shall meter all water taken from the City of Hayward Water System and pay the current rates for water consumed. The construction water meter shall be supplied by the City of Hayward Water Division. If the Contractor fails to obtain a construction water meter or draws water from a hydrant without one, the City reserves the right to halt all construction activities until a meter is properly issued by the City of Hayward Water Division. Water is available from the City of Hayward fire hydrants at or near the site of work. The Applicant shall submit an application to the City of Hayward Water Field Services and make payment of the appropriate fee or deposit for construction water meter.

Equipment, materials, hoses, and apparatus associated with watering purposes shall be sanitized or new, and in good working condition at all times. If the City determines whether any component is inadequate or not in proper condition, the Contractor shall immediately replace or repair it. Failure to comply may result in suspension of hydrant usage for water supply until the issue is resolved.

3.08 OBSTRUCTIONS

Attention is directed to Section 5-1.36, "Property and Facility Preservation," and Section 15, "Existing Facilities," of the Standard Specifications.

Applicant shall show the approximate location of all existing utilities on the Plans. Prior to performing any excavation, the Applicant shall contact Underground Service Alert (U.S.A.) within the time required by law. It shall be the Applicant's responsibility to locate all existing utilities in the work area prior to beginning any excavation activities.

Where required on the approved Plans, Applicant shall pothole existing utilities to determine their exact location and depth prior to performing any excavation operations in the subject area. The Applicant shall submit to the Engineer, at least fifteen (15) business days prior to excavation, drawings indicating the location and depth of all utilities encountered during potholing.

3.09 TRENCH EXCAVATION AND BACKFILL

All trenching and backfilling shall conform to the provisions in Section 19, "Earthwork", of the Standard Specifications and these Sewer Specifications.

The Contractor shall not perform both the initial sawcut and the T-cut during the initial trench excavation. The initial sawcut shall be made at the edge of the trench. After backfilling and compaction are complete, Contractor may saw cut for T-cuts. Additionally, no grinding shall be allowed.

The Applicant shall notify adjacent property owners of the work schedule and necessary access restrictions a minimum of 5 working days prior to start of operations.

The Applicant shall verify the location of existing underground utilities before trenching in accordance with Section 3.08, "Obstructions," of these Sewer Specifications.

Surplus excavated material shall become the property of the Applicant and shall be disposed of outside the street right-of-way and water, sewer, or storm drain easements.

Excavation for pipes shall be by open trench unless otherwise specified, or shown on the approved Plans, or permitted by the Engineer. No excavated material and equipment shall be allowed to be stockpiled overnight in or adjacent to public right-of-way.

Existing concrete and bituminous pavement to be removed for installation of a pipeline, before being broken and removed, shall be neatly sawed along the edges of the area to be removed to a depth of 2 inches minimum, with a concrete pavement saw.

The maximum length of open trench shall be 200 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. The distance is the collective length at any location, including open excavation, pipe laying and appurtenant construction and backfill which has not been temporarily resurfaced.

All excavation limits, backfill materials and compaction shall conform to the requirements per Standard Detail SD-125, "Permit and Subdivision Trench Sections," or as shown on the approved Plans and as directed by the Engineer. In the event trench width exceeds the indicated maximums, the Applicant shall provide special bedding or extra strength pipe, as required by the Engineer. Backfill shall be replaced around exposed existing utilities to the same conditions as existed prior to excavation. Plates shall be flush with the existing street/roadway.

3.09 TRENCH EXCAVATION AND BACKFILL (continued)

All trenches in State Highways or in unincorporated areas of Hayward shall be backfilled strictly in accordance with the provisions of the encroachment permits issued by the respective agencies.

Permanent pavement shall be placed to the finish grade on the same workday temporary pavement is removed. Testing, backfilling, compacting to the required relative compaction, and placing of temporary pavement shall be performed immediately after placing pipe.

1. DEWATERING: All water encountered during the work shall be disposed of by the Applicant in such manner as shall not damage public or property or create a nuisance or health menace. The Applicant shall furnish, install, and operate pumps, pipes, appliances, and equipment of sufficient capacity to keep all excavations and access free from water until the excavation is backfilled, unless otherwise authorized by the Engineer. The Applicant shall provide all means of facilities necessary to conduct water to the pumps. Applicant shall provide a means for desilting the water before discharging it at their expense. Prior to any discharge, the Applicant shall contact the City's Water Pollution Source Control Division at (510) 881-7900 for further information regarding discharge requirements and notify the Engineer.
2. EXCAVATION: The trench shall be excavated to a depth required to allow for placement of bedding material. Bedding material shall provide a uniform and continuous bearing and support for the pipe at every point between bell holes or joints unless otherwise shown on the Plans. It will be permissible to disturb the finished bedding surface over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle.

Any part of the bottom of the trench excavated below the specified grade shall be backfilled with approved material thoroughly compacted as directed by the Engineer. The finished grade of the bedding material shall be prepared accurately by means of hand tools.

Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, all types of refuse, vegetable or other organic material or large pieces or fragments of inorganic material which in the judgment of the Engineer should be removed, the Applicant shall excavate and remove such unsuitable material to the width and depth ordered by the Engineer. Before the pipe is laid, the subgrade shall be made by backfilling and compacting in 2-inch layer with material as specified on Standard Detail SD-125, "Permit and Subdivision Trench Sections" or as specified by the Engineer.

3.09 TRENCH EXCAVATION AND BACKFILL (continued)

All excavated materials shall be exported off-site. The delivery site shall be approved by the Engineer prior to use.

All excavated material shall be removed from the project site concurrently with the excavation operations. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters and drainage channels shall be kept clear at all times. All excavated material shall be piled in a manner which will not endanger the work, and which will avoid obstructing sidewalks and driveways.

3. MECHANICALLY COMPACTED BACKFILL: Backfill shall be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire roller, vibrating rollers, or other mechanical tampers. All such equipment shall be of a size and type approved by the Engineer. Impact-type pavement breakers (stompers) will not be permitted.

Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed by Applicant. The Applicant shall make their own determination in this regard.

Material for mechanically compacted backfill shall be placed in lifts which, prior to compaction, shall not exceed the thickness specified below for the various types of equipment:

- a. Vibratory equipment, including vibratory plates, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers – Maximum lift thickness of 1 foot.
- b. Rolling equipment, including sheepsfoot (both vibratory and nonvibratory), grid, smooth-wheel (nonvibratory), pneumatic-tired (nonvibratory), and segmented wheels – Maximum lift thickness of 8 inches.
- c. Hand-directed mechanical tampers – Maximum lift thickness of four (≤ 4) inches.

Regardless of the backfill materials and equipment used, the Applicant is responsible to achieve the required compaction in such a manner that the pipe is not damaged.

3.09 TRENCH EXCAVATION AND BACKFILL (continued)

Native material used in new streets or new off-street traffic areas shall be used only when specifically authorized by the City Engineer and approved by the Soils Engineer. The Soils Engineer shall be present on-site at all times to observe the native material used for backfilling. Native material used as backfill material, where allowed, shall contain no rocks or clods greater than 4 inches in greatest dimension and shall be free of organic material and other deleterious material.

Mechanically compacted backfill shall be placed in horizontal layers of thickness (not exceeding those specified above) compatible with the material being placed and the type of equipment being used. Each layer shall be evenly spread, moistened (or dried, if necessary) and then tampered or rolled until the specified relative compaction has been attained.

Testing for relative compaction of aggregate subbases and bases shall be performed by the City as outlined in Section 25-1.01D(2)(d) and 26-1.01D(2)(d), "Quality Control Testing," of the Standard Specifications.

Relative compaction of trench backfill materials shall conform to the requirements per Standard Detail SD-125, "Permit and Subdivision Trench Sections," as shown on the Plans, and shall be done concurrently with pipe installation and placement of backfill materials. In unpaved areas backfill shall match the existing ground grade.

3.10 TRENCH SHORING AND SAFETY

The Applicant is responsible for maintenance of plates, shoring, and temporary pavement, and shall perform any necessary maintenance or repairs immediately as needed.

Attention is directed to Section 7-1.02K(6), "Occupational Safety and Health Standards," of the Standard Specifications, and the applicable provisions of Sections 6422, 6423, and 6424 of the Labor Code of the State of California and these Sewer Specifications. The current CAL-OSHA trench shoring regulations shall be used as a guide for minimum shoring requirements.

No excavations shall remain open longer than is necessary to perform the work. If, in the opinion of the Engineer, the Applicant is not pursuing the work with diligence, the Engineer may require an excavation to be backfilled and protected with temporary paving or covered with steel traffic plates, even though that particular installation is not complete.

3.10 TRENCH SHORING AND SAFETY (continued)

At the close of work each day, all open trenches shall be backfilled or covered with recessed steel traffic plates and full access to all roads and driveways shall be provided. In roadway areas, backfilled excavations shall be covered with a minimum 3-inch layer of temporary asphalt conforming to the requirements of Section 2.11 and Section 3.22 of these Sewer Specifications. Trench plates shall be tightly butted to each other and flush with the street/roadway, and fine graded asphalt concrete shall be compacted to form ramps, maximum slope of 8.5% with a minimum 12-inch taper to cover all edges of the steel plates. Applicant shall have plates readily available for driveway/pedestrian access and anchor the plates or use whatever means necessary to secure the plates.

When close sheeting is required, it shall be so driven to prevent adjacent soil from entering the trench either below or through such sheeting. Where sheeting and bracing are used, the trench width shall be increased accordingly.

Sheeting and bracing, which have been ordered left in place, must be removed for a distance of 3 feet below the established street grade or the existing surface of the street, whichever is lower. Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing. Sheeting, except that which has been left in place, may be removed after the backfilling has been completed or has been brought up to such an elevation as to permit its safe removal. Sheeting and bracing may be removed before backfilling the trench, but only in such manner to ensure the adequate protection of the completed structures and adjacent underground or surface structures and prevent the disturbance of the adjacent ground. Trench shields or other types of sheeting systems may be needed under current CAL-OSHA regulations.

Contractor shall be responsible for providing all trench shoring and support systems to protect existing structures and facilities adjacent to and within trenches, including, but not limited to, underground utilities, the existing chain link, and wooden fences. Existing structures and facilities that are damaged due to any construction shall be repaired by the Contractor.

3.11 RESERVED

3.12 INSTALLING POLYVINYL CHLORIDE PIPE

The Applicant is specifically cautioned as to the possibility of empty pipeline floating due to flooding of the trench by ground water, rain water or backfill consolidation. Should any pipe sections be floated by water in the trench, that reach of pipeline shall be replaced, and damaged pipe repaired, the trench re-excavated, de-watered, and the pipe reinstalled at the Applicant's expense.

The installation of polyvinyl chloride (PVC) pipe shall conform to ASTM D2321 and these Sewer Specifications. Pipe bedding, trench backfill and relative compaction shall be per Standard Detail SD-125, "Permit and Subdivision Trench Sections." Pipe shall be uniformly supported throughout its length with no voids under or around the pipe.

Before joining bell and spigot PVC pipe, the plain end of the pipe shall be beveled to avoid damage to the rubber ring as the pipe is pushed home. The bell socket and the plain end of the entering pipe shall be absolutely clean and free of foreign material (e.g., sand, dirt, debris, etc.) prior to the seating of the rubber ring. The ring groove shall be cleaned prior to inserting a clean rubber ring. The ring shall be seated evenly all around and be free from twists. Do not lubricate the rubber rings.

The spigot end of the pipe shall be lubricated with lubricant recommended by the pipe manufacturer. No other lubricant shall be used. The spigot end should be inserted into the bell so that it is in contact with the ring. The pipe sections should then be aligned and the spigot end pushed in.

Following the placement and densification of backfill, and prior to the placing of permanent pavement, all pipes shall be cleaned, inspected for obstructions, and measured for uniform grade (offset joints, lateral pipe intrusions, deflections, sags, etc.). Refer to Section 3.21, "Cleaning and Testing of Sanitary Sewer Mains" of these Sewer Specifications for additional requirements.

3.13 INSTALLING DUCTILE IRON PIPE

The installation of Ductile Iron Pipe (DIP) shall conform to these Sewer Specifications. Pipe bedding, trench backfill, and relative compaction shall be per Standard Detail SD-125, "Permit and Subdivision Trench Sections." Pipe shall be uniformly supported throughout its length with no voids under or around the pipe.

Before joining bell and spigot of ductile iron pipe, the plain end of the pipe shall be beveled to avoid damage to the rubber gasket as the pipe is pushed home. The bell socket and the plain end of the entering pipe shall be absolutely clean and free of foreign matter, (such as mud, sand, cinders, gravel, frozen material, etc.) prior to the seating of the gasket. The gasket shall be wiped clean, flexed and then placed in the socket with the large round end entering first, so that the gasket is seated evenly around the inside of the socket with the groove fitted over the bead. As the gasket fits snugly in the gasket seat, it shall be necessary to smooth out the gasket around the entire circumference to remove any bulges which might interfere with the proper entry or the spigot end. Pipe shall be restrained using mechanical joint fittings.

A thin film of clean lubricant shall be applied to the inside surface of gasket which will come in contact with the plain end of the pipe. If necessary, apply a thin film of lubricant to the outside of the plain end for about 1 inch back from the end. Lubricant other than recommended by the manufacturer shall not be used.

All ductile iron pipe and fittings shall be polywrapped with V-Bio Polyethylene Encasement in accordance with Section 2.10 and Section 3.20, "Protection from Corrosion," of these Sewer Specifications.

If specifically approved or required by the Director, ductile iron sewer pipe may be installed in a curved alignment in accordance with the manufacture's recommendations.

Following the placement and densification of backfill, and prior to the placing of permanent pavement, all pipes shall be cleaned, inspected for obstructions, and measured for uniform grade (offset joints, lateral pipe intrusions, deflections, sags, etc.). Refer to Section 3.21, "Cleaning and Testing of Sanitary Sewer Mains" of these Sewer Specifications for additional requirements.

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS

The installation of high density polyethylene (HDPE) pipe shall conform to these Sewer Specifications. Pipe bedding, trench/pit backfill, and relative compaction shall be per Standard Detail SD-125, "Permit and Subdivision Trench Sections." Pipe exposed in trenches or access pits shall be uniformly supported throughout its length with no voids under or around the pipe.

Per Section 11-3.311 of the City's Municipal Code, Applicant may request authorization to use alternative pipe materials (i.e., fusible PVC) and installation methods not specifically prescribed herein. This request shall be submitted in writing to the Engineer and shall include suggested specifications, installation procedures, and quality control methods.

1. QUALIFICATIONS: Contractor shall be trained by the particular pipe bursting or trenchless system manufacturer such that contractor is a fully trained user of the system. Polyethylene pipe joining shall be performed by personnel trained by the manufacturer of the butt-fusion equipment to be used. Personnel directly involved with installing the new pipe shall have received training in the proper methods for handling and installing polyethylene pipe. All certifications shall remain valid and up to date for the duration of the work. Copies of the training certifications shall be submitted to the Engineer prior to the delivery of materials to the project site.
2. ACCESS PITS: Access pit locations shall be chosen and recommended by the Contractor with the intent of minimizing excavation and traffic disruption. Recommended locations shall be at service connections, new manhole locations, or at points where spot repairs need to be performed. The Contractor shall submit the number, location, and size of pits to Engineer for review at least 20 business prior to the start of the work.

The access pits shall be excavated to allow adequate width for access of workers, sheeting and shoring installation, and to provide clearance necessary to avoid damage to the pipe during insertion. Care shall be taken to protect existing utilities.

The minimum length of each access pit as measured at the bottom of trench shall be determined by the formula,

$$\text{Length} = (12 \times \text{New pipe O.D. in feet}) + (2.5 \times \text{Trench depth in feet})$$

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

3. PRE-INSTALLATION VIDEO INSPECTION: Contractor shall perform pre-installation video inspection on all existing sewer pipes to be burst or lined. Video inspections shall be performed in accordance with Section 3.21, "Cleaning and Testing of Sanitary Sewer Mains," of these Sewer Specifications. The locations of service laterals, obstructions, sags and debris shall be accurately documented. Any obstructions that will prevent the completion of the pipe installation process, and that cannot be removed by conventional sewer cleaning equipment, shall be excavated and removed prior to installation of the new pipe. All existing rise/sags, high/low spots or bellies greater than 33% of the diameter of the existing pipe shall be excavated and eliminated prior to installation of the new pipe. The Engineer may also require that existing rises or sags between 25% and 33% of the diameter of the existing pipe be eliminated, depending upon the diameter and slope of the pipe to be burst or lined.
4. JOINING: Pipes shall be joined to one another and to plastic fittings by thermal butt fusion or saddle fusion in accordance with ASTM D2657, or by automatic electrofusion. Electrofusion couplings will be considered on a case-by-case basis and shall be minimized. Weld on flanges may be used to join pipes in access pits if pre-approved by the Engineer.

Fusing procedures shall be per the fusing equipment manufacturer's recommendations. All manufacturer specifications/recommendations shall be submitted to the Engineer prior to the delivery of material to the project site. Temperature, pressure and time shall be automatically logged or manually documented during fusing operations and the records shall be submitted to the Engineer for final approval. At a minimum, butt fusion procedure shall be as follows:

- a. Secure the pipes in the butt fusion equipment and use pipe supports to provide a straight alignment.
- b. On the inside of both of the pipe ends, print the sequential number of the joint that matches the number used in the logging or documenting of the fusing operation. Use a permanent ink or paint-type marker that does not easily wipe off and in a color that contrasts to the interior color of the pipe. Note that during joining operations, the numbers on either pipe end need not be aligned.

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

- c. Face (plane) the pipe ends and remove the shavings and chips from the inside and outside of the pipes with a clean, untreated, dry, lint-free cloth. If any oil or other hydrocarbon contaminants are on the pipe, the ends must be cleaned with isopropyl alcohol.
- d. Align and melt the pipe ends. Do not force the pipe ends against the heating tool surface. Proper heating tool temperature is 400-450°F (typ.). Heating time ends when the proper melt bead size has formed all around both pipe ends.

Melt Bead Size & Transfer (Heating) Time

Pipe Diameter Size (inch)	Approx., Melt Bead Size (inch)	Typical Transfer Time (seconds)
3 to 8	$\frac{1}{8}$ to $\frac{3}{16}$	5
8 to 12	$\frac{3}{16}$ to $\frac{1}{4}$	6
12 to 24	$\frac{1}{4}$ to $\frac{7}{16}$	9
24 to 36	$\frac{7}{16}$	12

- e. Join the melted pipe ends together and apply joining pressure. Proper hydraulic fusion machine joining pressure is 60-90 psi (typ.). The correct fusion joining force is the minimum force required to adequately roll the melt beads over the pipe surfaces.

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

- f. Maintain joining pressure until the external fusion beads have cooled to 125°F or lower. Use of water, wet cloths or other rapid cooling devices is prohibited. Only fans may be used to accelerate the cooling process. While waiting for the joint to cool, print the joint number, date and time on the outside of the pipe near the joint. Use a permanent ink or paint-type marker that does not easily wipe off and in a color that contrasts to the exterior color of the pipe.

Wall Thickness vs. Colling Time

Pipe Wall Thickness (inch)	Typical Cooling Time At 74°F Ambient (minute)
0.6 to 0.8	15 to 20
0.8 to 1.2	20 to 30
1.2 to 1.6	30 to 40
1.6 to 2.0	40 to 50
2.0 to 2.4	50 to 60
2.4 to 2.8	60 to 70
2.8 to 3.2	70 to 80

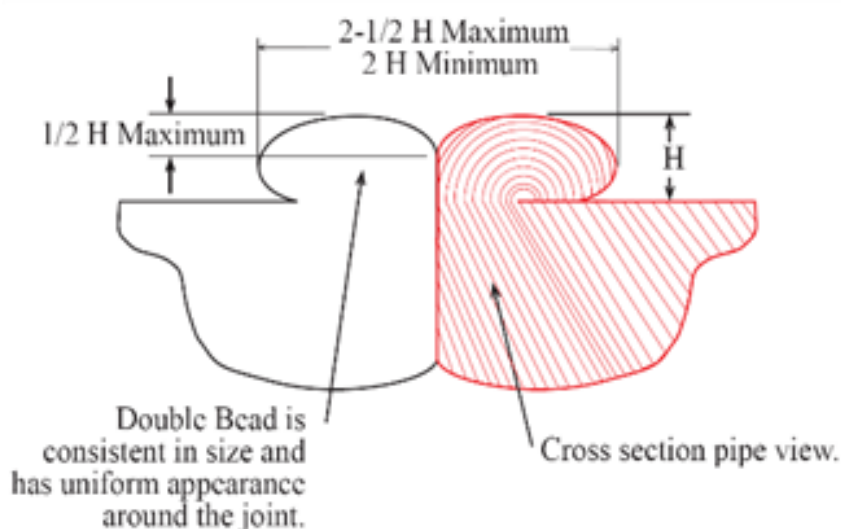
- g. Carefully remove the pipe from the butt fusion machine and allow the joint to cool a minimum of 30 additional minutes before subjecting the joint to any rough handling, severe bending, or pulling forces

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

Both the outside and inside of all fused joints shall be inspected by a qualified and certified fusion technician and observed by the City prior to installation. Fusion logs shall be submitted to the City. The inside of the joint shall be videoed and a copy of the video submitted to the Engineer for review. The video shall be in color and be of sufficient resolution to clearly show the details of the entire weld and the joint number. If a "push cam" is used, it shall be mounted in a device that centralizes it within the pipe diameter.

It is recommended that the video inspection of the joint be done during the cooling phase. At a minimum, properly fused joints shall have:

- Beads rolled over on the outside of the pipe, be rounded on the top and be of uniform size and shape.
- A combined width of the beads 2 to 2.5 times the height of the bead above the outside pipe surface.
- A v-groove between the beads not deeper than half the bead height above the outside pipe surface.



Butt Fusion Bead Proportions (Typ.)

Joints exhibiting the following will be rejected: A concave or cupped melt surface, beads not rolled over on the outside of the pipe, flat on top or of non-uniform size and shape; v-groove between the beads too deep; or a pockmarked/bubbly appearance (hydrocarbon contamination). Other factors may also be cause for rejection. It should be noted that in the case of hydrocarbon contamination, if the pipe has been permeated with liquid hydrocarbon (oil, gas, kerosene, etc.), the pipe cannot be joined by fusion and must be joined by mechanical means.

Internal beads shall be removed for all sewers. Joints must be completely cool before bead removal.

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

The table below presents typical daily butt fusion joining rates with one hydraulic butt fusion machine. Actual rates will vary depending upon pipe wall thickness, site conditions, crew size, experience, equipment, etc.

Field Joining Rates for HDPE

Pipe Diameter Size (inch)	Fusions per Day (typical)
≤ 10	15 to 40
10 to 18	10 to 24
18 to 24	6 to 16
24 to 36	5 to 15
36 to 48	4 to 10
54	3 to 8

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

5. PIPE INSTALLATION: Polyethylene pipe shall be supported on rollers or skids throughout its entire exposed length during installation. Dragging of the pipe along the ground shall not be permitted. For pipe bursting/trenchless methods, an air gap is required around critical and pressurized utilities. Potholes shall remain open for inspection prior to backfilling. Following the pipe installation, placement and densification of backfill, and prior to the placing of permanent pavement, all pipe shall be cleaned, inspected for obstructions and measured for uniform grade (offset joints, lateral pipe intrusions, deflections, rises, sags, etc.). Refer to Section 3.21, "Cleaning and Testing of Sanitary Sewer Mains" of these Sewer Specifications for additional requirements.

- a. Sliplining: For sliplining operations, the existing sewer pipe in the access pit shall be cut with a chain break (snap-cutter) or saw and completely removed. The access pit shall then be over excavated to allow for a minimum of 4 inches of bedding material. The bedding shall then be placed and compacted to the line and grade of the existing sewer. A stringline shall be used between the ends of existing sewer to verify proper grade.

The liner may be pulled or pushed into the existing piping. In either case, a molded or bolt-on closed steel face head shall be used to guide the liner past minor obstructions and to prevent debris from entering the liner during insertion. An insert protective sleeve shall be used to protect the liner from being scratched during insertion.

If the liner is pulled, the pulling apparatus shall be equipped with a load gauge to read the developing winching force directly. Maximum allowable stress on the liner is 1,000 psi. The top half of all liners through manholes shall be cut out to form a channel. The ends of all liners shall be sealed. The sealing material shall be compatible with the HDPE liner pipe and shall provide a watertight seal.

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

- b. Pipe Bursting: All sharp edges shall be removed from the exposed pipe opening. The Contractor shall also expose the main at every lateral connection to a depth equal to the outside diameter of the main under the invert of the existing main to allow free movement of the bursting head.

The maximum pulling length shall be limited to one reach (from manhole to manhole) at a time.

The pipe bursting tool shall make a tunnel along the path formerly occupied by the old sewer and shall install the new pipe by either pulling, pushing, or a combination of both. The pipe bursting tool shall be of the type and size recommended by the tool manufacturer for the size of pipe being burst and for the ambient ground conditions.

When the tool is pulled along the existing pipe, the pipe shall be broken up into small fragments and these fragments driven into the surrounding pipe zone. The tool shall then install the new pipe by pulling it into place. The new sewer pipe shall be installed in a straight horizontal and vertical line with the invert of the new sewer pipe matching the invert of the existing sewer at the exit of the upstream manhole and the entrance into the downstream manhole regardless of the size and alignment of the existing pipe.

Contractor shall allow the new HDPE pipe to return to its original length and shape in the unstressed state before trimming the excess pipe in the manholes. The manufacturer's recommendations shall be followed regarding the relief and normalization of stress and strain due to temporary stretching or elongation of the pipe after pulling operations are completed. Time allowed for stress and strain relief shall not be less than 24 hours.

6. SERVICE CONNECTIONS: After the pipe has been inserted into place and after testing, Contractor shall reconnect all active service connections to the new pipe. For sliplining, a portion not to exceed 24 inches of the existing sewer around each active service connection shall be cut with a chain-break (snap-cutter) and the host pipe removed to expose the liner pipe and provide sufficient working space for making the new service connection.

All services shall be reconnected within 24 hours after the liner has been pulled into place.

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

7. GROUTING OF THE ANNULAR SPACE (Sliplining Only): Grouting shall be performed for pipes with annular spaces of 1 inch or larger. Sealing of annular spaces shall not be done until a minimum of 24 hours has elapsed from completion of the insertion of the new pipe. After the liner is pulled into place, tested, and the active sewer services reconnected, the entire annular space between the outside of the liner and the inside of the existing pipe shall be grouted. The annular space shall be filled with a non-shrink grout (less than 1 percent shrinkage by volume). Contractor shall design a grout mix with a density to prevent floating of the liner pipe. The apparent viscosity shall not exceed 20 seconds in accordance with ASTM C939

Samples of grout shall be obtained in accordance with ASTM C172. One set of three standard cylinders shall be cast for each sliplined sewer reach in accordance with ASTM C31. Testing of specimens for compressive strength shall be in accordance with ASTM C39. One test shall be made 24 hours from time of casting, and two tests shall be made 28 days from time of casting. The average of the 28-day strength tests shall be equal to or greater than 300 psi tested in accordance with ASTM C495 or C109. If the 24-hour strength is less than 100 psi for any reach, per ASTM C403, the cement ratio shall be increased on subsequent reaches as directed by the Contractor's engineer. All testing shall be at the Contractor's expense.

The Contractor shall submit to the Engineer the proposed grouting mix, the proposed densities and viscosities, initial set time of the grout, the proposed grouting method, the maximum injection pressures, the 24-hour and 28-day minimum compressive strength, the proposed grout stage volumes, Bulkhead designs, Buoyant force calculations, flow control, provisions for service connections, pressure gauge certification, and vent location plans. The grouting system shall have sufficient gauges, monitoring devices, and tests to determine the effectiveness of the grouting operation and to ensure compliance with the liner pipe specifications and design parameters.

The grouting materials shall be mixed in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation. The equipment shall be capable of mixing the grout at densities required for the approved procedure and shall also be capable of changing density as dictated by field conditions at any time during the grouting operation.

3.14 INSTALLING HIGH DENSITY POLYETHYLENE PIPE BY TRENCHLESS METHODS (continued)

Grouting of the annular space shall be done in such a manner as to prevent deformation or collapse of the liner. Grout shall be pumped into the annular space at manholes, service connections, and wherever the line is exposed. The Contractor shall excavate additional grouting points if necessary. A grout pressure gauge and recorder shall be installed immediately adjacent to each injection port. During grouting operations, the recorder shall continuously record the actual grouting pressure versus time. The gauge shall conform to an accuracy of ± 0.5 psi. The range of the gauge shall not be more than 100 percent greater than the design grout pressure. Pressure gauges shall be instrument oil filled and attached to a saddle-type diaphragm seal (gauge saver) to prevent clogging with grout. All gauges shall be certified and calibrated in accordance with ANSI B40, Grade 2A. The grout pressure recordings shall be identified, as a minimum, with the date, batch, and time of day grouting was performed and shall be submitted to the Engineer at the end of the work day that grouting was performed. The gauged pumping pressure shall not exceed the liner pipe manufacturer's approved recommendations or 8 psi for SDR 26 HDPE pipe. The grout shall fill at least 95 percent of the calculated volume of the annular space. The Contractor shall trowel the grout to form a smooth transition between manhole base and liner.

3.15 INSTALLING HIGH DENSITY POLYETHYLENE PIPE

The installation of high density polyethylene (HDPE) pipe shall conform to these Sewer Specifications. Pipe bedding, trench/pit backfill, and relative compaction shall be per Standard Detail SD-125, "Permit and Subdivision Trench Sections." Pipe exposed in trenches or access pits shall be uniformly supported throughout its length with no voids under or around the pipe.

Installation procedures shall be a combination of the applicable portions of Section 3.13 and 3.14 of these Sewer Specifications.

3.16 SETTING FITTINGS AND VALVES

Fittings and valves shall be installed per the approved Plans. Such fittings and valves shall be lowered into the trench and cleaned and joined as specified in these Sewer Specifications and per the manufacturer's recommendations.

Where the approved Plans require restrained mechanical joints for pipe joints, fittings or valves, a ductile iron retainer gland shall be used that conforms to AWWA C111/A21.11, as manufactured by EBAA Iron (Megalug®) or approved equal, and installed in conformance with the manufacturer's recommendations.

All valves shall be installed complete with valve boxes and the required Class C concrete slab. Valve box extensions shall be machine cut or saw cut. Valve extension stems shall be installed when required. Refer to Standard Detail SD-205, "Valve Installation."

All fittings and valves shall be protected from corrosion in accordance with Section 2.10 and Section 3.20 of these Sewer Specifications.

3.17 SEWER SERVICE CONNECTIONS

All installations and materials shall conform to the approved Plans and the City of Hayward Standard Details (SD):

- SD-301 "Building Court Sewer Main,"
- Building Court Main Sewer shall connect to the public sanitary sewer main with a manhole regardless of the number of dwelling units.
- SD-312 "House Sewer" (Sewer Lateral Connection),
- SD-313 "House Sewer," and
- SD-314 "Backflow Preventer."

All existing sanitary sewer laterals in use shall be reconnected to the new sanitary sewer main with suitable adapters or couplings. All junctions connecting any pipe or fitting to the sanitary sewer main shall utilize a "WYE" fitting. PVC "WYE" fittings shall conform to ASTM D3034 and shall have a Standard Dimension Ratio (SDR) of 26. "Tee" and "Tap" connections will not be permitted on any sewer laterals. However, sewer lateral connections to HDPE sewer main may be allowed with Inserta Tee or approved equal.

The Contractor shall reconnect all existing sanitary sewer laterals and intercepting sewer mains in use. All sanitary sewer lateral runs shall have a minimum of ¼ inch per foot slope for 4-inch pipe and a minimum of ⅛ inch per foot slope for 6-inch pipe and greater.

3.18 SANITARY SEWER MANHOLE CONSTRUCTION

Refer to Section 1.12 Design & Location of Sewer Manholes & Industrial Waste Monitoring Structure of these Sewer Specifications for sewer manholes requirements.

Existing sanitary sewer manholes which are affected by the new vertical alignment of the new sanitary sewer pipe shall be replaced or reconstructed with the manhole base channelized for the connection of the new pipe(s), as required by the Engineer and as detailed in Section 3.19, "Sanitary Sewer Manhole Repair," of these Sewer Specifications. Applicant may elect to replace the existing sanitary sewer manholes that the Engineer has indicated must be reconstructed with new standard precast concentric manholes, frames and covers.

Concrete for special manhole structures shall conform to Section 90-2, "Minor Concrete," of the Standard Specifications. Reinforcing steel for special manhole structures shall conform to Section 52, "Reinforcement," of the Standard Specifications.

Standard manholes shall conform to Standard Detail SD-304, "Preset Concentric Sanitary Sewer Manhole," ASTM C478, and the requirements herein. The top and bottom of all manhole sections shall be parallel.

Drop assemblies shall be constructed per Sheet 1 of Standard Detail SD-306, "Sanitary Sewer Drop Connection." All plastic pipe connections to manholes shall have a rubber waterstop tightly banded to the pipe and cast into the manhole base. Banding material shall be stainless steel unless an alternative corrosion resistant material is pre-approved by the Engineer. Materials with corrosion resistant coatings, such as zinc galvanizing or epoxy, will not be allowed.

Pipe for stubouts shall be sewer pipe as approved and furnished for the project. Rubber gasketed watertight plugs shall be furnished at each stubout and shall be adequately braced against all hydrostatic or air test pressures.

Backfill around manholes shall be of the quality of trench backfill immediately adjacent.

All water in the excavation shall be removed prior to placement of materials. A minimum of 6 inches of base rock material shall be placed in the bottom of the excavation and thoroughly compacted with a mechanical vibrating or power tamper. The concrete base shall be constructed per the Standard Details. The concrete shall be vibrated for densification and screed so that the joint for the first precast manhole section can be formed level and uniform for the full circumference.

3.18 SANITARY SEWER MANHOLE CONSTRUCTION (continued)

Manhole inverts shall be constructed as part of the concrete base in conformance with details per the approved Plans, and with smooth transitions to ensure an unobstructed flow through manhole. The flow channels shall be constructed to direct all incoming sewer flows toward the downstream sewer pipe. Refer to City Standard Detail SD-304, "Precast Concentric Sanitary Sewer Manhole" for the standard channel and manhole detail. All sharp edges or rough sections which may obstruct flow shall be removed. No pipe joints are allowed within the base of a manhole. If the pipe was constructed such that a joint will be located inside or within twelve (≤ 12) inches of a manhole, the pipe sections shall be cut and replaced with a continuous section of pipe such that the joints occur at least twelve (≥ 12) inches away from the outside of the manhole base. Within the manhole, the top section of the pipe shall be neatly cut and removed (not broken out with a hammer or similar). The exposed edges of pipe shall be removed of all sharp edges and completely covered with mortar. All mortar surfaces shall be troweled smooth.

Precast manhole sections to be joined shall be carefully inspected. Any sections with chips or cracks in the tongue shall not be used. Preformed plastic gaskets shall be installed in strict conformance with the manufacturer's recommendations. Only pipe primer furnished by the gasket manufacturer shall be approved.

Stubouts from manholes for future sewer connection shall be installed as shown on the plans or as required by the Engineer. Maximum length shall be three (≤ 3) feet outside the manhole wall. Pipe stubouts shall have a rubber waterstop tightly bonded to the pipe and cast into the manhole base.

Semi-permanent plugs shall be installed in the end of stubouts. Plugs shall have gasket joints similar to sewer pipe being used or shall be an expandable type of standard sewer plug. Plugs shall be capable of withstanding all internal or external pressures without leakage. All plugs shall be braced to prevent blowoffs.

Extensions shall be installed per the Standard Details and to the height determined by the Engineer. Grade rings shall be laid in mortar with sides plumb and tops level. Joints shall be sealed with mortar. Extensions shall be watertight.

Frames and covers shall be per Standard Detail SD-307, "Manhole Frame, Cover and Pan." Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring. Set frames so top of covers are flush with surface of adjoining pavement or ground surface, unless otherwise shown or directed.

3.18 SANITARY SEWER MANHOLE CONSTRUCTION (continued)

False bottoms shall be installed inside the sewer manhole to prevent debris and unwanted items from entering the sewer system. Refer to Section 1.13.B Debris Protection of these Sewer Specifications for false bottoms requirements.

Not less than ten (≥ 10) percent of the total number of manholes on the project, or two manholes minimum, shall be hydrostatically tested. The Engineer shall designate the manholes to be tested. The test shall consist of plugging all inlets and outlets and filling the manhole with water to the top of the cone section. Leakage in each manhole shall not exceed 0.1 gallon per hour per foot of head above the invert. A manhole may be filled 24 hours prior to time of testing, if desired, to permit normal absorption into the walls to take place. Minimum time for a test shall be one (≥ 1) hour.

All manholes that do not meet the leakage test, or are unsatisfactory from visual inspection shall be repaired by Applicant at no cost to City. Manholes shall be watertight to infiltration, and any leakage of groundwater shall be eliminated by permanent repairs.

If more than 25 percent of the manholes tested fail the hydrostatic test, the Applicant shall be required to test all or as many manholes as the Engineer may deem necessary.

3.19 SANITARY SEWER MANHOLE REPAIR

Refer to Section 1.12 Design & Location of Sewer Manholes & Industrial Waste Monitoring Structure of these Sewer Specifications for sewer manholes requirements.

Where shown on the approved Plans, the Applicant shall clean the existing manhole base and expose all depressed areas and holes and re-channelize the base to accommodate the new pipe size. The re-channelization of the manhole base shall be per Standard Detail SD-304, "Precast Concentric Sanitary Sewer Manhole" and Section 1.13, "Connections To Existing Sewer Mains" of these Sewer Specifications.

Chipping and patching of the manhole base shall have a minimum concrete or mortar thickness of 2 inches, and commercial quality concrete shall be used. Portland cement concrete shall be per Section 2.12, "Portland Cement Concrete," of these Sewer Specifications.

Debris protection shall be provided by installing a false bottom, or other acceptable methods approved by the Engineer. Refer to Section 1.13.B Debris Protection of these Sewer Specifications for false bottoms requirements.

3.19 SANITARY SEWER MANHOLE REPAIR (continued)

All plastic pipe connections to manholes shall have a rubber waterstop tightly banded to the pipe and cast into the manhole base and cemented in place. Band material shall be stainless steel or other corrosion resistant material.

If the plans indicate a manhole drop connection, the connection shall be an "outside drop," unless an "inside" drop is specifically required or approved by the Engineer. Outside drop manholes shall be constructed per Standard Detail SD-306, "Sanitary Sewer Drop Connection" on Sheet 1.

3.20 PROTECTION FROM CORROSION

Refer to Section 2.10 of these Sewer Specifications for corrosion protection material requirements.

Where corrosion protection requirements for directly buried ferrous metal have not been shown on the plans or specified in detail, a mastic or tape coating shall be applied. The determination of the type of coating to be applied in each instance shall be reserved to the Engineer. Ferrous metal items to be protected shall include, but not be limited to, valves, fittings, service lines, reinforcing steel, anchor rods, flexible couplings, bolts and nuts, flanges, saddles, tapping sleeves, hydrant buries, and plugged end and blow off assemblies. **Mastic and tape coated ferrous metal shall also be protected with polywrap.**

All copper piping or any copper or brass part shall not be permitted to contact steel or cast iron pipe at any point. If contact is unavoidable, the copper or brass part shall be mastic or tape coated. All cast iron, steel or other ferrous metal shall be insulated from any concrete structure, such as footings, anchor blocks, encasements or structure walls using mastic, tape coating or other specified coating system extending six (6) inches beyond the concrete. All coatings shall be continuous, unbroken, and pinhole free. Protective coatings shall only be applied over a properly prepared surface.

3.20 PROTECTION FROM CORROSION (continued)

1. MASTIC COATINGS: Mastic coating shall be applied with spray equipment or by hand with brush or rubber gloves. A two-coat system shall be applied. The metal surface shall first be cleaned of all loose scale, dirt and other foreign matter. No primer is required before application. Each coat shall be applied to produce a minimum wet film thickness of 15 mil. with a minimum cure time of two hours between coatings. The second coat shall be allowed to dry a minimum of three hours before beginning backfilling operations.
2. SACRIFICIAL MAGNESIUM ANODES shall be installed for all ductile iron fittings to prevent corrosion. Magnesium anodes for the ductile iron fittings shall be High Potential, Magnesium Alloy. The anodes shall be of the size indicated on the Plans. Each anode shall be cast with a steel core, and the core shall protrude from one end and shall be of sufficient length to permit attachment of a lead wire. Protect with polywrap.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS

Prior to beginning any testing, the Contractor shall have completed items 1-19 of the Normal Sequence of Operations for Construction of Roadways (Refer to Appendix D).

These cleaning and testing specifications shall be used when there is a conflict between Standard Detail SD-311, "Test Requirement For Sanitary Sewer" and these testing procedures, unless otherwise directed by the Engineer. Wastewater flow control (bypass pumping) shall conform to Section 3.04 of these Sewer Specifications.

Prior to conducting testing, all sewer lines, manholes, and appurtenances shall be backfilled, compacted, and set to final grade.

These cleaning and testing specifications shall apply to the "Normal Sequence of Operations for Construction of Roadways" in Appendix D, both prior to performing closed-circuit television (CCTV) of the sanitary sewer mains and after completion of street improvements, and prior to any wastewater discharges into the newly installed sewer system.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

The Contractor shall perform the following tests in the presence of a City representative and in the order cited below:

1. CLEANING: The newly constructed sanitary sewer system shall be cleaned and flushed in the presence of a City representative prior to all the following:
 - a. Performing air, leakage, and/or deflection tests.
 - b. Performing video testing (CCTV) of the sanitary sewer mains.
 - c. Allowing wastewater to discharge into the newly installed sewer system.

The applicant shall implement appropriate measures to ensure the cleaning and flushing process does not adversely impact the existing sewer system.

Pipelines and structures shall be cleaned using a high velocity jet cleaner. The equipment shall be truck mounted for ease of operation. The equipment shall have a minimum of six hundred (≥ 600) feet of high pressure hose with a selection of two or more high velocity nozzles. Nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all designated line sizes. The equipment shall carry its own water tank capable of holding corrosive or caustic cleaning or sanitizing chemicals, auxiliary engines and pumps, and hydraulically driven hose reels. All controls shall be located so that the equipment can be operated above ground. Equipment shall include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream.

Any dislodged material resulting from the cleaning operation shall be intercepted at the downstream manhole of the reaches being cleaned, using a filtering device and removed. The material collected at the downstream manholes shall become the property of the Contractor. It shall be removed from the site by the Contractor in a closed container and disposed of in a legal manner. It shall not be dumped into streets, ditches, catch basins, or storm drain systems. Flushing of the material from manhole reach to manhole reach is unacceptable.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

Acceptance of the sewer line cleaning shall be made upon the successful completion of the video inspection and shall be to the satisfaction of the Engineer. If video inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer main at no additional cost to the City.

Contractor shall screen all debris collected prior to analysis and disposal. Contractor shall haul and properly dispose of material at a Class 3 or Class 2 landfill, as appropriate.

2. AIR TEST (ALL GAVITY PIPES): Air testing shall conform with the requirements of these Sewer Specifications. The pipeline shall be made as nearly watertight as practicable, and leakage tests and measurements shall be made using low-pressure air. All infiltration that was observed during the video testing shall be remedied before proceeding with the air test.

At any time during testing, the City may require verification either by pressurized air or water that the sewer line segment being tested was fully pressurized for the duration of the test.

For making the low-pressure air tests, the Applicant shall use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig.

The leakage test using low-pressure air shall be made in each manhole-to-manhole section of the pipeline after placement and acceptable compaction of the backfill up to but not including AC pavement.

Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

All air used shall pass through a single control panel.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

Low-pressure air shall be introduced into the sealed line until the internal air pressure reached 4 psig. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig shall not be less than that determined in the nomograph in Standard Detail SD-311 Sheet 2 of 2, "Test For Sanitary Sewer."

The testing shall be performed after backfilling but before permanent pavement replacement. If the pipe fails to pass the test, the Applicant shall make repairs and retest the pipe until the pipe passes the test. All repairs and testing shall be made at the Applicant's expense.

3. DEFLECTION TEST FOR FLEXIBLE PIPE: Deflection tests shall be performed on all installed flexible pipes (PVC, HDPE, etc.) to ensure that vertical deflections do not exceed the maximum allowable deflection. Deflection testing shall be performed in accordance with ASTM D2321 and these Sewer Specifications. Maximum allowable deflections shall be governed by the mandrel requirements stated herein and shall nominally be not greater than five (≤ 5) percent of the pipe's base Inside Diameter (ID). In the case where the pipe manufacture's deflection limit is less than 5%, the manufacture's deflection limit shall govern.

Ridged or stiff pipes such as VCP, DIP, RCP, etc., are exempted from this test.

Per ASTM D3034, the base ID shall be equal to the average outside diameter (OD) minus two times the minimum wall thickness. Manufacturing and other tolerances shall not be considered for determining maximum allowable deflections.

Deflection tests shall be performed no earlier than 30 days, and no later than 120 days, after completion of placement and densification of backfill. The pipe shall be cleaned and inspected for offsets and obstructions prior to testing in accordance with these Sewer Specifications.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

The pipeline deflection gauge shall be a fixed steel style, and aluminum fin shall not be allowed. A mandrel shall be dragged or pulled through the entire pipe by hand without excessive force to ensure that maximum allowable deflections have not been exceeded. Prior to use, the mandrel shall be certified by the Engineer or by another entity approved by the Engineer. Use of an uncertified mandrel or a mandrel altered or modified after certification will invalidate the test. If the mandrel fails to pass, the pipe will be deemed to be over-deflected.

Unless otherwise permitted by the Engineer, any over-deflected pipe shall be uncovered and, if not damaged, reinstalled. Damaged pipes shall not be reinstalled but shall be removed from the work site. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any over-deflection, shall be uncovered, removed from the work site and replaced with new pipe. Deflection testing shall be repeated after an additional minimum 30 days have elapsed following repair or replacement and completion of placement and densification of backfill.

The mandrel shall:

- a. Be a rigid, nonadjustable, odd-numbered-leg (9 legs minimum) mandrel having an effective length not less than its nominal diameter.
- b. Have a minimum diameter at any point along its full length as determined by multiplying the pipe's base inside diameter by 0.95 (per ASTM D3034). For example, if a nominal 8-inch pipe has an outside inside diameter of 8.625" and an average wall thickness of 0.507", the minimum mandrel diameter shall be $[8.625" - (2 \times 0.507")] \times 0.95 = 7.230"$.
- c. Be fabricated of steel, be fitted with pulling rings at each end, be stamped or engraved on some segment other than a runner indicating the pipe material specification, nominal size, and mandrel OD; and be furnished in a suitable carrying case labeled with the same data as stamped or engraved on the mandrel.
- d. All costs incurred by the Applicant attributable to mandrel and deflection testing shall be borne by the Applicant and at no cost to the City.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

HDPE/ Iron Pipe Diameter Size. HDPE DR 17, Class 100, WP = 100 psi
Source: WL Plastics

IPS Pipe Diameter (in)	Ave. O.D. (in)	Base I.D. (in)	Min. Wall Thick (in)	Testing Mandrel Diameter for 5% Deflection Limit (in)
8	8.63	7.62	0.51	7.2
10	10.75	9.49	0.63	9.0
12	12.75	11.25	0.75	10.7

HDPE/ Ductile Iron Pipe Diameter Size. HDPE DR 17, Class 100, WP = 100 psi
Source: Independent Pipe Products

DIPS Pipe Diameter (in)	Ave. O.D. (in)	Base I.D. (in)	Min. Wall Thick (in)	Testing Mandrel Diameter for 5% Deflection Limit (in)
8	9.05	7.99	0.53	7.6
10	11.10	9.79	0.65	9.3
12	13.20	11.65	0.78	11.1

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

PVC Pipe Diameter Size. PVC SDR 26.

Source: PW Eagle

Nom. Pipe Diameter (in)	Ave. O.D. (in)	Base I.D. (in)	Min. Wall Thick (in)	Testing Mandrel Diameter for 5% Deflection Limit (in)
8	8.40	7.75	0.32	7.4
10	10.50	9.69	0.40	9.2
12	12.50	11.54	0.48	11.0

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

4. VIDEO TESTING (ALL PIPES): All sewer lines and manholes shall be clean and clear of debris prior to video testing. The Applicant shall perform a video recorded inspection or closed-circuit television (CCTV) of the new sanitary sewer line in compliance with the NASSCO PACP reporting format and coding standards. CCTV of the sanitary sewer lines shall be performed after the sewer lines have been installed and backfilled and again after completion of street improvements, and prior to any wastewater discharges into the newly installed sewer system. Refer to "Normal Sequence of Operations for Construction of Roadways" in Appendix D.

The camera shall be equipped with a tolerance target of appropriate size to identify any possible deficiencies. Such inspection shall be performed by a firm who has been actively performing such services for a minimum of two (2) years and an operator who has completed NASSCO PACP certified training, or an equivalent training program subject to approval by the Engineer. The Applicant may request to have City crews and equipment perform the video testing at Applicant's expense and subject to the availability of the City crews.

Not less than ten (≥ 10) working days prior to performing a video recorded inspection of the sewer main, the Applicant shall submit to the Engineer the name and qualifications of the firm and personnel who will be performing the video inspection, the specifications of the video inspection system to be used, and the date of the proposed video inspection for review and approval by the Engineer.

- a. Video Equipment: The video equipment shall include a multi-angle color video camera capable of spanning 360-degrees circumference and 270-degrees on horizontal axis to televise sewer lines 6-inch diameter or larger and focal distance shall be adjustable through a range of one (1) inch to infinity (∞). The video camera shall have a minimum of 400 lines of resolution, be specifically designed and constructed for operation in connection with sewer inspection, and for operation in sewers under 100% humidity conditions. The camera shall be mounted on a self-propelled wheel or track-mounted transporter. Lighting and camera quality shall produce a clear, in-focus picture of the entire periphery of the pipe for a minimum distance of six (≥ 6) feet. The transporter and camera assembly shall be equipped with a slope measuring device (inclinometer) capable of detecting pipe grade variations ± 5 degrees from true horizontal ($\pm 8.7\%$ grade) with a maximum error of ± 0.1 degree with readings taken at minimum intervals of two (≤ 2) feet.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

Inclinometer data shall be capable of being displayed in both numerical and graphical formats that can be printed or exported to an external database. The inclinometer data submitted shall allow easy identification of any high and/or low sections, correlated with the proper footage, that exceed the limits per Section 3.03 of these Sewer Specifications. The video equipment shall be capable of accurately recording the date and time of the inspection.

- b. Inspection Procedures and Requirements: The video recorded inspection shall be done with no flow in the sewer. The camera shall be moved through the pipeline in the downstream direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition. In no case shall the television camera be pulled or propelled at a speed greater than thirty (≤ 30) feet per minute. The camera height shall be adjusted such that the camera lens is always centered in the pipe being inspected. The equipment shall have an accurate footage counter, which shall display on the monitor the exact distance of the camera from the centerline of the starting manhole. Unless otherwise required by the Engineer, footage measurements shall begin at the centerline of the upstream manhole. The inspection video shall accurately identify both upstream and downstream manhole numbers, as well as the date and time of the inspection.

The recorded video inspection shall be continuous and be of such quality to provide a clear, sharp, color image when played back. The image shall show sufficient detail and quality to determine the approximate size of cracks in the pipe, offset joints, leaking joints, sags, and other defects or flaws in the installed sewer main. The date, identification of sewer reach(es) by upstream and downstream manhole numbers, and manhole to manhole footage shall be displayed on the video data view at all times.

Video inspection logs submitted by the Contractor shall be typed or printed as a computerized report. The Engineer will provide the log format, or a sample copy may be submitted for approval. Data of significance includes the locations of service connections, types of upstream and downstream manhole structures, and any pipe defects.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

The inspection video shall be submitted on either a flash drive or shared link in either MPEG-2 (352x240 minimum) or MPEG-4 (640x480 minimum) format viewable on a standard PC running MS Windows with Windows Media Player. If a different video software is required to play the files on the submitted disk, a fully licensed version of that software shall be included with the submittal at no additional cost to the City. Each disk shall have a protective case and be permanently labeled with the Contractor's name, date recorded, project name, street name(s), identification of the sewer reach(es) inspected, and run number. Labeling shall consist of either hand or computer printed information in non-water soluble ink on a circular disk label that equally covers the surface of the disk. All video recordings shall become the property of the City.

All video recorded inspections shall be done in the presence of the Engineer. Upon completion of the video recording, the video shall be replayed for the Engineer. Any video recordings not meeting the quality standards stated above and as determined by the Engineer will be rejected and the video recording process repeated at no cost to the City.

After inspection of the video recording by the Engineer, the Applicant, at their own expense, shall replace or repair any materials or workmanship, which, in the opinion of the Engineer, do not meet the specification requirements. Upon completion of the repairs or replacements, the repairs shall be video inspected a second time and the process repeated until all the specification requirements are met.

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

c. Construction Deficiencies: The following construction deficiencies shall be considered as in need of correction prior to acceptance of the work:

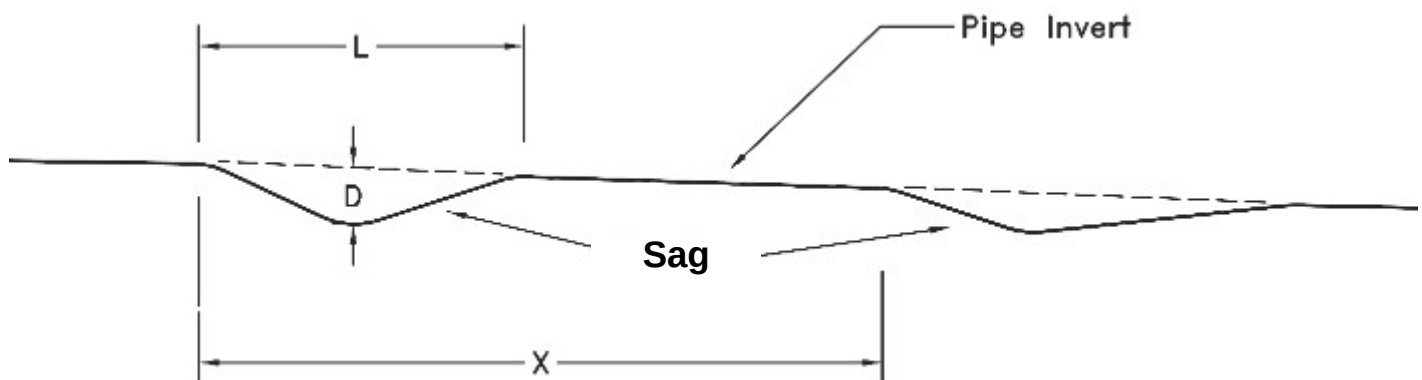
- Damaged pipes including cracks, gouges, and chipped ends of pipe sections.
- Slope less than the specified or absolute minimum slope.
- Deviations in slope greater than $\pm 0.05\%$ from the design slope.
- Low spots, sags, or bellies that hold water (see limits below).
- Dropped, offset or separated joints including failed welds.
- Excessive gap between pipe ends within a coupling or fitting (greater than 0.5 inch to 0.75 inch, depending upon materials, size and conditions).
- Oversized, raised or protruding internal weld beads including melted pipe material (≤ 0.25 inch for pipe diameter ≤ 8 inches; ≤ 0.50 inch for pipe diameter 10 inches to 18 inches).
- Infiltration/leaking joints.
- Other noted deficiencies.

Sags (low spots, bellies, etc.) in pipes that hold water after all flow has been stopped in the pipe are typically the result of settlement or consolidation of the bedding material and/or the native material below it in response to loading on the pipe from backfill operations and/or surface loading. The table below lists the allowable limits of sags in sanitary sewer pipes. Newly constructed pipes that exceed these limits shall be excavated and relayed, including replacing the pipe if damaged. It should be noted that pipes installed by trenchless methods are typically not susceptible to settlement/consolidation due to surface loads. As such, **the allowable sag in pipes installed by trenchless methods is zero (0).**

3.21 CLEANING AND TESTING OF SANITARY SEWER MAINS (continued)

Sag Limits

Pipe Diameter Size (inch)	Allowable Depth of Sag (D) (inch)	Allowable Length of Sag (L) (feet)	Allowable Distance between Sags (X) (feet)
Any Size by Trenchless (other than pipe bursting)	None	None	None
4" by Open Ex.	None	None	None
6" by Open Ex.	None	None	None
8" by Open Ex.	$\leq 0.25''$	$\leq 4'$	$\geq 40'$
10" by Open Ex.	$\leq 0.50''$	$\leq 6'$	$\geq 60'$
12" by Open Ex.	$\leq 0.66''$	$\leq 8'$	$\geq 80'$
> 12" by Open Ex.	$\leq 0.75''$	$\leq 10'$	$\geq 100'$



3.22 PAVEMENT REPLACEMENT AND TEMPORARY PAVEMENT

Refer to Section 2.11, "Trench Sections," of these Sewer Specifications for pavement material requirements.

1. **TEMPORARY PAVEMENT:** **Temporary pavement shall be maintained at all times until final paving is completed.** Temporary pavement to an adequate thickness to remain structurally sound shall be placed in all trenches over compacted untreated base which is placed below finish pavement in the trench area at all locations where existing pavement has been removed, and final pavement replacement is not done. Temporary pavement shall be maintained at all times and checked daily at a minimum.

Temporary pavement and base in all trenches shall be removed before final pavement replacement.

Cutback asphalt concrete installed in trenches from October through April shall be maintained at all times. Contractor shall monitor these locations and perform repairs as needed to ensure structural integrity.

2. **PAVEMENT REPLACEMENT:** After compaction of the trench backfill has been approved by the Engineer, the Applicant shall square the edges of the existing pavement and apply paint binder in accordance with Section 39, "Asphalt Concrete," of the Standard Specifications. Prior to placing asphalt concrete, the Applicant shall apply paint binder (tack coat) to the edges of existing asphalt concrete and gutters, construction joints, and driveway conforms. Paint binder shall be applied in one application at a rate from 0.02 to 0.10 gallons per square yard of surface covered. The Engineer shall determine the exact rate of application.

When shown on the Plans or directed by the Engineer, aggregate base shall be installed in accordance with the requirements of Section 26, "Aggregate Bases," of the Standard Specifications. Asphalt Concrete shall then be installed to the depth and width per Standard Detail SD-125, "Permit and Subdivision Trench Sections," or as otherwise specified on the approved Plans. The finished surface shall be true to the existing grade and free from open cracks or joints.

When the total compacted thickness of asphalt concrete is 0.25-foot or less, the asphalt concrete shall be spread and compacted in one layer. All other asphalt concrete thicker than 0.25-foot shall be spread and compacted in layers. The top layer of asphalt concrete shall be not more than 0.20-foot nor less than 0.15-foot in compacted thickness. The next lower layer shall be not more than 0.25-foot nor less than 0.10-foot in compacted thickness, and any lower layer shall be not less than 0.15-foot nor more than 0.40-foot in compacted thickness.

3.22 PAVEMENT REPLACEMENT AND TEMPORARY PAVEMENT (continued)

The spreading and compacting of asphalt concrete shall conform to the following requirements:

- a. Spreading and compacting shall be performed by methods that will produce an asphalt concrete surfacing of uniform smoothness, texture, and density.
- b. Asphalt concrete shall be compacted flush to existing grades and not "humped" or "dipped."
- c. Asphalt concrete shall be compacted to relative compaction of not less than 95 percent. Relative compaction will be determined by California Test 375. Laboratory specimens will be compacted in conformance with California Test 304. The asphalt concrete will be tested by lots, as specified in California Test 375. Any lot of asphalt concrete that has a relative compaction of less than 95 percent shall be removed and replaced by the Applicant at no cost to the City.

3.23 SIDEWALK AND CURB AND GUTTER RESTORATION

Refer to Section 2.13 of these Sewer Specifications for sidewalk and curb and gutter restoration requirements.

3.24 MICROSURFACING

Refer to Section 2.14 of these Sewer Specifications for microsurfacing requirements.

3.25 MARKER POSTS

Refer to Section 2.15 of these Sewer Specifications for marker posts requirements.

APPENDIX A

City of Hayward Sewer System Approved Materials

Materials	Specification ⁽¹⁾	Suppliers / Products ⁽²⁾
Sanitary Sewer Mains		
Polyvinyl Chloride (PVC) Pipe & Fittings	SDR 26 min., ASTM D3034, ASTM D3212, ASTM F477, ASTM F1336	Diamond Plastics, JM Eagle, Vinyltech.
PVC Pipe	AWWA C900 or C905 DR 14. Green color pipe for sewer.	JM Eagle, Vinyltech, Diamond, Westlake.
Ductile Iron Pipe (DIP)	AWWA C150/A21.50, AWWA C151/A21.51, AWWA C104/A21.4, 4" = Class 51 thick, 6" to 36" = Class 50 thick. Polyethylene lined & seal coated, Protecto 401 interior lining (sewer only).	U.S. Pipe, McWane Ductile, American DIP.
Ductile Iron Fittings	Class 54 thickness, AWWA C110/A21.10 or AWWA C153/A21.53	Star, Tyler, U.S. Pipe, Union Foundry, Sigma.

⁽¹⁾ For complete specifications, see the specific project specifications, the City's Standard Details, and the City's "Standard Specifications for Construction of Sanitary Sewer Mains."

⁽²⁾ Or approved equal.

APPENDIX A (continued)

City of Hayward Sewer System Approved Materials

Materials	Specification ⁽¹⁾	Suppliers / Products ⁽²⁾
Sanitary Sewer Mains		
Ductile Iron Mechanical Joints	AWWA C111/A21.11	Star, Tyler, U.S. Pipe, Union Foundry, Sigma.
High Density Polyethylene Pipe (HDPE) ⁽³⁾	SDR 17 or EHMW PE 4170 min., Type III, Grade P34, Cell Class PE345434C, D or E, ASTM D3350, ASTM F714, ASTM D1248, ASTM D2122	WL Plastics' Camcore™ Driscoplex's Plexvue™, PolyPipe's LightView™
Couplings & Reducers		
Vitrified Clay Pipe (VCP)	ASTM C425, Mechanical Compression	Mission Rubber Company, "Flex-Seal Adjustable Repair Coupling (ARC)"
PVC	SDR 26 min., ASTM D3034, ASTM F1336, Stop Coupling	IPEX / Multi Fittings Coupling.
DIP & Dissimilar	ASTM C425, ASTM C1173, Adjustable Repair Coupling	Romac 501.

⁽¹⁾ For complete specifications, see the specific project specifications, the City's Standard Details, and the City's "Standard Specifications for Construction of Sanitary Sewer Mains."

⁽²⁾ Or approved equal.

⁽³⁾ For trenchless pipe rehabilitation (slip-lining) or replacement (pipe-bursting) only.

APPENDIX A (continued)

City of Hayward Sewer System Approved Materials

Materials	Specification ⁽¹⁾	Suppliers / Products ⁽²⁾
Manholes	ASTM C478, ASTM C150 Type II, ASTM C387, ASTM A48 Class 30B, Fed. Spec. SS-S-00210A	Gaskets: Hamilton Kent Manufacturing's KentSeal No. 2, K.T. Snyder's Ram-Nek.
Cleanout and valve boxes	Traffic-rated type, covers marked "Sewer" or "S"	Christy (G-5)
Polywrap, mastic & primer	AWWA C105, Type I, Class C (black), Grade E1	<u>Tape</u> : Scotchwrap #50, Polyken #900, Tapecoat CT, or Protecto Wrap #200 <u>Mastic</u> : Protecto Wrap CA 1200 <u>Primer</u> : Protecto Wrap No. 1170 <u>Polywrap</u> : V-Bio Enhanced Polyethylene Encasement
Restrained Mechanical Joints	AWWA C111/A21.11	EBAA Iron (Series 1100, 2000PV Megalug [®])

⁽¹⁾ For complete specifications, see the specific project specifications, the City's Standard Details, and the City's "Standard Specifications for Construction of Sanitary Sewer Mains."

⁽²⁾ Or approved equal.

APPENDIX B

City of Hayward Sewer System Referenced Standards

AWWA Standards

Ductile-Iron Pipe and Fittings

- C104/A21.4: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
- C105/A21.5: Polyethylene Encasement for Ductile-Iron Pipe Systems
- C110/A21.10: Ductile-Iron and Gray-Iron Fittings for Water
- C111/A21.11: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- C150/A21.50: Thickness Design of Ductile-Iron Pipe
- C151/A21.51: Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- C153/A21.53: Ductile-Iron Compact Fittings for Water Service

ASTM Standards

- A48: Standard Specification for Gray Iron Castings
- A674: Standard Practice for Polyethylene Encasement of Ductile Iron Pipe for Water or Other Liquids
- A746: Standard Specification for Ductile Iron Gravity Sewer Pipe
- C12: Standard Practice for Installing Vitrified Clay Pipe Lines
- C150: Standard Specification for Portland Cement
- C387: Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete
- C425: Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
- C443a: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- C478a: Standard Specification for Precast Reinforced Concrete Manhole Sections
- C700: Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
- C828: Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines
- C990a: Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- C1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems

APPENDIX B (continued)

City of Hayward Sewer System Referenced Standards

ASTM Standards

- D1248: Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable
- D2122: Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- D2729: Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3034a: Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3212-e1: Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F679: Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- F714: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- F913: Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F1336: Standard Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings
- F1668: Standard Guide for Construction Procedures for Buried Plastic Pipe

California Test Methods

- CA304: Preparation of Bituminous Mixtures for Testing
- CA375: Determining the In-Place Density and Relative Compaction of AC Pavement

APPENDIX C

City of Hayward Index of Standard Details

Abbreviations and Symbols

SD-100	Abbreviations (2 sheets)
SD-101	Street and Utility Construction Drawing Symbols (5 sheets)

Streets

SD-102	Street Sections (4 sheets)
SD-103	Cul-de-Sac and Right Angle Bend (2 sheets)
SD-104	Building Setback and Slope Terraces
SD-105	Median Tapers
SD-106	Median Flares
SD-107	Concrete Construction Special Provisions (2 sheets)
SD-108	Sidewalk, Curb & Gutter, Island Curb & Curb Ramp Sections (6 sheets)
SD-108A	Driveway For Sidewalk < 8 Feet
SD-109	Driveway Local & Collector Streets (Non-Commercial & Non-Industrial) (3 sheets)

Streets (continued)

SD-110	Driveway Commercial & Industrial Streets (2 sheets)
SD-110A	PCC Valley Gutter and Apron
SD-110B	Off-Street Parking
SD-111	Stabilized Construction Entrance
SD-112	Gutter Flare at Inlet
SD-113	Tie-In Pavement
SD-114	Steel Beam Barricade
SD-115	Steel Beam Guard Rail
SD-116	Monument (4 sheets)
SD-117	Street Signage Requirements (5 sheets)
SD-118	Area Drain (5 sheets)
SD-119	Parking Meter Post
SD-120	Street Lighting (4 sheets)

APPENDIX C (continued)

Streets (continued)

Water

SD-120A	Ornamental Street Lighting (5 sheets)
SD-120B	Street Lighting Pull Box With Locking Cover
SD-121	Monitoring Well Box
SD-122	Street Tree Planting (2 sheets)
SD-123	Speed Lump (5 sheets)
SD-124	Pipe Connection to Reinforced Wall
SD-124A	Pipe Connection to Unreinforced Wall
SD-125	Permit and Subdivision Trench Sections (3 sheets)
SD-126	Pavement Mitigation For Streets On Moratorium
SD-127	Microtrenching Residential Street Only

SD-201	Double Check Valve Assemblies
SD-202	Reduced Pressure Principle Backflow Prevention Assemblies
SD-203	Tapping Tee and Valve Installation
SD-204	Fire Service 3" and Larger (2 sheets)
SD-205	Valve Installation (4 sheets)
SD-206	Hydrant Installation (2 sheets)
SD-207	Thrust Blocks for Horizontal and Sag Bends - 22½° or more
SD-208	Thrust Block – Crest Vertical Bends
SD-209	Optional Thrust Block – D.I.P. Crest Vertical Bend
SD-210	Thrust Blocks for Tees and Crosses
SD-211	Blow Off for Dead Ends
SD-212	Blow Off for Future Extension

APPENDIX C (continued)

Water (continued)

SD-213	Copper 3/4" & 1" Single Water Service Connection
SD-214	Plastic 5/8" & 3/4" Single Water Service Connection
SD-215	3/4" and 1" Consumer Water Service Connection – PE with Insta-Tite
SD-216	Residential Domestic & Fire Services 1", 1.5" & 2" (3 sheets)
SD-217	1-1/2" & 2" Water Service Connection
SD-218	Plastic Dual Water Service Connection
SD-219	Service Manifold for Three or More Meters
SD-220	Large Meter Water Service (2 sheets)
SD-221	Large Main Service Connection
SD-222	Facility References
SD-223	Hydrant Bollard Installation
SD-224	Ductile Iron Drop

Water (continued)

SD-225	Temporary Service Meter & Backflow Assembly
SD-226	Combination Air Valve 1" & 2"
SD-227	Water Transmission Main Crossing at the Hayward Fault
SD-228	Tracer Wire Installation
SD-229	Collar Type Thrust Block for New Water Main Testing
SD-230	Collar Type Thrust Block for Water Main Abandonment
SD-231	Jumper Pipe (2 sheets)

APPENDIX C (continued)

Sanitary Sewers

SD-301	Building Court Main Sewer
SD-303	Sewer Construction in the Vicinity of Other Utilities
SD-304	Precast Concentric Sanitary Sewer Manhole, 48" & 60" (2 sheets)
SD-305	Precast Eccentric Sanitary Sewer Manhole
SD-306	Sanitary Sewer Drop Connection Manhole (2 sheets)
SD-307	Manhole Frame, Cover, and Pan (2 sheets)
SD-308	Sanitary Sewer Riser & Minimum Grades
SD-309	Industrial Waste Monitoring Structure
SD-311	Test Requirement for Sanitary Sewer (2 sheets)
SD-312	House Sewer (Sewer Lateral Connection)
SD-313	House Sewer
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SD-315	Septic Tank (3 sheets)

APPENDIX C (continued)

Storm Sewers

SD-401	Storm Water Inlet Anchor, Frame, and Grate	SD-413	Rip Rap Energy Dissipator
SD-401A	Storm Water Inlet Markings	SD-414	Concrete Energy Dissipator (3 sheets)
SD-402	Type "A" Storm Water Inlet	SD-415	Energy Dissipator for Small Flows
SD-403	Type "C" Storm Water Inlet	SD-416	Lateral Pipe Entry to Earth Channel Type II
SD-404	Type "D" Storm Water Inlet	SD-417	Lateral Pipe Entry to Earth Channel Type I
SD-405	Type "E" Storm Water Inlet	SD-418	Pipe Entry
SD-406	Conversion Type "A" & "C" S.W.I. to Type "E" S.W.I.	SD-419	Erosion and Sedimentation Control Measures (4 sheets)
SD-407	Conversion Type "E" S.W.I. to Type "A" S.W.I.		
SD-408	Type "F" Storm Water Inlet (2 sheets)		
SD-409	Junction Box		
SD-410	Storm Drain Manhole (2 sheets)		
SD-410A	Plastic Step (2 sheets)		
SD-411	Side Connection		
SD-412	Reinforced Concrete Pipe Joint		

APPENDIX D

Normal Sequence of Operations for Construction of Roadways (Public and Private Projects)

The following will be the normal sequence of operation for the construction of a roadway in the City of Hayward, including roadway improvements constructed as part of private development projects. Each operation will follow only the applicable that precedes it on this list and then only after specific permission of the City Engineer. This list is to be used in coordination with all other project documents.

1. Perform clearing and grubbing.
2. Complete excavation or backfill to grading plane to within 6" of subgrade.
3. Install wet utilities (water, sanitary sewer, storm drain) and jumpers — Cut sheets required (signed and sealed by licensed civil engineer or land surveyor).
4. Install dry utilities (telephone, electric, fiber optic, gas, etc.) — Approved plans required prior to installation. Minimum 12-inch separation shall be maintained at crossings between wet and dry utilities unless specified on the plans.
5. Perform compaction testing of utility trenches — Trenches may be tested for compaction as each utility installed.
6. Perform preliminary tests of sewers and water lines — Unofficial, and for contractor verification purposes only.
7. Compact subgrade.
8. Perform compaction test on subgrade (written certification with seal by licensed engineer).
9. Perform grade verification of subgrade (written certification with seal by licensed engineer or surveyor).
10. Place, grade, and compact Class 2 aggregate base to curb & gutter grade (written certification with seal required for compaction and grade).
11. Place forms for curb and gutters, rolled curbs, and valley gutters — Cut-sheets required (signed and sealed by licensed civil engineer or land surveyor).
12. Perform grade verification on curb and gutter forms (written certification with seal by licensed civil engineer or surveyor).
13. Place concrete for curbs and gutters.
14. Place "back-up" material or concrete sidewalk and driveways against back of curbs.
15. Complete placement of roadway Class 2 aggregate base.
16. Perform compaction testing of base material (written certification with seal by licensed engineer).
17. Perform grade verification of base material (written certification with seal by licensed civil engineer or surveyor).

APPENDIX D (continued)

Normal Sequence of Operations for Construction of Roadways (Public and Private Projects)

18. Complete installation of hydrants, water services, and meter boxes to specified layout and grade.
19. Clean storm and sanitary sewer pipelines and appurtenances.
20. Perform initial closed-circuit television (CCTV) video inspection of storm lines and sanitary sewer. Perform air and deflection tests on sewers and pressure and leak tests on water lines.
21. Complete disinfection and flushing of water lines.
22. Remove temporary jumper and blow off and perform bacteriological test of water lines.
23. Put water lines into service (coordinate with City of Hayward Water Field Services or East Bay Municipal Utility District).
24. Remove and replace any damaged curbs and gutters or any concrete to abut new Hot Mix Asphalt (HMA).
25. Apply asphalt tack coat to all vertical surfaces.
26. Place first lift of Hot Mix Asphalt (HMA) (written certification of compaction with seal by licensed engineer). HMA with compaction less than specified shall be removed.
27. Place asphalt tack coat between HMA lifts as required by the State Standard Specifications.
28. Place second lift of HMA (written certification of compaction with seal by licensed engineer). HMA with compactions less than specified shall be removed.
29. Apply asphalt seal coat (if required by Project Specifications or as determined by the City Engineer).
30. Adjust all utility structures to grade and install monuments.
31. Clean and then re-video (CCTV) storm and sanitary sewer.
32. Install street name signs, traffic control signs, striping & pavement markings, barricades, and curb markings.
33. Complete all "punch list" items.
34. Conduct final "walk-through" inspection.
35. Submit "As-Built" drawings, Engineer's Final Report, Soils Engineer's Final Report, and Surveyor's Final Report.
36. Obtain final acceptance of Project.

In the event of any conflict, the following order shall prevail:

- 1) Special Provisions (City contract only), 2) Project Plans, 3) City Standard Details & Specifications, 4) State Standard Plans (Caltrans); 5) State Standard Specifications (Caltrans).