SAUSALITO-MARIN CITY SANITARY DISTRICT

STANDARD SPECIFICATIONS AND DRAWINGS

AUGUST 2026



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SECTION 1 GENERAL INFORMATION

1-01 Introduction and Scope. These STANDARD SPECIFICATIONS shall apply to the design and construction of all public sewerage facilities and side sewers in the District whether privately financed and constructed under permits issued by the District or whether publicly financed and constructed under contract with the District.

The jurisdiction of the District includes the entire sewerage system and its appurtenances from the point of connection with the building plumbing to the headworks of the Central Marin Sanitation Agency treatment plant. The side sewer between the main sewer and the building is privately owned and maintained, and the District has no ownership or maintenance responsibility therefor. In general, the service area of the District covers the Towns of Ross, San Anselmo and Fairfax, a portion of the City of Larkspur and unincorporated areas of Kentfield, Kent Woodlands, Oak Manor, Sleepy Hollow and Greenbrae. Maps showing the existing District boundaries and the planned future service area boundaries are available for inspection at the District office.

Special provisions, specifications addenda and/or notes on the plans shall be provided when deemed necessary by the District Manager and/or District Engineer and shall be considered as part of the specifications for the work.

1-02 District Ordinances. The Ordinances of the District comprise the rules and regulations of the District with respect to the construction and use of sanitary sewerage facilities. In general, the Code provides the authority of the District Manager, District Engineer and District Construction Inspectors, adopts the "Standard Specifications," provides regulations for side sewer construction and for the use and construction of public sewers, fixes annexation, plan checking, and permit and inspection fees, and provides for the establishment of uniform connection charges. A knowledge of the Code provisions and policies is essential to those proposing to design or construct sewerage facilities under permit in the District. Copies of pertinent Code sections may be obtained at the District office upon request.

1-03 Annexation Policy. The annexation policy of the District requires the consideration of service to any property within the planned ultimate service area and that all properties served must annex to the District. The annexation fees charged are intended to cover the District's costs for legal, engineering, and administrative services in processing the annexation. Only complete properties of legal record can be annexed. The District has established annexation procedure and further information can be gained by contacting the District office.

1-04 Downstream Capacity Policy. Where the District determines that downstream sewers lack sufficient capacity to accept wastewater flows from a proposed development or facility, the District may require the applicant to upsize the downstream sewer as necessary to accommodate the future flows or contribute funds toward a future upsizing by the District.

1-05 Right-of-Way Policy. The right-of-way policy requires that all public sewerage facilities be located in easements or rights-of-way granted or dedicated for sewers and public use. In the case of public streets, further dedication is not necessary unless specifically required. All new easements must be granted directly to the District as sewer easements by separate deed. Unless otherwise specifically permitted or required by the District Manager or District Engineer, all easements shall be fifteen (15) feet in width and the easement shall be centered on the sewer line. Ten (10) foot easements may be provided under special circumstances only if specifically approved by the District Manager. Easements shall be provided for sewers and granted to the District in all cases where future extensions of sewer lines will be required on the property being sewered.

1-06 Condemnation Policy. When a public sewer must pass through private property and a right- of-way cannot be obtained through negotiation with the property owner, the District may, under certain conditions, order condemnation of the required easement. If condemnation by the District is desired, the following will be required:

A. Requirements - Submit complete construction plans, a detailed easement plat, and a letter to the District Board of Directors explaining the situation and stating that all reasonable means to acquire the easement through normal procedures have been exhausted; no agreement could be reached; and requesting the District's assistance in acquiring the easement.

B. Condemnation Ordered - If condemnation is ordered by the District, a duplicate tracing of the easement map shall be submitted showing the entire easement, any required temporary working easements, all affected properties, and a description of the easement and temporary working easement including correct and complete names and addresses of all vested owners of the property shall be furnished.

C. Costs of Condemnation - All costs of the condemnation shall be borne by the applicant and he shall deposit with the District in advance, the estimated cost of the easement and all legal, appraisal, engineering, administrative and other costs associated with the condemnation. The amount of the deposit shall be determined by the District Engineer.

1-07 Engineering Policy. The engineering policy of the District requires strict compliance with the Civil and Professional Engineers Act of the California Business and Professions Code. All engineering plans, specifications, reports, or documents shall be prepared by a registered civil engineer, or by a subordinate employee under his direction, and shall be signed by him and stamped with his seal to indicate his responsibility for them. It shall be the Job Engineer's responsibility to review any proposed sewer system, extension and/or existing system change with the District Manager or District Engineer, prior to engineering or design work, to determine any special requirements or whether the proposal is permissible. Approval of preliminary or final plans by the District does not in any way relieve the Job Engineer of the Permittee of his responsibility to meet all requirements of the District. The plans and specifications for any job can be revised or

supplemented by the District at any time it is determined that the full requirements of the District have not been met. The Job Engineer shall review such changes and prepare the necessary revisions to the plans. Any cost of revisions or additions required by the District shall be paid for by the Permittee.

1-08 Environment Impact Report Regulations. The District Board of Directors has adopted "Local Guidelines for Implementation of the California Environmental Quality Act of 1970" and amendments thereto. Under these regulations, persons proposing to obtain permits for sewer construction may be required to prepare or finance the preparation of certain environmental impact studies and documents concerning the project. Persons planning projects involving extension of sewer mains are advised to contact the District's staff early in their planning process to determine the appropriate lead agency and exact District Environmental Impact Report requirements.

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SECTION 2 DEFINITIONS AND TERMS

2-01 Definitions and Terms. Whenever in these specifications, or in any documents or instruments where these specifications govern, the following terms, abbreviations or definitions are used, the intent and meaning shall be interpreted as follows:

Acceptance - Formal acceptance by action of the District Board of an entire contract or agreement or work done under permit which has been completed in all respects in accordance with the plans and specifications and any modifications thereof previously approved.

Annexation - The process of inclusion of property into District boundaries by proper legal procedures. Annexations must be processed through the Local Agency Formation Commission.

Applicant - The person making application for a permit and who shall be the occupant and/or owner of his/her/their authorized representative of the premises to be served by the sewer for which a permit is requested.

Building - Any structure used for human habitation or a place of business, recreation, or other purpose.

Building Sewer - That portion of any sewer beginning at a point two (2) feet outside the foundation line of any building and running to the property line, street right-of-way, or sewer easement right-of- way line or to a private sewage disposal system.

Building Sewer Permit - The written authorization from the District for the installation of a side sewer at a specific location and under specific conditions of the permit.

Central Marin Sanitation Agency (CMSA) - The Central Marin Sanitation Agency, which treats and disposes of all wastewater from the District.

City or Town - Any incorporated municipality lying partly or entirely within the District.

Contractor or Side Sewer Contractor - Any contractor licensed by the State of California to enter into contracts for and to perform the work of installing sewers within the District, or the owner of private property doing his own house sewer work on his private property only.

County - The County of Marin, State of California.

County Standard Specifications - The Standard Specifications, Cities & County of Marin, Department of Public Works, dated June 1992 and subsequent revisions.

Definition of Words - Whenever, in these specifications, the words directed, required, permitted, ordered, designated or words of like import are used, they shall be understood to mean the direction, requirement, permission, order or designation of the District Manager or District Engineer. Similarly, the words approved, acceptable, satisfactory, shall mean approved by, acceptable to, or satisfactory to the District Manager or District Engineer.

Developer - A private party installing sanitary sewer facilities.

District - The Ross Valley Sanitary District, California, as represented by the District Board, District Manager or District Engineer.

District Board - The governing body of the District.

District Engineer - The Engineer of the District, licensed by the State of California as a Civil Engineer, acting either directly or through authorized agents.

District Inspector - The engineering or technical inspector or inspectors duly authorized or appointed by the District Manager and responsible for the particular duties delegated to him/her or them.

District Manager - The Manager of the District acting either directly or through authorized agents.

Fixture Units - The fixture unit load values for drainage piping as computed from tables of the current Uniform Plumbing Code.

Host Pipe – The existing pipe being used as a host for

Job Engineer - The engineer, licensed by the State of California as a Civil Engineer, under whose direction plans, profiles and details for the work are prepared and submitted to the District for review and approval. The Job Engineer shall provide all field surveys, construction staking, confirm field changes and prepare record drawings.

Lateral Sewer - That portion of the side sewer lying within a street or sewer right-of-way. (Normally that portion of the side sewer between the main sewer and property line.) The lateral sewer is privately owned and maintained.

Main Sewer - A public sewer which has been or is being constructed to accommodate more than one side sewer. (Normally eight (8) inches in diameter or larger.) The District will accept and maintain main sewers which are constructed to these standards and installed under a District public sewer extension permit with District supervision and inspection.

Other Specifications - Whenever in these specifications other specifications are mentioned, it shall be understood that the materials or methods mentioned therewith shall conform to all requirements of the latest revision of the specifications so mentioned.

Outside Sewer - A sanitary sewer beyond the limits of the Sanitary District not subject to the control or jurisdiction of the District.

Owner - In the case of District projects, the term owner shall mean the Ross Valley Sanitary District. In the case of private projects, the term owner shall mean that person who is doing or having work done under permit or agreement with the District.

Permit - Any written authorization required for the installation of any sewer line or sewage works.

Permittee - The person to whom a public sewer permit or building sewer permit is issued.

Person - Any person, firm, company, corporation, association, or public agency.

Plans - Construction plans, sewer plans and profiles, cross sections, detailed drawings, etc., or reproductions thereof, approved or to be approved by the District, which show the location, character, dimensions, and details for the work to be done, and which constitute a supplement to these specifications.

Plumbing System - All plumbing fixtures and traps, or soil, wastes, special waste, and vent pipes within a building to a point two (2) feet outside the building foundation thereof.

Private Construction or Private Projects - Projects involving construction of sewerage facilities, other than District projects, which are to be performed by the Permittee and connected to the District sewerage system. Sewers to be accepted by the District shall be constructed under a Public Sewer Extension Permit. Side sewers, which are not accepted by the District, shall be constructed under a Building Sewer Permit with the District.

Private Sewer - A sewer serving an independent sewage disposal system not connected with a public sewer and which accommodates one or more buildings or industries.

Public Sewer Extension Permit - The written authorization from the District for the installation of a public sewer main at a specific location and under specific conditions of the permit.

Record Drawings (As-Built Drawings) - Reproducible plans signed and dated by the Job Engineer and District representative, indicating that the plans have been reviewed and revised, if necessary, to accurately show all elevations and construction details which were actually built.

Right-of-Way - All land or interest therein which by deed, conveyance, agreement, easement, dedication, usage, or process of law is reserved for or dedicated to the use of the general public, within which the District shall have the right to install and maintain public sewerage facilities.

Section - Any reference to a section which is not accompanied by further reference refers to a section or sections of these specifications.

Sewage - A combination of water-carried wastes from residences, business buildings, institutions, and industrial establishments.

Sewage Works - All facilities for collecting, pumping, treating, and disposing of sewage.

Side Sewer - The side sewer begins at its point of connection with the main sewer and terminates at its point of connection to the sanitary or waste plumbing. The point of connection to the sanitary or waste plumbing shall be two (2) feet or less from the building foundation at the point where the plumbing first extends outside the foundation (minimum four (4) inches inside diameter). The side sewer is privately owned and maintained, including the lateral sewer, which links the sanitary or waste plumbing of a house or other building with the main sewer.

Soils Engineer - Any soils engineering firm or authorized representative of such a firm which is retained by the owner of a project for the purpose of designing, testing, or controlling grading, installation of pavements, or trench backfill, and/or means to handle subsurface water and supplying to the District reports on the same. The Permittee shall pay all costs for the soils engineer.

Special Provisions - Special Provisions are specific clauses of the Specifications for a specific job which set forth conditions or requirements peculiar to the project under consideration and covering work or materials involved in the proposal and estimate but not satisfactorily covered by these Standard Specifications.

Specifications - The directions, provisions, and requirements contained herein as supplemented by such Special Provisions as may be necessary pertaining to the method and manner performing the work or to the quantities and qualities of materials to be furnished under the contract or permit.

Standard Drawings - The drawings of structures or devices commonly used on District work designated by the District as Standard Drawings at the time a District contract or agreement is entered into or permit is issued.

Standard Specifications - The Standard Specifications of the Ross Valley Sanitary District as contained herein and all subsequent additions, deletions, or revisions.

State Standard Specifications - The Standard Specifications of the State of California, Department of Public Works, Division of Highways, current issue. Where the terms "State" or "Engineer" are used in the State Standard Specifications, they shall be considered as meaning the "District" or "District Engineer" as defined hereinabove.

Streets or Roads - Any public highway, road, street, avenue, alley, way, easement, or right-of-way.

Surety - Any firm or corporation executing a surety bond or bonds payable to the District, securing the performance of the contract or permit either in whole or in part.

Traveled Way - That portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

Uniform Plumbing Code - The Uniform Plumbing Code adopted by the International Association of Plumbing and Mechanical Officials, current edition.

Work - All the work to be done under the District contract, or permit, in accordance with the plans, specifications and/or Special Provisions, and/or permit conditions.

2-02 Abbreviations. The following abbreviations shall have the designated meanings.

AC	- Asphalt Concrete
AAN	- American Association of Nurserymen
AASHO	- American Association of State Highway Officials
ACI	- American Concrete Institute
AREA	- American Railway Engineering Association
ASA	- American Standards Association
ASCE	- American Society of Civil Engineers
ASME	- American Society of Mechanical Engineers
ASTM	- American Society for Testing Materials
AWPA	- American Wood Preserver's Association
AWS	- American Welding Society
AWWA	- American Water Works Association
BCDC	- Bay Conservation and Development Commission
CDF	- Controlled Density Fill
CLSM	- Controlled Low Strength Material
CMSA	- Central Marin Sanitation Agency
DIP	- Ductile Iron Pipe
DR	- Standard Dimension Ratio
Fed. Spec.	- Federal Specifications
FL	- Flow Line
HDPE	- High Density Polyethylene

HMA	- Hot Mix Asphalt
IAPMO	- International Association of Plumbing and Mechanical Officials
ISA	- International Shadetree Association
Inv. El.	- Invert Elevation
LAFCo	- Local Agency Formation Commission
LDCC	- Low Density Cellular Concrete
LH	- Lamphole
MAX	- Maximum
MH	- Manhole
MIN	- Minimum
NEMA	- National Electrical Manufacturers Association
PCC	- Portland Cement Concrete
PE	- Polyethylene
PMP	- Perforated Metal Pipe
PVC	- Polyvinyl Chloride
RH	- Rodhole
RI	- Rodding Inlet
RVSD	- Ross Valley Sanitary District
S	- Pipe Slope
SDR	- Standard Dimension Ratio
Sta.	- Survey Station
SWPPP	- Storm Water Pollution Prevention Plan
VCP	- Vitrified Clay Pipe
WPCF	- Water Pollution Control Federation

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SECTION 3 DESIGN CALCULATIONS AND PLAN PREPARATION

3-01 Design Calculations. When requested to do so by the District, the Job Engineer shall submit design calculations for District review and approval. Design calculations shall be submitted in duplicate and shall be in a neat, acceptable form and shall indicate the date, signature of the Job Engineer and his stamp with his State of California registration number and expiration date.

Calculations for sewers shall be presented in tabular form and shall include the following information for each section of sewer: Terminal manhole designation, ground elevations at terminal manholes, incremental and cumulative tributary population, incremental average and maximum domestic sewage flow, incremental infiltration allowance, cumulative design flow, invert elevations of terminal manholes, length of sewer run, and sewer size, slope, capacity and velocity. Design calculation for pumping stations shall include soils data, structural design calculations, hydraulic calculations including the basis for average and peak flows, calculations for wet well volume, curves indicating force main characteristics, and individual and combined pump head capacity curves.

All calculations shall be accompanied by a small-scale map showing and identifying proposed sewerage facilities and tributary areas, etc.

For Design of new developments, sewer capacity and design shall be performed by the applicant as deemed appropriate by the District Engineer, using sewer hydrologic/hydraulic software such as Innovyze InfoWorks CS, or District approved equivalent.

3-02 Size of Plans and Data Required. Sheet sizes for plans for all sanitary sewerage facilities shall be 22 inches by 34 inches, unless otherwise specifically approved in advance by the District, and the plans shall include as a minimum the following information and data:

A. General - The plans shall show the name of the project subdivision, and each sheet shall bear the Job Engineer's signature and registration stamp with expiration date. Each map and plan sheet shall have a north arrow, appropriate scale or scales and date of preparation indicated thereon.

B. Sewer Plans - The sewer plans shall show the true horizontal relationship between the proposed sewer improvements and the existing and/or proposed field conditions, including all existing or proposed utilities and other facilities in accordance with available information (see Section 11-02). Plans shall include sewer line sizes and designations and shall show all structures and their respective numbers, the property lines, and corners adjacent to the sewer alignment, laterals and ties to property corners, all necessary required stationing, horizontal curve data, and street names. Horizontal scale must be 20 feet to the inch with a vertical scale of 5 feet to the inch unless another scale is specifically permitted by the District.

C. Sewer Profiles - The sewer profiles shall show the vertical relationship between the sewer line invert and the ground surface at the time of sewer construction and the finished ground and/or paving surface. The sewer line size, pipe type and pipe class shall be shown between each pair of consecutive structures on the profiles. Sewer profiles shall also show all existing and/or proposed utilities and/or other facilities in accordance with available information (see Section 11-02), which cross the alignment of the sewer and shall accurately indicate clearance when less than twelve (12) inches. (Sewer profiles must be prepared at the same horizontal scale as the plans and a vertical scale of five (5) feet to the inch unless another scale is specifically permitted by the District.

D. Easements - All existing and proposed easements and rights-of-way shall be shown on the plans.

E. Vicinity Map - A small scale vicinity map showing the location of the development within the town or city, together with the streets and downstream sewer, shall be shown on the first sheet of the plans.

F. Location Map - A location map at a scale of 100 feet to the inch shall be included on the first sheet of the plans showing the entire development, the overall sewer layout and appropriately indexing each plan sheet.

G. Line Stationing - Each sewer line with a separate designation shall be stationed continuously upgrade from 10+00 at its point of connection to another line.

H. Ties to Existing System - Horizontal and vertical ties to the existing District sewerage system shall be indicated on the plans.

I. Structure Numbers - Manholes, rodding inlets, and all other sewer structures shall be numbered or stationed consecutively upgrade by type of structure. The structure number shall appear on the plans and profiles whenever the structure is shown or referred to. Structure naming conventions shall be as directed by the District and in conformance with the naming conventions of the District's GIS database.

J. Side Sewer Locations and Elevations - All side sewers/laterals shall be shown on the plans with ties given to nearby property corners. The elevation of the lateral at the property line shall be shown on the plans and staked in the field by the Contractor.

Where properties are fronting on a cul-de-sac, the laterals for these properties shall be connected to a manhole. Normally, the lateral shall be shown to a point ten (10) feet from the lower lot corner at the property line on hillside lots (3%+ slope), and to the approximate center of the lot in relatively level terrain. The Job Engineer may locate laterals to fit building conditions, but the plans must show proper ties, and the completed lateral must be permanently marked with an "S" on the curb or a stake and accurately shown on the record drawings.

K. Elevation Datum - The elevation datum used shall be the North American Vertical Datum of 1988 (NAVD88). The plans shall include a note indicating the elevation datum and describing the location of one or more benchmarks in the area of the work.

L. Standard Notes - In addition to any other notes which may be appropriate or required, the following notes shall be included on all plans:

1. "All sewer construction shall be in accordance with the Ross Valley Sanitary District Standard Specifications and Drawings."

2. "The Contractor shall notify the District 48 hours prior to starting any sewer work."

3. "For any work in a public street, the Contractor shall obtain an encroachment permit from the agency having jurisdiction."

4. "The locations of utilities shown on these plans are approximate only, and it is the Contractor's responsibility to verify locations and depths with appropriate agencies or by potholing. The Contractor shall call USA Underground Service Alert at least 72 hours prior to commencing work."

5. "The Contractor shall pothole all underground utilities and sewers prior to any trenching operation.

6. "The Contractor shall notify the District immediately of any conflict between sewers and other underground facilities."

7. "The Contractor shall shore all excavations in accordance with applicable safety orders."

8. "All sewer laterals shall be a minimum 4 inches inside diameter and shall have a minimum slope of 2.0% and minimum depth of cover at the property line of 3.0 feet (measured from the top of curb), unless otherwise noted on these plans."

3.03 Rights-of-Way. Rights-of-way define and establish the rights for the District to maintain a sewer facility in the location designated by the Job Engineer (see Section 1-05). When main sewers are to be installed outside of public street rights-of-way in subdivisions, the required easements shall be shown on the subdivision final map and shall be granted to the District in a separate deed of easement. Outside of subdivisions, when sewers are to be installed on private property, an easement must be granted to the District and the easement description and required easement map shall be provided to the District by the Job Engineer, along with the name and address of the property owner or owners of record. Unless otherwise specifically approved by the District, public sewer

permits will not be approved nor will any work be permitted to proceed until the District receives, approves, and accepts and records all required easements.

A. Easement Descriptions - Easement descriptions shall provide legal metes and bounds description of all easements to be granted. The preamble of the easement description shall read as follows: “AN EASEMENT for the construction and maintenance of sanitary sewer facilities and appurtenances, together with the right of ingress and egress, over, on or under the following described property:"

B. Easement Maps - The easement map shall show the entire parcel over which the easement is granted, and all necessary survey ties, courses and distances, the point of beginning of the easement description, the last names of each grantor, the name of the sewer main extension involved, a north arrow, map scale, and the Job Engineer's signature and registration stamp with expiration date. Bearings and distances of easement courses shown shall conform to those given in the easement description. Two (2) black line prints of the easement map shall be submitted (for each grantor involved).

C. Easement Deeds - After approval of the required easement map and description, the Permittee shall prepare the necessary easement deed on an appropriate form and furnish the District with a properly signed and notarized deed of easement for recordation by the District.

3-04 Easements for Future Extensions. Easements shall be granted to the District through the property to serve the upstream property in all cases where future extensions of sewer lines could be required beyond the property being sewered. Such easements shall be included on the construction plans where there is any doubt as to the ability to properly serve the ultimate service area.

3-05 Flood Control Approval. In the event that a proposed sewer is to cross a creek, storm water channel, conduit, structure or drainage course under the jurisdiction of the Marin County Flood Control and Water Conservation District, a detailed large scale profile of the crossing shall be incorporated in the plans with approval of the Flood Control District, County and/ or city of jurisdiction prior to approval of the plans by the District.

3-06 Soils Investigation. Due to the inherent hazards involved in excavation, trenching, and pipe laying in certain common soil formations within the District, the right is reserved to required geological investigation and report prior to the approval of construction plans. In general, locations on steep side hills, locations in areas of established instability, locations in areas of bay mud or filled marshland, spring or seepage areas, or areas where concentrated or unusual development exists or is planned, shall be investigated and construction controlled by the recommendations contained in the Soils Engineer's report. The costs of all soils investigations shall be paid for by the Permittee.

3-07 Construction Permits. The Permittee shall be responsible for securing all necessary construction permits. Such permits include, but are not necessarily limited to, permits from BCDC, the U.S. Army Corps of Engineers, State Department of Fish and Game, Cal/OSHA, Division of Industrial Relations, street, or railroad encroachment permits, etc.

*****END OF SECTION*****

SECTION 4 DESIGN STANDARDS

4-01 Design Criteria. The following criteria for the design of gravity sewers within the jurisdiction of the Ross Valley Sanitary District is hereby established.

A. Population Density - Population densities for determining the ultimate tributary population shall be based on actual count, current General Plan of the agency exercising jurisdiction, or based upon the character of proposed development, whichever is the greatest.

B. Average Single-Family Unit - The average single family unit shall be taken as 3.5 persons per residence.

C. Per Capita Domestic Sewage Flow - The average per capita dry weather domestic sewage flow shall be taken as one hundred (100) gallons per day.

D. Design Flows - Areas Containing less than 2,000 Persons - In the design of sewers for residential tributary areas containing 2,000 persons or less, the unit design flow used shall be 400 gallons per capita per day. This factor includes appropriate allowance for storm water infiltration.

E. Design Flows - Areas Containing More Than 2,000 Persons - For tributary areas containing more than 2,000 persons, the total design flow shall be determined by multiplying the average dry weather sewage flow times the ratio of peak flow to average flow and adding an appropriate allowance for storm water infiltration.

1. Ratio of Peak to Average Sewage Flow - The ratio of peak to average dry weather sewage flow is a function of the tributary population, and the values tabulated below shall be used.

Population Range	Rate of Peak to Average Dry Weather Sewage Flow
2,000 - 5,000	2.5
5,000 - 7,000	2.3
7,000 - 9,000	2.2
9,000 - 13,000	2.1
13,000 - 18,000	2.0
18,000 - 25,000	1.9
25,000 - 35,000	1.8
35,000 - 50,000	1.7
50,000 - 80,000	1.6
Above 80,000	1.5

2. Storm Water Infiltration - Investigation has shown that areas of the existing sewerage system constructed prior to 1962 contribute significantly higher amounts of storm water infiltration than can be expected from more

recently constructed sewers. Accordingly, the following allowances shall be made for storm water infiltration flows:

Areas sewered prior to 1962 - 6,000 gallons per acre/day

Areas sewered after 1962 - 2,500 gallons per acre/day

Areas sewered after 1975 - 1,000 gallons per acre/day

F. Commercial or Industrial Flows - Unit design flows used for commercial or industrial areas shall be used on the type of existing or proposed development and shall be determined by special study subject to the review and approval of the District and the Central Marin Sanitation Agency.

G. Manning Formula - The diameter of gravity sewers shall be determined by use of the Manning formula, using a roughness coefficient, "n", of 0.013 or the pipe manufacturer's recommendation, whichever is greater.

H. Special Design Problems - Special design problems involving siphons, pumps, pump stations, force mains, non-residential connections, or other unusual features, require individual study and approval by the District Engineer.

I. References - Reference is made to WPCF and ASCE manuals, and to Minimum Design Standards of the Federal Housing Administration (FHA-G-4518.1).

4-02 Prohibited Wastes.

A. Prohibited Materials - It shall be unlawful for any person to connect any drain into the public sewer system. Dumping of garbage or septic tank sludge into manholes or sewers is strictly prohibited. It shall be unlawful to discharge any industrial waste or any solid or semisolid or liquid substances resulting from any industrial manufacturing or commercial process or from any garage, service station, or wash rack, into any sewer in the District without first having obtained a permit to do so from the Sanitary District.

Except as hereinafter provided, no person shall discharge or cause to be discharged any of the following described waters or wastes to any public sewer.

1. Any liquid or vapor having a temperature higher than 150 degrees F.

2. Any waste or waste which contains more than 100 parts per million, by weight, of fat, oil, or grease.

3. Any gasoline, benzene, naphtha, fuel oil or other flammable or explosive liquid, solid, or gas.

4. Any garbage that has not been shredded to such a degree that all particles will be carried freely under the flow conditions normally prevailing in public sewers, with no particle greater than on-half inch in any direction.

5. Any ashes, cinders, sand, mud, straw. shavings, metal, glass, rags, feathers, tar, plastics, wood, paunch manure or any other solid or viscous substance capable of causing obstruction to the flow in sewers or other interference with the proper operation of the sewage works.

6. Any waters or wastes having a pH lower than 5.5 or higher than 9.0 or having any other corrosive property capable of causing damage or hazard to structures, equipment, and personnel of the sewage works.

7. Any waters or wastes containing a toxic or poisonous substance in sufficient quantity to injure or interfere with any sewage treatment process, constitute a hazard to human or animals, or create any hazard in the receiving waters of the sewage treatment plant.

8. Any waters or wastes containing suspended solids of such character and quantity that unusual attention or expense is required to handle such materials at the sewage treatment plant.

9. Any noxious or malodorous gas or substance capable of creating a public nuisance.

10. Any septic tank sludge.

11. No leaders from roofs and no surface drains for rainwater shall be connected to any sanitary sewer. No surface or subsurface drainage, rainwater, stormwater, seepage, cooling water, or unpolluted industrial process waters shall be permitted to enter any sanitary sewer by any device or method whatsoever.

B. Interceptors Required - Grease, oil, and sand interceptors shall be provided when, in the opinion of the District, they are necessary for the proper handling of liquid wastes, containing grease in excessive amounts, or any flammable wastes, sand and other harmful ingredients; except that such interceptors shall not be required for buildings used for residential purposes. All interceptors shall be of a type and capacity approved by the District and shall be so located as to be readily and easily accessible for cleaning and inspection.

C. Maintenance of Interceptors - All grease, oil and sand interceptors shall be maintained by the Owner, at his expense, in continuously efficient operation at all times.

D. Swimming Pools - It shall be unlawful for any person to discharge the contents of a swimming pool into a sanitary sewer except in the manner specified herein and in Appendix B, Requirements for Draining Swimming Pools, and Spas to the Sanitary Sewer System. The size of pipe carrying discharge water shall not be larger than two (2) inches and shall not be under a head to exceed twenty (20) feet. If the water is discharged by pumping, the rate of flow shall not exceed 50 gallons per minute. Each swimming pool discharging to a sanitary sewer shall be equipped with an approved separator to preclude any possibility of a backflow of sewage into the swimming pool or piping system.

4-03 Sewer Pipes.

A. Pipe Materials - All main sewer and lateral sewer pipes shall be as specified in the Technical Specifications included in these Standard Specifications, and as indicated in the Piping Schedules included in the District's Approved Materials List. Special pipe and/or design provisions may be required by the District.

B. Minimum Pipe Sizes - The minimum pipe size for main sewers shall be eight (8) inches in diameter unless otherwise specifically allowed by the District. The minimum pipe size for side sewers shall be as specified in Section 02600, **SIDE SEWERS** in these Standard Specifications.

C. Minimum Slope - Main Sewers - The slope of the sewer shall be such that the velocity of flow in the pipe when flowing full shall be equal to or greater than two (2) feet per second. The minimum acceptable slopes for various main sewer sizes are tabulated below. For construction in filled marshland or bay mud, or other areas subject to possible differential settlement, the District may specify acceptable minimum slopes greater than those shown.

Pipe Size in Inches	Minimum Slope Ratio in Feet per Foot
6	0.006
8	0.004
10	0.0028
12	0.0022
15	0.0015
18	0.0012
21	0.0010
24	0.0008

D. Minimum Slope - Side Sewers - The minimum slope for side sewers shall be per, Section 02600, **SIDE SEWERS** in these Standard Specifications.

E. Steep Slopes - For sewers installed in areas with steep ground slopes, special design features may be required. Depending upon conditions of the specific installation, such items as check dams, rip-rap, trench dams, special anchorage or special pipe materials may be required by the District.

F. Minimum Pipe Cover - The following minimum pipe covers shall be attained in design and construction of sanitary sewers. If certain conditions exist which make it impractical to meet the minimum cover and clearance requirements, special pipe, bedding, encasement, rip-rap, and/or backfill will be required as directed by the District Engineer.

1. Main Sewers - The minimum pipe cover for main sewers shall be 3.0 feet. Lesser pipe cover may be approved by the District with use of special pipe materials or concrete pipe protection.

2. Side Sewers - That portion of a side sewer within a street right-of-way (lateral sewer) shall have a minimum cover of 3.0 feet. The minimum cover for side sewers from the property line to the building drain (building sewer) shall be eighteen (18) inches.

G. Pipe Strengths and Maximum Depths – Piping shall be per Section 15050, **GENERAL PIPING** in these Standard Specifications. Where, for any reason, the standard bedding conditions cannot be attained, or the maximum allowable trench width is exceeded, or the pipe depth is greater than fifteen (15) feet, special pipe, bedding, backfill and/or encasement may be required as directed by the District. Where pipe depths or other known conditions required pipe strengths other than those specified as standard, the Job Engineer shall indicate the required pipe classes on the plans.

H. Pipe Clearance - All sewer pipes and structures shall be designed and contracted to have a minimum of ten (10) feet from domestic water lines, three (3) feet from all other utility lines, and twelve (12) inches clearance from all other utilities and/or improvements, unless a special approval is received from the District.

I. Horizontal and Vertical Curves - Horizontal curves may be used on curved streets when the alignment can be kept concentric with street improvements. Pipe curves shall be in conformance with pipe manufacturer written recommendations. Vertical curves may be used in hilly terrain, when permitted by the District, in order to reduce the number of required manholes. The deflection in the joint between any two successive pipe sections shall not exceed 75% of the maximum deflection as recommended in writing by the pipe manufacturer.

J. Sewer Connections to Existing System - Connection of new main sewers to the existing sewer system shall be made at existing manholes or by constructing a new manhole at the point of connection. The elevation of new sewer mains or laterals connecting to a manhole shall be set so that the pipe crowns match. Side sewer connections to existing main sewers shall be per Section 02600, **SIDE SEWERS** of these Standard Specifications.

K. Individual Lot Pumping Systems - Special application must be made for installation of an individual sewage pump where gravity service is not feasible. All pumping systems shall be installed in accordance with all applicable codes. The District will only inspect the pressure line from the sewage pump to the point of connection to the District sewer system.

The gravity discharge line from the building outlet to the sewage pump sump shall be gravity flow. the District has jurisdiction, and the gravity line shall be inspected by the District Inspector.

The sump/holding tank and pumps shall be installed outside of the building envelope, and shall be under the responsibility of the property owners.

L. Sewer Alignment - Where sewer lines are to be installed within street rights-of-way, they shall, wherever practical, be designed and installed five (5) feet off the center line of the existing or future street (usually the side opposite the water line). In streets in hilly areas, the sewer shall be installed on the uphill side of the street where possible. Where practical, all sewer lines within easements shall be designed and installed with not less than five (5) feet between the center line of sewer and the edge of the easement. All sewer lines and structures shall be designed and installed well in the clear of all other improvements and utilities (see "Pipe Clearance" above).

M. Sampling Manhole - Dischargers of non-domestic wastes may be required to install a sampling manhole at the location where the lateral sewer connects to the sewer main as designated by the District or CMSA.

N. Manhole Accessibility - Insofar as possible, all manholes shall be situated so that they are accessible to the District's cleaning vehicles.

O. Sewer Pipe Stubs - Sewer pipe stubs shall be designed and installed in all manholes from which future sewer line extensions are anticipated. Pipe stubs shall be minimum eight (8) inches in size or as directed by the District and shall be of an approved type of pipe. Stubs shall protrude a minimum of five (5) feet outside of the manhole base and shall be channeled as though a regular sewer line within the manhole. A rubber coupling on the outside of the pipe shall be encased in the manhole base to prevent leakage. The outboard end of stubs shall be a standard bell joint end and shall be plugged with a standard watertight plug and cap, as supplied by the pipe manufacturer.

P. Sewer Line Extensions - In all new streets, where sewer lines are expected to be extended, the sewer line shall be designed and installed to the end of the proposed street improvements, prior to street construction. The sewer extension shall terminate with a manhole, at a location which will minimize the amount of pavement to be disturbed by future sewer extensions.

Q. Sewers to be Installed in Existing Improved Streets - Where sewers are being designed for installation in existing City and/or County streets, the Job Engineer shall submit the plans for the proposed work to the City and/or County Public Works Department for location and encroachment permit approval.

R. Sewers to be Installed in or Across Utility, Highway, Railroad Rights-of-Way, or Creeks - Where sewers are to be constructed across or within utility, railroad rights-of-way, or creeks requiring tunnels, bores and/or special pipe, the special pipe or construction shall extend the full length of the sewer line within the particular right-of-way. The Permittee shall secure all necessary encroachment permits or joint use permits for utility, highway, railroad rights-of- way or creek crossings.

S. Separate Side Sewers Required - Each individual building site shall be connected to the main sewer with a separate side sewer. Combined side sewers for buildings under the same ownership will be permitted only on specific approval of the District when the property is not likely to be subdivided in the future. A common side sewer may be used for connected buildings (i.e., buildings with common walls or multi-story buildings) under different ownership where the Covenants, Conditions and Restrictions (CC&R's) provide that the homeowners' association maintains all common laterals.

T. Side Sewer Connections - Side sewers shall be installed into manholes where possible. Side sewers shall connect near the bottom of the manhole, matching pipe crowns, unless a formal external drop connection is provided. Side sewer connections to sewer mains shall be per Section 02600, **SIDE SEWERS** of these Standard Specifications.

U. Side Sewer Cleanouts Required - Cleanouts shall be installed in the side sewer as provided in the Uniform Plumbing Code. The cleanout riser shall be equal in size to the side sewer (see Drawing SD-30).

Cleanouts shall be installed at the locations required in Section 02600, **SIDE SEWERS** of these Standard Specifications.

Note: All cleanouts, except the cleanouts with backwater prevention devices, shall be brought to grade, properly capped and completely watertight.

V. Backwater Prevention Devices - All side sewers shall be equipped with an approved backwater prevention device, as detailed on the Standard Drawings (see Drawing SD-31) and required in Section 02600, **SIDE SEWERS** of these Standard Specifications.

W. Backwater Check Valve - If the difference between the elevation of the lowest fixture and the backwater prevention device is less than six (6) inches, an extendable backwater check valve shall be installed between the backwater prevention device and house (see Drawing SD-32).

X. Abandoned or Unused Side Sewers - Any abandoned or unused side sewers connected to District mains, including side sewers from homes or buildings that are demolished, or any side sewer from property line to District mains shall be dug out and followed to the District main, and the old wye or tee or old connection area shall be cut away and spliced with a solid piece of pipe of the same size and dimension. The District Inspector shall be present when this procedure is done.

4-04 Sewer Structures.

A. Manholes - Manholes shall be placed at all intersections of sewer lines other than side sewer connections less than eight (8) inches in diameter, at all vertical or horizontal angle points, and at intervals not greater than 350 feet. Manholes shall not be allowed within intersections of streets larger than residential (typically with a pavement width exceeding 36 feet). For these intersections, the manholes must be located outside of the intersection in a configuration that allows maintenance to be performed by blocking only one lane of traffic at a time. Manholes are prohibited from being located within a crosswalk and other alignments designated for pedestrian travel. Manholes are also prohibited in areas designated for on- street parking. For residential streets, manholes shall be located near the center of street intersections and shall be accessible to maintenance vehicles. All manholes from which future sewer line extensions are anticipated shall have a pipe stub planned and installed at the grade and the direction of the anticipated sewer extension. The pipe stub shall be installed with permanent watertight plug in bell of 5-foot pipe stub out of manhole. The following regulations shall also apply:

1. A standard drop manhole connection (See SD-5 and SD-6) shall be installed when the invert elevation of the incoming sewer is greater than two (2) feet higher than the outgoing sewer. Otherwise, the crown elevation of the incoming sewer must match the crown elevation of the outgoing sewer, allowing for the appropriate slope through the manhole. The District must specifically approve all proposed drop manholes.

2. Where there is to be more than thirty (30) degrees deflection between any inlet line and the outlet line of a manhole, the fall through the manhole shall

be a minimum of 0.10 of a foot. Where there is to be less than thirty (30) degrees deflection between any inlet line and outlet line of a manhole, the slope inside of the manhole shall be less than or equal to the existing slope of the incoming pipe.

3. The angle of deflection between incoming and outgoing lines in a manhole shall not be greater than ninety (90) degrees.

4. Unless special arrangements are made, all lines connecting to existing manholes shall conform to the Standard Drawings for new manholes.

5. A manhole shall be located at the terminus of all main sewers in street.

C. Test Fittings - All test fittings shall, unless otherwise approved, be tees or wye branches of the same size, type, and quality as that of the line in which they are being installed. The branch of all test fittings shall be installed in an upright position and shall be brought to grade as a cleanout or removed after testing.

D. Remodeling Structures - All structures to be remodeled shall comply with the Standard Drawings. Any remodeling of any structure shall be specified and/or detailed on the plans and approved by the District prior to any remodeling work.

E. Special Structures - Trunk sewer manholes, siphons, pumping systems, and other unusual structures require specific design approval by the District.

H. Locator Wire and Detection Tape – Locator wire and detection tape shall be installed above all buried piping and in accordance with the Standard Drawings and Section 15050, **GENERAL PIPING** of these Standard Specifications.

*****END OF SECTION*****

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SECTION 5 PLAN APPROVAL AND PERMIT ISSUANCE

5-01 General. The procedure outlined in this Section shall be followed for submittal, review and approval of plans, and permit issuance for sewer main extensions.

5-02 Plan Checking Deposit. The Plan Checking Deposit shall be paid to the District prior to any review of plans. This deposit is not refundable but, upon issuance of a main extension permit, the deposit will be credited against the total Plan Checking and Inspection Fees due under District rules and regulations.

5-03 Preliminary Review. To facilitate the processing and review of plans for main extensions, all of the following materials shall be submitted at least three weeks prior to the District Board meeting at which approval of plans is desired.

A. Two (2) complete sets of sewer plans and profiles.

B. Two (2) complete sets of any required special specifications.

C. Two (2) copies of the Job Engineer's preliminary cost estimate.

D. Two (2) copies of maps and descriptions for any required sewer easements.

E. If the project is a subdivision, submit one (1) copy of the final map, including the proposed certificate page, and one (1) copy of the proposed grading plans.

After submittal, the above materials will be reviewed by the District staff and the District Engineer. If there are any required corrections and/or recommended revisions, they will be noted on the plans, easements, etc., and one set will be returned to the Job Engineer for revisions and resubmittal. This procedure will be repeated until all District requirements are met and the plans are ready for approval of the District Board.

5-04 Final Review and Approval. In order to obtain final approval, the Job Engineer shall submit the following materials, as revised in accordance with the above paragraph.

A. Four (4) complete sets of sewer plans and profiles.

B. Four (4) complete sets of any required special specifications.

C. One (1) copy of maps and descriptions for all required easements, together with signed and notarized deeds from each grantor, ready for recordation by the District.

D. If the project is a subdivision, submit one (1) copy of the final map, including one (1) copy of the grading plans (both in form to be presented to the City or County for final approval).

E. One (1) copy of the Job Engineer's estimate for all sanitary sewer facilities.

F. Any other pertinent plans, information or materials specifically required by the District Manager or District Engineer.

When all of these materials are received and given final review, the plans will be submitted to the District Board for approval. The Board meets regularly only once each month (specific dates may be obtained from the District office) and the Job Engineer will need to schedule his work and submittal of plans to meet an appropriate Board meeting date. After approval of the plans by the District Board, the District Manager will stamp "Approved" and sign all copies. He will then transmit one approved copy to the owner and one to the Job Engineer for his use. NOTE: The plan approval by the District shall become void six (6) months from the date of approval, unless a main extension permit for the work has been issued within that time.

5-05 Plan Revisions. In the event that any plan or field condition is encountered during construction that necessitates deviation from the approve plans, all work shall be halted until the plans are revised by the Job Engineer, resubmitted to the District and the revisions approved by the District. When revisions are required, the Job Engineer shall submit two (2) preliminary copies of the proposed revised sheets of the plans along with a letter explaining the recommended revisions. When the revisions are in approvable form, four (4) copies of the revised plan sheets shall be submitted for signature of the District Manager and distribution similar to the original plans. The Permittee shall bear all costs for any plan revisions. The Job Engineer shall be responsible for seeing that all revisions are appropriately shown on the "Record Drawings" for the project.

5-06 Statement of Fees and Charges. During District review of the plans but prior to final approval, the District Manager will prepare a Statement of Fees and Charges which will be sent to the Permittee, with a copy to the Job Engineer, detailing the fees and charges which must be paid and setting forth the required performance bond amount, and any other information or materials which may be required (other than approval of plans, specifications, etc.) prior to issuance of the main extension permit.

5-07 Issuance of Main Extension Permit. Written permission to construct the main extension will be granted only after all District requirements have been met, including final approval of all plans and specifications, payment of all appropriate fees and charges, posting of the required performance and maintenance bond, acquisition of all required easements, and the filing of a permit application form, receipt of the certificate of insurance from the Contractor, etc. (See Section 10-12.) No work shall be permitted to proceed until the main extension permit has been issued.

5-08 Subdivisions and New Developments. Before approving the recordation of a subdivision final map, the City, Town and/or the County require a letter from the District stating that plans and specifications for necessary sewerage facilities to serve each lot in the subdivision have been approved by the District and that financial arrangements have been made to insure installation of these facilities. Before this letter is written, the property must be annexed to the District (if not already in the District) and the main extension permit must have been issued as above provided.

Conditions placed by the relevant CEQA Lead Agency and Planning Agency for land use shall be followed.

Sewer capacity and design shall be performed by the applicant as deemed appropriate by the District Engineer, using sewer hydrologic/hydraulic software such as Innovyze InfoWorks CS, or District- Approved equivalent.

5-09 Items to Consider before Submitting Plans. The following is a general list of items which should be considered by the Job Engineer before submitting plans for review and approval of the District.

A. Have arrangements been made for the payment of the Plan Checking Deposit?

B. Are there any special details needed, such as special drawings, notes, and/or specifications to supplement the Standard Specifications?

C. Is the property to be sewered within the District boundaries?

D. If the property is not in the District, has the Owner requested in writing that his property be annexed and submitted the required Annexation Fee?

E. Can the proposed sewerage system provide service to properties other than those arranging for the installation? If so, have full provisions been made for the additional service or future extension?

F. Has County/City Flood Control approval been secured for all sewer line crossings of storm water channels?

G. Are all necessary easements prepared?

H. Are there any special permits and/or licenses required in connection with the work?

I. Have all existing and future underground utilities been shown on the plans and are there any conflicts or special requirements for field location?

*****END OF SECTION*****

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SECTION 6 CONSTRUCTION ENGINEERING

6-01 Staking Requirements. The Job Engineer shall be responsible for providing all necessary field surveys and construction staking. Grade and alignment stakes shall be set in advance of any trenching or excavation and, in general, stakes for straight sewers shall be set at either 25 or 50 foot intervals, depending upon topography and grade of the sewer. Intervals of 25 feet, or less, shall be used through all horizontal and vertical curves and for sewers with a grade flatter than 0.005. Stakes shall be approximately marked to show the Engineer's station, the offset, and the cut to sewer invert.

6-02 Side Sewer Locations. Prior to installation of lateral sewers, the lateral location and elevation at the property line shall be staked and flagged in the field by the Job Engineer.

6-03 Survey Authorization and Responsibility. When a survey is to be made on private property for a public sewer, permission of the property owner shall be obtained by the Job Engineer or his representatives prior to entry. The District will not be answerable or accountable in any manner for any loss or damage that may come about during or as a result of survey work by others.

6-04 Field Changes. During construction the District, through the District Manager, District Engineer or District Inspector, may request the Job Engineer to make changes in the work. The Job Engineer shall review such changes and prepare the necessary drawings and descriptions for execution by the Construction Contractor.

6-05 Soil Compaction Tests. For all works in public streets and works not in public streets as required by the District, the Applicant shall retain a Soils Engineer to take compaction tests in the trench backfill or embankment construction. On District projects, the District will retain a Soils Engineer.

The Soils Engineer shall take compaction tests at intervals and depths as required by the agency having jurisdiction on the right of way or as required by the District; as a minimum, one compaction test shall be taken midway in the intermediate backfill and on the surface every 100 feet of sewer line length. The Soils Engineer shall immediately provide the District Inspector the results of the soils tests. At the end of the job, the Soils Engineer shall provide the District with a summary of the soils tests taken.

6-06 Record Drawings. Upon completion of the work and prior to acceptance by the District, the Job Engineer shall provide "record drawings" to the District. Record drawings shall consist of all details shown on the original approved plans, corrected and/or expanded to reflect all design or construction changes from the approved plans. Particular attention should be paid to changes in the following items:

A. Sewer line and structure locations.

B. Surface and invert elevations of structures.

C. Slope, size, type of pipe, and length between structures.

D. Wye and lateral locations.

The Job Engineer shall submit a preliminary copy of the record drawings for review by the District. After review and approval by the Inspector or other District representative, the Job Engineer shall submit one (1) complete set of high quality prints and one (1) complete set of high quality duplicate tracings, noted and signed by the Job Engineer as "Record Drawings".

*****END OF SECTION*****

SECTION 7 DISTRICT PERMITS, LICENSES AND BONDS

7-01 Permits. All work performed in relation to and for connection to the District sewer system requires a specific permit in accordance with District rules and regulations. In the case of District contract work, the contract is considered to be the District permit for all work included in the contract under District jurisdiction.

A. Main Sewer, Structure and Manhole Installation Permits - Engineering plans and profiles are required in accordance with Sections 1 through 6 of these specifications.

B. Side Sewer, Lateral and Building Sewer Connection Permits - Location plans are required when a 6-inch or larger side sewer is to be installed and at any other time when specifically required by the District.

7-02 Licenses. Contractors performing work requiring a permit by the District shall be licensed by the State of California. Work on public property, streets, roads and other rights-of-way shall be performed only by duly licensed Contractors. Property owners may perform side sewer work on their own property.

7-03 Bonds. Prior to the issuance of a permit for a sewer main extensions (public sewer construction), the applicant shall furnish to the District a 100% faithful performance bond, cash, or other improvement security acceptable to the District, in the amount of the total estimated cost of the work as determined by the District, based on the District's Table of Current Construction Costs. Such faithful performance bond, cash deposit, or other improvement security shall be conditioned upon the performance of the work in accordance with the terms and conditions of the permit, and unless more stringent requirements are otherwise specified by the District Board, and 10% of the bond shall remain in effect to guarantee the *correction of faulty workmanship and the replacement of defective materials for a period of one (1) year from and after the date of acceptance of the work by the District Board.

*****END OF SECTION*****

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GENERAL CONSTRUCTION REQUIREMENTS

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SECTION 8 CONTROL OF WORK

8-01 Authority of District. All work shall be done in a workmanlike manner and shall be performed to the reasonable satisfaction of the District, which shall have general control of all work included hereunder. To prevent disputes and litigation, the District shall in all cases determine the amount, quality, acceptability, and fitness of the several kinds of work and materials which are provided; shall decide all questions relative to the true construction, meaning, and intent of the specifications and drawings; and shall have the power to reject or condemn all work or material which does not conform to the plans and specifications.

Should the Permittee or Contractor fail to act promptly or be remiss in the prosecution of any work done under these specifications, or should the exigencies of the case require that repairs or replacements be made before the Contractor can be notified or can respond to notification, the District may, at its option, make or cause to be made the necessary repairs or replacements or perform the necessary work, and the Permittee or Contractor shall pay to the District the cost of such work plus fifteen percent (15%) for District administration. Any such action by the District shall not relieve the Permittee, Contractor or his/her surety of their obligation or responsibility in the prosecution of the job, nor do these provisions establish contingent liability on the part of the District.

The Permittee shall pay all costs of his/her contractor, including the cost of any changes in the work required by the District.

8-02 Plans. The approved plans shall be supplemented by such working drawings as are necessary to control the work adequately. All authorized alterations affecting the requirements and information given on the approved plans shall be in writing. No changes shall be made in any plan or drawing after it has been approved by the District, except by its direction.

The Contractor shall keep on the job site a copy of the plans and specifications, as well as a copy of all City, County, State, and other governing specifications, which plans and specifications shall be accessible to the District at all times. The plans, specifications, standard drawings, Special Provisions, and all supplementary documents are to be considered the requirements of the work, and it shall be the responsibility of the Contractor to familiarize himself fully with the requirements of these and the various governing authorities having jurisdiction over the work.

Working drawings, not included in the plans furnished by the District or its appointed Representative, may be required for the prosecution of the work. They shall include shop details, erection plans, masonry layout diagrams, and bending diagrams for reinforcing steel, which shall be approved by the District before any work involving these plans is performed.

It is expressly understood that approval by the District of the Contractor's working drawings does not relieve the Contractor of any responsibility for accuracy of

dimensions and details. It is mutually agreed that the Contractor shall be responsible for agreement and conformity of his working drawings with the approved plans and specifications. Further, approval by the District of the Contractor's working drawings or any method of work proposed by the Contractor shall not relieve the Contractor of any of his responsibility for any errors therein and shall not be regarded as any assumption of risk or liability by the District or any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure or partial failure or inefficiency of any plan or method so approved. Such approval shall be considered to mean merely that the District has no objection to the Contractor using, upon his own full responsibility, the plan or method proposed.

8-03 Suggestions to Contractor. Any plan or method for work suggested by the District to the Contractor, but not specified or required, if adopted or followed by the Contractor in whole or part, shall be used at the risk and responsibility of the Contractor; and neither the District, District Board, District Manager nor the District Engineer or their agents shall assume responsibility therefor.

8-04 Conformity with Plans and Allowable Deviations. Finished surfaces in all cases shall conform with the lines, grades, cross-sections, and dimensions shown on the approved plans. Unless otherwise specified herein, deviations from the approved plans and working drawings, as may be required by the exigencies of construction, will in all cases be determined by the District and authorized in writing.

8-05 Interpretation of Plans and Specifications. The plans and specifications are intended to be explanatory of each other. Any work indicated in the plans and not in the specifications, or vice versa, is to be executed as if indicated in both. All work shown on the plans, the dimensions of which are not shown, shall be accurately followed to the scale to which the plans are made, but shown dimensions are in all cases to be followed, where given, though they differ from scaled measurements. Large scale drawings shall be followed in preference to small scale drawings. Should it appear that the work to be done, or any of the matters relative thereto, are not sufficiently detailed or explained in the plans and specifications, the Contractor shall apply to the District or its appointed Representative for such further explanation as may be necessary, and shall conform thereto as part of the contract. In the event of any doubt or question arising respecting the true meaning of the specifications, Special Provisions or plans, reference shall be made to the District and its decision thereon shall be final.

8-06 Superintendence. The Contractor shall give his personal attention to and shall supervise the work to the end that it shall be prosecuted faithfully, and when he is not personally present on the work, he shall at all reasonable times be represented by a competent superintendent on foreman who shall receive and obey all instructions or orders given by the District, and who shall have full authority to execute the same, and to supply materials, tools and labor without delay and who shall be the legal representative of the Contractor. The Contractor shall be liable for the faithful observance of any instructions delivered to him or to his authorized representative.

8-07 Character of Workmen. The Contractor shall employ only such foreman, mechanics and laborers as are competent and skilled in their respective lines of work, and, when required by the District, the Contractor shall discharge any person who commits trespass, or is, in the opinion of the District, incompetent, unfaithful, intemperate, disorderly, or uses threatening or abusive language to any person on the work representing the District, or is otherwise unsatisfactory, and such person shall not again be employed on the work. Such discharge shall not be the basis of any claim for compensation or damages against the District or any of its officers or representatives.

8-08 Construction Utilities. The Contractor shall be responsible for providing, for and on behalf of his work under the contract, all necessary utilities, such as special connections to water supply, sanitation facilities, telephones, power lines, fences, roads, watchmen, suitable storage places, etc. All utility arrangements, including applicable permits, shall be obtained prior to the start of work and paid for by the Contractor.

8-09 Lines and Grades. When the Contractor requires stakes or marks, he shall notify the District or its appointed Representative of his requirements at least forty-eight (48) hours in advance of starting operations that require such stakes or marks. The Contractor shall have all the utilities located and marked prior to staking.

Stakes and marks set by the District or its appointed Representative shall be carefully preserved by the Contractor. If any such stakes and marks, necessary to complete construction are destroyed or damages by reason of the Contractor's operation, the Contractor shall pay for replacing or restoring such stakes and marks by the District or its appointed Representative.

The Contractor shall furnish all additional stakes, templates, and other material necessary for accurately transferring lines and grades to the bottom of trenches or excavations for the construction of pipelines and structures. For this purpose, he shall employ competent personnel or an independent licensed Civil Engineer or licensed Land Surveyor acceptable to the District or its appointed Representative, who shall be responsible for accurately performing this work.

All distances given and measurements will be in a horizontal plane. Grades are given from the top of stakes or nails, or other points approved by the District.

Three (3) consecutive points shown on the same rate of slope must be used in common, in order to detect any variations from a straight grade, and in case an such discrepancy exists, it must be reported to the District or its appointed Representative and to the District. If such discrepancy is not reported, the Contractor shall be responsible for any error in the finished work.

8-10 Proof of Compliance with Specifications and Drawings. In order that the District may determine whether the Contractor has complied with the requirements of the contract not readily enforceable through inspection and tests of work and material, the Contractor shall, at any time when requested, submit to the District properly authenticated documents or other satisfactory proofs as to his compliance with such requirements.

8-11 Errors and Omissions. If the Contractor, in the course of the work, finds and errors or omissions in plans or in the layout as given by survey points and instructions, or if he finds any discrepancy between the plans and the physical conditions of the locality, he shall immediately inform the District, in writing, and the District shall promptly verify the same. Any work done after such discovery, until authorized, will be done at the Contractor's risk.

8-12 Inspection. The District's representatives shall at all times have access to the work whenever it is in preparation or progress, and the Contractor shall provide proper and safe facilities for such access and for inspection. The District shall be furnished with every reasonable facility for ascertaining that the materials and the workmanship are in accordance with the requirements and intentions of the plans and specifications. All work done and all materials furnished shall be subject to his inspection and approval.

If the specifications, the District's instructions, laws, ordinances, or any public authority require any work to be specifically tested or approved, the Contractor shall give the District timely notice of its readiness for inspection, and if the inspection is by another authority than the District, of the date fixed for such inspection. If any work should be covered up without approval or consent of the District, it must, if required by the District, be uncovered for examination and properly restored at the Contractor's expense.

The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill his contract as prescribed, and defective work shall be made good and unsuitable materials may be rejected, not withstanding that such defective work and materials have been previously overlooked by the District and accepted for payment.

All inspection requested outside of normal District working hours or days shall be reimbursed to the District by the Contractor at rates established by the District.

8-13 Inspection by Division of Industrial Safety. All work shall conform to the applicable requirements of the State of California Division of Industrial Safety. When the work involves construction of a treatment plant or pump station, it shall be inspected by representatives of said Division prior to the final inspection by the District (see Section 8-24). Any necessary corrective work disclosed by such inspection shall be satisfactorily completed at the Contractor's expense prior to acceptance of the work by the District.

8-14 Commencement of Work and Delays - Permit Work. This section shall apply to the commencement of work and delays for work done under permit within the District. For District contract work, requirements concerning the progress of the work, etc., refer to the job specifications for said work.

Before initial work is begun, the Contractor and his foremen shall file with the District addresses and telephone numbers where they can be reached during non-working hours.

As provided in Section 11-02, prior to excavation work, the Contractor shall contact all utilities and agencies which have or may have aboveground and/or underground facilities within the work area.

The Contractor shall also give the District notice of the time when he will start work or resume work when suspended. Notices shall be given at least forty-eight (48) hours in advance of the starting or resumption time, exclusive of Saturdays, Sundays, or holidays, for the purpose of permitting the District to make the necessary assignment of its representative or inspector on the work. After the Contractor once begins the work, the work shall be prosecuted diligently and continuously each day until completed. Work may be suspended only during emergencies or inclement weather or where required under these specifications.

In the event the District shall determine that the work is not proceeding in accordance with plans and these specifications, or any applicable rules and regulations, the District may order the cessation of further work until the work proceeds in compliance with such requirements. All delays in the work occasioned by such stoppage shall not relieve the Contractor of any duty to perform the work or serve to extend the time for its completion.

When, in the opinion of the District, the Contractor's delay in completing the work or failure to comply with the plans and specifications and any applicable rules and regulations has or may cause damage to the existing sanitary sewerage facilities of the District, the District may order such work to be done as is necessary to protect said facilities and the expense of such work shall be charged to the Contractor by the District.

8-15 Removal of Defective and Unauthorized Work. All work which has been rejected as defective shall be remedied, or removed and replaced by the Contractor in an acceptable manner at no cost to the District. Any work done beyond the lines and grades shown on the plans or established by the District, or any extra work done without written authority, will be considered as unauthorized and will not be paid for. Work so done may be ordered removed at the Contractor's expenses. Upon failure on the part of the Contractor to comply promptly with any order of the District made under the provisions of this article, the District shall have the authority to cause defective work to be remedied, or removed and replaced, and unauthorized work to be removed and bill the costs to the Contractor or the Permittee.

8-16 Access to Work. During the performance of the work, the District and its agents and employees may at any time enter upon the work, or the shops where any part of such work may be in preparation, or the factories where any materials for use in the work are being or are to be manufactured or fabricated, and the Contractor shall provide proper and safe facilities therefor, and shall make arrangements with manufacturers to facilitate inspection of their processes and products to such extent as the District's interest may require. Other Contractors performing work for the District may also, for all purposes required by their respective contracts, enter upon the work.

8-17 Placing Portions of Work in Service. If desired by the District, portions of the work, as completed, may be placed in service, and the Contractor shall give proper access to the work for this purpose, but such use and operation shall not constitute an acceptance of the work by the District, and the Contractor shall be liable for defects due to defective materials, workmanship and equipment until the entire work is finally accepted by the District. The warranty period on equipment shall not begin until the entire work is finally accepted by the District.

8-18 Removal or Replacement of Work Done Without Lines, Grades or Levels. Any work done without lines, levels or grades being given by the District or its appointed Representative or without favorable review of a District Inspector, may be ordered replaced at the Contractor's sole expense, except when such work is specifically authorized by the District.

8-19 Equipment and Methods. The work under the contract or permit shall be prosecuted with all materials, tools, machinery, apparatus, and labor and by such methods as are necessary to the complete execution of everything described, shown or reasonably implied. If at any time before the beginning or during the progress of the work, any part of the Contractor's plant, or equipment or any of his methods of execution of the work, appear to the District to be unsafe, inefficient or inadequate to insure the required quality or rate of progress of the work, he may order the Contractor to increase or improve his facilities or methods, and the Contractor shall comply promptly with such orders; but neither compliance with such orders nor failure of the District to issue such orders shall relieve the Contractor from his obligation to secure the degree of safety, the quality of the work, and the rate of progress required of the Contractor. The Contractor alone shall be responsible for the safety, adequacy, and efficiency of his plant, equipment, and methods.

8-20 Unfavorable Weather and Other Conditions. During unfavorable weather and other conditions, the Contractor shall pursue only such portions of the work as shall not be damaged thereby. No portions of the work whose satisfactory quality and efficiency will be effected by any unfavorable conditions shall be constructed while these conditions obtain, unless by special means or precautions approved by the District, the Contractor shall be able to overcome them.

8-21 Easement Construction. The Contractor shall make every effort to restrict his operations to areas within the easements or rights-of-way provided for the work. He shall caution all employees not to trespass or operate equipment outside the easements provided, without first having obtained written permission from adjacent property owners. A copy of said written permission is to be submitted to the District prior to any encroachment. Prior to commencing any work on private property or within easements, the Contractor shall take pictures of the original condition. The Contractor shall clean up and restore all easement and other disturbed areas to a condition equal to or better than the original.

The Contractor shall conduct his operations so as to cause as little damage as possible to existing yard improvements. Yard improvements such as fences, landscaping, trees, patios, walkways, driveways, etc., in the line of construction shall be removed by the Contractor only after approval by the District. Unless otherwise provided in the Special Provisions or permitted by the District and/or property owners, all fences, trees, plants, lawns, ornamental shrubbery, patios, walkways, driveways, and any other yard improvements within the working easements or rights-of- way which have been damaged by the Contractor's operations shall be completely replaced, repaired or restored to its original conditions by the Contractor to the satisfaction of the District and/or property owner. Replacing, repairing, and restoring shall be accomplished with materials of the same kind and quality as those of the original improvement.

The Contractor shall remove, haul, and dispose of, off the job site, all surplus and waste materials resulting from his operations that are not required to complete the project and shall thoroughly clean up the site of the work and dress the slopes and banks to the satisfaction of the District.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work and no additional allowance will be made therefor.

8-22 Alterations. The District reserves the right to increase or decrease the quantity of any items or portions of the work or to omit portions of the work as may be deemed necessary or advisable by the District; also to make such alterations or deviations, additions to, or omissions from the plans and specifications, as may be determine during the progress of the work to be necessary and advisable for the proper completion thereof. Upon written order of the District, the Contractor shall proceed with the work as increased, decreased or altered. On private work, the Permittee shall pay all costs of any alternatives to work required by the District.

8-23 Cleaning Up. The Contractor shall confine his equipment, storage of materials, and construction operations to such limits as may be directed by the District, and shall not allow the site of the work to become littered with trash and waste material, but shall maintain the same in a neat and orderly condition throughout the construction period. The District shall have the right to determine what is or is not waste material or rubbish and the place and manner of disposal.

On or before the completion of the work, the Contractor shall without charge therefor, carefully clean out all pits, pipes, chambers or conduits and shall tear down and remove all temporary structures built by him and shall remove rubbish of all kinds from any of the grounds which he has occupied and leave them in first class condition.

8-24 Final Inspection. When the work contemplated by the contract, permit or agreement has been completed, the District will, upon request by the Contractor, make the final inspection on the grounds together with an authorized representative or representatives of any and all other agencies having an interest in the work.

*****END OF SECTION*****

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SECTION 9 CONTROL OF MATERIAL

9-01 Source of Supply and Quality of Materials. Prior to commencement of any work, the Contractor shall submit to the District, a list of the suppliers or sources of all materials to be incorporated in the work. This list shall be approved by the District before any of the materials are delivered to the job site.

Any of the materials being used for replacement, rehabilitation, connections, etc. shall be made to match the existing material. If the material listed in District's Approval Material list are no longer available, the Contractor shall notify and get direction and approval for alternatives by the District.

Only materials conforming to the requirements of these Standard Specifications and approved by the District shall be used in the work. Special design consideration or variances from these Standard Specifications may be granted upon review and approval by the District Engineer.

Products of the USA shall be used where feasible.

The District prefers the use of recycled materials, as allowed in these Standard Specifications and where feasible.

All materials proposed for use may be inspected or tested at any time during their preparation and use. After trial, if it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved material from other approved sources. No material which, after approval, has in any way become unfit for use shall be used in the work. Manufacturer's guarantees, instructions, and parts lists shall be delivered to the District before acceptance of the work. All materials shall be manufactured, handled, and used in a workmanlike manner to insure completed work in accordance with the plans and specifications.

9-02 Quality in Absence of Detailed Specifications. Whenever under the contract, permit or agreement, the Contractor is required to furnish materials or manufactured articles or to do work for which no detailed specifications are set forth, the materials or manufactured articles shall be of the best grade in quality and workmanship obtainable in the market from firms of established good reputation, or, if not ordinarily carried in stock, shall conform to the usual standards for first class material or articles of the kind required, with due consideration of the use to which they are to be put. In general, the work performed shall be in full conformity and harmony with the intent to secure the best standard of construction and equipment of the work as a whole or in part.

9-03 Drawings, Samples and Tests. As soon as possible after execution of the contract or issuance of the permit, the Contractor shall submit to the District, in triplicate, sufficient information including, if necessary, assembly and detail drawings to demonstrate fully that the equipment and materials to be furnished comply with the

provisions and intent of the specifications and drawings. If the information thus submitted indicates the equipment or material is acceptable, the District will return one (1) copy stamped with his approval; otherwise one (1) copy will be returned with an explanation why the equipment or material is unsatisfactory. The Contractor shall have no claim for damages or extension of time on account of any delay due to the revision of drawings or rejection of material. Fabrication or other work performed in advance of approval shall be done entirely at the Contractor's risk. After approval of the equipment or material the Contractor shall not deviate in any way from the design and specifications given without the written consent of the District. When requested by the District, sample or test specimens of the materials to be used or offered for use in connection with the work shall be prepared at the expense of the Contractor and furnished by him in such quantities and sizes as may be required for proper examinations and tests, with all freight charges prepaid and with information as to their sources.

All samples shall be submitted before shipment and in ample time to permit the making of proper tests, analyses, or examinations before the time at which it is desired to incorporate the material into the work. All tests of materials furnished by the Contractor shall be made by the District in accordance with recognized standard practice. No material shall be used in the work unless or until it has been approved by the District. Samples will be secured and tested whenever necessary to determine the quality of the material.

9-04 District Furnished Materials. The Contractor shall furnish all materials required to complete the work, except such materials as are designated on the plans or in the Special Provisions to be furnished by the District.

Upon written request of the Contractor, materials to be furnished by the District will be delivered to him within a reasonable time at the points designated in the Special Provisions, or if not designated in the Special Provisions, then to the project. They shall be unloaded and hauled to the site of the work by the Contractor at his expense, the cost of handling and placing all materials after they are delivered to the Contractor shall be considered as included in the contract prices paid for the items in connection with which they are used.

The Contractor will be held responsible for all materials delivered to him, and deductions will be made from any monies due him to make good any shortages and deficiencies, for any cause whatsoever, which may occur after such delivery, or for any demurrage charges due to delinquency in unloading.

9-05 Local Materials. The Contractor shall satisfy himself as to the quantity of acceptable material which may be produced or obtained at local sources, and the District will not assume any responsibility as to the quantities or quality of acceptable material available.

When tests of materials from sources in the vicinity of the work have been made by the District, the results of such tests will be available to the Contractor or to prospective

bidders on inquiry at the office of the District. This information is furnished for the Contractor's or the bidder's convenience only and the District does not guarantee such tests and assumes no responsibility whatever as to the accuracy thereof or the interpretation thereof stated in the test records.

9-06 Acquisition of Materials. The Contractor shall have on hand, at the time he starts construction of any section of the work, all materials necessary to complete in a reasonable length of time, all work which would create a hazard or inconvenience if not completed.

9-07 Storage of Materials. Materials shall be so stored as to insure the preservation of their quality and fitness for the work. When considered necessary by the District, they shall be placed on wooden platforms or other hard, clean surfaces and not on the ground. They shall be placed under cover when so directed. Stored materials shall be so located as to facilitate prompt inspection.

All surplus piping materials shall be removed from the site of the work within five (5) days after completion of the pipe laying.

9-08 Defective Materials. All materials not conforming to the requirements of the specifications shall be considered as defective and all such materials, whether in place or not, shall be rejected. They shall be removed immediately from the site of the work, unless otherwise permitted by the District. No rejected material, the defects of which have been subsequently corrected, shall be used until approval in writing has been given by the District. Upon failure on the part of the Contractor to comply promptly with any order of the District made under the provisions of this section, the District shall have the authority to remove and replace defective material and to deduct the cost of removal and replacement from any monies due or to become due the Contractor.

9-09 Trade Names and Alternatives. For convenience and designation in these Standard Specifications, in these Standard Drawings, and the District's Approved Materials List, and Drawings certain equipment or articles or materials may be designated under trade names or the names of the manufacturers and with catalog information. Use of alternative equipment or an article or material which is of equal quality and of the required characteristics for the purpose intended will be permitted, subject to the approval of the District.

The burden of proof as to the comparative quality and suitability of alternative equipment or articles or materials shall be upon the Contractor and he shall furnish, at his expense, all information necessary or related thereto as required by the District. The District shall be the sole judge as to the comparative quality and suitability of alternate equipment or articles or materials and its decision shall be final. All additional costs required for redesign or modifications required to accommodate the substituted materials and/or equipment shall also be at the expense of the Contractor.

9-10 Certificates of Compliance. The District or its appointed Representative may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a certificate of compliance stating that the materials involved comply in all respects with the requirements of the specifications. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials. A certificate of compliance must be furnished with each lot of material delivered to the work and the lot so certified must be clearly identified in the certificate.

All materials used on the basis of a certificate of compliance may be sampled and tested at any time. The fact that material is used on the basis of a certificate of compliance shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements to the plans and specifications and any such material not conforming to such requirements will be subject to rejection whether in place or not.

The District reserves the right to refuse to permit the use of material on the basis of a certificate of compliance. The form of the certificate of compliance and its disposition shall be as directed by the District.

9-11 Salvage of Existing Materials. Unless otherwise indicated in the Special Provisions or permitted by the District, all old castings for manholes, rodholes, etc., and any other salvage construction materials which have been a part of the District's sewerage system may be claimed by the District and if so claimed such materials shall be delivered to the District yard.

*****END OF SECTION*****

SECTION 10 LEGAL RELATIONS AND RESPONSIBILITY

10-01 Laws to be Observed. The Contractor shall keep himself fully informed of all State and National laws and County, District and municipal ordinances and regulations which in any manner effect those engaged or employed in the work, or the materials used in the work, or which in any way effect the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same.

The Contractor shall at all times observe and comply with, and shall cause all his agents and employees to observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the District, and all of its officers and agents against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by himself or his employees. If any discrepancy or inconsistency is discovered in the plans, drawings, specifications, or contract for the work in relation to any such law, ordinance, regulation, order or decree, the Contractor shall forthwith report the same to the District in writing.

10-02 Permits and Licenses. The Contractor shall, prior to beginning any work, procure all permits and licenses, pay all inspection charges and permit fees, give all notices necessary and incident to the due and lawful prosecution of the work and shall furnish to the District written proof of compliance of this section.

Permits from the District do not cover any requirements from other agencies or relieve the Contractor or Permit Applicant from the requirement(s) to obtain all applicable permits and authorization from other agencies with jurisdiction. This may include but is not limited to requirements of the County of Marin, encroachment permits from City or Towns with jurisdiction, California Department of Fish and Wildlife (CDFW), the US Army Corps of Engineers, the Regional Water Quality Control Board (RWQCB), and the State Water Resources Control Board (SWRCB).

10-03 Patents. The Contractor shall assume all costs arising from the use of patented materials, equipment, devices, or processes used on or incorporated in the work, and agrees to indemnify and save harmless the District, the District Engineer and their duly authorized representatives, from all suits at law or actions of every nature for, or on account of the use of any patented materials, equipment, devices or processes.

10-04 Traffic Control. This section defines the Contractor's responsibility with regard to providing for the passage of public traffic through the work during construction. The Contractor shall so conduct his operations as to offer the least possible obstruction and inconvenience to public traffic, and he shall have under construction no greater length or amount of work than he can prosecute properly with due regard to the rights of the public. Prior to commencing work, the Contractor shall submit to the agency exercising jurisdiction over the road or street a written traffic control plan, including proposed street or land closure times, for their approval and shall comply with the approved traffic control plan and all requirements of the encroachment permit.

Unless detours are permitted or unless otherwise provided in the Special Provisions, all traffic shall be permitted to pass through the work with as little inconvenience and delay as possible. Street or lane closures shall only be made within the hours provided in the approved traffic control plan. Spillage resulting from hauling operations along or across the traveled way shall be removed immediately at the Contractor's expense.

While trenching and paving operations are underway, traffic shall be permitted to use shoulders and the side of the roadbed opposite the one under construction. When sufficient width is available, a passageway wide enough to accommodate two (2) lanes of traffic shall be kept open at all times at locations where construction operations are in active progress.

In order to expedite the passage of public traffic through or around the work and where ordered by the District or its appointed Representative, the Contractor shall install signs, lights, flares, barricades, and shall furnish flaggers and/or a pilot car and driver and other facilities for the sole convenience and direction of public traffic. Also where directed by the District or the agency having jurisdiction over the street, he shall provide and station competent flaggers whose sole duty shall consist of directing the movement of public traffic through or around the work. Where needed or required, flaggers shall be equipped with two-way radios.

In addition to the requirements herein specified for furnishing facilities and flaggers for expediting the passage of public traffic through or around the work, the Contractor shall furnish and erect, within or adjacent to the limits of the contract, such warning and directional signs required in the approved traffic control plan or as may be designated by the District Engineer or the agency having jurisdiction over the roadway.

All roads must be kept open for public traffic at all times unless specific written permission to close or restrict the use of a particular street is given by the District and by the Department of Transportation or the Public Works Director of Marin County or by any of the Public Works Director of the cities inside the District. In the event that closing of a particular street is allowed, it shall be the responsibility of the Contractor to notify police and fire departments, the school district and ambulance services as to the hours and dates of the street closure and routes of detours at least 24 hours in advance of their occurrence, and again to notify them when they are discontinued.

Whenever the Contractor's operations create a hazardous condition, he shall furnish at his own expense and without cost to the District, such flaggers and guards as are necessary to give adequate warning of and protection from any dangerous conditions to be encountered and he shall furnish, erect, and maintain such fences, barricades, lights, signs and other devices as are necessary to prevent accidents and avoid damage or injury. Flaggers and guards while on duty shall be equipped with red wearing and a red flag or paddle-type signal which shall be kept clean and in good repair. Flaggers shall be equipped with 2-way radios when needed for traffic control. Signs, flags, lights, and other warning and safety devices shall conform to the requirements set forth in the current "Manual of Traffic Controls for Construction and Maintenance Work Zones", issued by the State Department of Transportation.

10-05 Public Convenience. Convenience of abutting owners along the road or sewers shall be provided for as far as practicable. Convenient access to driveways, houses, and buildings along the line of the work shall be maintained and temporary approaches to crossings or intersecting highways shall be provided and kept in good condition.

The right is reserved to municipal corporations, county authorities, and to water, gas, telephone, telegraph, television, and other electric power transmission utilities to enter upon any public highway, road, or right-of-way for the purpose of making repairs and changes that have become necessary by the reason of the sewer installation.

All fences subject to interference shall be maintained by the Contractor until the work is completed, at which time they shall be restored to the condition prior to starting the work.

Excavation and backfill shall be conducted in such a manner as to provide a reasonably smooth and even surface satisfactory for use by the public traffic at all times. When possible, sewer construction shall be conducted on one-half the width of the traveled way at a time and that portion of the traveled way being used by public traffic shall be kept open and unobstructed until the opposite site of the traveled way is ready for use by traffic. The roadbed shall be sprinkled with water, if necessary, to prevent dust nuisance.

Bridges of approved construction shall be installed and maintained across the trench at all crosswalks, intersections, and at other points where, in the opinion of the District or its appointed Representative, traffic conditions make it advisable.

10-06 Safety. This section defines the Contractor's responsibility with regard to providing for safety during construction. The Contractor alone shall be responsible for the safety of his plant, equipment, and methods, including trench shoring. All trench shoring and other construction methods shall comply with State and Federal Safety Orders.

Should the Contractor appear to be neglectful or negligent in furnishing warning and protective measures, the District may direct attention to the existence of a hazard, and may order the Contractor to improve his facilities or methods, and the Contractor shall promptly comply with such orders, and the necessary warning and protective measures shall be furnished and installed by the Contractor at his own expense without cost to the District. Whether or not the District issues orders, and whether or not he points out the inadequacy of warning and protective measures shall be furnished and installed by the Contractor at his own expense without cost to the District. Whether or not the District or its appointed Representative issues orders, and whether or not he points out the inadequacy of warning and protective measures, and even though the Contractor takes appropriate steps in accordance therewith, the Contractor shall not be relieved from responsibility for securing the necessary degree of safety, nor shall his obligation to furnish and pay for appropriate plant, equipment and methods be abrogated.

No material or equipment shall be stored where it will interfere with the free and safe passage of public traffic, and at the end of each day's work and at other times when construction operations are suspended for any reason, the Contractor shall remove all equipment and other obstructions from that portion of the roadway to be opened for use by public traffic. No material or other obstructions shall be placed within fifteen (15) feet of fire hydrants, which shall be at all times readily accessible to the fire department, nor within five (5) feet of United States mailboxes.

Open fires, smoking, the striking of matches, open flame lamps or lanterns, and electrical equipment and appliances that will generate or produce sparks shall not be permitted in the sewer or portion thereof where there is or may be an accumulation of inflammable gas in explosive quantities.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work and no additional allowance will be made therefor.

10-07 Use of Explosives. When the use of explosives is necessary for the prosecution of the work, all necessary explosive work shall only be accomplished by a Contractor having the proper State of California license to handle and use explosives. Utmost care shall be taken to avoid danger or damage to life and property.

All explosives shall be stored in accordance with the provisions of Division XI of the Health and Safety Code. Attention is called to any local ordinance involving the use or storage of explosives. In advance of any blasting work, the Contractor shall obtain all necessary permits and clearances and shall comply with all Federal, State, and local laws regulating the use of explosives.

10-08 Preservation of Property. Attention is directed to Section 11 of these specifications. Due care shall be exercised to avoid injury to existing sewer improvements or facilities, streets, highways, pavements, utility facilities, adjacent property, and roadside trees and shrubbery that are not to be removed. Dust resulting from the Contractor's operations shall be kept to a minimum. If required by the District, the Contractor shall keep on the job site equipment for washing the streets. Where landscaping or landscape irrigation lines are disrupted, the Contractor shall provide for alternate watering for irrigation of lawns or landscaping.

In case it shall be necessary to remove any telephone, telegraph, or electric power transmission poles, gas pipes, water pipes, electrical conduits or underground structures of any character, or portion thereof, the owners or their agents or superintendents, upon proper application of the Contractor shall be notified by the authorized official to remove same within a specified time, and the Contractor shall not interfere with said structures until the time specified in the said notice shall have expired. In case water or gas service pipes crossing the line of the sewer trench are cut by the Contractor, such connection shall be restored without delay, after the passing of the trenching machine. Such cutting and restoration of service connections shall be at the

sole expense of the Contractor and shall be done at such times and manner as to insure the least inconvenience to the users.

The Contractor shall examine all roadbeds, bridges, culverts, and other structures on or near the work, over which he will move his materials and equipment, and before using them, he shall properly strengthened such roads and structures, where necessary. The Contractor shall be held responsible for any and all injury or damage to such roads and structures caused by reason of his operations.

Any painting, striping, safety buttons, traffic loops, catch basins, street signs and any public or private properties that are damaged or destroyed by the Contractor or his subcontractor shall be replaced with the consent of the District Engineer, the District Manager or the encroachment permit issuer. This pertains to the job site or any area being used by the Contractor. The cost of replacement shall be included in the bid price for sewer line.

The fact that any underground facility is not shown upon the plans shall not relieve the Contractor of his responsibility under this section. It shall be the Contractor's responsibility to ascertain the existence of any underground improvements or facilities which may be subject to damage by reason of his operations.

Full compensation for furnishing all labor, materials, tools, and equipment, and for doing all the work involved in protecting or repairing property as specified in this section, shall be considered as included in the contract work.

10-09 Responsibility for Damage or Injury. The District, District Board, District Engineer or any of their officers or employees shall not be answerable or accountable in any manner, for any loss or damage that may happen to the work or any part thereof; for any of the materials or other things used or employed in performing the work; for injury to any person or persons either workmen or the public; for damage to the property from any cause which might have been prevented by the Contractor, or his workmen, or anyone employed by him. The Contractor shall be responsible for any liability imposed by law upon the District, its officers, employees, or the District's appointed Representative(s) for any damage to any person or property occurring or arising in the execution of the contract or performance of the work, including such resulting from a failure to abide by all applicable laws and regulations, or occurring or arising out of the improper execution of the contract or performance of the work, including such resulting from the failure to abide by all applicable laws and regulations, or occurring or arising out of the improper execution of the contractor or performance of the work, or resulting from work or materials which are defective, unsatisfactory, or imperfect or whose defective, unsatisfactory, or imperfect nature is discovered during any guarantee period, and shall indemnify, defend, and save harmless the District, the District Engineer and each of their agents, officers and employees, from all suits, actions, claims and demands of every name and description, brought for, or on account of any such injuries or damages and in addition to any remedy authorized by law, so much of the money due the Contractor under and by virtue of the contract as shall be considered necessary by the District may be retained

by the District until the disposition has been made of such suits or claims for damages aforesaid.

No retention of money due the Contractor under and by virtue of the contract will be made by the District pending disposition has been made of such suits or claims for damages brought against the said county, city, or district.

10-10 Contractor's Responsibility for Work. Until the acceptance of the work under the contract or permit, the Contractor shall have the charge and care of the work and of the materials to be used therein and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work or materials occasioned by any of the above causes before its completion and acceptance and shall bear the expense thereof, except for such injuries or damages as are directly and proximately caused by acts of God.

10-11 In case of suspension of work for any cause whatever, the Contractor shall be responsible for the work as above specified, and he shall also be responsible for all materials delivered to the work, including materials for which he has received partial payment or materials which have been furnished by the District, and if ordered by the Engineer, he shall, at his own expense, properly store such materials. Such storage by the Contractor shall be on behalf of the District and the District shall at all times be entitled to the possession of such materials, and the Contractor shall promptly return the same to the site of the work when requested. The Contractor shall not dispose of any of the materials so stored except on written authorization from the District or its appointed Representative. Where necessary to protect the work from damage, the Contractor shall, at his expense, provide suitable drainage and erect temporary structures.

Neither the District, District Engineer nor any of their agents, officers and employees assumes any responsibility for collecting indemnity from any person or persons causing damage to the work of the Contractor.

10-12 Indemnity. The Contractor shall hold harmless, indemnify and defend the District, the District Board, the District Engineer and each of their officers, agents and employees from any and all liability claims, suits, actions, losses or damage arising or alleged to arise from the performance of the work described herein or damages or claims to which the District, District Board, District Engineer and each of their officers, agents and employees may be subjected arising out of the Contractor's negligent performance, willful misconduct or unreasonable delay in connection with the work.

Indebtedness incurred for any cause arising out of the Contractor's negligent performance or willful misconduct in connection with work must be paid by the Contractor; and the District, District Board, District Engineer and each of their officers, agents and employees are hereby relieved at all times from any indebtedness or claim other than the contract sum.

10-13 Contractor's Insurance. The Contractor shall not commence work under the contract until he has obtained all insurance as specified herein; nor shall the Contractor allow any subcontractor to commence work on this project until the same insurance requirements have been complied with by each subcontractor.

The types of insurance the Contractor shall obtain and maintain for the full period of the contract will be Workmen's Compensation Insurance, Comprehensive General Liability Insurance and Automobile Liability Insurance, as detailed below. Any insurance bearing on adequacy of performance will be maintained after completion of the project for the full guarantee period. The Contractor shall be solely responsible for damage payments up go the amount of the deductible. Nothing contained in these insurance requirements is to be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from his operations.

A. Worker's Compensation Insurance - The Contractor and all subcontractors shall obtain for the period of the contract full Workmen's Compensation Insurance coverage for all persons whom they employ or may employ in carrying out the work under this contract. This insurance will be in strict accordance with the requirements of the most current and applicable State Workmen's Compensation Insurance laws. In case any class of employees engaged in hazardous work under the contract at the site of the project is not protected under the Workmen's Compensation statute, the Contractor shall provide and shall cause each subcontractor to provide adequate insurance for the protection of his employees not otherwise protected. The Contractor shall sign and file with the District the certification required pursuant to Section 1861 of the Labor Code.

B. Comprehensive General Liability - The Contractor and all his subcontractors shall obtain for the period of the contract full Comprehensive General Liability Insurance coverage. This coverage shall provide for both bodily injury and property damage, including coverage for injury, sickness or disease, death, and destruction of property arising directly or indirectly out of or in connection with the performance of work under this contract, including explosion, collapse, under-ground exposure and flooding, and will provide for a limit of not less than one million dollars ($1,000,000) for all damages arising out of bodily injury, sickness or disease to, or death of one person in any one occurrence, and an aggregate limit of not less than two million dollars ($2,000,000). Included in such insurance will be contractual coverage sufficiently broad to insure that provision titled "Indemnity" set forth in Section 10-11.

C. Automobile Liability Insurance - The Contractor and all of his subcontractors shall obtain for the period of the contract Automobile Liability Insurance with a combined single limit of $1,000,000 for bodily injury or death and property damage. This insurance shall cover all vehicles, whether rented or owned, while being used in connection with performance of the work.

D. Proof of Carriage of Insurance - Before commencing work, the Contractor shall furnish the District a certificate or certificates, evidencing issuance of all insurance policies mentioned above. The Comprehensive General Liability insurance policy shall bear the following endorsements: (a) endorsement precluding cancellation or reduction in coverage before the expiration of thirty-five (35) days after the District shall have received written notification by registered mail from the insurance carrier, (b) a standard cross liability endorsement, (c) an endorsement naming as additional insureds the District, District Board, District Engineer and each of their officers, agents and employees, and (d) an endorsement that the insurance as provided is primary insurance, and no other insurance available to the above shall be called upon to contribute to a loss.

10-14 Disposal of Material Outside the Right-of-Way. Unless otherwise specified in the Special Provisions, the Contractor shall make his own arrangements for disposing of materials outside the right-of-way and he shall pay all costs involved therewith.

When any materials, including excess or unsuitable excavated earth or other sewer materials are to be disposed of outside the right-of-way, the Contractor shall first obtain a written permit from the property owner on whose property the disposal is to be made, and shall file a copy of the permit with the District, and the disposal area shall be kept in a neat and orderly condition throughout the construction period.

10-15 Cooperation Between Contractors and District. The Contractor shall cooperate with all other contractors who may be employed on the work or related or adjacent work, and any workmen who may be employed by the District on any work in the vicinity; he shall so conduct his operations as to interfere to the least possible extent with the work of such contractors or workmen. He shall make good promptly, at his own expense, any injury or damage that may be sustained by other contractors or employees of the District at his hands.

Any difference or conflict which may arise between the Contractor and other contractors, or between the Contractor and workmen of the District in regard to their work shall be adjusted and determined by the District.

If the work of the Contractor is delayed because of any acts or omissions of any other contractor or of the District, the Contractor shall on that account have no claim against the District other than for an extension of that time.

10-16 Acceptance of Work. When the District has made the final inspection as provided in Section 8-24, and determines that all work under the contract, permit or agreement has been satisfactorily completed in all aspects in accordance with the plans and specifications and District rules and regulations, he will recommend formal acceptance by the District Board of Directors. Approved record drawings as required under Section 6-05 shall be submitted prior to acceptance of the work by the District.

10-17 Guarantee of Work. Unless more stringent requirements are otherwise specified (or in the case of permit work set forth in the form of a condition on the main extension permit), all work shall be guaranteed for a period of one (1) year from the date of acceptance by the District. The Contractor shall promptly make all needed repairs arising out of defective materials, workmanship, and equipment. The District is hereby authorized to make such repairs if within ten (10) days after the mailing of the notice in writing to the Contractor, or his agent, the Contractor shall neglect to make or undertake with due diligence the aforesaid repairs; provided, however, that in case of an emergency where, in the opinion of the District, delay would cause serious loss or damage, repairs may be made without notice being sent to the Contractor, and the Contractor shall pay the costs thereof.

10-18 Personal Liability. Neither the District Board, the District Engineer nor any other officer or authorized employee of the District shall be personally responsible for any liability arising under or by virtue of the contract.

10-19 Protection of Survey Monuments. Various survey monuments consisting of iron pipe, cast iron, brass, and concrete markers may be located along the center lines of streets, at intersections, points of beginning and ending of curves, property corners, and at other points, and where the installation of the sewers or other work of the contract may cause these monuments to be destroyed or disturbed. The Contractor shall notify the District or its appointed Representative and the Contractor shall not disturb any monument or property corner that must be removed in the performance of his work until he has been advised by the District or its appointed Representative that it has been properly referenced out for resetting. Should the Contractor disturb or remove any monuments or property corners due to his neglect, he shall be held responsible for the expense of their resetting by the District.

10-20 Sewer Service. The Contractor shall be held solely responsible to provide uninterrupted sewer service to all services effected by his work. The Contractor shall protect and indemnify the District, the District Board, the Inspector and all other officers, agents and employees against any claim or liability arising from or based on failure to provide such continuous service.

10-21 Business License. Each City and Town in Marin County requires a business license.

*****END OF SECTION*****

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SECTION 11 UTILITIES, OBSTRUCTIONS AND CONCRETE REMOVAL

11-01 Preservation of Property. Attention is directed to Sections 10-08 and 10-09, "Preservation of Property", and "Responsibility for Damage or Injury" of these specifications. Due care shall be exercised to avoid damage to existing improvements, utility facilities, and adjacent property. When any railroad, street, highway, private or public utility is crossed, all precautionary construction measures required by the owner of said crossing shall be followed by the Contractor.

11-02 Utilities. A particular effort shall be made to locate and indicate on the plans underground utilities and/or other facilities which may conflict with, cross or lie close to the work. The service connections to these utilities may be, but are not necessarily, shown on the drawings. Overhead utilities, including wires, poles and guys, are not necessarily shown on the plans and shall be determined from the Contractor's visit to the site.

The District cannot guarantee the accuracy or adequacy existing utilities shown in Plans or Record Drawings. It shall be the responsibility of the Contractor to determine the exact location of all utilities and service connections thereto ahead of any excavations through marking by USA Underground Service Alert and by potholing. The Contractor shall make his own investigations, including exploratory excavations, referenced herein as potholing, to determine the locations and type of existing utilities, including service connections, prior to commencing work which could result in damage to such utilities or conflict with the grade or alignment of the new installation. The Contractor shall immediately notify the District or its appointed Representative as required under Section 11-07, "Changed Conditions."

The Contractor shall be responsible for all damage to underground utilities, whether they are shown on the plans or not, or whether they have been potholed or not. The Contractor shall determine the location of all underground utilities and services through conferring with the utility companies and through potholing as described herein.

11-03 Utility Locations and Potholing. The Contractor shall contact Underground Services Alert (USA) at (800) 227-2600 or (800) 642-2444 a minimum of forty eight (48) hours in advance of starting excavation to provide for marking of utilities. Shutdown of utilities shall be performed only by the utility owner.

The Contractor shall protect all existing utilities, pavement, sidewalks, curbs, fences, landscaping, and other improvements that are not designated for removal, from damage by his operations. Any such features that are damaged or temporarily relocated by the Contractor during construction shall be repaired or restored by the Contractor to a condition equal to or better than they were prior to such damage or temporary relocation all in accordance with requirements of the contract documents and at no expense to the District.

It shall be the Contractor's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in his construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The Contractor shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary. The cost of repair of any damages to existing utilities shown on the Plans, marked in the field, or attributable to negligence on the part of the Contractor shall be at the Contractor's expense.

The Contractor shall verify the exact locations and depths of all utilities shown on the Design or by USA. Prior to trenching or excavating for any pipe or structure, the Contractor shall perform exploratory excavations (potholing) to completely expose all utilities as required, shown on the Design, directed by the District, or located by USA that may interfere with the work. Excavations around underground electrical ducts and conduits shall be performed using extreme caution to prevent injury to workers or damage to the electrical ducts or conduits.

The Contractor shall contact the owner of each utility to determine if they permit potholing of their utility or if they pothole with their own personnel. All such exploratory excavations shall be performed as soon as practicable after USA has marked the area, in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor's work.

For Projects under contract with the District, if the Contractor does not expose all required utilities, it shall not be entitled to additional compensation for work necessary to avoid interferences or for repair to damaged utilities.

When such exploratory excavations show the utility location as shown to be in conflict with the work, the Contractor shall so notify the District and provide a method for correcting the conflict to the District.

All potholes dug by the Contractor or his subcontractors for any reason shall be backfilled and compacted, and a minimum of two (2) inches of cutback shall be placed and compacted as temporary cover during construction. All cutback shall be removed and replaced with asphalt pavement prior to completion of the work.

For Projects under contract with the District, the District may provide additional compensation to the Contractor for performing potholes that are specifically directed by the District

11-04 Utility Relocations and Suspension of Service. Any utility relocations necessary for the work shall be coordinated with and/or performed by the owner of the respective utility. The Contractor shall also arrange for all necessary suspension of service and make arrangements to physically locate and avoid interference with all existing facilities. The Contractor may make arrangements for alterations for his sole convenience (not actually required to complete the sewer installation); such alterations shall be completely at the expense of the Contractor.

Where existing utilities and/or facilities, aboveground and/or underground, are encountered during construction, they shall not be displaced or molested unless necessary. If necessary to disturb or relocate a facility in the prosecution of the work, including accidental damage, the Contractor shall notify the owner or proper authority and shall abide with the requirements of and cooperate with such owner or authority (who may enter upon the work at any time) while protecting, repairing, replacing or relocating such facilities. All abandoned pipe lines that are severed during the work, shall be immediately plugged by the Contractor, with approved material (see Section 15-01), unless otherwise approved by the District.

All utility and other facility arrangements, agreements, permits, fees, locating, protection, repair, replacement, suspension of service, temporary relocations and other work in connection with utilities and other facilities, shall be the sole responsibility of and at the expense of the Contractor. Necessary permanent relocation of utilities and other facilities to accommodate the sewer construction, shall be the owner's responsibility.

11-05 Alignment Changes. In the event the Contractor requests a change in alignment to gain the advantage of reduced interference with utilities or other physical hazards and said change is agreed to by the District, the Contractor thereafter shall assume all responsibility for any physical hazards encountered along the realigned route at no cost to the District. The costs of engineering, including surveys and administrative work, incurred by the District in connection with said requested change shall be paid by the Contractor.

11-06 Removal of Obstructions. The Contractor shall remove, or cause to be removed, all trees, bushes, landscaping, fences, and structures of all kinds, whether above or below ground, as and when required by the plans, or where the proper construction and completion of the work require their removal. The Contractor shall also remove at his expense, all rock, stones, debris, and all obstructions of whatsoever kind or character, whether natural or artificial, encountered in the construction of the work. However, no trees, plants, shrubbery, or ornamental vegetation shall be removed without the consent of the District first being obtained, and suitable mutually agreeable arrangements made by the Contractor and the District for the replacement of such improvements. In addition, a permit from the City, Town or County shall be obtained for any necessary tree trimming or removal within public street rights-of-way.

Unless otherwise provided on the plans, in the Special Provisions or permitted by the District, all fences, trees, plants, lawns, ornamental shrubbery or vegetation, structures, walkways, driveways, and any other yard or street improvements which have been damaged by the Contractor's operations shall be completely replaced, repaired or restored by the Contractor, at his expense, to the satisfaction of the District or its appointed Representative. Replacing, repairing, restoring shall be accomplished with materials of the same kind and quality as those of the original improvement.

Attention is directed to Section 8-21, "Easement Construction", for additional requirements for removal and replacement of obstructions within easements.

Any and all materials that are removed and are not to be incorporated in the improvement being constructed, shall be disposed of, off the job site, by the Contractor at his expense. Trenches or pits caused by the removal of existing improvements or obstructions shall be backfilled with suitable material designated by the District.

Existing improvements shown on the plans or required by the specifications or designated by the District to be salvaged, shall be carefully removed and stockpiled as directed by the District or its appointed Representative.

11-07 Changed Conditions. In accordance with Section 7104 of the Public Contract Code, the Contractor shall promptly, and before the following conditions are disturbed, notify the District or its appointed Representative, in writing, of any:

A. Material that the Contractor believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.

B. Subsurface or latent physical conditions at the site differing from those indicated.

C. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.

The District or its appointed Representative shall promptly investigate the conditions, and if he finds that the conditions materially differ, or involve hazardous waste, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the work shall issue a change order under the procedures described in the contract.

In the event that a dispute arises between the District and the Contractor, whether the conditions materially differ or involve hazardous waste and cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for by the contract, but shall proceed with all work to be performed under the contract. The Contractor shall retain any and all rights provided for, either by contract of by law which pertain to the resolution of disputes and protests between the contracting parties.

Conditions shall not be deemed to materially differ if (1) the Contractor has failed to comply in any respect with the provisions herein, or (2) the Contractor has failed to make such independent investigations, tests or examinations as a prudent contractor would deem necessary to satisfy itself as to conditions to be encountered in the performance of the work.

11-08 Disturbance to Trees. When working in the vicinity of any trees, the Contractor shall comply with the requirements of City, Town, or County ordinances and the requirements set forth below.

Disturbance of trees, shrubs and planting and their root structures shall be held to a minimum. Trees with root structure disturbed during construction shall be protected, pruned, treated, and watered as specified below. Where shrubs and plantings must be disturbed, they shall either be removed and replanted or shall be replaced in kind and size. All work on trees and shrubs shall be performed by a licensed Arborist. The Arborist and all work performed on trees and shrubs is subject to the approval of the District. All costs of the Arborist and all work on trees and shrubs which are damaged shall be borne by the Contractor.

No trees are to be removed unless specifically called for on the plans or specified in the Special Provisions. All trees within the work area shall be protected with a temporary barricade.

A. Tree limbs overhanging the line of the work and in danger of being damaged by the Contractor's operations shall be trimmed by the Contractor. The Contractor shall also remove other tree limbs under the direction of the District or its appointed Representative, so that the tree will present a balanced appearance.

B. All pruning and treating of trees shall be done by a professional arborist or established tree service whose operators are skilled in the care of trees, at the expense of the Contractor. The arborist or tree service selected shall be subject to approval by the District.

C. Where a tree to be left standing is so close to the work area that it could not be adequately protected during a conventional trenching operation, the Contractor shall employ an alternative method of excavation for the pipeline, such as tunneling or boring.

D. No tree roots shall be unnecessarily cut in excavating or trenching operations. Major roots, defined as roots two (2) inches or larger, which are encountered in the course of excavation shall be exposed but not severed, and they shall be wrapped in plastic as a protective measure while exposed. Any other roots that are cut shall be pruned cleanly so that jagged or torn ends do not exist. Where a root has been shattered or jaggedly cut, the Contractor shall dig back to a sound point, but as close as possible to the point of tearing, shattering, or splitting, and prune the root cleanly.

E. If any trees or shrubs are damaged or destroyed, the Contractor shall compensate the District or property owner for their full appraisal value using the method described in the "Guide for Establishing Values of Trees and Other Plants," current edition, published by the ISA or obtain a letter from the property owner that the claim has been settled.

F. The removal of any trees, shrubs, fences or other improvements outside of sewer easements or rights-of-way as deemed necessary by the Contractor, shall be arranged with the property owner involved, and such improvements shall be removed and replaced, if required, by the Contractor at his expense.

11-09 Removal of Concrete or Masonry Construction. At locations described in the Special Provisions, or shown on the plans or where directed by the District, portions of existing concrete pavement, curbs, gutter, sidewalks, foundations, and other concrete or mortared structures or objects not shown or noted in the plans or mentioned in the Special Provisions, but encountered in the line of construction shall be removed where necessary and disposed of by the Contractor.

All concrete curbs, gutters, aprons, patios, driveways, and sidewalks that are broken, cracked or damaged by the installation of the improvements shall be reconstructed by and at the expense of the Contractor (see Section 20-15). The repairs shall be made by removing and replacing the entire portions between joints or by removing the damaged portions by concrete saw and not by merely refinishing the damaged part.

Concrete removal operations in connection with the alteration of an existing structure shall be performed without damage to any portion of the structure that is to remain in place. If damage occurs, the Contractor shall repair any such damage at his own expense, to the satisfaction of the District. Where existing reinforcement is to be incorporated in new work, such reinforcement shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in new concrete.

Unless otherwise provided in the Special Provisions or directed by the District, material removed as above specified shall be broken into pieces not larger than two (2) feet in greatest dimension and disposed of in a manner acceptable to the District.

11-10 Crossing Under Railroad, Highway or Utilities. When any railroad, highway, private or public utility is crossed, all precautionary construction measures required by the owner of the railroad, highway, or utility shall be followed by the Contractor. All necessary permits, licenses, bonds, and fees required for the crossings shall be obtained at no cost to the District. The Contractor shall give all notices necessary and incident to the work.

*****END OF SECTION*****

SECTION 12 ORDER OF PRECEDENCE AND REFERENCED STANDARDS

12-01 Order of Precedence. For projects under direct contract with the District, in resolving inconsistencies among two or more sections of the Contract Documents, precedence shall be given in the following order:

A. Addenda, Supplemental Agreements and Change Orders, the one dated later having precedence over another dated earlier.
B. Construction Agreement in the Contract Documents
C. Permits
D. Contract Documents (not including the Construction Agreement)
E. District Standard Specifications
F. District Standard Drawings
G. Appendices to the District Standard Drawings
H. County Specifications
I. State Standard Specifications

For work that is not under Contract with the District, the District's Standard Specifications shall govern over the District's Standard Drawings.

12-02 State Standard Specifications. Whenever the words "State Standard Specifications" are referred to in the specifications, the reference is to the State of California, Business, Transportation and Housing Agency, Department of Transportation, (Caltrans) Standard Specifications, latest edition. All work shall be done in conformance with applicable provisions of the State Standard Specifications, except as modified in these Standard Specifications and in the Contract Documents. Where the terms "State" or "Engineer" are used in the State Standard Specifications, they shall be considered as meaning the "District" as defined herein. In case of a conflict between these specifications and the State Standard Specifications, these specifications will apply.

12-03 County Specifications. Whenever the words "County Specifications" are referred to the specifications, the reference is to the Cities of Marin County, and County of Marin, Department of Public Works, Uniform Construction Standards, most current addition.

12-04 Reference Specifications. Other specifications/standards referenced in these Standard Specifications include but are not limited to:

- American Concrete Institute (ACI)
- American Institute of Steel Construction (AISC)
- American National Standards Institute (ANSI)
- American Public Works Association (APWA)
- American Society of Testing and Materials (ASTM)
- American Welding Society (AWS)
- American Water Works Association (AWWA)

- Division of Occupational Safety and Health (Cal/Osha)
- Steel Structure Painting Council (SSPC)

When referenced, the most current addition shall be used, unless otherwise noted.

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TECHNICAL SPECIFICATIONS

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SECTION 02050

DEMOLITION, ABANDONMENTAND REMOVAL

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor as required for the demolition, salvage, relocation, and removal of equipment, structures, facilities, and electrical and mechanical equipment as required.

B. This specification addresses demolition, removal and abandonment of facilities, and associated debris generated in the execution of the contractwork.

1. Do not begin demolition until authorization is received from the District or its appointed Representative.
2. Remove rubbish and debris from the job site daily.
3. Store materials that cannot be removed daily in the Contractor's approved laydown and storage areas, following all requirements established by the property owner and associated permitting jurisdiction.
4. Properly dispose of materials and debris removed from the site. Disposal shall comply with all federal, state, and local regulations.

1.02 RELATED SECTIONS

A. Section 02060: SITE PREPARATION

B. Section 02200: EARTHWORK

1.03 REFERENCE SPECIFICATIONS

A. American National Standards Institute (ANSI)

1. ANSI A10.6 – Demolition Operations-Safety Requirements

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall submit a proposed Demolition Plan, including the following:

1. Proposed demolition and removal procedures.
2. Detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.06 NOT USED

1.07 NOT USED

1.08 WORK AND SAFETY REQUIREMENTS

A. Comply with federal, state, and local hauling and disposal regulations. Work safety requirements shall conform with ANSI A10.6, "Demolition Operations – Safety Requirements."

1.09 DUST AND DEBRIS CONTROL

A. Prevent the spread of dust and debris, and avoid the creation of a nuisance or hazard in the surrounding area.

B. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, flooding, or pollution.

C. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicles.

1.10 PROTECTION

A. Traffic Control Signs - Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Refer to Section 02800, TRAFFIC CONTROL for additional requirements.

B. Existing Work - Protect existing work which is to remain in place. Repair items which are to remain, and which are damaged during performance of the work to their pre-construction condition, or replace with new. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have District, Town, Agency, and/or County of Marin approval.

C. Facilities - Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Additional regulatory requirements, permits, and/or temporary controls may be required and shall in accordance with project specific Contract Documents, if applicable.

1.11 BURNING AND EXPLOSIVES

A. Burning and the use of explosives will not be permitted.

1.12 RELOCATIONS

A. Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the District and governing jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Demolition, abandonment, and removal shall be performed in accordance with the requirements of these Standard Specifications and Standard Drawings.

B. The Contractor shall take care to protect existing facilities outside the limits of work. Facilities outside the limits of work damaged by the Contractor's construction operations shall be repaired to their original condition at the Contractor's expense.

3.02 EXISTING FACILITIES TO BE REMOVED

A. Removal of Existing Pipes, Manholes and Related Equipment

1. Remove indicated existing sanitary sewer mains and manholes to the horizontal limits required. Existing alignment is shown based on record information. Actual locations of existing utilities may be different from that shown.

2. Submit to the District or its appointed Representative a plan and coordinated construction schedule for removal of existing active sewer facilities and reconnecting existing system elements to the permanent facilities as shown on the drawings.

B. Abandonment of Existing Pipes

1. Abandonment and plugging of existing pipelines shall include the filling of existing sewers with Controlled Low Strength Material (CLSM) or Low Density Cellular Concrete as specified in Section 02200, EARTHWORK and installation of a tight fitting plug or wall of Class 2 concrete a minimum of two feet thick to securely close pipeline, including excavation, backfill, and replacement of pavement section and/or landscaping as prior to work. A section of pipeline shall be removed adjacent to manholes that will remain in service after sewer abandonment.

2. CLSM or LDCC shall be injected into the pipe, completely filling segments to be abandoned in place.

3. Watertight bulkheads shall be provided to facilitate the placement of the CLSM or LDCC (fill material) as required. The fill material shall be thoroughly settled and compacted through the entire depth of the layer that is being consolidated into a dense, homogeneous mass.
4. The Contractor shall provide and install PVC pipe to feed and vent the fill material placement. The number of PVC pipes, size, and length shall be as required and determined by the Contractor.
5. The fill material shall be continuously placed against fresh material, unless otherwise approved by the District. Where new fill material must be placed against existing material, the placement shall be clean of all loose and foreign material. The surface of existing fill material shall be soaked a minimum of 1 hour before placement of fresh fill material. No standing water will be allowed before starting placement of fresh fill material.

C. Abandonment of Existing Manholes

1. Existing manholes to be abandoned shall have the castings, grade rings, and manhole body removed to the bottom of the cone section with the removal of the manhole rings to a minimum of three (3) feet below street grade or existing ground elevation. After plugging of existing pipelines at the manhole, the remainder of the manhole barrel shall then be filled and compacted with CLSM, LDCC, or Class 2 AB material as specified in Section 02200, EARTHWORK. The manhole frame and cover shall be salvaged and provided to the District. The removed concrete shall be disposed of by the Contractor in accordance with this Specification and state regulations.

D. Paving and Slabs

1. Remove asphaltic concrete paving and slabs, and concrete paving and slabs, including aggregate base in areas subject to proposed work.
2. Trench wing width shall be one foot. Asphalt concrete paving shall be removed a minimum of 12 inches from the edge of trench on both sides of the trench. Where the distance from the lip of concrete gutter to the saw cut edge of the trench is less than half of the width of the trench, the remaining pavement between the saw cut edge of the trench and the lip of the concrete gutter shall also be removed and replaced during this work.
3. Provide neat sawcuts at limits of pavement removal as indicated.
4. Contractor shall comply with all environmental regulations and local codes and dispose of all material at State approved recycling facilities or Class II landfills.

3.03 DEMOLITION

A. Disposal of all materials shall be performed in compliance with all applicable local, State, and Federal codes and requirements.

B. Where the demolition of major equipment or structures is required, removal of auxiliary systems such as water, auxiliary equipment, drainage, electrical wiring, controls, and instrumentation not necessarily shown shall also be performed unless otherwise indicated.

C. Wiring demolition shall be performed by electricians. Before removing or cutting wiring, check to be sure that it is wiring intended to be cut or removed, and label wiring which is to remain. Labels shall be fully documented on wiring diagrams, interconnection diagrams, elementary diagrams, and conduit and wire schedules. Wire bundles shall be rolled up and placed "out of the way" to the extent practicable.

D. Where existing materials and equipment are removed or relocated, remove all materials no longer used such as studs, straps, conduits, and wires. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4 inch below the final finished surface.

E. Where existing pipes and electrical conduits, supports, or hangers are removed from existing structures, fill all resulting holes in the structures and repair any resulting damage such that the finished rehabilitated structure shall appear as a new homogeneous unit with little or no indication of where the new and old materials join. The holes in water-bearing structures shall be filled with non-shrink grout to be watertight and reinforced as required. In all locations where the surface of the grout will be exposed to view, the non-shrink grout shall be recessed to approximately 1/2- inch back of the exposed surface and the recessed area filled with cement mortar grout, color to match existing concrete.

3.04 DISPOSITION OF MATERIAL

A. Title to Materials

1. Unless otherwise shown or specified, all materials and equipment removed shall become the property of the Contractor and shall be removed.

2. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the contractor's demolition and removal procedures, and authorization by the District or its appointed Representative to begin demolition.

3. The District will not be responsible for the condition or loss of, or damage to, such property after notice to proceed.

4. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.05 CLEANUP

A. Debris and Rubbish

B. Remove and transport debris and rubbish in a manner that will prevent spillage on pavements, streets, or adjacent areas.

C. Clean up spillage from pavements, streets, and adjacent areas.

*****END OF SECTION*****

SECTION 02060

SITE PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. This specification includes those measures required during the Contractor's initial move onto the site to protect existing fences, buildings, and associated improvements, and utilities adjacent to the construction areas from damage due to boulders, trees or other objects dislodged during the construction process; clearing, grubbing, and striping.

B. All materials removed shall become the property of the Contractor except as indicated or specified otherwise and shall be removed from the limits of the project. Remove rubbish and debris daily unless otherwise directed. Store material, which cannot be removed daily in areas specified by the District.

C. All work shall be done in conformance with the rules and regulations pertaining to safety established by California Division of Industrial Safety and OSHA.

1.02 RELATED SECTIONS:

A. Section 02050, DEMOLITION

B. Section 02200, EARTHWORK

C. Section 02900, PROTECTION OF TREES AND RESTORATION OF LANDSCAPING

1.03 REFERENCE SPECIFICATIONS

A. ANSI A10.6 – Demolition Operations-Safety Requirements

B. Caltrans Standard Specifications, Division III, Section 16, Clearing and Grubbing

C. ANSI A 300 - American National Standards Institute, Pruning Standards

D. ISA - International Society of Arboriculture Tree Pruning Guidelines

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall submit drawings that define the proposed site safety measures to the District for approval prior to performing any construction activity.

1.06 NOT USED

1.07 NOT USED

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Existing Conditions. The Contractor shall determine the actual condition of the site and the site preparation that will be necessary for completion of their work and conformance to this specification.

B. Protection. Site preparation shall not damage existing structures or cause obstruction and/or contamination to the property. The Contractor shall repair or replace any damaged property at no additional cost to the District.

3.02 SAFETY BARRIERS

A. The Contractor shall construct appropriate safety barriers such as temporary fencing, berms, or similar facilities where required or Directed by the District. To minimize disturbance of existing roads and facilities, safety barriers shall allow for normal maintenance and operation of existing facilities and roads as determined by the District or its appointed Representative.

3.03 CLEARING AND GRUBBING

A. Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the State Standard Specifications and the following requirements.

B. The Contractor shall coordinate with the Town, City, or County Arborist for overhanging limbs or landscaping, which may conflict with construction activities.

C. The Contractor shall verify and obtain approval from the Town, City, or County Arborist prior to any trimming and/or disturbance of existing tree roots in the areas designated. A Certified Arborist shall be used by the Contractor for removal, cutting or disturbance to the roots within the project limits identified on the drawings.

D. Removal of trees shall be in accordance with the Contract Documents and these Standard Specifications. No chipping of trees shall be allowed at the project site. Contractor shall take the trees off-site to chip.

E. Trees should be cut as close to the ground as possible and stumps should NEVER be more than 4 inches above ground level – with exceptions for rough topography, fencelines, or other obvious places where such cutting height is not possible. All construction areas shall be cleared of grass and weeds to at least a

depth of six (6) inches and cleared of structures, concrete, or masonry debris, pavement, logs, upturned stumps, loose boulders, and any other objectionable material of any kind that would interfere with the performance or completion of the work, create a hazard to safety, or impair the work's subsequent usefulness or obstruct its operation. Loose boulders within ten (10) feet of cut lines shall be incorporated in landscaping or removed from the site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage with chain link fencing or straw bale barricades during construction.

F. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Underground structures, debris, or waste shall be totally removed if they are found on the site. All objectionable material from the clearing and grubbing process shall be removed from the site. Shrubs, fences, and all other improvements that are removed to permit construction, shall be replaced (not including native trees under three (3) inches in diameter at the base and native brush) by the Contractor in kind and size or with substitutes acceptable to the property owner.

3.04 REGRADING

A. Any holes remaining after striping and grubbing shall be backfilled unless they are located within an area designated for further excavation. Backfill material and placement shall be in accordance with Section 02200, EARTHWORK.

3.05 DISPOSAL OF DEBRIS

A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction and per Section 02050, DEMOLITION, ABANDONMENT, AND REMOVAL.

B. Burying or burning of trash and debris on the site will not be permitted.

C. Remove trash and debris from the site daily.

D. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the District's property and disposed of in a legal manner. Location of disposal site and length of haul shall be the Contractor's responsibility.

3.06 DUST AND POLLUTION CONTROL

A. The Contractor shall employ water sprinkling, temporary enclosures, chutes, and other suitable methods acceptable to the District and the local agency having jurisdiction shall be used to limit dust and dirt rising from and scattering beyond the area of construction.

B. Water shall not be used when it creates hazardous or objectionable condition such as mud, flooding, or pollution.

C. The Contractor shall employ best management practices for control of erosion and jobsite runoff, pollution prevention and protection of water quality as specified in the District's Field Management Practices for Protection of Water Quality, latest edition.

3.07 CLEANING

A. The Contractor shall clean and sweep streets daily.

B. During and upon completion of work, the Contractor shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by work in a neat and clean condition.

C. Adjacent structures shall be cleaned of dust, dirt and debris resulting from demolition or construction operations, as directed by the District or governing authorities and adjacent areas shall be returned to the condition existing prior to start of work.

3.08 UTILITY INTERFERANCE

A. If an existing utility not indicated on the drawings is encountered which interferes with the work the Contractor shall notify the District.

3.09 RELOCATION AND REPLACEMENT

A. Where existing items interfere with the work and require relocation and/or replacement, the work shall replace or relocate the items to at least their original condition

*****END OF SECTION*****

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies requirements for dewatering and disposal of water from excavations. Standing water in excavations will not be allowed.

B. No water shall be discharged into existing sanitary sewers, or new sanitary sewers constructed unless a Special Discharge Permit is obtained from the District and the Central Marin Sanitation Agency (CMSA).

C. The discharge of water from excavation dewatering operations into the sanitary sewer system within twenty four (24) hours of a rain event will be prohibited.

D. The discharge of water from excavation dewatering operations into the sanitary sewer system shall not exceed a flow rate of fifty (50) gallons per minute at any time.

E. Any dewatering procedures discharged into the storm drain system, if allowed, shall conform to the requirements of the State Regional Water Quality Control Board and the Federal Clean Water Act, as well as the requirements of the County of Marin and the ordinances of the Town or City with jurisdiction. No water shall be discharged into the storm drain system unless the necessary permits have been obtained.

F. The Contractor shall:

1. Design, provide and maintain, at all times during construction, ample means, and devices with which to promptly remove and properly dispose of all water from any source entering the excavations. Dewatering shall be accomplished by methods that will ensure a dry excavation and preserve the final lines and grades of the bottoms of excavations.

2. Provide all labor, materials, and equipment necessary to adequately dewater excavations so that pipe and structures that are installed in excavations are free from standing, flowing, or boiling groundwater, surface water, storm water, precipitation, or wastewater; filter soil; and prevent loss of ground from dispersion or erosion.

3. Secure and comply with the provisions of permits required for dewatering operations, including permits from the District, CMSA, the County of Marin, the Regional Water Quality Control Board, and the Town/City with jurisdiction.

4. Comply with all Federal, State, and local laws and regulations concerning environmental pollution arising from construction activities.
5. Drawdown the groundwater level a minimum of two (2) feet below the trench bottom and beyond excavation sidewalls where shoring is not designed to resist hydrostatic pressures.
6. Control the rate and effect of dewatering so as to avoid settlement, subsidence or damage to structures or facilities adjacent to areas of proposed dewatering.
7. Be fully responsible and liable for all damages that result from failure to adequately keep excavations dewatered, and shall repair, restore, and/or replace facilities or structures damaged as a result of dewatering operations.

1.02 RELATED SECTIONS

A. Section 02200, EARTHWORK

B. Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS

C. Section 02735, SANITARY SEWER SYSTEM TESTING

1.03 NOT USED

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall submit a plan for all excavation dewatering procedures to the District for approval prior to performing dewatering operations. The dewatering plan shall include the following:
   1. Location(s) where water is to be disposed.
   2. Scale drawings showing locations of dewatering systems.
   3. A copy of required discharge permit(s).
   4. Details of dewatering systems, such as:
      a. Drilled hole and well casing diameter, slotted and solid lengths
      b. Sand packer gradation
      c. Size and capacity of pumps
      d. Filtration system acceptable to the District and other agencies having jurisdiction

1.06 QUALITY ASSURANCE

A. Where structures, utilities and/or facilities exist adjacent to areas of proposed dewatering, the Contractor shall establish reference points and shall survey these reference points daily to quickly detect any settlement, subsidence or damage that may develop during or following dewatering operations.

B. If disposal of water to the sanitary sewer is allowed, televising and cleaning of downstream sewers may be required at the District's discretion, and shall be done per the requirements set forth in Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

C. If disposal of water to the sanitary sewer is allowed, the contractor shall televising and cleaning of downstream sewers may be required at the District's discretion, and shall be done per the requirements set forth in Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

D. Wrap end of suction and discharge pipes with filter fabric, as specified in Section 02200, EARTHWORK filter the water.

1.07 NOT USED

PART 2 - PRODUCTS

2.01 GENERAL

A. Dewatering, where required, may include the use of wells, well points, sump pumps, storage tanks, settling tanks, filters, temporary pipelines for water disposal, rock or gravel placement, standby pumps and/or generators, and other means.

PART 3 - EXECUTION

3.01 GENERAL

A. Work shall meet or exceed the requirements of these Specifications unless applicable requirements of an agency having jurisdiction (including the terms and conditions of an encroachment permit issued by a city or county) are greater, in which case the greater requirements shall govern.

B. The Contractor's dewatering operations shall not interfere with vehicle or pedestrian traffic. Under no circumstances shall dewatering water be allowed to flood streets or cause hazardous conditions for traffic.

C. Dewatering pump noise shall be mitigated, especially at night, as required by applicable laws and ordinances and as prescribed by authorities having jurisdiction watering for structures and pipelines shall commence when

groundwater is first encountered, and shall continue until water can be allowed to rise without affecting structures, piping, and other project features.

D. Site grading shall promote drainage. Surface runoff shall be diverted prior to it entering excavations to maintain the bottom of the excavation free from standing water.

E. Dewatering shall be conducted so as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed bottom of excavation, filter soil particles and prevent loss of ground due to dispersion and erosion. Dewatering shall lower the water outside the excavation, if necessary to insure that seepage and migration of soil particles does not occur through openings in the shoring.

F. If subgrade soils are disturbed or loosened by the seepage or flow of water, the affected areas shall be excavated and replacement backfill placed in accordance with Section 02200, EARTHWORK.

G. The Contractor shall prevent pipeline and/or structure flotation by maintaining a positive and continuous removal of water.

H. If dewatering wells are used, they shall be adequately spaced to provide the required dewatering, and the Contractor shall use sand packing and/or other means to prevent pumping of soil particles (e.g., fine sand) from the subsurface. The Contractor shall continuously monitor the dewatering water discharge to ensure that subsurface soil is not being removed by the dewatering operation.

I. The demobilization of dewatering operations shall be performed so as to allow groundwater to rise to its ambient (static) level without disturbing natural foundation soils or compacted backfill, and prevent flotation or movement of structures, pipelines, and sewers.

J. The Contractor shall properly dispose of water without nuisance or damage to adjacent property, in accordance with its Storm Water Pollution Prevention Plan.

3.02 DISCHARGE INTO THE SANITARY SEWER SYSTEM

A. District and CMSA Special Discharge Permit: The Contractor shall obtain and comply with all requirements of the approved special discharge permit.

B. If the discharge is cloudy, murky, or otherwise colored, or where required by the District, the discharged water shall be settled or filtered using a District approved method to remove sand, silt, and fine soil particles before disposal into any sanitary sewer system. At a minimum, the filtration system should include a filter fabric bag attached to the discharge outlet and a debris trap in downstream manhole(s). If discharge continues to be murky or colored, or if these methods

are determined to be inadequate by the District, then additional settlement and/or filtration will be required. Additional treatment may include the use of Baker or Adler tanks, and/or particulate filtration systems.

C. Discharge rate into the sewer system shall be metered and shall not exceed fifty
D. (50) gallons per minute at any time.

E. The Contractor shall remove and dispose of any material that accumulates in the sanitary sewer systems used for water discharge as a result of dewatering operations.

3.03 DISCHARGE INTO THE STORM DRAIN SYSTEM

A. The Contractor shall obtain and comply with all required dewatering discharge permits from the State Regional Water Quality Control Board, the County of Marin, and the Town or City with jurisdiction.

B. Dewatering discharge shall be in conformance with the SWPPP, if applicable, and the State Water Resources Control Board Construction General Permit.

*****END OF SECTION*****

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SECTION 02145

SEWAGE FLOW CONTROL & BYPASSING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for temporary bypassing, dewatering, and disposal of water and wastewater from the sewer facilities as required to perform the work. Extract, pump, and/or dispose of wastewater from bypassing and dewatering gravity, sanitary sewer pipelines, building sewers (laterals), and cleanouts.

B. The Contractor shall provide bypass pumping during removal and installation of the main sewer. Accommodate flows from building sewers (laterals) at all times.

C. It shall be the Contractor's responsibility to maintain at all times the sewer flows through the Project site and from the adjacent properties during of construction of new main sewers and building sewers, removal and replacement of existing main sewers, rehabilitation of sanitary sewer pipelines or structures, and transfer of existing building sewer connections from existing main sewers to new main sewers.

D. The Contractor shall provide labor, materials, and full-time supervision, as required, to set up necessary equipment, and contain, bypass, dewater, and dispose of raw wastewater, treated wastewater, and storm drain flows, as necessary, for abandonment, television inspections, spot repairs, replacements, connections, rehabilitation, and other modifications made to complete the Work.

E. Bypass flows shall be discharged into a downstream sanitary sewer manhole. Discharging into sanitary sewer laterals or into the storm drain system will be strictly prohibited.

F. Sewer bypassing shall not commence until the District or its representative has provided written approval of the Contractor’s submitted bypass plan.

G. The Contractor shall coordinate directly with residents to minimize wastewater flows during scheduled work.

H. During non-working hours, a temporary connection shall be made from the existing sewer to the new sewer. Laterals and sewers crossing the trench shall be temporarily reconnected until they can be permanently connected to the sewer. Material used for connecting sewer laterals temporarily shall be approved by the District. Flexible drain pipe shall not be allowed.

I. Spill of sanitary wastewater can result in costs and/or fines levied against the District. The Contractor shall be responsible for fines, penalties and charges due to sanitary sewer spills resulting from the Contractor's operations and/or failure of bypass pumping.

J. The Work shall not result in water or wastewater flows to surcharge or exceed the specified limits. Surcharge shall be defined as the condition where the depth of flow exceeds the crown elevation in any pipe in any existing gravity pipe systems.

K. Dewatering requirements for grading and excavations are specified elsewhere in Section 02140, DEWATERING.

L. Water or wastewater discharges or disposals identified in the Bypass Pumping Plan shall be in conformance with the requirements of the SWPPP or other storm water management plan used on project. Storm drain discharges shall be managed as required by the Contractor's Storm Water Pollution Prevention Plan (SWPPP). The Contractor shall obtain and comply with all required permits from the State Regional Water Quality Control Board, the County of Marin, and the Town or City with jurisdiction.

1.02 RELATED SECTIONS

A. Section 02050: DEMOLITION, ABANDONMENT, AND REMOVAL

B. Section 02140: DEWATERING

C. Section 02200: EARTHWORK

D. Section 02300: CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS

E. Section 02315: CURED-IN-PLACE (CIPP)

F. Section 02330: HORIZONTAL DIRECTIONAL DRILLING (HDD)

G. Section 02345: PIPE BURSTING

H. Section 02365: PIPE REAMING

I. Section 02720: MANHOLE REHABILITATION

J. Section 15050: GENERAL PIPING

1.03 NOT USED

1.04 NOT USED

1.05 SUBMITTALS

A. Within ten (10) days of Notice to Proceed and at least fourteen (14) days prior to initiating bypass activities, submit a detailed Bypass Pumping Plan consisting of drawings and complete design data as specified herein to the District for approval prior to performing any sewage flow control or bypassing. Submittal shall show all proposed methods, layout, equipment, and discharge locations for bypassing and dewatering.

B. The Submittal shall include the following information:

1. A site plan showing the size and layout of pumps, valves, and temporary pipelines. Layout shall show how temporary facilities will be protected during use.
2. Drawings indicating the locations of temporary plugs, taps, pumping systems, suction and discharge piping, and locations of sanitary sewers and manholes to receive discharges of raw or treated wastewater.
3. Data that includes the locations and elevations of existing sanitary sewer systems, and the capacities of duty and standby pumps, prime movers, power and standby power, and other equipment.
4. Design Calculations:
   a. Submit design calculations that prove the adequacy of the bypassing, dewatering, and disposal system(s) and selected equipment. Design calculations shall confirm that the bypassing and pumping operations shall not cause surcharge in any portion of the existing sanitary sewer system.
   b. For bypassing of existing sanitary sewer pipelines equal to or larger than 18-inches in diameter, or for smaller pipelines where specifically required, design calculations shall be signed and sealed by a civil engineer registered in the State of California qualified to perform said analysis.
5. Narrative description of system staffing and monitoring.
6. Catalog data on pump controls and audible alarms.
7. Catalog data for portable generators when electric pumps are used.
8. An emergency response plan that provides in detail the procedure to be followed in the event of a failure of the bypass pumping systems.
9. Health and Safety Plan. No entry to any of the existing facilities will be permitted until appropriate work crews are certified for confined space entry and the Health and Safety Plan is reviewed. The Health and Safety Plan shall be developed specifically for the project.
10. Odor mitigation plan.

1.06 NOT USED

1.07 NOT USED

1.08 SITE CONDITIONS

A. Available Data

1. The Contractor may utilize existing dry weather and estimated peak wet weather flow data provided by the District, if available. However, the Contractor shall be responsible for flow verification. The design, construction, and operation of an adequate and properly functioning bypass and dewatering system shall be the sole responsibility of the Contractor.
2. Any testing or gathering of flow data is the responsibility of the Contractor.
3. Coordinate all sewer bypassing and dewatering operations with the District.

B. Protection

1. Where bypassing is required, ensure that service for connecting laterals is not disrupted. All bypassed flow shall be discharged into the nearest (downstream) sanitary sewer manhole. Take appropriate steps to ensure odor control at the discharge manholes.
2. Bypassing and dewatering operations resulting in discharges to the ground surface, streams, creeks, culverts, ditches, storm drains, or groundwater shall not be permitted. Perform work so as to protect the public from potential health hazards, and shall protect the environment from contamination.

C. Scheduling

1. The bypassing and dewatering systems shall not be shut down between shifts, during work stoppages, or during any periods when flows through the main sewer have not been properly restored.
2. Provide fourteen (14) days written notice to the District or its appointed Representative prior to performing all bypassing, dewatering, and disposal work.

D. Permits and Approvals

1. Obtain approval from the District for the proposed Bypass Pumping Plan.

PART 2 - PRODUCTS (NOT USED) PART 3 - EXECUTION

3.01 PLUGGING, BLOCKING, AND PUMPING

A. Flow control will be required for this Project. Bypass pumping will be allowed only during Contractor's working hours. At the end of every working day, flows must be properly restored to the sanitary sewer. Any emergency pumping operations

that are required outside of the Contractor's working hours must be approved in advance by the District or its appointed Representative. Bypass flows shall be discharged into a downstream sanitary sewer manhole. Discharging into sanitary sewer laterals or into the storm drain system will be strictly prohibited.

B. Furnish, install, and operate pumps, plugs, conduits, and other equipment to dewater existing sewer pipelines or to divert the flow of wastewater around the pipeline reach in which work is to be performed, and to maintain service to all properties connected to the sewer being replaced. Plugs shall be so designed that all or any portion of the wastewater can be released. Plugs shall be provided with a tag line.

C. The pumping system shall be of sufficient capacity to manage existing flows plus additional flow that may occur during a rainstorm. If pumping is required outside normal working hours, engines shall be equipped and/or shielded in a manner to keep noise to a minimum. Noise level shall conform to the noise ordinance requirements of the governing jurisdiction.

D. Engines shall be equipped with mufflers and/or shall be enclosed to comply with all local noise ordinances. Pumps and bypass lines shall be of adequate capacity and size to handle the flows. All bypassed flow shall be discharged to the nearest downstream manhole.

E. Bypass pumping shall be completed in such a manner as will not damage private or public property, or create a nuisance or public health menace. The pumped wastewater shall be in an enclosed hose or pipe that is adequately protected from traffic, and shall be redirected into the sanitary sewer system. Dumping or free flow of wastewater on private property, gutters, trenches, streets, sidewalks, or into storm sewers is prohibited. The Contractor shall be liable for all damages associated with this work. After the work is completed, flow shall be restored to original conditions and temporary facilities removed.

3.02 SEWER DEWATERING

A. Extract, pump, and/or dispose of wastewater from dewatering the existing sewers.

B. Dewater all sagged or submerged portions of the existing sewer as required for abandonment, or as otherwise required to complete the work.

C. Dewatering of excavations shall be conducted in accordance with the requirements of Section 02140, DEWATERING.

D. Coordinate all work with the District and comply with any and all associated permit requirements. Obtain work outage approval for the District's existing facilities where required.

3.03 SEWER BYPASSING

A. Where Contractor’s work on constructing the project pipeline requires sanitary sewers to be removed temporarily from operation, sewer bypassing shall be accomplished by pumping or diverting the upstream flow around the Contractor's work in accordance with this Section.

B. Unless otherwise specified, bypass flow around the work whenever the Contractor's equipment is operating in the sewer, or work related to the sewer provides an obstruction or otherwise restricts flow and causes the depth of flow as measured at the inlet pipe to the upstream manhole adjacent to the Contractor's work to exceed half of the diameter of the pipe.

3.04 STANDBY EQUIPMENT

A. Maintain on site sufficient equipment and materials to ensure continuous and successful operation of the bypass and dewatering systems. Standby pumps shall be fueled and operational at all times.

B. Maintain on site a sufficient number of valves, tees, elbows, connections, tools, sewer plugs, piping and other parts or system hardware to ensure immediate repair or modification of any part of the system, as necessary.

C. Bypassing and dewatering system(s) shall have one hundred percent (100%) redundancy.

3.05 DAMAGES

A. The Contractor shall pay for all fines and repair without cost to the District any damage that may result from the Contractor’s negligence, inadequate or improper installation, maintenance and operation of bypassing and a dewatering system including mechanical or electrical failures.

3.06 MONITORING

A. Provide monitoring of flow levels and pump operation to assure continued operation of bypass pumping.

B. Monitoring shall be with an audible alarm system including, at minimum, an auto dialer via cell phone with redundancy. Monitoring by Contractor’s personnel shall take place at all times that bypass pumps are in operation (including 24-hour, around-the-clock operation if required during an emergency).

C. In the event the pumps fail, workers shall immediately evacuate trenches until the bypass pumping system is operational.

3.07 ODOR MITIGATION

A. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work.

1. To minimize the dispersal of sewer odors above ground the Contractor shall Seal all open sanitary manholes or access openings in the sewers when his operations have been suspended for a period of two hours or more.
2. During construction operations when open manholes or access openings cannot be sealed, vent and filter hydrogen sulfide gases upstream of the openings in the sewer.

B. Odor related to construction around the work shall be controlled through the use of filters, chemical addition to the wastewater, and masking agents as needed to limit the levels of hydrogen sulfide gas to 5 parts per million (by volume) 25 feet from the source or at the outside wall of any habitable structure.

C. Payment for compliance with this Section shall be deemed included in the various other items of work, and no additional compensation will be allowed therefore.

3.08 SAFETY

A. When working inside manholes and sewer lines, exercise caution and comply with CAL/OSHA requirements when working in the presence of hydrogen sulfide. Contractor is warned that the existing sewers and the structures associated with the project contain high levels of hydrogen sulfide gas, a natural gaseous by-product of sanitary sewage. Take all the necessary precautions, such as portable hydrogen sulfide detectors per CAL/OSHA requirements, to ensure that the environment is safe for those at the work site.

B. No entry to any of the existing facilities will be permitted until appropriate work crews are certified for confined space entry and the Health and Safety Plan is reviewed. The Health and Safety Plan shall be developed specifically for the project.

3.09 TRAFFIC IMPACTS

A. The bypass pumping system must be coordinated with Section 02800, TRAFFIC CONTROL. This may require that bypass piping and facilities be buried in temporary trenches.

*****END OF SECTION*****

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SECTION 02160

SHORING

PART 1 - GENERAL

1.01 SUMMARY

A. This section covers the work necessary to furnish all tools, equipment, materials, supplies, and labor for shoring.

B. All trenches and excavations shall be vertically shored in accordance with the requirements of this section.

C. The Contractor shall design, furnish, install, and maintain a system of temporary supports, including all bracing and associated items, to retain excavations in a safe manner and to control ground movements. Upon completion of the required excavation and pipe and/or structure installation, the Contractor shall remove the support system, as specified and backfill the excavations.

D. The Contractor shall have sole responsibility for sizing the excavations to accommodate shoring, bracing, pipe, and pipe installation, structure, and structure installation to the specified lines, grades, and tolerances.

E. Where Contractor plans to use covers or bridges across excavations, submit design calculations stamped by an Engineer registered in the state of California in accordance with this section.

1.02 RELATED SECTIONS

A. 02200: EARTHWORK

1.03 REFERENCE SPECIFICATIONS

A. Reference codes, regulations, specifications, and standards include, but are not limited to:

1. California Labor Code.
2. Occupational Safety and Health Administrative Code.

B. Contractor's attention is directed to "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. Prior to beginning any trench or structure excavation exceeding 5 feet in depth, Contractor shall submit to the District and shall be in receipt of the District's written acceptance of the Contractor's trench excavation support plan showing design of all shoring, bracing, sloping of the sides, or other provisions for workers protection against the hazard of caving ground during the excavation for trenches or structures. Plan shall be prepared and sealed by a Civil or Structural Engineer registered in the State of California.

C. ANSI/AWS D1.1 STRUCTURAL WELDING CODE

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide submittals for items specified herein to the District for review and approval prior to performing any excavations that will require shoring.

1. Shop Drawings: No excavations shall be started until the District has reviewed and accepted the Contractor's shoring design. Design shall include:
   a. Design assumptions, analyses, calculations, and information on Contractor's proposed method of installation (and removal, if required) of all shoring. The design and calculations shall be performed by, sealed and signed by a professional engineer licensed in the State of California and experienced in the design of earth retaining structures.
   b. The maximum design load to be carried by the various members of the support system.
   c. Detailed excavation support drawings, showing all pertinent dimensions, spacings, and relationships among the components of the shoring, as well as construction sequence and scheduling.
   d. The method of bracing.
   e. The full excavation depth and depth(s) below the main excavation to which the support system will be installed.
   f. Detailed sequence of construction and bracing removal.
   g. Detailed description of shoring waterproofing system where required.
   h. Detailed drawings and descriptions of the method to be used by the Contractor to monitor shoring and adjacent ground/structure movements.

2. Prepare a Movement Monitoring Plan:
   a. Plan shall include the location identification and placement of survey monuments at regular intervals along the alignment above existing subsurface utilities and on surface structures that may be affected by the excavation. Surface structures include, but are not limited to, pavement, curb and gutter, utilities such as manholes and valve boxes, transformers, signs, and utility poles.
   b. Prepare trench excavation support plan addressing following topics: Details of shoring and bracing or other provisions for worker protection from hazards of caving ground.
   c. Design assumptions and calculations.
   d. Methods and sequencing of installing excavation support.

e. Proposed locations of stockpiled excavated material.
f. Minimum lateral distance from the crest of slopes for vehicles and stockpiled excavated materials.
g. Anticipated difficulties and proposed resolutions.
h. Anticipated loads and design for trench covers or temporary bridges.

3. Quality Control Submittals:
   a. Movement measurement data and reduced results indicating any movement trends.
   b. Submit proof of experience and qualifications required in this section.

1.06 QUALITY ASSURANCE

A. Provide surveys to monitor movements of critical facilities.

B. Work of this section shall be performed by an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field) for at least 5 years, which is regularly engaged in, and which maintains a regular force of workmen skilled in design, installation and maintenance of shoring.

C. All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the type of materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local approved testing agency not more than six (6) months prior to commencing work; unless having been continuously employed in similar welding jobs since last certification. Machines and electrodes similar to those used in the work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders.

1.07 NOT USED

1.08 SYSTEM DESCRIPTION

A. The shoring system as described in the Specifications shall be comprised of some or all of the following major items:

1. Steel Soldier Piles: Vertical steel member consisting of steel wide flange, “WF,” or steel “H” pile, installed in pre-drilled holes, plumbed vertically, and grouted in place with lean concrete, or piles driven in place.
2. Steel Wales: Horizontal steel member consisting of steel wide flange, “WF,” or steel “H” pile, installed across the inside face of the braced excavation.
3. Timber, Concrete or Steel Lagging: Supports installed to span between individual soldier piles or steel rings.
4. Steel Cross Bracing or Struts: (Horizontal steel member consisting of steel

wide flange, “WF,” or steel “H” or pipe pile, installed across open excavation from wale to wale to brace shoring wall and reduce horizontal wale spans, where necessary.)

5. Steel liner plates.
6. Steel Sheet Piles - Sheet Piles: (Vertical steel sheets driven or vibrated into the ground.)
7. Tie rods; butt plates, bolts, and other ancillary items, as necessary.
8. Slide rail solid wall tight shoring.
9. “Trench box” style shoring systems that provide active support to native ground.
10. Internal trench struts that provide pressure through the use of hydraulic jacks to provide internal bracing pressure.

B. DESIGN REQUIREMENTS:

1. The Contractor shall design and construct the shoring system in accordance with all applicable codes, and in accordance with the specific requirements described herein.
2. The Contractor shall design and construct shoring based on CAL/OSHA requirements. Contractor shall take into account all surcharge loadings. Surcharge loadings can be due to such things as material or soil stockpiles, sloping ground adjacent to shoring, and adjacent building foundations. Contractor shall assure that his assumed conditions and loadings are not exceeded in the field during construction.
3. The Contractor shall design shoring to withstand any construction loading and applicable traffic loads.
4. Should soldier piles be used, Contractor shall embed the soldier piles into the ground below the excavation bottom a distance determined by the Contractor’s design, but in no case shall embedment be less than 5 feet. All soldier piles shall be placed in pre-drilled holes and grouted in place.
5. Contractor shall install a sufficient number of wales and struts to satisfy the requirement that the shoring system be stiff and keep deflections to a practical minimum; Contractor shall balance this requirement with the need to keep enough clear opening to allow safe and sufficient access for excavation of soil within shoring system and construction of the applicable pipe/structures.
6. The Contractor may use sloped trench walls for the portion of the trench above the pipe zone on portions of the work where vertical trench shoring is not identified on the Plans.
7. The design of shoring shall conform to accepted engineering practice in this field. The District’s acceptance of the Contractor’s plans and methods of

construction does not relieve the Contractor of their responsibility for the adequacy of this support.

C. PERFORMANCE CRITERIA:

1. The Contractor shall be solely responsible for, and bear the sole burden of cost for, any and all damages resulting from improper shoring or failure to shore.
2. The safety of workmen, the protection of adjacent structures, property and utilities, and the installation of adequate supports for all excavations shall be the sole responsibility of the Contractor.
3. The design, planning, installation, (and removal, if required) of all shoring shall be accomplished in such a manner as to maintain stability of the required excavation and to prevent movement of soil and rock that may cause damage to adjacent shoring systems, structures and utilities, damage or delay the work, or endanger life and health.

PART 2 - PRODUCTS

2.01 GENERAL

A. All timber and structural steel used for the supporting system, whether new or used, shall be sound and free from defects which may impair their strength.

B. If used, sheet piling shall be of a continuous interlocking type forming a continuous wall. Sheet piling and all accessories shall conform to the requirements of ASTM A328.

C. Structural steel members shall be designed in accordance with the Manual of Steel Construction. Timber members shall be designed in accordance with the California Building Code.

PART 3 - EXECUTION

3.01 GENERAL

A. Design, provide, and maintain shoring, sheeting, and bracing as necessary to support the sides of excavations and to prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed work.

3.02 STEEL SHEET PILING (IF USED)

A. The Contractor shall drive sheet piling in plumb position with each pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground.

B. The sheet piling shall be driven to the minimum depth of below the bottom of the trench or excavation as shown on the approved shop drawings.

C. The Contractor shall exercise care in driving to avoid damage to existing utilities so that interlocking members can be subsequently extracted without injury to adjacent fills or existing utilities.

D. The methods of driving, cutting, and splicing shall conform to the submitted shop drawings.

E. The Contractor shall maintain a sufficient quantity of material on hand for sheeting, shoring, bracing, and other operations for protection of work and for use in case of emergency.

F. Sheet pile driving shall be restricted to the hours between 8:00 a.m. and 5:00 p.m., unless otherwise approved by the District.

3.03 INTERNAL BRACING SUPPORT SYSTEM

A. The CONTRACTOR shall provide internal bracing support system including lagging and sheeting, sheet piles, wales, struts, and/or shores.

1. All struts with intermediate bracing shall be provided as needed to enable them to carry maximum design load without distortion or buckling.

2. All web stiffeners, plates, or angles shall be provided as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members which allow for eccentricities caused by field fabrication and assembly.

B. The Contractor shall install and maintain all bracing support members in tight contact with each other and with the surface being supported. Support system monitoring provisions shall be installed as indicated on the approved shop drawings.

C. If necessary to control shoring movement, the Contractor shall preload bracing members by jacking struts to 50 percent of the design load. Preload bracing members shall be loaded in accordance with methods, procedures, and sequence as described on the approved shop drawings. Excavation work shall be coordinated with the installation of bracing and preloading. Steel shims and steel wedges welded or bolted in place to maintain the preloading force shall be used in the bracing after release of the jacking equipment pressure.

1. Procedures that produce uniform loading of bracing members to avoid eccentricities or overstressing and distortion of members of wall system shall be used.

2. Preloading systems shall include a method to measure the amount of preload induced into bracing members to within five percent.

D. Excavation shall proceed to no more than two feet below point of the support about to be placed. The support shall be installed and preloaded immediately after installation and prior to continuing excavation.

3.04 MOVEMENT MONITORING

A. Prepare a Movement Monitoring Plan: Plan shall include the location identification and placement of survey monuments at regular intervals along the alignment (not in excess of 500 feet) above existing subsurface utilities and on surface structures identified by the District or its appointed Representative that may be affected by the excavation. Surface structures include, but are not limited to, pavement, curb and gutter, utilities such as manholes and valve boxes, transformers, signs, and utility poles.

B. Surveys of the monuments established for the movement monitoring plan shall be made by the Contractor a minimum of two times before the start of the excavation, once a day during excavation, weekly once the excavation is complete, weekly during construction of the structure, daily during backfilling operations, and once after backfill is complete. The surveys shall measure horizontal and vertical movement resulting from deformation of the shoring system.

C. Monitor and record daily readings on the shoring to detect any vertical or horizontal movement. Measurements shall be referenced from an initial position of the shoring, as jointly established and agreed upon by the Contractor and the District.

D. Where surface structures or utilities exist adjacent to the excavation, monitor adjacent ground and structures on all sides of excavations to verify that no settlement is occurring or has occurred as a result of the Contractor's construction activities.

E. Should deflections become excessive and jeopardize worker safety and/or the structural integrity of the system or adjacent systems, the Contractor shall stop the excavation work until corrective measures have been taken.

3.05 EXCAVATION

A. The methods of constructing the temporary shoring are at the option of the Contractor and subject to review and approval by the District. Excavations shall be made to the lines, grade, and dimensions shown on the drawings. If the excavation is found to be deviating from the true lines and grade, the Contractor shall immediately make the necessary changes in operation to bring

the operation back to the correct position. Any excess deviation beyond that specified herein shall be remedied by the Contractor at no additional cost to the District.

B. Excavation shall be done in such manner as to provide adequate support at all times to adjacent conduits, structures, or roads and so as to offer no hazard to building movement or occupancy, train, truck, or automobile operations. Bracing and shoring shall be substantial and safe, and all work shall be done in full conformity and subject to the inspection of all affected parties. If and when required and to the degree necessary, the Contractor shall provide additional support as may be necessary at no additional cost.

C. Excavate only as much as can safely stand unsupported prior to installing shoring, but in no case shall more than 5 feet of vertical trench wall be left unsupported at any time per OSHA regulations. Install bracing or lagging immediately after excavation.

D. Protect, and where needed repair, utilities damaged by operations of this section. Protect adjacent structures and property from damage and disfiguration.

E. Provide necessary groundwater control and drainage in accordance with the then- current RVSD Standard Specifications and Drawings.

F. Every precaution shall be taken by the Contractor to prevent the entry of water, mud, and foreign matter into the excavation at all times. It is the intention of these Specifications that all construction work described herein shall be carried out under dry conditions.

G. Any and all excess excavation or over-excavation performed by the Contractor shall be in compliance with 02200, EARTHWORK.

H. All trenches left open at the end of a work day or work period shall remain shored and have suitably designed traffic rated coverings placed to allow traffic to cross where roadways are impacted. Trench in the Temporary Construction Easements may be fenced to secure the site.

3.06 REMOVAL OF EXCAVATION SUPPORT

A. Remove excavation support in manner that will maintain support, as excavation is backfilled and will not leave voids in backfill. As a minimum, remove excavation support between the existing adjacent surface grade and 2 feet below the adjacent surface grade.

B. Do not begin to remove excavation support until support can be removed without damage to existing facilities, completed Work, or adjacent property. Fill any void left by shoring system or voids created by the removal of the shoring

system immediately with well graded cohesionless sand or sanded grout to provide soil support between initial and intermediate backfill zone and the native soil.

3.07 REPAIR

A. All costs to repair and/or replace damaged facilities caused by surface deformations exceeding 1/4-inch of the actual facility related to excavation support systems placement, installation maintenance, or removal (i.e.; street pavement or structures) shall be borne by the Contractor. All surface deformations resulting in a cracked surface or other visual deformation shall be removed and replaced in accordance with the specifications of the local jurisdiction and all costs shall be borne by the Contractor as part of the Project.

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies earthwork, excavation, filling, grading, and disposal of excess material, which may including contaminated materials.

B. Excavations and backfill for appurtenant structures such as, but not limited to, manholes and vaults shall be deemed to be in the category of trench excavation and backfill.

C. The Contractor shall provide all labor, materials, and equipment necessary to perform required earthwork, including but not limited to the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, backfilling around structures and utilities and all backfilling of trenches and pits, the disposal of excess excavated materials, borrow of materials to make up deficiencies for fills; and all other incidental earthwork as required.

D. The Contractor shall support and protect structures and utilities below the ground, as required.

1.02 RELATED SECTIONS

A. 02050, DEMOLITION, ABANDONMENT, AND REMOVAL

B. 02140, DEWATERING

C. 02200, SHORING

1.03 REFERENCE SPECIFICATIONS

A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where

document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
APWA 201-6	Control Low Strength Material-Placement--1997
ASTM C94	Specifications for Ready-Mixed Concrete
ASTM C136	Standard Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C150	Specification for Portland Cement.
ASTM C231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
ASTM C260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C495	Test Method for compressive Strength of Lightweight Insulating Concrete
ASTM C618	Specification of Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
ASTM D422	Method for Particle-Size Analysis of Soils.
ASTM C796	Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam
ASTM D1556	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in. (457-mm) Drop
ASTM D2922	Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D2487	Classification of Soils for Engineering Purposes.
ASTM D2844	Resistance R-Value and Expansion Pressure of Compacted Soils.

Reference	Title
ASTM D2922	Test Methods for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D3017	Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3744	Aggregate Durability Index.
ASTM D3776	Test Methods for Mass per Unit Area (Weight) of Woven Fabric.
ASTM D3786	Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
ASTM D4253	Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
ASTM D4254	Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
ASTM D4355	Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon- Arc Type Apparatus).
ASTM D4491	Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM D4632	Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D4751	Test Method for Determining the Apparent Opening Size of a Geotextile.
ASTM D6241	Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
Caltrans 205	Method of Test for Determining Percentage of Crushed Particles
Caltrans 216	Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates
Caltrans 229	Method of Test for Durability Index
Caltrans 231	Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates by the Area Concept Utilizing Nuclear Gages

1.04 NOT USED

1.05 SUBMITTALS

A. Product information and data for fill materials to be used shall be submitted to the District at least two (2) weeks in advance of use. Where required by the District, the Contractor shall provide samples consisting of 0.5 cubic feet of specific fill materials.

B. Submittals related to the testing, handling, and transport of contaminated material shall be completed in accordance with requirements specified herein.

C. Low Density Cellular Concrete (LDCC)

1. When LDCC is used, the Contractor shall submit the following:

a. Mix design for LDCC, including materials, proportions, and gradations, to be used and their sources. The mix designs shall be tested by an independent testing laboratory for properties specified herein. The results of the independent testing laboratory shall be submitted with the LDCC mix designs. All costs related to such testing shall be borne by the Contractor.

b. Resume of contractor showing experience as specified below, including qualifications of contractor's superintendent and/or foreman.

c. Description of equipment and placement methods to verify compliance with specifications.

d. Test results from compression tests, as specified herein.

D. Controlled Low Strength Material (CLSM)

1. When CLSM is used, the Contractor shall submit the following:

a. Mix design for CLSM, including materials, proportions, and gradations, to be used and their sources. The mix designs shall be tested by an independent testing laboratory for properties specified herein. The results of the independent testing laboratory shall be submitted with the CLSM mix designs. All costs related to such testing shall be borne by the Contractor.

b. Test results from compression tests, as specified herein.

1.06 QUALITY ASSURANCE

A. Testing:

1. The District will take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these specifications. The Contractor shall remove surface material at locations designated by the District or its appointed Representative and provide such assistance as necessary for sampling and testing. The District or its appointed Representative may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these specifications.

2. Tests will be made by the District or its appointed Representative in accordance with the requirements of the agency having jurisdiction. In the absence of such jurisdiction, or with the concurrence of the agency, tests shall be made in accordance with the following:

Test	Standard Procedure
Moisture content	ASTM D3017
Gradation	ASTM C136
Density in-place	ASTM D2922
Moisture-density relationships	ASTM D1557

3. Geotextile Fabric (Filter Fabric)

   a. Testing. All materials testing will be based upon application ASTM Test Methods and referenced herein for the materials specified.

   b. All costs of such inspection and tests shall be borne by the Contractor.

   c. Certificates. Manufacturer's notarized certificates of compliance shall be furnished by the Contractor.

4. Low Density Cellular Concrete (LDCC)

   a. The Contractor shall have a record of experience and quality of work placing LDCC that is satisfactory to the District or its appointed Representative including the following:

      i. Shall be capable of developing a mix design, batching, mixing, handling, and placing of LDCC.

      ii. Shall be regularly engaged in the production and placement of LDCC for engineered fills.

iii. Workers, including the contractor's superintendent and/or foreman, shall be fully qualified to perform the work and have had previous experience in production and placement of LDCC under similar conditions.

b. Testing

i. Testing shall be performed by an approved agency.

ii. A minimum of four (4) 3 inch by 6 inch cylinders shall be molded for each 100 cubic yards placed.

iii. LDCC may be tested at any age (after 3 days) for compressive strength in accordance with ASTM C-495. At least two (2) specimens from each set should be tested at 28 days unless otherwise approved by engineer.

iv. Contractor shall record and measure wet cast densities at the point of placement hourly. Mix shall be adjusted as required to obtain the specified cast density at the point of placement."

5. CLSM

a. When controlled low strength material (CLSM) is used as a backfill, the Contractor shall take a minimum of two (2) cylinders for testing by the District. The Contractor shall furnish the cans for the test cylinders and pour the CLSM into the cans. The test cans shall be marked with the date and stored on the job site in conditions similar to the backfill that was poured. The District will pay for the testing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Storage of materials within the public right of way will be prohibited, unless otherwise approved by the District and other agencies having jurisdiction.

1.08 DEFINITIONS:

A. RELATIVE COMPACTION (ASTM METHOD): The ratio expressed as a percentage, of the dry density of the backfill material as compacted in the field, to the maximum dry density of the same material determined in the laboratory by ASTM D1557.

B. OPTIMUM MOISTURE CONTENT (ASTM Method): The ratio, expressed as a percentage, of the weight of water in the solid material to the weight of the solids which occurs at the maximum dry density as determined by ASTM D1557.

C. RELATIVE COMPACTION (CALTRANS METHOD): The ratio expressed as a percentage, of the wet density of the backfill material as compacted in the field, to the maximum wet density of the same material determined in the laboratory by Caltrans Test Method 216.

D. OPTIMUM MOISTURE CONTENT (Caltrans method): The ratio, expressed as a percentage, of the weight of the water in the soil material to the weight of the solids which occurs at the maximum wet density as determined by Caltrans Test Method 216.

E. EXCAVATION SLOPE: Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.

PART 2 - MATERIALS

2.01 GENERAL

A. The Contractor shall furnish fill materials and geotextile fabrics in accordance with the requirements specified herein and the Standard Drawings.

B. The District prefers the use of recycled materials for rock fill materials and aggregate base, where feasible. Recycled materials meeting the requirements and gradations specified herein may be submitted for approval at the Contractor's option. If the District approves, the Contractor shall pass cost-savings to District.

2.02 USE OF FILL AND BACKFILL MATERIAL TYPES

A. The Contractor shall use the types of materials as designated herein, shown in the Standard Drawings, for all required construction.

B. Fill and backfill types shall be used in accordance with the following provisions:

1. Pipe bedding, pipe zone, and trench zone backfill for all trenching shall be material shown on Typical Trench Section Standard Drawing, See SD-16, unless otherwise specified.

2. Where the specified compaction cannot be achieved for pipe bedding or in the pipe zone due to existing utilities and/or obstructions, the Contractor may use CLSM or LDCC in the area of conflict, if acceptable to the District.

3. Pipe bedding and bedding beneath structures shall conform to the following Pipe/Structure Bedding Schedule:

Pipe/Structure Bedding Schedule		
Existing Sub-Grade	Bedding Depth	Bedding Material
Soil-Dry	6”	¾” Crushed Rock
Soil w/Water	12”	1 ½” Crushed Rock
Dry Rock or Hard Pan-Dry	6”	¾” Crushed Rock
Rock or Hard Pan w/Water	6”	1 ½” Crushed Rock
Unstable soil and/or Bay Mud	18” (Over-excavate additional 12” min where directed by District)	1 ½” Crushed Rock

a. Pipe/structure bedding shall be encapsulated in geotextile fabric with a minimum of 12 inches overlap.

4. Backfill around structures shall be engineered fill material.

5. Backfill for over-excavation, where directed by the District, shall be a 18 inch thick minimum layer (including pipe/structure bedding) of CLSM, LDCC, or 1 ½” crushed rock. If crushed rock is used, then it shall be wrapped with the pipe/structure bedding in geotextile fabric to prevent migration of fines for wet conditions.

6. Base beneath pavement shall be per Section 02513, ASPHALT CONCRETE PAVEMENT AND BASE.

2.03 FILL MATERIALS

A. 3/4” Crushed Rock (Drain Rock)

1. Three-Quarter Inch (3/4”) crushed rock shall consist of clean, durable, crushed, uniformly graded angular drain rock conforming to Caltrans Standard Specifications. It shall be composed of hard, durable, sound pieces free from slaking or decomposition under action of alternate wetting and drying.

2. 3/4” Crushed Rock shall conform to the following requirements:

Property		Test Procedure
Gradation:		
Sieve Size	Percent Passing	
3/4-inch	100	ASTM D422
No. 200	Less than 3	ASTM D422
Durability Index:		
40 minimum		CTM D229
Percent Crushed Particles:		
95% minimum		CTM 205

B. 1½" Crushed Rock (Coarse Bedding Material)

1. Coarse bedding material shall consist of clean, durable, crushed, uniformly graded angular drain rock conforming to Caltrans Standard Specifications. It shall be composed of hard, durable, sound pieces free from slaking or decomposition under action of alternate wetting and drying and having a specific gravity of not less than 2.65.

2. 1 ½" Crushed Rock shall conform to the following requirements:

Property		Test Procedure
Gradation:		
Sieve Size	Percent Passing	
1½ inch	100	ASTM D422
3/8"`	Less than 5	ASTM D422
Durability Index:		
40 minimum		CTM D229
Percent Crushed Particles:		
95% minimum		CTM 205

C. Class 2 Aggregate Base (Class II AB)

1. Class 2 aggregate base shall be 3/4-inch maximum material conforming to Section 26 of the Caltrans Standard Specifications.

2. Aggregate base from recycled materials meeting the specified gradation shall be submitted for approval at Contractor's option. If District approves, the Contractor shall pass cost-savings to District.

D. Sand

1. Sand shall be free of organics and other deleterious materials.

2. Sand shall meet the following gradation requirements:

Sieve Size	Percent Passing
3/8”	100
No. 4	90-100

3. Sand shall have a sand equivalent not less than 30.

E. Controlled Low Strength Material (CLSM)

1. Control low strength material (CLSM) shall be manufactured in accordance with the following referenced standards. It shall be a hand-excavatable mixture of aggregate, cement, pozzolan, water and admixtures to be used as fill material where indicated in this specification or on the drawings. CLSM shall meet the requirements of Section 201-6 of the APWA Standard Specifications for Public Works Construction.

2. CLSM material shall have the following properties:

a. Cement shall be Type II in accordance with ASTM C150.

b. Pozzolan shall be Type F in accordance with ASTM C618.

c. Coarse aggregate shall consist of a well-graded mixture of crushed rock, soil, or sand with a maximum size aggregate of 3/8 inch. One hundred percent shall pass the 1/2-inch sieve. Not more than 30 percent shall be retained by the 3/8-inch sieve and not more than 20 percent shall pass the No. 200 sieve. All material shall be free from organic matter and not contain more alkali, sulfates, or salts than the native soils at the site of the work.

d. Air entraining shall be used to improve the workability of the mixture in accordance with ASTM C260. Entrained air content shall be between 8 and 20 percent.

e. Water reducing agent shall be added to improve the workability and shall be in accordance with ASTM C494.

f. Water shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities.

g. CLSM shall be a flowable material similar in all respects to Pozzolanic International Flowable Compacting Fill by RMC Lonestar, or equal. The 28-day compressive strength shall be between 50 and 150 psi.

h. CLSM that has a 28-day compressive strength in excess of 150 psi shall be removed as directed by the District or its appointed Representative and replaced with CLSM meeting the specifications at no additional cost to the District.

F. Low Density Cellular Concrete (LDCC)

1. LDCC material may be used for pipe or structure abandonment, or for backfill of trench zone and for structure backfill where specifically required.

2. LDCC shall be hand-excavatable mixture of cement, foam, and water that has been mixed, in accordance with ASTM C94.

3. LDCC Materials

   a. Portland cement shall comply with ASTM C150 (Type II).

   b. Fly ash shall be Class C or Class F and compatible with foaming agent.

   c. Water shall be free from deleterious substances.

   d. Foam shall be Geofill Concentrate conforming to ASTM C796; or equal.

   e. Admixtures for water reducing, retarding, accelerating, anti- washout and other specific properties may be used when specifically approved by the manufacturer of the preformed foam.

4. LDCC shall meet the following requirements, unless otherwise specified:

Cast Density, Per ASTM D2922	26-30 PCF
Minimum Compressive Strength	50 PSI
Min 12 hr Compressive Strength	20 PSI
Maximum Compressive Strength	150 PSI
Freeze-Thaw Resistance	330 Cycles
Min Modified Shear Modulus (G) per ASTM D4015 at confining stress of 3 PSI	27,000 PSI
Young's Modulus (E) based on Poisson's Ratio u = 0.22 and E=2G (1+u)	67,000 PSI
Min Relative E percent at cast	70% Max
Water Absorption after 120 days	20%
Coefficient of Permeability (k) per ASTM D2434	
Confining stress, 2.5 PSI	4.7x10-5 cm/sec
Confining stress, 18 PSI	1.9x10-5 cm/sec

G. Native Soil

1. Native soil, where permitted by the local jurisdiction for the intended purpose, shall be unclassified material which is free from peat, wood, roots, bark, debris, garbage, rubbish, or other extraneous material. The

native soil shall contain no material greater than 4 inches in size, including clods, and construction material, such as asphalt and concrete. Moisture conditioning of native materials (i.e., drying of wet soils and wetting of dry soils) may be required to achieve specified compaction and shall be done at no additional expense to the District. Soil types commonly referred to as “Bay Muds” shall not be used for any for any backfill.

H. Engineered Fill

1. Engineered fill shall meet one of the following criteria:

a. Aggregate Base, 3/4" crushed rock, or 1 ½” crushed rock, or CLSM as specified above.

b. On-site, clean (free of organicand deleterious materials), conforming to the following:

Property		ASTM Test Procedures
Gradation:		
Sieve Size	Percent Passing	
3-inch	100	D422
3/4-inch	70-100	D422
No. 4	50-100	D422
No. 40	30-100	D422
No. 50	30-100	D422
No. 200	15-70	D422
Plasticity:		
Liquid Limit	Plasticity Index	
<30	<12	D4318
Organic Content:		
Less than 3 %		D2974
Expansion Potential (UBC18-2):		
Less than 20		---
Maximum Dry Density:		
Greater than 105 pcf		D1557

2.04 LIGHTWEIGHT BACKFILL

A. In areas with poor soils and potential for settling, the District may allow or require the use of lightweight backfill in lieu of the products specified herein and shown in the Standard Drawings to prevent potential of future settling.

B. Lightweight backfills shall be one of the following:

1. LDCC

2. Lightweight coarse aggregate meeting the requirement of ASTM C 330 and conforming to the coarse aggregate gradation for 19 mm to 4.75 mm (3/4" to #4) specified in ASTM C 330 when tested in accordance with ASTM C 136.

3. Low Density CLSM

C. Lightweight backfill density shall not exceed 90 pounds per cubic foot, or the specific requirements of the Project Contract Documents.

2.05 UNSUITABLE MATERIAL

A. Unsuitable soils for fill material shall include, but not be limited to, all soils which when classified under ASTM D2487 fall in the classifications of PT, OH, CH, MH, or OL.

B. Unsuitable shall also include “bay mud,” man-made fills, refuse, and unsuitable materials from previous construction, either on the surface or buried.

C. Any soil that cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use shall be classified as unsuitable material.

D. Materials containing detrimental amounts of organic matter. Organic matter shall be no more than five percent. Amount of organic matter shall be determined based on ASTM Test Method D 2974.

E. Materials containing rock or similar irreducible material with a maximum dimension greater than four inches.

F. Materials containing foreign manmade objects, such as construction debris, concrete and asphalt.

G. Materials of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content.

H. Materials that are too wet to be properly compacted and circumstances prevent suitable in-place drying prior to incorporation into the work. However, the presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable.

I. Chemical testing for corrosivity shall be performed for all materials proposed for use as bedding and backfill for metallic or reinforced concrete pipe. The testing shall be in accordance with the requirements of CTM 417, CTM 422 and CTM 643. Bedding and backfill materials shall be considered unsuitable when the chloride concentration exceeds 500 ppm, sulfate concentration exceeds 1,500 ppm, resistivity is less than 2,000 ohm-cm or pH is less than 6.5. Testing shall be performed by a qualified laboratory approved by the District, and the data shall be submitted to the Inspector for acceptance prior to use of the material in the work.

2.06 GEOTEXTILE FABRIC

A. The geotextile fabric should be non-woven consisting of polymeric filaments formed into a stable network. The fabric should be inert to commonly encountered chemicals, rot-proof and resistant to ultraviolet light exposures, insects, and rodents.

B. The geotextile fabric shall also conform to the following physical properties:

Sieve Size	Percent Passing	Test Method
Weight	4 oz/yd.^{2} (min)	ASTM D5261
Grab tensile strength	120 lbs (min)	ASTM D4632
Elongation at break	50% (max)	ASTM D4632
CBR Puncture strength	300 lbs (min)	ASTM D6241
Apparent opening size	# 70 (max)	ASTM D4751
Permittivity	1.5 sec^{-1} (min)	ASTM D4491
UV resistance	70% retained (min)	ASTM D4355

C. Geotextile fabric shall be per the District's Approved Materials List.

2.07 ROCK SLOPE PROTECTION

A. Rock slope protection shall consist of clean, crushed, angular rock conforming to Caltrans Standard Specification Section 72-2, Rock Slope Protection. Rock shall be CLASS 1, unless otherwise noted.

B. Rock slope protection fabric shall be Type B conforming to Caltrans Standard Specification Section 96-1.02 I, Rock Slope Protection Fabric.

PART 3 - EXECUTION

3.01 GENERAL

A. Trench excavation shall be in accordance with Section 15.202 of the Caltrans Specifications.

B. Excavations shall be shored and braced as set forth in the rules, orders, and regulations of the Division of Industrial Safety of the State of California. The Contractor's shoring and bracing and general trenching operation shall consider vehicular and other loads that may be applied near the edge of an open trench and shall be in accordance with Section 02160, Shoring.

C. Excavated spoils not used for backfill in approved areas shall be dumped directly into trucks for off haul.

D. Trench width shall be as shown on the Standard Drawings. If maximum trench width is exceeded, the Contractor shall consult the District immediately, and the Contractor shall provide additional bedding, another more stringent type of bedding, or higher strength pipe as directed by the District or its appointed Representative at no additional cost to the District.

E. Dewatering of all excavations shall be performed in accordance with Section 02140, DEWATERING.

3.02 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

A. Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the Work. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. Excavations shall be supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926). All excavations shall be shored in accordance with Section 02160, SHORING.

B. Excavation Beneath Structures and Embankment. Except where specified for a particular structure or ordered by the Engineer, excavation shall be carried to a grade of at least 6 inches below the bottom of the footing or slab. All new structure foundations shall be founded on a minimum of 6 inches of bedding as specified herein.

C. Steel Plates. Skid resistant steel plates of 1-inch minimum thickness with adequate trench bracing shall be used to bridge across trenches at roadways where trench backfill and temporary patch have not been completed during regular working hours. Safe and convenient passage for pedestrians shall be provided. The District or its appointed Representative may designate a passage to be provided at any point deemed necessary. Access to fire stations, fire hydrant, and hospitals shall be maintained at all times.

D. Excavation Beneath Paved Areas. Excavation under areas to be paved shall extend to the bottom of the Aggregate base. After the required excavation has

been completed, the exposed surface shall be scarified, moisture-conditioned and compacted.

3.03 PIPELINE AND UTILITY TRENCH EXCAVATION

A. General. Unless otherwise shown, ordered, or accepted by the District, excavation for pipelines and utilities shall be vertical trenches.

B. Existing utilities, manholes, drainage structures, and other facilities shall be protected, supported, and kept in service per the Contract Documents.

C. Excavation and pipe laying shall be performed in the upstream direction, unless otherwise approved by the District or its appointed Representative.

D. Trench Bottom. The bottom of the trench shall be excavated uniformly at to a depth as required in the pipe bedding schedule in Section 2.02 above. The trench bottom shall be given a final trim, using a laser to set the string line for establishing grade. Rounding out the trench to form a cradle for the pipe will not be required.

E. Open Trench. The maximum lengths of open trench permitted in any one location shall be the length necessary to accommodate the amount of pipe installed in a single day. The distance is the collective length at any location, including open excavation, pipe laying and appurtenance construction, and backfill which has not been temporarily resurfaced. All trench excavations shall be fully backfilled at the end of each day. Use of steel plates as open trench covers will not be permitted except as described below:

1. Steel plates or other trench covers will not be permitted, except as follows:

    a. Trench plates will be allowed to cover a minimum area over the end of the last section of pipe installed each day.

    b. Provided the trench is properly shored, trench plates shall only be allowed to remain at one location for a maximum of two days without permission from the District.

    c. Temporary backfill of the trench in the plated area is not required.

    d. In other special circumstances, but only with the prior approval of The District or its appointed Representative.

    e. Traffic will not be allowed on plates unless asphalt concrete cutback edge transitions are provided and the plates are properly braced and of sufficient thickness to the satisfaction of the District.

2. The Contractor shall backfill all excavations prior to the end of the workday. Open trenches will not be permitted during non-working hours within street right-of-way unless conforming to the above requirements for steel plating.

3. Saw cutting shall be performed prior to the removal of asphalt concrete or Portland cement concrete.

F. Steep Slope. Steep Slope detail with Rock Slope Protection shall be per Section 2.07.

3.04 SURPLUS MATERIAL

A. Unless otherwise specified, surplus excavated material shall be disposed of off-site on a daily basis, in accordance with applicable ordinances and environmental requirements in a location authorized to accept surplus material. Contractor shall submit to the District or its appointed Representative authorization of disposal site or sites prior to beginning excavation.

3.05 HAULING

A. When hauling is done over highways or city or county streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading. The loads shall be watered and covered after trimming to eliminate dust. Contractor shall use approved truck haul routes as determined by the District, the County of Marin, and the City or Town with jurisdiction.

3.06 BAYMUD, UNSTABLE SUB-GRADE, AND OVER-EXCAVATION

A. Where the undisturbed condition of natural soils is inadequate for support of the planned construction and where directed by the District or its representative, the Contractor shall over-excavate to adequate supporting soils or to a depth determined and directed by the District (18” minimum depth below pipe). The over-excavated space shall be filled to the specified elevation for the bottom of the pipe/structure bedding with CLSM, LDCC, or 1 ½” crushed rock. The quantity and placement of additional foundation material and fabric shall be as directed by the District or its representative. If crushed rock is used, then it shall be wrapped with the pipe/structure bedding in geotextile fabric with a minimum of 12” inch overlap and it shall be compacted mechanically using a minimum of three (3) passes of a Vibraplate 220Y Wacker with a 12-inch-square shoe, or equal.

3.07 BACKFILL – GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed.

B. Backfill shall be placed after all water is removed from the excavation.

3.08 PLACING AND SPREADING OF BACKFILL MATERIALS (EXCEPT FOR CLSM AND LDCC)

A. Backfill materials shall be placed and spread evenly in layers, loose depth 8 inches or less. Larger lifts may be placed with District approval.

B. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer.

C. Where the backfill material moisture content is too low to permit the specified degree of compaction, water shall be added before or during spreading until the proper moisture content is achieved. Jetting will not be permitted for compaction.

D. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried until the moisture content is satisfactory.

E. Storage of backfill materials overnight within the right-of-way is prohibited, unless otherwise noted in the Contract Documents.

3.09 COMPACTION OF FILL, BACKFILL, AND EMBANKMENT MATERIALS

A. Each layer of backfill materials as defined herein, where the material is graded such that at least 10 percent passes a No. 4 sieve, shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content. Lightweight tampers or vibrating plate compactors shall be used in pipeline and utility trenches to prevent damage to existing or new utilities.

B. Compaction of backfill adjacent to all subgrade structure walls shall follow a pattern of compaction which begins at the wall face and progresses outward to the outside edge of the excavation before beginning a new lift.

C. Flooding, ponding, or jetting shall not be used.

D. Crushed rock (3/4" and 1 ½") shall be compacted by means of vibratory compaction equipment. At least three (3) passes from a flat plate vibratory compactor, number of passes shall be made as required until a firm unleaded state is achieved.

E. Compaction Requirements. The following compaction test requirements shall be in accordance with ASTM D1557 or in accordance with ASTM D4253 and D4254 as applicable.

F. If compaction fails to meet the specified requirements, the CONTRACTOR shall remove and replace the backfill at proper compaction or shall increase the compaction to specified level by other means acceptable to the District or its appointed Representative. Subsequent tests required to verify that the reconstructed backfill meets the specified compaction shall be paid by the Contractor.

3.10 UTILITY TRENCH BACKFILL

A. Trench backfill shall be per the District Standard Drawings.

1. Pipe Bedding: The pipe bedding is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe, i.e., the trench subgrade and the bottom of the pipe.

2. Pipe Zone Backfill: The pipe zone is defined as that portion of the vertical trench cross-section lying between the bottom surface of the pipe and a plane at a point 12 inches above the top surface of the pipe.

3. Trench Zone Backfill: The trench zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches above the top surface of the pipe and a plane at the finished surface grade. After the pipe zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the trench zone may proceed.

B. The CONTRACTOR shall exercise care to prevent damage to the pipeline and any pipeline coatings (if applicable) during the installation and backfill operations.

C. Periodic compliance tests may be made by the District at no cost to the Contractor to verify that compaction is meeting the specified requirements.

3.11 CONTROLLED LOW STRENGTH MATERIAL

A. General:

1. CLSM shall be used where indicated in the Drawings, or in localized areas where there is inadequate space between utilities and/or facilities to properly compact backfill. CLSM may be poured in place to fill inaccessible areas, or as a backfill where approved by the District or its appointed Representative. CLSM placed in and around structures or pipelines shall be as specified herein, in the Standard Drawings, and in APWA Standard Specifications, Section 201-6.6.

2. Where CLSM is used, placement of backfill on top of the CLSM shall not be allowed until the CLSM passes the ball drop test of ASTM D6024.

B. Structure Backfill: Where indicated in the Standard Drawings or the Contract Documents, CLSM shall be placed around structures as backfill evenly so that uneven loading of the structure does not occur as a result of the CLSM placement. A minimum of two lifts shall be used in placing the CLSM around structures. Where structures have pipes entering/exiting the structure, CLSM shall be placed in accordance with placement of CLSM for pipe installation locations.

C. Pipe Backfill: Where CLSM is used as trench backfill within the pipe zone, it shall be placed into the trench around the pipe so that the CLSM is placed evenly on both sides of the pipe to prevent uneven loading of the pipe. CLSM shall not be placed directly onto the pipe. The maximum depth of the first lift of CLSM shall not allow the pipe to move or float. Subsequent lifts of CLSM shall be placed so that the pipe does not shift or float. CLSM placed in trenches with steep slopes shall be placed in lifts to prevent flotation of the pipe, and the Contractor shall install approved anchor blocks as needed to secure the pipe in place during placement of the CLSM. Use of anchor blocks or deadman concrete collars may be used by Contractor with written approval by the District or its appointed Representative.

3.12 LOW DENSITY CELLULAR CONCRETE

A. Production.

1. Foam generating equipment shall be used to produce a predetermined quantity of pre-formed foam which shall be mixed and blended with cementitious slurry. Equipment shall be calibrated to produce consistent foam with stable, uniform cellular structure.

2. When producing neat cellular concrete (no sand or other aggregates), pre-formed foam under no circumstances shall be added or blended with cementitious slurry in a transit mixer.

3. LDCC shall be produced utilizing specialized automated proportioning, mixing, and foam producing equipment, which is capable of meeting the specified properties.

4. Avoid excessive handling of the material. After sufficient mixing of the foam with slurry, LDCC shall be conveyed promptly in its final location.

5. All equipment used must be approved by foam manufacturer.

B. Placement

1. Prior to placement of LDCC, the ground surface shall be excavated to the lines and grades shown on the plans. There shall be no standing water in the area to be filled. If necessary, dewatering shall be continuous during placement of materials.

2. Any items to be encased in LDCC shall be set in place and secured prior to installation of material.

3. Placement shall not be allowed on frozen ground.

4. Place LDCC in such a manner so that minimal consolidation of material occurs during or after placement. Placement of LDCC shall not exceed depths as recommended by the manufacturer.

5. Final surface of LDCC shall be within +1- 0.2 feet of the plan elevations.

6. LDCC shall not be vibrated or disturbed. Vehicles, equipment, backfills or other loadings on the fill material shall not be permitted until the material has attained an adequate compressive strength.

3.13 FINISH GRADING

A. Finished surfaces shall be smooth, compacted, and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.

B. Finished grade shall be as specified by the contours plus or minus 0.10 foot except where a local change in elevation is required to match sidewalks, curbs, manholes and catch basins, or to ensure proper drainage. Allowance for topsoil and grass cover, and subbase and pavement thickness shall be made so that the specified thickness of topsoil or pavement can be applied to attain the finished grade.

C. When the work is an intermediate stage of completion, the lines and grades shall be as specified plus or

D. If the soil is to be cultivated or straw is to be incorporated into the surface, rocks larger than 2-1/2 inches in maximum dimension, roots, and other debris on the surface of the slope shall be removed and disposed of prior to cultivation or placement of straw.

3.14 CONTROL OF EROSION

A. Erosion control shall be in accordance with Section 02270, EROSION CONTROL.

B. The Contractor shall maintain earthwork surfaces true and smooth and protected from erosion. Where erosion occurs, the Contractor shall provide fill or shall excavate as necessary to return earthwork surfaces to the grade and finish specified.

3.15 SUBGRADE FOR PAVEMENT

A. Pavement subgrade shall be scarified to a depth of at least 12 inches and recompacted to at least 95 percent of the maximum density.

3.16 EXPLOSIVES AND BLASTING

A. Blasting or the use of explosives shall not be permitted.

3.17 ROCK EXCAVATION

A. Rock excavation shall include removal and disposal of the following from open-cut excavations and that meet the requirements of the definition of “hard rock” specified herein:

1. All boulders measuring 1/3 of a cubic yard or more in volume.

2. Concrete or masonry structures which have been abandoned, excluding those shown on the drawings to be removed as part of the work.

3. All rock material in ledges, bedding deposits, and unstratified masses.

B. Definitions:

1. Hard Rock: Defined as interlocking crystalline material with firmly cemented laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding one half (1/2) cubic yard in volume.

2. Hard Material: Weathered rock, dense consolidated deposits, or conglomerate materials (excluding man made materials such as concrete) which are not including in the definition of “hard rock” but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

C. Removal of “hard material” will not be considered rock excavation because of intermittent drilling or use of above mentioned equipment that is performed merely to increase production.

D. Rock shall be excavated by mechanical means.

E. For projects under Contract with the District, if the Contractor encounters conditions to be claimed as “Rock Excavation,” these conditions must be observed in the field by the District or its appointed Representative and verified.

3.18 CONTAMINATED MATERIALS

A. Where Contract Documents indicate potential locations of soil contamination in required excavations, or where contaminated materials are encountered, then all work shall comply with the following codes:

1. Code of Federal Regulations – Title 40 – Protection of the Environment, Part 761 (40 CFR 761)

2. California Code of Regulations, Title 22, Social Security, Division 4, Environmental Health, Chapter 30 – Minimum Standards for Management of Hazardous and Extremely Hazardous Wastes

B. The Contractor shall submit the following to the District for review:

1. Job Plan: The Contractor shall prepare and submit to the District or its appointed Representative, for review, a detailed Job Plan describing the

proposed methods and procedures for excavating, segregating, testing, and disposing of petroliferous soil or groundwater. The Job Plan shall be submitted to the District or its appointed Representative no less than fourteen (14) days prior to the start of any excavation work at locations where contaminated soils and ground water is anticipated.

2. The Job Plan shall include step-by-step procedures for the actions to be taken in identifying, handling, removing, and disposing of any contaminated soil or groundwater encountered during excavation. The Job Plan shall include a description of monitoring considerations, subcontractor participation, and shall demonstrate conformance to environmental, local, State, and Federal laws and regulations. All required permits, licenses, certificates of disposal, and manifests shall be referenced. The equipment and procedures described in this section are intended to serve as guideline for the Contractor's use in preparing the Job Plan.

3. Health and Safety Plan: At least fourteen (14) days before the start of any excavation at locations where contaminated soils and ground water are anticipated, the Contractor shall prepare and submit to the District or its appointed Representative, for review, a Health and Safety Plan. The Health and Safety Plan shall be prepared by an industrial hygienist certified by the American Board of Industrial Hygiene and shall include, but not be limited to, training of the Contractor's personnel, protective equipment, air monitoring, sampling, and emergency procedures.

4. No excavation will be allowed to commence until the Health and Safety Plan has been returned by the District to the Contactor with the notation: "Resubmittal not required." The Contractor is referred to Section 5, General, Paragraph 5-1.16, Hazardous Waste in Excavation for additional information.

5. Manifests: Copies of hazardous waste transporter licenses, permits, or registrations for all states in which the shipment shall travel.

6. Permits and Licenses: The Contractor shall obtain all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including certification of transport vehicles carrying hazardous material. The National Environmental Quality Act of 1970 (Chapter 1433, STATS. 1970), as amended by Chapter 1154 STATS. 1972, may be applicable to permits, licenses, and authorizations which the Contractor shall obtain from local agencies in connection with performing the work of the contract.

7. The Contractor shall comply with the provisions of said statues in obtaining such permits, licenses, and authorizations.

8. Certified Testing Laboratory: Contractor shall submit documentation attesting to the certification and QA/QC procedures for the testing laboratory to be used.

C. MONITORING

1. Contractor shall furnish a properly calibrated, fully functional organic vapor analyzer (OVA) for use at the site of every excavation or open trench. The OVA shall utilized the principle of hydrogen flame ionizations, shall incorporate a chemically-resistant sampling system, shall provide accurate indication of gas concentration over the range of 0 to 10 parts per million (ppm), shall continuously sample and monitor the ambient atmosphere, shall provide both visible readouts and audible alarms, and shall be outfitted with a recording strip-chart or other permanent recording device.

2. If the OVA provides more than one (1) monitoring scale, then the monitor shall be set to monitor over the zero (0) to ten (10) ppm range at all times during use.

3. The audible alarms shall be set to activate at a level equal to ten (10) percent of the lower explosive limit (LEL) for methane.

4. The organic vapor analyzer shall be a Model OVA 128 Century Organic Vapor Analyzer, as manufactured by the Foxboro Company, Foxboro, Massachusetts, or approved equal.

5. The Contractor shall calibrate and make available the OVA equipment daily.

6. The preliminary mode of examination for petroliferous soil and/or groundwater shall be through visual and olfactory means. Upon the first observation of soil or water that may contain petroliferous products, the Contractor shall stop excavation work and immediately notify the District or its appointed Representative. No excavation of petroliferous soil, nor pumping of petroliferous water, shall proceed without the approval of the District or its appointed Representative.

7. Following sensory observation of petroliferous products, the OVA equipment shall be brought to the excavation site and the atmosphere shall be tested. The Contractor's Job Plan and Health and Safety Plan shall be immediately placed into effect.

8. Potentially contaminated soil or water shall be segregated and tested by the Contractor, at a certified laboratory approved by the District or its appointed Representative, to determine the consistency and quantity of petroliferous products. Costs for testing shall be paid by the Contractor. The soil or water shall then be disposed of in accordance with applicable local, State, and Federal law, following the procedures described in the Contractor's Job Plan and Health and Safety Plan.

D. CONTAMINATED MATERIALS HANDLING AND DISPOSAL

1. The Contractor shall avoid or minimize excavation in contaminated areas whenever possible.

2. Excavated trench material that, in the opinion of the District or its appointed Representative exhibits evidence of petroleum contaminated shall be removed from the site and temporarily stockpiled by the Contractor. The location of the temporary stockpile area must be reviewed by the District. The contaminated trench materials shall be placed on 10 mil polyethylene sheeting to prevent contamination of uncontaminated soils and shall be separated from all uncontaminated trench materials. The temporary stockpiles of contaminated trench materials shall be covered securely with 10 mil polyethylene sheeting to limit emissions and prevent rainfall from entering the stockpile. Runoff or drainage from the temporary stockpile shall be prevented from leaving the area and all materials shall be surrounded with 6-foot high temporary chain-link fence.

3. The temporary stockpiles of contaminated trench materials shall be sampled and analyzed by a certified testing laboratory, approved by the District or its appointed Representative, that is retained and paid for by the Contractor. Results of the laboratory analysis shall be provided by the District or its appointed Representative within seven (7) calendar days from the date that the material is stockpiled.

4. Disposal of the contaminated trench materials will depend on the results of the testing program. The Contractor shall dispose of the contaminated material in one of the following two ways with the approval of the District or its appointed Representative.

    a. Option 1: Thermal Remediation and Disposal

        i. The Contractor shall be responsible for storage, loading, transporting, and loading the contaminated soil to a plant licensed by the State of California to do remediation of the soil contamination.

        ii. Certification of Remediation of Contaminated Soils certifying that the contamination has been destroyed and the soil is inert shall be provided by the Contractor to the District. The Certificate shall include a provision holding the District harmless as a result of the thermal remediation work done for the project.

    b. Option 2: Disposal in a Class II Landfill

        i. The Contractor shall be responsible for proper handling, loading, transporting, and unloading the contaminated soil to a |

Class II Landfill. The disposal site shall be selected by the Contractor subject to District approval.

ii. A manifest or certificate attesting that the contaminated soil has been delivered and accepted by a licensed landfill authorized to accept such contaminated soil shall be provided by the Contractor to the District.

iii. All handling, storing, transporting, treatment, and disposal of contaminated soil and groundwater shall conform with Federal and State environmental regulations, including those of the Regional Water Quality Control Board, Department of Toxic Substance Control, Integrated Waste Management Board, State Air Resources Control Board, and the Bay Area Air Quality Management District. Transport of contaminated material and groundwater shall be performed by appropriately certified and/or licensed personnel.

iv. Upon completion of excavation within the contaminated area and the hauling and disposal of contaminated materials, the Contractor shall clean up the site, including proper removal and disposal of all plastic sheetings, containers, and other materials used.

v. Any groundwater from trenching activities within the contaminated soil area, as shown on the plan shall be stored in temporary Baker-type storage tanks. The Contractor shall pay for the groundwater to be sampled and analyzed by a certified testing laboratory approved by the District or its appointed Representative. After testing, Contractor shall dispose of the stored groundwater as directed by the District or its appointed Representative. If analyzed samples indicate that the groundwater may be discharged into the sewer system, no additional payment will be made to the Contractor. If analyzed samples indicate that the groundwater cannot be discharged into the sewer system, a change order for disposal only, will be negotiated with the Contractor.

*****END OF SECTION*****

SECTION 02270

EROSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. This section covers the work necessary to furnish all tools, equipment's, materials, and supplies for erosion control.

B. The Contractor shall provide erosion protection including fertilizing, seeding, and mulching for all disturbed areas that are not to be paved or otherwise treated, as specified, and other areas as shown on the plans.

C. Erosion Control (Vegetative) may be used as temporary erosion protection of landscaped areas as approved by the District. However, prior to final acceptance of landscaped areas Erosion Control (Vegetative) shall be replaced with the proper landscape material.

D. Erosion Control (Vegetative) shall be supplemented by straw bales, jute netting, and other similar erosion protection methods until the vegetative growth has been established.

E. An erosion control blanket shall be installed per manufacturer recommendations, in the following areas; non-landscaped areas, areas with slope gradients over 3:1, areas where mechanical compaction is not feasible, and areas parallel or perpendicular to drainage swales.

F. Erosion control measures shall be in accordance with the requirements of Marin County Stormwater Pollution Prevention Program (MCSTOPPP), the San Francisco Bay Region Regional Water Quality Control Board (RWQCB), and the State Water Resources Control Board (SWRCB). The Contractor shall be responsible for compliance with the State of California Construction General Permit Order 2009- 0009-DWQ adopted on September 2, 2009, as well as compliance with the District's Permit Coverage as a Small Municipal Separate Storm Sewer Systems (MS4s) under Phase II NPDES General Permit, and existing District storm water regulations.

G. The Contractor shall conduct inspections of the construction site prior to anticipated storm events and after storm events to assess effectiveness of the SWPPP. A record of the inspections must include the date of the inspection, the individual(s) who performed the inspection and the observations. The inspection reports shall be submitted within twenty-four (24) hours of the event.

H. In preparing and complying with its storm water pollution prevention submittal, Contractor shall consider best management practices ("BMPs") for erosion control, sediment control, run-on and runoff control and make all necessary

provisions for inspection, maintenance and repair of all BMPs employed during the course of construction and until the Project is accepted and the Contractor has fully demobilized from the site. All BMPs must be periodically inspected, maintained, and repaired to ensure that receiving water quality is protected.

I. Contractor shall eliminate sediment discharge into storm drains, the Bay, or any other receiving waters due to rainwater run-off, and shall eliminate all construction debris, soil, or contaminants prior to discharge of storm water.

J. Contractor shall control all non-storm water discharges directly connected to receiving waters or the storm drain system must during construction, including any dewatering activities associated with construction.

K. Erosion control measures shall be included as an element of the Contractor's Storm Water Pollution Prevention Plan (SWPPP).

L. For work performed that is not under direct contract with the District, such as developments or improvements to privately owned facilities, all costs associated with erosion control shall be borne by the Contractor or Permit Applicant.

1.02 RELATED SECTIONS

A. Section 02060, SITE PREPARATION

B. Section 02200, EARTHWORK

C. Section 02900, PROTECTION OF TREES AND RESTORATION OF LANDSCAPING

1.03 NOT USED

1.04 EXPERIENCE REQUIREMENTS

A. Where an SWPPP is required under the Construction General Permit, the Contractor's SWPPP shall be developed by a Qualified SWPPP developer (QSD) and implemented by a Qualified SWPPP Practitioner (QSP).

1.05 SUBMITTALS

A. The Contractor shall prepare a storm water pollution prevention submittal and obtain approval from District prior to the start of any construction activity with the potential for adverse impacts to storm water quality.

B. When a SWPPP is required under the Construction General Permit, the Contractor shall submit its SWPPP to the Storm Water Multiple Application and Report Tracking System (SMARTS) after receiving approval from the District. The Contractor shall coordinate with the District for submission and shall pay all applicable fees.

C. In the event that a SWPPP is not required, Contractor shall remain obligated to acquire District approval of a storm water pollution prevention submittal. In addition, the Contractor shall prepare and submit a Notice of Exemption letter to the District stating the reason(s) that the project is exempt.

1.06 QUALITY ASSURANCE

A. The Contractor's storm water pollution prevention submittal shall be developed by a QSD and implemented by a QSP, unless a SWPPP is not required under the Construction General Permit.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall properly handle, store, and dispose of any potential pollutants, and actively prevent the contamination of waterways or subsoil.

B. Contractor shall ensure that construction materials are properly handled and managed to minimize threats to water quality. These procedures shall include good housekeeping measures for: construction materials, waste management, vehicle storage and maintenance, landscape materials, and other potential pollutant sources.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials used for erosion control measures shall be in accordance with the requirements of Marin County Stormwater Pollution Prevention Program (MCSTOPPP), the San Francisco Bay Region Regional Water Quality Control Board (RWQCB), and the State Water Resources Control Board (SWRCB).

2.02 MATERIALS

A. Fertilizer shall be a commercial, chemical type, uniform in composition, free-flowing, conforming to state and federal laws and suitable for application with equipment designed for that purpose. Fertilizer shall have a guaranteed analysis showing no less than eleven percent (11%) nitrogen, eight percent (8%) available phosphoric acid, and four percent (4%) water-soluble potash.

B. Seed shall be delivered in original unopened packages bearing an analysis of the contents. Seed shall be guaranteed ninety-five percent (95%) pure with a minimum germination rate of eighty percent (80%). Seed mix shall be equal parts by weight of fescue and perennial ryegrass or perennial ryegrass and barley. Other mixes such as those specified by Caltrans or the local agency having jurisdiction may be proposed by the Contractor and used if approved by District.

C. Mulch shall be a fibrous, wood cellulose product produced for this purpose. It shall be dyed green and shall contain no growth or germination inhibiting substances, and shall be manufactured so that when thoroughly mixed with seed, fertilizer, and water, in the proportions specified it will form homogenous slurry which is capable of being sprayed.

PART 3 - EXECUTION

3.01 GENERAL

A. Work shall meet or exceed the requirements of these Specifications unless applicable requirements of an agency having jurisdiction (including the terms and conditions of an encroachment permit issued by a city or county) are greater, in which case the greater requirements shall govern.

B. Fertilizing, seeding, or mulching operations will not be permitted when wind velocities exceed fifteen (15) miles per hour or when the ground is frozen, unduly wet, or otherwise not in tillable conditions.

C. The ground to be seeded shall be reasonably free of large rocks, roots, and other material which will interfere with the work.

D. Fertilizer, seed, and mulch may be applied separately (Dry Method), or they may be mixed together with water and the homogeneous slurry applied by spraying (Hydraulic Method), except that all slopes steeper than three (3) units horizontal to one (1) unit vertical shall be stabilized by the hydraulic method.

3.02 DRY METHOD

A. The fertilizer shall be spread uniformly at the rate of eight hundred (800) pounds per acre (approximately 1 lb per 55 square feet). The fertilizer shall be raked in and thoroughly mixed with the soil to a depth of approximately two (2) inches prior to the application of seed or mulch.

B. The seed shall be broadcast uniformly at the rate of sixty (60) lbs/acre (approximately 1 lb per 730 sq ft). After the seed has been distributed it shall be incorporated into the soil by raking or by other approved methods.

C. Mulch shall be applied at the rate of one thousand five hundred (1,500) pounds (air dried weight) per acre (approximately 1 lb per 30 sq ft).

3.03 HYDRAULIC METHOD

A. The hydraulic method consists of the uniform application by spraying of a homogeneous mixture of water, seed, fertilizer, and mulch. The slurry shall be prepared by mixing the ingredients in the same proportions as specified above. The slurry shall have the proper consistency to adhere to the earth slopes without lumping or running. Mixing time of materials shall not exceed forty five

(45) minutes from the time the seeds come into contact with the water in the mixer to the complete discharge of the slurry onto the slopes; otherwise the batch shall be recharged with seed. The mixture shall be applied using equipment containing a tank, having a built-in continuous agitation and recirculation system, and a discharge system that will allow application of the slurry to the slopes at a continuous and uniform rate. The application rates of the ingredients shall be the same as those specified for the Dry Method. The nozzle shall produce a spray that does not concentrate the slurry nor erode the soil.

3.04 WATERING

A. Upon completion of the erosion control seeding, the entire area shall be soaked to saturation by a fine spray. The new planting shall be kept watered by a sprinkling system on the site during dry weather or whenever necessary for proper establishment of the planting until final project acceptance. At no time shall the planting be allowed to dry out. Care shall be taken to avoid excessive washing or ponding on the surface. Any damage caused by excessive washing or ponding shall be repaired by the Contractor. The Contractor shall provide his own water supply.

3.05 MAINTENANCE PRIOR TO FINAL ACCEPTANCE

A. The Contractor shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include the filling, leveling, and repairing of any washed or eroded areas, as may be necessary and sufficient watering to maintain the plant materials in a healthy condition. The District may require replanting of any areas in which the establishment of the vegetative ground cover does not appear to be developing adequately.

*****END OF SECTION*****

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SECTION 02300

CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS

PART 1 - GENERAL

1.01 SUMMARY

A. This section is intended to provide the Contractor with general guidelines and requirements for cleaning and television inspection of sanitary sewer pipelines, including but not limited cleaning and inspection for rehabilitation and new construction, as well as cleaning and inspection of existing pipelines.

B. The Contractor shall supply all labor, materials, equipment, and apparatus not specifically mentioned herein, but which are incidental and necessary to complete the cleaning and television inspection of sanitary sewer pipelines as required.

C. Prior to each television inspection, the sanitary sewer pipeline shall be thoroughly cleaned as required by these specifications.

D. Prior to Closed Circuit Television (CCTV) inspection for new and/or rehabilitated pipe, flow shall be plugged or bypassed to downstream manholes, and clean water introduced into the pipe. The camera shall have a 1'' gauge attached for pipes up to 10'' in diameter, and a 2'' gauge for pipes larger than 10''

E. Flow level in the sewer pipeline during CCTV inspection shall be no more than approximately one-third (1/3) of the inside diameter of the pipe so that approximately two-thirds (2/3) of the pipe can be inspected. The Contractor shall plug or bypass flow as required to meet this requirement.

F. CCTV inspection of sanitary sewer is required to:

1. Document the existing condition of the host pipe.
2. Verify pipe diameter, length, grade, and bends.
3. Ensure proper and timely lateral reinstatement.
4. Verify size and location of all lateral connections.
5. Verify all live laterals, including but not limited to the means of dye testing, vacuum potholing, etc.
6. For pipes to be rehabilitated by cured-in-place pipe method:
    a. Verify spot repair locations, if any, and determine if additional spot repairs are required.

b. Verify that the pipeline is properly cleaned just after any required spot repairs and immediately prior to installing the cured-in-place pipe liner. Verify proper installation of new pipelines and/or cured-in-place pipe liners.

1.02 RELATED SECTIONS

A. Section 02145, SEWAGE FLOW CONTROL

B. Section 02735, SANITARY SEWER SYSTEM TESTING

1.03 REFERENCE SPECIFICATIONS

A. National Association of Sewer Service Companies (NASSCO), Pipeline Assessment & Certification Program (PACP)

1.04 EXPERIENCE REQUIREMENTS

A. The Contractor shall be thoroughly familiar with all phases of pipeline cleaning and CCTV inspection to minimize risk of a health hazard, spill, or damage to the sewer system or to public and private properties.

B. The Contractor shall provide a PACP certified operator on site at all times during the entire survey. CCTV inspection shall be performed by experienced personnel trained in locating breaks, obstacles, defects, and side sewers by closed circuit television. If video is to be coded separately from the actual recording, both the onsite Operator and the individual performing the PACP coding shall be PACP certified. The Contractor shall provide proof of certification prior to commencement of work, prior to a change in personnel involved in data collection, and as requested by the District.

1.05 SUBMITTALS

A. The Contractor shall submit the following to the District prior to performing any pipeline cleaning operations:

1. Written documentation for arrangements of legal disposal of all liquids and materials removed from pipelines and manholes during cleaning.

2. Submit description of cleaning equipment and methods.

B. The Contractor shall submit the following to the District after performing pipeline cleaning operations, as applicable:

1. Weight tickets for hauling and disposing of hazardous material.

C. The Contractor shall submit the following to the District prior to performing any pipeline CCTV inspection:

1. Submit information pertaining to pipeline cleaning activities as specified above.

2. A written listing and manufacturer's product literature for the equipment proposed to be used for CCTV inspection.

3. Samples of the Contractor's previous work consisting of one (1) example of previous sewer CCTV inspection work. The CTV submittal shall include digital video of previous sewer inspection work complete with audio commentary, still images, and inspection log(s). The submitted examples shall be the work of the field supervisor or foreman to be used. The submitted video shall show operational and structural defects in sewers that are a similar size and the same materials as the sewers to be inspected. The video and inspection logs will be reviewed to determine I the image quality is acceptable and if defects were properly identified and documented. The examples provide shall have been obtained with the same CCTV camera and lighting equipment proposed for the work. Once approved, the report materials shall serve as a standard for remaining work. The Contractor shall be responsible for modifications to its equipment and/or inspection procedures to achieve report materials of acceptable quality.

4. Resumes and project references for the field personnel who will perform CCTV inspection, including NASSCO PACP certificate number for each operator.

5. The Contractor shall provide electronic data using NASSCO PACP coding system on a hard drive, DVDs, or similar storage media. Storage media type shall be at the sole discretion of the District.

6. For each sewer line to be rehabilitated and/or constructed, the Contractor shall provide to the District a video recording and suitable inspection log. Electronic files for the CCTV inspection video recording and a suitable log of the inspection shall be provided to the District at least five working days prior to rehabilitation and within three working days after rehabilitation. If post-rehabilitation inspection recordings are not submitted within three working days of the rehabilitation, the Construction Manager may, at their discretion, suspend any further rehabilitation until the post-rehabilitation recordings are submitted. As a result of this suspension, no additional working days will be added to the Contract, nor will any adjustment be made for increase in cost.

7. Submit CCTV Reports, logs, electronic reports, and worksheets, including the following information and conforming to the applicable guidelines:

    a. CCTV Reports, NASSCO PACP Certified Database, and electronic worksheets must accompany all inspection work.

    b. All District and NASSCO PACP required header information must be fully and accurately entered on all CCTV reports.

8. Electronic files provided for the video inspection shall meet the following requirements:

    a. One file shall be provided for each manhole to manhole pipe segment.

    b. Video files shall be provided in MPEG format with the following naming convention:

    c. VIDEO-UPSM_DSMH_Direction_Street_Date_Time.mpg

    d. Picture files shall be provided in JPEG format with the following naming convention:

    e. JPEG-UPSM_DSMH_Direction_Street_Date_Time_PACP Code.jpg

    f. Inspection log files shall provided in PDF format with the following naming convention:

    g. PDF-UPMH_DSMH_Direction_Street_Date_Time.pdf

9. Pre-rehabilitation or existing pipe inspection logs: Submitted with each video recording. The log shall identify the sewer line by manhole numbers, street location, and plan sheet number. The log shall include:

    a. The cleaning and inspection dates.

    b. Location and alignment length.

    c. Location of all laterals.

    d. Pipeline sags: length and depth

    e. Grade breaks: type and location

    f. Documentation and detailed description of defects and any repairs necessary prior to rehabilitation, including distance from nearest manhole and conformance to cleaning requirements.

10. Post-rehabilitation inspection log: Submitted with each post-rehabilitation video recording. The log shall identify the sewer line by manhole numbers, street location, and plan sheet number. The log shall include:

    a. The inspection dates.

    b. Location and alignment length.

    c. Location and description of all debris in the sewer.

    d. Defects in the new pipe or liner, including, but not limited to, gouges, cracks, bumps, wrinkles, or bulges.

e. Defects in the pipe installed by open-cut method, including, but not limited to sags, offset joints, or cracks.

f. Location and inspection of lateral reinstatements, and connection to manholes.

11. Where gas monitoring is required, submit gas monitoring equipment to be used and calibration records.

1.06 NOT USED

1.07 NOT USED

PART 2 - MATERIALS

2.01 GENERAL

A. The Contractor shall furnish and maintain, in good condition, all cleaning and televising equipment necessary for proper execution of the work. All equipment specification herein shall be manufactured or fabricated to withstand the severity of the work covered under this specification.

2.02 CCTV CAMERA

A. The Contractor shall use a color pan and tilt camera or a side wall scanning (panoramic) camera specifically designed and constructed for sanitary sewer inspection.

B. The Camera shall be a 360 degree radial view, color image camera capable of rotating to look directly up tee and wye connections.

C. The camera height shall be adjustable, as required. The camera height shall be centered within the pipeline(s) to be inspected.

D. The camera shall be intrinsically safe and shall be operative in wet conditions, 100 percent humid conditions, and completely submerged in sanitary sewer.

E. Lighting intensity shall be remotely controlled and shall be adjusted to minimize reflective glare.

F. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the sewer.

2.03 VIDEO TITLING

A. Video equipment shall include genlocking capabilities to the extent that computer generated data, (i.e., footage, date, size, address, and location, etc.) as determined by the District can be overlaid onto video, and both indicated on the television monitor and permanently recorded on the inspection video recording.

The overlay shall be located in the corners of the video, off the screen center. Inspection header information shall also be overlaid on still images, but shall be abbreviated to include at a minimum: upstream and downstream manhole IDs; direction of inspection; distance from deployment manhole; and video counter or video time elapsed.

2.04 RECORDING

A. Video recordings shall be in color and in MPEG 1 or 2 format. The minimum video bit rate shall be 4.0 Mega-bits per second (Mbps) and minimum audio bit rate shall be 128 Kilo-bits per second (Kbps).

B. The camera source image capture shall provide image with a minimum of 640 x 480 pixels capture. The video shall be at least 30 frames per second.

C. Out-of-focus video recording or low quality and blurred pictures due to steam or smudged camera lens, or portions thereof, shall be cause for rejection of the video recording.

D. Recordings shall include, a pause at and zoom in on the lateral connections sufficient for identification of the condition of the connection.

E. Recordings shall include a pause at and zoom-in on the defects sufficient for identification of the type of problem.

F. Audio portions shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of oral report. The Contractor shall give oral commentary on pipeline location, manhole numbers, direction of inspection, and at all structural features including, but not limited to, defects, debris build-up, lateral connections, and all features as directed by the District or its appointed Representative.

2.05 FOOTAGE COUNTER

A. A continuous read-out of the camera distance (in feet) from the starting manhole to the end point at all times. The footage counter shall be accurate to plus or minus two (2) feet of the measured linear footage between manholes along the existing sewer centerline from the start of pipe to end of pipe.

2.06 GAS MONITORING

A. Gas monitors shall be capable of measuring the ambient level of H2S gas to an accuracy of 0.5 parts per million.

PART 3 - EXECUTION

3.01 CLEANING OF SEWERS

A. Prior to conducting closed circuit television inspection it shall be the responsibility of the Contractor to plug and monitor or bypass sewer flows around the work and to thoroughly clean the host pipe. The word ‘clean’ in this specification is defined as the removal of all accumulations including sludge, dirt, sand, rocks, asphalt, concrete, grease, roots, and any other solid or semisolid material in the pipe down to the parent material with 100 percent debris removal.

B. It will be the Contractor’s responsibility to make as many cleaning passes as necessary to meet the above definition of “clean.” Acceptance of the cleaning, as determined by the District or its appointed Representative, shall be based upon the subsequent video inspection of the sewer and the lining manufacturer’s cleaning requirements.

C. Tree and plant roots shall be removed from within the sewers. Special attention should be used during the cleaning operation to assure removal of roots from the joints and laterals. Procedures may include the use of mechanical equipment such as rodding machines, root cutters, porcupines, and high-velocity jet cleaners.

D. Water Usage: The Contractor may use fire hydrants with temporary meters obtained from Marin Municipal Water District (MMWD) to supply water for this cleaning. The Contractor will be required to complete a hydrant meter application and obtain a fire hydrant flow meter and will be responsible for paying all applicable deposits and fees for use of the meter and water. The Contractor shall contact Joseph Eischens at (415) 945-1531, to obtain a fire hydrant flow meter.

E. Cleaning Equipment: Sewer line cleaning shall be performed with high-velocity jet equipment. When using a high-velocity jet machine, it shall not remain stationary while cleaning the sewer line. Selection of equipment shall be based on field condition such as access to manholes, quantity of debris, size of sewer, pipe bursting activities, and pipe lining activities. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. During sewer cleaning operations, precautions shall be taken by the Contractor in the use of cleaning equipment to avoid any damage to the pipe.

F. Removal and Disposal of Material:

1. Sludge, dirt, sand, rocks, grease, and other solids or semi-solid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing materials to downstream sewer reaches is not permitted.

2. Trucks hauling solids or semi-solids from the site shall be watertight so that no leakage or spillage will occur. Under no circumstances shall

sewage or solids be dumped onto the ground surface, streets, in the sewer system, catch basins, or within storm drains.

3. Material removed from the sewers during the cleaning operation shall be deposited in a sealed water-tight container and disposed legally by the Contractor at: Redwood Landfill and Recycling Center, 8950 Redwood Highway, Novato, CA 94948, Tel. (415) 892-2851

4. All debris and containers shall be removed from the right-of-way at the end of each work day. The Contractor shall coordinate with the District prior to each delivery at the landfill. Acceptable material at the landfill includes grit and grease. The District will be responsible for paying all disposal costs of acceptable material. Non-sewer material such as broken pipe, dirt, liner trimmings, etc. will not be accepted by the landfill. Contractor shall make his own arrangements to legally dispose these items at his own expense.

5. It is the Contractor's responsibility to determine the quantity of debris and solids to be removed during cleaning. Video recordings of a previous sewer inspection will be made available for the Contractor to examine. The tapes are for information only and the District does not guarantee the accuracy of the information provided.

3.02 CCTV INSPECTION OF SEWERS

A. Perform television inspection immediately after cleaning of the sewer pipeline (existing, lined, and/or new sewers) to document the pipeline condition, identify active laterals, to provide quality assurance of the pipe or pipe liner installation, and to verify the lines were cleaned.

B. The video recording shall start on the surface of the street and capture any landmarks available such as street signs, house numbers and or recognizable terrains. Continue the recording (un-paused) into the manhole and pipe invert where the PACP coding will begin. The entire inspection should not be paused providing a complete uninterrupted inspection from node to node.

C. The Contractor shall perform all CCTV inspections in accordance with NASSCO's Pipeline Assessment Certification Program (PACP). All District and PACP required header information must be fully and accurately entered on all CCTV reports. Work not following these specifications may be rejected for payment and the Contractor may be required to re-do the work.

D. Manual winches, power winches, TV cables, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. Winches, cables, or other devices shall not damage sewer pipes and appurtenances.

E. Video inspection shall be done on one sewer section at a time. CCTV inspection shall be performed after sewage flow diversion, control pumping is started, and clean water is introduced into the pipe. Sewage flow control shall be conducted from the upstream manhole in accordance with Section 02145, SEWAGE FLOW CONTROL.

F. The Contractor shall be responsible for cleanup, repair and property damage costs and claims should the Contractor's operation cause any backups or overflows. The Contractor shall also reimburse the District the full cost of any and all fines the District is required to pay as a result of a backup or overflow.

G. Should the camera get stuck in the sewer, the Contractor shall be responsible for all costs in extracting it. Costs related to difficulties encountered during internal video inspection are incidental to the contract, and claims will not be considered.

H. Inspection Rate

1. The camera advancement through the pipeline shall be in accordance with PACP requirements. It shall be at a speed that allows a clear picture of the pipeline and allows for thorough investigation of all structural features of the pipeline. The speed shall be adjusted based on direction from the District or its appointed Representative.

2. In no case may the CCTV camera travel at a speed greater than 30 feet per minute (60 feet per minute if optical digital scanning cameras by iBAK Panoramo, EnviroSight, or equal are used).

3. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition.

4. The Contractor shall pause, pan, and visually inspect all service connections, pipe ends, and maintenance or structural defects. If utilizing a camera with side wall scanning capabilities, pausing, and panning of each lateral is not necessary during the inspection if the image clearly depicts the inside of the lateral for post processing.

I. Reverse Setup

1. If, during the inspection operation, the inspection platform will not pass through the entire pipe reach from manhole to manhole, the Contractor shall set up its equipment so that the inspection can be performed from the opposite manhole (reverse setup). This reverse setup should immediately follow the initial direction.

2. During inspection of existing pipelines or pre-construction inspections, if the platform again fails to pass through the entire pipe reach in the reverse setup, the inspection shall be considered complete and noted as "Survey

Abandoned" (MSA). The Contractor shall notify the District immediately upon abandonment of any survey and must immediately report the any obstructions to the District.

J. Image Perspective: The camera image shall be down the center axis of the pipe when the camera is in motion. Points of interest shall be documented on the CCTV video and shall include, but not be limited to, structural defects, encrustations, deposits, debris, sediment, construction features, and service connections.

K. Verbal Commentary: The Contractor shall record on the audio track of the CCTV video inspection; narrative of the location, upstream and downstream control points, date, and time of the inspection.

L. All inspection shall be performed in the presence of the District or its appointed Representative. CCTV inspection shall be performed by experienced personnel trained in locating breaks, obstacles, defects, and side sewers by closed circuit television.

M. All post-construction CCTV (except upper side sewers) shall be performed after backfill and compaction, but prior to paving.

N. The locations of all side sewers and obstructions which may prevent proper installation of a new pipe or pipe liner shall be noted.

O. If the image quality is not adequate for post-inspection coding, the Contractor shall be required to repeat the survey at the Contractor's expense.

3.03 GAS MONITORING

A. Where gas monitoring is required, the Contractor shall measure gas levels in the top foot of the manhole immediately upon lifting the cover from each manhole used to deploy or recover the inspection platform. The H2S concentration, in parts per million, shall be recorded approximately five (5) seconds after inserting the meter probe. The time and depth for the readings shall be consistent throughout the project.

*****END OF SECTION*****

SECTION 02315

CURED-IN-PLACE PIPE (CIPP)

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Rehabilitation of sanitary sewer pipe by the cured-in-place (CIPP) method.

B. System Description: Rehabilitate existing pipes by inserting a resin-impregnated uniform flexible tube through the host pipe, inflating it to the inside diameter of the host pipe using hydrostatic head or compressed air, and curing by heated water or steam.

C. This section provides general guidelines. Nothing contained herein shall relieve the Contractor from completing the CIPP pipe rehabilitation in the most feasible, efficient, highest quality, and safe manner, using required materials to the lines and grades of the sewers to be rehabilitated and to the requirements of this specification.

D. Contractor shall supply all labor, materials, equipment, and apparatus not specifically mentioned herewith or noted on the Plans, but which are incidental and necessary to complete the specified work. All traffic control, bypass pumping, diversion of sewage flows, cleaning, removal of any and all debris, pre- and post-installation closed-circuit television (CCTV) inspection, installation and curing of CIPP, testing, reinstatement of side sewer connections, and site restoration shall be performed by the Contractor.

1.02 RELATED SECTIONS

A. Section 02145, Sewage Flow Control

B. Section 02300, cleaning and television inspection of sanitary sewer mains

Section 02600, SIDE SEWERS

C. Section 02735, Sanitary Sewer System Testing

1.03 REFERENCE SPECIFICATIONS

A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.

ASTM F1216	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
ASTM F1743	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
ASTM D5813	Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems
ASTM D2122	Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM F2561-06	Standard Practice for Rehabilitation of a Sewer Service Lateral and its Connection to the Main Using a One-Piece Main and Lateral Cured-in Place Liner
ASTM F2599-11	Standard Practice for The Sectional Repair of Damaged Pipe By Means of An Inverted Cured-In-Place Liner

1.04 EXPERIENCE REQUIREMENTS

A. The Contractor shall provide evidence of experience qualifications as required below. All projects shall be of similar size and complexity that indicate the Contractor's experience as a qualified Contractor as specified below. The bidder shall provide, as part of the bid, the listing and evidence of experience qualifications of the staff to be used that at minimum meets the specified requirements, and the information to verify the qualifications.

B. Required experience

1. CIPP Manufacturer: Minimum of 100,000 linear feet of CIPP installed in the U.S.

2. Installation Contractor:

   a. Minimum of 10,000 linear feet of CIPP installed in the U.S. Minimum of 2,000 linear feet of CIPP installation with a minimum pipe diameter of 6-inches.

   b. Each of five (5) referenced lining projects shall have been in service in the owner's system for at least one year and free of defects.

   c. Licensed by manufacturer.

   d. Name and qualification information shall be provided for five (5) projects. Each of the five (5) project descriptions shall provide the following information:

      Project Name:
      Owner:
      Construction Cost: $
      Length of Successfully Installed Liner (ft):
      Diameter of Successfully Installed Liner (inches):
      Construction Time: _____ Calendar Days
      Owner's Representative:
      Owner's Telephone No.: ( )
      Date of Substantial Completion:

3. Personnel: Name and qualification information shall be provided showing that the proposed personnel meet the following requirements:

   a. Field Superintendent: Field superintendent named is the superintendent assigned to the project shall be present in the field full time, and shall supervise and be onsite during all CIPP pipe rehabilitation operations. Superintendent shall have cured-in-place pipe supervisory field experience on a minimum of three (3) successfully completed projects. Qualifying experience for the three (3) reference projects submitted shall include:

      i. Length: At least 5,000 linear feet CIPP total length.

      ii. Minimum Pipe Diameter: 6-inches in diameter.

      iii. Sewage Flow Control: At least one year of sewage flow control supervisory field experience.

      iv. Tenure with Installation Contractor: Minimum of one (1) year.

   b. Installation Crew: At least three (3) persons from the CIPP installation crew shall have a minimum of two (2) years of CIPP experience, have at least one (1) year of tenure with bidding Contractor. At least

one (1) experienced person from the installation crew shall be onsite during all CIPP pipe rehabilitation options.

c. Side Sewer (Lateral) Reinstatement Technician: Shall have a minimum of two (2) years of experience operating the remote cutting equipment during the reinstatement of side sewers after CIPP installation.

d. Curing Technician: Shall be certified and approved as an operator by the rehabilitation system manufacturer or an independent testing agency. Provide certification information.

4. The final decision to accept or reject the product, manufacturer, and/or installer lies solely with the District. The named CIPP Manufacturer, Field Superintendent, Installation Crew, Lateral Reinstatement Technician, and Curing Technician shall be used to perform the work under this project, unless changes are specifically authorized by the District in writing.

1.05 SUBMITTALS

A. The Contractor shall prepare and submit the following to the District for review and approval prior to ordering materials:

1. Experience: Submit documentation demonstrating compliance with specified experience requirements as detailed in Section 1.02 herein.

2. List of field measurements verifying length and diameter of each pipe segment (including maximum and minimum dimensions).

3. Unless otherwise noted in this Section, CIPP submittals shall be submitted at least 30 calendar days before any work may be performed.

4. Product Data

a. Specifications and data sheets on CIPP materials, including liner tube material and resins.

b. CIPP materials submittal shall be approved prior to ordering liners.

5. Construction Details

a. CIPP Manufacturer's recommended storage procedures, resin application, curing process details and cure schedules (including heat up, hold and cool down cycles and temperature control for each diameter and CIPP thickness).

b. Methods, materials, equipment, and procedures used to trim and finish manhole walls.

c. Side sewer reinstatement methods.

d. Safety systems associated with the proposed curing equipment and operational safety systems for use with the curing process.

e. Methods, materials, equipment, and procedures employed to seal annular space between the CIPP and the host pipe at manholes.

f. Methods, materials, equipment, and procedures to seal reinstated side sewer connections using robotic equipment (lateral injection packer).

g. Methods, equipment and materials used to cut the liner for side sewer reinstatement, seal the connection between the rehabilitated sewer main and the reinstated service side sewer to prevent sewage from getting between the liner and the host pipe, and seal leaking side sewer connections.

h. Remedial Repair and Replacement Action Plan: Provide plan for repair of defects that may expose the host pipe during removal of the defect. The plans shall include detailed information on removal of defect and proposed methods and materials for defect repair.

i. Styrene Discharge Management Plan: Styrene present in any discharge water from the CIPP process shall be treated to an acceptable level through the use of activated carbon. Treatment and quality of discharge water shall be in compliance with Central Marin Sanitation Agency (CMSA) special discharge permit criteria.

   i. Copy of approved CMSA special discharge permit.

   ii. Plan layout for treatment equipment at project site.

   iii. Treatment system data including volume capacity, styrene removal capacity, material data sheets.

   iv. Analysis results from testing of treated waste flow.

   v. Weekly schedule of lining events.

6. Engineering calculations for design of the liner thickness

   a. Design calculations shall be checked and approved by a Registered Civil Engineer in the State of California. Liner design calculations shall be supported by field analysis, technical assumptions, and to the requirements of these Specifications and ASTM F1216.

   b. Calculations shall be submitted and reviewed prior to ordering liner.

7. During the curing process, keep logs, charts, and/or graphs of the liner temperatures at the specified locations to ensure that proper temperatures and cure times have been achieved.

8. Certifications and Testing

    a. Certification from the CIPP manufacturer that the resin, catalyst and tube material comply with the required application, meet the intended service conditions, and comply with the physical requirements.

    b. Literature and background information on the independent third party testing laboratory proposed for testing the physical properties of the installed CIPP.

    c. Manufacturer's certification that material is manufactured, sampled, tested and inspected in accordance with ASTM F1216 and F1743 as applicable. Include the manufacturing date of the lining materials in the certification.

    d. Verification of product conformance by third party testing for the chemical resistance and physical testing requirements along with a report of test results.

9. For each diameter and thickness to be installed on the project, provide volume of resin required per unit length (gal per foot or liters per meter) to fill the volume of air voids in the tube plus the additional allowance for polymerization shrinkage and to meet the finished CIPP strength requirements.

10. After each impregnation of a tube for an installation, submit a process record that verifies the resin impregnation yield matches the manufacturer's required quantity for the specific diameters and thicknesses within seven (7) calendar days of installation after impregnation of a tube for an installation.

11. Drawings showing field wet-out operations including tent location, equipment for cooling or heating, roller beds, lifting equipment, mixing equipment, quantity control equipment, and other equipment required for proper liner tube impregnation and verification of product.

12. Written notification of any crew changes. Notification shall be a minimum of one (1) week prior to date of actual change.

13. Schedule: The Contractor shall submit to the District, and to CMSA, a weekly schedule of lining dates and times for the following week.

1.06 QUALITY ASSURANCE

A. Contractor shall provide a warranty to be in force and effect for a period of one (1) year from the date of written final acceptance. The warranty shall require the repair or replacement of the liner due to failure resulting from faulty materials or installation as deemed necessary by the District. All required work incidental or required as part of the repair or replacement shall be provided by the Contractor at no additional cost to the District.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Liner tubes shall be properly shipped, stored, and handled to prevent damage in accordance with all manufacturer's and installation equipment recommendations, and as approved by the District.

B. Damage includes, but is not limited to, gouging, abrasion, flattening, cutting, puncturing, or ultraviolet (UV) degradation.

C. All damaged materials and pipe rejected by the District shall be promptly removed from the project site at no additional cost to District and disposed of in accordance with current applicable regulations.

D. In the event that these Specifications are found to be in conflict with the manufacturer's recommendations, the District shall be notified immediately in writing. The Contractor shall not proceed with the work in areas of discrepancy until all conflicts have been resolved.

PART 2 - PRODUCTS

2.01 GENERAL

Materials provided and process variables used in the CIPP installation process are the responsibility of the Contractor.

Materials, installation procedures, and the final product shall equal or exceed the CIPP manufacturer's requirements and requirements of ASTM F1216, Appendix X1, and F1743.

2.02 COMPONENT PROPERTIES

A. Liner Tube

1. One or more layers of flexible needled polyester felt capable of carrying resin, withstanding installation stresses, withstanding installation pressures and curing temperatures, and compatible with the resin and catalyst system used.

    a. The needled interlocked polyester felt shall be free from tears, holes, cuts, foreign materials, and other surface defects.

    b. The polyethylene or polyurethane coating of the felt tube shall be appropriate for the installation method proposed and shall have the required durability to remain integral with the liner for the life of the liner.

    c. The seam tape of the felt tube shall be bonded and welded appropriately for the installation method proposed and shall have the

required durability to remain integral with the liner for the life of the liner.

2. Shall be marked for distance at regular intervals along its entire length, not to exceed five (5) feet. These markings shall be used to measure elongation during insertion.

3. At the time of delivery, shall be homogeneous throughout, uniform in color, free of tears, cracks, holes, cuts, foreign materials, blisters, and other deleterious faults or surface defects.

B. Resin

1. Compatibility with Application: Liquid thermosetting resin that is compatible with the liner tube and CIPP rehabilitation process used, and designed for a municipal wastewater environment. Type: Thermosetting polyester, vinyl ester, or epoxy meeting the service conditions specified for the tube system and the applicable sections of ASTM F1216 and F1743.

2. Enhancers: Use of enhancers will not be allowed.

3. Characteristics: Sufficiently thixotropic to obtain non-draining characteristics when impregnated into the liner tube.

C. Catalyst: Compatible with the resin and other materials to be used in the CIPP rehabilitation process. Select quantity and type of catalyst based on the curing conditions and recommendations of the resin manufacturer.

2.03 FINISHED AND CURED LINER PROPERTIES

A. Design Parameters: The liner material and thickness shall be calculated and designed for use in gravity sanitary sewers and must be in strict conformance with all applicable sections of ASTM F1216, F1216 Appendix X1, F1743 and D5813.

B. The design shall be based on the following pipe conditions, service requirements, and physical conditions:

1. Deterioration design parameter: Fully Deteriorated.

2. Assume groundwater is at ground surface.

3. All pipes subjected to soil load of 130 lb/cu. ft. and H-20 live load.

4. Ovality of host pipe is minimum of 2 percent.

5. Factor of safety (N) is 2.

6. Modulus of passive soil reaction is 500 psi.

7. External Buckling Design - Acceptable third party testing and verification of the design analysis techniques (ASTM F1216, Appendix X1).

8. A minimum service life of 50 years under continuous loading conditions.

C. The liner shall be homogeneous throughout, white, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults. The physical properties of the cured liner shall meet the minimum chemical resistance requirements of ASTM F1216 and F1743 and shall conform to the minimum structural property standards listed in the following table:

Structural Property	ASTM Standard	Minimum Value	
		Polyester Resin	Vinyl ester or Epoxy Resin
Wall Thickness	D2122	As calculated	As calculated
Flexural Strength, psi	D790	4,500	5,000
Flexural Mod. of Elasticity (short-term), psi	D790	250,000	300,000
Flexural Mod. Of Elasticity (long-term), psi	D790	125,000	150,000
Tensile Strength, psi	D638	3,000	4,000

D. Liner Tube Sizing

1. Outside diameter of the liner tube being inserted shall be properly sized so that the CIPP liner will fit tightly to the internal circumference of the host pipe when cured.

2. Liner tube shall be properly sized to the length to be rehabilitated and be able to stretch to fit irregular pipe sections and negotiate bends and curves with the minimum tube length necessary to effectively span the designated run between manholes, unless otherwise specified.

3. Contractor shall verify the lengths of the pipelines to be rehabilitated in the field prior to impregnation of the tube with resin, to ensure that the tube will have sufficient length to extend the entire length of the run when cured.

4. Contractor shall measure the inside diameter of the existing pipelines in the field to verify the liner can be installed in a tight-fitted condition.

2.04 CHEMICAL GROUT

A. Chemical grout for sealing connections into manholes, side sewers, and other voids, shall be per the District's Approved Materials list.

B. Chemical grout shall be an ultra-low viscosity chemically reactive gel that creates a long-lasting water barrier and soil stabilization.

C. The grout shall have a controllable cure time frame.

D. The cured product shall have a conductivity of less than 10-8 m/s.

2.05 CIPP MAIN TO SIDE SEWER CONNECTION LINER

E. Main/Lateral CIPP connection liners shall be per the District's Approved Materials List.

F. Main/lateral CIPP connection liners shall be a one-piece, structural, stand-alone homogenous Main/Lateral CIPP connection liner that extends 3 feet up into the lateral pipe.

G. When cured, the liner shall extend over a three-foot length of the service lateral and a particular section of the main pipe as a continuous, one-piece, tight fitting, corrosion resistant and verifiable non-leaking cured in-place pipe. The Main/Lateral CIPP Lining shall be in accordance with ASTM F2561-06.

H. Main/lateral CIPP connection liners will not be allowed on mains less than 8-inches in diameter, unless specifically called for or Directed by the District or its appointed Representative.

I. Main/lateral CIPP connection liners will not be allowed where the main is not in suitable condition, as Determined by the District or its appointed Representative.

2.06 CIPP MAIN TO SIDE SEWER SEALS

A. CIPP Main/Lateral seals shall be per the District's Approved Materials List.

B. The material shall be an E-Class, corrosion resistant fiberglass mat pre-impregnated with Atlac E-Nova RE 3475 Vinyl Ester light reactive resin. The seal shall be cured in place using ultra violet light. The wall thickness can be determined per ASTM F1216.

C. Main/lateral CIPP connections will not be allowed on mains less than 8-inches in diameter.

D. Main/lateral CIPP connection liners will not be allowed where the main is not in suitable condition, as Determined by the District or its appointed Representative.

2.07 CIPP POINT REPAIRS (LOCALIZED REPAIRS)

A. CIPP point repairs may be used only where approved by the District. CIPP point repair products shall be per the District's Approved Materials.

B. CIPP point repairs shall be fully structural and shall conform to ASTM F2599-11.

C. The CIPP point repair shall provide a smooth tapered transition to the existing host pipe.

2.08 CIPP REHABILITATION OF SIDE SEWERS

A. CIPP rehabilitation of existing side sewers/laterals may be performed only where approved by the District and if a special condition exists. CIPP of side sewers shall be performed in accordance with Section 02600, SIDE SEWERS.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed as specified herein and performed and supervised by personnel with experience meeting or exceeding the experience requirements specified herein.

B. Installation guidelines from the CIPP supplier shall be followed for all installations.

C. Where spot repairs or new wyes for lateral connections are required prior to installation of the liner, it shall be the Contractor's responsibility to verify the alignment of subject pipe and the exact location of the defect requiring a spot repair or new wye fitting installation in the field. Any additional excavation or work caused by the Contractor's inaccuracies or errors in locating the defect(s) requiring repair shall be borne by the Contractor at no additional cost to the District.

D. Prior to wet-out of the liner and based on the pre-CCTV inspection, the Contractor shall determine if spot repairs and/or repairs to protruding laterals not shown in the Contract Documents are required for proper installation of liner as required by lining manufacturer. Written notification shall be provided to the District a minimum of three (3) days prior to all repairs that require excavation, such as collapsed pipe, or specialized equipment to stop heavy infiltration. The District will provide written approval prior to all work that requires excavation or specialty equipment.

E. It shall be the Contractor's responsibility to remove all debris, and control infiltration at no additional cost to the District.

3.02 PREPARATORY WORK

A. The Contractor shall provide temporary sewage flow control in accordance with Section 02145, SEWAGE FLOW CONTROL.

B. The Contractor shall thoroughly clean the host pipe in accordance with Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

C. Prior to conducting closed circuit television inspection it shall be the responsibility of the Contractor to plug and monitor or bypass sewer flows

around the work and to thoroughly clean the host pipe. The word 'clean' in this specification is defined as the removal of all accumulations including roots, sludge, dirt, sand, rocks, asphalt, concrete, grease, and any other solid or semisolid material in the pipe down to the parent material with 100 percent debris removal.

D. Diameter and Length Verification: Verify internal diameter and length of existing sewer pipe prior to sizing and ordering liner.

E. Pre-Installation CCTV Inspection: Perform internal CCTV inspection after cleaning of the sewer lines, spot repairs and lateral wye replacements, to document the condition of the host pipe, identify and locate any live service laterals, and verify the lines were cleaned in accordance with Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS and the lining manufacturer's requirements.

F. Spot Repairs: The Contractor shall perform the required spot repairs and installation of new wyes for lateral connections prior to performing the liner installation.

3.03 WET-OUT PROCEDURE

A. A minimum of ten (10) working days prior to performing wet-out procedures, the Contractor shall notify the District or its appointed Representative concerning of the initial wet-out schedule and the location of the wet-out facility. The District or its appointed Representative may elect to inspect the wet out facility to verify compliance with the Contract Documents. The Contractor shall coordinate with the District or its appointed Representative and facilitate inspection of the wet-out facility at no additional cost to the District.

B. Contractor shall utilize the resin and catalyst in sufficient quantities to ensure complete impregnation of the liner and provide the properties specified in this Specification.

C. The fiber-felt liner tube shall be fully impregnated with resin by vacuum or other means prior to installation. The resin and catalyst systems that are compatible with the requirements of the method shall be used. The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowance for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. Unless otherwise specified to provide for excess resin migration, the gap thickness of wet-out equipment shall be sized to allow an excess of 5 to 10 percent resin to pass during impregnation.

D. If resin impregnation/wet-out is to take place off-site, provide the District with 48 hours' notice for each scheduled wet-out. The District reserves the right to check, verify, or inspect all phases of production and testing of materials, from manufacturing, shipping, wet-out, installation, and cure, to finished product. If the

impregnated liner tube begins to harden prior to installation, that portion of the liner tube will be rejected.

3.04 FINAL CLEANING AND PRE-INSTALLATION INSPECTIONS

The existing host pipe shall be cleaned again after sewage has been bypassed and just prior to insertion of the liner.

A. A maximum of one (1) hour may elapse between this final cleaning pass and the insertion of the liner.

B. After the cleaning is complete, a final camera pass shall be made to verify the cleanliness of the line.

C. Bypass pumping: In accordance with the District's Standard Specifications and Drawings.

D. Pipe invert shall be cleared of any standing water and shall be continuously visible during the inspection.

E. Prior to insertion of the liner, the sewer main must be accepted as 'clean' as defined in Section 02300, CLEANING AND TELEVISION INSPECTION OF
F. SANITARY SEWER MAINS, by the District or its appointed Representative.

G. Post-cleaning final inspection shall be completed with the District or its appointed Representative present in the CCTV truck to verify the cleanliness of the line. At the sole discretion of the District, this inspection shall be required to be videotaped and recorded onto an external USB hard drive, DVDs, or similar storage media.

3.05 LINER INSTALLATION

A. Contractor shall install the liner tube through the existing manholes in accordance with the manufacturer's recommendations and procedures. Contractor shall protect manholes to withstand forces generated by equipment, water, or air pressures used while installing the liner tube.

B. The impregnated liner tube shall be transported to the site and stored in such a manner that it will not be damaged, exposed to heat and/or direct sunlight, or result in any public safety hazard. Materials shall be subject to inspection and review prior to installation. The impregnated liner tube shall be installed prior to exceeding the resin pot life or within two (2) weeks, whichever is less.

C. The installed pipe liner shall be in strict accordance with the liner manufacturer's instructions and recommendations. The liner shall be inserted through an existing manhole or other access approved by the District, by means of the installation process and the application of hydrostatic head or compressed air sufficient to fully expand and extend the liner to the next designated manhole or termination point. Contractor shall ensure that the impregnated liner tube is not

damaged in any way during the installation process. Contractor shall ensure that the liner shall be installed at a rate not to exceed that needed to remove water from the sewer during installation process.

D. Contractor shall abide by all requirements of Marin Municipal Water District (MMWD) for water acquisition.

3.06 CURING

A. The Contractor shall abide by all discharge requirements as required by the District and CMSA, and as required to meet the pollutant limits.

B. Heating Source and Distribution Equipment

1. After liner placement is completed, a suitable heat source and distribution equipment shall be provided to distribute or recirculate steam throughout the pipe.

2. The equipment supplied shall be capable of delivering steam necessary throughout the section to uniformly raise the temperature above the temperature required to uniformly cure the resin in accordance with the manufacturer's recommendations in order to meet the minimum design properties.

3. This temperature shall be as recommended by the manufacturer based upon the resin/catalyst system employed for curing.

4. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of the soil).

5. The heat source piping shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing steam.

6. A temperature gauges shall be placed between the impregnated tube and the host pipe's invert at a minimum of five (5) feet from the terminations of both ends of the pipe to monitor the temperatures during the curing process at both ends.

7. Steam temperature during the cure period shall meet the requirements of the resin manufacturer as measured at the heat source inflow and outflow return lines.

8. Provide standby equipment to maintain supply of the heat source in the event that the primary heat source fails.

9. Pipelines that connect the liner to the heat source shall be leak-free and no cure water is allowed to spill to the ground surface. Contractor shall take full responsibility for all required actions to prevent, contain, and

remediate, and pay all costs including fees and fines for any spilled or leaked cure water at no additional cost to the District.

C. Cure Period

1. Shall be of duration recommended by the resin manufacturer, during which time the recirculation of the steam to maintain the temperature continuously takes place.

2. The initiation temperature for cure shall be as recommended by the resin manufacturer.

3. Temperature monitoring devices shall be installed at all exposed portions of the pipe (beginning and end of run) for each inversion or run of installed liner pipe between the host pipe and the CIPP liner.

4. Abide by all requirements of any discharge permit for discharging any water. The Contractor shall provide filtering of discharge prior to releasing water to sanitary sewer infrastructure. The discharge permit may also require filtering to remove other substances that may affect CMSA's treatment plant operations.

3.07 COOL DOWN

A. After the tube is cured, Contractor shall allow a cool-down period in accordance with the manufacturer's specifications prior to returning normal flow back into the system.

B. The CIPP shall be cooled to a temperature below 90 degrees Fahrenheit, or to a temperature as required by the District, or as specified on the discharge permit, and held for one (1) hour before relieving the head in the inversion pipe.

C. Cool down may be accomplished by the introduction of cool water or air into the CIPP. Care shall be taken in the release of the static head so that a vacuum will not develop that could damage the newly installed liner.

D. Abide by all requirements of any discharge permit for discharging any water from the cool-down process. The Contractor shall provide filtering of cool-down water discharge prior to releasing water to sewer systems. The discharge permit may also require filtering to remove other substances that may affect CMSA's treatment plant operations.

E. Cure and cool down water shall be contained and shall not be allowed to leak on the ground surface or be discharged to the storm drain system.

3.08 SAMPLING AND LABORATORY TESTING

A. The physical properties of the installed CIPP shall be verified through field sampling and laboratory testing:

   1. Materials testing shall be performed at the Contractor's expense and by an independent third-party laboratory recommended by the manufacturer and pre-approved by the District.

   2. Testing shall be in accordance with applicable ASTM test methods to confirm compliance with the requirements for minimum wall thickness, flexural strength, and short-term flexural modulus of elasticity.

   3. Physical properties shall meet those specified in Section 2.03 herein, or those used in design, whichever is more stringent.

B. Testing short-term properties of the CIPP liner material from the actual installed liner:

   1. Certified results

   2. For each individual section (structure to structure), tests shall be conducted at a minimum of one (1) location per pipe size for each alignment, or

   3. For continuous run through multiple structures, tests shall be conducted per each 1,000 linear feet of installed liner per each alignment (there is only one diameter in each alignment)

   4. At the termination manhole.

   5. Sample: Taken from the tube and the resin system used and cured in a clamped mold placed in the downtube.

C. If required by the District, remove a sample from each pipe to be used to check the liner thickness, by core drilling 2-inch diameter test plugs at locations specified by the District.

D. The laboratory results shall identify the test sample location as referenced to the nearest manhole and station. Payment for the CIPP will not be made until installed liner samples meet the required physical properties, pending receipt and approval of the written report of the test results. If properties tested do not meet minimum requirements, the CIPP shall be removed, replaced, and re-tested at no additional cost to the District.

3.09 FINISHED PIPE LINER

A. Finished Liner:

   1. Shall be inner polyethylene *or polyurethane* layer and an outer polyester felt layer impregnated with a thermosetting resin to fit tightly against the existing inside pipe wall.

2. Shall be fabricated from materials that, when cured, shall be chemically resistant to withstand internal exposure to sewage gases containing quantities of hydrogen sulfide, carbon monoxide, methane, petroleum hydrocarbons, moisture saturation, and dilute sulfuric acid.

3. Shall be continuous over the length of pipe rehabilitated.

4. Shall be free from dry spots, delamination, lifts, fins, and the like as identified by the District. Contractor shall remove and replace the CIPP full circumference, from manhole to manhole or as directed by the District if these conditions are present.

5. If the liner fails to re-form or cure, the Contractor shall be required to remove the failed liner at no additional cost to the District.

B. Interior Surface

1. No wrinkles exceeding the tolerances found in Table 1-Liner Repair Guidelines.

2. Interior surface liner within ten (10) feet of manholes shall be wrinkle free. All wrinkles within this limit shall be properly removed to allow proper installation of flow restricting plugs.

3. Wrinkles in the finished lined pipe which:

a. Cause a backwater greater than three-eighths (3/8) inch in depth.

b. Reduce the hydraulic capacity of the pipeline as determined by the District.

c. Cause a maintenance problem or inconvenience as determined by the District.

d. Cause debris and solids to hang-up and accumulate.

e. Reduce the structural stability of the pipe.

f. Are unacceptable and shall be removed or repaired by the Contractor in a method that is approved by the District at no additional cost to the District.

4. If wrinkles are detected in the installed liner, the Contractor shall provide photographs and dimensions of the wrinkle including height and direction.

C. Liner terminations at manhole or rodhole:

1. The beginning and end of the CIPP shall be cut flush at the inlet and outlet points in the manhole.

2. The ends shall be permanently sealed to the rehabilitated pipeline to prevent any infiltration between the CIPP and the host pipe.

3. Ends shall be sealed with a sealing material that is recommended by the liner manufacturer.

4. Sealing:

   a. Shall be compatible with the liner/resin system, provide a watertight seal, and is approved by the District prior to start of construction.

   b. Hydraulic cements and quick-set cement products are not acceptable.

   c. Acceptable materials shall be an approved epoxy type product that will bond, not crack, dry up, slough off, or shrink in time, and provide a good transition in the manholes.

   d. Sealing terminations shall be performed at no additional cost to the District.

D. Defective Liner Assessment and Repair Guidelines:

1. All liners that do not meet the quality specified above shall be assessed by the District or its appointed Representative based on the guidelines shown in Table 1; District's assessment and remedy shall be final. All repairs shall be performed by the Contractor at no additional cost.

2. All repairs shall meet the original specifications for finished liner. The Remedial Repair and Replacement Action Plan shall be submitted by the Contractor, reviewed, and approved by the District prior to any corrective action for any and all defects.

3. All repairs shall be performed within ten working days after notification to the Contractor of the defect.

Table 1. Liner Repair Guidelines

Defect	Tolerance	Remedy
Wrinkles, Fins, or Folds along top of pipe (from 9 to 3 clock position)	Repair if exceeding 5% of nominal diameter of host pipe	Trim flush with liner wall and patch with epoxy
Wrinkles, Fins, or Folds along bottom of pipe (from 3 to 9 clock position)	Repair if exceeding 3% of nominal diameter of host pipe	Trim flush with liner wall and patch with epoxy
Bubbles, Blisters, Dimples, Lumps, Lifts, or Foreign Inclusions.	Repair if exceeding 5% of nominal diameter of host pipe	Remove and patch with epoxy
Cracked, Delaminated, Dry Spots, Burst, Collapsed, or Unraveled	Repair all	Remove and patch with epoxy

(1) It is the intent for the liner installation and all repairs to provide a circular liner that adheres firmly to the host pipe.

(2) All other quality requirements specified elsewhere still apply.

3.10 REINSTATEMENT OF SERVICE LATERALS

A. Contractor shall fully reinstate all live laterals that are connected directly to the rehabilitated sewer main, after the rehabilitation of each sewer is completed, using robotic cutting equipment.

B. Reinstatement using open-cut excavation shall not be allowed.

C. Reinstatement of laterals shall be as recommended by the liner manufacturer.

D. The opening in the liner for the lateral connection shall be one hundred percent (100%) and of the same configuration as the existing opening.

E. All cut edges at the reinstated laterals shall be smooth and free of jagged edges that can hang up solids and shall not be cut to expose host pipe.

F. Any over-cut lateral openings that expose the host pipe shall be sealed, as recommended by the liner manufacturer and approved by the District, as deemed necessary by the District.

G. The connection between the lateral and the rehabilitated sewer main shall not restrict flow from the lateral into the rehabilitated sewer main.

H. Any lateral reinstatement that has jagged edges or impedes the flow from the lateral shall be considered defective and shall be re-cut until the District approves.

I. Reinstatement of the laterals shall be performed in the presence of the District and/or its appointed Representative.

J. Seal the connection between the lateral and the sewer main where shown in Contract Documents to prevent groundwater infiltration into the sewer and to provide a smooth transition between the lateral and the sewer main. The seal shall be watertight and shall not cause flow restrictions in the lateral or in the sewer main. The robotic equipment (a lateral injection packer) shall use air bladders and a chemical grout injection system to seal each lateral connection. The sealing process shall be observed by CCTV inspection and shall be performed in the presence of the District.

K. The Contractor shall reinstate all active laterals immediately (within 4 hours) after District approval of a CIPP main installation.

3.11 QUALITY CONTROL

A. The Contractor shall clean and perform a CCTV inspection, with the District or its appointed Representative present in the CCTV truck, after installation of the CIPP liner and prior to reinstatement of laterals, to identify required repairs, if any. At the sole discretion of the District, this inspection shall be required to be

videotaped and recorded onto an external USB hard drive, DVDs, or similar storage media. All required equipment, material and labor required to repair the liner to meet specifications shall be provided at no additional cost to the District. The Contractor may conduct an exfiltration test using the cure water prior to performing CCTV inspection.

B. Prior to reinstatement of all live service laterals, the Contractor shall perform leakage testing on the liner in accordance with ASTM F1216 and Section 02735, SANITARY SEWER SYSTEM TESTING. If liner requires repair, testing shall be performed after repair is complete.

C. The Contractor shall clean and perform a post-installation CCTV inspection, with the District or its appointed Representative present in the CCTV truck, in accordance with Section 02300, CLEANING AND TELEVISION INSPECTION OF

D. SANITARY SEWER MAINS, after installation of the CIPP liner, completion of required repairs and reinstatement of laterals, and passing leakage test.

3.12 REBUILD MANHOLE SECTIONS REMOVED FOR LINER INSTALLATION

A. Locations of possible refurbishment of manholes due to removal of manhole frame and cover, manhole steps, and/or cone section during liner installation will be determined by the Contractor and approved by the District in writing. Rebuild manhole per District Standard Drawings.

3.13 STYRENE DISCHARGE MANAGEMENT

A. General: As part of the requirements for discharging to CMSA, the Contractor shall remove styrene from any waste flow resulting from rehabilitation work prior to discharging to sanitary sewer infrastructure.

B. CMSA Special Discharge Permit: The Contractor shall obtain and comply with all requirements of the approved special discharge permit.

C. Treatment and Discharge: The Contractor shall size the treatment facility to eliminate styrene from any waste flow to meet the requirements of the CMSA special discharge permit. No styrene breakthrough above the permit requirement shall be allowed. The completely installed treatment facility shall be inspected by the District or its appointed Representative prior to each use. The Contractor shall perform system testing as required by the discharge permit. A minimum of one treated sample shall be required for each lining. The Contractor is responsible for all testing as required by the special discharge permit at no additional cost to the District. The Contractor shall provide testing from an independent testing laboratory. Results of the testing shall be submitted to the District.

3.14 ODOR AND EMISSIONS (AIR QUALITY) MONITORING.

A. General: The Contractor Shall be responsible for the air monitoring of the work site during the installation of the CIPP.

B. The Contractor shall have a minimum of two correctly calibrated Photoionization Detectors (PID) with Volatile Organic Compounds (VOC) monitoring capabilities on-site at all times. Approved device is “miniRAE 3000” or equal.

C. The Contractor shall designate one employee per shift, who shall monitor and document VOC levels during the CIPP installation. Prior to commencing a CIPP installation a baseline VOC reading should be established and documented in tabular format. Should any VOC readings exceed the National Institute for Occupational Safety and Health (NIOSH) allowable limits as specified, the Construction Manager and the Engineer shall be notified immediately.

D. For each CIPP installation, VOC readings shall be taken at the CIPP upstream manhole, intermediate manholes and the CIPP downstream manhole. Readings shall be taken at each manhole location, edge of the right of way, and one other location at the direction of the Construction Manager. VOC readings shall also be taken at the steam line and at the edge of right of way adjacent to the steam line. Readings shall be taken every hour at each location and documented in tabular format. The completed VOC monitoring table shall be submitted to the Construction Manager and the District after each CIPP installation.

E. For installations adjacent to educational, medical, or assisted living facilities, and places of worship, readings shall be taken at the property line adjacent to the work areas at a known and documented location to demonstrate exposure or air quality impacts of installation and curing.

*****END OF SECTION*****

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SECTION 02330

HORIZONTAL DIRECTIONAL DRILLING (HDD)

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish and install sewer pipe, complete and in place, by the horizontal directional drilling (HDD) method. All work shall be performed as indicated in the Contract Documents and as required in these Specifications and shall be supervised by personnel experienced in HDD pipe installation. Note that HDD installation of sewers will only be allowed where the design slope is at least three percent (3 percent; $S \geq 0.0300$).

B. The HDD rig and tooling shall be of sufficient capacity to complete the pilot bore, reaming and pull-back of pipe.

C. The drilling fluid mixing and delivery system shall be of sufficient capacity to successfully complete the HDD work.

D. The Contractor shall provide all materials, labor, equipment, and services necessary for bypass pumping and/or diversion of sewage flow (if required), installation of sewer pipe and testing of the completed pipe system.

1.02 RELATED SECTIONS

A. Section 02145, SEWAGE FLOW CONTROL & BYPASSING

B. Section 02160, SHORING

C. Section 02200, EARTHWORK

D. Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS

E. Section 02735SANITARY SEWER SYSTEM TESTING

F. Section 15050, PIPING, GENERAL

G. Section 15061, DUCTILE IRON PIPE (DIP)

H. Section 15066, HIGH DENSITY POLYEHYLENE (HDPE) PIPE

1.03 NOT USED

1.04 EXPERIENCE REQUIREMENTS

A. Contractor shall have a minimum of three (3) HDD projects of similar diameter, length, soil type, and installation conditions successfully completed within the last 3 years.

B. See Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE for additional experience requirements.

1.05 SUBMITTALS

A. The Contractor shall submit the following to the District for review and approval prior to ordering materials:

1. Cut Sheets for field staking at twenty (20) foot intervals along the proposed centerline of the pipe alignment. No HDD work shall be started prior to the District's field check of the stakes.

2. Site maps to scale indicating the locations proposed for pipe assembly work (e.g., butt-fusion welding), laydown areas, pipe and material storage areas, insertion and receiving pits, Pipe location monitoring grid, tanks, pumps, HDD rig, and trailers.

3. Technical data for pipe and fittings, and pipe joining, drilling, reaming, pulling, and locating equipment.

4. A proposed construction sequencing plan.

5. Procedure for handling and disposal of drilling fluids and cuttings including the locations of disposal sites.

6. Calculations of anticipated HDD installation loads demonstrating that the pipe and pipe fittings system is capable of withstanding the anticipated installation and operating loads with an appropriate factor of safety.

7. Calculations of minimum penetration rates for all reaming passes.

8. Contingency Plan for dealing with the potential for drilling fluids to surface (e.g., through hydrofractures).

9. Material Safety Data Sheets (MSDS) for all drilling fluids, lubricants, and other products used for the HDD drilling and pipe installation work.

10. A statement of the qualifications of the foreman, local operator and crew who will be responsible for HDD work. No Substitution of these personnel shall be made without the written acceptance of the District.

B. The Contractor shall submit the following installation information daily:

1. Raw pilot hole data including all magnetic steering and surface monitoring readings.

2. The pitch and three (3) dimensional (x, y, z) coordinates of the probe for every drill rod length or thirty (30) feet, whichever is shorter length. Coordinates shall be referenced to the drilling entry pit coordinate taken as the origin (0, 0, 0).

3. A log of the maximum thrust, maximum torque, and maximum slurry flow during pull back at every drill rod length or thirty (30) feet whichever is shorter length.

4. Records of any hydrofracture encountered or other problems and correction measures taken.

5. The Contractor shall submit detail drawings and a written description of the construction procedure, sequence to bypass sewage flow, install pipe, and reconnect lateral sewers.

6. The Contractor shall submit Pre- and Post-CCTV Inspection videos of all sanitary sewer mains within the scope of work. See Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

7. The Contractor shall submit a copy of the technician's certification(s) for the operation of the fusion equipment for HDPE pipe.

8. Submit debeading process and equipment for use in removing the internal bead for the newly joined HDPE pipe sections.

1.06 QUALITY ASSURANCE

A. The Contractor shall test and inspect the installed pipeline and shall conduct post- job television inspection in accordance with the requirements of Section 02300,CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

B. All HDD work shall be done by a qualified Contractor with at least five (5) years' experience with HDD and a minimum of three (3) projects of similar diameter, depth, and length.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall exercise special care during the unloading, handling, and storage of all polyethylene pipe to ensure that the pipe is not cut, gouged, scored, or otherwise damaged. Any pipe segment which has cuts in the pipe wall exceeding 10 percent of the wall thickness shall be cut out and removed

from the site at the Contractor's cost. The pipe shall be stored so that it is not deformed axially or circumferentially.

B. All pipe without an ultraviolet inhibitor shall not be stored uncovered outside.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Contractor shall provide HDPE pipe with butt fusion welded joints, as specified in Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE.

1. For installations with shallow cover, restrained-joint ductile iron pipe as specified in Section 15061, DUCTILE IRON PIPE (DIP) may be used if approved by the District.

2.02 HDD EQUIPMENT AND MATERIALS

B. The drill unit shall be a remote-steerable tunneling system that is designed and is capable of accurately drilling (true to line and grade as specified on the drawings) through the ground conditions identified in the geotechnical report and in bedrock and in mixed bedrock and soil face conditions. The drilling system shall utilize a high-pressure, low-volume, slurry-assisted, mechanical excavation technology capable of installing pipelines of the diameter required.

C. The drilling slurry compound shall be totally inert.

D. The Contractor shall provide and use an electronic detection system that is capable of continuously locating the position of the drilling head to an accuracy of one percent (1%) of the depth in both the horizontal and vertical planes (e.g., within 0.1 feet when the drilling head is ten (10) feet deep), if the design slope of the sewer being installed by HDD is less that ten percent (10%; S = < 0.010 feet per foot). Where the design slope for the sewer being installed by HDD is equal to or greater than ten percent (10%), the electronic detection system shall be capable of continuously locating the drilling head to an accuracy of five percent (5%) of the depth in both the horizontal and vertical planes (e.g., within 0.5 feet when the drilling head is ten (10) feet deep).

E. All drilling equipment shall have a permanent, inherent alarm system capable of detecting an electrical current. The equipment shall be grounded and shall be equipped with an audible alarm to warn the operator when the drill head nears electrified cable.

F. All crews shall be provided with grounded safety mats, heavy gauge ground cables with connectors, hot boots, and gloves.

2.03 TRACER WIRE

A. Tracer wire shall be provided for all public mains. Tracer wire shall be attached to top of and along the entire length of all pipelines and shall extend to the surface at every 400 feet max and at all bends 45 degrees or greater. Provide within manholes, valve boxes, electrical boxes, or concrete traffic boxes at these locations for locator equipment to be attached. Wires shall extend a minimum of three (3) feet with 2 to 3-inch pigtails exposed. Wires shall be placed inside box as shown on Standard Drawings. All wire connections shall be made with copper crimps wrapped with electrical tape.

B. Tracer wire shall be secured to top of pipe at intervals no greater than 10 feet.

C. Tracer wire product shall be per Approved Material List or approved equal by the District.

PART 3 - EXECUTION

3.01 GENERAL

A. Work shall meet or exceed the requirements of these Standard Specifications.

B. The Contractor shall protect all surface and subsurface site improvements, facilities, and utility pipelines, ducts, and conduits from being damaged by the directional drilling operation.

3.02 PREPARATION

A. Cut Stakes shall be provided at twenty (20) foot intervals along centerline to provide for monitoring of the drilling head.

B. Easements shall be staked at fifty (50) foot intervals.

C. Potholing shall be required for marked utilities within ten (10) feet of centerline.

D. The Contractor shall walk the alignment to check for potential sources of interference that could affect the accuracy of the drilling head locating system. The Contractor shall properly calibrate the locating system prior to beginning and regularly during the HDD operation as required to achieve the accuracy specified herein.

3.03 BYPASS PUMPING

A. The Contractor shall provide bypass pumping and/or diversion in accordance with the requirements of Section 02145, **SEWAGE FLOW CONTROL AND BYPASSING** when required for acceptable completion of the pipe installation.

3.04 PIPE INSTALLATION

A. The Contractor shall locate, design, construct, properly brace or shore, dewater, maintain, and restore insertion and receiving pits. Insertion and receiving pits shall be a minimum of four (4”) feet by six (6”) feet in horizontal cross section and shall be shored in accordance with Section 02160, **SHORING**. Bracing shall be adequate to resist drilling and pull-back loads.

B. The Contractor shall employ a slurry-assisted, mechanical excavation process for the HDD operation. The drilling slurry compound shall maintain boring stability and provide lubrication to reduce frictional drag while the pipe is being installed.

C. The Contractor shall employ a mobile vacuum spoils recovery vehicle or drilling fluid recycling system to remove drilling spoils from the access pits. The Contractor shall collect, transport, and properly dispose of drilling spoils away from the jobsite. Disposal of drilling spoils to sanitary, storm or other public or private drainage systems or waterways is strictly prohibited. The Contractor shall immediately clean up any leakage or spillage of drilling fluids.

D. Mechanical, pneumatic, or water-jetting methods are unacceptable due to the possibility of surface subsidence.

E. After a pilot bore has been completed, a reamer shall be installed at the termination pit and the bore shall be reamed, as many times as necessary, for proper insertion of the pipe, before the pipe is pulled back to the starting pit. The reamer shall be capable of discharging drilling slurry compound to facilitate the installation of the pipe into a stabilized and lubricated tunnel.

F. Prior to insertion of thermo-fusion welded PVC or HDPE pipe larger than six (6) inches in diameter, the Contractor shall properly remove all internal weld beads from the interior surface of the pipe.

G. During insertion, the pipe shall be supported on roller supports to isolate the pipe from the ground or pavement and avoid damage to the pipe.

H. During pull back operations, the maximum safe pulling load for the pipe shall not be exceeded.

I. Prior to making connection at each end of an installed reach of PVC or HDPE pipe, the Contractor shall allow a minimum of six (6) hours to elapse to allow pipe to relax from the tension resulting from pulling the pipe into and for the pipe to equalize with ambient ground temperature.

J. Upon completion of boring and pipe installation, the Contractor shall remove all spoils, debris, and unsuitable material from the starting and termination pits. All pits shall be backfilled in accordance with the requirements of Section 02200, EARTHWORK.

K. The installed pipeline shall be within six (6) inches horizontal and one (1) inch vertical of the alignment indicated in the Project Contract Documents at all locations. In addition, for gravity sewers the pipeline shall be free-draining throughout.

L. The Contractor shall repair, replace, or compensate the respective Owners for any damage to property including, but not limited to, utilities, pavements, landscaping, and other improvements.

3.05 PIPE TESTING

A. All tests shall be completed and approved prior to placing of permanent resurfacing.

B. Testing of pipe shall be in conformance with the Section 02735, SANITARY SEWER SYSTEM TESTING.

C. After completion of construction of the pipeline and prior to final pavement restoration, the Contractor shall inspect all new pipelines for obstructions and shall clean all new lines. The Contractor shall inspect the new lines by television camera in accordance with Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS and submit logs and videos to the District. Television inspection shall be witnessed by the District or its appointed delegate.

1. Any lines showing unacceptable pipe construction such as offset joints >1/2" or deformed pipe shape (ovality >7% of pipe diameter) will be rejected and contractor will be required to repair those deficiencies at their own cost.

2. If the post-CCTV inspection indicates that sag(s) may be present which pond water greater than 1 inch in depth for pipes less than ten (10) inches in diameter, or sags greater than two (2) inches for larger piping, then the Contractor shall notify the District or its appointed Representative immediately.

3. If it is determined by the District or its appointed Representative that there is a sag or hump in the installed piping after completion of pipe bursting and repair is required, then the Contractor shall repair the sag for the length directed by the District. The sag repair shall be performed in accordance with the Standard Drawings.

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SECTION 02345

PIPE BURSTING

PART 1 - GENERAL

1.01 SUMMARY

A. This specification covers the work necessary to furnish and install, complete and in place, high density polyethylene pipe (HDPE) pipe by the pipe bursting method of all diameters necessary, as shown on the drawings and specified herein.

B. The Contractor shall provide all materials, labor, equipment, and services necessary for bypass pumping and/or diversion of sewage flows, installation of the pipe, reconnection of lateral sewers, and CCTV inspection and testing of the completed pipe system.

1.02 RELATED SECTIONS

A. Section 02145, SEWAGE FLOW CONTROL

B. Section 02200, EARTHWORK

C. Section 02300, PIPELINE CLEANING AND CCTV INSPECTION

D. Section 02600, SHORING

E. Section 02735, SANITARY SEWER SYSTEM TESTING

F. Section 15050, GENERAL PIPING

G. Section 15066, HIGH DENSITY POLYTHYLENE (HDPE) PIPE

1.03 NOT USED

1.04 EXPERIENCE REQUIREMENTS

A. Contractor shall have a minimum of three (3) pipe bursting projects of similar diameter, length, soil type, and installation conditions successfully completed within the last 3 years.

B. See Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE for additional experience requirements.

1.05 SUBMITTALS

A. The Contractor shall submit catalog cuts, specifications, dimensioned drawings, the proposed diameters of bursting head and expander to be used for each pipe

size manufacturer's recommendation for installation, installation details and sketches, and other pertinent information for the HDPE pipe installation work. All materials provided shall be fully in accordance with the requirements of the reference specifications specified herein.

B. The Contractor shall submit detail drawings and a written description of the construction procedure, sequence to bypass sewage flow, install pipe, and reconnect lateral sewers.

C. The Contractor shall submit Pre- and Post-CCTV Inspection videos of all sanitary sewer mains within the scope of work. See Section 02300, **CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS**.

D. The Contractor shall submit a copy of the technician's certification(s) for the operation of the fusion equipment.

E. Submit debeading process and equipment for use in removing the internal bead for the newly joined HDPE pipe sections.

1.06 QUALITY ASSURANCE

A. Quality assurance procedures shall be performed by the pipe manufacturer fully in accordance with the requirements of this specification. The certification shall include certified laboratory data confirming that said tests have been performed on a sample of the pipe to be provided under this contract, or pipe from that production run, and that satisfactory results were obtained.

B. Fusion joining and other procedures necessary for correct assembly of the pipe shall be done only by personnel trained in those skills and have three years of experience in fusion joining, to the satisfaction of the District or its appointed Representative and the pipe manufacturer/supplier.

C. Only those tools designed for the aforementioned procedures, and approved by the pipe manufacturer or supplier and the District or its appointed Representative, shall be used for assembly of pipe fittings to ensure proper installation. The heater plate shall be equipped with suitable means to measure the temperature of plate surfaces and to assure uniform heating such as thermometers or pyrometers.

D. Pipe insertion equipment shall be operated only by technicians who have a minimum of three years of experience in the installation of the pipe as specified herein. The technician's experience shall be documented in the bid submittal.

E. The Contractor shall videotape the installed pipe after existing services have been reconnected and manhole work has been completed. The original television inspection videotape shall be provided to the District or its appointed Representative for approval.

F. The Contractor and/or Subcontractor performing the pipe bursting work, if applicable, shall provide to the District a warranty to be in force and effect for a period of one (1) year from the date of final project acceptance by the District. The warranty shall require the Contractor and/or Subcontractor to repair or replace the pipe should leakage, separation, collapse or other failure result from faulty materials or installation as determined by the District or its appointed Representative.

G. The Contractor shall furnish a manufacturer's certificate affidavit of compliance for all HDPE pipe and fittings furnished confirming that the materials supplied fully conform to the requirements specified herein.

H. The Contractor shall perform trial fusion welds and submit samples to the District or its appointed Representative for review prior to installation of the pipe. Full penetration welds shall provide a homogeneous material across the cross section of the weld. The fusion machine employed for the trial welds shall be the same machine to be utilized for the installation work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall exercise special care during the unloading, handling, and storage of all polyethylene pipe to ensure that the pipe is not cut, gouged, scored, or otherwise damaged. Any pipe segment which has cuts in the pipe wall exceeding 10 percent of the wall thickness shall be cut out and removed from the site at the Contractor's cost. The pipe shall be stored so that it is not deformed axially or circumferentially.

B. All pipe without an ultraviolet inhibitor shall not be stored uncovered outside.

PART 2 - PRODUCTS

2.01 GENERAL

A. Piping used for pipe bursting shall be High Density Polyethylene (HDPE) pipe as specified in Section 15066, HIGH DENSITY POLYETHYLENE (HDPE).

B. Joints: pipe shall be joined by butt fusion welding, as specified Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE.

2.02 LATERAL RECONNECTIONS

A. All active sewer laterals shall be reconnected to the main line by use of electrofusion saddles per the District's Approved Materials List and as Specified in Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE.

2.03 TRACER WIRE

A. Tracer wire shall be provided for all public mains. Tracer wire shall be attached to top of and along the entire length of all pipelines and shall extend to the surface at every 400 feet max and at all bends 45 degrees or greater. Provide within manholes, valve boxes, electrical boxes, or concrete traffic boxes at these locations for locator equipment to be attached. Wires shall extend a minimum of three (3) feet with 2 to 3- inch pigtails exposed. Wires shall be placed inside box as shown on Standard Drawings. All wire connections shall be made with copper crimps wrapped with electrical tape.

B. Tracer wire shall be secured to top of pipe at intervals no greater than 10 feet.

C. Tracer wire product shall be per Approved Material List or approved equal by the District.

PART 3 - EXECUTION

3.01 GENERAL

A. All work shall be performed and supervised by personnel experienced in the installation of the pipe by pipe bursting method as specified herein.

B. Installation guidelines from the pipe supplier shall be followed for all installations.

C. The Contractor shall protect facilities from damage by forces generated by the pipe bursting equipment. Adjacent utilities shall be identified by means of USA verification and/or potholing prior to work.

3.02 HIGH DENSITY POLYETHYLENE PIPE JOINING

A. Sections of polyethylene pipe shall be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations and per Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE.

B. The inside weld bead shall be removed by cutting the bead away without scoring the inside wall of the pipe.

3.03 PIPE INSTALLATION

A. Insertion/Receiving Pits: Insertion/receiving pits shall be prepared and backfilled in accordance with Section 02200, EARTHWORK, and the Standard Trench Section Detail. All pits shall be adequately shored and braced, to insure safe work areas in accordance with Section 02160, SHORING.

B. When not indicated in the Contract Documents, the locations for the insertion/receiving pits are to be determined by the Contractor and approved by the

District. In considering locations for insertion/receiving pits, the Contractor shall consider the size of the existing sewer and new pipe, locations of obstructions and services, locations of manholes, pulling distances, traffic conditions, and locations of utilities. Insertion pits shall have a maximum slope of 2.5:1 entry slope and shall be shaped to permit as long a radius in the new pipe as feasible. This radius shall not be less than 35 times the outside diameter at pipe. If existing manholes are destroyed or damaged while constructing the insertion/receiving pits, they shall be reconstructed and/or repaired at no cost to the District.

C. The Contractor shall backfill all points where the new pipe has been exposed, such as insertion pits, outside of manholes, lateral connections, critical utility crossings, etc. The backfill material shall be compacted according to the surface restoration required as outlined in these Standard Specifications.

D. The Contract shall excavate to provide air gaps at utility crossings for existing utilities with less than 2'-0" clearance to the outside diameter of the new sewer pipe. All loose soil shall be removed from the excavation prior to backfilling.

E. The Contractor shall physically disconnect all laterals from the existing main prior to pipe bursting, as shown in the Standard Drawings.

F. The pipe will be installed in a manner so the pipe curve radius is never less than the pipe manufacturer's recommended minimum bending radius.

G. The Contractor shall install the pipe by utilizing static bursting or cone cracking methods. The use of hydraulic or pneumatic bursting devices must be approved by the District. The void created by the bursting device shall be sufficient in size to accommodate the pipe which shall be installed immediately after the void has been formed.

H. Where pipe is installed by pulling in tension, the recommended Safe Pulling Force, according to the pipe supplier, shall not be exceeded.

I. . Pipe bursting through a manhole shall not be allowed unless approved by the District or its appointed Representative. Manhole inverts and bottoms shall be removed to permit access for installation equipment and the larger proposed pipe. Manholes must be inspected prior to performing any surface repairs. Structural damage to manholes during pulling operations shall be repaired by the Contractor at no extra cost.

J. The Contractor shall anchor the pipe to concrete structures or manholes after the pipe has been installed along the length of sewer replaced. The Contractor shall use a water stop or flange adapter, as supplied by the pipe manufacturer that is firmly seated perpendicular to the pipe axis, around the pipe exterior and cast into the structure base or near the structure wall center. The structure or manhole connection shall be made after adequate time has been allowed for the pipe to relax from the applied tension forces, as specified herein.

K. Lateral Reconnection: The Contractor shall be responsible for disconnecting and reconnecting all live laterals to the main pipe. Capped/abandoned laterals shall not be reconnected to the new main.

3.04 STRESS AND STRAIN RELIEF OF HDPE PIPE AFTER PULLING OPERATIONS

A. The Contractor shall allow the pipe to return to its original length and shape in the unstressed state prior to trimming the excess pipe in the manholes. The pipe manufacturer's recommendations shall be followed regarding the relief and normalization of stress and strain due to temporary stretching or elongation after pulling operations are completed. Contractor shall consider temperature and pulling time required when calculating required time for stress and strain relief. Time allowed for stress and strain relief shall be not less than 24 hours without a specific recommendation otherwise from the pipe manufacturer.

B. The Contractor shall allow a minimum of six (6) hours to elapse after pipe bursting mainlines prior to connecting permanent lateral connections to the new main, in order to allow the pipe to relax from the applied tension forces. The Contractor shall provide temporary lateral connections and or bypassing as required to prevent overflows from side sewers.

3.05 PIPE TESTING

A. All tests shall be completed and approved prior to placing of permanent resurfacing.

B. Testing of pipe shall be in conformance with the Section 02735, SANITARY SEWER SYSTEM TESTING.

C. After completion of construction of the pipeline and prior to final pavement restoration, the Contractor shall inspect all new pipelines for obstructions and shall clean all new lines. The Contractor shall inspect the new lines by television camera in accordance with Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS and submit logs and videos to the District. Television inspection shall be witnessed by the District or its appointed delegate.

1. Any lines showing unacceptable pipe construction such as offset joints >1/2” or deformed pipe shape (ovality >7% of pipe diameter) will be rejected and contractor will be required to repair those deficiencies at their own cost.
2. If the post-CCTV inspection indicates that sag(s) may be present which pond water greater than 1 inch in depth for pipes less than ten (10) inches in diameter, or sags greater than two (2) inches for larger piping, then the Contractor shall notify the District or its appointed Representative immediately.

3. If it is determined by the District or its appointed Representative that there is a sag or hump in the installed piping after completion of pipe bursting and repair is required, then the Contractor shall repair the sag for the length directed by the District. The sag repair shall be performed in accordance with the Standard Drawings.

*****END OF SECTION*****

SECTION 02365

PIPE REAMING

PART 1 - GENERAL

1.01 SUMMARY

A. This specification covers the work necessary to furnish and install, complete and in place, high density polyethylene pipe (HDPE) by the pipe reaming method as shown on the drawings and specified herein. Pipe reaming consists of removal of the existing pipe with directional drilling equipment while installing new HDPE pipe. The Contractor shall provide all materials, labor, equipment, and services necessary for bypass pumping and/or diversion of sewage flows, installation of HDPE pipe, modifications and repairs to existing manholes, and CCTV inspection and testing of the completed pipe system.

B. All fees or claims for any patented invention, article, or arrangement that may be used upon, or in, any manner connected with the performance of the work or any part thereof shall be included in the price bid for doing the work, and the Contractor and its sureties shall defend, protect, and hold the District or its appointed Representative, and Design Consultants, together with all their officers, agents, and employees harmless against liability of any nature or kind for any and all costs, legal expenses, and damages made for such fees or claims and against any and all suits and claims brought or made by the holder of any invention or patent, or on account of any patented or unpatented invention, process, article, or appliance manufactured for or used in the performance of the Contract, including its use by the District, unless otherwise specifically stipulated in the Contract. Before final payment is made on the Contract, the Contractor shall furnish an affidavit to the District regarding patent rights for the project. The affidavit shall state that all fees and payments due as a result of the work incorporated into the project or methods utilized during construction have been paid in full.

1.02 RELATED SECTIONS

A. Section 02145, SEWAGE FLOW CONTROL

B. Section 02200, EARTHWORK

C. Section 02300, PIPELINE CLEANING AND CCTV INSPECTION

D. Section 02735, SANITARY SEWER SYSTEM TESTING

E. Section 15050, GENERAL PIPING

F. Section 15066, HIGH DENSITY POLYTHYLENE (HDPE) PIPE

1.03 NOT USED

1.04 EXPERIENCE REQUIREMENTS

A. Contractor shall have a minimum of three (3) pipe reaming projects of similar diameter, length, soil type, and installation conditions successfully completed within the last 3 years.

B. Fusion equipment shall be operated only by technicians who have been certified by the pipe manufacturer or supplier and who have a minimum of three (3) years of experience fusion welding 4-inch or larger diameter HDPE pipelines. The technician's experience shall be documented in the bid submittal.

1.05 SUBMITTALS

A. The Contractor shall submit catalog cuts, specifications, dimensioned drawings, the proposed diameters of pipe reaming pipe, sealant, clamps, couplings, fittings, adapters, saddles, and service connection materials and methods to be used for each pipe size manufacturer's recommendation for installation, installation details and sketches, breakaway devise detail and calculations, and other pertinent information for the HDPE pipe installation work. All materials provided shall be fully in accordance with the requirements of the reference specifications specified herein.

B. The Contractor shall submit detail drawings and a written description of the construction procedure, sequence to bypass sewage flow, install pipe, and reconnect lateral sewers.

C. The Contractor shall submit pre and post installation TV Inspection videos of all sanitary sewer mains within the scope of work. See Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

D. The Contractor shall submit a copy of the technician's certification(s) for the operation of the fusion equipment.

E. Certification: The Contractor shall furnish a certified affidavit of compliance for all HDPE pipe and fittings furnished confirming that the materials supplied fully conform to the requirements specified herein.

F. The Contractor shall perform trial fusion welds and submit samples to the District or its appointed Representative for review prior to installation of the pipe. Full penetration welds shall provide a homogeneous material across the cross section of the weld. The fusion machine employed for the trial welds shall be the same machine to be utilized for the installation work.

G. Fusion equipment shall be operated only by technicians who have been certified by the pipe manufacturer or supplier and who have a minimum of two (2) years of experience fusion welding 12-inch or larger diameter pipelines. The technician's experience shall be documented in the HDPE pipe submittal.

H. Submit debeading process and equipment for use in removing the internal bead for the newly joined HDPE pipe sections.

I. Calculations and connection details of “weak link” or breakaway device used to protect pipe from excessive pulling forces.

1.06 QUALITY ASSURANCE

A. Quality assurance procedures shall be performed by the pipe manufacturer fully in accordance with the requirements of this specification. The certification shall include certified laboratory data confirming that said tests have been performed on a sample of the pipe to be provided under this contract, or pipe from that production run, and that satisfactory results were obtained.

B. Fusion joining and other procedures necessary for correct assembly of the polyethylene pipe shall be done only by personnel trained in those skills to the satisfaction of the District or its appointed Representative and the pipe supplier.

C. Only those tools designed for the aforementioned procedures, and approved by the pipe manufacturer or supplier and the District or its appointed Representative, shall be used for assembly of pipe fittings to ensure proper installation. The heater plate shall be equipped with suitable means to measure the temperature of plate surfaces and to assure uniform heating such as thermometers or pyrometers.

D. Pipe insertion equipment shall be operated only by technicians who have a minimum of three (3) years experience in the installation of the reamed pipe as specified herein. The technician's experience shall be documented in the HDPE pipe submittal.

E. The Contractor shall televise the installed pipe after existing services have been reconnected and manhole work has been completed. The original television inspection video tape shall be provided to the District or its appointed Representative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling and Storage - The Contractor shall exercise special care during the unloading, handling, and storage of all polyethylene pipe to ensure that the pipe is not cut, gouged, scored, or otherwise damaged. Any pipe segment which has cuts in the pipe wall exceeding 10 percent of the wall thickness shall be cut out and removed from the site at the Contractor’s cost. The pipe shall be stored so that it is not deformed axially or circumferentially.

B. All polyethylene pipe without an ultraviolet inhibitor shall not be stored uncovered outside.

1.08 WARRANTY

A. The contractor shall provide to the District a warranty to be in force and effect for a period of one (1) year from the date of final acceptance by the District. The warranty shall require the Contractor to repair or replace the pipe should leakage, separation, collapse or other failure result from faulty materials or installation as determined by the District or its appointed Representative.

1.09 ROYALTIES

A. Use of pipe reaming equipment may require that royalties to be paid. Royalties are the responsibility of the Contractor. Any and all royalties owed by the Contractor for use of pipe reaming technologies and equipment shall be included in the unit price per foot for the pipe to be installed. In no case will royalties be considered as an additional cost to the District.

PART 2 - MATERIALS

2.01 GENERAL

A. Piping used for pipe reaming shall be High Density Polyethylene (HDPE) pipe as specified in Section 15066, HIGH DENSITY POLYETHYLENE (HDPE).

B. Joints: pipe shall be joined by butt fusion welding, as specified Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE.

2.02 LATERAL RECONNECTIONS

A. All active sewer laterals shall be reconnected to the main line by use of electrofusion saddles.

1. Lateral connections to sanitary sewer mains 12 inch in diameter (nominal) or smaller shall be with an electrofusion “wye” type saddle, manufactured by Central Plastics or approved equal.

2. Lateral connections to sanitary sewer mains greater than 12 inch in diameter (nominal) may be with a “tee” type saddle if the “wye” type electrofusion saddle is not available or approved by the District.

PART 3 - EXCECUTION

3.01 GENERAL

A. Preparation - All work shall be performed as specified herein and supervised by personnel experienced in the installation of the pipe by the pipe reaming method.

B. Installation guidelines from the pipe supplier shall be followed for all installations.

C. The Contractor shall protect facilities from damage by forces generated by the pipe equipment.

3.02 PIPE JOINING

A. Pipe Joining: Sections of polyethylene pipe shall be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations and per Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE. The inside weld bead shall be removed by cutting the bead away without scoring the inside wall of the pipe.

B. The Contractor shall submit to the District or its appointed Representative, for review as part of the submittal requirements, a debeading process for use in removing the internal bead for the newly joined HDPE pipe sections.

C. Electrofusion may be used for field closures, as necessary. Threaded or solvent cement joints and connections are not permitted.

3.03 PIPE INSTALLATION

A. The Contractor shall provide Pre and Post Construction Television Inspection in accordance with Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

B. Insertion/Receiving Pits: Insertion/receiving pits shall be prepared and backfilled in accordance with Section 02200, EARTHWORK, and the Standard Trench Section Detail. All pits shall be adequately shored and braced, to insure safe work areas in accordance with Section 02160, SHORING.

C. When not indicated in the Contract Documents, the locations for the insertion/receiving pits are to be determined by the Contractor and approved by the District. In considering locations for insertion/receiving pits, the Contractor shall consider the size of the existing sewer and new pipe, locations of obstructions and services, locations of manholes, pulling distances, traffic conditions, and locations of utilities. Insertion pits shall have a maximum slope of 2.5:1 entry slope and shall be shaped to permit as long a radius in the new pipe as feasible. This radius shall not be less than 35 times the outside diameter at pipe. If existing manholes are destroyed or damaged while constructing the insertion/receiving pits, they shall be reconstructed and/or repaired at no cost to the District.

D. The Contractor shall backfill all points where the new pipe has been exposed, such as insertion pits, outside of manholes, lateral connections, critical utility crossings, etc. The backfill material shall be compacted according to the surface restoration required as outlined in these Standard Specifications.

E. The Contractor shall physically disconnect all laterals from the existing main prior to pipe reaming any mainlines.

F. The Contractor shall utilize a “weak link” or breakaway device at the leading end of the HDPE pipe to protect the pipe from excessive pulling loads. The weak link device shall be installed between the drilling head and the regular pipe. Connection details and calculations used to determine the weak link material and size shall be subject to the approval of the District or its appointed Representative.

G. Contractor shall prepare the site for use of a directional drill with pavement cuts or other surface preparations prior to beginning the construction. Contractor shall provide and install all pulleys, rollers and other alignment control devices required to protect the pipe from damage during installation. Under no circumstances shall the pipe be stressed beyond the manufacturer’s recommendations.

H. New HDPE pipe shall be inserted immediately behind the reaming head in accordance with the reaming head manufacturer’s recommended procedures. Any proposed changes in installation procedures shall require submittal of revised procedures, bearing the approval of the reaming head manufacturer, and shall be subject to approval and acceptance by the District or its appointed Representative.

I. Contractor shall supply all materials and equipment required for lubricating fluid during installation. Unit prices for pipe reaming shall include supply and handling of lubricating fluid.

J. Slurry generated by the reaming procedure shall be collected by a vacuum truck or slurry pump and removed from the site. Costs for removing and disposing of the slurry shall be included in the cost of pipe installation by the Contractor and shall not be considered additional cost to the District.

K. The Contractor may utilize existing manholes where practical. Manhole inverts and bottoms may be removed to permit access for installation equipment. Manholes must be fully restored upon completion of the work.

L. Existing Manhole Base Modifications: Modifications to the existing invert of flow channels of existing manholes shall be made as needed to accommodate the new pipe and maintain a smooth surface and positive slope through the length of pipe. If the existing manhole base is broken during modifications, it shall be repaired or replaced by the Contractor to the satisfaction of the District or its appointed Representative at no additional cost.

M. The Contractor shall anchor the pipe to concrete structures or manholes after the pipe has been installed along the length of sewer replaced. The Contractor

shall use a water stop or flange adapter, as supplied by the pipe manufacturer, that is firmly seated perpendicular to the pipe axis, around the pipe exterior and cast into the structure base or near the structure wall center. The structure or manhole connection shall be made after adequate time has been allowed for the pipe to relax from the applied tension forces, as specified herein.

N. New pipe must be completely watertight at the manhole connections. If a sealing material is required to obtain and assure a watertight seal, the material shall be compatible with the HDPE pipe in every way and shall require the approval of the District or its appointed Representative. The sealing system shall be a continuous filler, no more than ½" across, placed along the entire circumference of the new liner pipe on all surfaces in contact with the manhole channel, interior wall, and rehabilitated host pipe. The sealant system and materials shall conform to the requirements of Section 210-2.3.3 of the Standard Specifications for Public Works Construction (Greenbook).

O. Lateral Reconnection: The Contractor shall be responsible for disconnecting and reconnecting all live laterals to the main pipe. Capped/abandoned laterals shall not be reconnected to the new main.

3.04 STRESS AND STRAIN RELIEF OF HDPE PIPE AFTER PULLING OPERATIONS

A. The Contractor shall allow the pipe to return to its original length and shape in the unstressed state prior to trimming the excess pipe in the manholes. The pipe manufacturer's recommendations shall be followed regarding the relief and normalization of stress and strain due to temporary stretching or elongation after pulling operations are completed. Contractor shall consider temperature and pulling time required when calculating required time for stress and strain relief. The structure or manhole connection shall be made a after adequate time has been allowed for the pipe to relax from the applied tension forces, as specified herein.

B. The Contractor shall allow a minimum of six (6) hours to elapse after pipe reaming mainlines prior to connecting permanent lateral connections to the new main, in order to allow the pipe to relax from the applied tension forces. The Contractor shall provide temporary lateral connections and or bypassing as required to prevent overflows from side sewers.

3.05 FINAL TESTING, CLEANING AND TELEVISION INSPECTION

A. All tests shall be completed and approved prior to placing of permanent resurfacing.

B. Testing of pipe shall be in conformance with the Section 02735, SANITARY SEWER SYSTEM TESTING.

C. After completion of construction of the pipeline and prior to final pavement restoration, the Contractor shall inspect all new pipelines for obstructions and shall clean all new lines. The Contractor shall inspect the new lines by television camera in accordance with Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS and submit logs and videos to the District. Television inspection shall be witnessed by the District or its appointed Representative.

1. Any lines showing unacceptable pipe construction such as offset joints >1/2" or deformed pipe shape (ovality >7% of pipe diameter) will be rejected and contractor will be required to repair those deficiencies at their own cost.

2. If the post-CCTV inspection indicates that sag(s) may be present which pond water greater than 1 inch in depth for pipes less than ten (10) inches in diameter, or sags greater than two (2) inches for larger piping, then the Contractor shall notify the District or its appointed Representative immediately.

3. If it is determined by the District or its appointed Representative that there is a sag or hump in the installed piping after completion of pipe reaming and repair is required, then the Contractor shall repair the sag for the length directed by the District. The sag repair piping shall be performed in accordance with the Standard Drawings.

*****END OF SECTION*****

SECTION 02513

ASPHALT CONCRETE PAVEMENT AND BASE

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall perform all work associated with asphalt concrete pavement and base repair as shown on the Standard Drawings and/or as specified herein. The Contractor shall provide all labor, materials, equipment, supplies, and facilities associated with providing a finished product satisfying all the requirements of the Contract Documents.

B. All work specified herein shall conform to or exceed the requirements of the County of Marin Uniform Construction Standards (UCS), and the requirements of the Town or City with jurisdiction.

C. For projects performed under contract with the District, the Contractor shall provide a minimum five (5) year warranty for any asphalt concrete pavement and base installed in privately owned roads.

D. All pavement areas that are not required to be repaved shall be protected by the Contractor. Such areas shall not be damaged in anyway and shall be fully restored to the pre-construction condition at the Contractor's expense. Pictures of the existing roadways shall be taken by the Contractor prior to work to document the pre- construction condition.

1.02 RELATED SECTIONS

A. Section 02060, SITE PREPARATION

B. Section 02050, DEMOLITION, ABANDONMENT, AND REMOVAL

C. Section 02200, EARTHWORK

1.03 REFERENCE SPECIFICATIONS

A. This section contains references to the following documents. In case of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail. The latest edition of the following references at the time of bid shall be used.

AASHTO M82	Cut-Back Asphalt (Medium Curing Type)
AASHTO M140	Emulsified Asphalt
AASHTO M208	Cationic Emulsified Asphalt
AASHTO M226	Viscosity Graded Asphalt Cement
AASHTO T209	Maximum Specified Gravity of Paving Mixtures
ASTM D242	Mineral Filler for Bituminous Paving Mixtures
ASTM D692	Coarse Aggregate for Bituminous Paving Mixtures
ASTM D977	Emulsified Asphalt
ASTM D1073	Fine Aggregate for Bituminous Paving
ASTM D1188	Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin- Coated Specimens
ASTM D1557	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in (457-mm) Drop
ASTM D2027	Cutback Asphalt (Medium Curing Type)
ASTM D2397	Cationic Emulsified Asphalt
ASTM D2726	Bulk Specific Gravity and Density of Compacted Bituminous Mixture Using Saturated Surface-Dry Specimens
ASTM D3381	Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D3515	Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
ASTM D2922	Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods
Caltrans Standard Specification, Section 26	Aggregate Bases
Caltrans Standard Specification, Section 37	Bituminous Seals
Caltrans Standard Specification, Section 39	Asphalt Concrete
Caltrans Standard Specification, Section 92	Asphalts
Caltrans Standard Specification, Section 94	Asphaltic Emulsions

1.04 EXPERIENCE REQUIREMENTS

1.05 SUBMITTALS

A. The Contractor shall provide submittals to the District to confirm that material to be used comply with information specified herein and the requirements of the County of Marin Uniform Construction Standards (UCS), and the requirements of the Town or City with jurisdiction.

B. The Contractor shall submit, in writing, materials testing reports, job-mix formulas, and other pertinent information satisfactory to the District demonstrating that the materials and methods that the Contractor proposes to utilize comply with the provisions of this Section.

C. Suitability Tests of Proposed Materials. Tests for conformance with the Specifications shall be performed prior to start of the Work. The samples shall be identified to show the name of the material, aggregate source, name of the supplier, and the segment of the Work where the material represented by the sample is to be used. Results of all tests shall be submitted to the District for approval. Materials to be tested shall include aggregate base, aggregate subbase, coarse and fine aggregate for paving mixtures, mineral filler, asphalt cement, and asphalt emulsion.

D. Certificate of Compliance of Proposed Materials. Certificate of Compliance with the specifications shall be provided prior to start of the Work. The Certificate of Compliance shall identify the name of the material, aggregate source, name of the supplier, contract number, and the segment of the Work where the material represented by the sample is to be used. Results of all tests shall be submitted to the District for approval. Materials to be tested shall include aggregate base, coarse and fine aggregate for paving mixtures, mineral filler, liquid asphalt, asphaltic emulsion, slurry seal mixture, and asphalt concrete mixture properties in accordance with Caltrans Standard Specifications and theoretical maximum asphalt concrete density in accordance with AASHTO T209. AC paving and slurry seal shall have final mix design approved by the appropriate agency prior to submittal to the District or its appointed Representative for approval.

E. Trial Batch. Before placing any paving material, a testing laboratory acceptable to the District or its appointed Representative shall prepare a trial batch of asphalt concrete for each job-mix formula to be used by the Contractor for the Work. The trial batch shall be prepared using the aggregates and asphalt cement proposed by the Contractor and approved by the District or its appointed Representative . The compacted trial batch shall provide a basis for computing the voids ratio, provide an indication of the optimum asphalt content, and establish a basis for controlling compaction during construction. The cost of not more than 2 laboratory trial batch tests will be borne by the District but the Contractor shall furnish the materials at no cost. Any additional trial batch testing required shall be performed at the expense of the Contractor.

F. Load Slips. The Contractor shall submit batch data and load slips to the District or its appointed Representative as asphalt is delivered to the project site to allow verification of location and use.

G. Samples. The Contractor shall submit samples of all geotextile materials proposed to be used on the Work. The samples shall be clearly marked to show the manufacturer's name and product identification and shall be submitted along with the technical data and installation instructions.

H. Submittal shall also include a traffic control plan and a coordination plan for the pavement work. The coordination plan shall address staging issues that will provide minimum interference with use of street. Coordination submittal shall address all coordination issues of concern to the governing agencies. No paving shall start until the traffic control and coordination submittals are approved.

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

PART 2 - PRODUCTS

2.01 GENERAL

A. The Contractor shall furnish asphalt concrete pavement and base in accordance with the requirements specified herein and in accordance with the County of Marin Uniform Construction Standards and the requirements of the Town or City with jurisdiction.

B. The District prefers the use of recycled aggregate and asphalt pavement materials where feasible. Recycled materials meeting the requirements and gradations specified herein and Caltrans Standards may be submitted at the Contractor's option. If the District approves, the Contractor shall pass cost-savings to District. Up to 25 percent recycled asphalt pavement (RAP) may be used at the Contractor's option.

2.02 AGGREGATE BASE

A. Materials for aggregate base shall be Class 2 aggregate base material as specified in Section 02200, EARTHWORK.

2.03 TACK COAT

A. Tack coat shall be of the penetration type asphalt emulsion grade RS-1, furnished and applied in conformance with the provisions of Section 94, Asphaltic Emulsions, of the Caltrans Standard Specifications.

2.04 ASPHALT BINDER/CEMENT

A. Asphalt binder to be mixed with the mineral aggregate shall be steam-refined paving asphalt Type PG 64-16 conforming to Section 92 of the California State Specifications. Asphalt binder for temporary paving shall consist of liquid asphalt grade MC-800 conforming to Section 93 of the California State Specifications.

2.05 ASPHALT CONCRETE

A. Asphalt concrete shall conform to the requirements of Section 39 of the Caltrans Standard Specifications.

1. Aggregate for HMA base course (lifts of asphalt placed prior to or below the final lift) shall be 3/4 -inch gradation, Type A.

2. Aggregate for HMA surface course (the final lift placed for a given area) shall be ½-inch gradation, Type A.

3. The asphalt concrete mixture, composed of the aggregate proposed for use and the optimum amount of asphalt as determined by California Test 367, shall conform to the following quality requirements:

Quality Characteristic	Test Method	Value (HMA Type A)
Air Void Content (%)	California Test 367	4.0
Voids in Mineral Aggregate	California Test 367	
½" grading		14.0
¾" grading		13.0
Voids filled with asphalt (%)	California Test 367	
½" grading		65.0-75.0
¾" grading		65.0-75.0
Dust Proportion	California Test 367	0.6-1.3
Stabilometer value (min.) [a]	California Test 366	37

2.06 PAVEMENT MARKINGS, STRIPES, PAVEMENT MARKERS AND CURB PAINTING

A. Stripes and pavement marking replacement shall be thermoplastic material in accordance with Caltrans Standard Specifications, Section 84.

B. Pavement marker replacement shall be in accordance with Caltrans Standard Specifications, Section 85.

C. Paint for replaced curbs, where required for fire lanes, no parking zones, and other similar markings shall match existing color and be in accordance with Caltrans Standard Specifications, Section 59-6.

D. Pavement lane delineators shall match existing and shall be in accordance with Caltrans Standard Specifications requirements.

PART 3 - EXECUTION

3.01 GENERAL

A. Where pavement restoration is required due to trenching, the road section shall be restored to the previous as-built section. In no case shall the section be less than the requirements of the County of Marin UCS, or the requirements of the Town or City with Jurisdiction.

B. Existing curbs and sidewalks being demolished shall be replaced to match the existing curb and sidewalk and in conformance with the County of Marin UCS.

C. Adjustment of Iron. Valve boxes, survey monument boxes, manholes, cleanouts, and blowouts shall be brought to finished grade after the final pavement lift has been installed.

D. Failed pavement adjacent to the trench shall be removed and replaced by the Contractor. Any pavement damaged by the Contractor shall be removed and replaced by the Contractor.

E. Removal operations shall be performed without damage to any portion of the existing pavement, curb, gutter, or sidewalk that is to remain in place. All damage to the existing surfaces to remain in place shall be repaired to a condition equal to the existing condition prior to the beginning of removal operations. The cost of repairing existing concrete or asphalt concrete pavement damaged by the Contractor's operations shall be at his expense.

F. Contractor shall furnish and use canvas tarpaulins to cover all loads of asphalt concrete from the time that the mixture is loaded until it is discharged from the delivery vehicle, unless otherwise directed in writing by the District.

3.02 SUBGRADE PREPARATION

A. The subgrade shall be prepared as specified in Section 02200, EARTHWORK. The surface of the subgrade after compaction shall be hard, uniform, smooth, and true to grade and cross-section. Subgrade for pavement shall not vary more than 0.02 feet from the specified grade and cross section. Subgrade for base material shall not vary more than 0.04 feet from the specified grade and cross section.

3.03 AGGREGATE BASE

A. Where required, the aggregate base section shall be restored to the previous as-built section. In no case shall the section be less than the requirements of the County of Marin UCS, or the requirements of the Town or City with Jurisdiction.

B. Imported aggregate bases shall be delivered to the job site as uniform mixtures and each layer shall be spread in one operation. Segregation shall be avoided and the bases shall be free of pockets of coarse or fine material. Where the required thickness is 6 inches or less, the base materials may be spread and compacted in one layer each.

C. The relative compaction of each layer of aggregate base and subbase shall be not less than 95 percent of maximum density. Placement of aggregate base shall be in lifts no greater than 6-inches. The compacted surface of the finished aggregate shall be hard, uniform, smooth, and at any point shall not vary less than the minimum specified cross section.

3.04 REMOVAL OF PAVEMENT

A. Vertically sawcut all bituminous pavements, regardless of the thickness prior to excavation. Cuts shall be made with an approved saw. Pavement shall be removed from the trench utilizing two or more separate sawcuts. The initial pavement cut shall coincide with the vertical wall of the actual trench. The Contractor shall maintain the neat sawcut edge throughout the excavation, placement, and compaction of backfill and base course materials. Should the Contractor fail to maintain the neat sawcut edge of the initial or any subsequent cut, another sawcut, representing an additional initial sawcut, shall be made. The additional initial sawcut shall be made outside the limits of the pavement damage as directed by the District or its appointed Representative . Prior to placement of the tack coat for the replacement asphalt, the second sawcut shall be made. The limits of the second pavement cut shall be a distance shown on the Drawings from the edge of the previous sawcut at ground surface or as determined by the District or its appointed Representative in the field to address damage by the Contractor. The existing asphalt concrete shall be removed and sufficient aggregate base shall be added between the previous and secondary sawcuts to bring the surface of the base course to a smooth even grade at the correct distance below the top of the existing pavement surface. Pavement materials removed shall be hauled from the site and not used as backfill.

3.05 PAVEMENT PREPARATION

A. The Contractor shall clean the surface by sweeping, blowing or other means to remove all loose particles of paving, all dirt, and all other extraneous material immediately before applying the tack coat.

3.06 TACK COAT

A. A tack coat shall be applied to existing paved surfaces where new asphalt concrete is to be placed on or against existing pavement. It shall also be applied to the contact surfaces of all cold pavement joints, curbs, gutters, manholes, and the like immediately before the adjoining asphalt pavement is placed. Care shall be taken to prevent the application of tack coat material to surfaces that will not be in contact with the new asphalt concrete pavement. Tack coat shall be applied at the rate of approximately 0.10 gallons per square yard.

B. No traffic shall be allowed on the tack coat with the exception of vehicles unloading asphalt concrete. All vehicles involved with the Contractor's operations shall turn around within the roadway right-of-way. Driveways and other private property shall not be used without prior written consent of the involved owner, a dated copy of which must be delivered to the District or its appointed Representative prior to the use thereof.

3.07 ASPHALT CONCRETE

A. The Contractor shall install all concrete, steel, piping, backfill, and bedding before placing asphalt concrete.

B. Asphalt concrete shall not be placed on any surface that contains ponded water or excessive moisture in the opinion of the District or its appointed Representative.

C. New asphalt concrete for pavement repairs shall be placed in two lifts unless otherwise directed by the District.

D. The Contractor shall notify the District before the paving has begun. At the time of delivery to the Work site, the temperature of mixture shall not be lower than 280 degrees F nor higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather.

E. Asphalt concrete shall not be placed when the atmospheric temperature is below 50 degrees F or during unsuitable weather, including rain or fog. Should unsuitable weather conditions develop during paving operations and force a shut down, loaded trucks in transit shall return to the plant and no additional compensation will be allowed.

F. All trimming of the surface, prior to placing the final lift, shall be completed while the temperature of the mix is above 200 °F.

G. The asphalt concrete shall be evenly spread upon the base to such a depth that, after rolling, it will be of the minimum specified cross section and grade of the course being constructed. All spreading and compacting shall be in conformance

with Section 39 of the California State Specifications. Loaders (pick-up machines) shall not be used.

H. The depositing, distributing, and spreading of the asphalt concrete shall be accomplished in a single, continuous operation by means of a self-propelled mechanical spreading and finishing machine designed especially for that purpose. The machine shall be equipped with a screed or strike-off assembly capable of being accurately regulated and adjusted to distribute a layer of the material to a definite predetermined thickness. When paving is of a size or in a location that use of a self-propelled machine is impractical, the District or its appointed Representative may waive the self-propelled requirement.

I. Spreading, once commenced, must be continued without interruption.

J. Asphalt concrete, when required to be distributed by hand, shall be placed using a shovel into a mass of asphalt, the asphalt concrete shall not be broadcast or scattered resulting in segregation.

K. The mix shall be compacted immediately after placing. Initial rolling with a steel-wheeled tandem roller, steel three-wheeled roller, vibratory roller, or a pneumatic-tired roller shall follow the paver as closely as possible. If needed, intermediate rolling with a pneumatic-tired roller shall be done immediately behind the initial rolling. Final rolling shall eliminate marks from previous rolling. In areas too small for the roller a vibrating plate compactor or a hand tamper shall be used to achieve thorough compaction.

L. Pneumatic-tired rollers shall be used during compaction of all surface courses of asphalt concrete. Compaction with steel drum, vibratory rollers in lieu of pneumatic- tired rollers is not acceptable.

M. The relative density after compaction shall be 95 percent of the density obtained by using ASTM D1188 or D2726. A properly calibrated nuclear asphalt testing device shall be used for determining the field density of compacted asphalt concrete, or slabs or cores may be laboratory tested in accordance with ASTM D1188. A minimum of one compaction test per day shall be provided and an additional compaction test for each 500 square feet completed. If the test results for any lot of asphalt concrete indicate that the relative compaction is less than 95.0%, the asphalt concrete represented by that lot shall be removed and replaced at Contractor's expense. Asphalt concrete spreading operations shall not continue until the Contractor makes significant adjustments to his/her materials, procedures, or both in order to meet the required compaction. The adjustments shall be as agreed to by the District or its appointed Representative .

N. Upon completion, the pavement shall be true to grade and cross-section. When a 10 foot straightedge is laid on the finished surface parallel to the center of the roadway, the surface shall not vary from the edge of the straightedge more than

1/8 inch, except at intersections or changes of grade. In the transverse direction, the surface shall not vary from the edge of the straightedge more than 1/4 inch.

O. Upon completion, slope of street draining to the gutter shall match existing.

P. The finished grade of asphalt concrete at the lip of the gutter shall be 1/4-inch above the concrete.

3.08 PROTECTION OF STRUCTURES

A. Provide whatever protective coverings may be necessary to protect the exposed portions of buildings, curbs, posts, guard fences, equipment pads, and any other structures from splashing oil and asphalt from the paving undesirable matter that may come upon these structures by reason of the paving operations.

3.09 CONTRACTOR'S RESPONSIBILITY

A. Settlement of replaced pavement over trenches within the warranty period shall be considered the result of improper or inadequate compaction of the subbase or base materials. The Contractor shall promptly repair all pavement deficiencies noted during the warranty period at the Contractor's sole expense.

3.10 TEMPORARY PAVING

A. The same day the trench is backfilled, it will be graded to conform to the existing surface and temporary pavement consisting of a minimum of 2 inches of premixed asphaltic paving material will be placed over the trench. Temporary pavement shall be maintained in a safe and drivable condition until permanent paving is placed.

B. Temporary pavement shall be removed and permanent pavement shall be installed within 10 calendar days after excavation unless otherwise specified by the District. The permanent pavement shall be maintained to the satisfaction of the District or its appointed Representative for the full guarantee period or until relief from maintenance is obtained in writing from the District.

*****END OF SECTION*****

SECTION 02600

SIDE SEWERS

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all pipe, fittings, tools, materials, and labor required to install and test sanitary side sewers (laterals), in accordance with the requirements of these Standard Specifications and the Project Contract Documents, as applicable.

B. Requirements specified herein are used to establish the standards of quality and utility required for side sewers. However, alternates to or variance from requirements specified herein which are equal in quality and utility to those specified herein may be permitted by the District subject to the following provisions:

1. The Contractor shall submit to the District sufficient data, drawings, samples, literature, calculations, or other detailed information as will demonstrate to the District or its appointed Representative that the proposed alternate is equal in quality and utility to the requirements Specified herein.

2. The District or its appointed Representative must favorably review in writing such proposed variances and/or substitutions as are, in its opinion, equal in quality to the requirements of the District's Standard Specifications, or acceptable under special conditions.

3. Failure of the Contractor to submit proposed substitutions or variances for review in the manner described above shall be sufficient cause for rejection by the District of any alternates or variances otherwise proposed.

1.02 RELATED SECTIONS

A. Section 02145, SEWAGE FLOW CONTROL & BYPASSING

B. Section 02200, EARTHWORK

C. Section 02270, EROSION CONTROL

D. Section 02300, CLEANING AND TELEVISION INSPECTION OF SEWER MAINS

E. Section 02315, CURED-IN-PLACE PIPE (CIPP)

F. Section 02513, AC PAVEMENT AND BASE

G. Section 02900, PROTECTION OF TREES AND RESTORATION OF LANDSCAPING

H. Section 15050, PIPING, GENERAL

I. Section 15061, DUCTILE IRON PIPE (DIP)

J. Section 15064, POLYVINYL CHLORIDE (PVC) PIPE

K. Section 15066, HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

1.03 NOT USED

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide Submittals for items specified herein to the District for confirmation that materials to be used comply with requirements specified herein.

1.06 NOT USED

1.07 NOT USED

PART 2 - PRODUCTS

2.01 GENERAL

A. Side sewer piping must conform to the size requirements for horizontal drainage based on the Equivalent Dwelling Unit (EDU) as set forth by the Marin County Assessor's office records, or fixture unit loading as set out in the Uniform Plumbing Code.

B. The minimum diameter for side sewers shall be four (4) inches or the same size as the building plumbing stub, whichever is greater. Where more than 150 fixture units, or 3 or more EDUs are to be connected, the side sewer shall have a six (6) inch minimum diameter.

C. When more than one building sewer is allowed to be connected to a single side sewer, the side sewer from the point of intersection of one or more building sewers to the main sewer shall be calculated and submitted to the District for the proper size, and the approval shall be at the District's discretion.

D. All side sewers materials shall be new, free from defects, and marked to identify manufacturer, material, class, and other appropriate information.

E. Side sewer pipe material, fittings, couplings, appurtenances, and other components used for side sewer construction or repair shall be as specified herein.

2.02 SIDE SEWER PIPING

A. Pipe materials for side sewer piping shall be per the Side Sewer Piping Schedule in the District's Approved Materials List.

B. All side sewer pipe material between structures shall be of the same type and material, unless otherwise permitted by the District.

2.03 CURED-IN-PLACE REHABILITATION OF EXISTING SIDE SEWERS

A. CIPP of private side sewers may be performed only upon prior approval by the District and if a special condition exists.

1. CIPP products for side sewer rehabilitation shall be per the District's Approved Materials list.

2. The Contractor or subcontractor installing the CIPP shall be certified by the lining manufacturer. The installer's experience installing the submitted lining product, and their Certification from the lining Manufacturer shall be submitted to the District for review. The District may reject the use of CIPP method for rehabilitation of existing side sewers by a Contractor if it determines that their experience is inadequate.

3. The Contractor shall perform pre-CCTV of the side sewer prior to ordering materials in accordance with Section 02315, CURED-IN-PLACE PIPE (CIPP) and Section 02300, CLEANING AND INSPECTION OF SANITARY SEWER MAINS. A copy of the pre-CCTV shall be furnished to the District for review. The District may reject the use of CIPP method for rehabilitation of side sewers based on the pre-installation CCTV.

B. The Permit Applicant or Contractor shall be required to repair or replace the side sewer connection to the mainline as part of the construction work/permit. The connection to the existing main shall be as specified in Section 2.05.

1. If the connection to the main is in suitable condition, as determined by the District, then connection rehabilitation may be performed by trenchless methods, as specified in Section 02315, CURED-IN-PLACE PIPE (CIPP) and per the District's Approved Materials List.

2.04 CONNECTIONS TO NEW SEWER MAINS

A. Side sewer connections to new PVC sewer mains shall be with new wye fittings. The wye fitting shall be PVC C900/C905. Tee fittings will not be acceptable.

B. Side sewer connections to new HDPE mains shall be per Section 15066, HIGH DENSITY POLYETHYLYNE (HDPE) PIPE.

2.05 CONNECTIONS TO EXISTING SEWER MAINS

A. Connections to existing PVC, VCP, DIP, cast iron, or asbestos cement sewer mains shall be made by cutting and removing a portion of the existing main, and installed a new wye fitting, spools of pipe, and adjustable repair couplings for connection the existing main (a pipeline spot repair with a new wye fitting). New wye fitting material shall match existing main unless otherwise approved by the District. Contractor is responsible to verify existing main material.

1. When the new wye fitting is within 12 inches of an existing joint on the main line, the installation and replacement of the main shall extend beyond the joint (i.e., the joint shall be cut and removed). The new pipe materials shall match existing main, unless otherwise noted.

B. For connections to existing sewer mains with an inside diameter of equal to or larger than 10 inches, a “wye” type tap connection may be used instead of a new wye fitting. Tap connections shall be per the District’s Approved Materials List. All hardware and bolts for tap connections shall be Type 316 stainless steel. Only pre-qualified Contractors shall be permitted to install tap and saddle connections.

C. Side sewer connections to existing HDPE mains shall be per Section 15066, HIGH DENSITY POLYETHYLYNE (HDPE) PIPE.

D. Connections to existing sewer mains with an existing CIPP liner shall be with a tap connection per the District’s Approved Materials List. Hammer tap connections, and new wye fittings will not be allowed on the existing CIPP liner or on the existing host pipe.

2.06 CLEANOUTS

A. All cleanouts shall be installed in utility boxes.

B. Fittings and utility boxes for cleanouts shall be per the District’s Approved Materials List.

C. Property line cleanouts shall be a two-way, wye, or a “Tee” as specified below:

1. PVC 900: Two-way

2. HDPE: Wye (facing sewer main)

3. Sch 80: Wye (facing sewer main)

4. CIP/DIP: “East Bay Code” Two-way

5. Blow off: Tee

6. BPD: Tee

Contractor is advised to discuss with property owner, and the District encourages the use of those per District's Approved Material List.

D. All risers on property line cleanouts shall be installed vertically. If there is a utility conflict preventing property line cleanouts being installed vertically, a one-way cleanout shall be installed with a bend making the rise vertical, allowing clearance for the cleanout.

2.07 WARNING TAPE

A. Warning tape shall be three (3) inch wide green plastic electronically detectable marking tape labeled "Buried Sewer Line Below," and installed above the pipe zone, as defined in Section 02200, EARTHWORK.

B. Warning tape shall be installed above all side sewers.

2.08 BACKWATER PREVENTION DEVICES (BPDS)

A. Backwater prevention devices shall be per the Districts Approved Materials List, or approved equal.

B. Type 1 Backwater Prevention Devices (Mushroom type) shall be with no hub, compatible with ductile iron pipe outside diameter. The mushroom cap shall aluminum.

C. Type 2 Backwater Prevention Devices (Sewer Poppers) shall meet the following requirements:

1. Automatic pop-up release to release sewage overflow outside the building

2. Vandal- and tamper-resistant center

3. Threaded for minimum 4" riser pipe

4. Constructed of PVC

5. Conforms to ASTM Standard D-2665

6. Type 2 Backwater Prevention Devices shall only be used in areas with potential for flooding, where a Type 1 backflow cannot be installed, where extendable backwater valves are required, or where required by the District.

D. Utility boxes for Type 2 BPDs shall be provided with a grated lid and per the District's Approved Materials List. Utility boxes over BPDs in areas subject to vehicular traffic shall be rated for H-20 traffic service. Utility boxes over BPDs shall be fitted with a grated lid and box extensions, if required to provide proper clearances.

2.09 BACKWATER CHECK VALVES

A. Backwater valves shall be per the District's Approved Materials List.

B. Backwater check valves shall be extendable type, and shall be constructed of PVC.

PART 3 - EXECUTION

3.01 GENERAL

A. Side sewers shall be installed in accordance with the requirements of Section 15050, GENERAL PIPING, and the specific section of these Standard Specifications for the particular pipe material being used.

B. Excavation and backfill shall be in accordance with the requirements of Section 02200, EARTHWORK, and the Typical Trench Section in the Standard Drawings.

1. The District may reserve the right to require compaction tests for trench backfill by a soils engineer. The cost of compaction test must be paid by the Contractor or property Owner.

C. All pipe must be laid to line and grade. Each length of pipe must be laid on a firm bed as detailed in Standard Drawings and must have full bearing for its entire length between bells. Blocking under the side sewer will not be permitted. Pipe must not be covered until inspected by a District Inspector.

D. Minimum slope:

1. Minimum slope shall be one and one half percent (1.5%) for four (4) inch diameter side sewer pipe.

2. Minimum slope shall be seven tenths percent (0.7%) for six (6) inch side sewer pipe or larger.

3. The slope of any portion of a side sewer shall not be greater than one hundred and fifty percent (150%).

4. Wherever available slope is less than two percent (2%) or the length of the side sewer is greater than one hundred (100) feet, the side sewer shall be installed using an industrial-standard laser grade control system to confirm that the pipe is installed to the proper grade.

E. Minimum cover:

1. Side sewers within the street right of way, in paved areas, or areas that may be subject to vehicular loads shall have a minimum cover of three (3) feet between crown of the pipe and finished grade.

    a. If the side sewer has less than three (3) feet of cover within the street right-of-way, Ductile Iron Pipe (DIP) shall be used in accordance with Section 15061, DUCTILE IRON PIPE (DIP).

2. Side sewers in non-paved areas that will not be subject to vehicular loads shall have a minimum cover of eighteen (18) inches between crown of the pipe and finished grade.

    a. District approval will be required for any side sewer that cannot meet this minimum cover requirement. The District may require special pipe materials, pipe protection, and/or special backfill materials.

F. To mark the location of side sewers, electronically detectable marking tape shall be installed from the main sewer end of each side sewer to the connected building.

G. When performing work on side sewers, the Contractor shall bypass wastewater around the work area in accordance with the requirements of Section 02145, SEWAGE FLOW CONTROL AND BYPASSING, or shall arrange with the Property Owner to temporarily shut down the side sewer. The Contractor shall ensure that no wastewater is discharged from side sewer to the excavation.

H. No person shall install, alter, or repair a side sewer that is connected, or is intended for connection to the District sewer system without installing a BPD of the type and in the manner prescribed in these Standard Specifications.

I. Performing any work or repairs on side sewers will require a permit from District.

3.02 PIPE BURSTING OF SIDE SEWERS

A. Pipe bursting rehabilitation of existing side sewers with a minimum of three (3) feet of cover within the street right of way may be performed with District approval.

1. Pipe bursting shall be performed in accordance with Section 02345, PIPE BURSTING.

2. The Contractor shall perform pre-CCTV of the side sewer prior to ordering materials in accordance with Section 02345, PIPE BURSTING and Section 02300, CLEANING AND INSPECTION OF SANITARY SEWER MAINS. The District may reject the use of pipe bursting method for rehabilitation of side sewers based on the pre-installation CCTV.

3. The Contractor shall provide air gaps between existing utilities, repair surface upheaval, and repair sags in accordance with Section 02345, PIPE BURSTING, and the Standard Drawings.

B. The Contractor shall allow a minimum of 6 hours for new HDPE pipes to “relax” prior to final inspection.

3.03 EXISTING SIDE SEWER LOCATIONS

A. Where an existing side sewer or its connection to the main is to be replaced or rehabilitated, it is the responsibility of the property owner or their contractor to locate and uncover the existing side sewer to serve the property.

1. When the side sewer stub or wye cannot be located, even if the District's records indicate such a connection exists, the side sewer must be connected to the main sewer at a location designated by the District at the expense of the property owner.

2. The District does not guarantee the presence or location of side sewer stubs or wyes.

3.04 NEW SIDE SEWER LOCATIONS

A. Prior to installation of side sewers in subdivisions, the lot corner nearest the side sewer and the side sewer terminus shall both be staked and flagged in the field.

B. Side sewers must be laid by the shortest route from the main sewer connection to the building plumbing outlet.

C. Pipes shall not have back to back bends. A minimum of 2 feet separation between bends shall be maintained.

D. Where curbs, gutters and/or sidewalks exist or are to be a part of an improvement, the location of each side sewer shall be permanently marked by imprinting an "S" (2" size) or by chiseling an "S" (4" size) in the concrete surface vertically above the side sewer pipe. The "S" shall be marked on the curb, gutter or on the sidewalk. It shall be the Contractor’s responsibility for providing the marking and for its accuracy.

3.05 OLD SIDE SEWERS

A. A new structure is not permitted to connect to an old side sewer unless the old side sewer is tested and inspected in the presence for a District Inspector and found to meet all current District Requirements.

3.06 ABANDONING SIDE SEWERS

A. When abandoning side sewers connected to the main sewer, including side sewers from structures that are demolished, the connection to the main must be dug out, cut away, and plugged with a solid piece of pipe of the same size and material. Plugging off must be done in the presence of a District Inspector.

B. Abandonment of side sewer piping shall be in accordance with Section 02050, **DEMOLITION, ABANDONMENT AND REMOVAL**. The side sewer to be abandoned shall be either completely removed, or abandoned in place and completely filled with controlled low strength material (CLSM) or low density cellular concrete (LDCC), per Section 02200, **EARTHWORK**. Provide ventilation during abandonment to allow air to escape from side sewers.

3.07 TAP CONNECTIONS TO MAINS

A. Only pre-qualified contractors shall be permitted to install tap and saddle connections.

B. Taps into mains shall not be allowed in pipes less than 10'' in diameter.

C. Hammer taps shall not be allowed in any pipes.

D. Before commencing excavation for tap installation, the Contractor shall have sufficient backfill material at the site to properly re-bed the main and side sewers, and backfill the excavation.

E. The outer surface of the main in this exposed area shall be thoroughly cleaned prior to tapping.

F. The excavation for the tapping work shall be a minimum of two (2) feet in width, give enough length for work space, without under-cut sides and shall be properly shored in conformance with Section 02160, **SHORING**. A minimum clearance of three (3) inches below, six (6) inches on each side and twelve (12) inches each way along the main from the point of connection shall be provided for tap installation.

G. If the main sewer is damaged during excavation for or during installation of the tap, the Contractor shall install a main sewer repair spool (replacement pipe section) as specified herein, including a new wye branch fitting.

H. Use of tap fitting connection requires prior District approval.

3.08 CLEANOUT INSTALLATION

A. Cleanouts shall be installed at the following locations:

1. When there are more than one building and the side sewers run from one building to the other, cleanouts shall be installed where the side sewer

enters each building, and a cleanout and/or BPD shall be installed where the side sewer exists each building.

2. Within two (2) feet of the building foundation.

3. At or near the property line or public right of way line.

4. At intervals not to exceed ninety (90) feet of laid pipe length. If two-way (Tee) cleanouts are being installed at both ends, the length in between can be up to one hundred and eighty (180) feet.

5. At any single bend, or any combination of bends that are greater than forty-five degrees (45°).

6. At intervals along the side sewer system where the cumulative total of deflection from the point of connection to the main sewer or from another cleanout equals or exceeds ninety degrees (90°)

7. At locations where there is a pipe material change, a cleanout shall be installed with secured cap to prevent from overflow.

B. The cleanout(s) nearest the building foundation shall be provided with a backwater prevention device. The cleanout(s) shall be installed in accordance with RVSD standards.

3.09 BACKWATER PREVENTION DEVICES

A. A backwater prevention device shall be required at every location where sanitary sewer piping exits a building/home. Multiple backwater prevention devices may be required for some homes/buildings. If multiple pipes that exit a building are within five feet of each other, only one BPD may be required.

B. All Property Owners shall install and maintain an Backwater Prevention Device (BPD) on any side sewer that is connected or is intended for connection to, the DISTRICT sewer system.

1. Side Sewer Installations or Alterations or Repairs: No person shall install, alter, or repair a side sewer that is connected, or is intended for connection to the DISTRICT sewer system without installing a BPD of the type and in the manner prescribed in these Specifications. Prior to installation of coupling when repairing side sewers a maximum spacing of 1/4” shall be left between the pipe ends to allow for proper installation of coupling.

2. Maintenance Requirements: BPDs and backwater valves shall be maintained by the Property Owner so as to provide for their continuing function as designed. BPDs shall be accessible at all times and shall be kept free from any obstructions including, but not limited to, rocks, soil, vegetation, grass, trees, bushes, plants, landscaping, concrete, asphalt, or

other ground coverings that may impair the function of and accessibility to the devices.

3. Elevation Requirements: BPDs shall be installed at an elevation that protects the property from damage and at least 6 inches below the lowest fixture unit in the building. The Property Owner is responsible to either:

   a. The Property Owner or Contractor is responsible to confirm that the backwater prevention device is at the proper elevation.

   b. If any subsequent modification of the property results in the BPD being at an improper elevation, the Property Owner or Contractor shall adjust the BPD to the proper elevation at their cost.

3.10 BACKWATER CHECK VALVES

A. Extendable backwater check valves shall be installed if the difference in elevation between the lowest fixture unit in the building and the backwater prevention device is less than six (6) inches.

B. Installation requirements for backwater check valves shall be determined by District or its appointed Representative for the given field conditions, and as shown in the Standard Drawings.

3.11 INTERCEPTORS

A. For commercial side sewers, grease, oil, and/or sand interceptors must be installed where required by the District or the Central Marin Sanitation Agency (CMSA) for proper handling of liquid wastes grease in excessive amounts, flammable wastes, sand, or other substances capable of causing Public nuisance, damage or hazards to structures, equipment, and personnel.

B. Sewer pipe where the side sewer exits the building to the connection with the interceptor, and where the side sewer exits the interceptor to the connection with the sewer main shall be under the jurisdiction of RVSD. A BPD shall be installed where the side sewer exits the building. A two-way clean-out shall be installed where the side sewer exits the interceptor. Cleanout shall be per RVSD's Standard Drawings.

3.12 EXISTING SEPTIC TANKS

A. When an existing building which is sewered by a septic tank is to be connected to the District public sewer system, the new side sewer shall be installed in accordance with these Specifications. A cleanout and backwater prevention device shall be installed at the building. If the existing sewer from the building to the septic tank is of a material as specified herein, is a minimum of four (4) inches in diameter, passes a hydrostatic or low-pressure air test, and passes a

B. television inspection, the existing sewer may be used as part of the new side sewer for the building.

C. All building plumbing outlets must connect to the side sewer and completely bypass the septic tank.

D. Removal of septic tanks after installation of a new side sewer connection to the District public sewer shall be in accordance with the requirements of Marin County Environmental Health Services, the California Department of Public Health, and the Uniform Plumbing Code.

3.13 EROSION CONTROL

A. The Contractor shall install vegetative erosion control, where required, per the requirements of Section 02270, EROSION CONTROL.

B. The District may require the installation of trench dams per the Standard Details.

3.14 SURFACE RESTORATION

A. The Contractor shall restore the area affected by its side sewer installation operations in kind and accordance with the requirements of any encroachment permits, Section 02050, DEMOLITION, Section 02900, PROTECTION OF TREES AND RESTORATION OF LANDSCAPING, and the Project Contract Documents.

3.15 TESTING AND TELEVISING

A. New side sewers and/or side sewer repairs shall be inspected in accordance with Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

B. New side sewers and/or side sewer repairs shall be tested with a low-pressure air or hydrostatic pressure test in accordance with Section 02735, SANITARY SEWER SYSTEM TESTING.

*****END OF SECTION*****

SECTION 02700

MANHOLES

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish and install manholes, complete with cast-in-place or precast bases, pipe connections, barrel and cone components, preformed joint sealant, grade rings, frames, covers, and other appurtenances shown on the Plans or specified in this Section.

B. Manholes shall be concentric type unless utility conflicts or other issues require the use of an eccentric cone.

C. Where new manholes are installed on existing piping, the pipe size and material entering the manhole shall match the existing piping.

1.02 RELATED SECTIONS

A. Section 02200, EARTHWORK

B. Section 02140, DEWATERING

C. Section 02145, SEWAGE FLOW CONTROL & BYPASSING

D. Section 02735, SANITARY SEWER SYSTEM TESTING Section 03300, CAST-IN-PLACE CONCRETE

E. Section 03600, GROUT

1.03 REFERENCE SPECIFICATIONS

ASTM C 150	Specification for Portland Cement
ASTM C 478	Specification for Precast Reinforced Manhole Sections
ASTM C 923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
ASTM D 4101	Specification for Molded Polypropylene
ASTM F 1759-97	Standard Practice for Design of High Density Polyethylene (HDPE) Manholes for Subsurface Applications

1.04 NOT USED

1.05 SUBMITTALS

A. Submittals shall be provided to the District to confirm that material to be used comply with information specified herein. No work shall proceed on any item specified herein until it has been submitted and favorably reviewed.

B. If allowed, the Contractor shall submit complete shop drawings for a precast manhole bases to the District, and shall receive favorable review prior to ordering the bases.

1.06 QUALITY ASSURANCE

A. After installation, the Contractor shall demonstrate that all manholes have been properly installed, level, with tight joints, at the correct elevations and orientations and that the backfilling has been carried out in accordance with the plans and these Specifications. Manhole testing shall be performed in accordance with Section 02735, SANITARY SEWER SYSTEM TESTING.

1.07 NOT USED

PART 2 - PRODUCTS

2.01 GENERAL

A. Manhole shall be of the size, shape, and depth as indicated on the Project Contract Documents or required by these Standard Specifications and Drawings, but manholes shall never be less than 4 feet-0 inches inside diameter with 5-inch thick walls.

2.02 MANHOLE BASES

A. Manhole bases shall be cast-in-place concrete, unless otherwise approved by the District.

B. Inlet and outlet pipe connections shall match the pipe diameter and material of the connecting sewer mains or side sewers.

C. Channels and shelves shall conform to the requirements of the Standard Drawings. Manhole channels shall be shaped to form a smooth transition of uniform cross- section from inlet pipes to the outlet pipe, both horizontally and vertically.

2.03 PRECAST CONCRETE COMPONENTS

A. Manhole shall be constructed of precast concrete manhole rings. Precast concrete rings shall be manufactured by a process that will produce a dense, homogeneous concrete ring of first quality.

B. Precast concrete sections shall conform to ASTM C478 unless otherwise modified in the Drawings.

C. The precast rings shall have a minimum wall thickness of 1/12 of the inner diameter of the manhole unless otherwise stated.

D. Precast manhole components shall be constructed of 5000 psi reinforced concrete (min) at 28 days using cement Type II portland cement as specified in ASTM C150.

E. All precast manhole components shall be H20 load rated.

F. Eccentric manholes, where required, shall be provided with steps. The manhole frame and cover and steps for eccentric manholes shall be positioned over the manhole shelf.

G. Pre-cast Bases

1. The use of pre-cast bases will require District approval. Precast manholes bases shall not be used in areas where the finished grade slope is greater than ten (10) percent.

    a. Flexible pipe connectors shall be cast into the base at the pre-cast plant to provide a tight seal between base and pipe.

    b. Channels and shelf shall be cast at the pre-cast plant. The Contractor shall field verify size, location, and depth of any existing pipes prior to ordering materials.

H. Precast Concrete Components manufacturer shall be per the District's Approved Materials List.

2.04 CONCRETE EXPANSION RINGS

A. The manhole frame and cover shall be set to such an elevation that the top of the cover is placed at the proposed street grade or the elevation shown on the drawings, with a minimum of one 6-inch precast riser section placed between the top of the reducing slab section and the iron manhole frame. Maximum height of extension rings shall be 12 inches in paved areas, and in unpaved areas only one extension ring of 6 inches shall be used.

2.05 FRAME AND COVERS

A. Manhole frame and covers shall be per the District's Approved Materials List.

B. Castings for manhole frames and covers shall conform to the requirements of ASTM A48, Class 30B Heavy Duty cast iron construction. Cast-iron covers and frames shall be heavy traffic type, H-20 load rated.

C. Frame and cover size, design, and design shall be as shown in the Standard Drawings. See SD-10

D. Castings shall be machined flat bearing surface, non-rocking removable lid, special non-skid cover design.

E. Manhole covers shall be sealed to prevent escape of odors. All castings shall be dipped in asphalt paint.

2.06 JOINTS

A. Joints gaskets shall be per the District's Approved Materials List.

B. Joints between sections shall have a preformed flexible plastic sealing gasket installed between the tongue and groove joint to make a watertight joint.

C. Joint gasket compound shall be suitable for use with wastewater and shall conform to Federal Specification SS-S-00210 (GSA-FSS), Type 1, Rope Form, and hydrostatic pressure tests of ASTM C443.

D. External manhole joint sealant tape shall be per the District's Approved Materials list.

2.07 MORTAR AND GROUT.

A. Mortar for finishing and sealing shall be in accordance with Section 03600, GROUT.

2.08 WATERPROOFING

A. All new manholes shall be provided with a minimum of two coats of waterproofing.

B. Waterproofing products shall be per the District's Approved Materials List.

2.09 FLEXIBLE PIPE CONNECTOR

A. The flexible connector shall be per the District's Approved Materials List.

B. Pipe connections to precast manhole bases shall be with a flexible pipe connection.

C. Flexible pipe connectors shall be cast into the precast base at the precast plant. The connector shall assure that a seal is made between the connector and the structure wall by casting the connector integrally with the structure wall during

the manufacturing process in a manner that it will not pull out during pipe coupling.

D. Flexible connectors shall be molded from EPDM compound engineered to conform with the requirements of section 4.1.1 of ASTM C-923, latest edition.

E. Flexible connector shall meet or exceed all material and testing requirements of ASTM C923.

F. All hardware shall be Type 316 stainless steel.

G. The flexible connector shall be sized specifically for the type of pipe being used and shall be installed in accordance with the recommendations of the manufacturer. The Contractor shall verify any existing pipe size, material, and locations prior to ordering materials.

2.10 HDPE MANHOLES

A. In non-paved areas that are not subject to vehicle loading and where construction access is difficult, the District may approve the use of HDPE manholes in lieu of the concrete products specified herein.

B. HDPE manholes shall be per the District's Approved Materials List.

C. HDPE manholes shall be fabricated from materials made from high-density polyethylene resin compound with a minimum cell classification of 345464C according to ASTM D 3350

D. HDPE manholes shall be designed and installed in accordance with ASTM F 1759- 97.

E. Install ballast consisting of CLSM or concrete and weighing at least one and one- half (1-1/2) times the calculated buoyant force on the manhole assuming the groundwater surface is one (1) foot below finish grade shall be provided. A cast-in- place base weighing 1-1/2 times the calculated buoyant force may also be used in lieu of the ballast.

2.11 TEMPORARY PLUGS

A. Temporary plugs shall be of the mechanical expanding type, not pneumatic, and shall be permanently marked in a manner acceptable to the District with the Contractor's identification or initials.

PART 3 - EXECUTION

3.01 GENERAL

A. Work shall meet or exceed the requirements of these Specifications unless applicable requirements of an agency having jurisdiction (including the terms and conditions of an encroachment permit issued by a city or county) are greater, in which case the greater requirements shall govern.

B. An All-Weather Access Road as specified in this Section is required for access to all structures in off-road locations (e.g., easements).

3.02 INSTALLATION

A. Temporary Plugs

1. Mechanical expanding type temporary plugs shall be installed and removed as specified below in the presence of the District or its appointed Representative. Plugs shall be secured by tethering with a one-quarter (1/4) inch nylon rope attached to the top of a wood two (2) feet x four (4) feet of sufficient length to extend from the shelf to a point in the throat within six (6) inches of the underside of the cover.

a. When a manhole exists or a new manhole is constructed at the beginning of a new main extension, a temporary plug shall be installed at the inlet of the new pipe at the existing manhole or new manhole.

b. When a new main extension begins at an existing rodding inlet or stub, a temporary plug shall be installed on the outlet of the first manhole upstream from the beginning of the new main extension.

B. Cast-in-Place Manhole Bases:

1. Base shall be poured on a well compacted structural bedding as specified in Section 02200, EARTHWORK.

a. Where soft ground is present and directed by the District or the District's Representative, over-excavation shall be performed as specified in Section 02200, EARTHWORK.

2. Cast-in-place manhole bases shall be poured to the dimensions shown on the Standard Drawings. If the excavation extends beyond the dimensions shown on the Standard Drawings, the Contractor shall construct forms and pour the base to the specified dimensions.

3. A joint forming ring shall be used to form a level joint groove in the manhole base while the concrete is fresh to receive the first precast barrel

section. The metal forming ring may be removed as soon as the concrete has set sufficiently to eliminate any slump in the joint groove.

4. Manhole channels shall be shaped to form a smooth transition from inlet pipes to the outlet pipe, both horizontally and vertically.

C. Precast Manhole Bases:

1. Precast manhole bases shall be placed to the lines and grades shown on the Standard Drawings and in the Project Contract Documents as an integral part of the pipe laying operation on well compacted structural bedding as specified in Section 02200, EARTHWORK.

   a. Where soft ground is present and directed by the District or its Representative, over-excavation shall be performed as specified in Section 02200, EARTHWORK.

2. Inlet and outlet pipe connections at precast bases shall be with flexible pipe connectors, as specified herein, cast into the base by the precast manufacturer.

D. Setting Precast Barrel and Cone Sections

1. If manhole base is cast-in-place, then no precast barrel or cone shall be placed within 24 hours of the base being poured.

2. All joint surfaces of precast manhole bases, barrel and cone sections shall be thoroughly cleaned and dried prior to setting, and shall be sealed with a preformed plastic sealing gaskets as specified herein.

3. Apply one (1) coat of primer to clean, dry joint surface (both tongue and groove) and allow the primer to dry. Remove the paper wrapper from one side of the gasket, retaining the outside paper in place to protect the gasket and assure against stretching. Place the plastic gasket strip in the joint, forming a continuous gasket around the entire circumference of the manhole joint. Remove the paper wrapper from the exposed side of the gasket and place the next manhole component.

4. Care shall be taken in the handling of barrel and cone sections after the plastic gasket has been affixed to avoid displacing the gasket or contaminating the joint or gasket with dirt or other foreign material. Any displaced or soiled gaskets shall be removed and replaced.

5. Care shall be taken to properly align the manhole section with the previously set section before it is lowered into position.

6. During cold or wet weather, the joint surfaces shall be heated with hot air until ice, frost, and moisture are removed and surface to be primed is dry and warm. Hot air shall also be passed over plastic gasket strips

immediately prior to attaching them to joint surfaces and immediately prior to setting the section.

7. After the shaft is in place, the joint gasket shall be trimmed smooth with a sharp tool on the inside of the manhole. The interior of the joint shall be grouted/mortared after the joint is trimmed.

E. Manhole frames and covers shall not be set to final grade until the pavement has been completed, unless otherwise approved by the District. Precast concrete grade rings shall be installed as shown in the Standard Drawings. The completed manhole frame and cover shall conform to finished pavement within $1/8^{th}$ of an inch. Paving around the manhole shall be in accordance with local jurisdiction requirements. Openings in manholes shall be protected from construction loads, debris, and unauthorized entry.

F. When new piping is installed in existing structures, the Contractor shall accurately position core-drilled openings in the concrete as shown on the job plans and Standard Drawings or otherwise directed by the District or its appointed Representative. Openings shall be of sufficient size to permit a final alignment of pipelines and fittings without deflection of any part and to allow adequate space for satisfactory placement of mechanical seals or packing with non-shrink grout where the pipe passes through the wall to ensure the resulting structure is watertight. Before placing the non-shrink grout, concrete surfaces shall be sandblasted, thoroughly cleaned of sand and any other foreign matter, and coated with epoxy bonding compound. After connection of the new inlet pipe, the Contractor shall rechannel the inside of the existing manhole base to provide a smooth flow channel to the new exit pipe.

G. The throat shall be constructed using appropriately sized reinforced concrete grade rings to bring the manhole cover to finished grade surface. No plastic sealing gaskets shall be used for jointing grade or extension rings. The extension rings shall have a finished mortar applied from the cone to the base of frame smooth finish.

H. Manhole top blocks shall be poured against forms constructed to the specified dimensions shown in the Standard Drawings.

I. All manholes located on slopes steeper than 3:1 (horizontal to vertical) in easement areas shall be constructed with a reinforced concrete, reinforced concrete masonry unit or interlocking masonry unit retaining wall as shown on the Standard Drawings.

J. All manholes shall be tested in accordance with Section 02730, SANITARY SEWER SYSTEM TESTING.

K. Temporary covers shall be used during construction until permanent frames and covers are installed. The Contractor shall provide continuous access for the District maintenance forces to the structure at all times.

3.03 RECONSTRUCTION OF EXISTING STRUCTURES

A. General

1. Reconstruction work on any particular structure including reconstruction during paving projects shall be diligently prosecuted so as to be completed within three (3) calendar days after work is begun on that particular structure. The Contractor shall provide continuous access for the District maintenance forces to the structure at all times.

2. When removing existing structures, the Contractor shall use a debris catcher and take precautions to ensure that no foreign material enters the structure or the downstream system. Before any work is started, the base shall be covered with a plywood ("false bottom") and then the false bottom shall be covered with a drop cloth of heavy canvas. The drop cloth and false bottom shall be kept in place during the work to catch debris, and upon completion, shall be removed with the collected debris. No debris shall enter the downstream system or be allowed to remain in the manhole. The debris catcher shall be per the District's Approved Materials List.

B. Structure Adjustments and Repairs

1. All workmanship and materials for structure adjustments shall conform to the requirements of these Standard Specifications. In the case of existing brick or cast-in-place concrete structures, repair or adjustments shall be accomplished with materials in kind or with precast elements as specified herein.

2. Existing structure precast elements, adjustment rings, frames, and covers removed for adjustments and/or repairs may be reinstalled only when such undamaged items are permitted by the District or its appointed Representative for reuse.

3. Manhole adjustments shall be accomplished by one of the methods specified below or as detailed on the job plans.

a. Upward adjustments of manholes to finish grade surface may be accomplished with reinforced concrete grade rings, or formed concrete when the adjusted manhole throat will not exceed twelve (12) inches in height. When adjustments are made that position the bottom of the cast iron manhole frame above the existing concrete top block, the top block shall be reconstructed in accordance with the requirements of the Standard Drawings.

b. Whenever upward adjustment of new manholes would result in a completed manhole throat section exceeding twelve (12) inches in height, the upper manhole section, including the top block and cone section, shall be removed and the adjustment shall be made by reconstructing the structure using manhole barrel and cone sections, grade rings and frames and covers in accordance with the requirements of these Specifications and the Standard Drawings.

c. Downward adjustments of manholes shall be accomplished by removal of existing grade or extension rings and cone and barrel sections as required, and reconstructing the structure using manhole barrel and cone sections, grade rings and frames and covers in accordance with the requirements of these Specifications and the Standard Drawings.

3.04 TESTING

A. All new manholes shall be tested in accordance with Section 02735, SANITARY SEWER SYSTEM TESTING.

*****END OF SECTION*****

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SECTION 02720

MANHOLE REHABILITATION

PART 1 – GENERAL

1.01 SUMMARY

A. This section covers the work necessary to furnish, prepare surfaces, and install a lining system for rehabilitation of concrete and/or brick sanitary sewer manholes.

B. Sanitary sewer manholes shall be rehabilitated using one of the following methods:

1. Cementitious lining with calcium aluminate mortar

2. Epoxy or Polyurethane Lining

C. Lining material shall be applied to all concrete and/or brick and mortar surfaces within the manhole, including the cone, walls, shelf, base, and invert.

D. Where replacement of the manhole frame and cover is required, the frame and cover shall be replaced prior to lining operations.

E. Reference is made to the “Applicator” throughout this specification. Applicator shall be the Contractor or subcontractor who is applying the manhole lining.

1.02 RELATED SECTIONS

1.03 REFERENCE SPECIFICATIONS

ASTM C 94	Standard Specification for Ready-Mixed Concrete
ASTM C 109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C 157	Standard Test Method for Length Change of Hardened Hydraulic- Cement Mortar and Concrete
ASTM C 234	Standard Test Method for Comparing Concretes on the Basis of the Bond Developed with Reinforcing Steel
ASTM C 267	Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes
ASTM C 348	Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars

ASTM C 469	Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
ASTM C 496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C 642	Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
ASTM C 666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear

1.04 EXPERIENCE REQUIREMENTS

A. The applicator shall be certified by the lining manufacturer as specified herein.

1.05 SUBMITTALS

A. The Contractor shall provide submittals for items specified herein to the District for review and approval prior to ordering materials.

B. The following items shall be submitted:

1. Technical data sheet on each product used, including independent third party ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.

2. Material Safety Data Sheets (MSDS) for each product used.

3. Project specific guidelines and recommendations.

4. Qualification of Applicator:

a. Manufacturer certification that Applicator has been trained and approved in the handling, mixing and application of the products to be used.

b. Certification by the protective lining manufacturer that the equipment to be used for applying the products has been approved and Applicator personnel have been trained and certified for proper use of the equipment.

c. Five (5) recent references of Applicator indicating successful application of the manhole lining material specified herein.

5. Design details for any additional ancillary systems and equipment to be used in site and surface preparation, application, and testing.

6. Contractor and Manufacturer Warranty information.

1.06 QUALITY ASSURANCE

A. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, and SSPC standards and the protective lining manufacturer's recommendations.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Materials are to be kept dry, protected from weather and stored under cover.

B. Protective lining materials are to be stored between 50 degrees F and 90 degrees F. Do not store near flame, heat, or strong oxidants.

C. Protective lining materials are to be handled according to their material safety data sheets.

D. Materials shall be manufactured within 6 months of application.

1.08 SITE CONDITIONS

A. Applicator shall conform with all local, state, and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.

B. For manholes that have not been inspected by the District or its appointed Representative, as indicated in the Drawings, the Contractor shall inspect the manholes and alert the District or its appointed Representative immediately if the specified rehabilitation methods are not feasible, or if the frame and cover requires replacement and/or the manhole channel and base requires repair. Frame and cover and channel and base repairs not shown in the Drawings shall be performed where directed by the District.

1.09 WARRANTY

A. The Contractor and the Manufacturer shall provide a guarantee of workmanship, materials, installation and completed product for a period of ten (10) years from the date of substantial completion of the project. The Contractor and Manufacturer shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said ten (10) year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the District.

PART 2 – PRODUCTS

2.01 INFILTRATION CONTROL MATERIALS

A. Prior to applying repair materials, all leaks present in the manhole shall be stopped by the use of either chemical foam grout injection or a quick setting hydraulic cement specifically formulated for leak control.

1. Chemical foam grout injection shall be Avanti 202, or approved equal.

2. Hydraulic cement shall meet the following requirements:

Hydraulic Cement Minimum Requirements		
Compressive Strength	ASTM C109	>1000 psi, 1hr. >2500 psi, 24 hrs.
Sulfate Resistance	ASTM C267	No weight loss after 15 cycles @ 2000 ppm
Freeze/Thaw	ASTM C666 "Method A"	100 cycles
Pull Out Strength	ASTM C234	14,000 lbs.
Set Time	<1.0 minute	

2.02 REPAIR MATERIALS

A. Repair materials shall be used to fill voids, structurally reinforce, and/or rebuild surfaces, as determined necessary by the District or its appointed Representative and lining applicator. Repair materials must be compatible with the specified manhole lining and shall be applied in accordance with the manufacturer's recommendations.

B. Repair materials shall be used to return manhole to its original inside diameter.

C. The following products may be accepted and approved as compatible repair basecoat materials for lining rehabilitation as specified herein:

1. 100% solids, solvent-free epoxy grout compatible with the lining system. The epoxy grout manufacturer shall provide instructions for trowel or spray application and for epoxy toplining procedures.

2. Factory blended, rapid setting, high early strength, non-shrink repair mortar that can be trowelled or pneumatically spray applied. Such repair mortars should not be used unless their manufacturer provides information as to its compatibility with the lining material. Project specific submittals should be provided including application, cure time and surface preparation procedures which permit optimum bond strength with the lining system.

2.03 WATER

A. Water used to mix product shall be clean and potable. Questionable water shall be tested by a laboratory per ASTM C94 procedure. Potable water need not be tested.

2.04 LINING MATERIAL

A. Method 1: Cementitious Lining With Calcium Aluminate Mortar

1. Cementitious liner material shall be per the District's Approved Materials List, or approved equal:

2. Cementitious liner shall be applied to a thickness of ½- inch minimum. The thickness minimum is in addition to any repair material required.

3. Cementitious lining material shall be composed entirely of calcium aluminates. It shall be a pre-packaged ready to use, fiber reinforced, high strength wet shotcrete material designed for rehabilitation of deteriorated concrete and brick structures. It shall be a mortar that is designed to coat both new and existing municipal wastewater structures including manholes, lift stations, wet wells, etc. It shall be designed specifically to provide an abrasion and corrosion-resistant, protective lining that can withstand severe biogenic corrosion caused by the hydrogen sulfide (H_2S) found in wastewater environments.

4. The chemical composition of the cement portion as well as the aggregates of the mortar mix shall be as follows:

Chemical Analysis of Main Constituents

Al_2O_3	CaO	$FeO + Fe_2O_3$	SiO_2
39% - 47%	33% - 39%	6% - 15%	4% - 9%

5. The cementitious lining material shall meet the following requirements:

TYPICAL MATERIAL PROPERTIES

TEST/ PROPERTY		24 HRS	7 DAYS	28 DAYS
ASTM C 109	Compressive Strength, psi	>5,500	>6,000	>7,000
ASTM C 348	Flexural Strength, psi	>900	>1,100	>1,300
ASTM C 157	Shrinkage after 28 day immersion, %	< 0.04	< 0.05	< 0.07
ASTM C 496	Splitting Tensile Strength, psi	>550	>600	>700
ASTM C 882	Bond Strength by Slant Shear, psi	>2500		>2500
ASTM C 666	Freeze-Thaw – 300 cyc, Rel. Dyn. Modulus	102		
ASTM C 642	Volume of Permeable Voids (40 days), %	15		
ASTM C 642	Apparent Density (40 days)	2.74		
ASTM C 469	Modulus of Elasticity (28 days), ksi	>5,000		

B. Method 2: Epoxy or Polyurethane Lining

1. Epoxy or polyurethane lining material shall be per the District's Approved Materials list.

2. Epoxy lining system shall be a 100 percent solids, solventless two-component epoxy resin system thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance acceptable to these specifications.

Epoxy Liner Properties

Product type	Amine cured epoxy
Color	Light Blue - standard
Solids Content (vol %)	100
Mix Ratio, Part A, resin. Part B, hardener	3:1 by volume
Compressive Strength, psi	18,000
Tensile Strength, psi	7,600
Tensile Elongation, %	1.5
Flexural Strength psi	13,000
Hardness, Type D	80
Bond Strength - Concrete	>Tensile Strength of Concrete
Chemical Resistance to:	
Sulfuric Acid, 10%	Immersion Service
Sodium Hydroxide, 20%	Immersion Service
MEK	Incidental Contact

3. Polyurethane lining shall be a self-priming, 100 % solids, Zero VOC, fast-setting, corrosion, and abrasion resistant polyurethane lining system.

Polyurethane Liner Properties

Compressive strength	ASTM D 695	> 18,000 psi
Tensile strength	ASTM D 638	> 7,450 psi
Tensile Elongation	ASTM D 638	< 4%
Bond (Concrete)	ASTM D7234	> 200 psi
Flexural Strength or Substrate Failure	ASTM D790-03	> 12,000
Bond (Steel)	ASTM D4541	> 1,600 psi
Density		87 ± pcf
Chemical Resistance:	ASTM D543	
Severe Municipal Sewer:	All types of service	
Successful Pass:	Sanitation District of L.A. County Lining Evaluation Study or SSPWC 211-2	

4. Epoxy and/or polyurethane lining system shall be applied to minimum and average wet film thicknesses of 125 mils.

2.05 PROTECTIVE LINING APPLICATION EQUIPMENT

A. Application equipment shall be specifically designed, or approved for use by the protective lining manufacturer.

PART 3 – EXECUTION

3.01 ACCEPTABLE APPLICATORS

A. Repair mortar applicators should be trained to properly apply the cementitious mortar according to manufacturer's recommendations.

B. Lining material must be applied by a Certified Applicator of the protective lining manufacturer and according to manufacturer specifications.

3.02 EXAMINATION

A. Appropriate actions shall be taken to comply with local, state, and federal regulatory and other applicable agencies with regard to environment, health, and safety.

B. Manhole lining material shall be installed after all manhole modifications are completed.

C. Installation of the protective lining shall not commence until the concrete substrate has properly cured and been prepared in accordance with these specifications.

D. Temperature of the surface to be coated should be in accordance with the manufacturer's recommendations.

3.03 SURFACE PREPARATION

A. Applicator shall inspect all surfaces specified to receive a protective lining prior to surface preparation. Applicator shall notify District or its appointed Representative of any noticeable disparity in the surfaces which may interfere with the proper preparation on application of the repair mortar and protective lining.

B. Any leaks or infiltration shall be stopped using infiltration control materials in accordance with manufacturer's recommendations.

C. Any existing ladder rungs/steps inside the manhole shall be cut and removed flush with the existing wall prior to application of repair materials.

D. Surface preparation method(s) should be based upon the conditions of the substrate and the requirements of the protective liner to be applied.

E. All surfaces shall be repaired as required by the manhole protective lining system in the intended service condition.

F. Surfaces to receive protective liner shall be cleaned and abraded to produce a sound concrete surface with adequate profile and porosity to provide a strong bond between the protective lining and the substrate. This may be achieved with a high pressure water cleaning using equipment capable of 5,000 psi at 4 gpm. Other methods such as high pressure water jetting (refer to NACE Standard No. 5/SSPC-SP12), abrasive blasting, shotblasting, grinding, scarifying, or acid etching may also be used. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease, or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface that is not excessively damaged.

G. A mild chlorine solution may be used to neutralize the surface to diminish microbiological bacteria growth prior to final rinse and lining.

H. The Applicator shall test the pH of the prepared surfaces after cleaning but prior to application of the lining to verify that it is in accordance with the recommendations of the lining manufacturer. If it is not, then the Applicator shall perform additional surface preparation per the manufacturer's recommendations until the pH is within the manufacturer's recommended range.

I. The moister content of the prepared surface shall be in accordance with the lining manufacturer's recommendations. The Applicator shall add water or dry the surface as required.

J. All surfaces shall be inspected during surface prep and before the repair mortar is applied.

3.04 APPLICATION OF REPAIR MATERIALS

A. Repair materials shall meet the specifications contained herein. The materials shall be trowel or spray applied utilizing proper equipment on to specified surfaces. The material thickness shall be such that the new material surface matches the manholes original inside diameter, or as specified by the District or its appointed Representative according to manufacturer's recommendations.

B. Cementitious repair materials shall be troweled to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the protective lining. No bugholes or honeycomb surfaces should remain after the final trowel procedure of the repair mortar.

C. The repair materials shall be permitted to cure according to manufacturer recommendations.

D. Application of the repair materials, if not performed by the lining certified applicator should be inspected by the protective lining manufacturer's representative or certified applicator to ensure proper finishing for suitability to receive the specified lining.

E. After abrasive blast has been performed, all surfaces shall be inspected for remaining laitance prior to protective lining application. Any evidence of remaining contamination or laitance shall be removed by additional abrasive blast, shotblast or other approved method. If repair materials are used, refer to these specifications for surface preparation. Areas to be coated must also be prepared in accordance with these specifications after receiving a cementitious repair mortar and prior to application of the manhole lining material.

F. All surfaces should be inspected during and after preparation and before the protective lining is applied.

3.05 INVERT/BENCH REPAIR:

A. After all preparations have been completed, remove all loose material and wash wall again.

B. Any bench, invert, or service line repairs shall be made at this time using the quick setting patching mix and shall be used per manufacturer's recommendations.

C. Invert repair shall be performed on all inverts with visible damage or where infiltration is present or when vacuum testing is specified. After blocking flow through manhole and thoroughly cleaning invert, the quick setting patch material shall be applied to the invert in an expeditious manner. The material shall be troweled uniformly onto the damaged invert at a minimum thickness of ½ inch at the invert extending out onto the bench of the manhole sufficiently to tie into the structural monolithic liner to be spray applied. The finished invert surfaces shall be smooth and free of ridges. Repair material shall allow for the flow to be re- established in the manhole within 30 minutes after placement of the material.

3.06 APPLICATION OF LINING

A. Application procedures shall conform to the recommendations of the protective lining manufacturer, including material handling, mixing, environmental controls during application, safety, and equipment.

B. Where spray equipment is required, the spray equipment shall be specifically designed to accurately ratio and apply the specified protective lining materials and shall be regularly maintained and in proper working order.

3.07 INSPECTION

A. Cementitious Lining With Calcium Aluminate Mortar

1. For each manhole rehabilitated, the Contractor shall perform thickness testing of the mortar lining at various locations prior to the mortar setting. The method of measurement shall be approved by the District or its appointed Representative.

2. Four (4) cubes or cylinders shall be cast each day or from every pallet of product used, and shall be properly packaged, labeled, and returned to manufacturer for testing in accordance with the owner's or manufacturer's directions for compression strength per ASTM C109 procedure.

B. Epoxy or Polyurethane Lining System:

1. During application a wet film thickness gage, such as those available through Paul N. Gardner Company, Inc. meeting ASTM D4414, Standard Practice for Measurement of Wet Film Thickness of Organic Linings by Notched Gages, shall be used to ensure a monolithic lining and uniform thickness during application.

2. For epoxy and polyurethane lining systems, after the protective lining has set hard to the touch it shall be inspected with high-voltage holiday detection equipment. An induced holiday shall be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the lining for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday. All detected holidays shall be marked and repaired by abrading the lining surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective lining material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective lining manufacturer's recommendations.

3. Measurement of bond strength of the protective lining to the substrate shall be made at one (1) out of every five (5) manholes where protective lining is installed. Bond strength shall be measured in accordance with ASTM D4541 and ASTM D7234. Pull tests with results between a minimum 150 psi and 200 psi shall be acceptable if more than 50% of the subsurface is adhered to the back of the dolly. A test result can be discarded, as determined by the District or its appointed Representative, if there is a valid non-statistical reason for discarding the test results as directed by Sections 8.4 and 8.5 of ASTM D4541 and ASTM 7234. If any test fails, a minimum of three additional locations in the section of the failure shall be tested, as directed by the District or its appointed Representative. If any of the retests fail, all loosely adhered or un-adhered liner in the failed area, as determined by the District or its appointed Representative, shall be removed and

replaced at the Contractor's expense. Repairs shall be made by Applicator in strict accordance with manufacturer's recommendations.

C. A final visual inspection shall be made by the District or its appointed Representative. Any deficiencies in the finished lining shall be marked and repaired according to the lining manufacturer's written directions.

D. The manhole may be put into service no sooner than recommended by the lining manufacturer.

3.08 SAFETY

A. When working inside manholes and sewer lines, exercise caution and comply with CAL/OSHA requirements when working in the presence of hydrogen sulfide. Contractor is warned that the existing sewers and the structures associated with the project contain high levels of hydrogen sulfide gas, a natural gaseous by-product of sanitary sewage. Take all the necessary precautions, such as portable hydrogen sulfide detectors per CAL/OSHA requirements, to ensure that the environment is safe for those at the work site.

3.09 TESTING

A. All rehabilitated manholes shall be tested in accordance with Section 02735, SANITARY SEWER SYSTEM TESTING.

*****END OF SECTION*****

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SECTION 02735

SANITARY SEWER SYSTEM TESTING

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor, materials, tools, and equipment necessary to perform acceptance testing for completed sewer pipelines and manholes.

B. The Contractor shall notify the Inspector at least one (1) business day prior to any testing work. All final testing of sewer lines shall be done in the presence of the Inspector.

C. The Contractor shall complete testing of sewer piping and manholes as required in this Section prior to performing post installation television inspection.

D. In new subdivisions or jobs involving potential conflicts with other new underground utilities, preliminary tests may be conducted at the discretion of the Contractor or Inspector at any time. The final test for acceptance will be made after the installation of all underground facilities, curb, gutter, lateral sewers, and subbase, but prior to placing the final layer of paving.

E. If deficiencies are identified during testing, the Contractor shall re-test after the deficiencies have been corrected.

1.02 RELATED SECTIONS

A. Section 02200, EARTHWORK

B. Section 02300,CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS

C. Section 02315, CURED-IN-PLACE PIPE (CIPP)

D. Section 02330, HORIZONTAL DIRECTIONAL DRILLING (HDD)

E. Section 02345, PIPE BURSTING Section 02365, PIPE REAMING Section 02600, SIDE SEWERS Section 02700, MANHOLES Section 15050, GENERAL PIPING

F. Section 15055, VITRIFIED CLAY PIPE (VCP)

G. Section 15061, DUCTILE IRON PIPING

H. Section 15064, POLYVINYL CHLORIDE (PVC) PIPE

I. Section 15066, HIGH DENSITY POLYETHYLENE (HDPE) PIPE

1.03 REFERENCE SPECIFICATIONS

A. Commercial Standards:

ASTM C 969	Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 1091-03a	Test Method for Hydrostatic Infiltration Testing of Vitrified Clay Pipe Lines
ASTM F 1417	Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
AWWA C600-54T	Installation of Ductile Iron Water Mains and Their Appurtenances
ASTM D 3034	Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F 679	Specification for Poly (Vinyl Chloride) (PVC) Large- Diameter Plastic Gravity Sewer Pipe and Fittings
Uni-Bell, B-6	Recommended Practice for low Pressure Air Testing of Installed Sewer Pipe

1.04 NOT USED

1.05 NOT USED

1.06 NOT USED

1.07 NOT USED

PART 2 - PRODUCTS

2.01 GENERAL

A. Mandrels, temporary plugs, low-pressure testing equipment, and all other necessary materials shall be provided by the Contractor, subject to the District's approval. No materials shall be used which would be injurious to the public, personnel, adjacent improvements, or the pipeline.

2.02 PRESSURE GAUGES

A. Pressure gauges shall be laboratory-calibrated test gauges and shall be recalibrated by a certified laboratory prior to the leakage test. Gauge shall be easy to read in no more than one (1) pound per square inch (psi) increments and have a maximum full-scale range of five (5) psi.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall clean pipelines in accordance with Section 02300 CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS prior to performing testing.

B. After testing is performed, as specified herein, the Contractor shall perform post-installation television inspection of pipelines per Section 02300 CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS.

C. The Contractor shall perform pipeline testing after submittal of compaction reports demonstrating compliance with the backfill compaction requirements included in Section 02200, EARTHWORK and before performing post installation television inspections.

D. Work shall meet or exceed the requirements of these Specifications unless applicable requirements of an agency having jurisdiction (including the terms and conditions of an encroachment permit issued by a city or county) are greater, in which case the greater requirements shall govern.

3.02 PIPE OVALITY AND joint displacement/Deflection TESTING

A. PVC and HDPE pipe eight (8) inches in diameter or larger shall be tested for deflection, joint displacement, or other obstruction by passing a rigid mandrel through the pipe. Deflection shall be tested after submittal of daily compaction reports demonstrating compliance with, but prior to, permanent resurfacing.

B. The mandrel shall be a full circle, rigid, non-adjustable, an odd-numbered leg (9 leg minimum), approved by the Engineer as to design and manufacturer. Mandrel size shall meet the minimum requirements set forth in ASTM D 3034 and ASTM F 679. The circular cross section of the mandrel shall have a diameter of at least ninety five percent (95%) of the specified average inside diameter of the pipe and the minimum length of the circular portion of the mandrel shall be equal to the nominal diameter of the pipe.

C. Where obstructions and excessive deflection are encountered by the mandrel, the Contractor shall remove, replace, and retest the deficient section. Re-rounding will not be allowed.

3.03 LEAKAGE TESTING FOR GRAVITY SEWER PIPELINES

A. All gravity lines shall be tested with air as the test medium, unless otherwise approved by the District.

B. The Contractor shall test the air tightness of all new or rehabilitated gravity sanitary sewer pipelines. Testing shall be performed in the presence and under the direction of the District or its appointed Representative.

1. PVC piping shall be tested in accordance with Uni-Bell PVC Pipe Association, B-6 Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe, latest edition and as specified herein.

2. VCP piping shall be tested in accordance with ASTM C828-06, Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines and the requirements specified herein.

3. HDPE piping shall be tested in accordance with ASTM F 1417, Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.

4. Ductile Iron pipe shall be tested as specified herein.

C. Each section of new sewer and its appurtenant connected laterals shall be tested between successive manholes or structures by plugging and bracing all openings in the sewer lines. If any leaks are found, the air pressure shall be released, the leaks eliminated, and the test procedure re-started.

D. The pipeline shall be thoroughly cleaned prior to testing.

E. Air testing sewer mains, particularly larger diameter mains, can be very dangerous due to the very large forces developed. The Contractor shall be fully responsible and take all precautions necessary to ensure the safety of their workers. All plugs shall be adequately braced and restrained to support the full load developed. No workers shall be allowed in the excavation or manhole while the line is under pressure. The Contractor shall make provisions for reading the pressure at the ground surface and for safely releasing the air pressure without entering the manhole or excavation.

F. The following procedure shall be used for air testing:

1. Plug all pipe outlets with suitable test plugs. Brace each plug securely.

2. If the pipe to be tested is submerged in groundwater, insert a pipe probe by boring or jetting into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the backpressure due to groundwater submergence over the end of the probe. All gauge pressures in the test shall be increased by this amount.

3. Add air slowly to the portion of the pipe being tested until the internal pressure is raised to 4.0 psig.

4. Check exposed pipe and plugs for abnormal leakage by coating with a soap solution. If any leakage is observed, bleed off air and make necessary repairs.

5. After an internal pressure of 4.0 psig is obtained, allow at least two (2) minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure. After two (2) minute period, disconnect the air supply.

6. Begin the test period. In no case shall the air pressure within the line be less than four (4) pounds per square inch at the beginning of the test period.

7. Main Sewers:

   a. If the pressure drop during the required test period equal to or less than 1 psi (6.9 kPa), the line has passed. If the pressure drop is greater than 1 psi (6.9 kPa) during the test time, the line has failed the test. Side Sewers: If the pressure remains constant during the test period, the line has passed. If the pressure drops during the test time, the line has failed the test.

   b. The required test time shall be based on the diameter and length of pipe to be tested and in accordance with the following, or 10 minutes, whichever is greater:

Minimum Test Time for Various Sewer Main Pipe Sizes	
Nominal Pipe Size (inches)	Test Time (min/100 ft)
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
39	6.6
42	7.3
48	8.5

c. At the District's option, one half of the test time specified above may be used with a maximum pressure drop of 0.5 psi (3.45kPa), but in no case will a test time of less than 10 minutes be allowed.

8. Side Sewers: Side sewers shall be tested for a minimum period of ten (10) minutes. If the pressure remains constant during the test period, the line has passed. If the pressure drops during the test time, the line has failed the test.

G. Hydrostatic testing of gravity pipelines may be performed in lieu of air testing if approved by the District, testing shall be in accordance with the following procedures:

1. After installation of new sewer pipeline it shall be thoroughly cleaned prior to pressure testing. A section of sewer shall be prepared for testing between two structures by plugging the inlet side of the discharge manhole and all openings in the upstream manhole except the discharge opening. All plugs shall be properly braced against the manhole wall to withstand the forces of the test in order to prevent loss in the event of a failure.

2. The section of the piping shall be tested by filling it with water to an elevation ten (10) feet above the top of pipe at the upstream end of the test section, or ten (10) feet above the existing groundwater elevation, whichever is greater. If the water level is maintained for a minimum of fifteen (15) minutes, the line has passed.

H. When leakage exceeds the amount allowed by the specifications, the Contractor shall locate the leaks, submit a repair procedure for the District review, make the necessary repairs, and re-test the segment at no additional cost to the District.

3.04 LEAKAGE TESTING FOR GRAVITY CURED-IN-PLACE PIPE (CIPP)

A. New CIPP shall be tested for leakage using the air test method described above.

B. Time for a one (1) psi pressure drop shall be at least ten (10) minutes or as approved by the District or its appointed delegate

C. The Contract may substitute a hydrostatic test in lieu of the exfiltration test if approved by the District or its appointed Representative.

1. Contractor shall perform the hydrostatic test as specified in ASTM F1216.

2. The allowable water exfiltration shall not exceed the limits stated in ASTM F1216 for the pipe to be accepted as watertight.

D. If the lined pipe segment does not meet the requirements of the exfiltration test, the Contractor shall repair or replace and retest the lined pipe segment so that it meets the requirements at no additional cost to the District.

3.05 LEAKAGE TESTING FOR PRESSURE PIPELINES

A. All pressure piping shall be tested with water as the test medium.

B. Conduct pressure and leakage tests on all newly installed pressure pipelines. Furnish all necessary equipment, instrumentation, and material including temporary plugs and blind flanges and make all taps in the pipe, as required. The District Inspector or District or its appointed Representative shall be present for all pressure testing.

C. Where any section of pipe is provided with concrete thrust blocking, do not make the pressure test until at least 5 days have elapsed after the thrust blocking is installed. If high-early strength cement is used for thrust blocking, the time may be reduced to 3 days.

D. Conduct the tests on piping after the piping has been completely installed, including all supports, hangers, and anchors.

E. Hydrostatic testing. Expel all air from the piping system prior to testing and apply and maintain the test pressure hereinafter specified by means of a hydraulic force pump. Valve off the piping system when the test pressure is reached and conduct the pressure test for a minimum of 2 hours, reopening the isolation valve only as necessary to restore the test pressure. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to maintain the test pressure may be measured accurately.

1. Pressure side sewers may be tested for a minimum period of fifteen (15) minutes.

F. Repairs of defects that are discovered as a result of inspection or tests shall be made with new materials. Caulking of screwed joints, cracks, or holes will not be accepted. Tests shall be repeated after defects have been eliminated at no additional cost to the District.

G. For pressure sewers, the minimum test pressure shall be one hundred fifty percent (150%) of maximum design operating pressure measured at the lowest point of the pipeline section being tested, or 50 psi, whichever is greater.

H. If air test is to be used, all sewer/water shall be removed prior to pressure test.

I. If hydrostatic test is to be used, all sewer/water shall be removed prior to pressure test.

J. Exposed Pipe.

1. Leakage shall be zero at the test pressure hereinafter specified throughout the duration for exposed piping. Conduct testing and maintain the testing pressure for two hours continuously.

K. Buried Pipe.

1. Pipelines shall be tested and visually examined for leaks. Leakage shall be zero at the specified test pressure. Testing shall be in accordance with individual pipe specifications in these Standard Specifications. All details of the testing procedure shall be subject to the review of the Engineer and District.

2. Plug all connections with gasketed caps or plugs securely fastened or backed to withstand the internal test pressure. Such plugs or caps shall be removable, and their removal shall provide a bell suitable for making a flexible jointed lateral connection or extension.

3. Pressure tests shall be made by filling the system for two hours continuously.

4. For hydrostatic tests, the pipe test section may be filled 24 hours prior to the time of testing, if desired, to permit normal absorption into the pipe walls to take place.

5. New pipelines which are to be connected to existing pipelines shall be tested by isolating the new pipe.

3.06 ALLOWABLE PIPELINE SAG

A. For new piping installed by open trench method or other methods including but not limited to horizontal direction drilling, pipe bursting, and pipe reaming method, if it is determined that a sag is present during the post-installation CCTV inspection and the sag depth is equal to or greater than 1'' in pipes up to 12'' in diameter, and 2'' in pipes greater than 12'' in diameter, the contractor shall repair the sag at no additional cost to the District.

B. The Contractor shall re-perform testing as specified herein and post-installation CCTV inspection after the pipeline sag has been repaired. All costs associated with re-testing and re-inspection of the pipeline shall be borne by the Contractor.

3.07 TESTING OF MANHOLES

A. All new manholes or rehabilitated manholes shall be vacuum tested by the Contractor for leakage after installation and prior to backfilling.

B. Prior to vacuum testing, all manholes shall be visually inspected. All defects shall be repaired by the Contractor, with grout, to the satisfaction of the District or the District's Representative.

C. All pipes entering the manhole shall be sealed at a point outside the manhole walls so as to include testing of the pipe/manhole joints.

D. A vacuum of ten (10) inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test hood closed and the vacuum pump shut off. The manhole shall be deemed to have passed the test if the vacuum drop is less than one inch of mercury during the required test period. The minimum duration of the test period shall be based on the inside diameter of the manhole and shall conform to the following table:

Vacuum Test Time for Manholes	
Manhole Inside Diameter (inches)	**Test Time (seconds)**
48	60
60	75
72	90

E. If the manhole does not pass the vacuum testing, then the Contractor shall either replace the manhole or make the necessary repairs and re-test at no additional Cost to the District.

3.08 SAFETY

A. The District may reschedule any testing tasks when needed if they determine that the conditions are not safe due to weather and/or any other factors.

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SECTION 02900

PROTECTION OF TREES AND RESTORATION OF LANDSCAPING

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall protect trees and restore landscaping in accordance with the requirements of this Section.

B. The Contractor shall exercise due diligence and implement necessary precautions so as not to needlessly damage or destroy trees, shrubs or other landscaping including those within street rights-of-way and project limits. Removal or pruning of trees or shrubs shall occur only with prior approval of the Inspector and only in the presence of and under the supervision of a certified arborist acceptable to District, the County of Marin, and the City or Town with Jurisdiction in the area. If the Contractor damages any tree or shrub not specifically designated for removal on the plans, the Contractor shall replace or trim the damaged tree or shrub as directed by a certified arborist engaged by the Contractor and acceptable to District. The Contractor shall obtain approval from the jurisdictional agency where required, and the owner of the trees and or shrubs prior to replacement or pruning.

C. Existing growth on adjacent land and rights-of-way shall be preserved. Construction equipment shall not be operated in areas designated for preservation. If necessary for preservation of trees and shrubs, the Contractor shall install temporary protective fences, protective padding and/or staked straw bales around trunks of trees along the construction alignment to prevent damage by vehicles, equipment and material storage, pedestrian activity, and/or disposal of phytotoxic material.

1.02 NOT USED

1.03 REFERENCE SPECIFICATIONS

A. Commercial Standards:

ANSI A 300	American National Standards Institute, Pruning Standards
ISA	International Society of Arboriculture Tree Pruning Guidelines

1.04 NOT USED

1.05 SUBMITTALS

A. A list of the materials used, together with typical certificates of each material, shall be submitted to District prior to the final acceptance of the job.

1.06 QUALITY ASSURANCE

A. The Contractor shall request inspection at least one (1) business day in advance of the time inspection is required. Inspection will be required on the following stages of the work:

1. During preliminary grading, soil preparation, and initial weeding.

2. When trees are spotted for planting, but before planting holes have been excavated.

3. When finish grading has been completed.

4. When all specified work, except warranty work has been completed.

5. Final inspection at the completion of the warranty period.

B. Plants shall be subject to inspection upon delivery to the site and at any time before or during progress of the work.

C. Rejected plants shall be identified in an obvious manner, removed from the site, and replaced.

1.07 DELIVERY, STORAGE AND HANDLING

A. Plants shall not be pruned prior to delivery.

B. Plant material shall be planted on the day of delivery if possible. The Contractor shall protect the stock in a temporary nursery at the project site where it shall be protected from sun and drying winds and shall be shaded, kept moist, and protected with damp soil, moss, or other acceptable material.

C. No plants shall be bound with wire or rope at any time so as to damage the bark or break branches.

D. Plants shall not be picked up or moved by stem or branches, but shall be lifted and handled from the bottom of the ball or the sides of the containers. Plants with balls cracked or broken before or during planting operations will not be accepted and shall be immediately removed from the site and replaced.

1.08 CLEANUP

A. During landscaping work and upon completion of planting operations, the site used for work or as a storage area by the Contractor shall be maintained in a neat and clean condition.

1.09 MAINTENANCE OF LANDSCAPING DURING WARRANTY PERIOD

A. The Contractor shall be responsible for protecting, watering, and maintaining all planting and irrigation systems until the end of the warranty period.

B. Trees and shrubs shall be thoroughly soaked after planting and provided with additional water at intervals as necessary to provide for good health and growth of the planting.

PART 2 - PRODUCTS

2.01 GENERAL

A. All landscaping materials for soil conditioning, weed abatement, or planting shall be first-grade, commercial quality and shall have certificates indicating the source of material, analysis, quantity, or weight attached to each sack or container or provided with each delivery.

2.02 TOPSOIL

A. Topsoil shall be obtained from naturally drained areas and shall be fertile, friable loam suitable for plant growth, and be of uniform quality, free from stiff or lumpy clay, hard clods, hardpan, rocks, disintegrated debris, plants, roots, seeds, or any other materials that would be toxic or harmful to plant growth. Topsoil shall contain no harmful weeds or harmful weed seeds.

2.03 FERTILIZER AND ADDITIVES

A. Fertilizer shall be furnished in bags or other standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon, and shall be applied at recommended rates.

2.04 MULCH

A. Mulching material shall be shredded bark, free of sticks, stones, clay, or other foreign materials.

2.05 PLANT MATERIALS

A. All plants shall be symmetrical and shall conform to the size, age, and condition as specified on the plant list. Plants shall be of sound health, vigorous, and free from plant disease and shall be well-branched, shall have full foliage when in leaf, and shall have a healthy well-developed normal root system. Cold storage plants will not be accepted.

B. Roots and root balls of all plants shall be adequately protected at all times from sun and/or drying winds.

C. Trees shall have straight trunks and all abrasions and cuts shall be completely callused over. In no case shall trees be topped before delivery.

2.06 STAKES

A. Stakes for supporting trees shall be two (2) inch diameter, sound No. 2 redwood, or lodge pole pine stakes.

B. Tree ties shall be approved by the Inspector prior to use.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall provide protection to structures, pavements, adjacent properties, and other facilities that are subject to damage during landscape work. Open excavations shall be provided with barricades and warning lights which conform to the requirements of governing authorities and the Cal/OSHA safety requirements from dusk to dawn each day and when needed for safety.

B. Work shall meet or exceed the requirements of these Specifications unless applicable requirements of an agency having jurisdiction (including the terms and conditions of an encroachment permit issued by a city or county) are greater, in which case the greater requirements shall govern.

3.02 REMOVAL OF TREES AND SHRUBS

A. The roots of trees or shrubs not specifically designated for removal on the plans shall be protected from damage by the Contractor's operations. If necessary for preservation of trees or shrubs, as determined by the arborist, **the Contractor shall either hand dig or use an "air-spade" around roots in the drip zone**. No tree roots over two (2) inches in diameter shall be cut without permission of the Inspector. Trees shall be supported during excavation, and no herbicides shall be used.

B. The Inspector may authorize removal of tree and shrub branches that interfere with construction operations. When tree or shrub branches must be removed, the removal shall be done in a manner that does not injure the tree or shrub as directed by a certified arborist engaged by the Contractor and acceptable to DISTRIT. The trimming shall be completed in a manner that will preserve the symmetry of the tree or shrub presenting a balanced appearance. No stubs, splits or torn branches shall remain following the trimming. Clean cuts shall be made close to the trunk or a large branch.

C. The Contractor shall notify the Inspector a minimum of one (1) week in advance if a tree limb greater than three (3) inches in diameter needs to be removed and shall request authorization to remove the limb from the owner. Submitting a

request to remove limbs does not guarantee approval. If approval is denied, the Contractor shall modify its operation in order to protect the limb.

D. Trees or shrubs designated for removal shall be felled in sections from the top down and removed in such a manner as not to injure standing trees, plants, structures, or other improvements. Trees or shrubs to be removed shall be removed to a depth of eighteen (18) inches below existing minimum grade.

E. Trunks, stumps, dead or fallen limbs and branches, and roots of dead vegetation within the construction limits shall be removed from the jobsite.

F. The Contractor shall notify the Inspector prior to removal of any tree with a trunk diameter greater than six (6) inches at four and one-half (4-1/2) feet above its natural grade or any riparian tree with a trunk diameter of four (4) inches at four

G. and one-half (4-1/2) feet above its natural grade or a multi-trunk riparian tree with a cross-sectional area of all trunks equal to a cross-section of a single stem of four (4) inches at four and one-half (4-1/2) feet above its natural grade. “Riparian Tree” is a tree within thirty (30) feet of the edge of a creek bank.

3.03 PRUNING AND MULCHING

A. Root Pruning

1. No tree roots larger than two (2) inches in diameter shall be cut without the permission of the Inspector. A certified arborist engaged by the Contractor and acceptable to DISTRIT shall be present during trenching in root zones. If roots larger than two (2) inches in diameter are cut, the arborist may require some plant reduction. The arborist shall evaluate damaged trees and shrubs for stability, health, and aesthetic appearance. If reduction or removal is required, the Contractor shall notify the owner in writing and approval shall be secured prior to pruning or removal.

2. All damaged roots regardless of size shall be pruned square and clean, in accordance with standard horticultural practice.

B. Pruning of Trees and Shrubs

1. Pruning shall be done under the direction and in the presence of a certified arborist acceptable to DISTRIT and performed by tree workers who are competent in the area of tree trimming, maintenance, repairing, and removal and familiar with equipment used in this work. The use of climbing spurs, spikes, or irons is prohibited in pruning operations on live trees. Pruning shall be done in accordance with the ISA “Pruning Guidelines” and ANSI A-300 Standards.

2. All cuts shall be made close to the trunk without cutting into the branch collar so that closure can readily start under normal conditions. Clean cuts shall be made at all times. Heavy branches shall be notched from below to prevent splitting or peeling the bark. Cuts and wounds shall be treated with tree dressing where open wounds may attract insects that carry disease or allow fungus invasion. After use on a tree or shrub known to be diseased, tools shall be disinfected with methyl alcohol or seventy percent (70%) bleach solution after each cut and before use on another tree or shrub.

3. No more than thirty-three percent (33%) of the total plant mass shall be reduced at a single operation. Where practical, avoid cutting back to small suckers. In reducing overall size, attention shall be given to achieving a symmetrical appearance. The top shall remain higher than the sides to maintain a natural appearance.

C. All dead wood or suckers and all broken or badly bruised branches shall be removed by thinning out and shortening branches. All cuts shall be made just above a healthy bud. Pruning shall be done with clean, sharp tools.

D. Plants shall be mulched after planting has been completed. A layer of mulch materials shall be spread on finished landscaping grade to a depth of two (2) inches. Mulching around isolated plants shall be six (6) inches greater in diameter than the planting hole.

3.04 REPLACEMENT OF DAMAGED TREES AND SHRUBS

A. If any tree or shrub is damaged by the Contractor's operations, the Contractor shall immediately notify the Inspector and the Owner of the tree or shrub. If, in the judgment of a certified arborist engaged by the contractor and acceptable to DISTRIT, the damage is such that replacement is necessary, the Contractor shall replace the tree or shrub. If possible, the replacement shall be of like size and variety as the tree or shrub damaged.

B. The size of replacement trees shall be no less than three (3) inches in diameter or less than six (6) feet in height contained in a 24" x 24" box. The size of replacement shrubs shall not be less than five (5) gallon in size. Place topsoil around tree to allow root crown to remain at the original grade so that the root flares can be seen for at least several inches away from the trunk. The root crown shall remain dry and free of debris, such as lawn or ivy. Place an acidic, organic compost or mulch around the rooting area.

3.05 SOIL PREPARATION

A. The landscape work shall not begin until all other trades have repaired all areas of settlement, erosion, rutting, etc., and the soils have been re-established, re-compacted and refinished to finish grades.

B. Areas requiring grading by the landscaper including adjacent transition areas shall be uniformly level or sloping between finish elevations to within 0.10 ft. above or below required finish elevations.

C. The landscape work shall not proceed until roadways and irrigation systems are in place, and other construction operations are completed to a point where the landscape areas will not be disturbed. The subgrade shall be free of waste materials of any kind.

D. During grading, waste materials in the planting areas such as weeds, rocks (2 inches and larger), building materials, rubble, wires, cans, glass, lumber, sticks, etc., shall be removed from the site. Weeds shall be dug out by the roots.

E. Fertilizers, additives, seed, peat, etc. subject to moisture damage shall be kept in a weatherproof storage place in such a manner that they will be kept dry.

F. After removal of waste materials, the planting areas' subgrade shall be scarified and pulverized to a depth of no less than six (6) inches and all surface irregularities below the cover of topsoil removed.

G. Finish grading shall consist of:

1. Final contouring of the planting areas.

2. Placing four (4) inches of topsoil over all areas to be planted unless shown or specified otherwise.

3. Placing all soil additives and fertilizers.

4. Tilling of planting areas.

5. After tilling, bring areas to uniform grades by floating and/or hand raking.

6. Making minor adjustment of finish grades as directed by the Inspector.

7. Removing waste materials such as stones, roots, or other undesirable foreign material and raking, discing, dragging, and smoothing soil ready for planting.

H. Topsoil shall be uniformly distributed over all areas where required. Subgrade and topsoil shall be damp and free from frost.

I. Surface drainage shall be provided as shown by grading the surface to facilitate the natural run-off of water. Low spots and pockets shall be filled with topsoil and graded to drain properly.

J. Finish grade of all planting areas shall be one and one-half (1-1/2) inches below finish grades of adjacent pavement of any kind.

3.06 TREE AND PLANT LOCATIONS

A. The Contractor shall locate and stake all tree and shrub locations and have the locations approved by the Property Owner before starting excavation of planting holes.

B. No trees shall be located closer than eighty-four (84) inches to sewers or sewer structures.

3.07 PLANTING HOLES

A. Planting holes shall be excavated circular pits centered on location stakes with vertical sides and flat or saucer shape bottom.

B. Holes for trees shall be at least two (2) feet greater in diameter than the specific diameter of ball or spread of roots, and at least six (6) inches below depth of ball or roots.

3.08 PREPARED BACKFILL

A. All soil for backfilling operations shall be prepared soil consisting of: one (1) part soil amendment, three (3) parts of topsoil. Commercial fertilizer shall be mixed with topsoil per manufacturer's printed recommendations.

B. Soil amendments shall be thoroughly mixed on the site before placement. Mixing of materials in pits will not be permitted.

3.09 ROCKS OR UNDERGROUND OBSTRUCTIONS

A. In the event that rock or underground obstructions are encountered in the excavation of plant pits, alternative locations shall be selected by the Property Owner.

3.10 SETTING PLANT MATERIALS

A. Prior to setting, all broken or frayed roots shall be properly cut off. Water shall be applied if necessary to provide ideal moisture for filling and for planting as specified herein.

B. Plants shall be set plumb and straight in the center of pits.

C. Planting soil around roots or root balls shall be compacted and watered. Muddy soil shall not be used for backfilling.

D. All plants shall be thoroughly watered immediately after planting. Remove all tags and labels after final inspection.

3.11 STAKING

A. Staking of trees shall be done immediately after planting. Plants shall stand plumb after staking.

B. Trees less than two (2) inches in diameter shall be supported by two (2) stakes placed diametrically opposite at perimeter line of the root ball and to sufficient depth to hold the tree rigid. Trees shall be supported by guy wires in accordance with standard horticultural practice.

*****END OF SECTION*****

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all materials for concrete work in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete in accordance with these Standard Specifications.

B. This Section includes:

1. Cast-in-place concrete
2. Reinforcing steel
3. Forms
4. Concrete accessories

1.02 RELATED SECTIONS

A. Section 02050, DEMOLITION

B. Section 02200, EARTHWORK

C. Section 02700, MANHOLES

D. Section 03600, GROUT

E. Section 05500, MISCELLANEOUS METALWORK

1.03 REFERENCE SPECIFICATIONS

A. Referenced Standards, latest version of all:

ACI 214:	Recommended Practice for Evaluating Compression Test Results of Field Concrete.
ACI 224:	Control of cracking in Concrete Structures.:
ACI 301	Specifications for Structural Concrete.
ACI 305:	Recommended Practice for Hot Weather Concreting.
ACI 306:	Recommended Practice for Cold Weather Concreting.

ACI 306.1:	Standard Specifications for Cold Weather Concreting.
ACI 315:	Manuals of Standard Practice for Detailing Reinforced Concrete Structures.
ACI 318:	Building Code Requirements for Reinforced Concrete.
ACI 347:	Recommended Practice for Concrete Formwork
ACI 350:	Environmental Engineering Concrete Structures.
ASTM A82:	Cold-Drawn Steel Wire for Concrete Reinforcement.
ASTM A185:	Welded Wire Fabric for Concrete Reinforcement.
ASTM A497:	Welded Preformed Steel Wire Fabric for Concrete Reinforcement.
ASTM A615:	Deformed Billet-Steel Bars for Concrete Reinforcing.
ASTM C31:	Making and Curing Concrete Test Specimens in the Field.
ASTM C33:	Concrete Aggregate.
ASTM C39:	Test for Compressive Strength for Cylindrical Concrete Specimens
ASTM C94:	Ready-Mixed Concrete.
ASTM C127:	Test for Specific Gravity and Adsorption of Coarse Aggregate.
ASTM C128:	Test for Specific Gravity and Adsorption of Fine Aggregate.
ASTM C136:	Test for Sieve or Screen Analysis of Fine and Coarse Aggregates.
ASTM C143:	Test for Slump of Portland Cement Concrete.
ASTM C150:	Portland Cement.
ASTM C192:	Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C231:	Test for Air Content of Freshly Mixed Concrete.
ASTM C260:	Air Entraining Admixtures for Concrete.
ASTM C494:	Chemical Admixtures for Concrete.
ASTM C618:	Fly Ash and Raw on Calcined Natural Pozzolans for use in Portland Cement.
PS1:	Construction and Industrial Grade Plywood (ANSI A199.1)

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide submittals for items specified herein to the District for review and approval prior to ordering materials.

B. The Contractor shall submit reports of tentative concrete mix design and testing including:

1. Slump on which the design is based.

2. Total gal of water per cu yd.

3. Brand, type composition, and quantity of cement.

4. Brand, type, composition, and quantity of fly ash.

5. Specific gravity and gradation of each aggregate.

6. Ratio of fine to total aggregates.

7. Surface-dry weight of each aggregate per cu yd.

8. Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture.

9. Air content.

10. Compressive strength based on 7 day and 28 day compression tests.

11. Time of initial set.

C. Submit suppliers certified fly ash test reports for each shipment delivered to concrete supplier.

1. Physical and chemical characteristics.

2. Certification of compliance with the specifications.

3. Signed by Contractor and concrete supplier.

1.06 QUALITY ASSURANCE

A. Tolerances: ACI 301 and ACI 347 as modified herein. In case of conflict ACI 347 governs over ACI 301.

B. For quality assurance of the concrete mix design, the Contractor shall provide the following:

1. Contractor to provide and pay for the concrete mix design.

2. Test the proposed concrete mix for each size and graduation of aggregates and each consistency intended for use in the project.

3. Aggregates:

    a. Sample and test according to ASTM C33.

    b. Determine bulk specific gravity in accordance with ASTM C127 and C128.

4. Compression tests:

    a. Contractor shall prepare two (2) sets of compression test cylinders from each proposed concrete mix, three (3) cylinders per set.

    b. Test one (1) set of three (3) cylinders at seven (7) days, the other at 28 days.

    c. Make, cure, and store in accordance with ASTM C192.

    d. Test in accordance with ASTM C39.

    e. Slump test: ASTM C143.

5. Total air content: ASTM C231.Initial set test:

    a. In accordance with ASTM C403.

    b. Test at 70 degrees F and 90 degrees F ambient.

    c. Test at 70 degrees F on mix including specified plasticizing and air entraining admixtures.

    d. Test at 90 degrees F on mix including specified retarding and air entraining admixtures.

6. Fly ash: Supplier's chemical composition and physical analysis test.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Storage and protection:

1. Cement and fly ash.

    a. Store in moisture proof enclosures.

    b. Do not use if caked or lumpy.

2. Aggregate.

    a. Store to prevent segregation and inclusion of foreign materials.

b. Do not use the bottom 6 inches of piles in contact with the ground.

c. Reinforcing steel: Store on supports that will keep it from contact with the ground.

3. Rubber and plastic materials.

a. Store in a cool place.

b. Do not expose to direct sunlight.

4. Sealers, form coatings, etc.

a. Store indoors according to manufacturer's request.

b. Discard any improperly stored materials.

B. Acceptance at site:

1. Prepare a delivery ticket for each load of ready-mixed concrete.

2. Truck operator shall hand ticket to District or its appointed Representative at the time of delivery.

3. Ticket to show actual:

a. Quantity delivered.

b. Actual amount of each material in batch.

c. Outdoor temperature in the shade.

d. Time at which cement was added.

e. Truck, project, and mix design identification number.

4. Failure to provide the delivery ticket will be cause to reject the load.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials furnished for the work shall comply with eh requirements of Section 201, 203, and 204 of ACI 301, as applicable.

B. Concrete shall be composed of cement, admixtures, aggregates, and water. These materials shall be of the qualities specified herein. The mix shall be designed to produce a concrete capable of being deposited to obtain maximum density and minimum shrinkage and where deposited in forms to have good consolidation properties and maximum smoothness of surface.

2.02 MATERIALS

A. Forms:

1. Prefabricated: Simplex "Industrial Steel Frame Forms," Symons "Steel Ply," Universal "Uniform," or equal.

2. Plywood: PS1, waterproof resin-bonded, exterior type Douglas Fir; face adjacent to concrete, Grade B or better.

3. Fiberboard FS LLL-B-810, Type IX, tempered, waterproof, screen back, concrete form hardboard.

4. Lumber: Straight; uniform width and thickness; and free from knots, offsets, holes, dents, and other surface defects.

5. Form coating: Industrial lubricants "Nox-crete Form Coating," W. R. Meadows "Durogard," PRECO "Reebol Form Cote," or equal.

6. Form ties: Removable end, permanently embedded body type not requiring auxiliary spreaders, with cones on outer ends, embedded portion 1-inch minimum back from concrete face. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.

B. Reinforcing steel:

1. Bars: ASTM A615, Grade 60.

2. Welded wire fabric: ASTM A185 or A497.

3. Bar supports: PS7; CRSI Class B or E, fabricated from galvanized wire or having stainless steel legs.

C. Concrete:

1. Cement shall be: ASTM C150, Type II or Type II LA.

2. Fly ash shall be in accordance with ASTM C618, Class F, except loss on ignition not more than 5 percent.

3. Fine aggregate shall be clean, natural sand ASTM C33, or natural materials processed to conform to ASTM C33.

4. Coarse aggregate shall be crushed rock, natural gravel, or other inert granular material, ASTM C33 except clay and shale particles no more than 1 percent.

5. Water shall be clean and free of deleterious substances.

6. Admixtures shall be the following, or equal:

a. Retarder: ASTM C494, Type D; Grace "Duratard-HC," Master Builders "Pozzolith 300-R," Protex "Protard," Sika Chemical "Plastiment".

b. Plasticizer: ASTM C494, Type A; Grace "Daracem-100," Master Builders "Rheobuild 1000".

c. Air entraining agent: ASTM C260; Grace "Darex AEA," Master Builders "Micro-Air," W. R. Meadows "Sealtight".

d. Water reducer: Master Builders “Pozzolith 322N.

2.03 MIXES DESIGN

A. Concrete Mix Designs Shall Comply with ASTM C94.

B. Unless otherwise specified, concrete mix designs shall have a minimum 28-day compressive strength of 4,000 psi, a maximum aggregate size of 1.0 inch, a minimum of six sacks of cement per cubic yard, maximum water to cement ratio of 0.45 by weight, and slump between 3-5 inches.

C. Concrete used for thrust blocks shall have a minimum 28-day compression strength of 2,500 psi, a maximum aggregate size of ¾ inches, a minimum of four sacks of cement per cubic yard, and a maximum water to cement ratio of 0.60 by weight, unless otherwise specified.

D. All concrete shall have an air entrainment of 4.0 ±1.0 percent.

E. Initial set:

1. 5-1/2 hours ±1 hr after water and cement are added to the aggregates as determined by ASTM C403.

2. Adjust retarder quantities to compensate for temperature and job condition variations.

F. Admixtures:

1. Content, batching method, and time of introduction in accordance with the manufacturer's recommendations for compliance with this specification.

2. Include a water reducing admixture.

3. Calcium chloride is not permitted.

PART 3 - EXECUTION

3.01 GENERAL

A. Work shall meet or exceed the requirements of the Standard Specifications.

3.02 INSTALLATION

A. Forms:

1. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms, and any forms that are unsafe or inadequate in any respect shall promptly be removed from the jobsite and replaced. The design and inspection of concrete forms, false work, and shoring shall comply with applicable local, state, and federal regulations. All design, construction, maintenance, preparation, and removal of forms shall be in accordance with ACI 347 and the requirements specified herein.

2. All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is called for on the plans.

3. Forms may be reused only if in good condition and acceptable to the District.

B. Reinforcing steel:

1. Accurately position reinforcing steel on supports, spacers, hangers, or other reinforcing steel.

2. Secure with wire ties or suitable clips.

3. Except at contact splices, minimum clear distance between bars, the greater of:

   a. Nominal diameter of bars.

   b. 1.5 times maximum size of coarse aggregate.

   c. 1-inch in beams.

   d. 2 inches in other locations.

4. Where beam reinforcement is placed in 2 layers, place bars in upper layer directly above bars in lower layer.

5. Accurately formed.

6. Free from loose rust, scale, and contaminants that will reduce bond.

7. Splices:

    a. Do not weld or tack weld reinforcing steel except where specifically indicated on Drawings.

    b. Remove and replace steel upon which any unauthorized welding has been performed.

    c. When splicing bars in tie beams subject to tensile loading, splice no more than half the bars within a length of 40 bar diameter and hook each spliced bar end 180 degrees.

8. Do not bend or rebend reinforcing steel at job site. Bending of steel in locations not shown on Drawings shall be cause for rejection of work.

C. Concrete:

1. Notify District or its appointed Representative not less than 24 hours in advance of the times and places at which Contractor intends to place concrete.

2. Predetermine limits at each pour.

3. Place all concrete within limits of pour in one (1) continuous operation.

4. Rigidly secure forms, and reinforcing steel in proper position.

5. Remove all mud, water, and debris from space to be occupied by concrete.

6. Clean surfaces encrusted with dried concrete from previous concrete operations.

7. Bonding to hardened concrete:

    a. Place new concrete on rough, clean, damp faces of existing concrete.

    b. Remove surface mortar to expose aggregate.

    c. Clean hardened concrete of all foreign substances, including curing compound.

    d. Wash with clean water, and keep saturated for 24 hours preceding placement of fresh concrete.

    e. Omit coarse aggregate from the first batch or batches of concrete placed on hardened concrete in wall forms.

f. The mortar puddle shall cover the hardened concrete to a depth of at least 2 inches at every point.

8. Conveying concrete:

   a. Convey to the point of final deposit by methods that will prevent separation or loss of ingredients.

   b. Place concrete in final position without being moved laterally more than 5 feet.

   c. No aluminum materials shall be used in conveying any concrete.

9. Placing concrete:

   a. Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section.

   b. Concrete shall be conveyed from the mixer to place of deposit by methods that prevent separation or loss of material.

   c. Place concrete in approximately horizontal layers of proper depth for proper compaction, not more than 2 feet.

   d. Place subsequent layer while the preceding layer is still plastic. No concrete shall be placed after there is evidence of initial set

   e. Fill form at a rate not less than 2 ft/hr.

   f. Do not allow concrete to free fall more than 4 feet when pouring.

   g. Top finish concrete when thoroughly settled.

   h. Remove all laitance, debris, and surplus water from the tops of the forms by screeding, scraping, or other effective means.

   i. Overfill the forms for walls whose tops will be exposed to the weather and screed off the excess after the concrete has settled.

10. Compaction:

    a. Thoroughly compact concrete during and immediately after placement.

    b. Work concrete around all reinforcements and embedments and into the corners of the forms.

    c. Use mechanical vibrators which will maintain 9,000 cycles/min when immersed in the concrete, 1-1/2 hp motor min.

11. Cold weather concreting:

    a. Comply with ACI 306 and 306.1, except as modified herein.

    b. Minimum concrete temperature at the time of mixing shall meet the following requirements:

Outdoor Temperature at Placement (in shade)	Concrete Temperature at Mixing
Below 0º F	70º F
Between 0º F and 30º F	65º F
Between 30º F and 45º F	60º F
Above 45º F	45º F

    c. Do not place heated concrete which is warmer than 80 degrees F.

    d. If freezing temperatures are expected during curing, maintain the concrete temperature at or about 50 degrees F for five (5) days or 70 degrees F for three (3) days.

    e. Do not allow concrete to cool suddenly.

    f. Do not place concrete on frozen subgrade.

12. Hot weather concreting:

    a. Comply with ACI 305, except as modified herein.

    b. If the air temperature is expected to be 80 degrees F or greater in the next 24 hours.

        i. Keep concrete as cool as possible before, during, and after placement.

        ii. Do not allow concrete temperature to exceed 70 degrees F at placement.

        iii. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.

        iv. Addition of ice, or other cooling methods, will be required to meet temperature requirements.

    c. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 lbs/sq ft/hr as determined from ACI 305.

d. No concrete shall be placed when the ambient temperature exceeds one hundred five degrees Fahrenheit (105°F).

D. Finishing unformed surfaces:

1. Do not finish buried or permanently submerged concrete not forming an integral part of a structure except as required to attain surface elevations, contours, and freedom from laitance.

2. Screed and initial float finish followed by additional floating, and troweling as required, all other surfaces.

3. Screeding:

a. Screed concrete surfaces to the proper elevation and contours with all aggregates completely imbedded in mortar.

b. Surface free of irregularities of height or depth more than 1/4 inch measured from a 10-foot straightedge.

4. Floating:

a. Float finish screeded surfaces as soon as the concrete has stiffened sufficiently for working.

b. Remove and replace with mortar any coarse aggregate which is disturbed by the float or which causes a surface irregularity.

c. Initial floating to produce a surface of uniform texture and appearance without unnecessary working of the surface.

d. Follow initial floating with a second floating at the time of initial set.

e. Second floating to produce a finish of uniform texture.

f. Except as otherwise specified, the second floating finish is the final finish.

g. Use hand floats or mechanical compactor floats.

5. Troweling:

a. Steel trowel finish interior floor surface which will be exposed at the completion of construction, the exposed portion of the equipment bases, interior curbs, and where indicated on the Drawings.

b. Do not trowel floor surfaces which will be normally submerged.

c. Trowel after the second floating when the surface has hardened adequately to prevent drawing an excess of fines to the surface.

d. Trowel to produce a dense, smooth, uniform surface free from blemishes and trowel marks.

6. Aggregate exposure:

a. Remove surface mortar from surfaces to be covered later with concrete or mortar topping.

b. Expose coarse aggregates to improve bonding.

7. Unless specified to be beveled, edge floated or troweled surfaces with a tool having a 1/4-inch radius.

E. Curing:

1. Protect concrete from moisture loss for at least seven (7) days after placement except that the time period for curing by saturation for concrete being protected from low temperature shall be one day less than the duration of low temperature protection.

2. Cure concrete by methods that will keep concrete surfaces adequately wet during curing.

3. Water curing:

a. Begin water saturation as quickly as possible after initial set.

b. Regulate water application to provide complete surface coverage with a minimum of runoff.

c. Use absorptive blankets to hold moisture to concrete or flood the surface.

4. Membrane curing:

a. Membrane curing compound may be used in lieu of water curing on concrete which will not be covered later with mortar or concrete where water curing is not specifically called for.

b. Spray apply membrane curing compound at not more than 300 sq ft/gal.

c. Cover unformed surfaces within 30 minutes of final finishing.

d. If forms are removed before the end of the curing period, immediately apply curing compound to the formed surfaces before they dry out.

e. Protect curing compound against abrasion during the curing period.

5. Film curing:

    a. Polyethylene sheeting may be used in lieu of water curing on concrete which will be covered later with mortar or additional concrete, or will otherwise be covered or hidden from view where water curing is not specifically called for.

    b. Begin film curing as quickly after initial set of the concrete as possible.

    c. Completely cover the surfaces with polyethylene sheeting.

    d. Overlap the sheeting edges for sealing and anchorage.

    e. Seal joints between sheets.

    f. Promptly repair tears, holes, and other damages.

    g. Anchor covering continuously at edges and on the surfaces as required to prevent billowing

F. Finishing formed surfaces:

1. Remove fins and other surface projections from all formed surfaces except exterior surfaces that will be in contact with earth backfill and are not specified to be dampproofed.

2. Use a power grinder, if necessary, to remove projections and provide a flush surface.

3. Remove fins and fill tie hole on surfaces to be dampproofed but do not do any other finishing of those surfaces.

4. Tie holes:

    a. Clean, wet and fill with patching mortar.

    b. Finish flush to match the texture of adjacent concrete.

5. Grout - cleaned finish:

    a. ACI 301, 5.3.3.4.b.

    b. Grout clean surfaces to produce a smooth uniform surface free of marks, voids, surface glaze, and cement dust.\

    c. Grout clean all surfaces exposed to view and surfaces indicated on Drawings.

    d. Fill all voids, regardless of location, that are 1/4-inch deep or 1/2-inch diameter.

3.03 FIELD QUALITY CONTROL

A. The Contractor shall be responsible for the quality of the materials and workmanship of the placement of the concrete. Sampling, preparation of test specimens, and testing shall be the Contractor's responsibility.

B. Slump Testing: Concrete consistency shall be determined by slump tests in accordance with ASTM C143. At least one test shall be made at the commencement of the concrete placement and each time standard test cylinders are molded. Tests shall be performed by the Contractor’s independent firm, to be approved by the District.

C. Air Content Testing: At least one test shall be taken at the commencement of the concrete placement and thereafter with each standard test cylinders are molded. Test shall comply with either the pressure method (ASTM C231) or by the volumetric method (ASTM C173). Tests shall be performed by the Contractor’s independent testing firm, to be approved by the District.

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SECTION 03400

PRECAST CONCRETE BOXES AND VAULTS

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish and install precast boxes and vaults as shown on the plans, including appurtenances necessary for a complete installation.

1.02 RELATED SECTIONS

A. Section 03300, CAST-IN-PLACE CONCRETE

B. Section 03600, GROUT

C. Section 05500, MISCELLANEOUS METAL WORK

1.03 REFERENCE SPECIFICATIONS

A. All work specified herein shall conform to or exceed the requirements of the California Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section.

ACI 301	Specifications for Structural Concrete
ACI 303.1	Standard Specifications for Cast-in-Place Architectural Concrete
ACI 318	Building Code Requirements for Structural Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C478	Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C857	Standard Practice for Minimum Structural Design Loading for Underground Precast Utility Structures
ASTM C858	Standard Specification for Underground Precast Concrete Utility Structures

ASTM C877	Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
ASTM C890	Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
ASTM C891	Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C913	Standard Specification for Precast Concrete Water and Wastewater Structures
ASTM C979	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, American Concrete Institute
SS-S-00201	Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints
PCI MNL-116	Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
PCI MNL-120	PCI Design Handbook – Precast and Prestressed Concrete
PCI MNL-123	Design and Typical Details of Connections for Precast and Prestressed Concrete

1.04 NOT USED

1.05 SUMITTALS

A. The Contractor shall provide submittals for items specified herein to the District for review and approval prior to ordering materials.

B. The Contractor shall submit shop drawings for all precast concrete items. Submitted drawings shall show all dimensions, location, and type of embedded items, lifting inserts, and details of reinforcement and joints.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with requirements of PCI MNL-116, PCI MNL-120, and PCI MNL-123.

B. Inspection. After installation, the Contractor shall demonstrate that precast structures has been properly installed, level, with tight joints, at the correct elevations and orientations, and that the backfilling has been carried out in accordance with the Contract Documents.

1.07 NOT USED

PART 2 - PRODUCTS

2.01 GENERAL

A. Precast boxes shall be per model numbers as indicated in the Standard Drawings.

B. Concrete used for manufactured vaults shall have a minimum twenty-eight (28) day compressive strength of three thousand (4,000) psi. Boxes, vaults, and lids/covers to be installed in areas subject to vehicular traffic shall be designed for H20 loads.

2.02 MANUFACTURED PRECAST BOXES

A. Manufactured precast boxes shall per the District's Approved Materials List and the Standard Drawings.

2.03 PRECAST VAULTS

A. Precast concrete vaults shall be provided where shown in the Project Contract Documents.

B. Precast vault manufacturer shall be per the District's Approved Materials List.

C. Precast concrete vaults and covers shall be manufactured in a plant especially designed for that purpose.

D. The design of precast units is the responsibility of the Contractor and Contractor's Engineer.

E. Vault shall be a reinforced concrete box with interior dimensions and depth as shown on the Drawings. The minimum wall thickness shall be 8 inches.

F. Design loads shall consist of dead load, live load, impact load, and loads due to water table and any other loads which may be imposed upon the structure. For vaults to be installed in areas that may be subject to vehicular traffic, design live loads shall be for H20 per AASHTO standard specifications. Design wheel load shall be 16 kips. The design live load shall be that which produces the maximum shears and bending moments in the structure.

G. Reinforcing steel shall conform to ASTM A615, Grade 60. Installation of reinforcing steel shall conform to ACI 318. Welding of reinforcing steel is prohibited.

H. Hatches on precast vaults shall be installed at the precast plant. The size and position of hatches shall be as shown on the Contract Documents. Hatches shall be as specified in Section 05050, MISCELLANEOUS METALWORK.

I. Floor drains in precast vaults shall be installed at the precast plant. The position of floor drawings shall be as shown on the Contract Documents.

J. Vault floor shall be cast to slope at a minimum of 1% to vault floor drain(s), typing of the vault in the field to slope the floor will not be allowed.

K. Pipe penetrations into precast concrete shall be formed or core drilled, not jack hammered in field. Pipe penetrations 4 inches in diameter or larger shall be formed at the precast plant.

L. CONTRACTOR shall provide and install moisture proofing and damp proofing to precast vault exteriors in accordance with Section 07110, DAMPPROOFING AND MOISTUREPROOFING.

2.04 PREFORMED JOINT SEALANT

A. Joints gaskets shall be per the District’s Approved Materials List.

B. External joint sealant tape shall be per the District’s Approved Materials List manufactured by, or equal:

2.05 GROUT

A. Grout products shall be as specified in Section 03600, GROUT.

PART 3 - EXECUTION

3.01 GENERAL

A. Work shall meet or exceed the requirements of these Standard Specifications.

3.02 INSTALLATION

A. Excavation and backfill for precast concrete box and vault installation shall be performed in accordance with Section 02200, EARTHWORK.

B. All precast items shall be installed placed plumb and level and in accordance with the manufacturer's recommendations. All joints shall be sealed by the use of preformed sealant so as to be watertight. All precast boxes and vaults shall be set on a minimum foundation of six (6) inches of bedding material. Where soft

ground is present and directed by the District or its appointed Representative, over- excavation shall be performed as specified in Section 02200, EARTHWORK.

C. Connections to precast boxes and vaults shall be made by one of the following:

1. Casting sections of pipe into the item.

2. Core drilling or casting pipe chases into the items. Where core drilled holes or cast-in pipe chases are used; the annular space between the core- drilled hole or chase and the connecting pipe shall be filled with non-shrink grout or sealed using an approved resilient connector, skirt or reducing coupling, unless otherwise specified in the Project Contract Documents. All such connections shall be watertight.

*****END OF SECTION*****

SECTION 03600

GROUT

PART 1 - GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall furnish all materials for grout work in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete and grout in accordance with the requirements of the project Contract Documents.

B. This Section includes:

1. Patching cavities in concrete.
2. Filling annular space at pipe wall penetrations.
3. Grouting of anchors and dowels into existing concrete.
4. Other grouting specified or indicated in the Standard Drawings and specific project Contract Documents.

1.02 RELATED SECTIONS

A. Section 03300 , CAST-IN-PLACE CONCRETE

B. Section 02700, MANHOLES

C. Section 05050, MISCELLANEOUS METALWORK

1.03 REFERENCE SPECIFICATIONS

A. Commercial Standards:

Corps of Engineers Specifications:

CRD-C-621	Specification for Non-Shrink Grout.
ASTM C33:	Concrete Aggregates.
STM C109:	Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-inch or 50mm cube specimens).
ASTM C143:	Test Method for Slump of Portland Cement Concrete.
ASTM C150:	Portland Cement.
ASTM C172	Method of Sampling Freshly Mixed Concrete.
ASTM C231:	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

ASTM C260:	Air-Entraining Admixtures for Concrete.
ASTM C-307:	Tensile Strength.
ASTM C-579:	Compressive Strength.
ASTM C494:	Specification for Chemical Admixtures for Concrete.
ASTM C595:	Blended Hydraulic Cements.
ASTM C827:	Test Method for Early Volume Change of Cementitious Mixtures.
ASTM C-882:	Bond Strength.
ACI 211.1:	Standard Practice for Selecting Proportions for Normal and Heavyweight, and Mass Concrete.
ACI 301:	Specifications for Structural Concrete.

1.04 NOT USED

1.05 SUBMITTALS

A. Submittals for items specified herein shall be submitted to the District for review and approval prior to ordering materials.

B. Submit the following product data:

1. Copies of manufacturer's specifications and installation instructions for all proprietary materials.

2. Certification that materials meet specification requirements.

3. For ordinary cement grout, submit copies of grout design mix and laboratory test reports for grout strength tests.

C. Quality control submittals:

1. Test reports: Submit proportioning mix design report.

1.06 QUALITY ASSURANCE

A. Compliance with the requirements specified herein may necessitate modification to the manufacturer's standard material or equipment.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver and store material in manufacturer's original, unopened, undamaged containers.

B. Store in dry areas protected from moisture and wet weather.

C. Store away from traffic areas.

PART 2 - PRODUCTS

2.01 GENERAL

A. Grout types shall be as indicated in the Standard Drawings and project Contract Documents. General uses of grout types specified shall include:

1. Cement Grout: Used for sloping finished floors within structures and finishing joints in precast structures.

2. Non-Shrink Grout: Used for baseplates, equipment bases, pipe entrance to precast/existing structures, pipe supports, etc.

3. Epoxy Grout: Used for patching cavities in concrete, and grouting of dowels and anchor bolts into existing concrete.

4. Grout for Topping: Used for topping of slabs and building up surfaces of channels and structure bottoms.

2.02 CEMENT GROUT

A. Cement grout shall be composed of one (1) part cement, three (3) parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum required compressive strength at twenty-eight (28) days shall be four thousand (4,000) psi.

B. Component materials for cement grout materials shall be as specified in Section 03300, CAST-IN-PLACE CONCRETE.

2.03 NON-SHRINK GROUT

A. Non-shrink grout shall be inorganic, non-gas liberating, nonmetallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout shall be as recommended by the manufacturer for the particular application.

B. Non-shrink grouts shall have a minimum twenty eight (28) day compressive strength of five thousand (5,000) psi; shall have no shrinkage (0.0%) and a maximum of four percent (4%) expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (0.0%) and a maximum of point two percent (0.2%) expansion in the hardened state when tested in accordance with ASTM C1107.

C. Non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the plans; except for those applications where epoxy grout, grout for topping and concrete fill, and abandonment grout is specified herein.

D. Non-Shrink Grout. Non-shrink grout shall be nonmetallic, non-gas-liberating type, and per the District's Approved Materials List.

2.04 EPOXY GROUT

A. Epoxy Grout shall be per the District's Approved Materials List.

B. Epoxy grout shall be used for bonding reinforcing bars to existing concrete structures. Epoxy grout shall be a pourable, non-shrink, one hundred percent (100%) solids system. The epoxy grout system shall have three (3) components: resin, hardener, and specially blended aggregate, all pre-measured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

C. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

D. The mixed epoxy grout system shall have a minimum working life of forty- five (45) minutes at seventy-five degrees Fahrenheit (75°F).

E. The epoxy grout shall develop a compressive strength of five thousand (5,000) psi in twenty four (24) hours and ten thousand (10,000) psi in seven (7) days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0%) and a maximum four percent (4%) expansion when tested in accordance with ASTM C 827.

2.05 GROUT FOR TOPPING

A. Grout for topping of slabs and building up surfaces of channel and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All component materials and procedures specified for concrete in Section 03300, **CAST-IN-PLACE CONCRETE**, unless otherwise noted.

B. Topping grout and concrete fill shall contain a minimum of six (6) sacks (564 pounds) of cement per cubic yard with a maximum water-cement ratio of 0.45.

C. Coarse aggregate shall be graded as follows:

U.S. Standard Sieve Size	Percent by Weight Passing
1/2"	100
3/8"	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

D. Final mix design shall be as determined by trial mix design under supervision of an approved testing laboratory.

E. Strength: Minimum compressive strength of topping grout and concrete fill at the end of twenty-eight (28) days shall be three thousand (3,000) psi.

2.06 ABANDONMENT GROUT

A. Grout for abandoning pipelines and structures shall be CLSM or LDCC, as specified in 02200, **EARTHWORK**.

2.07 CURING MATERIALS

A. Curing materials shall be as specified in Section 03300, **CAST-IN-PLACE CONCRETE** for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.08 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency shall be such that the grout is plastic and moldable but will not flow. Where dry pack is called for on the plans, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump of grout for topping shall be adjusted to match placement and finishing conditions but shall not exceed four (4) inches.

PART 3 - EXECUTION

3.01 GENERAL

A. Work performed shall meet or exceed the requirements of these Standard Specifications.

3.02 EXAMINATION

A. Examine the areas and conditions under which grout is to be installed.

B. Notify the District or its appointed Representative of conditions detrimental to the proper and timely completion of the Work.

C. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.03 GROUTING PROCEDURES

A. Cement Grout and Grout for Topping

1. All finish work shall be completed prior to placement of topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting, exposing the aggregates, to ensure bonding to the base slab.

2. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is free from standing pools or ponds of water. A thin coat of Type II cement shall be broomed into the surface of the slab just before topping of fill placement. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated.

3. The minimum thickness of grout topping and concrete fill shall be one (1) inch. Where the finished surface of concrete fill is to form an intersecting angle of less than forty-five degrees (45°) with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of three (3) inches wide by one (1) inch deep.

4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.

5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

B. Non-Shrink Grout

1. Clean concrete surface to receive grout.

2. Saturate concrete with water for 24 hours prior to grouting.

3. Mix in a mechanical mixer.

4. Use no more water than necessary to produce flowable grout.

5. Place in accordance with manufacturer's instructions.

6. Completely fill all annular space to be filled.

7. Provide forms where baseplates and bedplates do not confine grout.

8. Where exposed to view, finish grout edges smooth.

9. Except where a slope is indicated on the Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.

10. Wet cure grout for seven (7) days minimum.

11. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.

12. Place in accordance with manufacturer's instructions.

C. Epoxy grout:

1. Mix and place in accordance with manufacturer's instructions.

2. Completely fill all cavities and spaces around dowels and anchors without voids.

3. Grout base and baseplates as specified for non-shrinking, non-metallic grout.

4. It may be required for the Contractor to obtain manufacturer's field technical assistance as required to insure proper placement.

3.04 FIELD QUALITY CONTROL

A. General:

1. District or its appointed Representative will employ a testing laboratory to perform field quality control testing on ordinary cement-sand grout.

2. District or its appointed Representative will direct the number of tests and cubes required.

3. The testing laboratory will make standard compression test cubes and entrained air tests as specified.

4. Furnish all necessary assistance required by the District or its appointed Representative.

B. Quality control testing during construction:

1. Sampling and testing for field quality control will be performed by the testing laboratory during the placement of cement-sand grout, as follows:

a. Sampling Fresh Grout: ASTM C172.

b. Slump: ASTM C143; one (1) test for each grout load at point of discharge from the vender's delivery vehicle; and one (1) for each set of compressive strength specimens.

c. Air content: ASTM C231; one (1) for every other grout load at point of discharge from the vender's delivery vehicle, or when required by an indication of change as determined by the District or its appointed Representative.

d. Compressive strength tests: ASTM C109; one (1) set of compression cubes for each 50 cubic yards or fraction thereof, of each mix design placed in any one (1) day or for each 2,500 square feet of surface area placed, whichever provides more cubes. Break one (1) specimen tested at seven (7) days; break two (2) specimens tested at 28 days; and break one (1) specimen tested at the direction of the District or its appointed Representative.

i. Adjust mix if test results are unsatisfactory and resubmit for review.

ii. Grout that does not meet the strength requirements is subject to rejection and removal from the Work at the expense of the Contractor.

iii. The Contractor shall provide all samples required for testing at no additional costs to the District.

e. Compression test specimens:

i. ASTM C109; the testing laboratory will take a minimum of one (1) set of four (4) standard cubes for each compressive strength test, unless otherwise directed by the District or its appointed Representative.

f. Grout temperature: Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time a set of compression test specimens is made. Comply with the requirements of Section 03001 for Cold and Hot Weather Placement.

g. Shrinkage: ASTM C827.

2. The testing laboratory will submit certified copies of test results directly to the District or its appointed Representative, who will forward copies to the Contractor.

C. Evaluation of quality control tests:

1. Do not use grout delivered to the final point of placement that has slump, temperature, or total air content outside the specified values.

2. Compressive strength tests for laboratory-cured cubes will be considered satisfactory if the averages of all sets of three (3) consecutive compressive strength test results equal or exceed the 28-day design compressive strength of the type of grout.

3. If the compressive strength tests fail to meet the minimum requirements specified, the grout represented by such tests will be considered deficient in strength and subject to removal, replacement, reconstruction, or to other action required, all at no additional cost to the District.

*****END OF SECTION*****

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SECTION 05500

MISCELLANEOUS METALWORK

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish, fabricate, and install miscellaneous metalwork and appurtenances, complete, all in accordance with the requirements of these Standard Specifications and the Project Contract Documents.

B. This Section Includes:

1. General requirements for metals.

2. General requirements for bolts other than anchor bolts and expansion anchors.

3. Aluminum hatches.

1.02 RELATED SECTIONS:

A. Section 03300, CAST-IN-PLACE CONCRETE

B. Section 3400, PRECAST CONCRETE BOXES AND VAULTS

C. Section 03600, GROUT

D. Section 09800, PROTECTIVE COATINGS

1.03 REFERENCE SPECIFICATIONS

A. Without limiting the generality of other requirements of these Specifications, all work specified herein shall conform to or exceed the requirements of the California Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section; provided, that for California Building Code, the latest edition of the Code, as adopted as of the date of award by the agency having jurisdiction, shall apply to the Work.

1. ASTM International, standards, and specifications as referred to herein.

2. American Welding Society (AWS) "Structural Welding Code-Steel" (AWS D1.1) which includes qualification procedures for welders.

3. American Institute of Steel Construction (AISC) "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and "Commentary on the AISC Specification."

4. American Iron and Steel Institute (AISI) "Specifications for the Design of Cold-Formed Steel Structural Members," and "Commentary on the AISI Specification."

5. Division of Occupational Safety and Health (Cal/OSHA) Regulations.

6. Aluminum Association "Specifications for Aluminum Structures" and "Engineering Data for Aluminum Structures."

7. National Association of Architectural Metal Manufacturers "Metal Stairs Manual."

B. This Section contains references to the following documents. In case of a conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail. The latest edition of the following references at the time of bid shall be used:

ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A307	Standard Specification for Carbon Steel Bolt and Studs, 60,000 psi Tensile Strength
ASTM A563	Standard Specifications for Carbon and Alloy Steel Nuts

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide submittal for items specified herein to the District for review and approval prior to ordering materials.

B. Shop drawings of all miscellaneous metalwork shall be submitted for review.

1.06 QUALITY ASSURANCE

A. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding Code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2.

B. All welding procedures and welder qualification shall be available in the Contractor's field office for District or its appointed Representative's review.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Items damaged during transit, inadequate storage, improper handling, or corroded shall be repaired, at the Contractor's expense, to the satisfaction of the District or its appointed Representative, prior to incorporating into the Work.

1.08 PROJECT/SITE REQUIREMENTS

A. The Contractor shall take field measurements at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 - PRODUCTS

2.01 GENERAL

A. All structural steel shapes, plates, bars, and their products shall conform to the requirements of ASTM A36. Structural steel members shall be constructed entirely of Type 316 stainless steel (Type 316L for welding) where indicated.

B. Unless otherwise indicated in the Contract Documents, miscellaneous "steel" metalwork of fabricated steel, which will be used in a corrosive environment such as in a vault below ground and/or as indicated in the Contract Documents shall be Type 316 stainless steel (Type 316L for welding) and shall not be galvanized.

C. Unless otherwise shown, iron castings shall conform to the requirements of ASTM A48, Class 30B or better.

D. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have contact surfaces coated in accordance with Section 09800 and as specified herein.

2.02 BOLTS

A. All bolts, threaded rod, nuts, and washers shall be Type 316 stainless steel. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads for all bolts and nuts.

B. Except as otherwise provided herein, steel for bolts and cap screws shall be in accordance with the requirements of ASTM A307 Grade B, or threaded parts of ASTM A36. All bolts and cap screws shall have hexagon heads, unless noted otherwise.

C. Except as otherwise provided herein, steel for nuts shall be in accordance with the requirements of ASTM A563 Grade A, heavy hexagon series. The nut material shall be free-cutting steel, and the nuts shall be capable of developing the full strength of the bolts.

D. All bolts and nuts shall be installed with washers fabricated of material matching the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification. Lock washers shall be installed with washers where indicated and shall be fabricated of material matching the bolts.

E. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than ½-inch beyond the nut.

F. Provide threaded rod as recommended by manufacturer and as required per this section. Provide nut and washer at all adhesive anchors.

2.03 ALUMINUM HATCHES

A. Hatches shall be per the District's Approved Materials List.

B. Hatches shall be aluminum unless specifically stated otherwise. Provide traffic H20- rated hatches for hatches that may subject to vehicular loading.

C. Hatches shall conform to O.S.H.A. standard 1910.23.

D. Hatch opening sizes, number, and direction of swing of door leaves, and locations, shall be as called out or shown on the Drawings. Sizes given shall be for the clear opening. Where the number of leaves is not given, openings larger than 42 inches in either direction shall have double-leaf doors. Hinges shall be located as shown.

E. Hatches shall be designed for flush mounting unless indicated otherwise on the Drawings.

F. The door leaves shall be a minimum of 1/4–inch aluminum diamond pattern plate (5086 aluminum). Channel frames shall be a minimum of 1/4-inch aluminum with an anchor flange around the perimeter. Material shall be 6061-T6 aluminum for bars, angles, and extrusions. Doors shall be equipped with heavy forged type 316 stainless steel hinges having 3/8-inch minimum diameter stainless steel pins and pivot so that the cover does not protrude into the channel frame. Hinges shall be bolted to the channel frame and diamond plate with type 316 stainless steel bolts and ny-lock nuts. Brackets shall be provided on the underside of the hatches to hold the safety bars when not in use.

G. Hatches shall be designed for easy opening by one person from both inside and outside and shall be balanced to require no more than 30 lbs of opening force.

H. Hatches shall be designed to be water-tight and shall be equipped with a joint gutter and a moat-type edge drain. A 1-1/2-in diameter (minimum) Type 304 stainless steel drain connection shall be provided. Drainline shall be routed to the sump as indicated on the Drawings. Hatch shall be gasketed. Gasket material shall be suitable for use outdoors.

I. Hatch skirt shall extend down to bottom of concrete cap

J. Aluminum shall be supplied with mill finish. Exterior of frame which comes in contact with concrete shall have an isolation coating to deter reaction of dissimilar materials.

K. Hatches shall be provided with:

1. Automatic hold-open arm with release handle.

2. Doors shall lock open in the 90-degree position. Hold open arms shall be fastened to the frame with ½" grade 316 stainless steel bolts.

3. A cast stainless steel lift handle, flush with the top of the ¼" diamond plate.

4. Heavy duty stainless steel pneu-spring for smooth, easy, and controlled door operation throughout the entire arc of opening and closing.

5. Spring shall consist of a minimum ½" stainless steel shaft which slides into a minimum 1" stainless steel tube. Spring shall be charge with an inert gas (nitrogen).

6. Spring design must ensure ease of maintenance.

7. Mechanical, torsion, or coil type springs shall not be accepted as equal.

8. Slam lock, type 316 stainless steel, with keyway protected by a threaded aluminum plug. Plug shall be flush with the top of the ¼" diamond plate. Slam lock shall be fastened with four type 316 stainless steel bolts and washers.

9. Recessed padlock compartment and padlocks.

10. The recessed padlock clip shall be supplied with its own separate hinged cover for access. The separate hinged cover shall be supplied with a spring- loaded cover so that there is no possibility of the cover being left in the "open" position, which would cause a tripping hazard.

L. Traffic/H20 Rated Hatches: Hatch shall be H20 rated where indicated in the Contract Documents. The design live load shall be rated for AASHTO H20 wheel loading. Maximum deflection shall be 1/150th of the span, unless noted otherwise.

M. Pedestrian Rated Hatches: Hatches shall be pedestrian rated where indicated in the Contract Documents and shall be designed for at minimum live load of 300 psf and a minimum concentrated load of 300 lb.

PART 3 - EXECUTION

3.01 GENERAL

A. Fabrication and Erection. Except as otherwise shown, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction".

B. Manufactured metalwork items specified herein shall be installed according to the manufacturer's instructions and recommendations.

C. All steel surfaces that come into contact with exposed concrete shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with manufacturer’s instructions prior to installation.

D. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

E. Where aluminum contacts concrete, apply one coat of TT-P-645B zinc-molybdate primer or heavy coat of approved alkali resistant bituminous paint to the aluminum or concrete.

3.02 WELDING

A. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

B. In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS Code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material that is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

*****END OF SECTION*****

SECTION 07110

DAMPPROOFING AND MOISTUREPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers the work necessary to furnish and install damp proofing and moisture proofing on outside of below grade concrete walls as specified herein.

1.02 RELATED SECTIONS

A. Section 03300, CAST-IN-PLACE CONCRETE

B. Section 03400, PRECAST CONCRETE STRUCTURES

1.03 NOT USED

1.04 NOT USED

1.05 SUBMITTALS

A. Submittals for items specified herein shall be submitted by the Contractor to the District for review prior to ordering materials.

B. Submit the following items:

1. Certificates:

a. Evidence of acceptance of applicator by manufacturer.

b. That materials and components furnished conform with requirements of these Specifications.

2. Samples and Manufacturer's Literature

a. Product data and samples.

b. Manufacturer's requirements for product use.

c. List of materials proposed for use.

3. Shop Drawings – Show locations and extent of waterproofing. Including details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing and other termination conditions.

1.06 QUALITY ASSURANCE

A. Applicator shall have applied accepted system on two or more projects which have been completed and performing satisfactorily for at least 2 years.

B. Installation shall be by applicator acceptable to the approved manufacturer.

C. Pre-installation Conference (Conduct at Project Site)

1. Review waterproofing requirements including surface preparation substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

D. Contractor shall make, at his own expense, repairs necessary because of faulty materials or workmanship.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with labels intact and legible.

B. Deliver materials in sufficient quantity to allow continuity of work.

C. Handle rolled goods so as to prevent damage to edge or ends.

D. Select and operate material handling equipment so as not to damage existing construction.

E. Store materials on clean raised platforms with weather protective covering when stored outdoors.

F. Provide continuous protection of materials against wetting and moisture absorption.

G. Protect materials against damage by construction traffic.

H. Remove wet materials from project site.

I. Comply with fire and safety regulations.

J. Store emulsions in temperature above 45 degrees F.

1.08 JOB CONDITIONS

A. Environmental Requirements

1. Application of waterproofing systems shall be performed in dry conditions.

2. Apply waterproofing within the range of ambient and substrate temperatures recommended by the waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

3. Do not apply waterproofing in rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials, as recommended by waterproofing manufacturer.

C. Protection

1. Provide special protection for completed work when ambient temperature is above 80 degrees F. Protect from rain and surface water for 36 hours after application.

2. Restore to original condition or replace work or materials damaged during handling of bitumens and materials.

PART 2 - PRODUCTS

2.01 GENERAL

A. Damp proofing and moisture proofing products shall be furnished in accordance with the requirements specified herein.

2.02 MATERIALS

A. Waterproofing Membrane

1. Waterproofing membrane per the Districts Approved Materials List.

2. Protective Board. Protective board shall be 1/2-inch asphalt impregnated celotex insulation board.

B. Damp proofing

1. Acceptable products shall be per the District's Approved Materials List.

2. Coating shall be a one-component bitumen modified polyurethane membrane system.

3. Total dry film thickness shall be 60 mils ±5; apply in 2 coats of 30 mils each.

4. Product shall meet the local, state, and federal air quality regulations and rules in effect at time of application.

C. Crystalline Waterproofing

1. Treating the concrete with the crystalline waterproofing product/technology, prior to the sealant performs as a combination for damp proofing/waterproofing.

2. Crystalline waterproofing product/technology per the Districts Approved Materials List.

PART 3 - EXECUTION

3.01 GENERAL

A. Work performed shall meet or exceed the requirements specified herein.

3.02 WATERPROOFING MEMBRANE

A. Location. Waterproofing membrane shall be applied to exterior surfaces of below grade vaults or structures where specified.

B. Surface Preparation. Concrete surfaces to receive waterproofing membrane shall be clean, dry, and free of voids, spalled areas, loose aggregate, and sharp protrusions, with no coarse aggregate visible.

1. Concrete shall have cured and aged for the minimum time period recommended by the waterproofing manufacturer.

2. Test for capillary moisture by plastic sheet method according to ASTM D4263.

C. Application.

1. Waterproofing membrane shall be applied in accordance with the manufacturer's recommendations. Surfaces shall be clean and primed prior to application of the membrane. The manufacturer's representative shall be present during initial application to certify that the Contractor's procedures comply with manufacturer's specifications.

2. Pipes or conduits entering structures shall be watertight. The protective board shall be placed directly against the membrane prior to backfilling. Where the membrane is turned up from the base of the walls, at angles in walls, and at any other place where the membrane may be subjected to unusual strain, strips consisting of two additional plies of membrane shall be applied.

3.03 DAMPPROOFING

A. Location: Unless otherwise specified, damp proofing shall be applied below grade on outside of all miscellaneous concrete structures including, but not limited to, electrical handholds, electrical pullboxes, vaults, and miscellaneous structures.

B. Surface Preparation: Examine surfaces for foreign material, moisture, and unevenness which would prevent the execution and quality of application of system as specified. Remove any paraffin or wax base non-bonding compounds. Fill all cracks, voids, joints, depressions, and places around projections with cement grout to provide smooth and flush surface. Proceed with damp proofing application only after surface defects are corrected. Application of material will be considered as evidence of installer's acceptance of substrate as a proper base for damp proofing.

C. Application. Install materials in accordance with requirements of damp proofing system manufacturer. Maintain neat line at upper edge. Mask as required to prevent overrun of materials onto exposed surfaces.

3.04 CRYSTALLINE WATERPROOFING

A. Concrete placement, curing and protection shall be per manufacturer’s recommendations.

*****END OF SECTION*****

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SECTION 09800

PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish all labor and materials for protective coatings systems in accordance with the provisions of this Section, including protective coating of all required surfaces, including but not limited to all:

1. Surface preparation
2. Pretreatment
3. Coating application
4. Touch-up of factory-coated surfaces
5. Protection of surfaces not to be coated
6. Cleanup and appurtenant work

B. The following surfaces shall not require protective coating unless otherwise shown or specified.

1. Concrete
2. Stainless steel
3. Machined surfaces
4. Grease fittings
5. Glass
6. Equipment nameplates
7. Traffic boxes
8. Gratings and frames, checker plates, hatches, stair treads, and other walk surfaces
9. Existing surfaces, unless specifically identified to be recoated or if existing coatings are damaged due to the work of this contract.

C. All other surfaces shall be protective coated unless otherwise specified.

D. Coating systems to be used shall be per the coating schedule specified herein, unless otherwise specified in the Project Contract Documents.

E. All coatings shall comply with all local, state, and federal air pollution rules and regulations in effect at the site of application. If a specified coating system does not meet the current local, state, and federal air pollution rules and regulations at the time of application, the Contractor shall submit a substitute coating system for review by the District or its appointed Representative.

1.02 RELATED SECTIONS

A. Section 11000, GENERAL EQUIPMENT

B. Section 15050, GENERAL PIPING

C. Section 15061, DUCTILE IRON PIPE (DIP)

D. Section 15100, GENERAL VALVES

E. Section 15109, PLUG VALVES

F. Section 15110, CHECK VALVES

1.03 REFERENCE SPECIFICATIONS

A. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of the Steel Structure Painting Council, 4400 Fifth Avenue, Pittsburg, PA 15213.

B. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 986, Katy, TX 77450.

C. References herein to "DOD" shall mean the methods approved for use by agencies of the Department of Defense and for listing in the DOD Index of Specifications and Standards.

1.04 EXPERIENCE REQUIREMENTS

A. Skilled applicators shall be used and experienced supervision shall be provided on all protective coating work.

B. The protective coatings applicator shall possess a valid state license as required for performance of the painting and coating work called for in this Specification and shall provide five (5) references which show successful experience with the specified or comparable coating systems. Include the name, address, contact name, and telephone number for the owner of each installation for which the protective coating was provided.

1.05 SUBMITTALS

A. The Contractor shall provide submittals for items specified herein to the District for review and approval prior to ordering materials.

B. The Contractor shall submit the following:

1. Protective coatings applicator references, as specified above.

2. Paint manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

3. Paint manufacturer's instructions and recommendations on surface preparation and application.

4. Colors available for each product (where applicable).

5. Compatibility of shop and field applied coatings (where applicable).

6. Material safety data sheet for each product used.

1.06 QUALITY ASSURANCE

A. General. The Contractor shall give the District a minimum of 3 days advance notice of the start of any field surface preparation work of coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

B. All protective coating work shall be performed only in the presence of the District or its appointed Representative unless the District has granted prior approval to perform such work in its absence.

C. Inspection by the District or its appointed Representative, or the waiver of inspection of any particular portion of the work, shall not relieve the Contractor of its responsibility to perform the work in accordance with these Specifications.

D. Inspection Devices. The Contractor shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the measurement of dry- film thicknesses of protective coatings. Dry-film thickness gauges shall be made available for the District or its appointed Representative's use at all times while coating is being done, until final acceptance of such coatings.

E. Film Thickness Testing. On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge such as Mikrotest model FM, Elcometer model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the

coating thicknesses shall be measured at the time of application using a wet film gauge.

F. Surface Preparation. Evaluation of blast cleaned surface preparation work shall be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Recommendations. Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed. The Contractor shall supply the District or its appointed Representative with copies of each manufacturer's instructions.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage and Mixing. Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

PART 2 - PRODUCTS

2.01 GENERAL

A. Definitions. The term "paint", "coatings", or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. General. Coating materials shall be sealed in containers that plainly show the designated name, formula, or specification number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

C. The Contractor shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.

D. Compatibility. In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of

the District or its appointed Representative, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

E. Protective Coating Materials. Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the Contractor shall provide the District with the names of not less than 10 successful applications of the proposed manufacturer's products demonstrating compliance with this specification requirement.

F. Substitute or "or-equal" Submittals. Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed. The Contractor shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or-equal" material that said material meets the specified requirements and is equivalent or better than the listed materials in the following properties:

1. Quality
2. Durability
3. Resistance to abrasion and physical damage
4. Life expectancy
5. Ability to recoat in future
6. Solids content by volume
7. Dry film thickness per coat
8. Compatibility with other coatings
9. Suitability for the intended service
10. Resistance to chemical attack
11. Temperature limitations in service and during application
12. Type and quality of recommended undercoats and topcoats
13. Ease of application
14. Ease of repairing damaged areas
15. Stability of colors

G. The cost of all testing and analyzing of the proposed substitute materials that may be required by the District shall be paid by the Contractor. If the proposed substitution requires changes in the contract work, the Contractor shall bear all such costs involved and the costs of allied trades affected by the substitution.

H. Material Sources. Each of the following manufacturers is capable of supplying many of the coating materials specified herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. Proposed substitute materials must be shown to satisfy the material descriptions and to equal or exceed the properties of the listed materials.

1. Tnemec Company

2. Carboline Coatings Company

3. Ameron, Protective Coatings Division

4. Devoe High Performance Coatings

2.02 COATING SYSTEM SCHEDULE

A. Ferrous Metal-Not Galvanized (FM)

Item No.	Item	Surface Preparation	System No.
FM-1	All exposed surfaces indoors and outdoors, except those included below	SSPC-SP10	Epoxy/ polyurethane (1)
FM-2	Buried surfaces not specified elsewhere to be coated	SSPC-SP10	Amine cured epoxy (2)
FM-3	Surfaces submerged or intermittently submerged in water/wastewater	SSPC-SP5	Amine cured epoxy (2)
FM-4	Ferrous surfaces inside all valves, 4 inches and larger	SSPC-SP10	See Specific Valve Sections
FM-5	Ferrous surfaces of steel couplings and flange coupling adapters, lining and coating of steel pipe and fittings	SSPC-SP5	Fusion bond epoxy (4)
FM-6	Exposed surfaces that have been shop coated with fusion bonded epoxy	Light sandblast to roughen surface	Aliphatic Polyurethane (5)
FM-7	Exposed rebar from core drills and demolition	SSPC-SP1	Amine cured epoxy (2)
FM-8	Surfaces of pipe, valves, and equipment inside of below grade vaults	SSPC-SP10	Amine cured epoxy (2)
FM-9	Buried ductile iron pipe and fittings	See Section 15062	See Section 15062

B. Ferrous Metal-Galvanized (FMG)

Item No.	Item	Surface Preparation	System No.
FMG-1	All exposed surfaces indoors and outdoors, except those included below	Alkaline Cleaning	Aliphatic polyurethane w/tie coat (6)
FMG-2	Buried small galvanized steel pipe	Removal of dirt, grease, oil	PVC or PE Tape (3)
FMG-3	Surfaces buried or potentially submerged in water	Alkaline cleaning	Amine cured epoxy (2)
FMG-4	Buried valves, grooved end couplings, or flanged joints	SSPC-SP10	Amine cured epoxy (2)

C. Non-ferrous metal, plastic, fiberglass (NFM)

Item No.	Item	Surface Preparation	System No.
NFM-1	All exposed surfaces indoors and outdoors, except as included below	SSPC-SP1	Aliphatic polyurethane w/tie coat (6)
NFM-2	Aluminum surfaces in contact with concrete, or with any other metal except galvanized ferrous metal	SSPC-SP1	Aluminum metal isolation (7)
NFM-3	PVC pipe, valves and fittings exposed indoors and outdoors (not submerged and/or buried)	SSPC-SP1	Aliphatic polyurethane w/tie coat (6)
NFM-4	Buried non-ferrous metal pipe	Remove dirt, grease, oil	PVC or PE tape (3)

1. Where isolated non-ferrous parts are associated with equipment or piping, the Contractor shall use the coating system for the adjacent connected surface. Do not coat handrails, gratings, frames or checker plates. Only primers recommended by the coating manufacturer shall be used.

D. Concrete (C):

Item No.	Item	Surface Preparation	System No.
C-1	Exterior of Vaults (Below grade)	See Section 07110	See Section 07110
C-2	Interior of Manholes and Wet Wells, where rehab and/or lining/coating required	See Section 02720	See Section 02700
C-3	Waterproofing in Interior of New Manholes and Wet Wells.	See Section 02720	See Section 02700

2.03 PROTECTIVE COATING SYSTEMS

A. System 1 - Epoxy/polyurethane. Rust inhibitive epoxy prime coat, and pigmented aliphatic polyurethane finish coat. Where this system is used for shop-primed equipment, a suitable epoxy primer shall be submitted for review and surface preparation shall be per the epoxy/polyurethane manufacturer's recommendations.

1. Prime Coat (DFT = 6-8 mils), Tnemec V69, Carboline Carboguard 890, Devoe Bar-Rust 231, or equal.

2. Finish coat (DFT = 2-3 mils), Tnemec 1075, Carbothane 134VOC, Devthane 379H, or equal.

3. System DFT = 8.0 to 11.0 mils.

4. Safety colors such as safety yellow, safety green or safety red may require an additional intermediate coat for uniform color. The cost shall be included as part of the work.

B. System 2 - Amine-Cured Epoxy. High build, amine-cured, straight epoxy resin shall be suitable for long-term immersion service in raw wastewater/sewage. Where this system is used for shop-primed equipment, a suitable epoxy primer shall be submitted for review and surface preparation shall be per the amine-cured epoxy manufacturer's recommendations.

1. Prime coat and finish coats (3 or more, DFT = 16 mils), Amercoat 133, Tnemec V69, Carboguard 890, Devoe Bar-Rust 233H or equal.

   a. Where this system is used for indoor electrical, instrumentation, control panels and enclosures, a minimum DFT of 8 mils will be acceptable.

C. System 3 - PVC or PE Tape. Prior to wrapping the pipe with PVC or PE tape, the pipe and fittings shall be primed using a primer recommended by the PVC or PE tape manufacturer, and in accordance with AWWA C214. After being

primed, the pipe shall be wrapped with an adhesive PVC or PE tape system, half-lapped, to a total thickness of 50 mils. The tape system shall be in accordance with AWWA C214. Tape shall extend 6 inches above the finished grade elevation.

D. System 4 - Fusion Bonded Epoxy. The coating material shall be a 100 percent powder epoxy. It shall be applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines,". The coating shall be applied using the fluidized bed process. Coating shall include ends of pipe unless specified to be field welded.

1. Liquid Epoxy. For field repairs or where, as confirmed by the District or its appointed Representative, it would be impossible to use the powder epoxy method without causing damage to the item, the use of a liquid epoxy will be permitted, applied in not less than 3 coats to provide a DFT of 15 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer.

2. Coating (DFT = 16 mils): Scotchkote 206N, Scotchkote 134, or equal.

3. Total system DFT = 16 mils.

E. System 5 - Aliphatic Polyurethane. Two component aliphatic acrylic or polyester polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering and with a minimum solids content of 58 percent by volume. Primer shall be a rust inhibitive two component epoxy coating with a minimum solids content of 75 percent by volume.

1. Prime coat (DFT = 6-8 mils): Amerlock 2/400, Carboguard 890, Tnemec V69, Devoe Bar-Rust 231, or equal.

2. Finish coat (one or more, DFT = 2-3 mils): Amershield, carbothane 134VOC, Tnemec Series 1075, Devthane 379H, or equal.

3. System DFT = 9.0 to 13.0 mils.

4. More than one finish coat shall be applied as necessary to produce a finish with uniform color and texture.

F. System 6 - Aliphatic Polyurethane finish over a tie coat.

1. Tie coat (DFT = 3-5 mils), Tnemec 135, Carboline Rustbond, Devoe Devran 203, or equal.

2. Finish coat (DFT = 3.0 to 5.0 mils/coat, 2 coats), Tnemec 1075, Cartothane 134VOC, Devoe Devthane 379H, or equal.

3. Minimum System DFT = 6 mils.

G. System 7 - Aluminum Metal Isolation.

1. Prime coat (DFT = 3.0 to 5.0 mils): Tnemec 135, Carboline Rustbond, Devoe Bar-Rust 231, or equal.

2. Finish coat (one or more, DFT = 3.0 to 5.0 mils): Tnemec V69, Carbogaurd 890, Devoe Bar-Rust 231 or equal.

3. Minimum system DFT = 8 mils.

PART 3 - EXECUTION

3.01 GENERAL

A. All protective coating work shall be performed only in the presence of the District or its appointed Representative, unless the District has granted prior approval to perform such work in its absence.

B. Skilled applicators shall be used and experienced supervision shall be provided on all protective coating work.

C. Clean drop cloths shall be used. All damage to the surface resulting from the work hereunder shall be cleaned, repaired, and refinished to their original condition.

D. All coatings shall be applied under dry and dust-free conditions. Coating shall be done in a manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure that they have been thoroughly cleaned and that they receive an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to insure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other approved precautionary measures.

E. Where protective coatings are to be applied, Contractor shall provide adequate ventilation during application of coatings meeting all applicable codes.

3.02 PREPARATION FOR COATING

A. General. All surfaces to receive protective coating shall be cleaned as specified herein prior to application of said coatings. The Contractor shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on

factory- finished surfaces shall receive touch-up restoration prior to any coating application.

B. Protection of Surfaces Not to be Coated. Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.

C. All hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.

D. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The Contractor shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

E. Protection of Painted Surfaces. Cleaning and coating shall be so programmed that dust and other contaminants from the cleaning process will not fall on, or be blown onto, wet, newly-coated surfaces.

3.03 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:

1. Solvent Cleaning (SSPC-SP1). Removal of oil, grease, dirt, soil, salts, and contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.

2. Hand Tool Cleaning (SSPC-SP2). Removal of loose rust, loose mill scale, and loose paint to degree specified, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3). Removal of loose rust, loose mill scale, and loose paint to degree specified, by power tool chipping, descaling, sanding, wire brushing, and grinding.

4. White Metal Blast Cleaning (SSPC-SP5) (NACE No. 1). Removal of all visible rust, mill scale, paint, and foreign matter by blast cleaning by wheel or nozzle (dry or wet) using sand, grit, or shot.

5. Commercial Blast Cleaning (SSPC-SP6) (NACE No. 3). Blast cleaning until at least two-thirds of each element of surface area is free of all visible residues.

6. Brush-Off Blast Cleaning (SSPC-SP7) (NACE No. 4). Blast cleaning of all except tightly adhering residues of mill scale, rust, and coatings, exposing numerous evenly distributed flecks of underlying metal.

7. Near-White Blast Cleaning (SSPC-SP10) (NACE No. 2). Blast cleaning nearly to White Metal Cleanliness, until at least 95 percent of each element of surface area is free of all visible residues.

8. The Contractor shall note that the definition of Near White Metal Blast Cleaning, SSPC-SP10, and requires that 95 percent of "each element" of surface area be free of all visible residues. The other surface preparation standards shall be the most recent versions published by the SSPC.

3.04 METAL SURFACE PREPARATION (UNGALVANIZED)

A. The minimum abrasive blasting surface preparation shall be as specified on the Coating Schedule specified herein. Where there is a conflict between the Contract Documents and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.

B. Metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70.

C. All oil, grease, welding fluxes and other surface contaminants shall be removed by solvent cleaning per SSPC-SP1 prior to blast cleaning.

D. All sharp edges shall be rounded or chamfered and all burrs, and surface defects and weld splatter shall be ground smooth prior to blast cleaning.

E. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions.

F. The abrasive shall not be reused unless otherwise approved by the DISTRICT OR ITS APPOINTED REPRESENTATIVE. For automated shop blasting systems, clean oil-free abrasives shall be maintained.

G. The Contractor shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

H. Compressed air for air blast cleaning shall be supplied at adequate pressure from well-maintained compressors equipped with oil/moisture separators which remove at least 95 percent of the contaminants.

I. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming or another approved method prior to painting.

J. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

K. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.

L. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC-SP2, hand tool cleaning or SSPC-SP3, power tool cleaning, will be permitted.

M. Shop applied coatings of unknown composition shall be completely removed before the specified coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop- applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

3.05 SURFACE PREPARATION FOR GALVANIZED FERROUS METAL

A. Galvanized ferrous metal shall be brush-off blast cleaned SSPC-SP7 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used.

B. Pretreatment coatings, barrier coatings, or washes of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

3.06 SURFACE PREPARATION OF FERROUS SURFACES WITH EXISTING COATINGS

A. General. All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The generic type of the existing coatings shall be determined by laboratory testing.

B. Abrasive Blast Cleaning. The Contractor shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, Brush-off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.

C. Incompatible Coatings. If coatings to be applied are not compatible with existing coatings the Contractor shall apply intermediate coatings per the paint manufacturer's recommendation for the specified coating system or shall completely remove the existing coating prior to abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.

D. Unknown Coatings. Coatings of unknown composition shall be completely removed prior to application of new coatings.

PLASTIC, FIBERGLASS AND NONFERROUS METALS SURFACE PREPARATION

A. Plastic and fiberglass surfaces shall be sanded or brush-off blast cleaned prior to solvent cleaning with a chemical compatible with the coating system primer.

B. Non-ferrous metal surface shall be solvent-cleaned SSPC-SP1 followed by sanding or brush-off blast cleaning SSPC-SP7.

C. All surfaces shall be clean and dry prior to coating application.

3.02 SHOP COATING REQUIREMENT

A. All items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the specified or approved color. The methods, materials, application equipment and all other details of shop painting shall comply with this Section. If the shop primer requires topcoating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.

B. All items of equipment, or parts of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating work performed in the field.

C. For certain pieces of equipment it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, main fuel tanks, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the specified quality in the field. Such equipment shall be shop primed and finish coated and touched up in the field with the identical material after installation. The Contractor shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

D. For certain small pieces of equipment the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, etc.

E. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 6

months before topcoating, or less time if recommended by the coating manufacturer.

F. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.

G. The Contractor shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

3.03 APPLICATION OF COATINGS

A. The application of protective coatings to steel substrates shall be in accordance with "Paint Application Specification No. 1, (SSPC-A-1)", Steel Structures Painting Council. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The Contractor shall schedule such inspection with the District or its appointed Representative in advance.

B. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

C. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

D. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.

E. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

F. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.

G. Coatings shall not be applied under the following conditions:

1. Temperature exceeding the manufacturer's recommended maximum and minimum allowable.

2. Dust or smoke laden atmosphere.

3. Damp or humid weather.

4. When the substrate or air temperature is less than 5 degrees F above dewpoint.

5. When air temperature is expected to drop below 40 degrees F, or less than 5 degrees F, above the dewpoint, within 8 hours after application of coating.

H. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychometric tables.

I. AWWA fabricated steel piping shall be abrasive blast cleaned and primed before installation.

J. The finish coat on all work shall be applied after all concrete and equipment installation is complete and the work areas are clean and dust free.

3.10 CURING OF COATINGS

A. The Contractor shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the highest requirement, prior to placing the completed coating system into service.

B. In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.

C. Forced Air Ventilation of Enclosed Hydraulic Structures. Forced air ventilation is required for the application and curing of coatings on the interior surfaces of enclosed hydraulic structures. During curing periods, continuously exhaust air from the lowest level of the structure using portable ducting. After all interior coating operations have been completed, provide a final curing period for a minimum of ten days, during which the forced ventilation system shall operate continuously.

*****END OF SECTION*****

SECTION 11000

GENERAL EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall provide all tools, supplies, materials, equipment, and all labor necessary for the furnishing, construction, installation, testing, and operation of all equipment and appurtenant work, complete and operable, all in accordance with the requirements of these Standard Specifications.

B. The provisions of the Section shall apply to all equipment specified and where referred to, except where otherwise specified or shown in the Project Contract Documents.

C. Products manufactured in the USA shall be used where feasible.

D. Requirements specified herein are used to establish the standards of quality and utility required for equipment. However, alternates to or variance from requirements specified herein which are equal in quality and utility to those specified herein may be permitted by the District subject to the following provisions:

1. The Contractor shall submit to the District sufficient data, drawings, samples, literature, calculations, or other detailed information as will demonstrate to the District or its appointed Representative that the proposed alternate is equal in quality and utility to the requirements Specified herein.

2. The District or its appointed Representative must favorably review in writing such proposed variances and/or substitutions as are, in its opinion, equal in quality to the requirements of the District's Standard Specifications, or acceptable under special conditions.

3. Failure of the Contractor to submit proposed substitutions or variances for review in the manner described above shall be sufficient cause for rejection by the District of any alternates or variances otherwise proposed.

1.02 RELATED SECTIONS

A. Section 05500, MISCELLANEOUS METALWORK

B. Section 09800, PROTECTIVE COATINGS

1.03 REFERENCE SPECIFICATIONS

A. Without limiting the generality of other requirements of these Specifications, all work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section; provided, that for Building Codes, the latest edition of the code, as adopted as of the date of award by the agency having jurisdiction, shall apply to the Work.

B. Commercial Standards. All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as specified in each section of these specifications:

1. Air Moving and Control Association (AMCA)
2. American Gear Manufacturers Association (AGMA)
3. American National Standards Institute (ANSI)
4. American Public Health Association (APHA)
5. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
6. American Society of Mechanical Engineers (ASME)
7. American Society for Testing and Materials (ASTM)
8. American Water Works Association (AWWA)
9. American Welding Society (AWS)
10. Anti-Friction Bearing Manufacturers Association (AFBMA)
11. Federal Specifications (FS)
12. General Industry Safety Orders (Cal/OSHA)
13. Manufacturer's published recommendations and specifications
14. Mechanical Power Transmission Association (MPTA)
15. National Electrical Manufacturers Association (NEMA)
16. National Fire Protection Association (NFPA)
17. Rubber Manufacturers Association (RMA)
18. California Building Code (CBC)

C. The following references are part of this Section. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail. The latest edition of the following references at the time of bid shall be used.

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys
ANSI B46.1	Surface Texture
ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
ANSI/ASME B1.20.1	General Purpose Pipe Threads
ANSI/ASME B31.1	Power Piping
AWWA C206	Field Welding of Steel Water Pipe
ASTM A48	Specification for Gray Iron Castings
ASTM A108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide submittals for and items specified herein to the District for review and approval prior to ordering materials.

B. Shop Drawings. The Contractor shall furnish complete shop drawings for all equipment specified in the various Sections, together with all piping, valves, and controls for review by the District.

C. Technical Manuals (Operation and Maintenance Manuals). The Contractor shall submit technical manuals as specified herein.

D. Tools. The Contractor shall supply to the District one complete set of special wrenches and/or other special tools necessary for the assembly, adjustment, and dismantling of the equipment. All tools shall be of best quality hardened steel forgings with bright, finished heads and with work faces dressed to fit nuts. The set of tools shall be neatly mounted in a labeled tool box of suitable design provided with a hinged cover. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices. No additional compensation shall be provided to the Contractor for provision of the items listed above.

E. Spare Parts. The Contractor shall obtain from the supplier and submit to the District a list of suggested spare parts including those spare parts specifically required in the provisions of the Section, for each piece of equipment. The Contractor's price to supply each spare part to the District shall include the Contractor's markup, taxes, shipping, storage, and all other incidental costs associated with each spare part, in accordance with the provisions of frontend specifications. After approval, Contractor shall furnish such spare parts suitably packaged, identified with the equipment number, and labeled. Contractor shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment. Payment for those items approved by the District shall be paid by the District. Any item listed within the Contract Documents to be provided as spare parts shall be provided to the District at no additional cost.

F. Equipment Supports and Foundations. The Contractor shall furnish to the District an analysis of the equipment support and foundation for all items in excess of 1,000 pounds. The analysis shall be performed and stamped by a licensed Structural Engineer in the State of California. Foundation drawings shall be submitted to the District in accordance with the requirements of front end specifications.

G. Submit calculations for the anchor systems for each item specified which weights in excess of 400 pounds (wet, or operating weight). Calculations shall include seismic horizontal and vertical forces as well as dead load or live load calculations, as applicable. Calculations shall include details which show size and material of anchor bolts, spacing requirements, grout and filler specifications, strap material, spacing and fastening requirements, and any miscellaneous information required to properly secure the item of equipment.

1.06 QUALITY ASSURANCE

A. Inspection and Field Adjustment. The Contractor shall demonstrate that all equipment meets the specified performance requirements. Contractor shall provide the services of an experienced, competent, and authorized service representative of the supplier of each item of major equipment who shall visit the site of work to perform the following tasks:

1. Assist the Contractor in the installation of the equipment.

2. To inspect, check, adjust if necessary, and approve the equipment installation.

3. To start-up and field-test the equipment for proper operation efficiency and capacity.

4. To perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the District.

5. To instruct the District's personnel and contract personnel in the operation and maintenance of the equipment, in accordance with the provisions of frontend specifications. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

B. Costs. The costs of all inspection, startup, testing, adjustment, and instruction work performed by said factory- trained representatives shall be borne by the Contractor. The District's operating personnel will provide assistance in the field testing.

C. Machine Finish. The type of finish shall be the most suitable for application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:

1. Surface roughness not greater than 63 micro-inches shall be required for all surfaces in sliding contact.

2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.

3. Rough finish not greater than 500 micro-inches shall be required for other machined surfaces.

4. Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.

D. Tolerances. Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16-inch for members 30 feet or less in length, and not greater than 1/8-inch for members over 30 feet in length.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall deliver, store, and handle equipment in accordance with the equipment manufacturer's recommendations and in a manner that will not damage the equipment.

B. Shipping

1. Equipment shall be shipped in sealed, weather-tight, enclosed conveyances and protected against damaging stresses during transport.

2. Bearing housings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt, and ventilation and other types of openings shall be taped closed.

3. Damage shall be corrected to conform to the requirements of the contract before the assembly is incorporated into the work. The Contractor shall bear the costs arising out of dismantling, inspection, repair, and reassembly.

C. All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. All equipment shall be protected rom exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment having anti- friction or sleeve bearings shall be stored in weather-tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers should be avoided to prevent accumulation of condensate in gears and bearings. Manufacturer's recommendations for extended storage periods shall be strictly adhered to.

D. Factory Applied Coatings. Each item of equipment shall be shipped to the site of the work with either the manufacturer's shop-applied prime coating or a chlorinated rubber prime coating. The prime coating shall be applied over clean dry surfaces in accordance with the paint manufacturer's recommendations. The prime coating will serve as a base for field-applied finish coats. Prime coats shall conform to the requirements of Section 09800, Protective Coatings.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Submit hardcopy sets of final approved versions of the Operation & Maintenance Manuals.

1. Provide electronic files on diskette for all non-preprinted text (Word), spreadsheets (Excel), or CAD drawings (AutoCAD) included in operations and maintenance manuals. These files shall become the property of the District for use in a master plant operations and maintenance manual, training programs, and other uses.

B. Submit Operation and Maintenance Manuals printed on 8 1/2 x 11-inch size, heavy, first quality paper with standard 3-hole punching. All operation and maintenance materials shall be original literature; no photocopied information shall be accepted. All information submitted shall be specific to the exact equipment supplied. Generic literature is unacceptable. Before final acceptance of a project by the District, the Contractor shall bind all sets of final accepted operation and maintenance materials in appropriately labeled, expanding post-type binders. Each completed binder shall contain only that material which can be held with the posts in the non-expanded position. Provide binders with titles on front and on spine of binder. Tab each section of manuals for easy reference with plastic-coated dividers. A complete table of contents listing all items and their location in the set shall be included in each binder. Provide plastic sheet lifters prior to first page and following last page.

C. Reduce drawings or diagrams bound in manuals to an 8 1/2 x 11-inch or 11 x 17- inch size. However, where reduction is not practical to ensure readability, fold larger drawings separately and place in vinyl envelopes that are bound into the binder. Identify vinyl envelopes with drawing numbers.

D. Submission of Operation and Maintenance Manuals , including a complete Mechanical and Electrical Equipment Maintenance Summary Sheet (attached to this specification section), is applicable but not necessarily limited to:

1. Major equipment
2. Equipment used with electrical motor loads.
3. Intelligent actuators.
4. Specialized equipment including valves and instrumentation and control system components for process systems such as level and pressure transmitters.
5. Valves greater than or equal to 12-inch diameter.

E. Operation and maintenance manuals shall include, but not necessarily be limited to, the following detailed information, as applicable:

1. Name, address, and phone number of local representative/supplier and spare parts warehouse.
2. Equipment function, normal operating characteristics, limiting operations.
3. Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
4. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
5. Lubrication and maintenance instructions and schedule.
6. Guide to “troubleshooting.”
7. Parts identification with exploded view drawing and predicted life of parts subject to wear.
8. Outline, cross-section, and assembly drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
9. Test data and performance curves.

10. A list of recommended spare parts with a price list and a list of spare parts provided under these specifications.

11. Copies of installation instructions, parts lists or other documents packed with equipment when delivered.

12. Instrumentation or tag numbers relating the equipment back to the Contract Documents.

13. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

14. Operating and Maintenance Manual Contents, for each electrical and electronic system, in accordance with Division 16.

    a. Control Diagrams: Internal and connection wiring, including logic diagrams, wiring diagrams for control panels, ladder logic for computer based systems, and connections between existing systems and new additions, and adjustments such as calibrations and set points for relays, and control or alarm contact settings.

    b. Provide electrical and instrumentation schematic record drawings.

PART 2 - PRODUCTS

2.01 GENERAL

A. Noise Level. When in operation, no single piece of equipment (except standby generators) shall exceed the Cal/OSHA noise level requirements for a one-hour exposure, and all equipment shall meet noise requirements specified in individual specification sections.

B. Welding. Unless otherwise specified or shown, all welding shall conform to the following:

1.	ANSI/AWWA	D100
	AWWA	C206
	AWS	D1.1, D1.2, D1.3

2. All composite fabricated steel assemblies which are to be erected or installed inside a hydraulic structure, including any fixed or movable structured components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.

3. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook", as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

4. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

C. Protective Coatings. All equipment shall be painted or coated in accordance with Section 09800, **PROTECTIVE COATINGS**, unless otherwise approved by the District or otherwise noted. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

D. Identification of Equipment Items. Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.

E. Shop Fabrication. Shop fabrication shall be performed in accordance with the Contract Documents and the approved shop drawings.

2.02 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. Seismic Anchorage of Equipment and Other Appurtenant Facilities

1. All pieces of electrical, mechanical, and instrumentation equipment and appurtenant facilities which are separately mounted or anchored shall be so installed as to be in conformance to all requirements of the California Building Code, latest edition, both for vertical and seismic loading. This requirement applies, but is not limited to, such items as electrical and instrumentation equipment, tanks, pumps, piping, pipe supports and hangers, generators, above-ground storage tanks, motors, fans, ventilating ducts and equipment, and other similar equipment or facilities.

2. All equipment or facilities noted within these Specifications or on the Project Drawings shall be considered essential and shall be anchored to resist seismic forces appropriate for this seismic zone. These forces are noted in the following table. All equipment or facilities shall be functional during and after an earthquake. Anchorage or restraints shall be so

designed as to resist the specified force acting in any direction. The entire anchoring system, including anchor bolts, shall be supplied by the appropriate equipment manufacturers.

3. Shop Drawing Submittals shall include calculations, details, and other amplifying data demonstrating conformance to the seismic requirements of this section. Such calculations shall be prepared and signed by a registered professional civil or structural Engineer licensed within the State of California.

B. Equipment foundations shall be as per manufacturer's recommendations. All mechanical equipment, tanks, control cabinets, etc., shall be mounted on concrete bases as shown on standard structural details, unless otherwise shown or specified.

2.03 PIPE HANGERS, SUPPORTS, AND GUIDES

A. All pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment. Supports and hangers shall be in accordance with the requirements specified herein. All supports, hangers, and guides shall be adequately designed for static, dynamic, seismic and wind loads, in accordance with prevailing California Building Code and other applicable requirements.

B. Pipe supports shall be in accordance with Section 15050**, PIPING, GENERAL**.

2.04 NAMEPLATES

A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Name plates shall indicate clearly the following information:

1. Manufacturer
2. Date of manufacture
3. Model and size
4. Serial number
5. Rating in capacity
6. Feet of head at capacity (pumps and fans only)
7. Speed at rated capacity
8. Impeller diameter (pumps and fans only)
9. Equipment number

10. Weight

2.05 SAFETY REQUIREMENTS

A. Where work areas are located within a flammable or toxic gas environment, suitable gas detection, ventilating, and oxygen deficiency equipment shall be provided. Workers shall be equipped with approved breathing apparatus.

2.06 RESPONSIBILITY FOR SPARE PARTS AND SPECIAL TOOLS

A. Where special repair tools, safety equipment, spares, or other loose parts are specified to be furnished, they shall be stored by the Contractor until permanent building storage areas are complete, secure, and lockable. Each part shall be fully identified as to the manufacturer, part number, purpose, and associated item of equipment. The Contractor shall inventory such parts and transmit the inventory, in writing, to the District at an agreed-upon time prior to the final testing and start-up period.

PART 3 - EXECUTION

3.01 GENERAL

A. Equipment shall be installed in accordance with the Manufacturer's recommendations.

3.02 PIPE HANGERS, SUPPORTS, AND GUIDES

A. Pipe Hanger materials and design shall be in accordance with ANSI/MSS SP-58

B. Hangers shall be spaced in accordance with ANSI/ASME B.31.1 Standard, and in accordance with this specification.

3.03 TESTING

A. Items of equipment specified shall be tested as required in the project Contract Documents

B. General. Where the Project Contract Documents require work to be specially tested or approved, it shall be tested only in the presence of the District or its appointed Representative after timely notice of its readiness for inspection and test, and the work after testing shall be covered up only upon the consent thereto of the District. The results of any tests made are for the information of the District. Regardless of any test results, the Contractor is solely responsible for the quality of workmanship and materials and for compliance with these Standard Specification.

Except as specifically required under detailed materials specifications for shop testing and inspection, all tests of materials furnished by the Contractor where tests will be made by the District will be done in accordance with commonly recognized standards of national organizations. The Contractor shall furnish such samples of all materials as required by the District without charge. No material shall be used unless it has been favorably reviewed by the District.

Where such inspection and testing is to be conducted by an independent laboratory or agency, the sample(s) of materials to be tested shall be selected by such laboratory or agency, or the District, and not by the Contractor.

Water for curing concrete shall be from a source approved by the District and shall be furnished and disposed of by the Contractor.

C. Costs of Testing

1. The Contractor shall be responsible for, and shall pay for, all off-site tests of materials required. The District or its appointed Representative, unless specified otherwise, shall have the right to witness all off-site tests; and the Contractor shall furnish adequate notice of when tests will be made.

2. The Contractor shall be responsible for, and shall pay for, all on-site tests, except those tests specifically noted to be performed and paid for by the District. The District or its appointed Representative shall have the right to witness all on-site tests performed by the Contractor, and the Contractor shall furnish adequate notice of when tests will be made.

3. When, in the opinion of the District or its appointed Representative, additional tests or inspections are required because of the manner in which the Contractor executes its work, such tests and inspections will be paid for by the District but will be deducted from the Contract price. Examples of such additional tests and inspections are: tests of materials substituted for previously accepted materials or substituted for specified materials or retests made necessary by failure of material to comply with the requirements of the Specifications.

3.04 PAINTING

A. Equipment shall be painted in accordance with Section 09800, **PROTECTIVE COATINGS** unless otherwise noted.

3.05 INITIAL START-UP AND OPERATION OF FACILITIES

A. For some projects, use of the newly constructed facilities prior to overall District acceptance may be necessary in order for the entire facility to be constructed. Use of facilities will in no way constitute acceptance of the facilities being used. Initial lubrication of all equipment, and all lubrication and maintenance as required for test operation shall be provided by the Contractor until the District

assumes operation. The Contractor shall furnish mechanical and electrical workers as required to make adjustments and maintain the operating equipment until acceptance.

B. After assuming operation, the District will supply operating personnel and will pay for lubricants.

C. Where required in the project Contract Documents, the Contractor shall train the District's operating personnel in the proper operation and control of the new facilities.

D. The cost of all labor, material, and equipment required to be furnished by the Contractor as part of the initial start-up operation shall be paid by the Contractor.

3.06 TRAINING

A. Where required in the Project Contract Documents, operations and maintenance training of the District's personnel shall be provided for mechanical, electrical, and instrumentation equipment. These training services shall be conducted by the manufacturer's representative and shall include all necessary classroom and on-site instruction.

3.07 OPERATION AND MAINTENANCE MANUALS

A. Manuals and Instructions. The Contractor shall deliver to the District sets of acceptable manufacturer's operation and maintenance instructions in accordance with this specification and the Project Contract Documents.

1. Following completion of an item, instructions and procedures shall be modified by the Contractor to reflect field changes.

3.08 AFFIDAVITS

A. The Contractor shall provide field service by equipment manufacturers as required in the Contract Documents. Equipment shall not be considered ready for operation until after the authorized factory-trained and qualified manufacturer's representative for the specific equipment has checked and adjusted the equipment and certified by written affidavit that the equipment has been properly installed, tested, adjusted, lubricated, and calibrated and is ready for full-time operation.

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SECTION 13100

INDIVIDUAL LOT PUMPING SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Design and construction of private individual lot pumping systems shall be in conformance with applicable Cal/OSHA regulations, electrical, plumbing, and building codes, and the requirements of this Section.

B. Pumping systems for single residential units may be either simplex (one pump) or duplex (two pumps). Systems to serve multiple residential units or nonresidential uses service shall be duplex systems (two pumps).

C. Flow Rates

1. Sizing and selection of the pump(s) shall be by an Engineer licensed in the State of California.
2. Pumping systems shall produce a velocity in the pressure side-sewer of three (3) to five (5) feet per second when pumping against the non-surcharged head at sump Low Water Level (LWL).
3. Connection to Side Sewer: Systems connected to side sewers shall discharge at a minimum flow rate of twenty (20) gpm and at a maximum flow rate of fifty (50) gpm.

1.02 RELATED SECTIONS

A. Section 02200, EARTHWORK

B. Section 02600, LATERALS AND BUILDING SEWERS (SIDE SEWERS)

C. Section 05500, MISCELLANEOUS METALWORK

D. Section 09800, PROTECTIVE COATINGS

E. Section 15064, POLYVINYL CHLORIDE (PVC) PIPE

1.03 REFERENCE SPECIFICATIONS

A. National Electrical Manufacturing Association (NEMA)

B. NATIONAL ELECTRICAL CODE (NEC)

C. California Occupational Safety and Health Administration (Cal/OSHA)

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall submit a complete Individual Lot Pumping System Application to District including manufacturer's Specifications and shop drawings for pumps, piping, valves, electrical controllers, sumps, and alarms and receive favorable review prior to purchasing any pumping system components, or commencing construction work.

B. The Contractor shall submit the calculated operating point of the submitted pump(s). The operating point shall be the discharge flowrate (in gallons per minute) of the pump at the operating total dynamic head, determined by the site specific discharge system. The Contractor shall provide the manufacturer's pump curve for the submitted pump, as well as information for the site specific discharge system, including but not limited to the static head, the discharge piping length, discharge piping diameter and material, fittings, and/or valves to be provided in the discharge piping.

C. Even the "pre-approved package systems" specified herein may be rejected by the District if the proposed system will not meet the flow rate requirements specified herein at the specific site.

D. The Contractor shall submit a copy of the electrical permit signed off as approved by the local building code enforcement agency to the Inspector prior to startup testing of the pumping system.

1.06 QUALITY ASSURANCE

A. Leakage Test

After closing the isolation valve at the pump station, the pump discharge pressure sewer shall be filled with water and pressurized to a minimum of 50 psi or to 120 percent of the pump shutoff head according to the pump manufacturer, whichever is greater. The pressure shall be allowed to stabilize for a period of five (5) minutes immediately preceding a ten (10) minute test period. To pass the test, there shall be no pressure drop during the test period.

B. Electrical Permit and Inspection

The Property Owner or the Contractor shall obtain an electrical construction permit for the electrical control and alarm work from the local building code enforcement agency and shall show evidence of favorable inspection of the system prior to functional testing of the pumping system. The Contractor shall coordinate with PG&E for any modifications that may be required to the electrical service.

C. Functional Test

When the pumping system installation is complete and favorable inspection of the electrical work has been obtained, the Contractor shall call for functional testing of the system. The Contractor shall arrange for a supply of water for use in the functional testing. The Inspector will witness the Contractor's operation of the system during the functional test, which shall include running through more than one (1) normal automatic pumping cycle; hand/manual switching of pumps (where applicable); alternation of pumps in duplex systems; activation, silencing and resetting of alarms (visual and audible); and activation of all other switches and system features.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare and load all material and articles for shipment in a manner that shall protect the equipment from damage in transit, shall include a packing list, and shall be responsible for and make good any and all damage. During shipping the rotating elements shall be suitably supported to protect bearings.

PART 2 - PRODUCTS

2.01 GENERAL

A. All equipment and accessories shall be standard manufactured items and shall be specifically manufactured for use with raw sewage. The manufacturer shall be a company regularly engaged in the manufacture and assembly of pumping system components.

2.02 PUMP SYSTEMS

A. All components of pump systems not listed as "Pre-Approved Pump Systems" herein are subject to review by District.

B. Pre-Approved Pump Systems

Complete packages are required for Pre-Approved Pump Systems, as specified herein. This includes a pump, alarm panel, isolation and check valves, sump, and sump extensions (as required). Individual components of packaged systems are not pre-approved. Pre-Approved Pump Systems for single residential units shall be as listed on the current Approved Materials List.

2.03 PUMPS

A. Pumps shall be approved for residential sewage service by a Nationally Recognized Testing Entity (NRTE) such as Underwriters Laboratories (UL Listed) and/or CSA, and shall carry a certification label for this use. Pumps shall be one of the following types:

1. Submersible, centrifugal, non-clog pumps: Impeller shall be a non-clog type and shall be capable of passing a two (2) inch solid sphere.

2. Submersible, centrifugal or positive displacement grinder pumps: The grinder pump shall be constructed of long-lasting, low maintenance material that is capable of reducing all components in normal domestic sewage (including “foreign objects”, such as paper, wood, plastic, glass, rubber, etc.) to finely divided particles which will pass freely through the passages of the pump, force main, and fittings.

B. Pumps shall be sized to meet the flow requirements specified in Section 1.01 of this section.

2.04 DISCHARGE PIPING AND VALVES

A. The pressure portion of the discharge line, including the isolation valve, and check valve shall be at least the minimum size recommended by the pump manufacturer, or the equal or larger than the pump discharge. Discharge piping and valves shall be at least two (2) inches in diameter.

1. Exception: Internal piping and valves in some pre-approved grinder pump packaged systems may be one and one-quarter (1-1/4) inches in diameter. However, piping outside of the sump shall be at least two (2) inches in diameter.

B. Discharge piping shall be Schedule 80 PVC per Section 15064, POLYVINYL CHLORIDE (PVC) PIPE as listed on the current Approved Materials List, or as approved by the District. All buried bends shall be long radius.

1. Pipe cover to finished grade shall be a minimum of 18 inches.

C. Isolation Valve: Each pump shall be provided with an isolation valve. Isolation valves shall be a full-port PVC ball or plug valves. The valve(s) shall be operable from grade and shall be placed in a utility box if outside the sump.

D. Check Valve: A check valve shall be provided at each pump discharge. Spring type or Ball type shall not be allowed. A brass swing check valve may be used if Schedule 80 is not available.

E. Threaded unions shall be provided on piping within the pump sump to allow for pump and valve removal.

F. No couplings will be allowed on the pressure piping. Only pressure rated glue on couplings will be allowed on pressure piping.

G. A cleanout shall be installed within two (2) feet of the sump.

H. Cleanout(s) shall be installed at every 90 feet, or change of direction equal or greater to 45 degrees.

2.05 PUMP SUMPS

A. The pump sump shall include integral anti-flotation flanges, and shall be fabricated from one of the following materials, or approved equal:

1. Asphalt-coated steel (minimum three-sixteenth (3/16) inch plate), with interior and exterior surfaces protected with an amine cured epoxy coating system, as specified in Section 09800, PROTECTIVE COATINGS.

2. Filament wound fiberglass, minimum one-quarter (1/4) inch wall thickness with tank interior surface protected with a minimum of 0.10- inch thick, resin-rich corrosion barrier.

3. Reinforced concrete pipe or manhole barrel sections with a corrosion barrier of PVC “T-lock” or other material or coating acceptable to District.

4. High density polyethylene (HDPE).

B. The sump shall be sufficiently sized to prevent overflows and also such that the pump(s) will not exceed the manufacturer’s recommended maximum starts per hour for the anticipated incoming flow rates.

C. The sump shall have a four (4) inch minimum inlet, the outlet shall match the pump manufacturer’s recommended discharge size, but shall be at least one and one- quarter (1-1/4) inches in diameter. The invert of the inlet shall be at least six (6) inches above the High Water Alarm (HWA) set-point elevation.

D. The pump sump cover shall be the pump system manufacturer’s standard molded plastic, an aluminum hatch as specified in Section 05500, MISCELLANEOUS METALWORK cast into a concrete slab, or heavy cast iron and shall be designed to support reasonably anticipated dead and live loads, including impact (H20 required for traffic areas).

2.06 MOTORS

A. Motors for column-type pumps shall be a drip-proof vertical type, totally enclosed, weather protected, and shall conform to the standards of NEMA.

B. Only explosion proof pump and motor assemblies approved by an NRTE and listed as explosion proof for Class 1, Division 1, Groups C and D locations shall be used in non-residential applications.

C. Pumps constructed with separate thermal overload protection and moisture-sensing seal failure probes shall have these devices connected to sensors and to an alarm in the control panel according to the manufacturers’ recommendations.

2.07 MOTOR LEVEL CONTROLS AND PANELS

A. The pump's level controls shall employ either of the following, or a District approved alternate:

1. A ball and rod mechanical float switch mounted above the cover.

2. A weighted mechanical-type float switch sealed within a polypropylene shell with a neoprene-covered cable.

B. Each pump level control switch shall be wired directly and independently to terminals in the control panel.

C. Each pump and the level control/alarm system shall be on separate electrical circuit breakers.

D. At a minimum, the following level control switches shall be provided:

1. A "High Water Alarm (HWA)" switch set to alarm a minimum of six (6) inches below the invert elevation of the gravity inlet sewer and to start the "lag" pump in a duplex system.

2. A "Pump On" (High Water Level (HWL)) switch set to start the single pump in a simplex system or the "lead" pump in a duplex system at a reasonable elevation below the HWA.

3. A "Pump Off" (Low Water Level (LWL)) switch set to turn off the pump(s) at a reasonable elevation above the LWA. The distance between the HWL and LWL shall be great enough to allow the pump to run for at least thirty (30) seconds during each pump cycle.

4. An optional "Low Water Alarm" (LWA) switch set to alarm at an elevation above the pump suction inlet and wired to a redundant pump shut off.

E. For duplex systems (two pumps), an alternator shall be provided to automatically alternate between the pumps on each operating cycle so that each pump is assured of near-equal operating time. For duplex systems, the High Water Alarm (HWA) shall be activated in the event that the lead (first) pump is unable to maintain proper level and the lag (second) pump is called to run.

2.08 ELECTRICAL AND CONTROLS

A. All electrical wiring and installation cabling, conduit, and controls shall meet NEC Class 1, Division 2 requirements and shall conform to the requirements of the County of Marin and the Town or City with jurisdiction. Watertight conduit, watertight fittings, and liquid tight materials shall be used as required.

B. Intrinsically Safe Circuits: Level control and alarm system circuit wiring connected to level switches in the tank shall be listed as intrinsically safe by an

NRTE. The circuits shall reduce the power to the pilot devices and alarms to a value incapable of releasing sufficient thermal or electrical energy to ignite an explosive environment. Separate conduits for the control and motor power wiring shall be run between the sump and the control panel. Both conduits shall be provided with seals to prevent sewer gases from migrating to the control panel.

PART 3 - EXECUTION

3.01 GENERAL

A. Work shall meet or exceed the requirements of these Specifications unless applicable requirements of the County of Marin, or the Town or City with jurisdiction are greater, in which case the greater requirements shall govern.

B. Installation of pumping system components shall conform to the manufacturer recommendations.

C. A standard clean out with an backwater prevention device shall be installed between the served building and the sump inlet.

D. Excavation and backfill shall be in accordance with Section 02200, EARTHWORK.

3.02 PUMP SUMP

A. Install ballast consisting of CLSM or concrete and weighing at least one and one- half (1-1/2) times the calculated buoyant force on the sump assuming the groundwater surface is one (1) foot below finish grade shall be provided.

B. The top of the cover shall be at least three (3) inches above the surrounding ground surface in non-traffic areas. The sump cover shall be securely attached to the pump sump with stainless steel bolts, and all joints between the component parts and openings shall be sealed with gas tight gaskets.

3.03 VENT PIPING

A. The sump shall be vented to atmosphere, either to the building drain-waste-roof vent, or through an integral vent in the cover.

B. Vent piping shall extend above the building roofline and be installed in accordance with the plumbing and building codes, as well as the requirements of the County of Marin and the City or Town with jurisdiction.

3.04 CONTROL PANEL, ALARM SYSTEM AND ELECTRICAL WORK

A. The Control Panel (as required) shall be mounted outside the pump sump on a post or building wall, or inside the served building. The panel shall have a

NEMA 1 classification when mounted inside a building or a minimum NEMA 4X classification when mounted outside the building.

B. The Alarm Panel, or a remote alarm indicator, shall be mounted within the building that is served by the pump and shall provide a visible pilot light and audible alarm with silencer to alert the building occupants to alarm events. The alarm system shall be on a separate electrical circuit from pump motor power. When activated by a high water or low water condition, the alarm system shall remain latched until manually acknowledged and cleared.

C. Electrical work shall conform to the technical and permitting requirements of the local building code enforcement agency.

3.05 DISCHARGE LINE

A. Trench excavation and backfill shall be in accordance with Section 02200, EARTHWORK, and the Standard Drawings. Depth requirements shall be as shown in the Standard Drawings.

B. A standard wye branch with cleanout shall be placed where the discharge line connects to the private gravity side sewer as shown in the Standard Drawings.

C. Where feasible, the installation of a high water passive overflow pipe is optional. If installed, the pipe shall extend to a sanitary sewer main. An extendable backwater valve, as shown in the Standard Drawings shall be installed in the passive overflow line.

3.06 TESTING

A. All individual lot pumping stations shall be tested in accordance with Section 02735, SANITARY SEWER SYSTEM TESTING.

*****END OF SECTION*****

SECTION 15050

GENERAL PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish and install all piping systems in accordance with the requirements of these Standard Specifications. Pipe materials and installation procedures shall be in accordance with the pipe manufacturer's recommendations unless otherwise specified herein, or in the specific Section of these Standard Specifications for the particular pipeline material being used.

B. Products manufactured in the USA shall be used where feasible.

C. Pipe sizes cited in these Standard Specifications and Drawings refer to the nominal diameter of the pipe in whole inches.

D. For a particular sewer installation, pipe and manufactured fittings connecting pipe between structures shall be of one and only one manufacturer's brand and of the same type, quality, class, and size.

E. Where field cuts are required, the Contractor shall use tools and/or equipment recommended by the pipe manufacturer. No hammer and chisel cuts will be permitted.

F. All pipe and fittings delivered to the jobsite shall be marked by the manufacturer with such inventory and identification (Brand Name, Pipe Type, Strength Class, Batch Lot, Lengths, etc.) as to be properly identified in the field as meeting the requirements of these Specifications.

G. Requirements specified herein are used to establish the standards of quality and utility required for piping. However, alternates to or variance from requirements specified herein which are equal in quality and utility to those specified herein may be permitted by the District subject to the following provisions:

1. The Contractor shall submit to the District sufficient data, drawings, samples, literature, calculations, or other detailed information as will demonstrate to the District or its appointed Representative that the proposed alternate is equal in quality and utility to the requirements Specified herein.

2. The District or its appointed Representative must favorably review in writing such proposed variances and/or substitutions as are, in its opinion, equal in quality to the requirements of the District’s Standard Specifications, or acceptable under special conditions.

3. Failure of the Contractor to submit proposed substitutions or variances for review in the manner described above shall be sufficient cause for rejection by the District of any alternates or variances otherwise proposed.

1.02 RELATED SECTIONS

A. Section 02160, SHORING

B. Section 02200, EARTHWORK

C. Section 02600, SIDE SEWERS

D. Section 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS

E. Section 02735, SANITARY SEWER SYSTEM TESTING

F. Section 09800, PROTECTIVE COATINGS

G. Section 15061, DUCTILE IRON PIPE (DIP)

H. Section 15064, POLYVINYL CHLORIDE (PVC) PIPE

I. Section 15066, HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

1.03 REFERENCE SPECIFICATIONS

A. Commercial Standards:

1. ANSI/ASME B1.20. Pipe Threads, General Purpose (inch)

2. ANSI/AWS D1.1 Structural Welding Code

B. Codes:

1. Cal/OSHA Construction Safety Orders

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide submittals for items specified herein for District review and approval prior to ordering materials.

1.06 QUALITY ASSURANCE

A. Pipe shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the District shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with these Specifications.

B. Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. The manufacturer shall perform all tests at its own cost.

C. All installed pipe shall be cleaned and televised in accordance with Section, 02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS and tested in accordance with Section 02735, SANITARY SEWER SYSTEM TESTING.

1.07 DELIVERY, STORAGE, AND HANDLING

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition, and stored off the ground. All pipe and appurtenances shall be protected from damage by sunlight, moisture, corrosive materials, equipment, and other sources. All defective or damaged pipe or appurtenances shall be removed from the jobsite and replaced with new materials.

1.08 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is required, in order to obtain compliance for pipe joints, supports, or special connections, the Contractor shall arrange for such assistance.

PART 2 - PRODUCTS

2.01 GENERAL

A. Pipes, fittings, and appurtenances shall be furnished in accordance with the requirements specified herein and the applicable Section of these Specifications for the particular pipeline material being used.

B. Application of pipe coatings shall be in accordance with the requirements of the applicable Section of these Standard Specifications for the particular pipeline material being used and Section 09800, PROTECTIVE COATINGS.

2.02 PIPING

A. Pipe Schedule:

1. Materials for sewer main piping used in specific applications shall be as indicated in the Piping Schedule in the District's Approved Materials List.

B. Pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Section of these Standard Specifications.

C. Where joint type is specifically indicated in the Standard Drawings or project Contract Documents, then that joint type shall be used.

D. Special approval may be granted by the District for other pipe materials as necessary for the specific application.

E. Pipe material shall be purchased in longest length practical in order to achieve the minimum number of pipe joints.

F. Side sewer (lateral) pipe material shall be in accordance with Section 02600, SIDE SEWERS.

2.03 CONNECTION OF SIDE SEWERS TO MAINS

A. Connection of side sewer piping to sanitary sewer mains shall be per Section 02600, SIDE SEWERS.

2.04 WARNING TAPE

A. Warning tape shall be provided above all buried sanitary sewer main piping. Warning tape shall indicate type of pipeline and shall be specifically designed for this use.

B. The warning tape shall be 4.0 mil thickness minimum, linear low-density polyethylene specifically formulated for extended use underground.

C. Sanitary sewer main warning tape shall be green in color. The warning tape shall be minimum 12-inches wide and printed continuously with the words "CAUTION: SEWER MAIN BELOW".

D. Warning tape for laterals/side sewers shall be provided in accordance with Section 02600, SIDE SEWERS.

2.05 TRACER WIRE

A. Tracer wire shall be provided for all buried public sanitary sewer mains. Tracer wire shall be number 12 THHN insulated copper wire shall be attached to top of and along the entire length of all pipelines and shall extend to the surface at every 400 feet max and at all bends 45 degrees or greater. Provide within manholes, valve boxes, electrical boxes, or concrete traffic boxes at these locations for locator equipment to be attached. Wires shall extend a minimum of three (3) feet with 2 to 3-inch pigtails exposed. Wires shall be placed inside box as shown on Standard Drawings. All wire connections shall be made with copper crimps wrapped with electrical tape.

B. Tracer wire shall be secured to top of pipe at intervals no greater than 10 feet.

2.06 ADJUSTABLE REPAIR COUPLINGS (BANDED RUBBER COUPLINGS)

A. Adjustable repair couplings shall be used for joining dissimilar pipe materials or repairs on gravity pipelines, or where shown in the Standard Drawings.

B. Adjustable repair couplings shall be per the District's Approved Materials List.

C. Adjustable repair couplings shall meet the requirements of ASTM C1173, Standard Specification for Flexible Transition Couplings for Underground Piping Systems.

D. Couplings shall be suitable for use with raw sewage.

E. Couplings shall have sealing "O" rings under each sealing clamp band to prevent pipe slippage and provide a watertight seal.

F. Where bushings for dissimilar types or sizes of pipe are required, bushings shall be installed by the coupling manufacturer.

G. All hardware shall be type 316 stainless steel.

H. The gap between the pipes being connected shall be a maximum of one quarter (1/4) inch, or as recommended by the coupling manufacturer.

2.07 SLEEVE-TYPE FLEXIBLE COUPLINGS

A. Sleeve type couplings shall be used for joining dissimilar pipe materials on pressure pipelines, or where shown in the Standard Drawings.

B. Sleeve type Couplings shall be per the District's Approved Materials List.

C. Contractor shall field verify existing pipe dimensions prior to ordering materials.

D. Sleeve-type flexible couplings shall be of steel, without pipe stop, and shall be of sizes to fit the pipe and fittings shown. The middle ring shall be not less than 1/4- inch in thickness and shall be a minimum of 7 inches long. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket.

E. Sleeve-type flexible couplings shall be lined and coated with fusion bonded epoxy as specified in Section 09800, PROTECTIVE COATINGS.

F. Pipe Preparation. The ends of the pipe, where specified or shown, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. Connecting pipes shall be cut to provide a gap of approximately 1/4 inch. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

G. Gaskets. Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. The gaskets shall be immune to attack by impurities normally found in water, wastewater, and wet well ventilation air, and shall be suitable for use with temperatures at 180 degrees F. All gaskets shall meet the requirements of ASTM D2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above.

H. Buried couplings shall include stainless steel nuts, bolts, and washers.

I. Sleeve-type couplings shall be sized for specific pipe material indicated in pipe schedule.

J. Reducing and/or transition couplings shall be used to join new pipe to existing pipe where indicated.

K. Where cement mortar coated pipe is to be provided with couplings, cement mortar coatings shall be left back for coupling. Pipe shall be coated with amine cured epoxy at location of coupling and cement mortar coating intersection.

2.08 FLANGE COUPLING ADAPTERS

A. Flange adapters shall be fabricated from high strength steel. Flanges shall be supplied to AWWA C207 as well as all ANSI standards. Compression ends shall have wedge gasket for efficient sealing. Gasket material shall be suitable for raw wastewater. All miscellaneous metalwork items shall be Type 316 stainless steel.

B. Pipe ends shall be properly prepared for accepting the flange adapter in accordance with manufacturer's recommendations. The outside diameter and pipe type shall be verified prior to ordering adapters. Flange adapters shall be lined and coated with fusion bonded epoxy as specified in Section 09800, PROTECTIVE COATINGS.

C. Where cement mortar coated pipe is to be provided with couplings, cement mortar coatings shall be left back for coupling. Pipe shall be coated with amine cured epoxy at location of coupling and cement mortar coating intersection.

D. Flange adapters shall be per the District's Approved Materials List.

2.09 PIPE SUPPORT SYSTEMS

A. General.

1. Exposed piping shall be supported to accommodate loading, expansion, and contraction.

2. The absence of pipe supports and details on Contract Documents shall not relieve the Contractor of the responsibility for providing them where required.

3. Where piping connects to equipment it shall be supported by a pipe support and not by the equipment.

4. All supports, hangers, and guides shall be adequately designed for static, dynamic, and seismic loads, in accordance with prevailing building codes and other applicable requirements. Pipe support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation, and shall have a minimum safety factor of 5. At each support, every pipe shall be provided with a pipe clamp or guide.

5. No punched strap, wire, or other make shift devices will be accepted.

6. All exposed hangers, rods, clamps, protective shields, metal framing support components, and hanger accessories shall be hot dip galvanized. Submerged or potentially submerged (i.e., below grade within a structure, such as above the wet well) components shall be Type 316 stainless steel.

B. Vertical Pipe Supports.

1. Where exposed pipes change from horizontal to vertical, the pipes shall be supported on the horizontal runs within 2 feet of the change in direction.

2. For vertical runs exceeding 10 feet, pipes shall be supported by a base elbow.

3. All vertical pipes shall be supported at intervals of no more than 8 feet, on wall rests, and at all points necessary to ensure rigid construction.

4. All pipe supports shall be in accordance with the Project Contract Documents or as directed by the District or its appointed Representative.

C. Special Supports. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes, concrete, and anchor hardware similar to items previously specified herein and shall be subject to the approval of the District or its appointed Representative.

2.10 SEISMIC ANCHORAGE

A. Exposed piping and appurtenant facilities shall be seismically anchored in accordance with Section 11000, EQUIPMENT.

2.11 SLAB, WALL, AND ROOF PENETRATIONS

A. All piping penetration of slabs, walls, and roof shall be as shown on the Standard Drawings and the Contract Documents. It shall be the CONTRACTOR's responsibility to verify the size and location of all structure penetrations prior to pouring concrete or making core drills. CONTRACTOR shall x-ray existing or precast walls and slabs prior to core drilling. Contractor

shall receive written approval from the precast concrete manufacturer prior to cutting any rebar in new precast structures.

2.12 THREADED INSULATING CONNECTIONS

A. General. Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals, threaded piping from exterior to interior, or for piping systems where corrosion control and cathodic protection are involved.

B. Materials. Threaded insulating connections shall be of nylon, Teflon, poly-carbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.13 BOLTS, NUTS, AND WASHERS

A. Unless otherwise specified, all bolts, nuts, washers, hardware, and other miscellaneous metalwork for pipe installation be Type 316 stainless steel.

2.14 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.

2.15 VALVES

A. Valves shall be the same size as the pipelines in which they are installed, unless otherwise specified.

PART 3 - EXECUTION

3.01 GENERAL

A. Sewer pipelines shall be constructed to the alignment and grade shown on the project Contract Documents, and in compliance with the specified requirements of this Section and of the applicable sections in these Standard Specifications.

B. Excavation for trenching shall be performed as shown in the Standard Drawings and as specified in Section 02200, EARTHWORK.

C. Pipe cover for sewer mains shall be a minimum of 36 inches. Where this requirement cannot be met, then a concrete cap/encasement or ductile iron pipe shall be used, unless otherwise shown or Directed by the District.

1. Requirements for cover of side sewers shall be per Section 02600, SIDE SEWERS.

D. Sewer pipelines shall have a minimum wall-to-wall horizontal clearance of three (3) feet and a minimum vertical clearance of twelve (12) inches from all other

improvements and utilities unless otherwise shown on the plans as being allowed by the District under special approval.

E. Where sewer pipelines are to be installed in the vicinity of potable water pipelines, wall-to-wall sewer-to-water pipeline separation shall be in conformance with the minimum requirements of the California Department of Health and Safety, Guidance memo number 2003-02. Sewer pipeline installation in the area labeled “Special Permission,” will not be allowed unless specifically approved in writing by the water utility.

F. Unless otherwise approved by the District, the Contractor shall connect sewer mains being installed/rehabilitated back into the existing system prior to leaving the job site at the end of each day.

3.02 SEWER INSTALLATION

A. For main sewers and trunk sewers, the grade line shall be established by setting cut stakes and obtaining District approval before trench excavation is started. During pipe installation, the Contractor shall continuously utilize an industrial-standard laser grade control system to confirm that the pipe is installed to the design grade, subject to the following requirements:

1. The Contractor shall provide a properly calibrated laser instrument and an operator who is qualified and trained in the operation of the particular laser instrument being used. The operator shall adhere to the provisions of the CalOSHA Construction Safety Orders regarding the use of laser equipment.

2. Laser control points shall be established bench marks or construction cut stakes.

3. Laser must contain a direct grade reading screen, which will allow the Inspector to verify the grade at all times.

B. Pipe shall not be laid if the Inspector determines that the condition of the trench is unsuitable.

C. If the sewer is to be laid in an area that is to be filled, and the cover prior to filling is less than the required minimum cover specified pipe material and type, the pipe shall not be laid until the area has been properly filled and compacted to a level at least equal to required minimum cover above the proposed pipe, unless otherwise authorized by the Inspector.

D. If field conditions in areas that are potentially unstable or subject to settlement warrant, the Inspector may require that the Contractor substitute a different pipe material/type for the pipe shown on the plans.

E. Pipe, fittings and appurtenances shall be carefully handled and protected against damage, impact shocks, and free fall. Pipe shall be stored in a manner which will protect it from damage at the trench site or elsewhere. The Contractor shall inspect each pipe and fitting prior to installation to determine that only undamaged material is installed.

F. Before placement of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance and shall be kept clean at all times thereafter.

G. Sewer pipelines shall be laid upgrade from the point of connection to the existing sewer with the bell end at the upgrade end of each pipe length.

H. Layout of deflections and/or curves shall conform to the requirements specified in the applicable section of these Standard Specifications for the particular pipe material being used.

I. Non-marring slings shall be used for lowering each length of pipe into the trench (chains shall not be used). The pipe shall be laid on properly compacted bedding material as specified in Section 02200, **EARTHWORK**. No blocking will be permitted and the pipe shall have full bearing for its entire length between bell holes excavated in said bedding material to prevent point loading at the bells or couplings and to allow for unobstructed assembly of all joints. Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations and for application of coating on field joints. After jointing is completed, bell holes shall be backfilled with properly compacted bedding material, taking care not to damage, move, or lift the pipe from its bedding support.

J. Where it becomes necessary to modify the design pipe alignment to resolve conflicts with unforeseen obstructions or other causes, the Contractor shall propose a revised alignment to the District or the District's Representative for consideration. Such revision may be made by the deflection of joints, by the use of fittings or by forced bending of the pipe if permitted, however, in no case shall the deflection in the pipe or at any joint exceed the maximum deflection recommended by the pipe manufacturer.

K. Sewer pipes, branches, stubs, or other open ends which are not to be immediately connected, shall be plugged or capped.

L. The Contractor shall take all necessary precautions to prevent excavated or other foreign material from getting into the pipe during the laying operations. At all times when laying operations are not in progress and at the close of the day's work, the openings of all pipe and specials, whether in the trench or in storage, shall be protected with suitable bulkheads to prevent unauthorized access by persons, animals, water, or any undesirable substance. If debris is observed in the system downstream of work, it is the responsibility of the Contractor to clean and CCTV the main lines.

M. The Contractor shall prevent the pipe from floating during and after its installation.

3.03 CONNECTIONS TO EXISTING SEWERS

A. Project Contract Documents may not show all existing side sewer/laterals and locations may be approximate. The Contractor shall be responsible for locating all service connections within the repair/replacement area and determine if services are active. The Contractor shall reinstate all active laterals. It is the responsibility of the Contractor to determine the exact location and depth of the existing sewers prior to the installation of any sewer pipe. New pipe shall be plugged with mechanical plugs until further connection is necessary.

B. Connection of new sewer mains and/or trunk sewers to existing lines up to and including forty eight (48) inches in diameter shall be made at existing manholes or by constructing a new manhole over the point of connection, or by removing an existing rodding inlet or plug and extending new pipe of the same diameter, material and class from the point of connection.

1. Where the connection is to be made into an existing manhole, the Contractor shall make the connection by core-drilling through the manhole shelf to the existing channel, installing the new pipe, finishing a new channel within the manhole and repairing any damage to the structure.

2. Where the connection is to be made by constructing a new manhole on an existing sewer, the manhole and new connection shall conform to the details shown in the Standard Drawings. The existing sewer shall be kept intact until immediately before the cleaning and flushing operation for the new sewer is to begin.

3. Where the connection is to be made at a removed rodding inlet or plug, the existing piping shall be cut square and ends properly prepared for the connection shown and an air test fitting shall be installed at the connection of new and existing pipelines.

4. All new pipe shall be plugged with an approved mechanical plug or brick/mortar until the line is completed and ready for testing.

C. Side Sewer Connections to Main Sewers shall be performed per Section 02600, **SIDE SEWERS**.

3.04 REPAIRS TO EXISTING MAINS AND SIDE SEWERS

A. Repairs to main sewers and side sewers shall be as shown in the Standard Drawings.

B. The replacement pipe shall be squarely cut approximately one-half (1/2) inch shorter than the missing section, providing no larger than a one quarter (1/4) inch gap between pipes on each side.

C. When repair of a damaged section of pipe is required within eighteen (18) inches of a pipe joint, the replacement section shall extend to and include the joint.

D. Where repair couplings are permitted, couplings shall be per the District's Approved Materials List and as specified herein.

E. The District Inspector may require replacement of broken, damaged, or improper pipe or fittings discovered during sewer repair or replacement work.

3.05 REPAIRS TO NEW SEWER MAINS

A. If damage to the new main sewer pipe is identified during inspection, testing or televising, the Contractor shall repair the damage or replace the pipe as instructed by the Inspector. When repair of a damaged section of pipe is required within eighteen (18) inches of a pipe joint, the replacement section shall be extended to include the joint. Repair procedures shall comply with the following:

B. PVC C900/C905 SEWER MAINS - PVC double bell repair couplings shall be used. Coupling material shall be PVC C900/905 and shall include a stop centered in the coupling. The damaged pipe shall be removed by squarely cutting out the damaged section, and the remaining ends shall be beveled. The replacement pipe shall be a minimum of three (3) feet in length and shall be squarely cut approximately one-inch (1/2) inch shorter than the missing section, and its ends shall be beveled. Reference lines indicating the spigot stab distance required for centering the repair coupling shall be clearly marked on all cut ends. The repair couplings shall be placed onto the pipe ends, the replacement assembly inserted into the gap, the repair couplings moved to be centered over each new joint. The Contractor shall re-bed the pipe and backfill the excavation with properly compacted bedding and backfill material in accordance with Section 02200, EARTHWORK.

C. DUCTILE IRON PIPE SEWER MAINS – Manufacturer's recommended couplings shall be used. The damaged pipe shall be removed by squarely cutting out the damaged section. The replacement pipe shall be squarely cut approximately one-half (1/2) inch shorter than the missing section. The repair couplings shall be placed onto the pipe ends, the replacement assembly inserted into the gap, the repair couplings moved to be centered over each new joint, and the fasteners or bands tightened as required. The Contractor shall re-bed the pipe and backfill the excavation with properly compacted bedding and backfill material in accordance with Section 02200, Earthwork.

3.06 TESTING

A. Testing of new sewer piping shall be in accordance with Section 02735, **SANITARY SEWER SYSTEM TESTING**.

*****END OF SECTION*****

SECTION 15055

VITRIFIED CLAY PIPE (VCP)

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish and install vitrified clay pipe (VCP) and all appurtenances as specified herein, complete and in place. This Section includes requirements for vitrified clay pipe (VCP) for gravity service.

B. VCP shall only be used for repairs to existing VCP.

1.02 RELATED SECTIONS

A. Section 02145, SEWAGE FLOW CONTROL

B. Section 02060, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS

C. Section 15050, GENERAL PIPING

1.03 REFERENCE SPECIFICATIONS

A. American Society of Testing and Materials (ASTM)

1. ASTM C 12 - Practice for Installing Vitrified Clay Pipe Lines
2. ASTM C 301 - Standard Test Methods for Vitrified Clay Pipe
3. ASTM C 425 - Specification for Compression Joints for Vitrified Clay Pipe and Fittings
4. ASTM C 700 - Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
5. ASTM C 828 - Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines

1.04 NOT USED

1.05 SUBMITTALS

A. Contractor shall provide submittals to the District for items specified herein for review and approval prior to ordering materials.

1. Product technical data acknowledging that products meet requirements of standards referenced.

2. Copies of manufacturer's written directions regarding material handling, delivery, storage, and installation.

1.06 NOT USED

1.07 DELIVERY, STORAGE AND HANDLING

A. All materials delivered and stored shall be handled and stored in such a manner that pipe, fittings and accessories, and pipe coatings are not damaged.

PART 2 - PRODUCTS

2.01 GENERAL

A. VCP piping shall only be used for repairs to existing VCP piping.

2.02 VITRIFIED CLAY PIPE (VCP) AND FITTINGS

A. Vitrified clay pipe and fittings shall be extra strength and conform to and meet all of the requirements of ASTM C700, and shall conform to all materials data contained in the current Clay Pipe Engineering Manual published by the National Clay Pipe Institute. Compression joints shall conform to ASTM C425. A certification of compliance with these requirements must be furnished by the pipe manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall prepare pipe trench as indicated on the Standard Drawings, and as specified in Section 02200, EARTHWORK.

B. Assemble joints per manufacturer’s instructions.

3.02 PIPE LAYING

A. Sewer pipe shall be laid in strict conformance with the line and grade indicated on the Plans. The maximum deviation from grade shall not be greater than one (1) inch per 400 feet of pipe between consecutive manholes.

B. Pipe laying shall proceed from "downstream" to "upstream", with the bell ends of the bell and spigot pipe placed upstream in such a manner as to form a watertight, concentric joint with the adjoining pipe.

C. Pipe shall not be laid when the condition of the trench or the weather is unsuitable in the opinion of the District or its appointed Representative.

D. The Contractor shall be responsible for dewatering the trench where ground water is present.

E. Water shall be disposed of in such a manner that no property damage, public nuisance, or hazard to public health occurs. All pipe, fittings, and accessories shall be carefully lowered into the trench by suitable equipment in such a manner prevent damage to the materials. Under no circumstances shall these materials be dropped or dumped into the trench. The pipe, fittings, and accessories shall be inspected for visible defects prior to lowering into the trench. Any visible defect or unsound material shall be replaced and removed from the project site.

F. The interior of the pipe shall be cleared of all dirt and debris and excess joint sealing material as the work progresses.

G. All joint surfaces shall be cleaned before the pipes are connected.

H. All open ends of sewer pipe and fittings shall be adequately and securely closed whenever the work is discontinued at the end of each day.

I. The Contractor shall expose the end of the existing pipe to be extended for verification of alignment and elevation by the Construction Manager, prior to trenching for any pipe which may be affected.

J. Trench excavation, bedding and backfill shall conform to Section 02200, EARTHWORK and the Standard Drawings.

****END OF SECTION****

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SECTION 15061

DUCTILE IRON PIPE (DIP)

PART 1 - GENERAL

A. This section includes ductile iron piping, fittings, gaskets, pipe lining and coating, polyethylene encasement, and other necessary appurtenances.

1.01 RELATED SECTIONS

A. Section 02200, EARTHWORK

B. Section 02735, SANITARY SEWER SYSTEM TESTING

C. Section 09800, PROTECTIVE COATINGS

D. Section 15050, GENERAL PIPING

1.02 REFERENCE SPECIFICATIONS

A. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME):

1. ASME/ANSI B16.1: Cast Iron Pipe Flanges and Flanged Fittings.

B. American Society for Testing and Materials (ASTM):

1. ASTM A47: Specifications for Ferritic Malleable Iron Castings.

2. ASTM A48: Standard Specification for Gray Iron Castings.

3. ASTM A183: Specifications for Carbon Steel Tank Bolts and Nuts.

4. ASTM A 283: Specifications for Low and Intermediate Tensile Strength Carbon Steel Plates.

5. ASTM A377: Standard Index of Specification for Ductile-Iron Pressure Pipe.

6. ASTM A536: Standard Specification for Ductile-Iron Castings.

7. ASTM A674: Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.

8. ASTM D1248: Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

9. ASTM D395-89 Method B: Standard Test Method for Rubber Property - Compression Set.

10. ASTM D412-87: Standard Test Method for Rubber Properties in Tension.

11. ASTM D2240-86: Standard Test Method for Rubber Properties - Durometer Hardness.

12. ASTM A307: Standard Specification for Carbon Steel Bolts and Studs.

C. American National Standards Institute/ American Water Works Association (AWWA):

1. ANSI/AWWA C105/A21.5: Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

2. ANSI/AWWA C110/A21.10: Standard for Ductile Iron and Gray Iron Fittings, 3-In. Through 48-In., for Water and Other Liquids.

3. ANSI/AWWA C111/A21.11: Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

4. ANSI/AWWA C115/A21.15: Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.

5. ANSI/AWWA C150/A21.50: Standard for Thickness of Ductile-Iron Pipe.

6. ANSI/AWWA C151/A21.51: Standard for Ductile Iron Pipe, Centrifugally Cast, for Water and Other Liquids.

7. ANSI/AWWA C153/A21.53: Standard for Ductile Iron Compact Fittings 3-In. through 16-In. for Water and Other Liquids.

8. ANSI/AWWA C600: Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

9. ANSI/AWWA C606: Grooved and Shouldered Joints.

D. NACE International, the Corrosion Society (NACE):

1. RP0188-99-Discontinuity (Holiday) Testing of Protective Coatings.

E. National Association of Pipe Fabricators, Inc.

1. NAPF 500-03: Surface preparation standard for ductile iron pipe and fittings receiving special external coatings and/or special internal linings.

1.03 NOT USED

1.04 SUBMITTALS

A. The Contractor shall provide Submittals for products specified herein to the District for review and approval prior to ordering materials.

B. Submit list of pipe and fittings to be used, which includes the following information, where applicable:

1. Manufacturer
2. Inside diameter, outside diameter, schedule
3. Material
4. Pressure Rating
5. Catalogue Information
6. Drawings/Part List
7. Coating and Lining information.
8. Certification. The Contractor shall furnish a certified letter stating that the pipe and fittings meet all applicable AWWA Standards and that the required AWWA hydrostatic pressure test is performed.

C. All expenses incurred in making samples for certification of tests shall be borne by the Contractor.

1.05 NOT USED

1.06 DELIVERY, STORAGE, AND HANDLING

A. During loading, transporting, unloading and storage, prevent damage to material.

1. To ensure undamaged condition, use wide bearing area slings and wide padded skids. Do not use bare cables, chains, hooks, metal bars, or narrow skids.
2. Do not drop pipe or fittings.
3. Repair damaged linings and coatings in accordance with the pipe and coating manufacturer's recommendations to match quality, thickness, and bonding of original coating or lining. When lining or coating cannot be repaired or repairs are defective, replace defective piping with undamaged piping.
4. Protect gaskets and polyethylene encasement from long-term exposure to sunlight.
5. Store piping, fittings, nuts, bolts, glands, and other accessories in original, marked shipping containers and in a manner such that they do not accumulate and hold rainwater, dirt, and debris.

B. Adequately tag or otherwise mark all piping and fittings as to size.

C. Acceptance at site:

1. Reject products with dents, kinks, abrupt changes of curvature or other injuries.

2. Reject any product dropped from truck or crane.

3. Replace or recondition at Contractor's expense rejected items.

4. Reconditioning subject to District's acceptance.

5. Replace coatings as originally specified on reconditioned pipe.

1.07 THRUST RESTRAINT SYSTEM DESIGN FOR FORCE MAINS

A. Where restrained joints are used in lieu of thrust blocks for the installation of DIP pressure piping and the Project Contract Documents has not designed the required restraint length, the DIP supplier shall assume responsibility for the restrained joint thrust restraint system design.

B. Determine the length of pipe that must be restrained on each side of the focus of a thrust load in accordance with the procedures and criteria established by the Ductile Iron Pipe Research Association (DIPRA) and the following additional criteria:

1. Design Pressure: Test pressure as Specified Section 02735, SANITARY SEWER SYSTEM TESTING.

2. Laying Condition: Type 3 as defined by AWWA C150.

3. Unit Friction Resistance: Based upon polyethylene encasement of pipe.

4. Safety Factor: 1.5 (for thrust restraint calculations only).

PART 2 - PRODUCTS

2.01 GENERAL

A. Ductile iron pipes, fittings, and appurtenances shall be furnished in accordance with the requirements specified herein.

2.02 DUCTILE IRON PIPING

A. Type: AWWA C 150 and AWWA C 151 with minimum Class 350 pressure class wall thickness that meets project pressure and structural requirements, unless otherwise specified or indicated on the Drawings.

B. Type with Screw-on Flanges: AWWA C 115 with minimum special thickness Class 53 wall thickness that meets project pressure and structural requirements, unless otherwise specified or indicated.

C. Manufacturers shall be per the District's Approved Materials list, or approved equal:

2.03 FITTINGS

A. Joint Type shall be the same as that of the associated piping and as specified herein. Unless otherwise specified, exposed fittings shall have flanged or grooved end joints, buried fittings shall have push-on or mechanical joints.

B. All fittings shall be ductile iron conforming with AWWA C 110/ANSI A 21.10 or AWWA C 153/ANSI A 21.53.

C. Push-on Joint or mechanical joint fittings shall be restrained joint type, where specified.

D. Groove Joint Fittings: In accordance with AWWA C 606, rigid radius-cut groove.

1. Dimensions and Wall Thickness: In accordance with AWWA C 110/ ANSI A21.10 or AWWA C 153/ANSI A 21.53.

2.04 JOINTS:

A. Type: If not otherwise scheduled or indicated, provide the following:

1. Exposed Piping: Flanged or grooved joints

2. Buried Piping: Push-on joint or mechanical joints (restrained where indicated in the Project Contract Documents)

B. Flanged joints:

1. Flanges, Screw-on: Comply with the diameter, thickness, drilling, and other characteristics in accordance with ANSI B 16.1. In addition, comply with the following requirements:

a. Ductile iron.

b. Long hub, threaded, and specially designed for ductile iron pipe.

c. After attaching to pipe, machine flange face to make pipe end and flange even and perpendicular to the axis of the pipe.

2. Cap Screw or Stud Bolt Holes: Tapped.

3. All Flanged bolts and nuts shall be type 316 stainless steel for the following conditions:

4. Gaskets: Shall be suitable for use with wastewater. Gasket stock shall be a synthetic rubber compound in which the elastomer is neoprene. The compound shall contain not less than 50 percent by volume neoprene and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall, in addition, comply with AWWA C111.

C. Mechanical Joints shall be in accordance with ANSI/AWWA C111.

1. Mechanical joint restraints, where required, shall be per the District's Approved Materials List.

D. Push-on joints: Push-on or rubber gasket joints shall conform to AWW C111/A21/11.

1. Restrained push-on joints shall be per the District's Approved Materials List.

E. All welding shall be performed at the factory, no field welding will be allowed. The Contractor may use push-on joints with Field Lok gaskets, and shall be approved by the District.

1. Restrained push-on joints shall be capable of joint deflection in any direction after assembly and installation. Contractor shall consider the addition of thrust block when use push-on joint with Field Lok gaskets.

F. Grooved Joints: Per AWWA C 606, as complemented and modified below, radius cut or roll-grooved types, with following components:

1. Couplings: Per the District's Approved Materials List. Rigid type, cast from ductile iron in accordance with ASTM A 536, Grade 65 45 12 or malleable iron in accordance with ASTM A 47, Grade 32510.

2. Bolts and nuts shall be type 316 stainless steel.

3. Gaskets: EPDM, for liquid service, capable of being applied on surface of piping with cavities to provide for an improved seal with the internal piping pressure.

4. Flanged Unit Connections: Flanged to grooved joint adapters or a long enough spool with 1 end flanged and the other grooved to prevent interference with the operation of adjacent valves, pumps, or other items.

2.05 PROTECTIVE LINING

A. Interior surfaces of pipe and fittings shall be lined with materials per the District's Approved Materials List.

B. The dry film thickness shall be no less than 40 mils.

2.06 PROTECTIVE COATING

A. Buried Piping: Unless otherwise specified, the exterior of all buried pipe and fittings shall be coated with asphaltic material as specified in AWWA C151. The exterior of all buried pipe and fittings shall be polywrapped as specified herein.

B. Exposed Piping: shall be provided with shop priming compatible with field coating for pipe to be installed above ground in accordance with Section 09800, **PROTECTIVE COATINGS**. Surface preparation for primer, intermediate and finish coats shall be as specified in Section 09800, **PROTECTIVE COATINGS**.

C. Exposed Piping in Sanitary Sewer Wet Wells: Exterior surfaces of pipes and fittings inside of the sanitary sewer wet wells shall be prepared with a near-White Blast Cleaning per SSPC-SP10 and coated with an exterior protective pipe coating incorporating high solids amine cured epoxy for maximum protection of the exterior of ductile iron pipe and fittings. Coating shall be Tnemec Series 141 at a minimum of 16 mils dry film thickness, or US Pipe Ceramawrap at a minimum dry film thickness of 20 mils.

2.07 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement or “polywrap” and adhesive tape shall be per the District’s Approved Materials List.

B. Encase all buried ductile iron pipe and fittings in two layers of loose polyethylene wrap in strict accordance with ANSI/AWWA Standard C105/A21.5-99.

C. Polyethylene film in tube form complying with AWWA C105 (ANSI A21.5), Type I, Class B, Grade E-1, minimum thickness of 8 mils. The tensile strength shall be 1,200 psi minimum. The elongation shall be 300 percent minimum.

D. Minimum polywrap flat tube size shall be as listed in Table 1 of AWWA C105.

E. The color shall be green to identify sanitary sewer.

F. General purpose adhesive tape to connect plastic film shall be two inches wide by 10 mils thick.

PART 3 - EXECUTION

3.01 GENERAL:

A. Install ductile iron piping in accordance with AWWA C 600.

B. Pipe lengths may be field cut to fit installation conditions. Bevel cut edge and grind smooth.

C. Polyethylene Encasement:

1. Wrap ductile iron pipe and fittings to be buried with two layers polyethylene encasement in accordance with ASTM A 674, AWWA C 105.

2. Repair tears and make joints with two layers of plastic tape or by adding another layer of polyethylene over the tear or joint and taping in place.

3.02 INSTALLATION

A. Cutting pipe:

1. Cut pipe neatly without damage to pipe or cement lining.

2. Cut smooth, straight, and at right angles to pipe axis.

3. Dress and bevel end of cut pipe to remove roughness and sharp corners.

4. Cut cast iron with mechanical pipe cutters.

a. Cut ductile iron pipe with saw or abrasive wheel.

B. Cleaning:

1. Thoroughly clean pipe and fittings of foreign matter before installation.

2. Keep pipe and fittings clean until final acceptance.

3. Joint contact surfaces:

a. Wire brush, if necessary.

b. Wipe clean.

c. Keep clean until jointing is complete.

C. <u>Piping underground:</u>

1. Install in accordance with AWWA C600, except as specified herein.

2. Protect from lateral displacement while placing backfill.

3. Embedment and backfill per Section 02200, EARTHWORK.

4. Do not lay pipe:

a. In water.

b. Under unsuitable weather conditions.

c. Under unsuitable trench conditions.

D. Jointing:

1. Follow manufacturer's instructions.

    a. Do not over-tighten bolts to compensate for poor installation.

    b. Carefully align holes in mechanical joints with tie rods to permit installation of the harness bolts.

    c. Install flanges so the flange holes straddle the top centerline for horizontal piping or the side centerline for vertical piping.

2. Flanged joints:

    a. Take care when bolting flanges to ensure that there is no restraint on the opposite end of the pipe which would prevent gasket compression or cause unnecessary stress in flanges.

    b. Leave one (1) flange free to move in any direction while tightening flange bolts.

    c. Tighten bolts gradually at a uniform rate to compress gaskets uniformly.

    d. Take special care in connecting to pumping equipment to ensure no stresses are transmitted to pump flanges by connecting piping.

        i. Permanently support piping for accurate matching of bolt holes and uniform contact over the entire face of abutting pump and pipe flanges are obtained before bolting those flanges.

        ii. Allow pump connection piping to move parallel to its longitudinal centerline while bolts are tightened.

        iii. Level, align, and wedge pipes into position to fit connecting piping; but, do not install grout until after initial pipe fitting and alignment to allow shifting the pump on its foundation.

        iv. Grout pumps prior to final bolting of connecting piping.

3. Flanged coupling adapters:

    a. After the pipe is in place and bolted tight, determine the location of anchor stud holes and field drill.

    b. Maximum hole diameter: Stud projection diameter plus 1/8 inch.

4. Mechanical couplings:

    a. Cut pipe ends clean and smooth.

    b. Leave a space of 1/4-inch between pipe ends.

5. Grooved Joints:

    a. Install piping with grooved joints where specified or indicated on the Drawings.

    b. Assemble grooved joints in accordance with manufacturer's published instructions.

    c. Support grooved-end pipe in accordance with manufacturer's published instructions. Install at least 1 support between consecutive couplings.

    d. Grooved joints may be installed where flanged joints are scheduled, if acceptable to the District or its appointed Representative, except under the following conditions:

        i. In underground and underwater installations.

        ii. In piping subject to test pressure of 150 pounds per square inch gauge or more.

        iii. When wall thickness of pipe is less than the minimum recommended in published instructions by the manufacturer of the grooved end coupling.

    e. Make connections to flanged valves, pumps, and piping appurtenances by either:

        i. Flanged-to-grooved joint adapters.

        ii. Flanged-by-grooved end pipe spool of sufficient length to prevent interference with the operation of adjacent valves, pumps, or other items.

        iii. Integrally cast flanged-by-grooved end pipefittings.

E. Reducers:

1. Provide eccentric reducers.

2. Install with straight side on top to avoid trapping air.

F. Anchorage:

1. In interior locations and where subject to internal pressure block, anchor, or harness piping with mechanically coupled or similar joints to prevent separation of joints.

2. Other location: Provide reaction blocking anchorages or other supports for fittings above grade or exposed in structure as indicated on the Drawings or as required to prevent movement.

3. Concrete blocking:

   a. Bearing area as specified, or as directed by the District or its appointed Representative.

   b. Extend from fitting to solid undisturbed earth.

   c. Install so joints are accessible for repair.

   d. If adequate support against undisturbed earth cannot be obtained, provide restrained joints or metal harness anchorages across the joint and secure by anchoring to the pipes or fittings or other anchorage facilities as required for adequate support.

   e. If the lack of a solid vertical excavation face is due to improper excavation, all excess costs shall be borne by Contractor.

4. Restrained joints: All joints shall be restrained and designed to develop full thrust restraint at piping test pressure.

G. Connection to existing pipelines:

1. Make connections between new and existing piping with suitable fittings.

2. Schedule connection to minimize inconvenience to the District.

3. Provide facilities for adequate dewatering and disposal of water from dewatered line and excavations without damage to adjacent property.

H. Alignment:

1. Unless shown otherwise, piping shall be installed parallel to building lines, plumb, and level.

2. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment.

3. All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.

3.03 TESTING

A. Testing shall be performed in accordance with Section 02735, SANITARY SEWER SYSTEM TESTING.

*****END OF SECTION*****

SECTION 15064

POLYVINYL CHLORIDE (PVC) PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish and install PVC pipe and all appurtenances as specified, complete and in place, as specified herein.

1.02 RELATED SECTIONS

A. Section 02200, EARTHWORK

B. Section 02600, SIDE SEWERS

C. Section 02735, SANITARY SEWER SYSTEM TESTING

D. Section 15050, GENERAL PIPING

1.03 REFERENCE SPECIFICATIONS

A. Commercial Standards:

1. AWWA C900-07 Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm through 300 mm), for Water Transmission and Distribution

2. AWWA C905-08 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution

3. ASTM D 1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

4. ASTM D 2241 Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)

5. ASTM D 2321 Practice for Underground Installation of Thermoplastic Sewer Pipe for Sewers and Other Gravity-Flow Applications

6. ASTM D 3034 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

7. ASTM F 477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

8. ASTM F 1674 Test Method for Joint Restraint Products

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide submittals for items specified herein to the District for review and approval prior to ordering materials.

B. Submit list of pipe and fittings to be used, which includes the following information, where applicable:

1. List of Pipe Fittings to be used

2. Manufacturer(s)

3. Model Number, if applicable

4. Size and Schedule

5. Material

6. Pressure Rating

7. Catalog Data

8. Drawings

A. Certificates and Compliance. Certificates of compliance shall be provided for all products and materials proposed to be used under this Section as specified in the referenced standards.

B. All expenses incurred in making samples for certification of tests shall be borne by the Contractor.

1.06 QUALITY ASSURANCE

A. Except as modified in this Section, all materials used in the manufacture or installation of the pipe shall be tested in accordance with the requirements of the referenced standards.

1.07 DELIVERY, STORAGE AND HANDLING

A. All PVC piping and plastic materials shall not be stored in direct sunlight.

PART 2 - PRODUCTS

2.01 GENERAL

A. All PVC piping shall meet the requirements specified herein and indicated in these Standard Specifications.

B. All PVC pipe shall be continuously and permanently marked with the manufacturer's name, pipe size, and pressure rating in psi in conformance with the appropriate ASTM.

2.02 PVC C900/C905

A. All PVC main piping shall be rated for 150 psi minimum working pressure. It shall conform to AWWA C900/C905. Minimum pipe dimension ratio (DR) shall be the following.

Nominal Pipe Diameter (inches)	Minimum Pipe Dimension Ratio
≤ 24	DR-18
26 to 36	DR-21
>36	DR-25

B. Pipe shall be white or green, for wastewater service.

C. All rubber rings shall be furnished by the pipe manufacturer. These rubber rings (elastomeric gaskets) shall be manufactured to conform with the requirements of ASTM F477.

D. Bending of pipe shall not exceed recommendations of AWWA or manufacturer’s printed recommendations.

E. All fittings for PVC pipe shall conform to the requirements of ASTM D 2241. The ring groove and gasket ring shall be compatible with PVC pipe ends.

F. Restrained Joints:

1. Restrained joints shall be installed where indicated in the Project Contract Documents.

2. Piping 4 to 12 inch, pipe and fittings shall be internally restrained push-on joint with elastomeric gasket bell ends. The bell ends shall be integral thickened bell end or an integral sleeve-reinforced bell end. The bell end joints shall have a minimum wall thickness of the bell or sleeve-reinforced bell equal, at all points, to the DR (dimension ratio) requirements for the

pipe. The minimum wall thickness in the bell-entry sections shall equal or exceed the minimum wall thickness of the pipe barrel. Restrained joints shall be per the District's Approved Materials List.

3. Piping larger than 12: All restrained joints shall meet or exceed the requirements of ASTM F 1674. Restrained joints shall be manufactured by EBAA Iron, or approved equal. All hardware shall be type 316 stainless steel.

2.03 SCHEDULE 80 PVC (FOR INDIVIDUAL LOT PUMP STATION DISCHARGES)

A. Schedule 80 PVC shall be used for individual lot pumping station discharges.

1. Schedule 80 PVC pipe shall conform to ASTM D1785 and ASTM D1784.

2. Joints. Pipe shall be joined using solvent cement in accordance with ASTM D2564 and ASTM D1784. Primers for use on solvent cement joints shall be in accordance with ASTM F656, and handling of primers and solvent cements shall conform to ASTM F402. Solvent cements shall comply with requirements for potable water use. Threaded and flanged joints shall be used where required.

B. Solvent Cement: All connections to be joined by PVC (polyvinyl chloride) solvent cement shall be industrial grade and shall conform to ASTM D2564 and shall bear a dated stamp on the container indicating the date of manufacture. Manufacture and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility.

1. Solvent Cement shall be per the District's Approved Materials List.

C. Threaded Lubricant shall be teflon tape. Lubricant, if required, shall be suitable for lubricating the parts of the joints in the assembly. The lubricant shall have no deteriorating effects on the gasket and pipe material.

D. PVC flanges shall be supplied with all necessary gaskets, bolts, and nuts. Gaskets shall be full face, 1/16-inch thick Viton. Primers used in solvent cement connections shall be in accordance with ASTM F656 and handling of primers and solvent cements shall conform to ASTM F402.

PART 3 - EXECUTION

3.01 GENERAL

A. Sewer pipelines shall be constructed in compliance with the requirements of this Section and of Section 15050, **GENERAL PIPING**.

B. Work shall meet the specified requirements of these Specifications unless the requirements of the local agency having jurisdiction are greater, in which case the greater requirements shall govern.

C. Where plastic pipe passes through walls, wall penetrations shall be made as shown on the Standard Drawings or Construction Documents.

3.02 INSTALLATION

A. PVC pipe shall be installed in accordance with the requirements of ASTM D 2321; as specified herein and shown on the plans. Underground installation of PVC pipe, fittings and valves shall be as specified herein and ASTM D2774.

3.03 HORIZONTAL CURVES

A. Bending of pipe shall not exceed recommendations of AWWA or manufacturer's printed recommendations.

3.04 FIELD JOINTING

A. Pipe compression type joint shall be joined with a lock-in rubber ring and a ring groove that is designed to resist displacement during pipe insertion.

B. The ring and the ring seat inside the bell shall be wiped clean before the gasket is inserted. A thin film of lubricant shall be applied to the exposed surface of the ring and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used.

C. Joints shall not be deflected either vertically or horizontally in excess of the printed recommendations of the pipe manufacturer.

3.05 TESTING

A. Testing of installed PVC piping shall be in accordance with Section 02735, SANITARY SEWER SYSTEM TESTING.

****END OF SECTION*****

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SECTION 15066

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

1.01 SUMMARY

A. The Contractor shall furnish and install high-density polyethylene pipe (HDPE) and all appurtenances as specified herein and in these Standard Specifications, complete in place,

B. HDPE pipe and fittings specified herein shall be used only in association with pipe- bursting, pipe reaming, and horizontal directional drilling construction methods, unless otherwise approved by the District.

1.02 RELATED SECTIONS

A. Section,02300, CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS

B. Section 02330, HORIZONTAL DIRECTIONAL DRILLING (HDD)

C. Section 02345, PIPE BURSTING

D. Section 02365, PIPE REAMING

E. Section 02735, SANITARY SEWER SYSTEM TESTING

F. Section 15050, PIPING, GENERAL

1.03 REFERENCE SPECIFICATIONS

A. Commercial Standards:

ASTM D 638	Test Method for Tensile Properties of Plastics
ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics
ASTM D 746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 1238	Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1248	Specification for Polyethylene Plastics

	Molding and Extrusion Materials
ASTM D 1505	Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D 1525	Test Method for Vicat Softening Temperature of Plastics
ASTM D 1693	Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D 2240	Test Method for Rubber Property - Durometer Hardness
ASTM D 2837	Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D 3350	Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM F 585	Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers
ASTM F 714	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
PLASTICS PIPE	Renewing Sewers with Polyolefin Pipe Industry (PPI)

1.04 EXPERIENCE REQUIREMENTS

A. Fusion equipment shall be operated only by technicians who have been certified by the pipe manufacturer or supplier and who have a minimum of three (3) years of experience fusion welding 4-inch or larger diameter HDPE pipelines.

1.05 SUBMITTALS

A. The Contractor shall furnish a manufacturer's certificate affidavit of compliance for all HDPE pipe and fittings furnished confirming that the materials supplied fully conform to the requirements specified herein prior to ordering materials.

B. The Contractor shall furnish submit a copy of the technicians' certification(s) for the operation of the fusion equipment.

C. Submit debeading process and equipment for use in removing the internal bead for the newly joined HDPE pipe sections.

D. The Contractor shall perform trial fusion welds and submit samples to the District or its appointed Representative for review prior to installation of the pipe. Full penetration welds shall provide a homogeneous material across the cross section of the weld. The fusion machine employed for the trial welds shall be the same machine to be utilized for the installation work.

1.06 QUALITY ASSURANCE

A. Except as modified in this Section, all materials used in the manufacture or installation of the pipe shall be tested in accordance with the requirements of the referenced standards.

B. All installed pipe shall be cleaned and televised in accordance with Section, 02300, **CLEANING AND TELEVISION INSPECTION OF SANITARY SEWER MAINS** and tested in accordance with Section 02735, **SANITARY SEWER SYSTEM TESTING**.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall exercise special care during the unloading, handling, and storage of all polyethylene pipe to ensure that the pipe is not cut, gouged, scored, or otherwise damaged. Any pipe segment which has cuts in the pipe wall exceeding 10 percent of the wall thickness shall be cut out and removed from the site at the Contractor's cost. The pipe shall be stored so that it is not deformed axially or circumferentially.

B. All pipe without an ultraviolet inhibitor shall not be stored uncovered outside.

PART 2 - PRODUCTS

2.01 GENERAL

A. HDPE pipe, fittings, couplings, and appurtenances shall be furnished in accordance with the requirements specified herein.

B. Referenced pipe sizes are nominal pipe diameters.

2.02 PIPING MATERIALS

A. Pipe and fittings shall be high density, high molecular weight polyethylene with a cell classification of 345434D, as defined in ASTM D 3350. In addition, the material shall be listed by the Plastic Pipe Institute with a designation of PE 3408 and shall be classified as a Type III, Class C, Category 5, Grade P34 material, as defined in ASTM D 1248.

B. Pipe Color (inside and outside) shall be grey.

C. UV rated HDPE may be used for exposed piping. Pipe shall be high density, high molecular weight polyethylene with a cell classification of 445574C, as defined in ASTM D 3350, with a density of 2% minimum carbon black. In addition, the material shall be listed by the Plastic Pipe Institution with a designation of PE 4710, and the interior of the pipe shall be grey in color.

D. Fittings shall be of the same material and class as the pipe. Identification of pipe and fittings shall be in accordance with ASTM D 3350. Pipe and fittings shall be made from virgin material. No rework compound, except that obtained from the manufacturers own production of the same formulation, shall be used. Pipe and fittings shall be homogeneous throughout and shall be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.

E. Dimensions of pipe and fittings shall be in accordance with ASTM F 714. Pipe and fittings shall be at minimum SDR 17 for gravity sewer mains and SDR 11 for force mains. Cast iron/ ductile iron outside diameter shall be provided where specified. Pipe and fittings shall have a minimum pressure rating of one hundred (100) psi at seventy-three and four-tenth degrees Fahrenheit (73.4°F).

F. The physical properties of the pipe and fittings material shall be as follows:

PROPERTY	**TEST METHOD**	**VALUE**
Density	ASTM D 1505	0.955 gm/cc
Melt Index	ASTM D 1238	0.14 gm/10 min
Environmental Stress-Cracking Resistance	ASTM D 1693	> 5,000 hr > 800 hr
Tensile Strength, Yield [b]	ASTM D 638	3,200 psi
Elongation at Break [c]	ASTM D 638	> 750 percent

Vicat Softening Temperature	ASTM D 1525	257º F
Brittleness Temperature	ASTM D 746	< -180º F
Flexural Modulus	ASTM D 3350	125,000 psi
Modulus of Elasticity	ASTM D 638	105,000 psi
Hardness	ASTM D 2240	65 Shore D
Coefficient of Linear Thermal Expansion [d]	ASTM D 696	$8.3x10^{-5}$ in/in/°F $1.2x10^{-4}$ in/in/°F
Long Term Strength [e]	ASTM D 2837	1,600 psi 800 psi

a - Condition A, B & C @ 0°F; Compressed Ring @ 50°F
b - Type IV specimen
c - Type IV specimen
d - Molded specimen; Extruded pipe
e - @ 73°F; @ 140°F

2.03 MARKINGS

A. Pipe materials shall be legibly marked by the pipe manufacturer. The following shall be printed on the pipe:

1. Name and trademark of manufacturer.
2. Nominal pipe size.
3. Dimension Ratio (DR).
4. The letters PE followed by the polyethylene grade per ASTM D1248, followed by the Hydrostatic Design Basis in hundreds of psi.
5. Manufacturing Standard Reference.
6. A production code from which the date and place of manufacture can be determined.

2.04 JOINTS

A. Joints in HDPE pipe shall be made using thermal butt-fusion welding equipment designed for the specific purpose of permanently connecting HDPE pipes. This equipment shall be capable of squarely facing the pipe ends to be joined, properly heating each pipe end to the temperature range specified by the pipe manufacturer, and applying and sustaining the appropriate pressure, as

recommended by the pipe manufacturer. Test joints may be requested at the Inspector's discretion to ensure the quality of the joints.

B. For main sewer installation and pressure pipe, the butt-fusion welding machine shall be outfitted with a measuring and recording unit that documents the conditions existing during the fusion of each individual weld. A printout that includes the date and time each joint was made, the joint number, the initials of the machine operator, the platen temperature at the time of mating, the pressure during the heating cycle, the time period for the heating cycle, the pressure during the soak cycle, and the time period of the soak cycle shall be machine-generated and delivered to the District at the end of each work shift.

   1. The recording unit shall be a DataLogger, as manufactured by McElroy Manufacturing, Inc., or approved equal.

C. Fusion equipment shall be operated by certified technicians. A copy of the technician's certification shall be provided to the District prior to the start of the work. Furthermore, all technicians performing butt-fusion welding on this project shall have a minimum of two (2) years experience operating the same equipment used hereon.

D. Butt-fusion welding equipment shall be as follows, or approved equal:

   1. McElroy No. 412 Hydraulic Fusion Machine, McElroy Manufacturing, Tulsa, Oklahoma.

   2. Proweld Field 12 (315)-R, Asahi/America, Malden, Massachusetts.

2.05 FITTINGS

A. The Contractor shall provide fabricated fittings where required. Fabricated fittings shall be of the same material as, and shall have a minimum pressure rating equal to, the pipeline material. If the fitting is in-line with the pipeline (i.e., a flange adapter), then the I.D. of the fitting shall be the same as the pipe. If the fitting is off-line (i.e., a tee), then the fitting shall have an I.D. in accordance with the plans. Unless otherwise required, all fittings shall be butt-fusion welded or flanged.

B. Terminations to pipe or fittings made of other pipe materials shall be made by using flanges. Flanges shall consist of flange adapters butt-fusion welded to the HDPE pipe end, ductile iron back-up rings with a pressure rating of at least one-hundred and fifty (150) pounds per square inch (psi), Type 316 stainless steel bolts, nuts, and washers, and one eighth (1/8) inch thick, black-reinforced rubber gaskets. In no case shall threaded fittings or adapters be used to connect HDPE materials.

2.06 FIELD CLOSURE (ELECTROFUSION) COUPLINGS

A. Electrofusion couplings shall be per the District's Approved Material List.

B. Field closure couplings shall be electrofusion couplings designed and manufactured in accordance with ASTM F-1055 for use with pipe conforming to ASTM D2513/3035, -714 and with Butt fittings conforming to ASTM D3261 as applicable.

C. Electrofusion couplings shall be produced from a pre-blended virgin resin that has a PPI listing of PE3408 which complies with ASTM D3350 and shall tested in accordance with AWWA C906 specification.

D. The electrofusion coupling shall have the following features:

1. Engineered for use on HDPE pipe
2. Dual electrofusion coils
3. Pressure rated for 200 psi for water
4. NSF listed Resin
5. Meets AWWA C906

2.07 SIDE SEWER (LATERAL) CONNECTIONS

A. Side sewers to be connected to an HDPE sewer main line shall be connected by use of electrofusion saddles. Electrofusion saddles shall be per the District's Approved Materials List.

B. Lateral connections to sanitary sewer mains 12 inch in diameter (nominal) or smaller shall be with an electrofusion "wye" type saddle.

C. Lateral connections to sanitary sewer mains greater than 12 inch in diameter (nominal) may be with a "tee" type saddle if the "wye" type electrofusion saddle is not available.

D. If approved by the District, Sidewall (Saddle) Fusion connections, may be used instead of Electrofusion saddles, and shall be performed in accordance with manufacture's recommendations.

1. Sidewall (Saddle) Fusion welding equipment shall be as follows, or approved equal:
    a. McElroy Sidewinder Saddle Fussion, McElroy Manufacturing, Tulsa, Oklahoma.
    b. McElroy 2CU, McElroy Manufacturing, Tulsa, Oklahoma.

2. Sidewall/saddle fusion fittings shall be per District's approved material list.

PART 3 - EXECUTION

3.01 GENERAL

A. Sewer pipelines shall be constructed in compliance with the requirements of this Section and of Section 15050, GENERAL PIPING.

B. Work shall meet or exceed the requirements of these Specifications.

C. The Contractor shall inspect each pipe and fitting prior to butt-fusion welding and again prior to installation. Any damaged pipe or fittings shall be replaced by the Contractor.

D. Prior to butt-fusion welding or installation, each pipe or fitting shall be thoroughly cleaned and shall be kept clean. The material used to clean the pipe and fittings shall be as recommended by the pipe manufacturer.

3.02 BUTT-FUSION WELDING

A. Butt-fusion welds shall be performed in accordance with manufacturer's instructions. The butt-fusion welding procedures are summarized below:

1. Clean each pipe end with a clean cotton cloth to remove dirt, oil, grease, and other foreign materials.

2. Square (face) the mating surfaces of each of the pipes to be fused.

3. Bring the two (2) pipe ends together and adjust the pipe locations to ensure proper alignment.

4. Verify that the surface temperature of the heater plate is between three hundred seventy-five degrees Fahrenheit (375°F) to four hundred degrees Fahrenheit (400°F) and then clean the heater surface with a clean cotton cloth.

5. Insert the heater plate between the pipe ends, bring the ends into firm contact with the heater plate without applying pressure and achieve a proper melt pattern.

6. After achieving the proper melt bead, remove the heater plate and quickly examine the pipe ends for complete melt.

7. Once complete melt has been accomplished, rapidly bring the pipe ends together and apply pressure as recommended by the pipe manufacturer.

8. Hold the pressure constant and at the proper level throughout the cooling

period, for the minimum time period recommended by the pipe manufacturer or as necessary to achieve proper cooling.

B. For main and side sewer installations, the Contractor shall mark each joint with the individual joint number, corresponding to the joint identification number appearing on the printout of the data logger attached to the butt-fusion welding machine. The printout shall be attached to the pipe near the joint for collection by the District.

C. For main and side sewer installations, including fittings, the Contractor shall remove the internal melt bead from the welded joint. Bead removal shall be accomplished in a manner that does not score or gouge the pipe.

D. Where pipe laydown area available prevents feasibility of debeading all joints, then the District may allow non-debeading of some joints as required. In no instance will less than 200 feet between internal beads be allowed.

3.03 INSTALLATION

A. All pipe bursting, directional drilling, and pipe reaming procedures that require the use of HDPE pipe shall be executed as listed in Section 02330, **HORIZONTAL DIRECTIONAL DRILLING (HDD)**, Section 02345, **PIPE BURSTING**, and Section 02365, **PIPE REAMING**.

3.04 PIPE DEFLECTION

A. Horizontal curves shall be installed by forced bending of the pipe. Minimum curvature radius requirements for HDPE pipe are shown on the table below. All designs of curvilinear sewers are subject to approval by the District.

HDPE	
Pipe DR	Minimum Curve Radius
≤ 9	20 times pipe O.D.
> 9 - 13.5	25 times pipe O.D.
> 13.5- 21	27 times pipe O.D.
> 21	30 times pipe O.D.
Fitting or flange present in bend	100 times pipe O.D.

3.05 FIELD COUPLINGS

A. Fittings/joints that are to be assembled after the pipe has been installed shall be butt fused where accessible. Electrofusion couplings shall be used for field closures as needed.

*****END OF SECTION*****

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SECTION 15100

GENERAL VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes basic requirements for valves including:

1. General Requirements
2. Bolts and Nuts
3. Interior Protective Coatings
4. Underground Valves
5. Valve Operators

B. The Contractor shall furnish and install all valves systems in accordance with the requirements of these Standard Specifications.

C. Products manufactured in the USA shall be used where feasible.

D. Requirements specified herein are used to establish the standards of quality and utility required for valves. However, alternates to or variance from requirements specified herein which are equal in quality and utility to those specified herein may be permitted by the District subject to the following provisions:

1. The Contractor shall submit to the District sufficient data, drawings, samples, literature, calculations, or other detailed information as will demonstrate to the District or its appointed Representative that the proposed alternate is equal in quality and utility to the requirements Specified herein.

2. The District or its appointed Representative must favorably review in writing such proposed variances and/or substitutions as are, in its opinion, equal in quality to the requirements of the District's Standard Specifications, or acceptable under special conditions.

3. Failure of the Contractor to submit proposed substitutions or variances for review in the manner described above shall be sufficient cause for rejection by the District of any alternates or variances otherwise proposed.

E. Design Requirements

1. Pressure Rating:

a. Suitable for service under minimum working pressures of 150 pounds per square inch gauge.

b. When a piping system is specified to be tested at a pressure greater than 150 pounds per square inch gauge, provide valves for that piping system with design working pressure which is sufficient to withstand the test pressure.

2. Valve to Piping Connections, unless otherwise specified:

a. Valves 3 Inch Nominal Size and Larger: Flanged or mechanical joints.

b. Valves less than 3 Inch Nominal Size: Threaded connections.

1.02 RELATED SECTIONS

A. Section 11000, **GENERAL EQUIPMENT** Section 15050, **GENERAL PIPING** Section 15105, **CHECK VALVES**

B. Section 15109, **PLUG VALVES**

C. Section 15110, **MISCELLANEOUS VALVES**

1.03 REFERENCE SPECIFICATIONS

A. Aluminum Association (AA):

1. DAF-45 – Designation System for Aluminum Finishes.

B. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ ASME):

1. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.

2. B16.34 - Valves - Flanged, Threaded, and Welding End.

C. American Society for Testing and Materials (ASTM):

1. A 126 - Specification for Gray Iron Casting for Valves, Flanges, and Pipe Fittings.

2. A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

3. A 536 - Specification for Ductile Iron Castings.

4. E 527 - Practice for Numbering Metals and Alloys (UNS).

D. American National Standards Institute/American Water Works Association (ANSI/AWWA):

1. C 111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe Fittings. American

E. Water Works Association (AWWA):

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall submit the following to the District for review and approval prior to Ordering Materials:

1. Product Data: Submit detailed technical information relating to the valve including description of component parts, materials of construction, performance, dimensions, and weights.

2. Shop Drawings. Shop drawings of all valves and operators, as shown or as specified, including associated wiring diagrams and electrical data.

3. Valve Labeling. Submit a schedule of all valves indicating in each case the valve location and the proposed wording for the label. Valve labels shall be similar to equipment nameplates as specified in Section 11000, GENERAL EQUIPMENT.

B. Operation and Maintenance Data:

1. Furnish bound sets of installation, operation, and maintenance instructions for each type of valve 4 inch in nominal size and larger. Include information on valve operators in operation and maintenance instruction manual.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Valves: Manufactured by manufacturers whose valves have had successful operational experience in comparable service.

B. Valve Operators:

1. Valve Provide valve operators integral with valve.

2. Provide similar operators by one manufacturer.

3. Provide motorized operators by one manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect valves and protective coatings from damage during handling and installation; repair coating where damaged.\

PART 2 - PRODUCTS

2.01 GENERAL

A. Stainless Steel: ASTM A 167, Type 316, or Type 304, UNS Alloy S31600 or S30400.

B. Bolts and Nuts for Valves, Gates, and Operators: Unless specified elsewhere, provide the following:

1. Fabricated of Type 316 stainless steel.

2. Where dissimilar metals are being bolted, use stainless steel bolts with isolation bushings and washers.

C. Bronze and Brass Alloys: Use bronze and brass alloys with not more than 6 percent zinc and not more than 2 percent aluminum in the manufacture of valve parts; UNS Alloy C83600 or C92200 unless specified otherwise.

D. Valve Bodies: Cast iron in accordance with ASTM A 126 Class 30 minimum or ductile iron in accordance with ASTM A 536 Grade 65-45-12 minimums unless specified otherwise.

2.02 PROTECTIVE COATINGS

A. Interior Protective Coatings:

1. Provide valves with type of protective coating specified in the particular valve specification and in. Section 09800, **PROTECTIVE COATINGS**.

2. Apply protective coating to interior, non-working surfaces, except stainless steel surfaces.

B. Exterior Coating:

1. Provide valves with factory and field coating specified in particular valve specification and in Section 09800, **PROTECTIVE COATINGS**.

2.03 UNDERGROUND VALVES

A. Provide underground valves with flanged, mechanical, or other type of joint required for the type of pipe to which the valve is to be connected.

2.04 VALVE BOXES

A. Valve Boxes shall be as specified in Section 03400, PRECAST CONCRETE STRUCTURES.

2.05 VALVE OPERATORS

A. Valve Operators:

1. Geared Operators: Provide for the following:

a. Plug or ball valves 4 inches, nominal size, and larger.

B. Valve Operator "Open" Direction:

1. Provide the word “OPEN” and an arrow indicating the direction to open cast on each valve body or operator. Cast arrow and legend indicating direction to rotate operator on handwheel, chain wheel rim, crank, or other prominent place.

C. Valve Operation: Counterclockwise to open with suitable and adequate stops, capable of resisting at least twice normal operating force to prevent overrun of valve or gate in open or closed position.

D. Provide manually operated valves and gates located not more than 6 feet above the operating level with tee handles, wrenches, or handwheels.

1. Make the valve operator more conveniently accessible by rolling valves, located more than 5 feet but less than 6 feet above the operating level, toward the operating side.

2. Secure tee handles and wrenches to the valve head or stem, except where a handle or wrench so secured constitutes a hazard to personnel; in which case, stow handle or wrench immediately adjacent to the valve on or in a suitable hanger, bracket, or receptacle.

E. Extension Stems:

1. Provide extension stems where indicated on Drawings, as specified, and where required for proper operation.

2. Provide an operator shaft extension from valve or valve operator to finish grade or deck level for buried valves more than 30 inches below grade, and for all other valves located below the operating deck or level that are key operated.

3. Provide 2 inch square AWWA operating nut, and box and cover as specified, or a cover where a box is not required.

4. Provide operating key for each type of valve provided (six (6) keys maximum).

5. Non-rising stems:

    a. Solid steel shafting with OD not less than OD of valve stem or galvanized steel pipe with ID not less than OD of valve stem.

    b. Connected to the valve by a flexible socket coupling.

    c. All other connections pinned, keyed, or socket.

6. Rising stems:

    a. Stainless steel or carbon steel shafting with OD not less than OD of valve stem.

    b. Bronze or stainless steel sleeves securely attached to stem.

    c. Sleeve length and location to extend through each stem guide throughout the full vertical travel of the stem.

7. Stem guides:

    a. Cast iron, bronze bushed, adjustable in two (2) directions.

    b. If extension stem length exceeds 10 feet or the weight exceeds 20 lbs, design top guide to carry the stem weight and provide a collar on the stem to bear against the thrust guide.

    c. Maximum spacing:

        i. Non-rising stems: 100 times stem OD.

        ii. Rising stems: 60 times stem OD.

        iii. Ten (10) feet maximum.

F. Buried Operator Housing: Oil and watertight, specifically designed for buried service, factory packed with suitable grease, completely enclosed space between operator housing and valve body so that no moving parts are exposed to soil; provide operators with 2 inch square AWWA operating nut.

G. Worm Gear Operators: Provide gearing on worm gear operators that is self-locking with gear ratio such that torque in excess of 160 foot pounds will not need to be applied to operate valve at most adverse conditions for which valve is designed.

PART 3 - – EXECUTION

3.01 EXAMINATION

A. Preparation: Required Information Prior to Installation:

1. Install valves after the required submittal on installation has been accepted.

2. Determine, after flanged valves and flanged check valves are selected, the face-to-face dimensions of flanged valves and flanged check valves.

B. Fabricate piping to lengths taking into account the dimensions of flanged valves and flanged check valves.

3.02 INSTALLATION

A. Provide incidental work and materials necessary for installation of valves including flange gaskets, flange bolts and nuts, valve boxes and covers, concrete bases, blocking, and protective coating.

B. Install valves so that handles clear obstructions when the valves are operated from fully open to fully closed.

C. Place top of valve boxes flush with finish grade, unless otherwise specified.

D. Valves with Threaded Connections:

1. Install valves by applying wrench on end of valve nearest the joint to prevent distortion of the valve body.

2. Apply pipe joint compound and Teflon tape on external (male) threads to prevent forcing compound into valve seat area.

E. Valves with Flanged Connections:

1. Align flanges and gasket carefully before tightening flange bolts.

2. When flanges are aligned, install bolts and hand tighten.

3. Tighten nuts opposite each other with equal tension before moving to next pair of nuts.

*****END OF SECTION*****

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SECTION 15105

CHECK VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall furnish and install all check valves in the types and sizes shown and specified, complete and operable, including coating, appurtenances, and accessories, in accordance with the requirements of these Standard Specifications.

1.02 RELATED SECTIONS

A. Section 09800, PROTECTIVE COATINGS

B. Section 15100, GENERAL VALVES

1.03 REFERENCE SPECIFICATIONS

A. Without limiting the generality of other requirements of these Specifications, all work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section; provided, that for Building Codes, the latest edition of the code, as adopted as of the date of award by the agency having jurisdiction, shall apply to the Work.

B. The following references are part of this Section. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail. The latest edition of the following references at the time of bid shall be used:

1. ASTM A126 Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM A148 Specification for Steel Castings, High Strength, for Structural Purposes.

3. ASTM A276 Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

4. ASTM A536 Specification for Ductile Iron Castings.

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide submittals for items specified herein to the District for review and approval prior to ordering materials.

1.06 NOT USED

1.07 DELIVERY, STORAGE, AND HANDLING

A. The equipment delivered prior to installation shall be stored where it is protected from theft, vandalism, and deterioration due to the elements.

B. All equipment delivered in excess of sixty (60) days prior to its installation date shall be accompanied by manufacturer's maintenance instructions outlining all requirements to maintain the equipment in top condition while in storage. The Contractor shall provide the manufacturer with all the target installation dates. The Contractor shall also provide the Engineer with a copy of all such maintenance instructions.

1.08 MANUFACTURER/SUPPLIER'S SERVICES

A. A manufacturer/supplier's representative shall be present at the job site for a minimum of one-half man day, travel time excluded, for assistance during installation, equipment startup, and testing. Additional requirements for training are specified herein.

PART 2 - PRODUCTS

2.01 GENERAL

A. Check valves and appurtenances shall meet or exceed the requirements specified herein.

B. Check valves shall be suitable for use with raw wastewater.

2.02 CHECK VALVES

A. Check valves shall be per the District's Approved Materials List.

B. Equipment Requirements. Check valves except as otherwise indicated shall be swing check valves and shall be of the lever and weight type, designed for a water- working pressure of 150 psi, and shall have a flanged cover piece to provide access to the disc.

C. All check valves shall be designed for operation in either horizontal or vertical flow up position.

D. For check valves 2 inches in size and larger, the valve body and cover shall be ASTM A126, Class B, cast-iron, flanged end. The valve seat shall be stainless steel (ASTM A276) and locked in place with stainless steel screws and be field replaceable without the use of special tools. The disc and seats shall be field replaceable without disconnecting either inlet or outlet flanges.

E. The valve disc shall be ductile iron, ASTM A536 or cast-iron, ASTM A126, Class B utilizing a double clevis and connected to a ductile iron disc arm. Disc arm shall be ductile iron, ASTM A536. The disc seat shall be resilient Buna-N and shall be easily replaceable in the field without the use of special tools. Disc seat shall provide for water tight shut-off. Hinge pins shall be stainless steel. The lever and weight shall be so constructed and so positioned that it can operate without interference by any piping, supports, or equipment. Contractor shall coordinate this with the check valve manufacturer prior to ordering materials.

F. The pivot shaft shall be continuous stainless steel, and fully extended from the body.

G. Check valves shall be suitable for intended use.

H. Contractor shall verify valve dimensions to ensure the valves fit into the required spaces and are accessible for maintenance. Contractor shall also verify that the check valve will operate without interference with the plug valves and the other check valve and shall coordinate this with the check valve and plug valve manufacturers.

2.03 FACTORY LININGS/COATINGS

A. Factory lining. Ferrous surfaces inside check valves shall be factory coated with an amine cured, rust inhibitive epoxy. Valves 4 inch diameter and larger shall have a minimum dry film thickness of 16 mils (minimum dry film thickness of 10 mils is acceptable for valves smaller than 4 inch diameter). Factory lining shall be Tnemec V69, Carboline Carboguard 890, Devoe Bar-Rust 231, or approved equal.

B. Factory Coating. Exterior of check valves shall factory coated with an amine cured, rust inhibitive epoxy with a minimum dry film thickness of 6 mils. Coating shall be suitable as a primer and accept top coats. Factory coating shall be Tnemec V69, Carboline Carboguard 890, Devoe Bar-Rust 231, or approved equal.

C. Contractor shall field coat valves per Section 09800, PROTECTIVE COATINGS. Contractor shall coordinate with valve and coating manufacturer's and verify compatibility of materials.

2.04 SPARE PARTS AND SPECIAL TOOLS

A. Contractor shall provide special tools and a list of recommended spare parts with price list.

B. Contractor shall provide a seat, disc, and bonnet gasket for each size check valve provided.

PART 3 - EXECUTION

3.01 GENERAL

A. All check valves shall be installed in strict accordance with the manufacturer's instructions.

B. Contract shall field coat valves as specified above.

3.02 VALVE INSTALLATION

A. General. All valves and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. Access. All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and piping and structural members.

C. Check valves shall be field adjusted by manufacturer’s representative to provide for no backflow and no slamming on closure.

*****END OF SECTION*****

SECTION 15109

PLUG VALVES

PART 1 - – GENERAL

1.01 SUMMARY

A. The Contractor shall furnish and install plug valves, complete and operable including operators, protective coatings, and appurtenant work, all in accordance with the requirements specified herein.

1.02 RELATED SECTIONS

A. Section 09800, PROTECTIVE COATINGS

B. Section 15100, VALVES, GENERAL

1.03 REFERENCE SPECIFICATIONS

ASTM A126:	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A536:	Standard Specification for Ductile Iron Castings
ASTM A743:	Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ANSI B16.1:	Cast Iron Pipe Flanges and Flanged Fittings

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall provide submittals for products specified herein for District review and approval prior to ordering materials.

B. Submit complete valve fabrication drawings with parts list, material specification, dimensions, and construction details for all parts used in the construction of the valves and operators in accordance with the requirements. Submit for approval drawings, dimensions, and parts list with materials of the valves and operators.

1.06 QUALITY ASSURANCE

A. The valves specified herein shall be the end product of one manufacturer.

B. For manually operated valves to be supplied, the valve manufacturer shall be responsible for the operators.

C. The Contractor shall ensure that all plug valves are of the same end product of one manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

A. The equipment delivered prior to installation shall be stored where it is protected from theft, vandalism, and deterioration due to the elements.

B. All equipment delivered in excess of sixty (60) days prior to its installation date shall be accompanied by manufacturer's maintenance instructions outlining all requirements to maintain the equipment in top condition while in storage. The Contractor shall provide the manufacturer with all the target installation dates. The Contractor shall also provide the District with a copy of all such maintenance instructions.

PART 2 - PRODUCTS

2.01 GENERAL

A. Plug valves and appurtenances shall meet or exceed the requirements specified herein.

B. Plug valves shall be eccentric type and shall be suitable for raw wastewater service.

2.02 ECCENTRIC PLUG VALVES

A. Plug valves shall be per the District's Approved Materials List.

B. Plug valves shall be of the non-lubricated eccentric type with cast iron bodies, conforming to ASTM A126, Class B or ductile iron conforming to ASTM A536 Grade 65-45-12.

C. Plugs shall be one piece ASTM A536 Grade 65-45-12 ductile iron, resilient faced (Buna-N) and suitable for their intended service.

D. Valves shall be in accordance with AWWA C517. Valves shall be furnished with welded overlay seats of not less than 90% nickel, of a minimum thickness of 1/8". Sprayed, plated, or screwed seats are not acceptable.

E. Valves shall be furnished with sleeve type bearings. Bearings shall be constructed of Type 316 stainless steel, conforming to ASTM A743, Grade CF-8M, furnished with permanently-lubricated bearing surfaces.

F. All valves for sizes 4 inches and larger shall have worm gear operators and ANSI 125/150 psi flanged ends, in accordance with ANSI B16.1. All gear actuators shall have both open and closed position stops.

G. All valves 2-inch and smaller shall have operating levers and screwed or flanged ends and shall have an unobstructed port area of not less than 80 percent.

H. All valves shall be suitable for buried or submerged service. Valves and worm gears shall be lubricated and sealed to prevent entry of dirt or water into the operator.

I. All valves less than 14 inches in diameter and greater than or equal to 3 inches in diameter shall have an unobstructed port area of not less than 100-percent of full pipe area or provide equivalent flow. All valves 14 inches and larger shall have an unobstructed port area of not less than 80-percent of full pipe area. All eccentric plug valves 12 inches and smaller shall have a pressure rating of not less than 175 psi WOG, and valves larger than 12 inches shall have a pressure rating of not less than 150 psi WOG for bubble-tight shut-off. Each valve shall be given a hydrostatic and seat test. All operators shall indicate valve position.

J. The valve shaft seats shall be multiple rings of V-type packing or “U” cup type. O- rings are not acceptable. Valves shall have top and bottom grit excluders of PTFE, Buna-N or Delrin.

K. Valve Lining. Ferrous surfaces of valves, 4-inches and larger, which will be in contact with wastewater or water, shall be coated as specified in Section 09800, PROTECTIVE COATINGS.

L. Extension stems. Extension stems shall be provided where required for buried valves. Stems shall bring the operating nut to a point 2 inches below the operating surface. Extension stems shall be constructed of steel and shall be complete with 2- inch square operating nut.

M. All valves shall be provided with manual operators. See valve schedule in the Contract Documents for operator type.

N. Listed manufacturers may not be suitable due to size of actuator and space constraints. Contractor shall coordinate valve and manual actuator dimensions to ensure that actuators fit into required spaces and are accessible for maintenance. Contractor shall verify the plug valve does not interfere with the check valve operation and shall coordinate with the check valve and plug valve manufacturers.

2.03 FACTORY LINING/COATING

A. Factory lining. Ferrous surfaces inside plug valves shall be factory coated with an amine cured, rust inhibitive epoxy. Valves 4 inch diameter and larger shall have a minimum dry film thickness of 16 mils (a minimum dry film thickness of 10 mils is acceptable for valves smaller than 4 inch diameter). Factory lining shall be Tnemec V69, Carboline Carboguard 890, Devoe Bar-Rust 231, Amerlock 400 or approved equal.

B. Factory Coating. Exterior of plug valves shall factory coated with an amine cured, rust inhibitive epoxy with a minimum dry film thickness of 6 mils. Coating shall be suitable as a primer and accept top coats. Factory coating shall be Tnemec V69, Carboline Carboguard 890, Devoe Bar-Rust 231, Amerlock 400, or approved equal.

C. Contractor shall field coat valves per Section 09800, PROTECTIVE COATINGS. Contractor shall coordinate with valve and coating manufacturers and verify compatibility of materials.

2.04 SPARE PARTS AND SPECIAL TOOLS

A. Contractor shall provide special tools and a list of recommended spare parts with price list.

PART 3 - EXECUTION

3.01 GENERAL

A. All plug valves shall be installed in strict accordance with the Supplier's published recommendations and the applicable provisions of Section 15100, **VALVES, GENERAL**.

3.02 VALVE INSTALLATION

A. General. All valves, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown in the Contract Documents. All plug valves shall be installed with stems horizontal and plug rotation to the top of the valve, unless physical space requirements prohibit such installation, or unless stated otherwise. Contractor shall obtain District's approval for vertical shaft installation prior to installation. Valves shall be firmly supported to avoid undue stresses on the pipe. Access shall be provided for operation, removal, and maintenance. Conflicts between other equipment, piping, and miscellaneous improvements shall be avoided.

3.03 PAINTING

A. All plug valves shall be painted as specified herein and coated in accordance with the requirements of Section 09800, PROTECTIVE COATINGS and as specified herein.

3.04 CLEANING

A. After manufacture of the valves and before shipment, the valves shall be cleaned of all foreign substances.

*****END OF SECTION*****

SECTION 15110

MISCELLANEOUS VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. The Contactor shall furnish and install miscellaneous valves as shown and as specified herein, complete, and operable including accessories and, where designated, operators, all in accordance with the requirements of the these Standard Specifications .

1.02 RELATED SECTIONS

A. Section 15100, GENERAL valves

1.03 NOT USED

1.04 NOT USED

1.05 SUBMITTALS

A. The Contractor shall submit items specified herein to the District for review and approval prior to ordering materials.

B. Submit complete valve fabrication drawings with parts list, material specification, dimensions, and construction details for all parts used in the construction of the valves and operators in accordance with the requirements. Submit for approval drawings, dimensions, and parts list with materials of the valves and operators.

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE AND HANDLING

PART 2 - – PRODUCTS

2.01 RUBBER CHECK VALVES

A. Rubber or “Duckbill” check valves shall be per the District’s Approved Materials List.

B. Rubber check valves shall be a rubber and flow operated check type with a slip-on end connection suitable for attachment to the appropriate pipe.

C. The valve shall be furnished with Type 316 stainless steel band clamps.

D. The port area shall contour down to a duckbill that shall allow passage of flow in one direction while preventing reverse flow. The valve shall be one piece rubber construction with nylon reinforcement.

E. The flexible duckbill sleeve shall be neoprene suitable for raw wastewater.

F. Company name, plant location, valve size, and serial number shall be bonded to the check valve.

2.02 COMBINATION AIR VALVES

A. Combination air release and vacuum valves shall be of the single body, double orifice type. The large orifice shall allow air to escape during pipeline filling and to enter during drainage of the pipeline. The small orifice shall release small pockets of air after the pipeline is filled and under pressure. Except as modified or supplemented herein, all air valves supplied under this Specification shall be designed and manufactured in strict compliance with AWWA C512. The valves shall be installed in a vertical position in an underground vault.

B. The valve body shall be AISI Type 304 or 316 stainless steel, and the ends shall be epoxy coated steel or Type 304 or 316 stainless steel, secured with Type 304 or 316 stainless steel rods. The floats shall be solid cylindrical high density polyethylene or stainless steel. The baffle plate, nozzle seat retaining plate, small orifice nozzle and all connecting hardware shall be stainless steel. Valve seats shall be natural or synthetic rubber equal to Buna-N or EPDM. All 3 inch and 4-inch valves shall be furnished with flanged inlets conforming in dimension and drilling to ANSI B16.1, Class 200. Each flange face shall be machined to a flat surface with a serrated finish in accordance with AWWA C207. All two inch valves shall be furnished with NPT inlets. All valves shall be provided with 1/2-inch NPT pipe plugs in the top cover and in the bottom of the body.

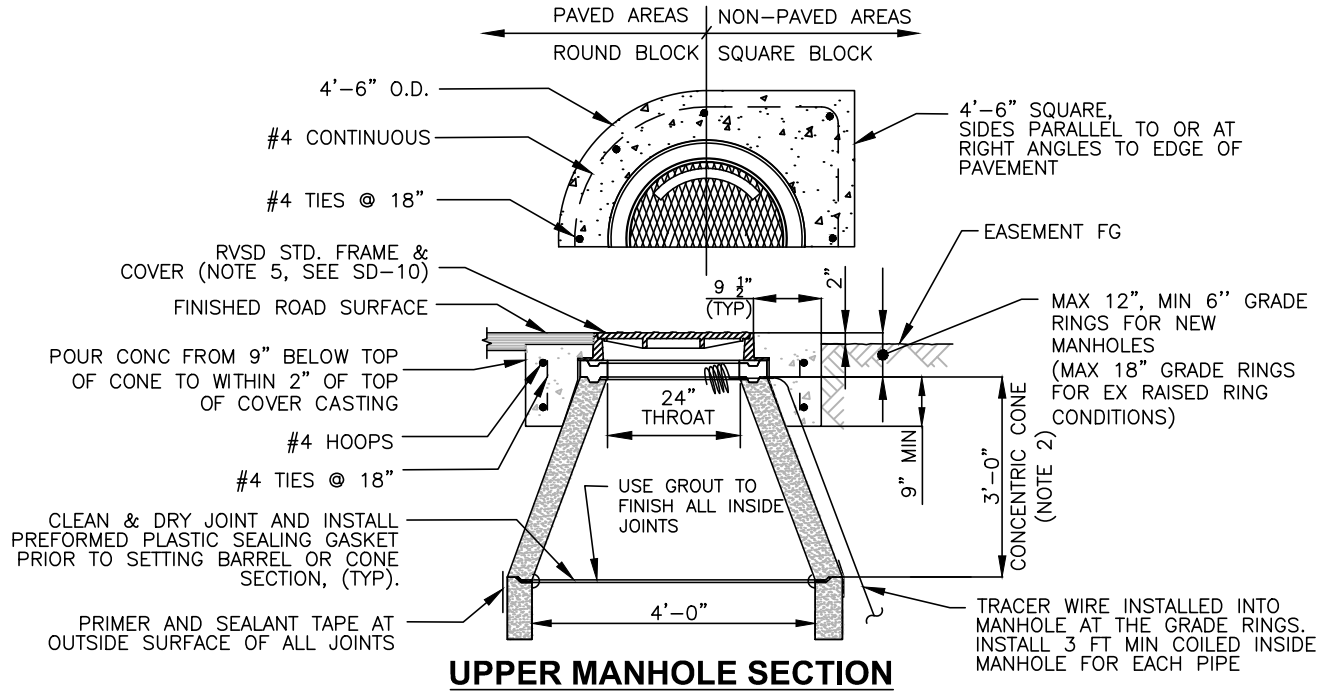
C. Combination Air Valves shall be per the District’s Approved Materials List.

PART 3 – EXECUTION

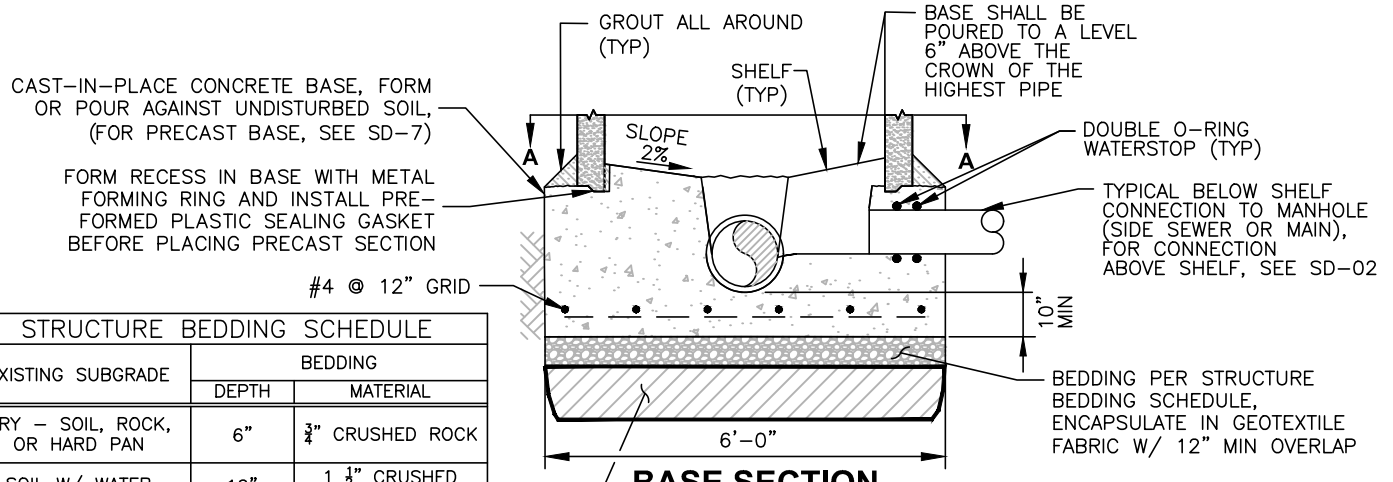
3.01 INSTALLATION

A. All valves shall be installed in accordance with the Supplier's printed recommendations.

*****END OF SECTION*****

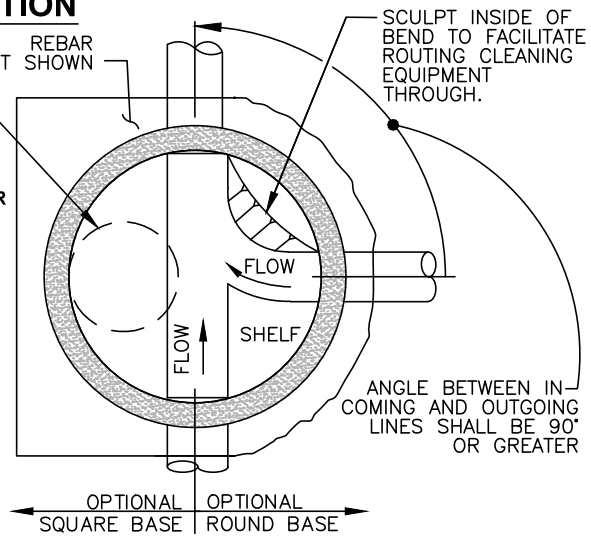


UPPER MANHOLE SECTION



BASE SECTION

STRUCTURE BEDDING SCHEDULE		
EXISTING SUBGRADE	BEDDING	
	DEPTH	MATERIAL
DRY – SOIL, ROCK, OR HARD PAN	6"	¾" CRUSHED ROCK
SOIL W/ WATER	12"	1 ½" CRUSHED ROCK
ROCK OR HARDPAN W/ WATER	6"	1 ½" CRUSHED ROCK
UNSTABLE SOIL AND/OR BAY MUD	18" (NOTE 3)	1 ½" CRUSHED ROCK



BASE SECTION A-A

NOTES:

1. **REBAR SHALL HAVE 3" MIN CONC COVER. REBAR IN PRECAST SECTIONS NOT SHOWN FOR CLARITY.**
2. **ECCENTRIC CONE MAY BE USED TO AVOID UTILITY CONFLICTS IF APPROVED BY THE DISTRICT. THE DISTRICT MAY REQUIRE THAT ECCENTRIC MANHOLES BE PROVIDED W/ STEPS.**
3. **IF UNSTABLE SUB-GRADE IS EXPOSED PRIOR TO BEDDING PLACEMENT, THE DISTRICT SHALL BE ADVISED IMMEDIATELY. WHEN DIRECTED BY THE DISTRICT, OVER-EXCAVATE AN ADDITIONAL 12" MIN UNSUITABLE SUB-GRADE MATERIAL FOR A TOTAL OF 18" BELOW PIPE AND BACKFILL PER STANDARD SPECIFICATION SECTION 02200, EARTHWORK.**
4. **WHEN NEW MANHOLES ARE CONNECTED TO EXISTING MAINS, NEW PIPE ENTERING THE MANHOLE SHALL MATCH THE EXISTING PIPE MATERIAL AND SIZE, UNLESS OTHERWISE NOTED.**
5. **FRAME AND COVER ELEVATION SHALL CONFORM TO FINISHED PAVEMENT TO WITHIN 1/8".**
6. **APPLY TWO COATS OF WATERPROOFING TO ALL CONCRETE SURFACES INSIDE MANHOLE.**

OCTOBER 2026

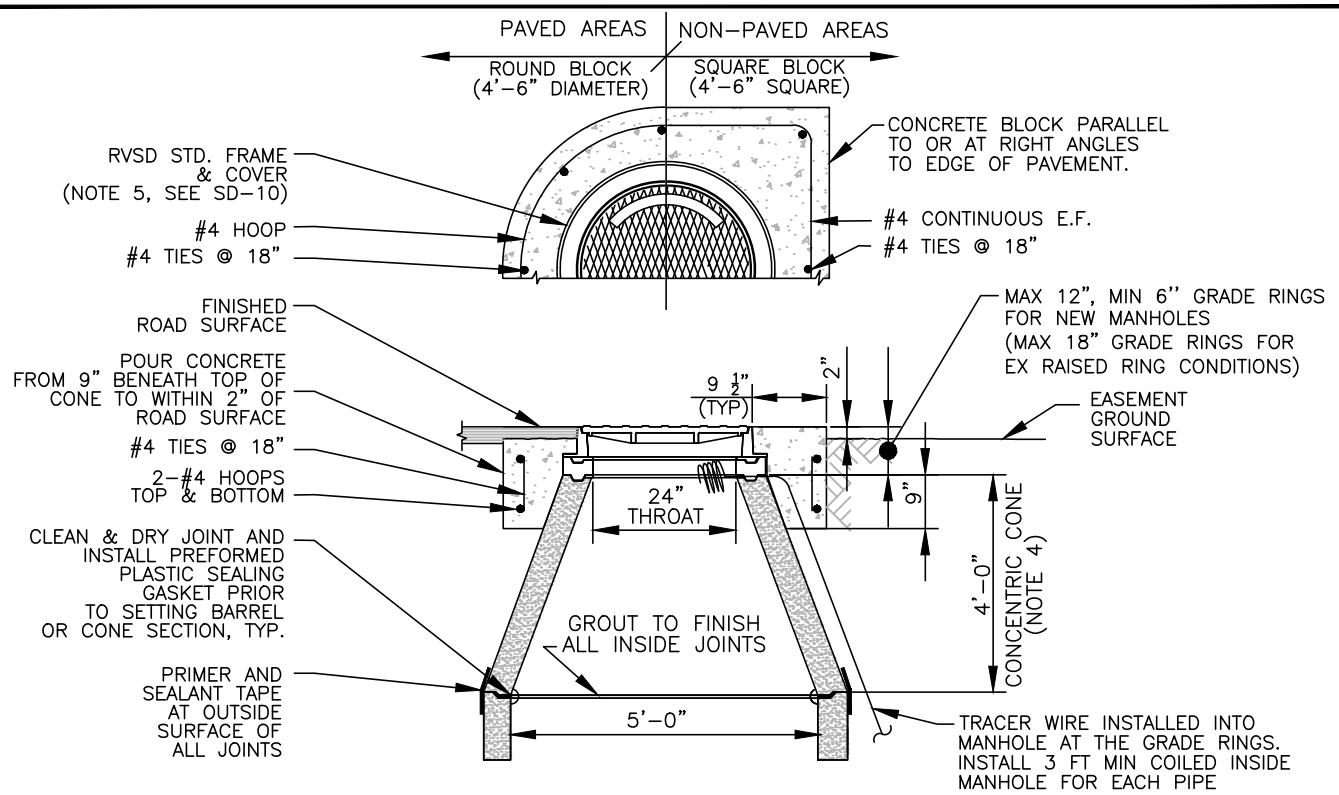
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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

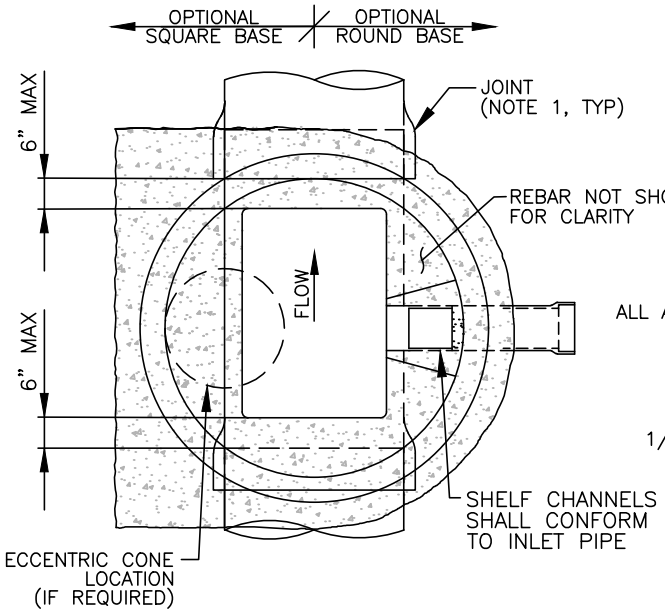
STANDARD SEWER MANHOLE FOR LINES LESS THAN 14"

SD-01

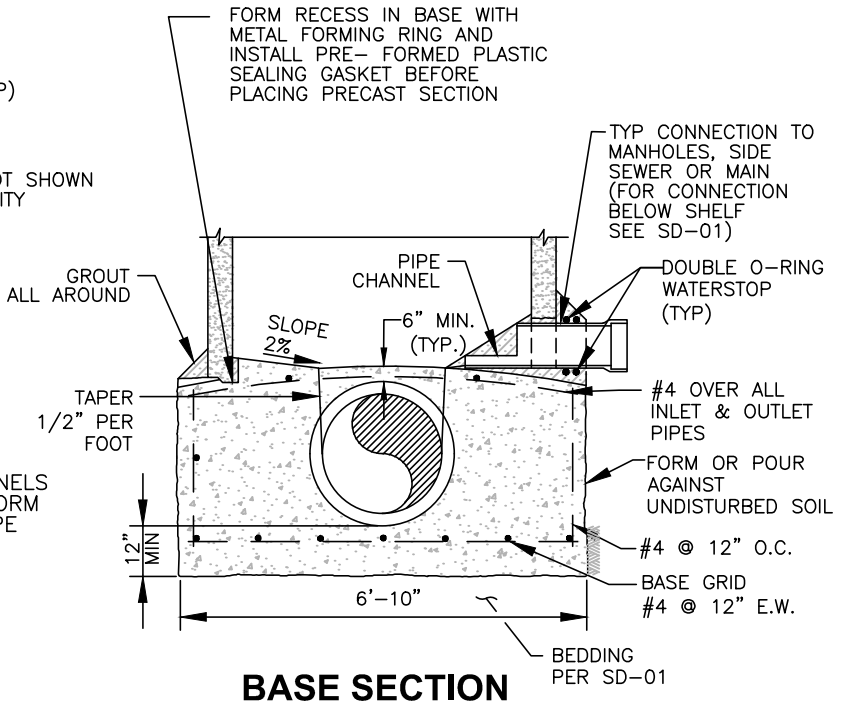
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UPPER SECTION



BASE PLAN



BASE SECTION

NOTES:

1. **REMOVE THE ENTIRE SECTION OF PIPE TO INSIDE 6" OF THE WALL AND GROUT THE CHANNEL. GROUT SHALL BE SHAPED IN THE BASE POUR STEP.**
2. **REBAR SHALL HAVE 3" MINIMUM CONCRETE COVER. REBAR IN PRECAST SECTIONS NOT SHOWN FOR CLARITY.**
3. **FRAME AND COVER ELEVATION SHALL CONFORM TO FINISHED PAVEMENT TO WITHIN 1/8".**
4. **ECCENTRIC CONE MAY BE USED TO AVOID UTILITY CONFLICTS IF APPROVED BY THE DISTRICT. THE DISTRICT MAY REQUIRE THAT ECCENTRIC MANHOLES BE PROVIDED W/ STEPS.**
5. **APPLY TWO COATS OF WATERPROOFING TO ALL CONCRETE SURFACES INSIDE OF MANHOLE.**

OCTOBER 2026

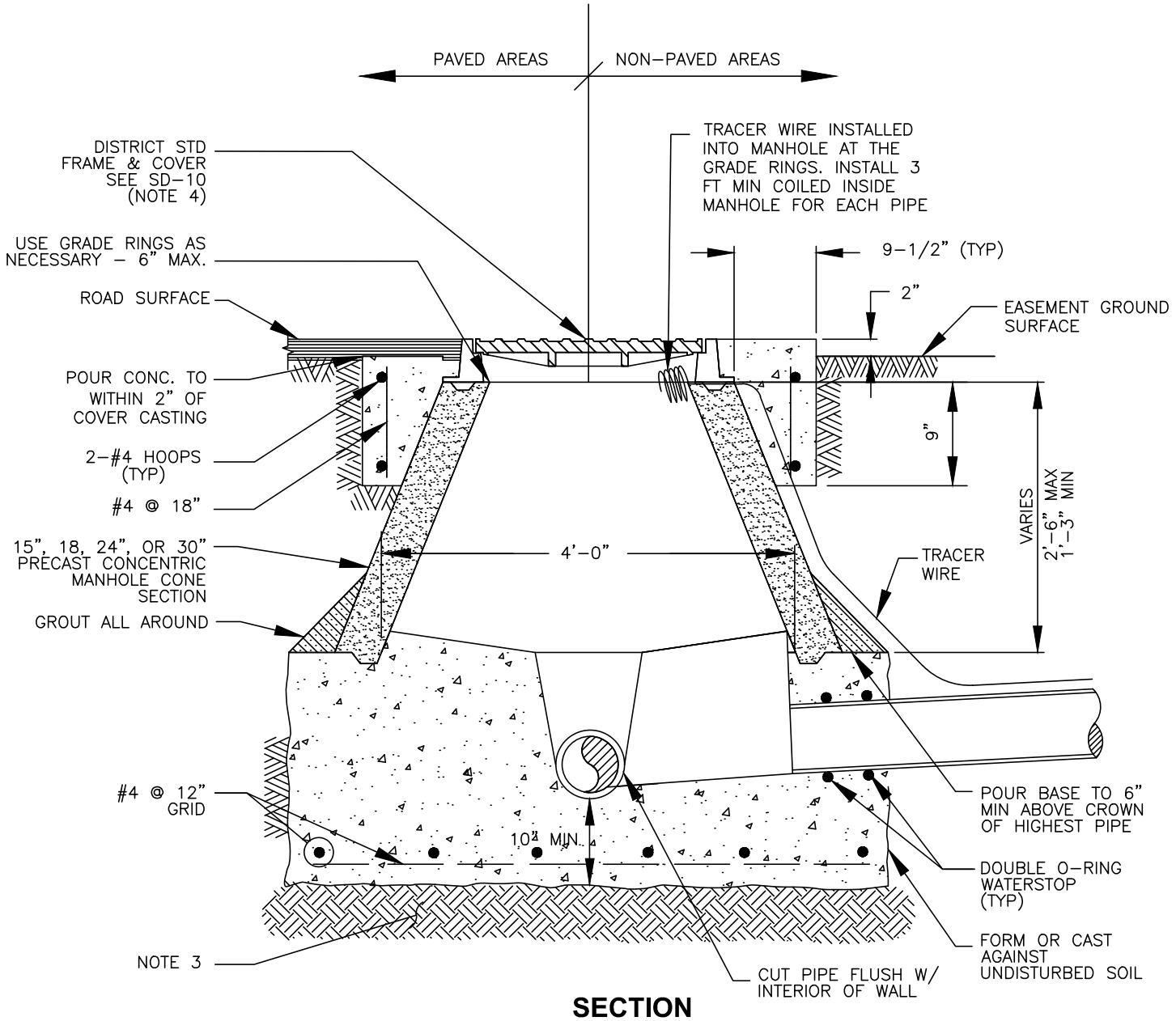
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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

TRUNK SEWER MANHOLE FOR 14" TO 45" LINES

SD-02

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SECTION

NOTES:

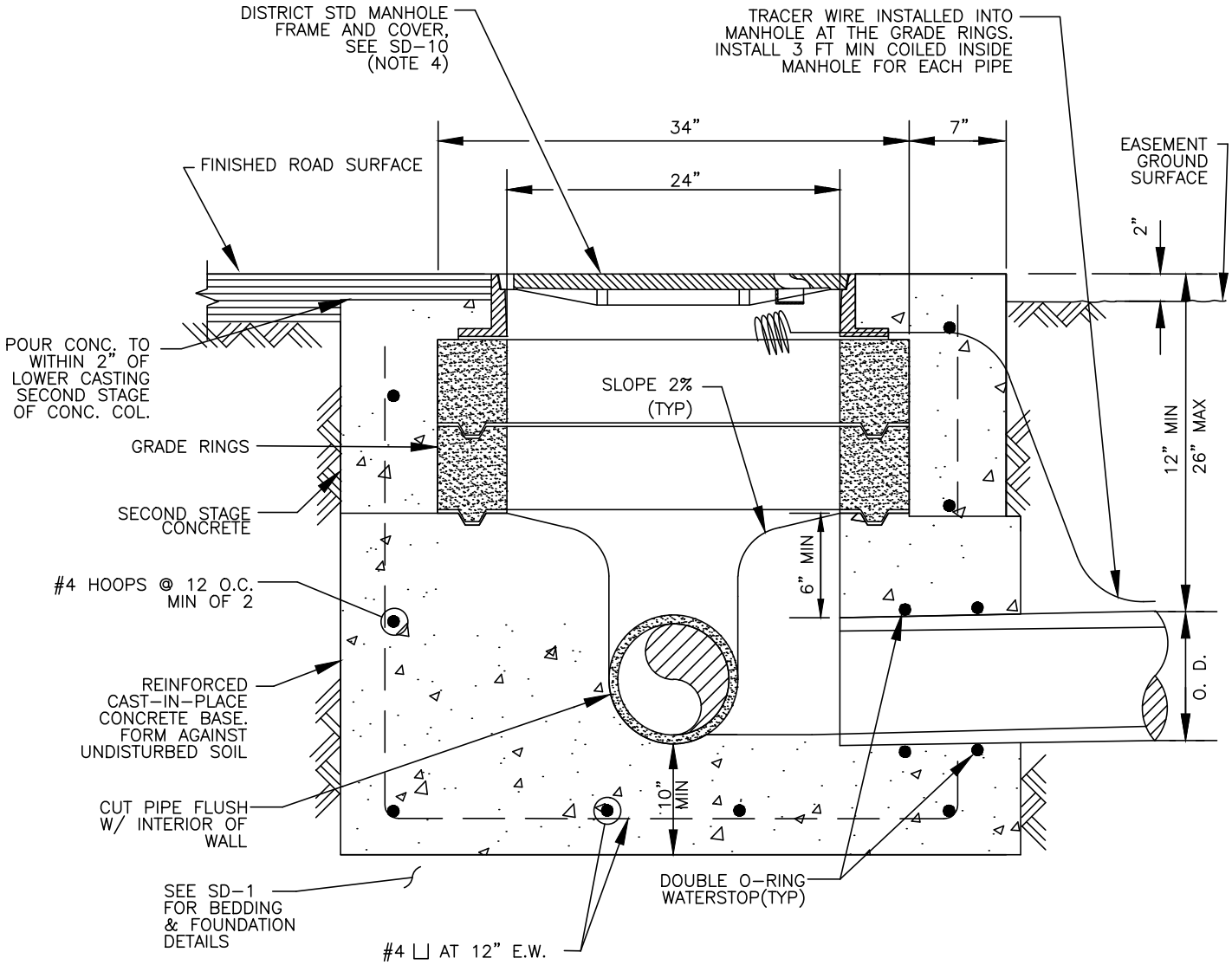
1. **TYPE 1 SHALLOW MANHOLE TO BE USED WHERE DISTANCE FROM THE RIM OF THE FRAME AND COVER AND THE CROWN OF THE HIGHEST PIPE IS BETWEEN 26" AND 42".**
2. **ALL STEEL REINFORCING SHALL HAVE A MINIMUM OF 3" CONCRETE COVER.**
3. **SEE SD-01 FOR BEDDING AND FOUNDATION DETAILS.**
4. **FRAME AND COVER ELEVATION SHALL CONFORM TO FINISHED PAVEMENT WITH 1/8".**

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SHALLOW MANHOLE TYPE 1 | **SD-03**

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SECTION

FOR 6 & 8 INCH PIPE ONLY

NOTES:

1. **TYPE 2 SHALLOW MANHOLE TO BE USED WHERE PIPING IS TOO SHALLOW TO USE TYPE 1 SHALLOW MANHOLE.**
2. **ALL STEEL REINFORCING SHALL HAVE A MINIMUM OF 3" CONCRETE COVER.**
3. **SEE SD-01 FOR BEDDING AND FOUNDATION DETAILS.**
4. **FRAME AND COVER ELEVATION SHALL CONFORM TO FINISHED PAVEMENT WITH 1/8".**

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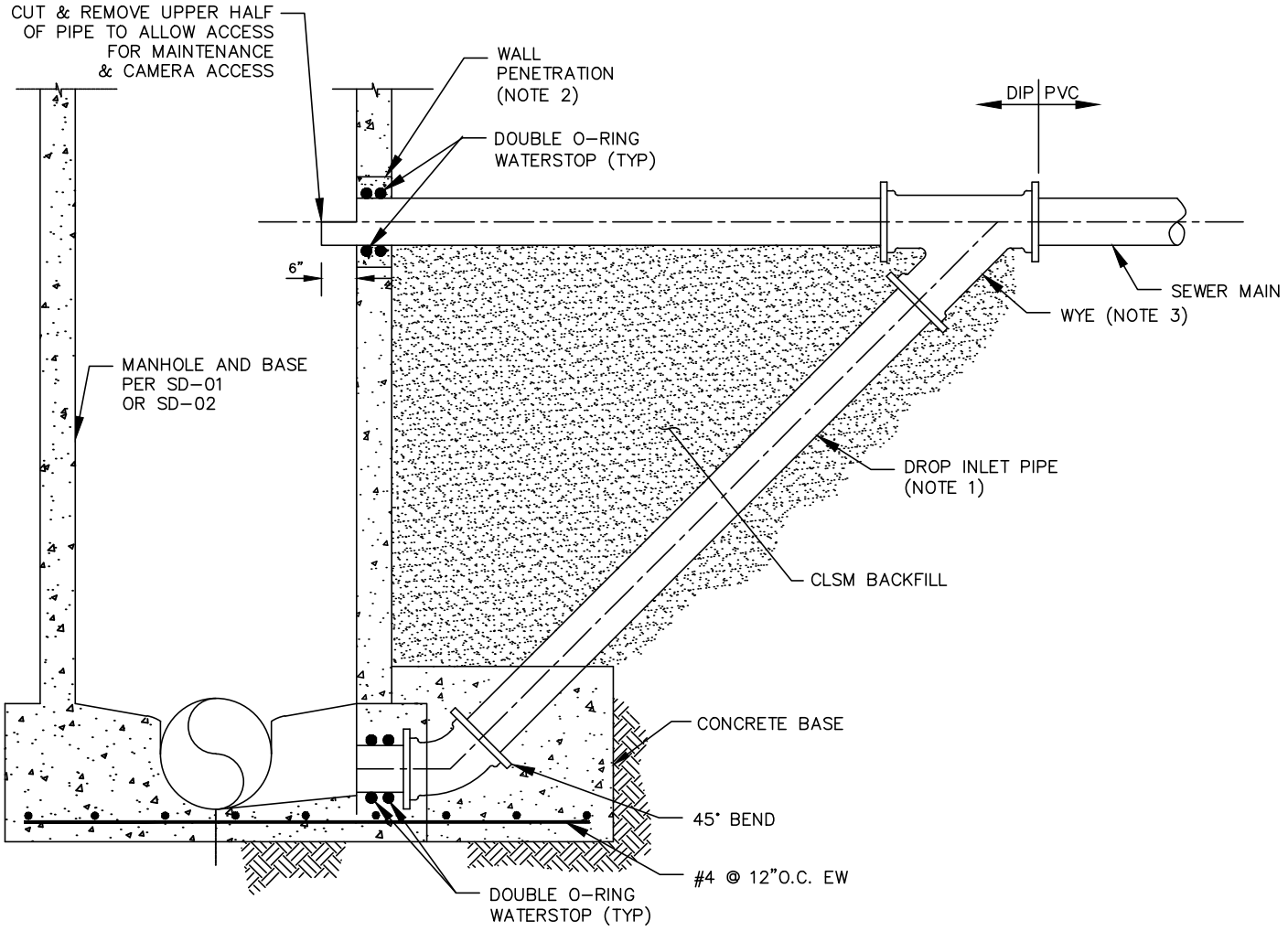
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

SHALLOW MANHOLE TYPE 2

SD-04

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P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-05-Sewer MH Drop Conn-Type 1.dwg Save Date: 10/2/2026 9:03 AM Plot Date: 10/2/2026 9:03 AM BODwyer



SECTION

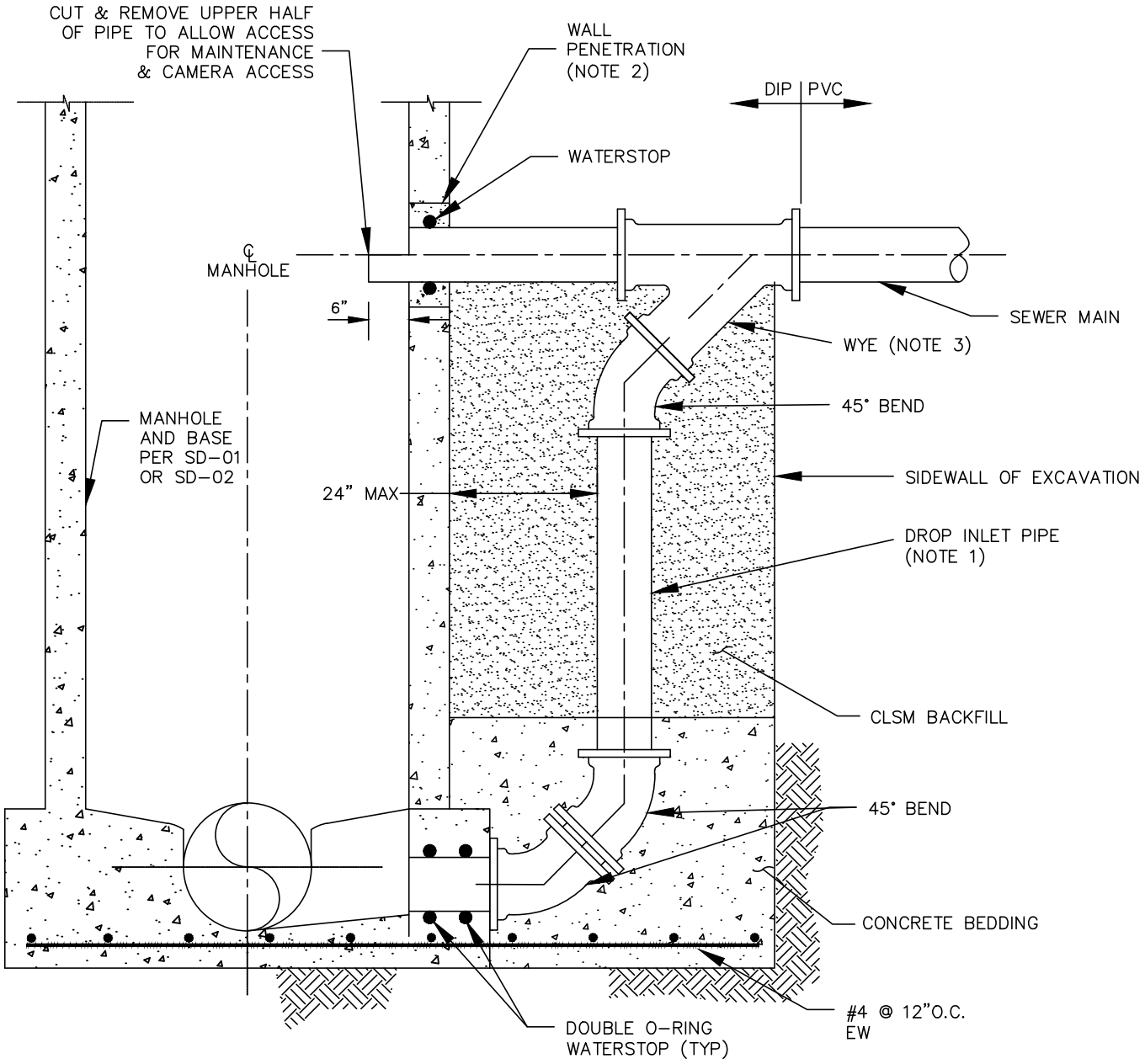
NOTES:

1. **INSTALL SEWER TYPE 1 MANHOLE DROP CONNECTION IF PIPE INVERT IS MORE THAN 2 FEET ABOVE MANHOLE INVERT. DROP INLET PIPE AND FITTINGS SHALL MATCH SIZE OF INCOMING SEWER MAIN. TYPE 1 MANHOLE DROP CONNECTION IS PREFERRED OVER TYPE 2 AND SHALL BE USED WHERE FEASIBLE.**

2. **CORE DRILL MANHOLE WALL TO ALLOW 1 INCH ANNULAR SPACE AROUND NEW PIPE. INSTALL O-RING WATERSTOP CENTERED IN WALL AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. FILL ANNULAR SPACE WATERTIGHT WITH NON-PERMEABLE NON-SHRINK GROUT.**

3. **WHEN JOINING C-900 PVC PIPE TO DUCTILE IRON GASKETED BELL END, CONTRACTOR SHALL FOLLOW C-900 MANUFACTURER'S RECOMMENDATIONS FOR SPIGOT END BEVEL OF PVC PIPE AND INSERTION DEPTH.**

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						SEWER MANHOLE DROP CONNECTION - TYPE 1	SD-05



SECTION

NOTES:

1. **IF PIPE INVERT IS MORE THAN 2 FEET ABOVE MANHOLE INVERT AND TYPE 1 MANHOLE DROP CONNECTION CANNOT BE INSTALLED DUE TO UTILITY CONFLICTS, THEN INSTALL TYPE 2 MANHOLE DROP CONNECTION. DROP INLET PIPE AND FITTINGS SHALL MATCH SIZE OF INCOMING SEWER MAIN.**

2. **CORE DRILL MANHOLE WALL TO ALLOW 1 INCH ANNULAR SPACE AROUND NEW PIPE. INSTALL O-RING GASKET AROUND PIPE CENTERED IN WALL AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. FILL ANNULAR SPACE WATERTIGHT WITH NON-PERMEABLE NON-SHRINK GROUT.**

3. **WHEN JOINING C-900 PVC PIPE TO DUCTILE IRON GASKETED BELL END, CONTRACTOR SHALL FOLLOW C-900 MANUFACTURER'S RECOMMENDATIONS FOR SPIGOT END BEVEL OF PVC PIPE AND INSETION DEPTH.**

OCTOBER 2026

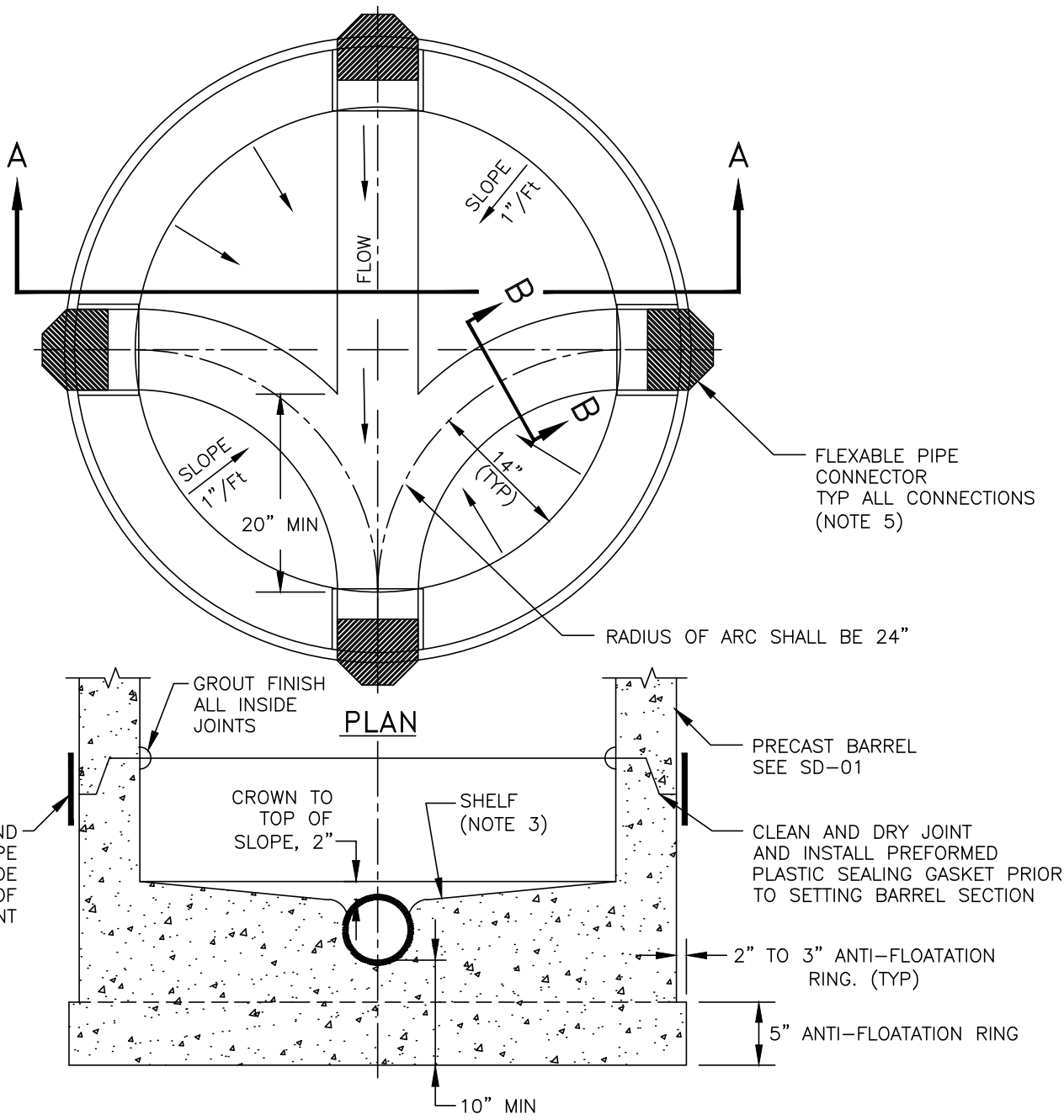
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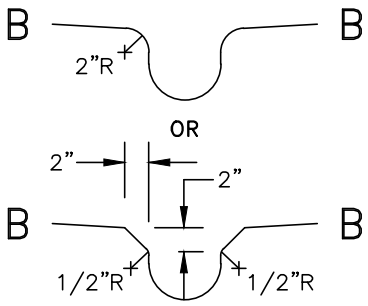
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

SEWER MANHOLE DROP CONNECTION - TYPE 2

SD-06

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NOTES:

1. PRECAST MANHOLE BASES WILL NOT BE ALLOWED WHERE FINISHED GRADE AND/OR PIPE SLOPE EXCEEDS 10%.
2. FIELD VERIFICATION THE LOCATIONS, INVERTS, AND MATERIALS OF ANY EXISTING PIPELINES ENTERING THE MANHOLE BASE SHALL BE PERFORMED PRIOR TO ORDERING MATERIALS. PIPELINE ANGLES AND LOCATIONS FOR USE IN POSITIONING PRECAST BASE PIPE ENTRY LOCATIONS SHALL NOT BE TAKEN OFF OF THE PROJECT PLANS, BUT SHALL REFLECT ACTUAL FIELD PIPELINE LOCATIONS.
3. REINFORCEMENT NOT SHOWN FOR CLARITY. REINFORCEMENT SHALL HAVE A MINIMUM OF 3" CONCRETE COVER. PRECAST BASE SHALL BE BE DESIGNED FOR H20 LOADING, AND SHALL CONFORM TO ASTM C478.
4. SHELF AND CHANNELS SHALL BE CAST AT THE PRECAST PLANT. PLACEMENT OF CONCRETE OR GROUT CHANNELS AND/OR SHELF IN THE FIELD WILL NOT BE ALLOWED.
5. FLEXIBLE PIPE TO MANHOLE CONNECTORS SHALL BE USED FOR ALL PIPE PENETRATIONS INTO PRECAST MANHOLE BASES. FLEXIBLE CONNECTORS SHALL BE CAST INTO BASE AT THE PRECAST PLANT. INSTALLATION OF FLEXIBLE CONNECTORS IN THE FIELD WILL NOT BE ACCEPTABLE. IF PIPE SLOPE EXCEEDS FLEXIBLE CONNECTOR MANUFACTURER'S RECOMMENDED MAXIMUM DEFLECTION ANGLE, THEN A CAST-IN-PLACE BASE PER SD-01 SHALL BE INSTALLED, SKIVING OF MANDRELS TO INCREASE PIPE DEFLECTION WITH A FLEXIBLE CONNECTOR WILL NOT BE ALLOWED.

OCTOBER 2026

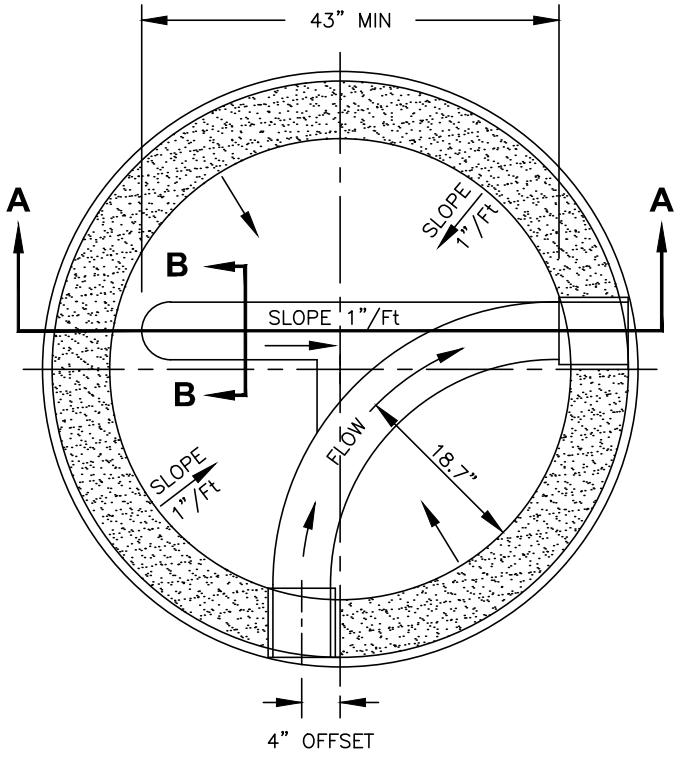
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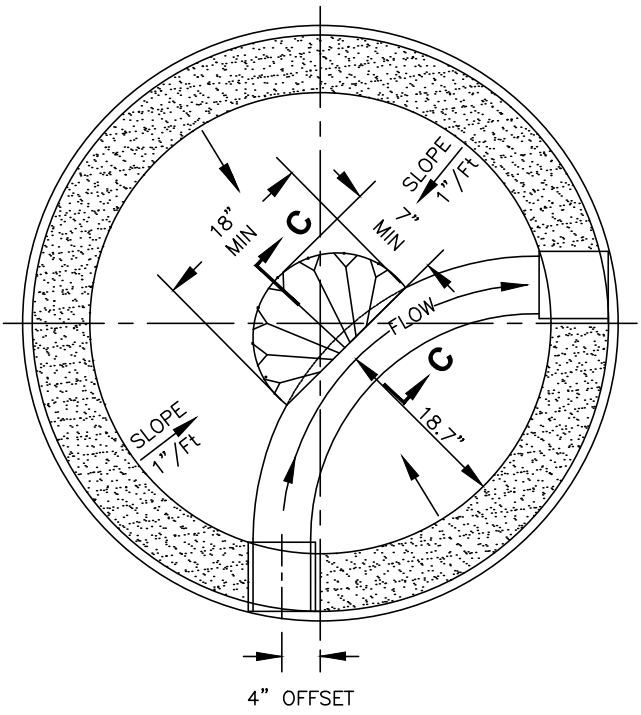
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

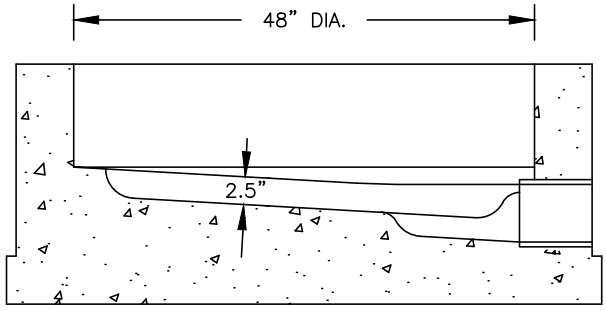
PRECAST MANHOLE BASE

SD-07

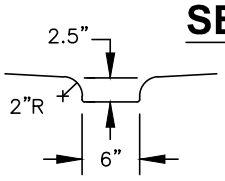
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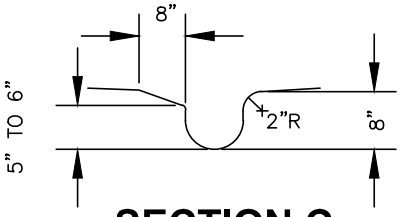




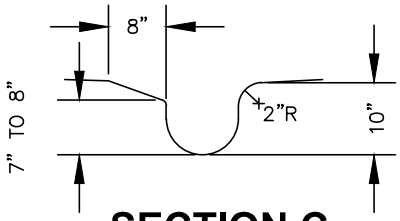
SECTION A



SECTION B



SECTION C
FOR 8" PIPE BASES



SECTION C
FOR 10" PIPE BASES

TYPE 1

TYPE 2

NOTES:

1. SEE SD-01 FOR CAST-IN-PLACE CONCRETE BASE DETAILS, OR SD-07 FOR PRE-CAST CONCRETE BASE DETAILS.

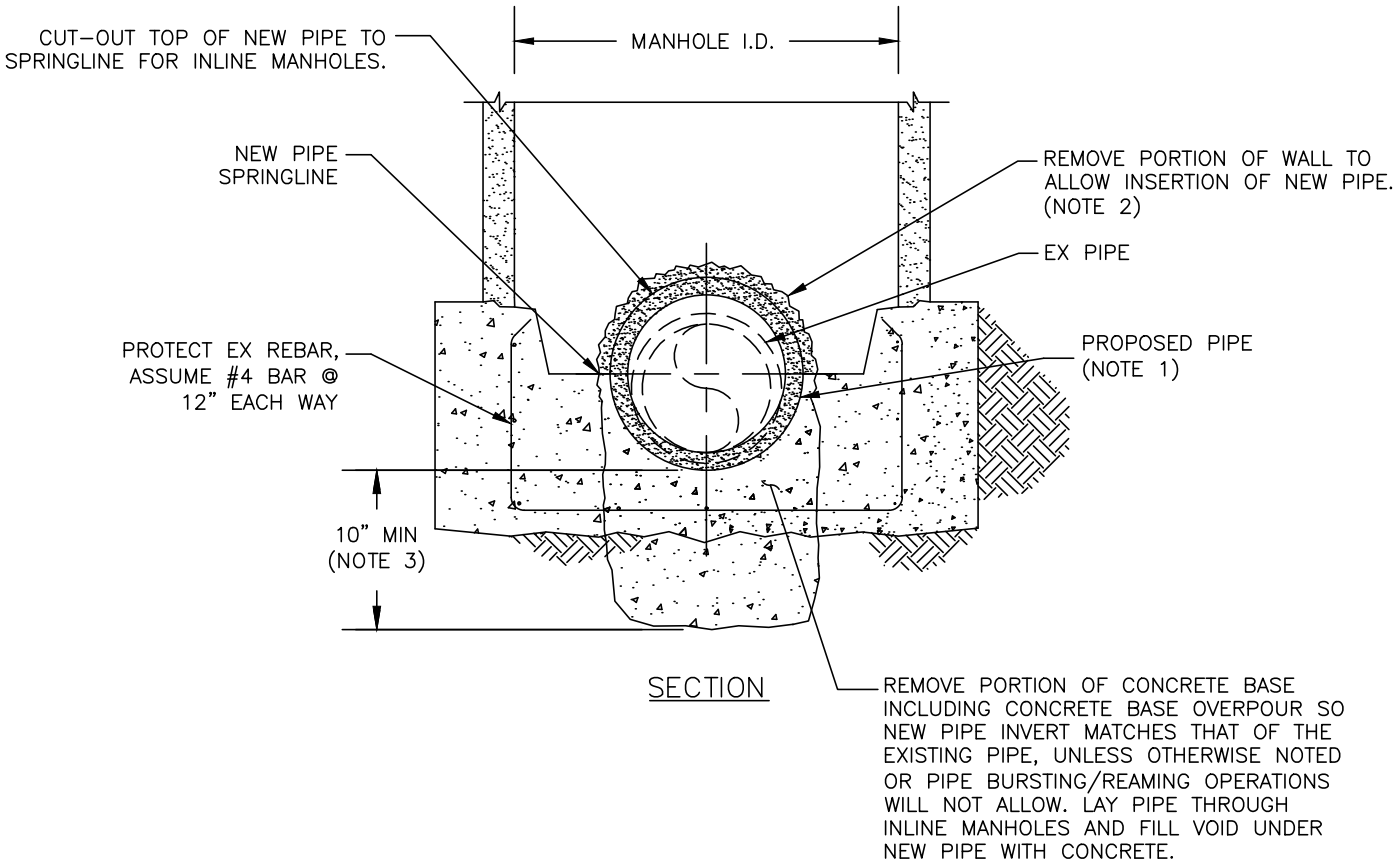
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SAUSALITO-MARIN CITY SANITARY DISTRICT
STANDARD DRAWINGS

90 ° MANHOLE BASE

SD-08

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NOTES:

1. **INSTALL 0-RING WATERSTOP AROUND NEW PIPE AND CENTERED WITHIN EXISTING MANHOLE WALL.**
2. **FILL ANNULAR SPACE BETWEEN NEW PIPE AND EXISTING MANHOLE WALL WITH NON-PERMEABLE NON-SHRINK GROUT. ROUGHEN EXISTING CONCRETE SURFACE TO FULL AMPLITUDE OF $\frac{1}{4}$" AND APPLY A BONDING AGENT PRIOR TO PLACING NON-SHRINK GROUT.**
3. **10" MINIMUM OF EXISTING CONCRETE BASE TO REMAIN INTACT UNDER NEW PIPE OR CHIP OUT EXISTING CONCRETE BASE AS NEEDED TO INSTALL NEW CONCRETE WITH A 10" MINIMUM THICKNESS UNDER NEW PIPE.**

OCTOBER 2026

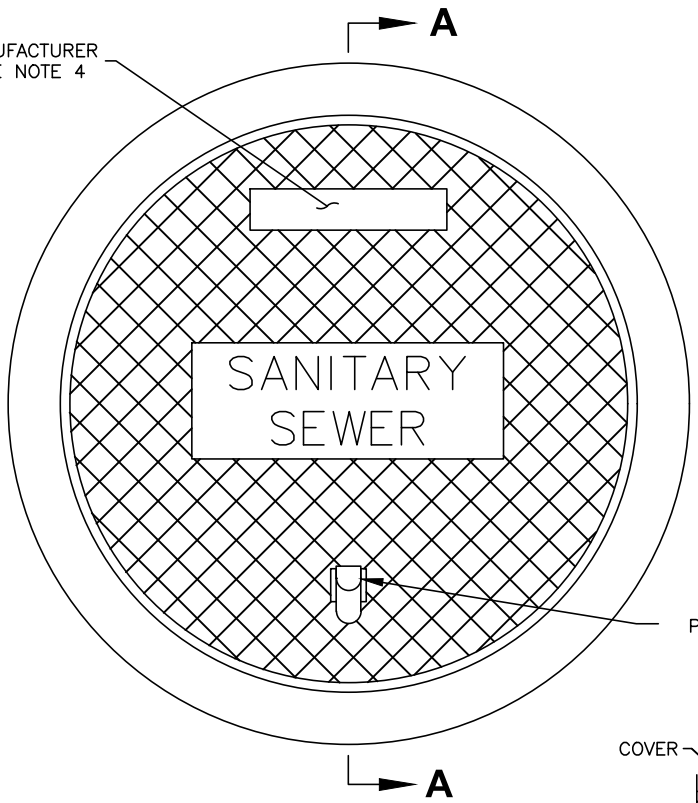
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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

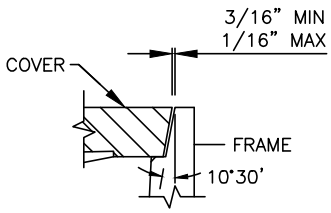
MANHOLE BASE MODIFICATIONS FOR PIPELINE REPLACEMENT

SD-09

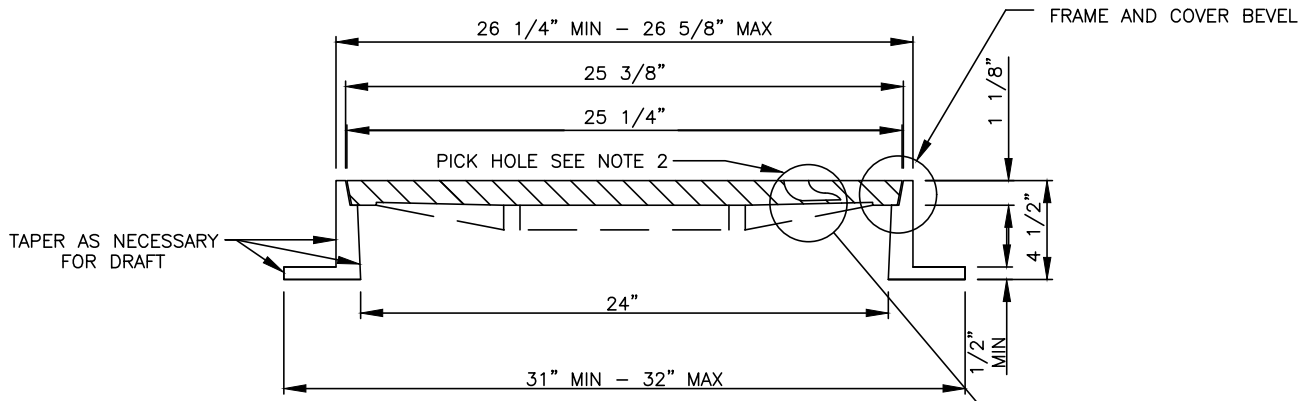
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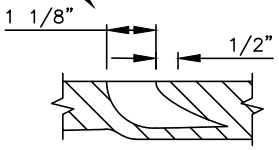
PLAN



DETAIL



SECTION A-A



DETAIL
PICK HOLE

NOTES:

1. COVER SHALL BE DESIGNED FOR H20 HIGHWAY LOADING.
2. PICK HOLE SHALL BE CLOSED AND FIT A STANDARD PICK.
3. BOTTOM OF COVER SHALL INDICATE MANUFACTURED DATE, MONTH AND YEAR.
4. MANHOLE COVER SHALL BE PER DISTRICT'S APPROVED MATERIAL LIST.

No.	BY	DATE	REVISION

OCTOBER 2026

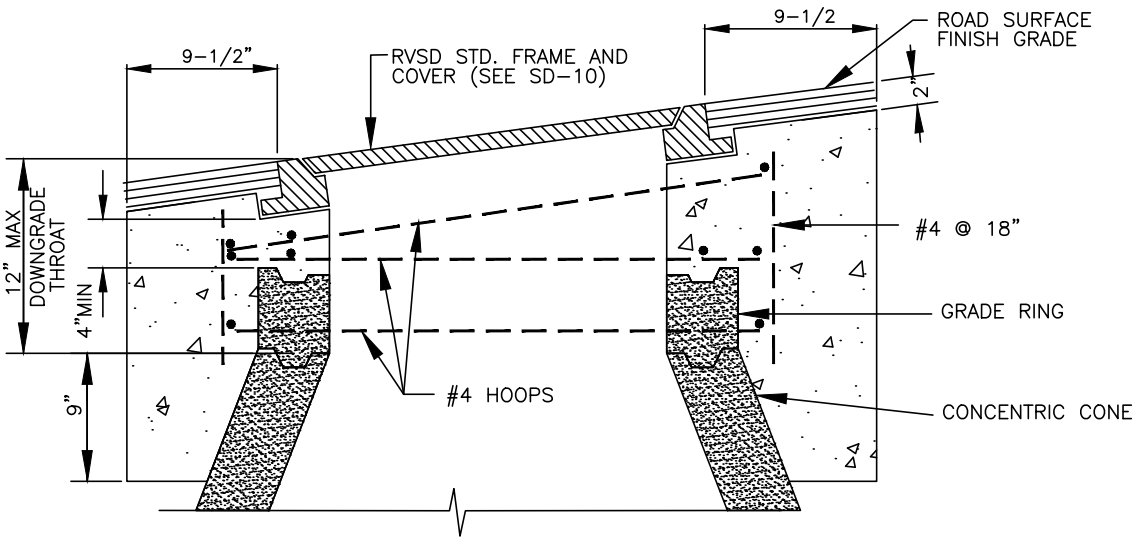
SAUSALITO-MARIN CITY SANITARY DISTRICT
STANDARD DRAWINGS

MANHOLE FRAME AND COVER

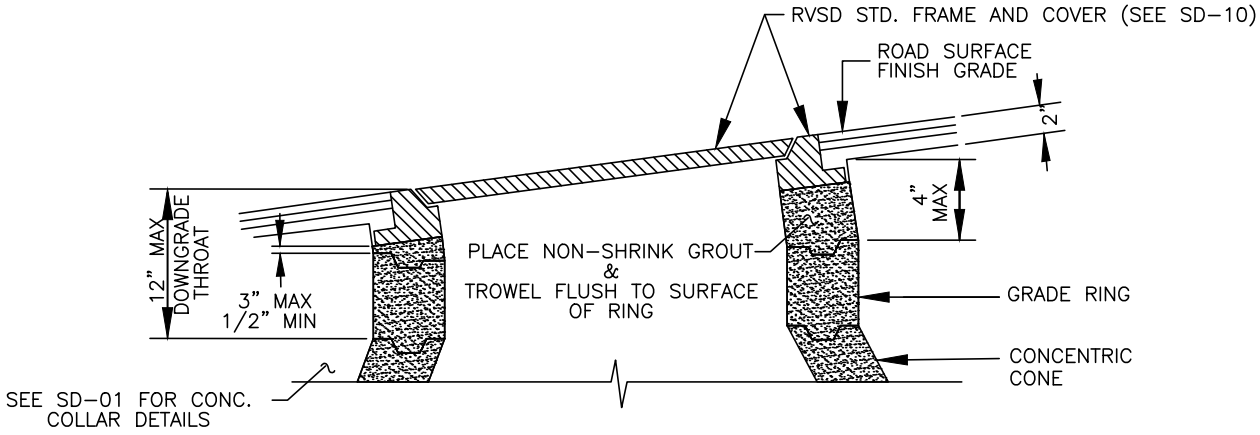
SD-10

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-10-Frame And Cover.dwg Save Date: 10/2/2026 9:04 AM Plot Date: 10/2/2026 9:04 AM BODwyer

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-11-MH Adjust To Grade.dwg Save Date: 10/2/2026 9:04 AM Plot Date: 10/2/2026 9:04 AM BODwyer



GREATER THAN 13% GRADE



13% GRADE OR LESS

NOTE:

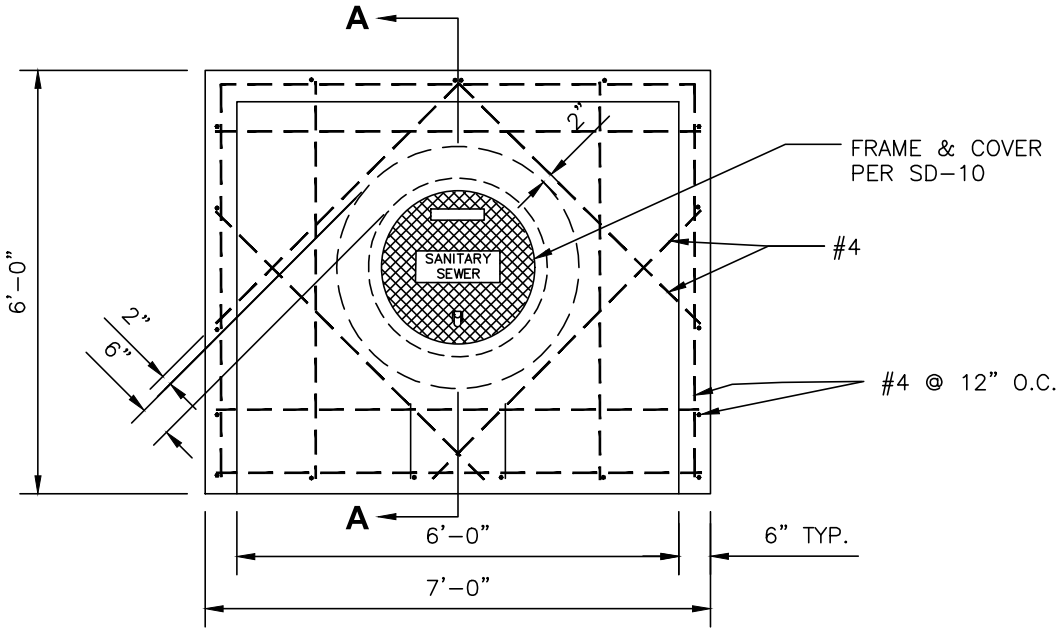
1. **FRAME AND COVER SHALL CONFORM TO ROAD SURFACE FINISH GRADE WITHIN 1/8".**

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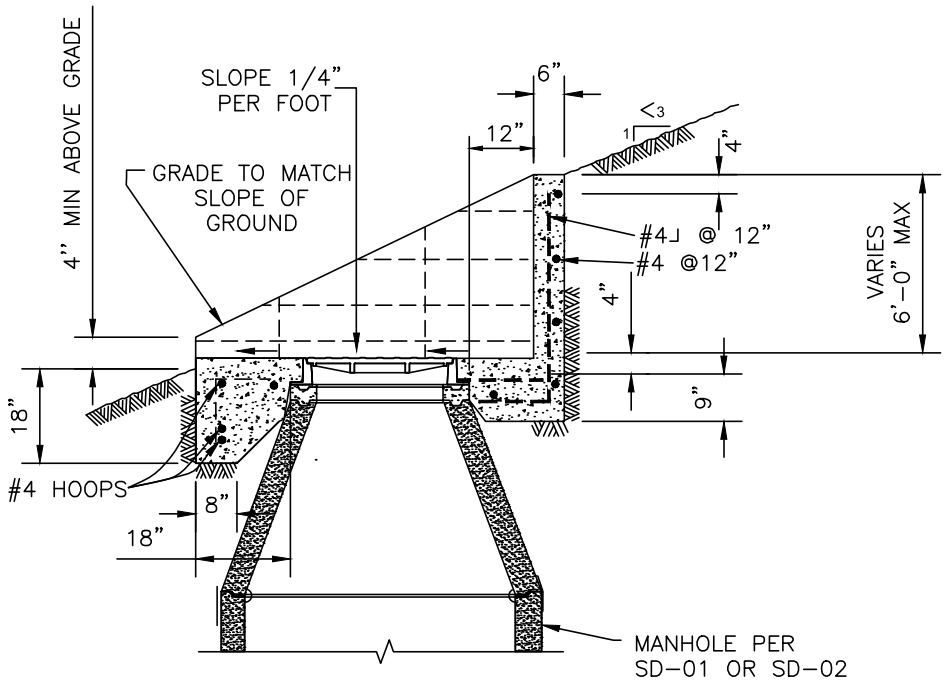
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

MANHOLE ADJUSTMENT TO FINSH GRADE | **SD-11**

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-12-MH Protection Wall & Top Block.dwg Save Date: 10/2/2026 9:04 AM Plot Date: 10/2/2026 9:04 AM BODwyer



PLAN



SECTION A-A

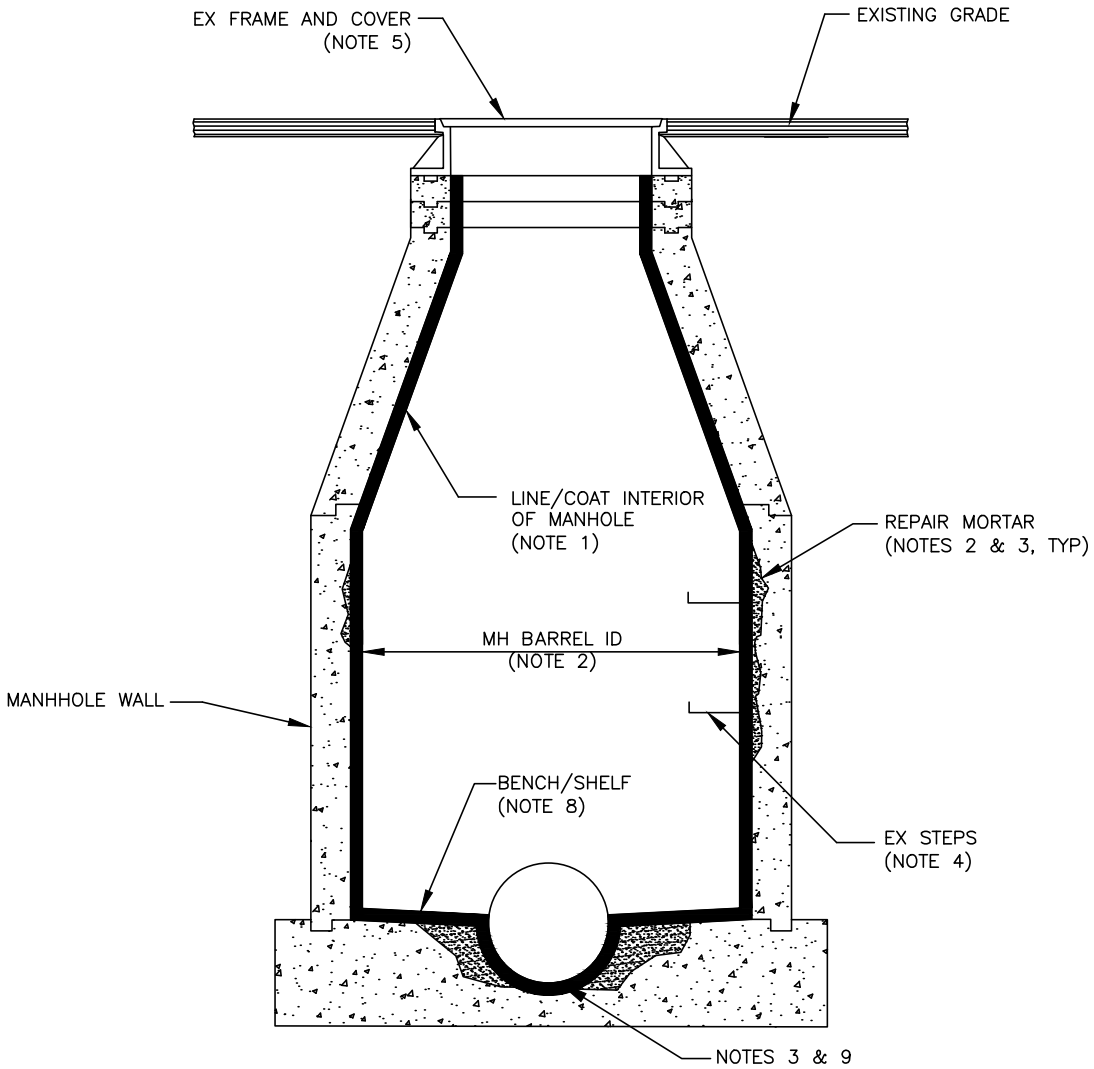
NOTES:

1. **ALL EXPOSED CORNERS SHALL HAVE ¾" CHAMFER OR ROUND WITH ¾" RADIUS.**
2. **WALLS MAY BE CONSTRUCTED USING CONCRETE MASONRY UNITS OR INTERLOCKING UNITS IF DESIGNED BY A REGISTERED ENGINEER.**

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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

MANHOLE PROTECTION WALL AND TOP BLOCK | **SD-12**



NOTES:

1. TYPE AND METHOD OF REPAIR OR REHABILITATION SHALL BE AS DIRECTED BY THE DISTRICT.
2. CONTRACTOR SHALL COAT/LINE ALL INTERIOR CONCRETE, BRICK, AND OR MORTAR SURFACES INSIDE OF MANHOLE INCLUDING WALLS, CONES, BASE, AND CHANNEL. CONTRACTOR SHALL CLEAN AND PREPARE ALL SURFACES IN ACCORDANCE WITH LINER MANUFACTURER'S RECOMMENDATIONS AND PER THE STANDARD SPECIFICATIONS. PERFORM TESTING IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
3. REPAIR DETERIORATED SURFACES INSIDE OF MANHOLE WITH REPAIR MORTAR IN ACCORDANCE WITH LINER MANUFACTURER RECOMMENDATIONS. THE REPAIR MATERIAL THICKNESS SHALL BE SUCH THAT THE NEW MATERIAL SURFACE MATCHES THE MANHOLE'S ORIGINAL INSIDE DIAMETER, OR AS DIRECTED BY THE DISTRICT OR ITS REPRESENTATIVES.
4. PERFORM TESTING OF EXISTING SURFACE PRIOR TO PLACING REPAIR MATERIALS IN ACCORDANCE WITH REPAIR MATERIAL MANUFACTURER'S RECOMMENDATIONS AND THESE STANDARD SPECIFICATIONS.
5. CONTRACTOR SHALL CUT AND REMOVE ALL EXISTING STEPS BELOW CONCRETE WALL SURFACE FROM ¼ TO ⅜ INCH DEPTH. CONTRACTOR SHALL PATCH CONCRETE SURFACE WITH REPAIR MATERIAL PER APPROVED MATERIAL LIST (SIKA TOP 123, OR EQUAL) PRIOR TO MANHOLE REHABILITATION BY LINING.
6. WHERE FRAME AND COVER R/R IS REQUIRED, REPLACE WITH NEW FRAME AND COVER PER SD-01 AND SD-10 PRIOR TO PERFORMING MANHOLE REHABILITATION AND LINING.
7. CONTRACTOR SHALL COMPLY WITH ALL CAL-OSHA CONFINED SPACE ENTRY REQUIREMENTS.
8. PERFORM BYPASS PUMPING AS REQUIRED AND IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
9. WHERE REQUIRED, CONTRACTOR SHALL REPAIR EXISTING CHANNEL AND BASE PRIOR PRIOR TO INSTALLING LINING MATERIAL. FORM A SMOOTH CHANNEL IN ACCORDANCE WITH SD-01.
10. CONTRACTOR SHALL CHIP OUT AND REPAIR EXISTING INVERT PRIOR TO LINING SO THAT FINISHED INVERT SURFACE MATCHES EXISTING INVERT. CHANNEL SHALL BE SMOOTH AND MINIMIZE DISTURBANCE TO FLOW.

OCTOBER 2026

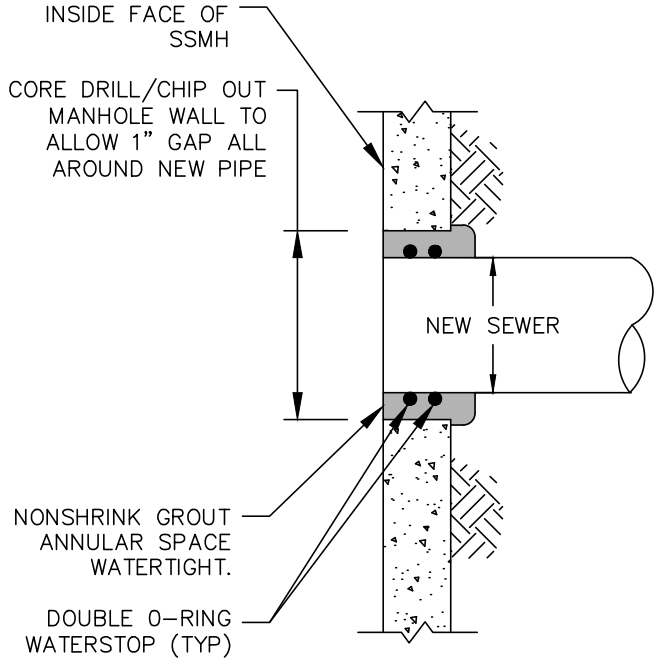
No.	BY	DATE	REVISION

SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

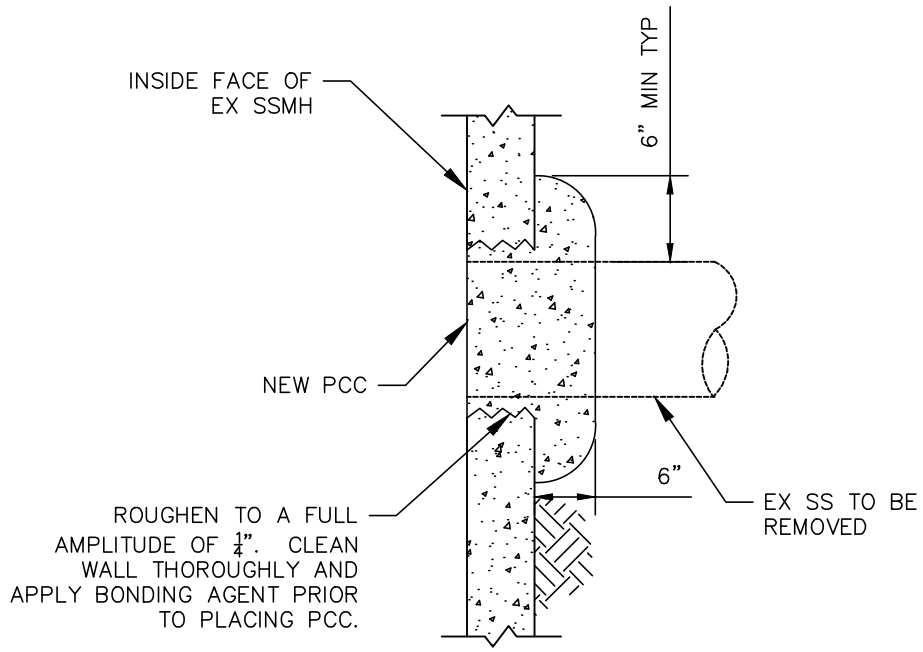
SSMH REHABILITATION BY LINING/COATING

SD-13

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-13-MH Rehab By Lining.dwg Save Date: 10/2/2026 9:04 AM Plot Date: 10/2/2026 9:04 AM BODwyer



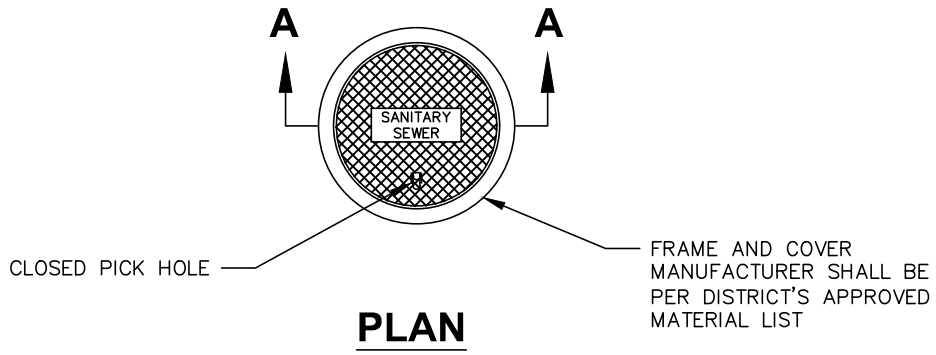
SEWER CONNECTION TO EX MANHOLE



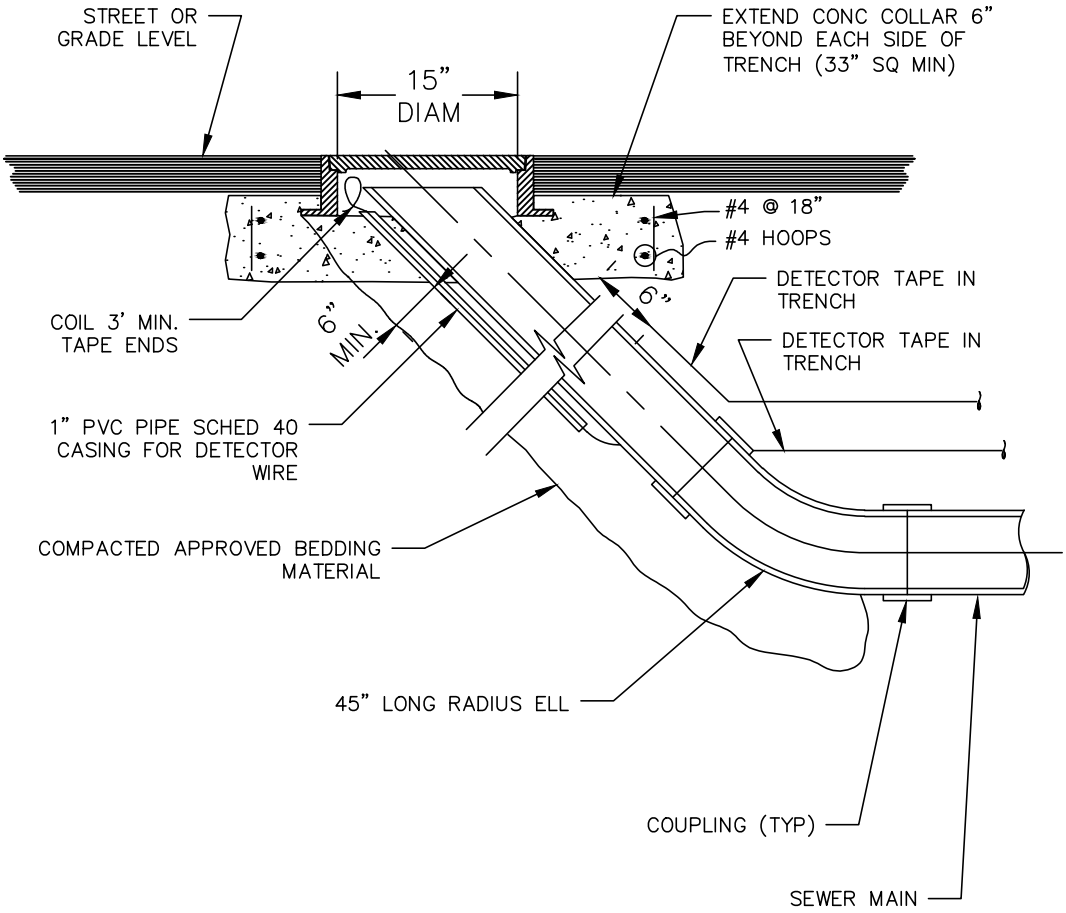
PLUG EX MANHOLE

OCTOBER 2026		No.	BY	DATE	REVISION	SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS	
						SEWER CONNECTION TO OR PLUG EXISTING MANHOLE	SD-14

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-14-MH Connection & Ex Pipe Abandon.dwg Save Date: 10/2/2026 9:04 AM Plot Date: 10/2/2026 9:04 AM BODwyer



PLAN



SECTION A-A

No.	BY	DATE	REVISION

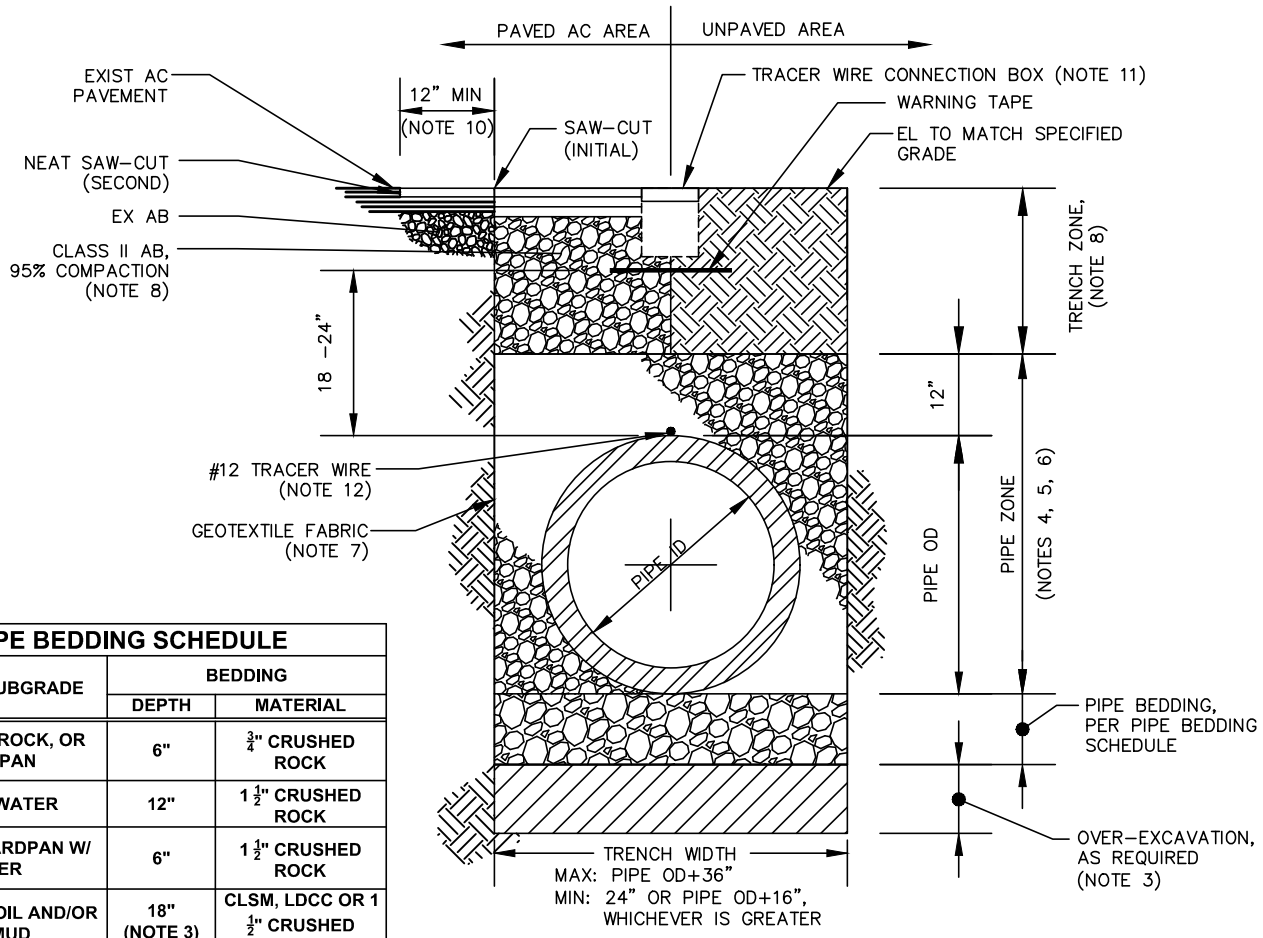
OCTOBER 2026

SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

STANDARD 6 INCH RODDING INLET

SD-15

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-15-Standard 6in Rodding Inlet.dwg Save Date: 10/2/2026 9:04 AM Plot Date: 10/2/2026 9:04 AM BODwyer



PIPE BEDDING SCHEDULE		
EXISTING SUBGRADE	BEDDING	
	DEPTH	MATERIAL
DRY - SOIL, ROCK, OR HARD PAN	6"	$\frac{3}{4}$" CRUSHED ROCK
SOIL W/ WATER	12"	1 $\frac{1}{2}$" CRUSHED ROCK
ROCK OR HARDPAN W/ WATER	6"	1 $\frac{1}{2}$" CRUSHED ROCK
UNSTABLE SOIL AND/OR BAY MUD	18" (NOTE 3)	CLSM, LDCC OR 1 $\frac{1}{2}$" CRUSHED ROCK

NOTES:

1. TRENCHING SHALL CONFORM TO THE "CONSTRUCTION SAFETY ORDERS OF THE STATE OF CALIFORNIA"AND SECTION 6705 OF THE CALIFORNIA LABOR CODE.
2. PAVEMENT AND PAVEMENT THICKNESS SHALL CONFORM TO THE REQUIREMENTS OF THE TOWN OR CITY WITH JURISDICTION AND THE ENCROACHMENT PERMIT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COMPLY WITH TRENCH PAVING REQUIREMENTS OF THE ENCROACHMENT PERMIT.
3. IF UNSTABLE SUB-GRADE IS EXPOSED PRIOR TO BEDDING PLACEMENT, THE DISTRICT SHALL BE ADVISED IMMEDIATELY. WHEN DIRECTED BY THE DISTRICT, OVER-EXCAVATE ADDITIONAL 12" MIN UNSUITABLE SUB-GRADE MATERIAL FOR A TOTAL OF 18" BELOW PIPE AND BACKFILL PER STANDARD SPECIFICATION SECTION 02200, EARTHWORK.
4. PIPE ZONE BACKFILL SHALL BE $\frac{3}{4}$" CRUSHED ROCK, COMPACTED TO 90% RELATIVE COMPACTION.
5. BACKFILL SHALL PLACED IN 8" MAXIMUM LIFTS UNLESS OTHERWISE APPROVED BY THE DISTRICT. EACH LIFT SHALL BE COMPACTED BY A MINIMUM OF THREE (3) PASSES WITH A VIBRATORY PLATE COMPACTOR.
6. WHERE ADEQUATE COMPACTION CANNOT BE ACHIEVED ABOVE CROWN OF PIPE DUE TO OBSTRUCTION OR OTHER CONDITIONS, REPLACE PIPE ZONE MATERIAL WITH CLSM, AS DIRECTED BY CONSTRUCTION MANAGER.
7. GEOTEXTILE FABRIC INSTALLATION:

   MAIN SEWERS: WRAP/ENCAPSULATE PIPE BEDDING AND PIPE ZONE BACKFILL TOGETHER USING GEOTEXTILE FABRIC WITH MINIMUM 12" OVERLAP

   SIDE SEWERS: INSTALL A SINGLE LAYER/BLANKET OF GEOTEXTILE FABRIC AT THE TOP OF THE PIPE ZONE.
8. TRENCH ZONE BACKFILL SHALL BE:

   IN PAVED AREAS: CLASS II AB, 95% COMPACTION, UNLESS OTHERWISE SPECIFIED OR DIRECTED BY THE DISTRICT.

   IN NON PAVED AREAS: ENGINEERED FILL COMPACTED TO 90% RELATIVE COMPACTION. IN LANDSCAPED AREAS TOP 12" MAY BE TOPSOIL OR NATIVE.
9. SAW-CUT FULL DEPTH OF EXISTING AC PAVEMENT. PAVEMENT EDGES OF SECOND NEAT SAW CUT DAMAGED DURING CONSTRUCTION SHALL BE RE-CUT TO NEAT LINES PRIOR TO PAVING. TACK COAT SHALL BE APPLIED TO ALL VERTICAL SURFACES IN ACCORDANCE TO THE LATEST CALTRANS STANDARD SPECIFICATIONS. TACK COAT SHALL BE APPLIED TO COMPLETE WIDTH AND EDGE JUST PRIOR TO PLACING ASPHALT CONCRETE.
10. WHERE EDGE OF GUTTER IS WITHIN 3 FEET OF SAW-CUT, REMOVE REMAINING EXISTING AC PAVING AND REPLACE WITH NEW AC PAVING. EXPOSED EDGE OF SAW-CUT SHALL BE APPLIED WITH A TACK COAT PRIOR TO PAVING.
11. ALL ROADWAY SURFACE MARKINGS, INCLUDING BUT NOT LIMITED TO STRIPING SHALL BE REPLACED TO PRE-EXISTING CONDITIONS.
12. TRACER WIRE SHALL BE TAPED TO THE TOP OF ALL BURIED FORCE MAINS. FOR FORCE MAINS AND WHERE THE DISTANCE BETWEEN MANHOLES IS GREATER THAN 400 FT, A TRACER WIRE CONNECTION BOX SHALL BE INSTALLED, SEE SD-27. ALL OTHER TRACER CONNECTIONS SHALL BE INSTALLED WITHIN MANHOLES. FOR SIDE SEWERS, INSTALL DETECTABLE WARNING TAPE PER STANDARD SPECIFICATION SECTION 02600, SIDE SEWERS.

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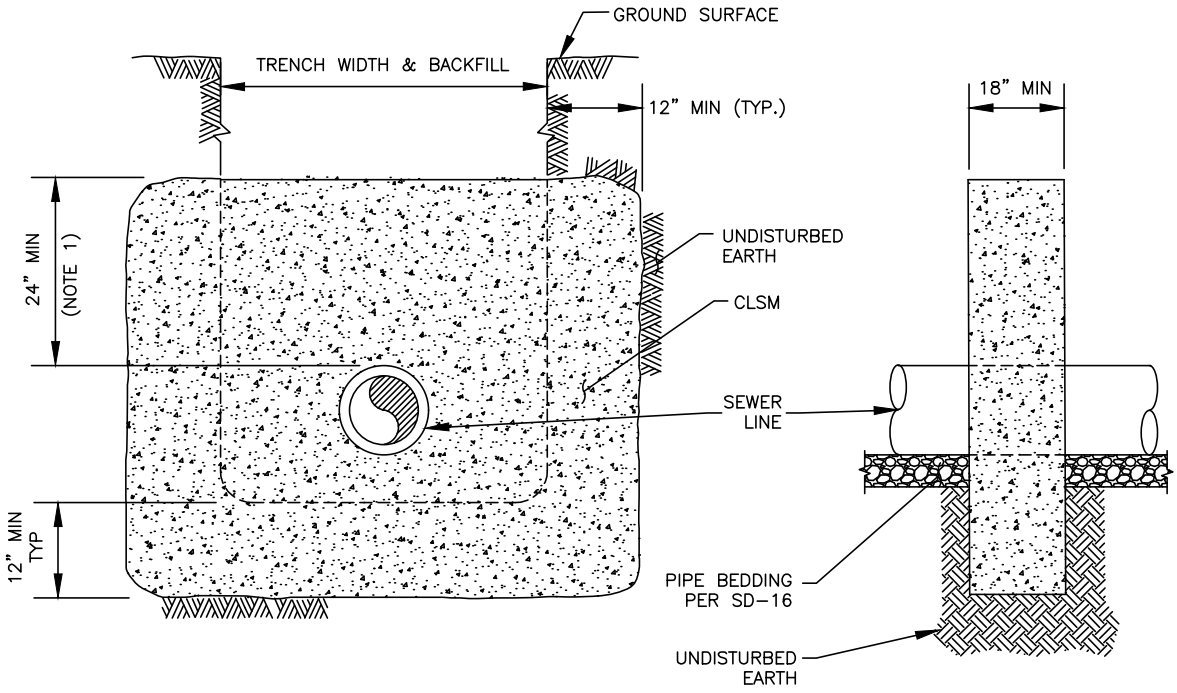
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

TYPICAL TRENCH SECTION

SD-16

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-16-Typ Trench Section.dwg Save Date: 10/2/2026 9:05 AM Plot Date: 10/2/2026 9:05 AM BODwyer

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-17-Typ Trench Dam.dwg Save Date: 10/2/2026 9:05 AM Plot Date: 10/2/2026 9:05 AM BODwyer



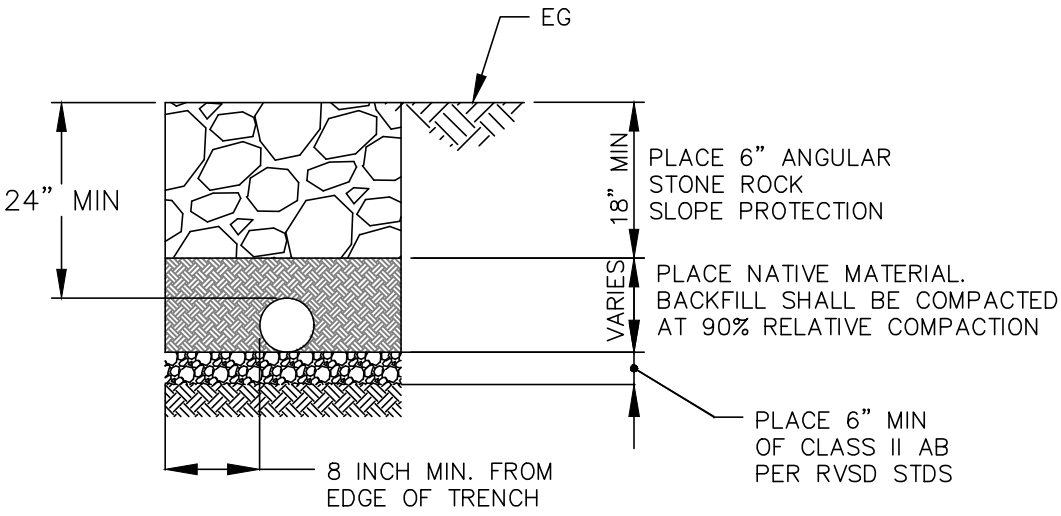
SECTIONS

NOTES:

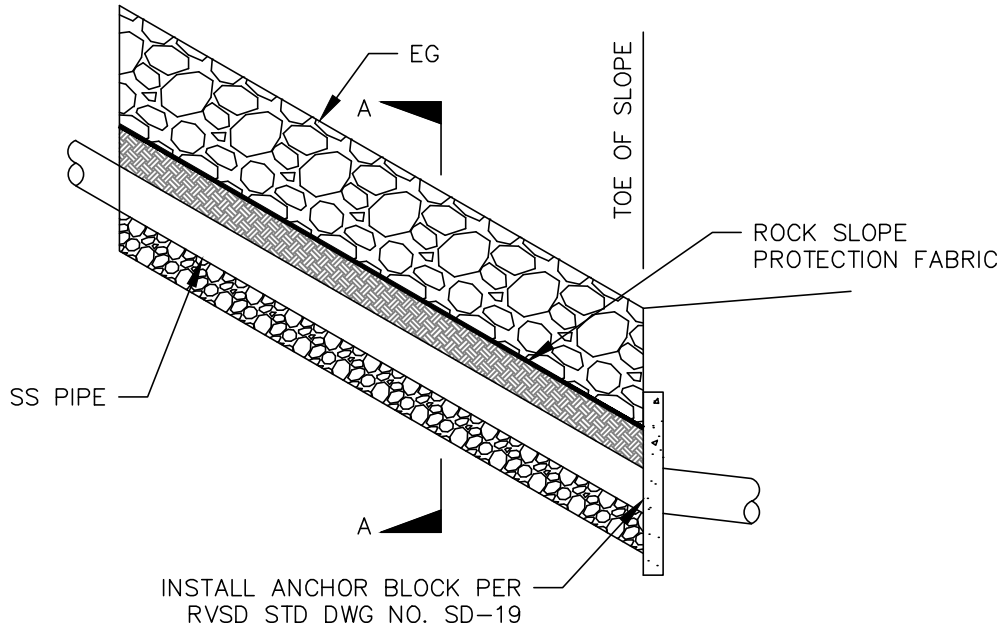
1. **TOP OF DAM TO EXTEND INTO TRENCH ZONE BACKFILL 12" MINIMUM OR TOP OF GROUND WATER HYDRAULIC GRADE LINE, WHICHEVER IS LESS.**

2. **TRENCH DAM SHALL BE PLACED AT A MINIMUM OF 40 FT SPACING ON CENTER FOR ALL OPEN TRENCH INSTALLATIONS.**

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						TYPICAL TRENCH DAM	SD-17



SECTION A–A



NOTES:

1. ROCK SLOPE PROTECTION SHALL CONSIST OF CLEAN, CRUSHED, ANGULAR ROCK CONFORMING TO CALTRANS STANDARD SPECIFICATION SECTION 72.2 "ROCK SLOPE PROTECTION". ROCK SHALL BE CLASS 1, UNLESS OTHERWISE NOTED.
2. ROCK SLOPE PROTECTION FABRIC SHALL BE TYPE B CONFORMING TO CALTRANS STANDARD SPECIFICATION SECTION 96–1.02 I, "ROCK SLOPE PROTECTION FABRIC".

STEEP SLOPE TRENCH SD-18

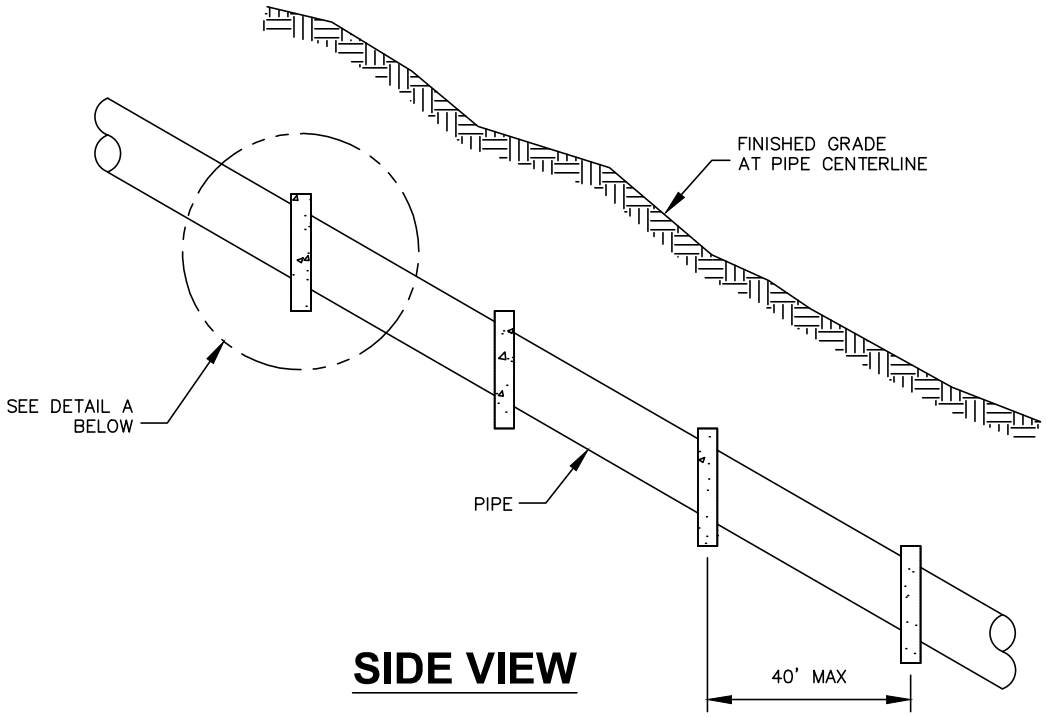
OCTOBER 2026

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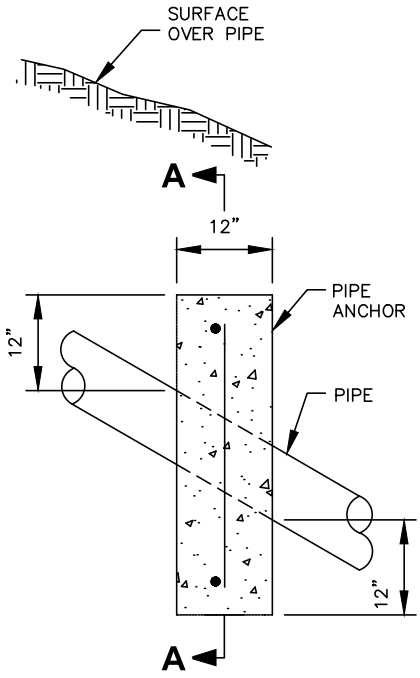
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

STEEP SLOPE TRENCH | **SD-18**

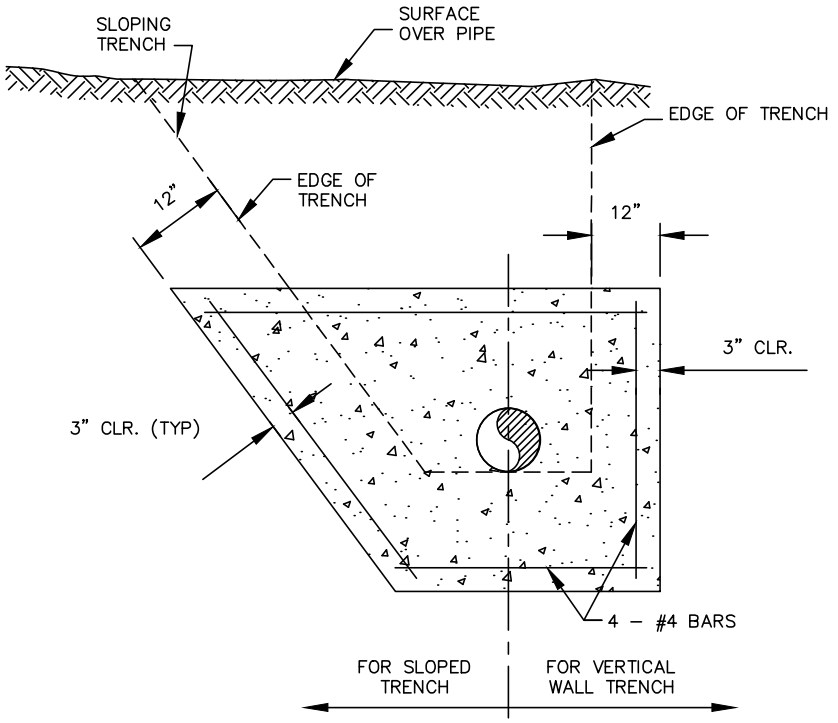
P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-18-Rock Slope Protection.dwg Save Date: 10/2/2026 9:05 AM Plot Date: 10/2/2026 9:05 AM BODwyer



SIDE VIEW



DETAIL A



SECTION A-A

NOTES:

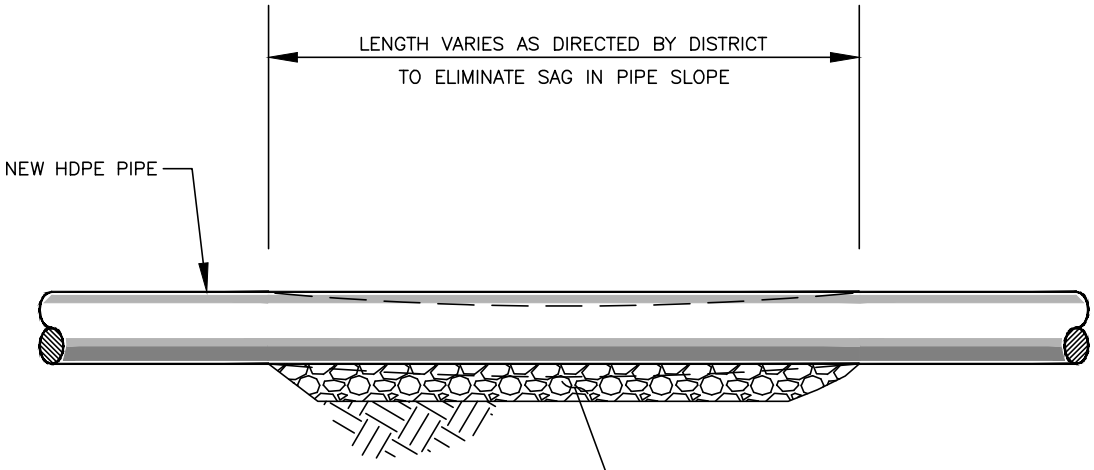
1. **PIPE ANCHORS SHALL BE CONSTRUCTED AT 40 FT MAXIMUM HORIZONTAL INTERVALS ON ALL SLOPES GREATER OR EQUAL TO 30%.**
2. **ANCHORS SHALL BE CAST-IN-PLACE CONCRETE.**

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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

PIPE ANCHOR | **SD-19**

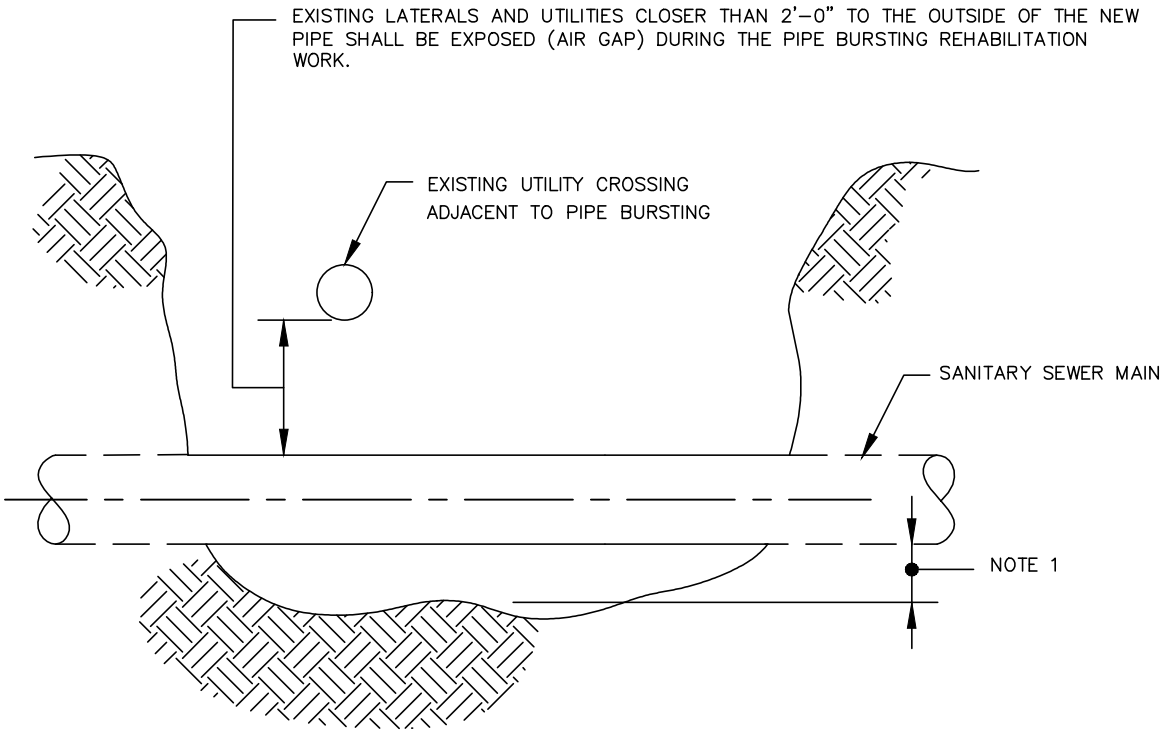
P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-19-Pipe Anchor.dwg Save Date: 10/2/2026 9:05 AM Plot Date: 10/2/2026 9:05 AM BODwyer



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						SANITARY SEWER SAG REPAIR (AFTER PIPE BURSTING)	SD-20

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-20-Sanitary Sewer Sag Repair.dwg Save Date: 10/2/2026 9:05 AM Plot Date: 10/2/2026 9:05 AM BODwyer

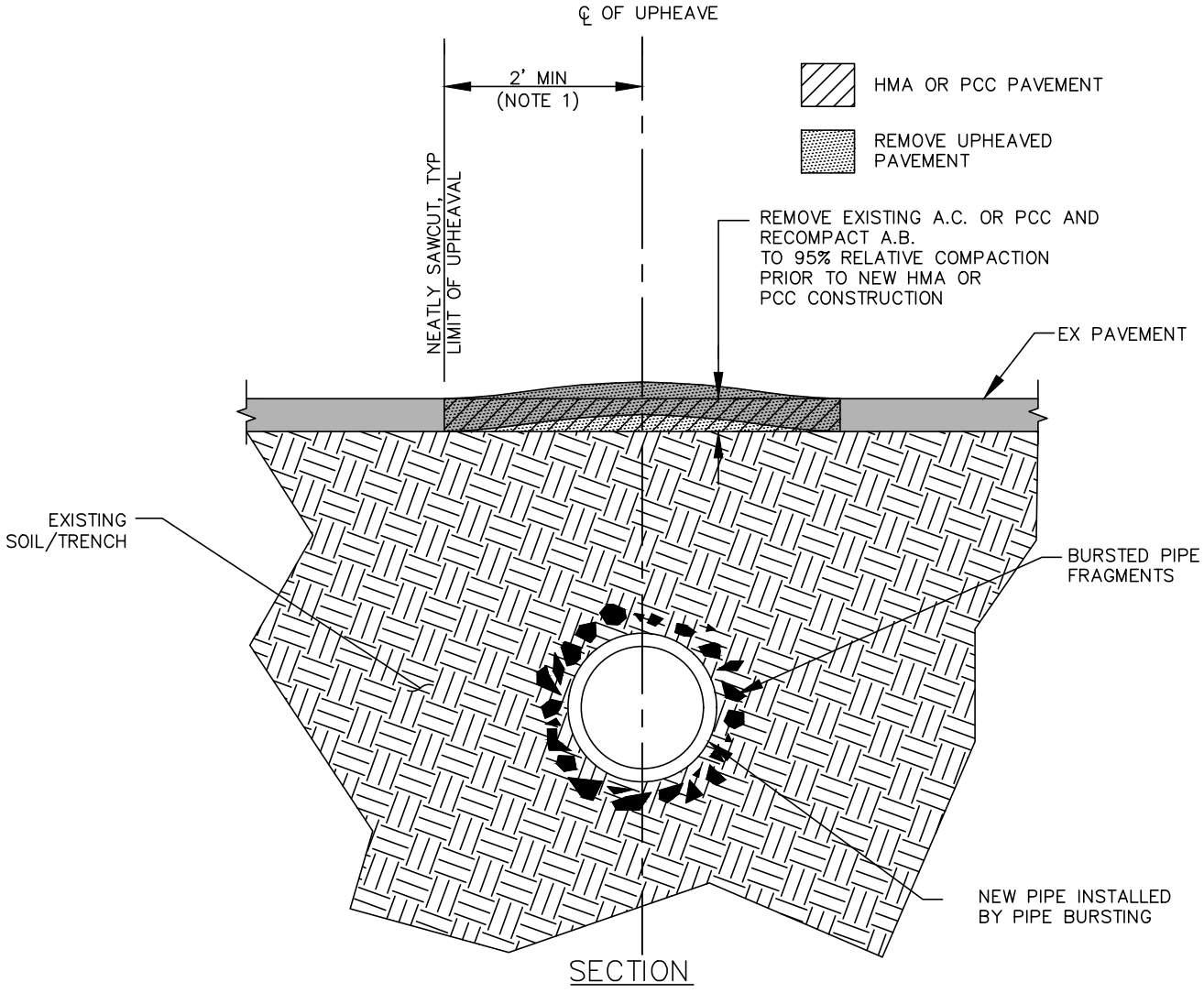
P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-21-Air Gap @ Util- Crossing.dwg Save Date: 10/2/2026 9:05 AM Plot Date: 10/2/2026 9:05 AM BODwyer



NOTES:

1. **EXCAVATE COMPLETELY AROUND THE SANITARY SEWER MAIN TO BE BURST. MAINTAIN 3" OF CLEARANCE FROM SOIL TO THE NEW PIPE OUTSIDE DIAMETER TO ENSURE THE BURSTING HEAD DOES NOT RAISE UP AT THESE LOCATIONS.**
2. **REMOVE ANY LOOSE AND/OR NATIVE SOIL FROM THE EXCAVATION AFTER BURSTING/REAMING OPERATIONS AND PRIOR TO BACKFILLING.**
3. **BACKFILL AND SURFACE RESTORATION SHALL BE PER SD-16.**

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						AIR GAP FOR PIPE BURSTING AT UTILITY CROSSING	SD-21



NOTE:
LIMITS OF PAVEMENT REPAIR TO BE VERIFIED BY DISTRICT OR ITS APPOINTED REPRESENTATIVES AFTER PIPE BURSTING. WHERE LIMIT OF SURFACE UPHEAVAL REPAIR IS INDICATED IN THE DESIGN, SAWCUT FULL DEPTH OF PAVEMENT PRIOR TO BURSTING PIPE.

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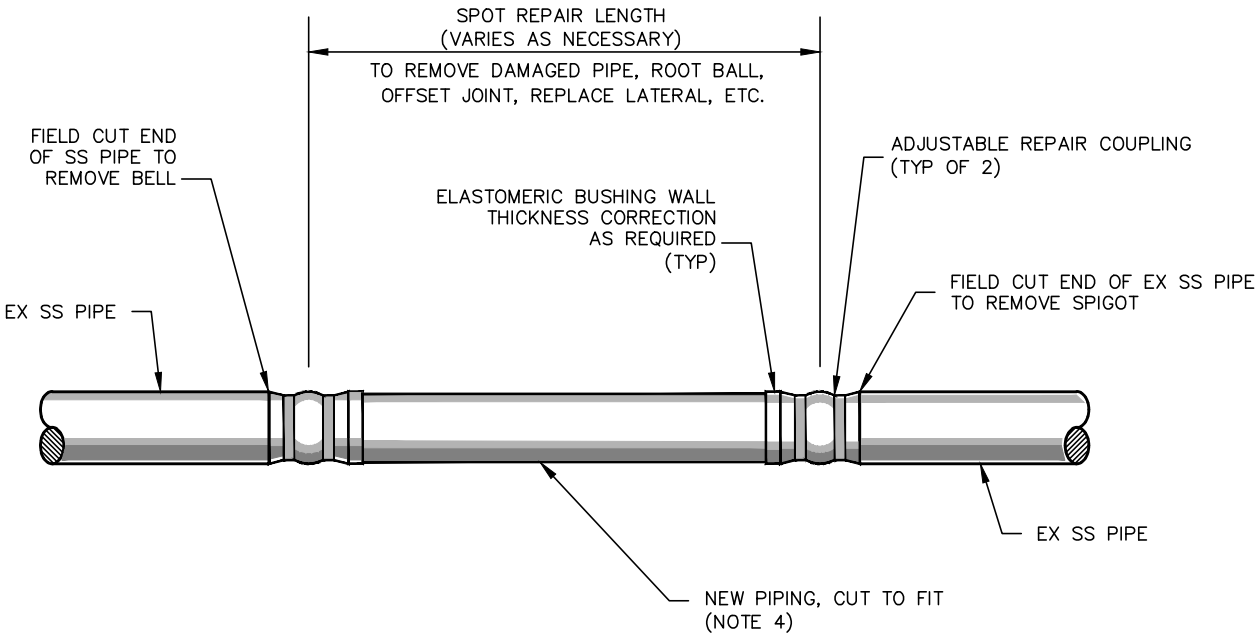
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

SURFACE UPHEAVAL REPAIRS

SD-22

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-22-Surface Upheaval Repair.dwg Save Date: 10/2/2026 9:06 AM Plot Date: 10/2/2026 9:06 AM BODwyer

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-23-Pipeline Point Repair.dwg Save Date: 10/2/2026 9:06 AM Plot Date: 10/2/2026 9:06 AM BODwyer

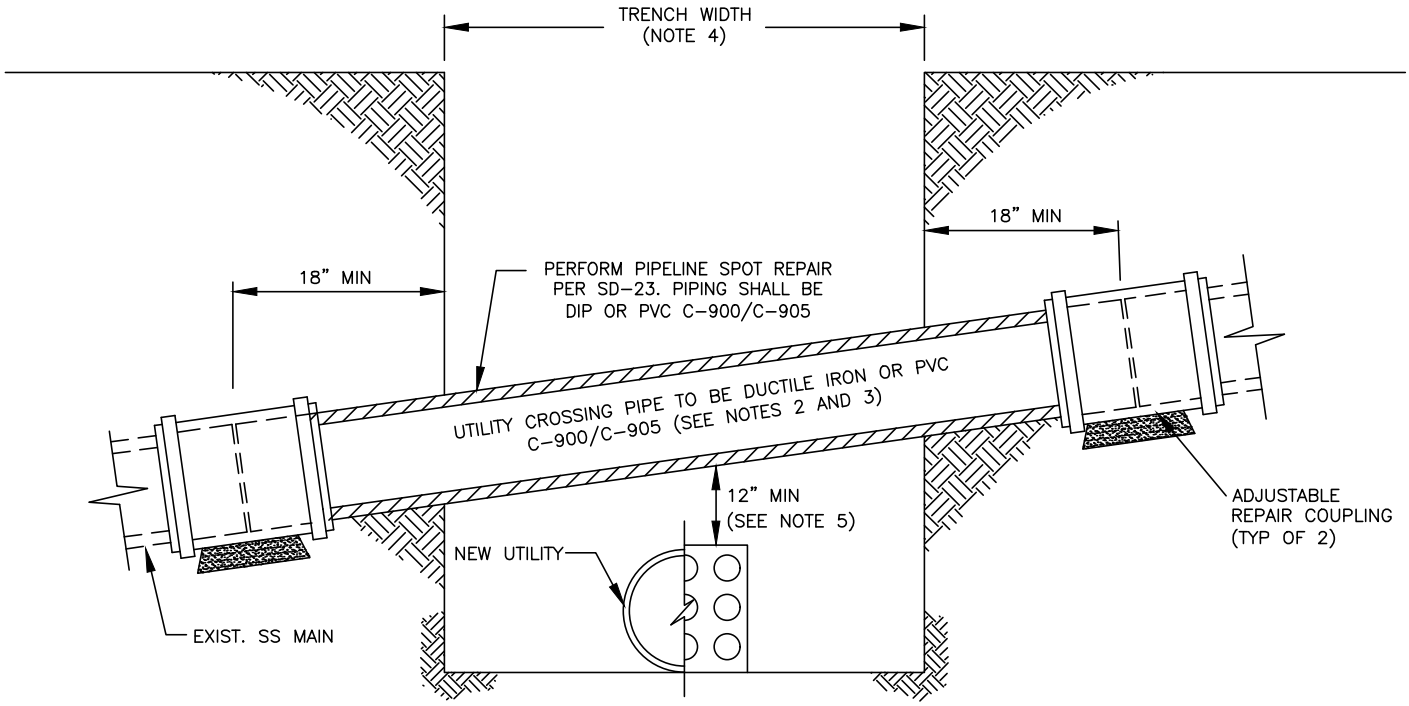


NOTES:

1. **THE CONTRACTOR SHALL VERIFY ACTUAL POINT REPAIR LOCATIONS IN THE FIELD IN COORDINATION WITH THE REVIEW OF PRE-INSTALLATION CCTV. ANY POINT REPAIRS OR ADDITIONAL LENGTHS NOT SHOWN IN THE DESIGN DRAWINGS SHALL BE APPROVED BY THE DISTRICT OR ITS REPRESENTATIVES PRIOR TO INSTALLATION.**
2. **WHERE SPOT REPAIRS ARE SHOWN IN DESIGN DRAWINGS TO ENTER INTO AN EXISTING MANHOLE, REMOVE AND REPLACE EXISTING PIPE AND REPAIR MANHOLE WALL AND BASE PER SD-9.**
3. **TRENCH BACKFILL AND SURFACE RESTORATION SHALL BE IN ACCORDANCE WITH SD-16.**
4. **NEW PIPING SHALL BE PER THE DISTRICT'S APPROVED MATERIAL LIST, AND MATCH EXISTING PIPE MATERIAL. IF EXISTING PIPE MATERIAL IS NOT ON THE DISTRICT'S APPROVED MATERIAL LIST, CONTRACTOR SHALL USE MATERIAL AS SPECIFIED BY THE DISTRICT.**

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						PIPE LINE SPOT REPAIR	SD-23

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-24-Sewer Repair New Utility Crossing.dwg Save Date: 10/2/2026 9:06 AM Plot Date: 10/2/2026 9:06 AM BODwyer



NOTES:

1. **ALL LINES ARE TO BE PROTECTED IN PLACE. THIS DETAIL SHALL APPLY WHENEVER THE MAIN COLLECTOR OR LATERAL SEWER SERVICE IS CUT OR DAMAGED WHEN NEW CONSTRUCTION PASSES BENEATH THESE LINES, AND MAY ONLY BE USED WHEN APPROVED BY THE DISTRICT.**
2. **INSIDE DIAMETER OF UTILITY CROSSING PIPE TO BE THE SAME AS THE PIPE TO WHICH IT CONNECTS.**
3. **UTILITY CROSSING PIPE TO HAVE THE SAME SLOPE AS ADJACENT PIPELINES.**
4. **WHENEVER THE SPAN, WHETHER CAUSED BY TRENCH WIDTH OR CROSSING ANGLE OF THE UTILITY CROSSING PIPE EXCEEDS 5'-0", PLACE BEDDING PER SD-16 TO 12" ABOVE THE NEW UTILITY AND 18" EACH SIDE OF ITS CENTER LINE.**
5. **ANY NEW UTILITY SHALL HAVE A MINIMUM OF 12" CLEARANCE FROM ANY SEWER FACILITY. WHERE 12" OR GREATER IS NOT FEASIBLE PLACE CLSM BETWEEN THE LINES. IF 12" CLEARANCE FROM A WATER MAIN IS NOT FEASIBLE, INSTALL A SEWER SLEEVE PER SD-25.**

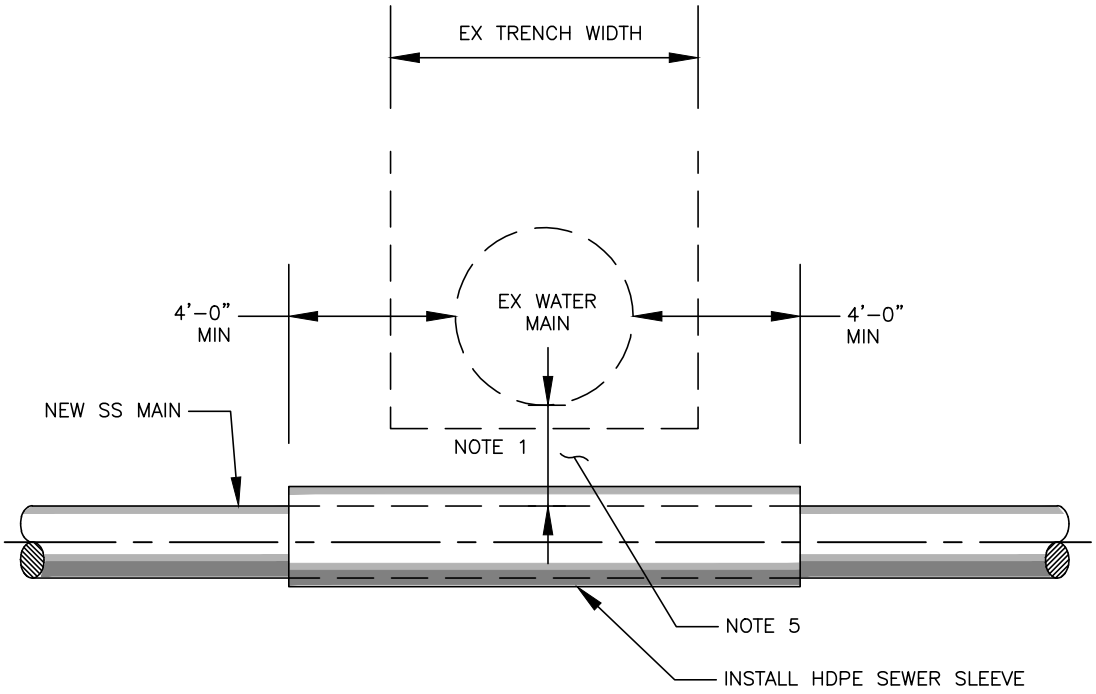
OCTOBER 2026

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SAUSALITO-MARIN CITY SANITARY DISTRICT
STANDARD DRAWINGS

SEWER REPAIR FOR NEW UTILITY CROSSING

SD-24

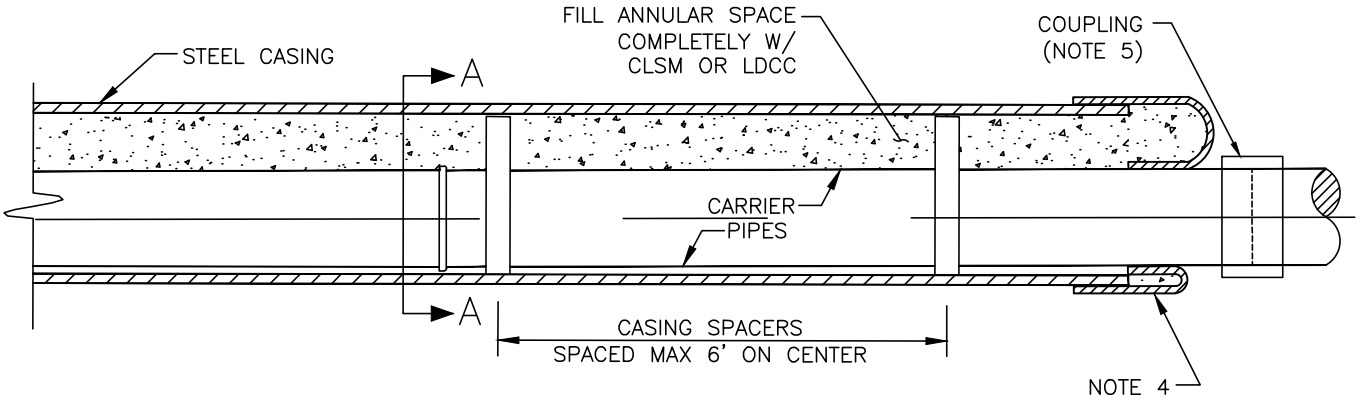


NOTES:

1. FOR OPEN TRENCH INSTALLATIONS, INSTALL HDPE SLEEVE WHERE VERTICAL CLEARANCE IS LESS THAN 12" BETWEEN NEW SEWER MAIN AND EXISTING WATER MAIN. VERTICAL CLEARANCE BETWEEN SEWER AND WATER MAINS SHALL NOT BE LESS THAN 4 INCHES.
2. IF NEW SEWER CROSSES ABOVE EX WATER MAIN AND WITH LESS THAN 12" CLEARANCE, THEN HDPE SLEEVE SHALL EXTEND A MINIMUM OF 10 FT FROM OUTSIDE DIAMETER OF WATER MAIN ON BOTH SIDES.
3. HDPE SLEEVE SHALL BE SIZED SUCH THAT ITS INSIDE DIAMETER PROVIDES APPROXIMATELY 1 INCH CLEARANCE FROM NEW SEWER PIPE BELLS.
4. FILL ANNULAR SPACE BETWEEN NEW PIPE AND SLEEVE WITH CLSM OR LDCC.
5. BACKFILL WITH CLSM OR LDCC WHERE SPECIFIED COMPACTION CANNOT BE ACHIEVED BETWEEN UTILITIES.
6. SLEEVES MAY NOT BE REQUIRED IF THE PIPE JOINTS ARE WITHIN THE MINIMUM DISTANCE TO THE EX WATER MAIN.
7. CONTRACTOR SHALL CONFORM WITH TITLE 22, SECTION 64572 OF CALIFORNIA CODE OF REGULATION, STATE OF CALIFORNIA WATER BOARD OF SEWER AND WATER MAIN CROSSING.

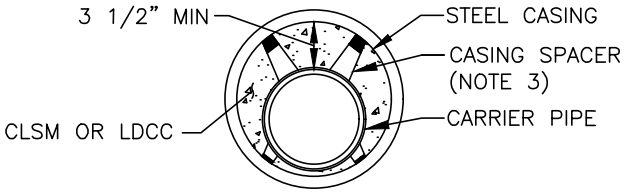
OCTOBER 2026		No.	BY	DATE	REVISION	SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS	
						SEWER SLEEVE AT WATER MAIN CROSSINGS	SD-25

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-25-Sewer Sleeve Install.dwg Save Date: 10/2/2026 9:06 AM Plot Date: 10/2/2026 9:06 AM BODwyer



ELEVATION

NOT TO SCALE



SECTION A-A

NOTES:

1. **CARRIER PIPES SHALL BE HDPE.**
2. **CASING SHALL BE STEEL PIPE WITH SCHEDULE 40 MINIMUM WALL THICKNESS. CASING DIAMETER SHALL SHALL ALLOW FOR A MINIMUM OF 3 1/2" CLEARANCE FROM CARRIER PIPE BELL OUTSIDE DIAMETER. ACTUAL CASING WALL THICKNESS AND DIAMETER SHALL BE DETERMINED BY THE ENGINEER BASED ON APPLICABLE FORCES AND INSTALLATION CONDITIONS.**
3. **CASING SPACERS SHALL BE STAINLESS STEEL AND RESTRAINED TO PREVENT FLOATATION AND KEEP THE CARRIER PIPE AT THE BOTTOM OF THE CASING.**
4. **AFTER INSTALLATION OF THE CARRIER PIPES IN THE CASING, THE ENDS OF THE CASING SHALL BE SEALED. END SEALS SHALL BE "U" AS MANUFACTURED BY T.D. WILLIAMSON, INC. OR APPROVED EQUAL.**
5. **FOR GRAVITY PIPING (OTHER THAN HDPE), COUPLING SHALL BE AN ADJUSTABLE REPAIR COUPLING. FOR PRESSURE PIPING (OTHER THAN HDPE), COUPLING SHALL BE A SLEEVE TYPE COUPLING. FOR CONNECTION TO HDPE PIPING, COUPLING SHALL BE AN ELECTRO FUSION COUPLING. SLEEVE TYPE COUPLINGS IN THE APPROVED MATERIAL LIST ARE NON-RESTRAINED COUPLINGS. FOR PRESSURE PIPING, THE ENGINEER WILL CONSIDER THE ADDITION OF RESTRAINT AT COUPLINGS WHEN THESE COUPLINGS ARE INCORPORATED IN THE DESIGN.**

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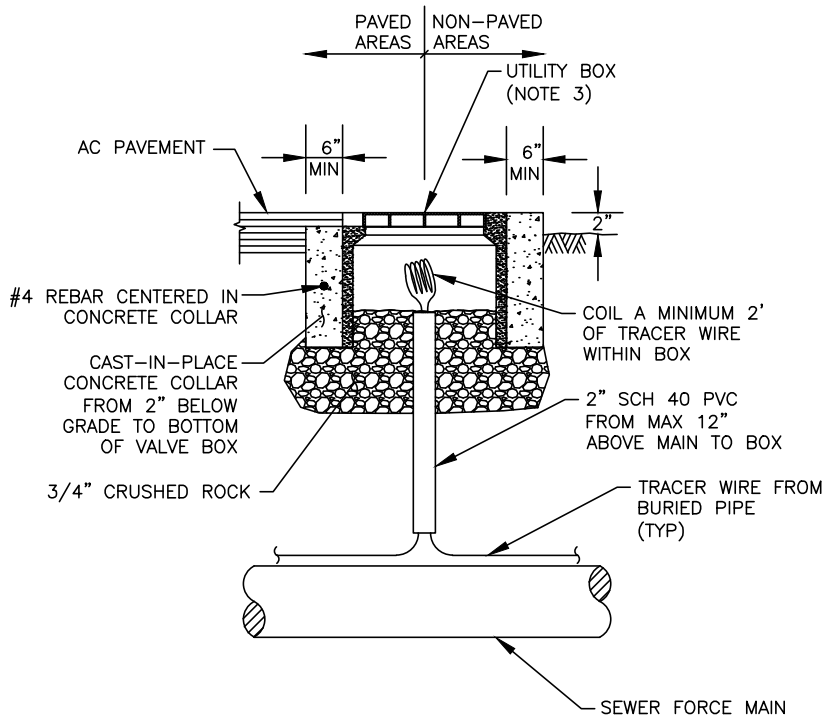
SAUSALITO-MARIN CITY SANITARY DISTRICT
STANDARD DRAWINGS

STEEL PIPE LINE CASING

SD-26

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-26-Pipeline Casing.dwg Save Date: 10/2/2026 9:06 AM Plot Date: 10/2/2026 9:06 AM BODwyer

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-27-Tracer Wire Box.dwg Save Date: 10/2/2026 9:06 AM Plot Date: 10/2/2026 9:06 AM BODwyer



SECTION

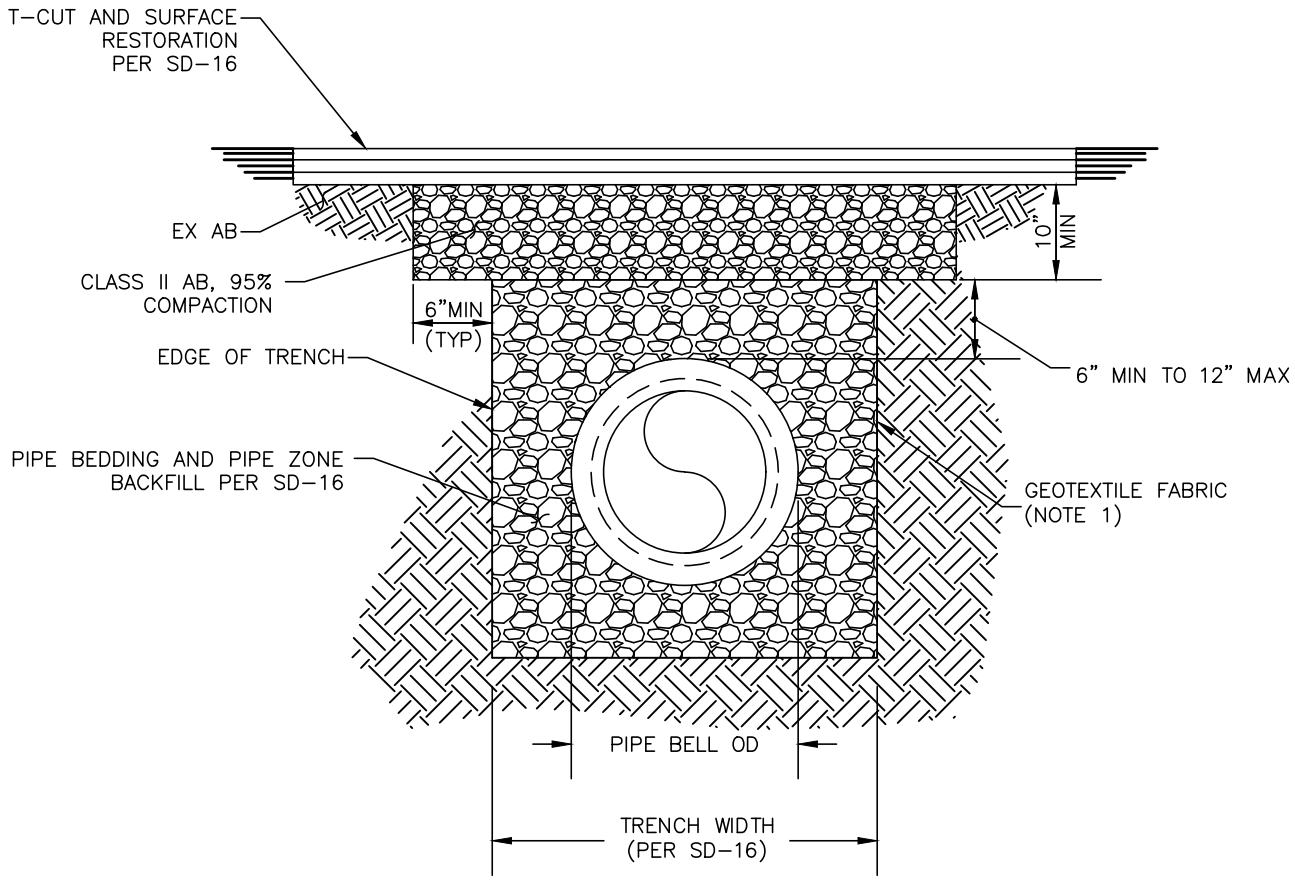
NOTES:

1. **TRACER WIRE SHALL BE TAPED TO THE TOP OF ALL BURIED FORCE MAINS. WHERE THE DISTANCE BETWEEN VALVE VAULTS IS GREATER THAN 400 FT, THEN A TRACER WIRE CONNECTION BOX SHALL BE INSTALLED.**
2. **TRACER WIRE CONNECTION BOX SHALL BE PLACED DIRECTLY ABOVE SEWER FORCE MAIN WHERE FEASIBLE. BOX SHALL BE POSITIONED WITH APPROXIMATELY EQUAL DISTANCE TO UPSTREAM AND DOWNSTREAM SEWER VALVE VAULTS.**
3. **SET PRECAST UTILITY BOX FLUSH WITH GRADE. BOX SHALL BE PER THE DISTRICT'S APPROVED MATERIALS LIST, EXCEPT BOX SHALL BE MARKED "SMCSD".**

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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

TRACER WIRE CONNECTION BOX ON FORCE MAIN | **SD-27**



SECTION

DISTRICT APPROVAL REQUIRED PRIOR TO INSTALLATION OF SHALLOW PIPE.

NOTES:

1. **GEOTEXTILE FABRIC INSTALLATION:**

   MAIN SEWERS: **WRAP/ENCAPSULATE PIPE BEDDING AND PIPE ZONE BACKFILL TOGETHER USING GEOTEXTILE FABRIC WITH MINIMUM 12" OVERLAP**

2. **PAVEMENT AND PAVEMENT THICKNESS SHALL CONFORM TO THE REQUIREMENTS OF THE TOWN OR CITY WITH JURISDICTION'S ENCROACHMENT PERMIT.**

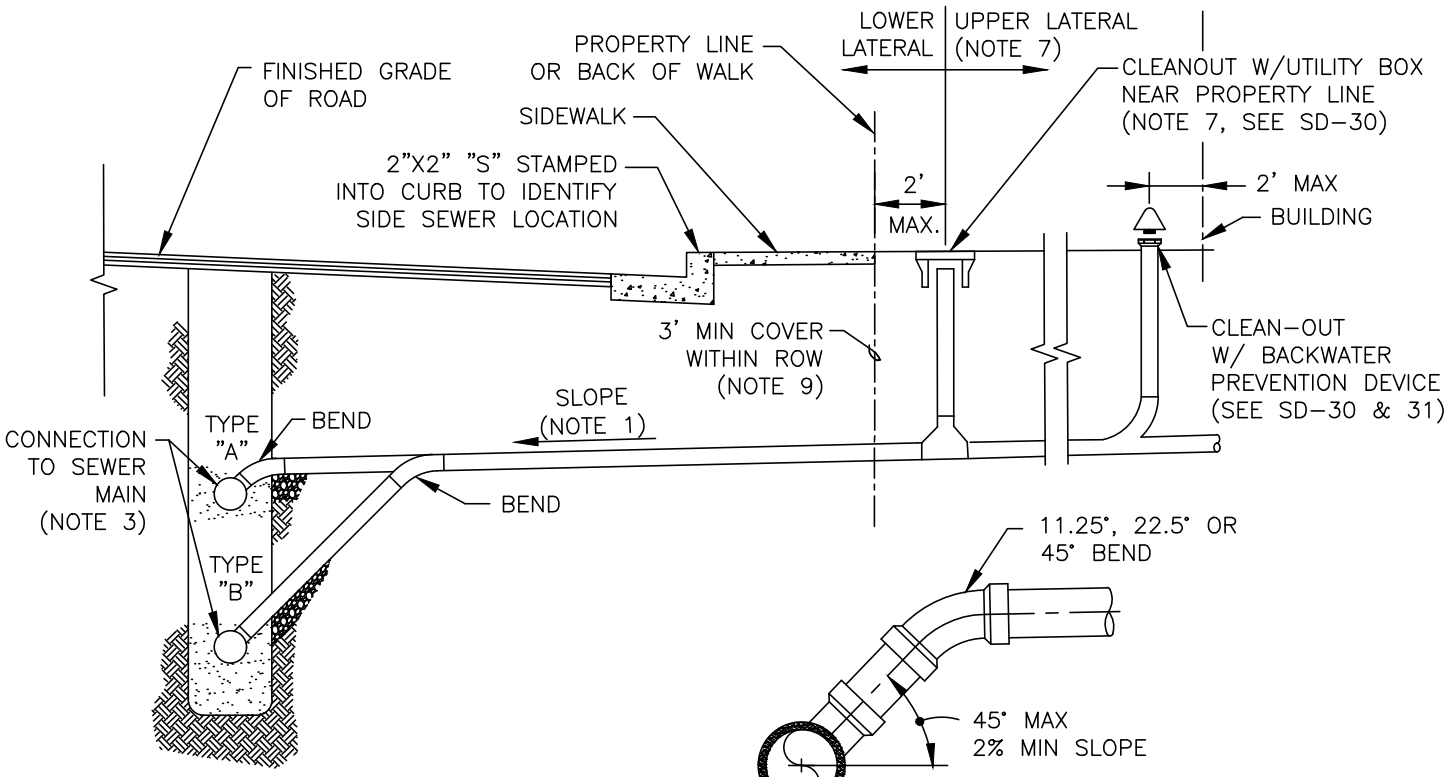
3. **THIS DETAIL DOES NOT APPLY TO SEWER LATERALS. NO SHALLOW PIPE PROTECTION SHALL BE ALLOWED FOR SEWER LATERALS. IF SIDE SEWER HAS LESS THAN THREE (3) FEET OF COVER WITHIN THE STREET RIGHT-OF-WAY, C-900 DR-18 SHALL BE USED AND CAPPED WITH CONCRETE, WHERE APPLICABLE.**

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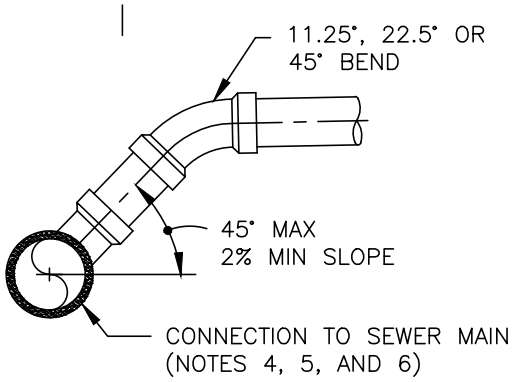
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

SHALLOW PIPE PROTECTION | **SD-28**

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-28-Shallow Pipe Protection.dwg Save Date: 10/2/2026 9:07 AM Plot Date: 10/2/2026 9:07 AM BODwyer



TYPICAL ELEVATION



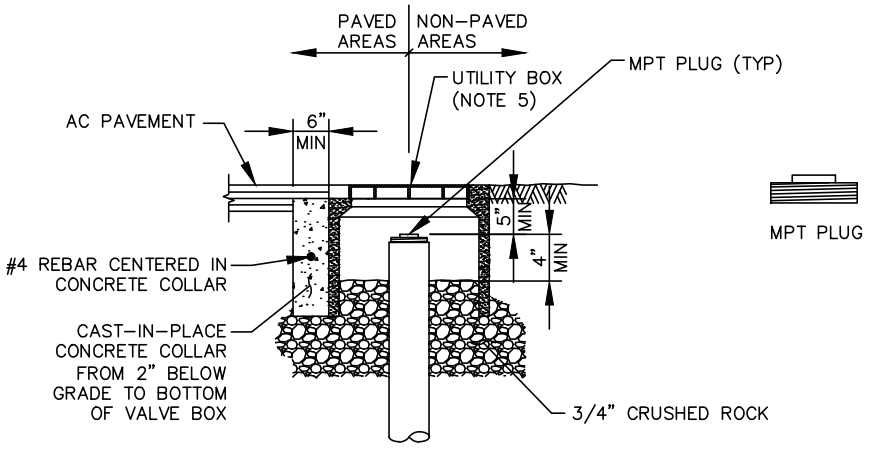
SIDE SEWER CONNECTION TO SANITARY SEWER MAIN

NOTES:

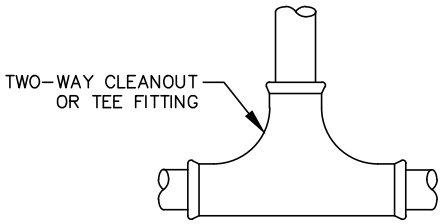
1. MIN SLOPE FOR 4-INCH SIDE SEWERS SHALL BE 1.5%. MIN SLOPE FOR 6-INCH OR GREATER SHALL BE 0.7%.
2. TRENCHING AND SURFACE REPAIR SHALL BE PER SD-16.
3. CONTRACTOR SHALL USE THE MOST APPROPRIATE TYPE CONNECTION (A OR B) FOR THE PARTICULAR SITUATION.
4. SIDE SEWER CONNECTION TO SEWER MAIN SHALL BE WITH A NEW WYE FITTING. FOR CONNECTIONS TO EXISTING SEWER MAINS, REMOVE AND REPLACE A PORTION OF SEWER MAIN AS REQUIRED FOR THE WYE FITTING AND PIPING INSTALLATION. PIPING AND CONNECTIONS TO EXISTING MAINS AND EXISTING SIDE SEWERS SHALL BE WITH ADJUSTABLE REPAIR COUPLINGS AND PER STANDARD PIPELINE SPOT REPAIR DETAIL, SEE SD-23. NEW WYES AND PIPING SHALL MATCH EXISTING MAIN MATERIAL.
5. TAP CONNECTIONS PER DISTRICT'S APPROVED MATERIALS LIST MAY BE USED TO SEWER MAINS 10-INCH OR LARGER IF APPROVED BY THE DISTRICT.
6. FOR CONNECTIONS TO HDPE MAINS, SEE SD-34.
7. PROPERTY LINE CLEANOUTS SHALL BE A TWO-WAY, WYE OR A "TEE" AS SPECIFIED IN SPECIFICATION SECTION 02600, AND SHALL BE PER DISTRICT'S APPROVED MATERIAL.
8. ADDITIONAL CLEANOUT(S) WILL BE REQUIRED IN ACCORDANCE WITH THE REQUIREMENTS OF SPECIFICATION SECTION 02600, SIDE SEWERS.
9. A MINIMUM COVER OF UP TO 30" AT THE EDGE OF ROW IS ALLOWED ON A CASE-BY-CASE BASIS.

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						TYPICAL SIDE SEWER	SD-29

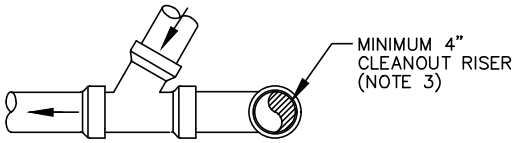
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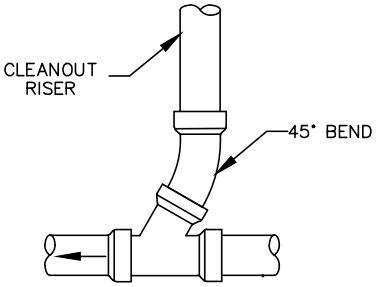
PRECAST UTILITY BOX COVER
SECTION



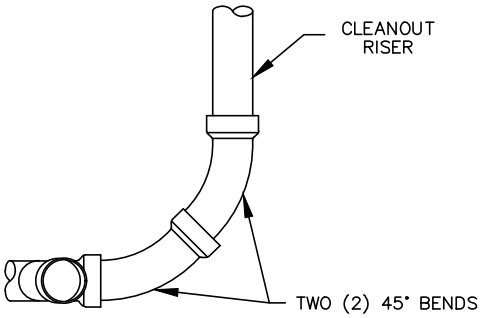
TWO-WAY CLEANOUT
SECTION



ANGLE POINT CLEANOUT
PLAN



IN-LINE CLEANOUT
SECTION



ANGLE POINT CLEANOUT
SECTION

NOTES:

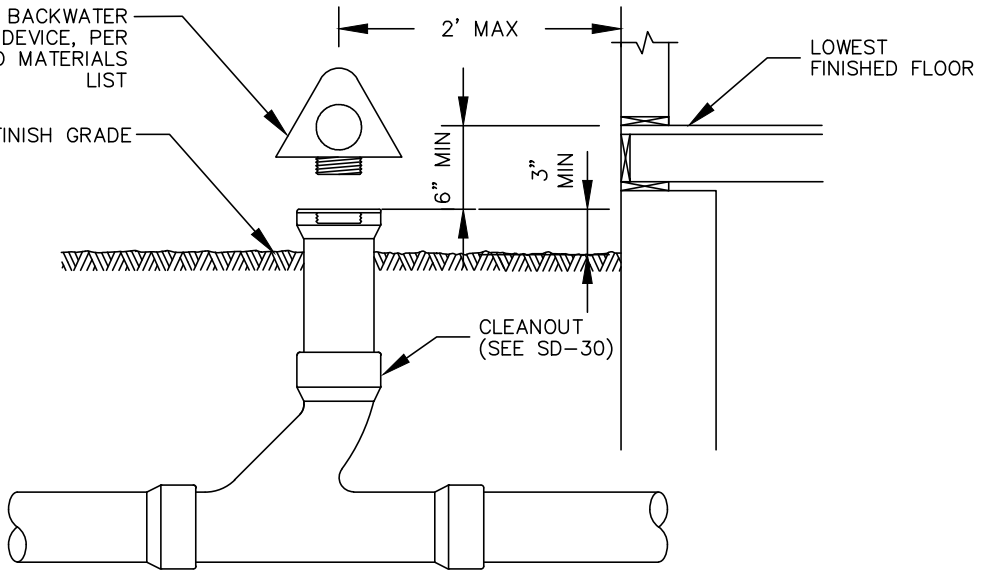
1. **CLEAN-OUT SHALL BE THE SAME SIZE AS THE SIDE SEWER.**
2. **FITTINGS FOR CLEANOUTS AND SIDE SEWERS SHALL BE PER THE DISTRICT'S APPROVED MATERIALS LIST, SEE SIDE SEWER FITTINGS.**
3. **ANGLE POINT CLEAN-OUT REQUIRED AT SIDE SEWER DEFLECTIONS EQUAL TO OR GREATER THAN 45°, OR/AND AT INTERVALS NOT TO EXCEED NINETY FEET OF LAID PIPE LENGTH.**
4. **CLEAN-OUT IS REQUIRED AT INTERVALS NOT TO EXCEED NINETY FEET OF LAID PIPE LENGTH. IF TWO-WAY (TEE) CLEAN-OUTS ARE BEING INSTALLED AT BOTH ENDS, THE LENGTH IN BETWEEN CAN BE UP TO ONE HUNDRED AND EIGHTY FEET.**
5. **THE CLEAN-OUT NEAREST TO SEWER MAIN (NEAR THE PROPERTY LINE) SHALL BE PROVIDED WITH A UTILITY BOX. ALSO, THE DISTRICT ENCOURAGES THE USE OF TWO-WAY CLEANOUTS WHERE FEASIBLE FOR PROPERTY LINE CLEANOUTS.**
6. **ALL SEWER LATERAL CLEANOUTS SHALL BE INSTALLED IN PRECAST UTILITY BOXES. PRECAST UTILITY BOXES SHALL BE PER DISTRICT'S APPROVED MATERIALS LIST. ALL COVERS SHALL BE MARKED "SEWER". CLEANOUT BOXES SHALL BE REQUIRED FOR ALL CLEANOUTS IN PAVED AREAS.**
7. **THE CLEAN-OUT NEAREST TO BUILDING/HOME SHALL HAVE AN BACKWATER PROTECTION DEVICE PER SD-31.**

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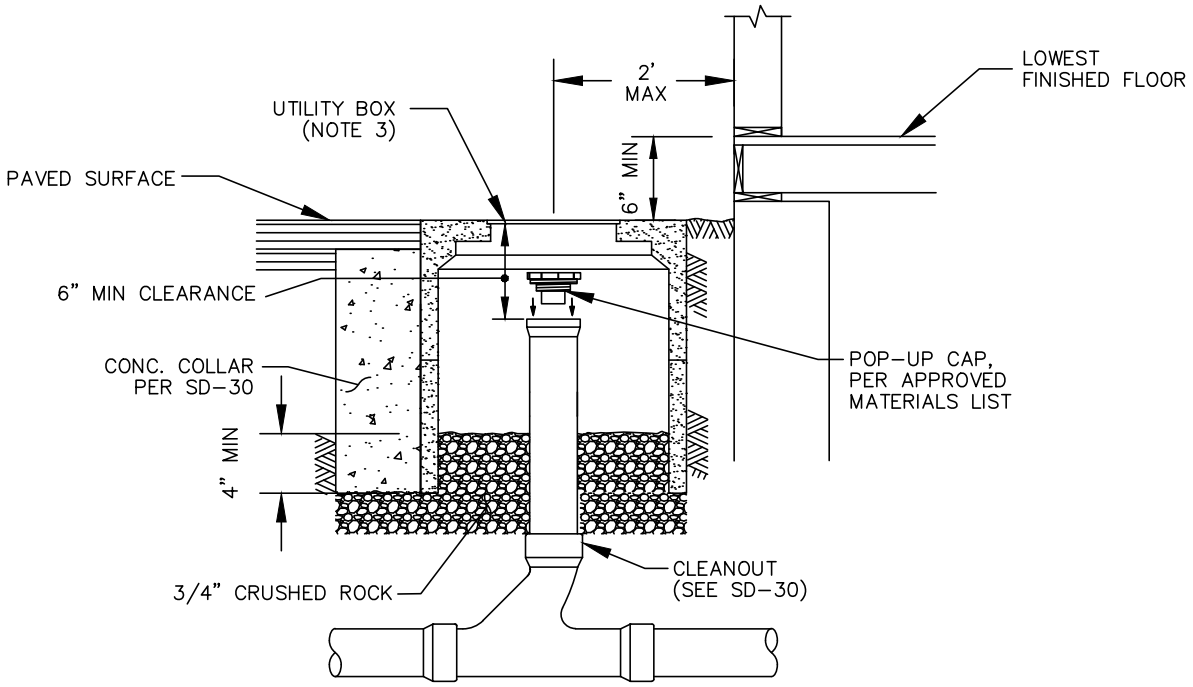
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

SIDE SEWER CLEANOUT | **SD-30**

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-30-Side Sewer Cleanout.dwg Save Date: 10/2/2026 9:07 AM Plot Date: 10/2/2026 9:07 AM BODwyer



TYPE 1



TYPE 2

NOTES:

1. **A BACKWATER PREVENTION DEVICE, SHALL BE REQUIRED ON ALL SIDE SEWERS AT EVERY LOCATION WHERE SEWER PIPING EXITS A BUILDING/HOME. MULTIPLE BACKWATER PREVENTION DEVICES MAY BE REQUIRED FOR SOME BUILDINGS/HOMES.**

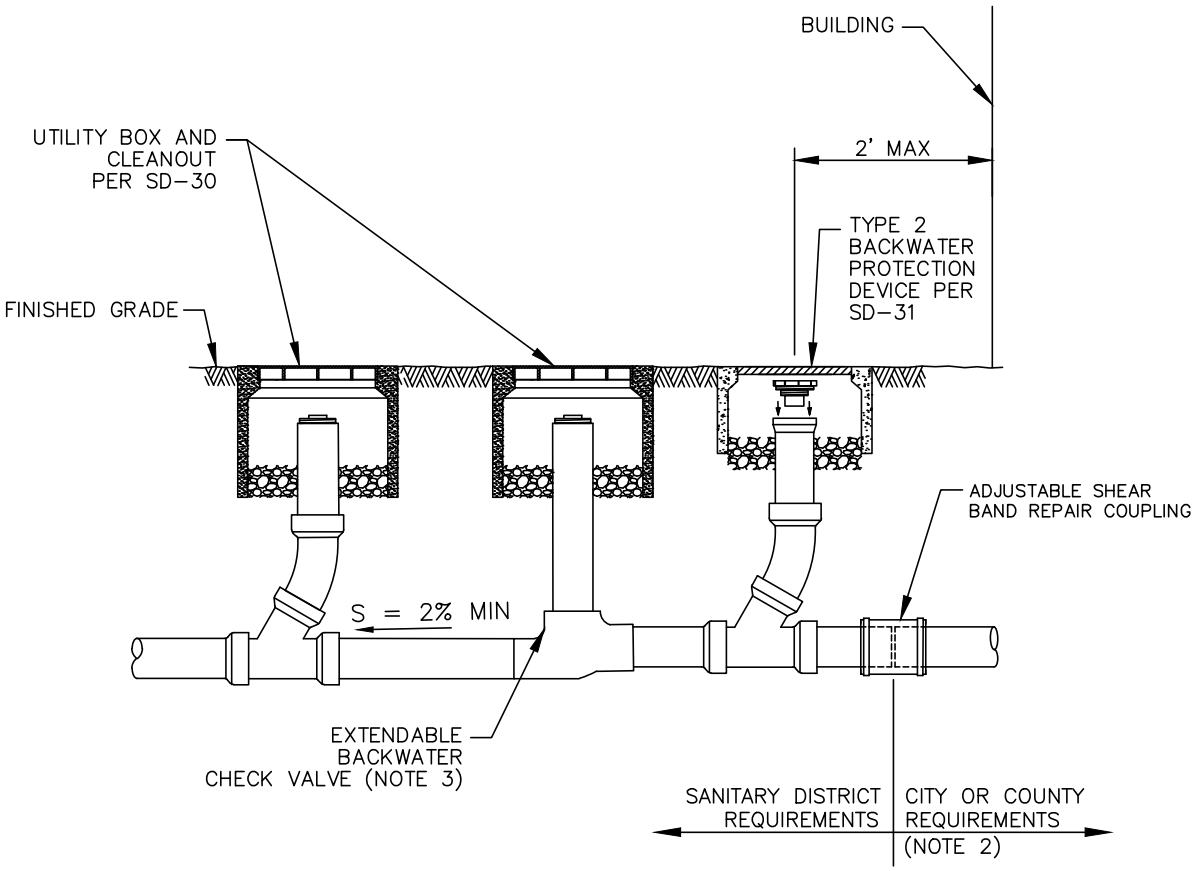
2. **TYPE 1 BACKWATER PREVENTION DEVICES WILL BE REQUIRED FOR MOST APPLICATIONS. TYPE 2 BACKWATER PREVENTION DEVICES SHALL ONLY BE USED IN AREAS WITH A POTENTIAL FOR FLOODING, WHERE TYPE 1 DEVICES CANNOT BE USED, WHERE BACKWATER CHECK VALVES ARE REQUIRED, OR WHERE REQUIRED BY DISTRICT. THE USE OF TYPE 1 CAPS WILL NOT BE ALLOWED IN AREAS WITH A POTENTIAL FOR FLOODING.**

3. **UTILITY BOXES SHALL HAVE GRATED LIDS PER DISTRICT'S APPROVED MATERIALS LIST.**

4. **POP-UP DEVICES SHALL HAVE A MINIMUM CLEARANCE EQUAL TO THE PIPE DIAMETER. CLEARANCE SHALL NOT BE LESS THAN THE PIPE DIAMETER.**

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						BACKWATER PREVENTION DEVICE	SD-31

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-31-Backwater Prevention Device.dwg Save Date: 10/2/2026 9:07 AM Plot Date: 10/2/2026 9:07 AM BODwyer



NOTES:

1. **EXTENDABLE BACKWATER CHECK VALVES SHALL BE INSTALLED IF THE DIFFERENCE IN ELEVATION OF THE LOWEST FIXTURE UNIT AND THE BACKWATER PROTECTION DEVICE IS LESS THAN 6 INCHES.**
2. **THE HOUSE PLUMBING MUST MEET THE BACKWATER VALVE MANUFACTURER'S RECOMMENDATIONS FOR MINIMUM SLOPE.**
3. **BACKWATER CHECK VALVES SHALL BE PVC EXTENDABLE TYPE AND PER THE DISTRICT'S APPROVED MATERIALS LIST.**

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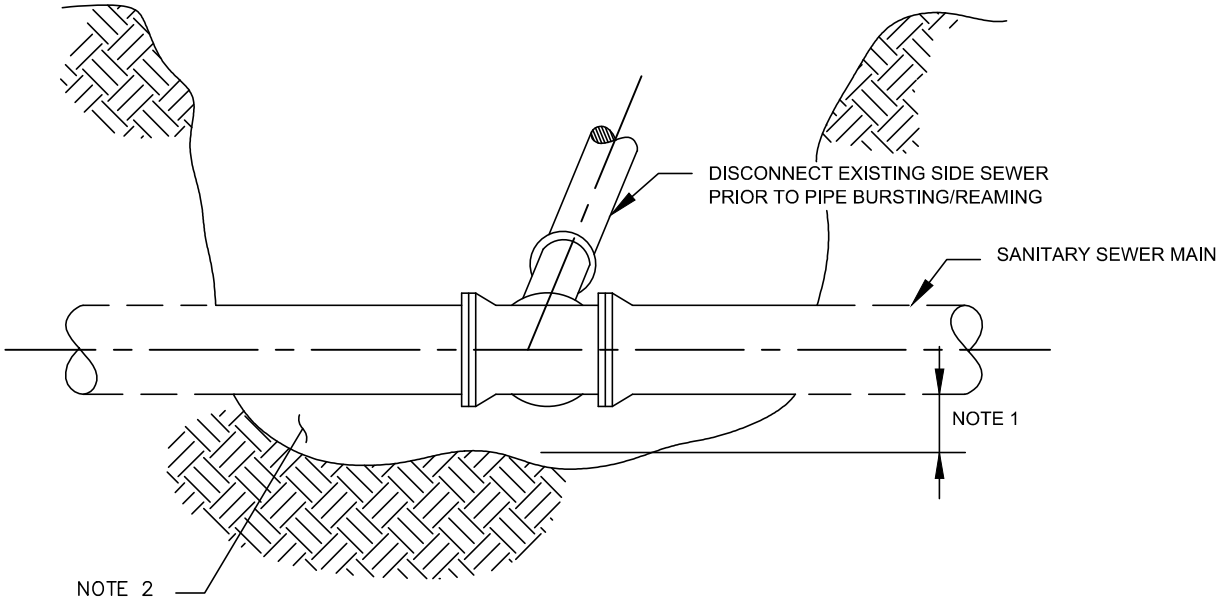
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

BACKWATER CHECK VALVE

SD-32

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-32-Backwater Check Valve.dwg Save Date: 10/2/2026 9:07 AM Plot Date: 10/2/2026 9:07 AM BODwyer

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-33- Side Sewer Disconnect.dwg Save Date: 10/2/2026 9:07 AM Plot Date: 10/2/2026 9:07 AM BODwyer



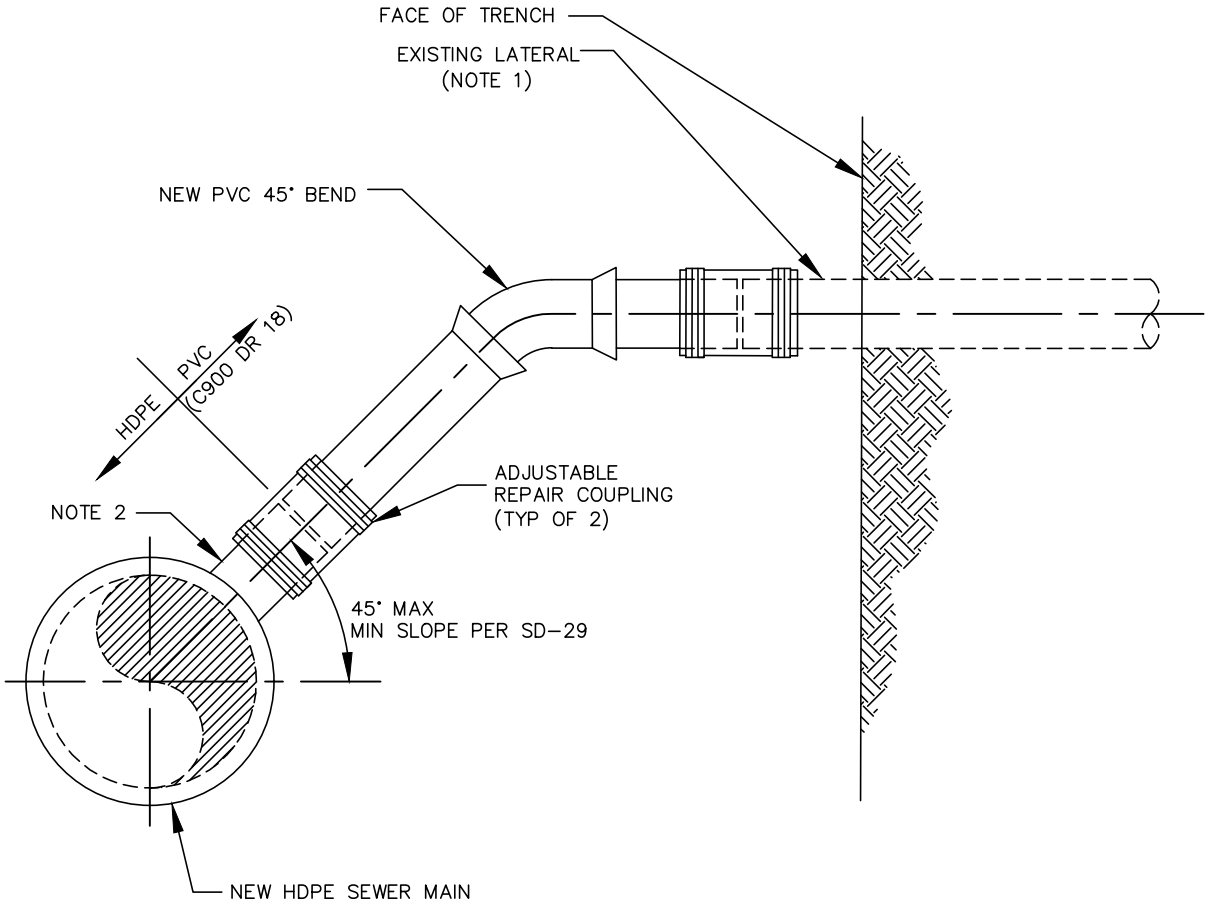
NOTES:

1. **EXCAVATE COMPLETELY AROUND THE SS MAIN TO BE BURST. MAINTAIN 3" OF CLEARANCE FROM SOIL TO THE NEW PIPE OUTSIDE DIAMETER TO ENSURE THE BURSTING HEAD DOES NOT RAISE UP AT THESE LOCATIONS.**
2. **REMOVE ANY LOOSE AND/OR NATIVE SOIL FROM THE EXCAVATION AFTER BURSTING/REAMING OPERATIONS AND PRIOR TO BACKFILLING.**
3. **BACKFILL AND SURFACE RESTORATION SHALL BE PER SD-16.**
4. **IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROPERLY ADDRESS SIDE SEWER WASTE WATER FLOW DURING PIPE BURSTING AND/OR REAMING PROCESS.**

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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

SIDE SEWER DISCONNECT FOR PIPE BURSTING/REAMING | **SD-33**



NOTES:

1. **EXTEND NEW LATERAL AS REQUIRED TO REMOVE DETERIORATED PIPE AND CONNECT TO PIPE IN GOOD CONDITION.**

2. **CONNECTION TO MAIN SEWER SHALL BE MADE WITH AN ELECTROFUSION SADDLE PER DISTRICT'S APPROVED MATERIALS LIST. SADDLE CONNECTIONS TO MAIN EQUAL TO OR LESS THAN 12" DIAMETER (NOMINAL) SHALL BE "WYE" TYPE. SADDLE CONNECTIONS TO MAINS LARGER THAN 12" DIAMETER (NOMINAL) MAY BE "TEE" TYPE.**

3. **TRENCH BACKFILL AND SURFACE RESTORATION SHALL BE PER SD-16.**

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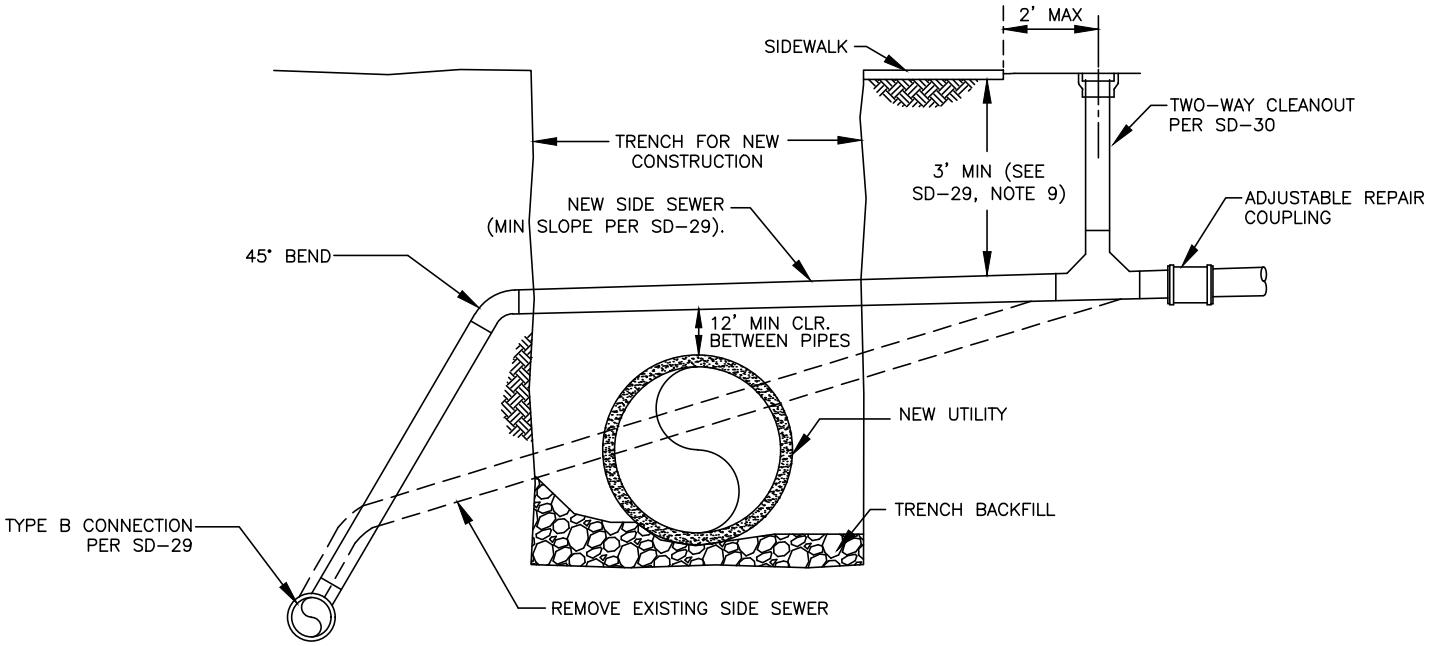
No.	BY	DATE	REVISION

SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

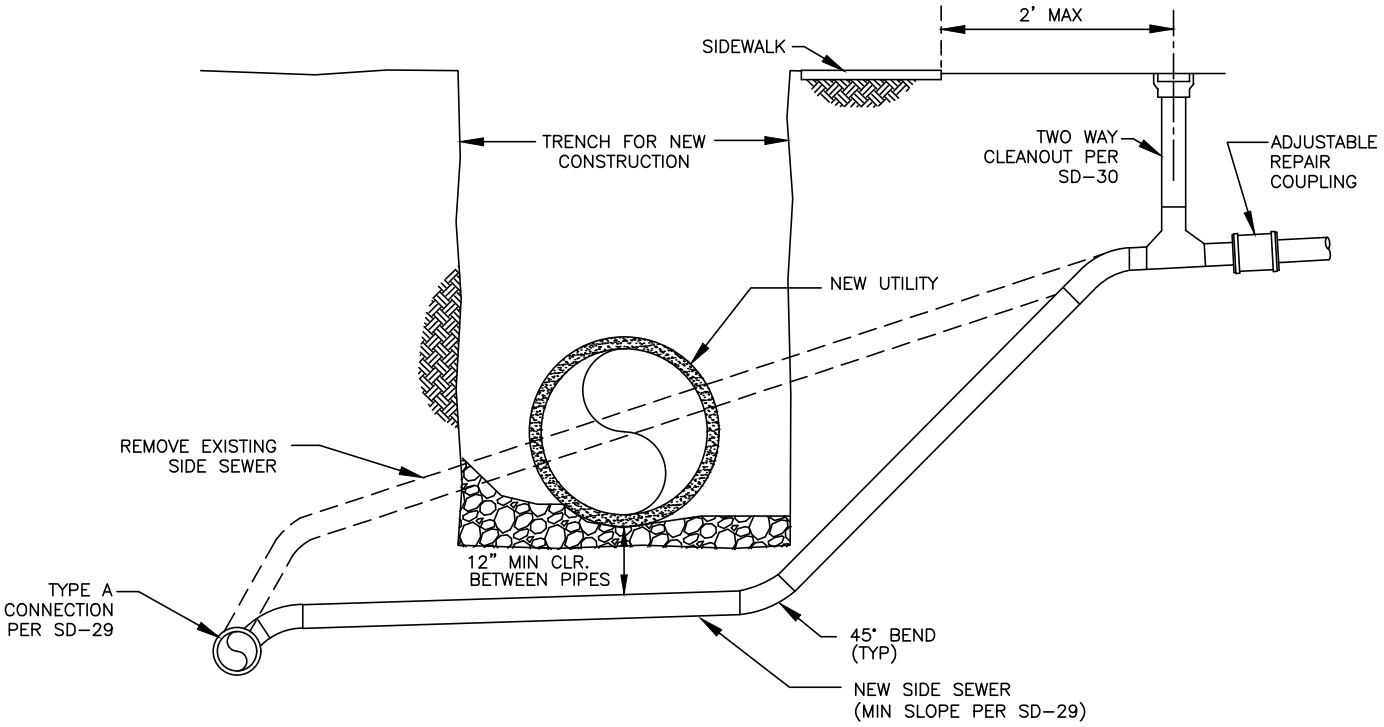
SIDE SEWER CONNECTION TO HDPE MAIN

SD-34

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-34-Side Sewer Connectiont O HDPE.dwg Save Date: 10/2/2026 9:08 AM Plot Date: 10/2/2026 9:08 AM BODwyer



EXISTING LOWER SIDE SEWER RELOCATION OPTION OVER NEW CONSTRUCTION



EXISTING LOWER SIDE SEWER RELOCATION OPTION UNDER NEW CONSTRUCTION

NOTES:

1. **IF NEITHER OF THE OPTIONS SHOWN ARE FEASIBLE, THEN THE ELEVATION OF THE NEW FACILITY WILL NEED TO BE ADJUSTED AS REQUIRED.**
2. **SIDE SEWER CONSTRUCTION AND CLEANOUT PLACEMENT SHALL BE IN ACCORDANCE WITH SIDE SEWER DETAIL, SEE SD-29.**
3. **WHERE ADEQUATE COMPACTION CANNOT BE ACHIEVED BETWEEN UTILITIES, CLSM BACKFILL SHALL BE USED.**

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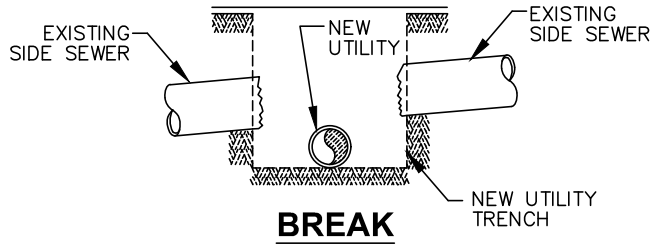
SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

SIDE SEWER REPLACEMENT FOR NEW UTILITIES

SD-35

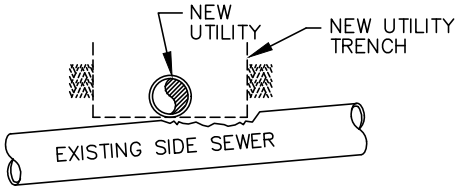
P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-35-Lateral Replacement For New Utility.dwg Save Date: 10/2/2026 9:08 AM Plot Date: 10/2/2026 9:08 AM BODwyer

SIDE SEWER BREAK
NO CONFLICT IN GRADE

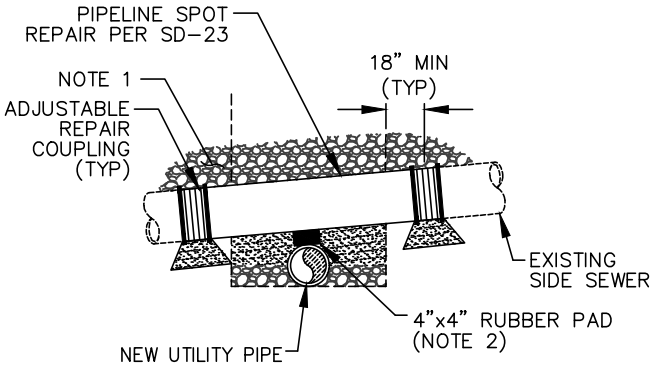


BREAK

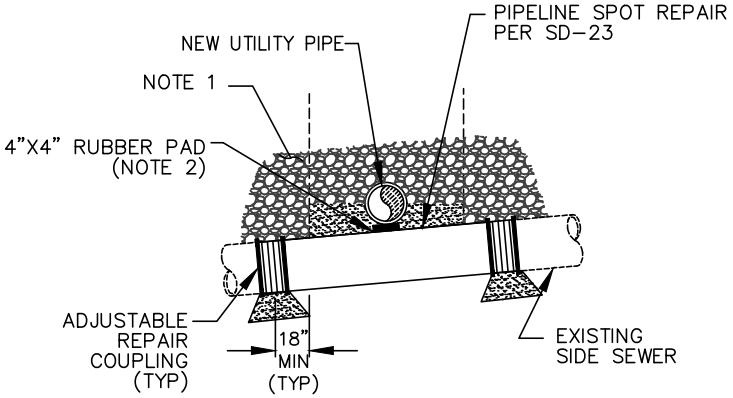
SIDE SEWER BREAK
NO CONFLICT IN GRADE



BREAK

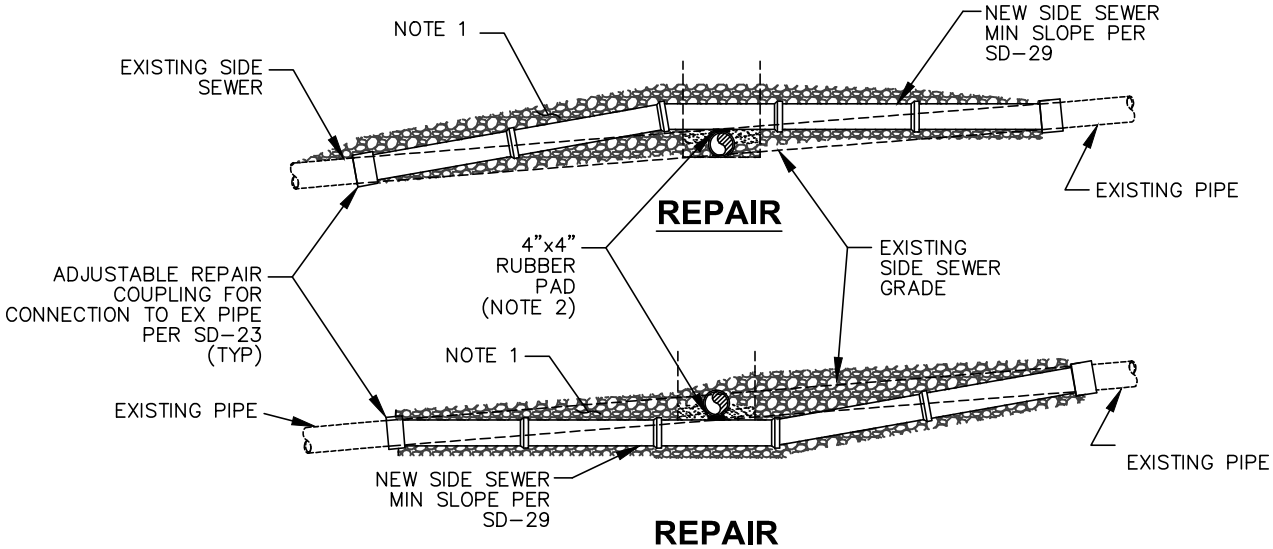


REPAIR



REPAIR

SIDE SEWER WITH CONFLICT IN GRADE

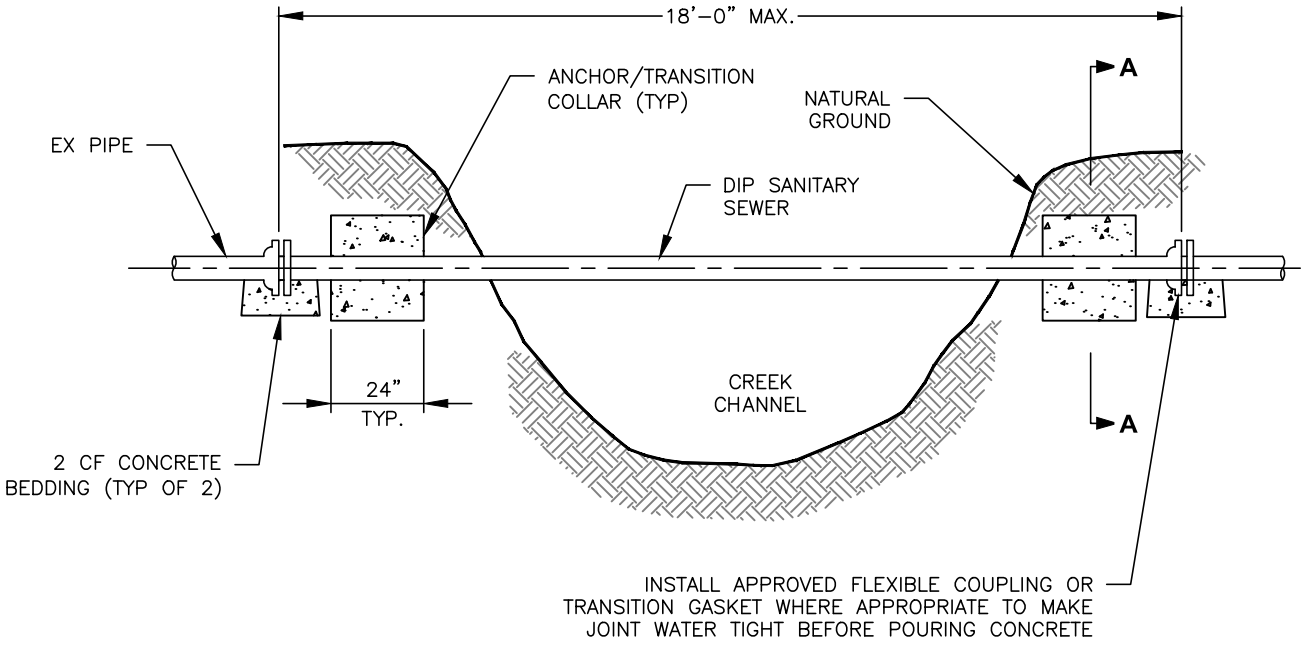


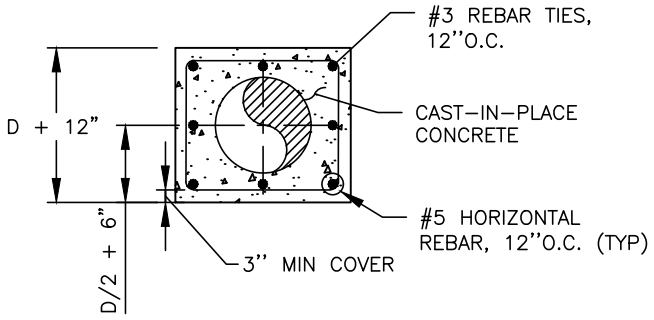
NOTES:

1. **TRENCHING, BACKFILL AND SURFACE RESTORATION SHALL BE PER SD-16. USE CLSM WHERE CLEARANCE BETWEEN UTILITIES PREVENTS ADEQUATE COMPACTION.**
2. **RUBBER PAD SHALL BE 35-45 DURO PLACED SNUGLY BETWEEN THE PIPES WHEN O.D. OF CROSSING PIPES ARE WITHIN 1" OF EACH OTHER.**
3. **SIDE SEWER REPAIR PIPE MATERIALS SHALL BE PER APPROVED MATERIAL LIST.**

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						SIDE SEWER REPAIRS	SD-36

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-36-Side Sewer Repairs.dwg Save Date: 10/2/2026 9:08 AM Plot Date: 10/2/2026 9:08 AM BODwyer





SECTION A-A

NOTES:

1. **ALL AERIAL CROSSING MUST BE APPROVED BY THE DISTRICT.**
2. **ALL AERIAL CROSSING REQUIRES DESIGN TO BE DONE BY REGISTERED ENGINEER AND APPROVAL BY THE DISTRICT.**

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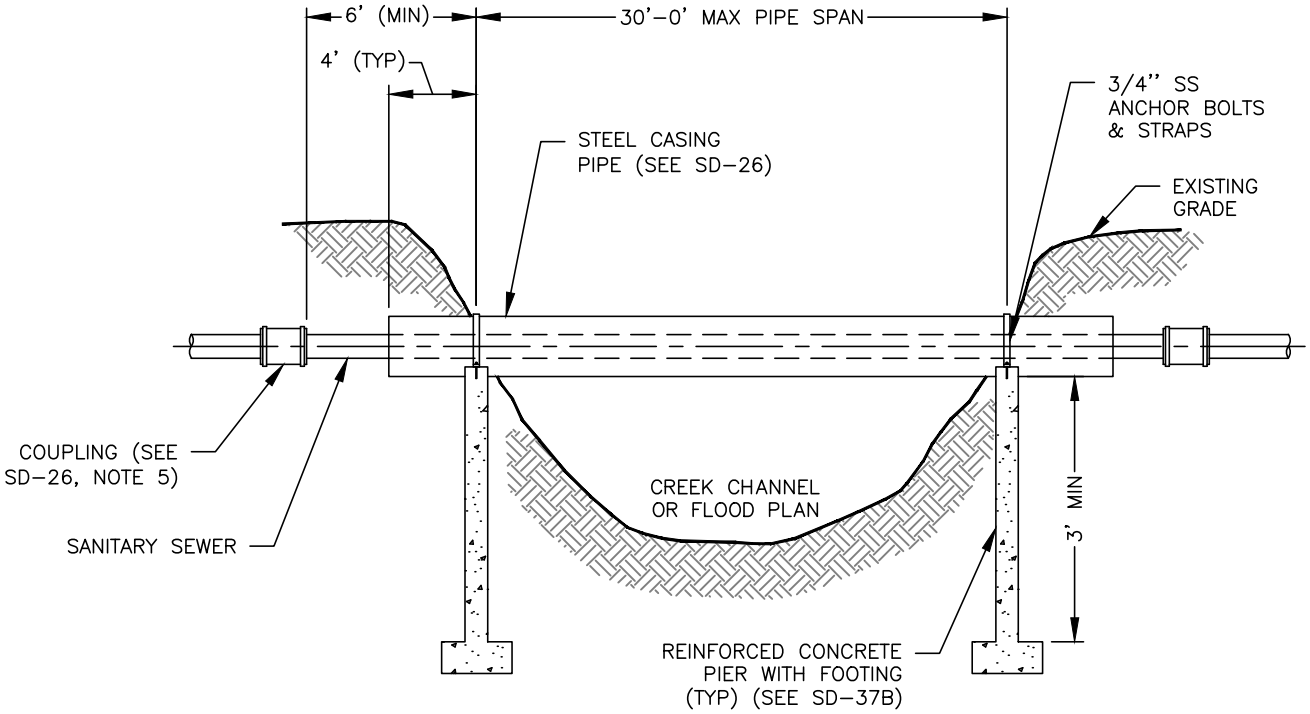
OCTOBER 2026

SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

TYPICAL NARROW WIDTH CREEK PIPE CROSSING

SD-37

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-37A-B-Aerial Pipe Crossing.dwg Save Date: 10/2/2026 9:08 AM Plot Date: 10/2/2026 9:08 AM BODwyer



NOTES:

1. **PIERS MAY NOT BE REQUIRED IF THE SPAN IS LESS THAN 18'-0".**
2. **SPAN EXCEEDING 30'-0' REQUIRES SUBMITTAL OF DESIGN CALCULATIONS.**
3. **THIS CONSTRUCTION DETAIL (SD-37A AND SD-37B) IS A SUGGESTED DESIGN ONLY AND DOES NOT RELIEVE THE ENGINEER FROM THE RESPONSIBILITY AND OBLIGATION TO CONSIDER ALL ISSUES RELATED TO THE PROPER DESIGN OF ALL STRUCTURES AND SYSTEMS AND COMPLIANCE WITH ALL APPLICABLE REGULATIONS AND STANDARDS.**
4. **ALL AERIAL CROSSINGS REQUIRE DESIGN TO BE DONE BY REGISTERED ENGINEER AND APPROVAL BY THE DISTRICT.**

OCTOBER 2026

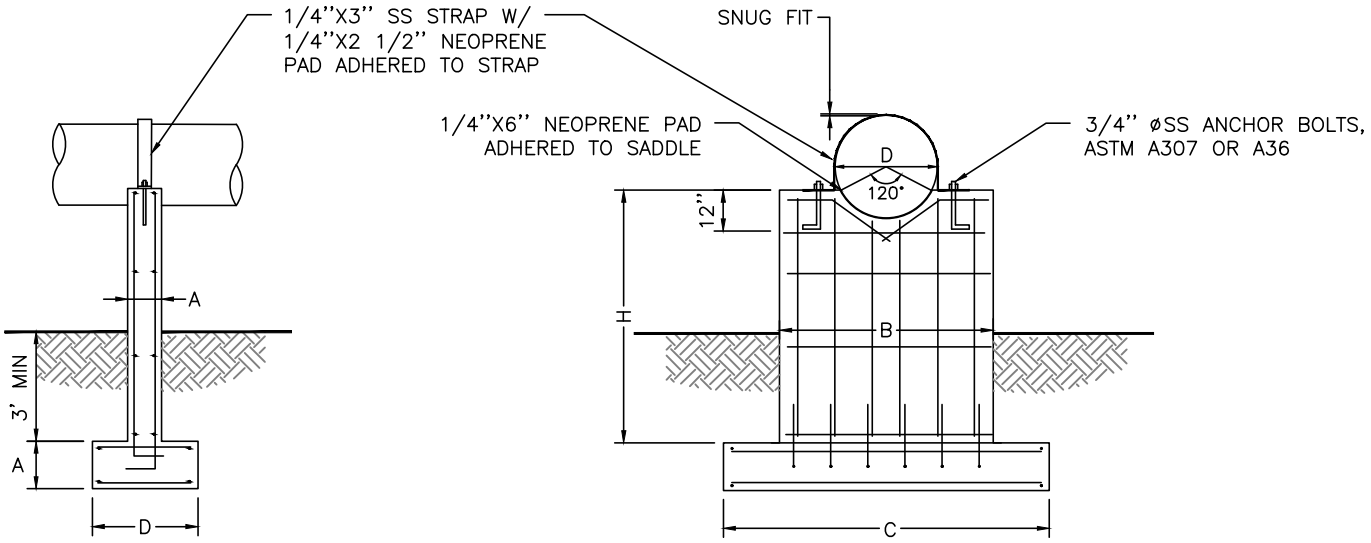
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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

AERIAL PIPE CROSSING

SD-37A

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-37A-B-Aerial Pipe Crossing.dwg Save Date: 10/2/2026 9:08 AM Plot Date: 10/2/2026 9:08 AM BODwyer



CASING PIPE DIA. "D" (IN)	"H" (FT)	THICKNESS "A" (IN)	PIER WIDTH "B" (FT)	FOOTING LENGTH "C" (FT)	FOOTING WIDTH "D" (FT)
6-12	<=6	12	2'-4"	5'-6"	3'-0"
	8	12	2'-4"	6'-3"	3'-0"
	10	12	2'-4"	6'-8"	3'-0"
	12	12	2'-4"	7'-2"	3'-0"
14-20	<=6	12	3'-0"	8'-0"	3'-0"
	8	12	3'-0"	9'-0"	3'-0"
	10	12	3'-0"	9'-10"	3'-0"
	12	14	3'-0"	10'-6'	3'-0"

NOTES:

1. SHALLOW FOUNDATION DESIGN SHOWN ON THIS DETAIL IS BASED ON THE FOLLOWING PARAMETERS:

   ALLOWABLE SOIL BEARING CAPACITY = 2000 PSF
   CONCRETE COMPRESSIVE STRENGTH = 4000 PSI
   GRADE 60 REINFORCING STELL
   MAXIMUM STREAM VELOCITY = 10FT/SEC
   MAXIMUM SUPPORT HEIGHT (H) =12'-0"
   IF FIELD CONDITIONS REQUIRE ANY DEVIATION FROM THESE PARAMETERS, THE FOUNDATION DESIGN SHALL BE REVIEWED BY THE DISTRICT.

2. IF SUBGRADE AT LOCATION OF SUPPORTS IS DEEMED UNABLE TO WITHSTAND 2000 PSF BEARING PRESSURE, A PILE SUPPORTED FOUNDATION SHALL BE UTILIZED AND DESIGNED. THE DESIGN SHALL BE APPROVED BY THE DISTRICT.

3. IF BEDROCK IS ENCOUNTERED WHICH WILL PREVENT 3 FT MINIMUM COVER OVER FOOTING, DOWELS SHALL BE DRILLED INTO BEDROCK PRIOR TO PLACING FOUNDATION.

4. 12 INCH AND 14 INCH THICK PIERS AND FOOTINGS SHALL BE REINFORCED WITH #5 BARS AT 12 INCHES O.C. IN EACH DIRECTION ON EACH FACE.

5. WHEN CONCRETE SUPPORTS ARE REQUIRED TO BE LOCATED WITHIN A STREAM AND ARE NOT COVERED WITH BACKFILL, MODIFICATIONS TO UPSTREAM FACE OF SUPPORT SHALL BE REQUIRED, AND SHALL BE REVIEWED AND APPROVED BY THE DISTRICT.

No.	BY	DATE	REVISION

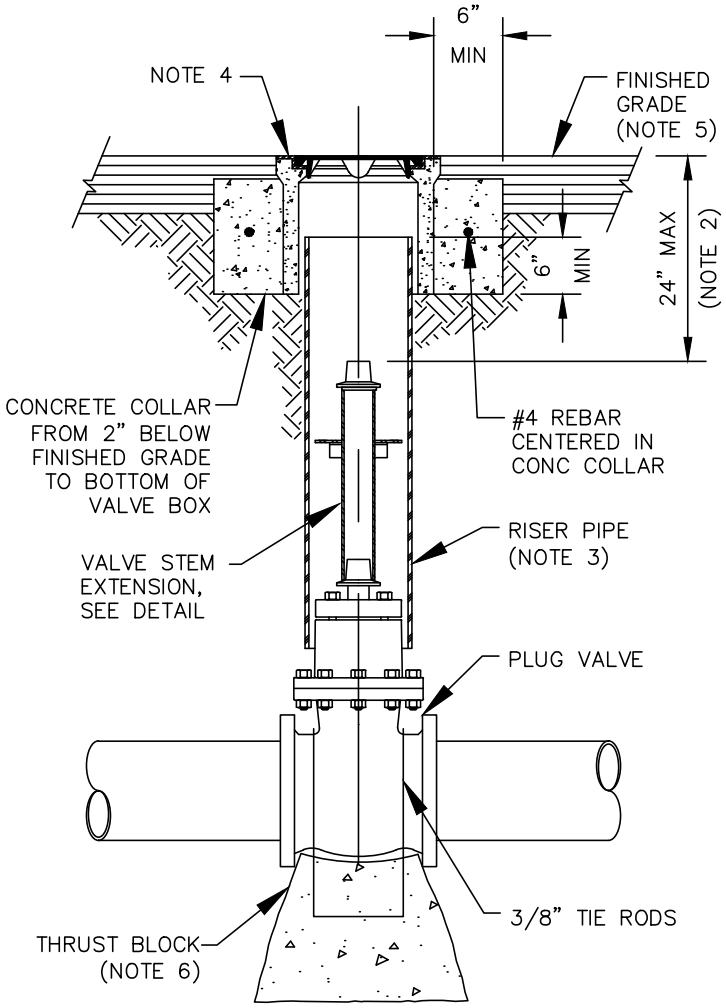
OCTOBER 2026

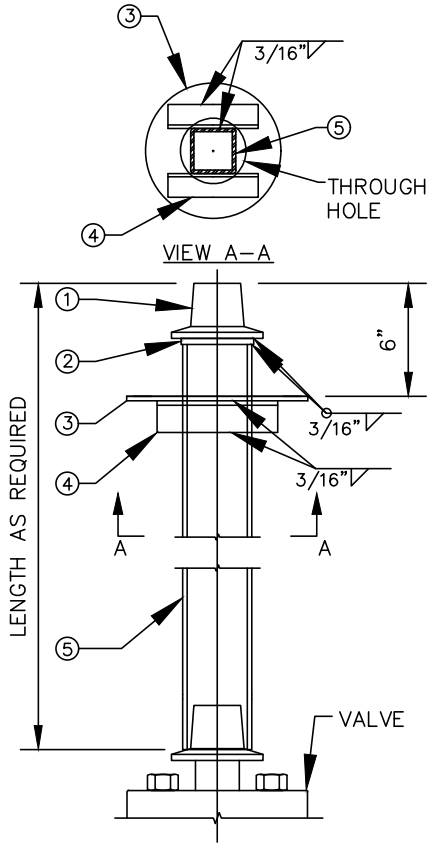
SAUSALITO-MARIN CITY SANITARY DISTRICT
STANDARD DRAWINGS

AERIAL PIPE CROSSING CONCRETE PIER DETAIL

SD-37B

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-37A-B-Aerial Pipe Crossing.dwg Save Date: 10/2/2026 9:08 AM Plot Date: 10/2/2026 9:08 AM BODwyer





No. VALVE STEM EXTENSION PARTS LIST (316SS)

①	VALVE OPERATING NUT OR 1–7/8" X 1–7/8" X 2" HIGH SOLID STEEL PIECE WELDED TO TOP PLATE.
②	3" X 3" X 1/4" STEEL TOP PLATE. WELD TO RISER SHAFT AFTER GUIDE PLATE IS IN PLACE.
③	3/16" THK X 7–1/2" DIA FREE SPINNING GUIDE PLATE, WITH 3–5/8" DIA HOLE IN CENTER.
④	TWO 3/16" X 1–1/2" X 1–1/2" X 5"L STEEL ANGLE WELDED TO TWO SIDES OF RISER SHAFT. (TO REINFORCE GUIDE PLATE.)
⑤	2–1/2" X 3/16" SQUARE STEEL TUBING LENGTH AS REQUIRED END WELDED TO GUIDE PLATE.

VALVE STEM EXTENSION DETAIL

NOTES:

1. ALL EXTERNAL BOLTS AND NUTS ON VALVES, AND ALL THE VALVE STEM EXTENSION PARTS LISTED SHALL BE TYPE 316 STAINLESS STEEL.
2. IF VALVE IS INSTALLED SO THAT THE TOP OF THE OPERATING NUT IS MORE THAN 24" BELOW FINISHED GRADE, A VALVE STEM EXTENSION SHALL BE REQUIRED.
3. RISER PIPE SHALL BE 8" DIA SDR 35 PVC SEWER PIPE CONFORMING TO ASTM 3034. RISER PIPE TO BE PLUMB AND CENTERED OVER VALVE STEM AND SHALL BE CONSTRUCTED FROM A SINGLE LENGTH OF PIPE WITH NO JOINT.
4. PRECAST VALVE BOX SET FLUSH WITH STREET SURFACE OR FINISHED GRADE WITH CAST IRON RING AND "SEWER" MARKING CAST INTO THE COVER. VALVE BOX SHALL BE H20 RATED AND PER DISTRICT'S APPROVED MATERIALS LIST.
5. BACKFILL AND SURFACE RESTORATION SHALL BE PER TYPICAL TRENCH SECTION, SEE SD-16.
6. THRUST BLOCK SHALL BE DESIGNED BY ENGINEER FOR SPECIFIC PIPELINE SIZE, PRESSURE, DEPTH, AND SOIL CONDITIONS. RESTRAINED JOINTS FOR MINIMUM DESIGNED LENGTHS FROM VALVE MAY BE USED IN LIEU OF THRUST BLOCK.
7. ALL WELDS TO VALVE STEM EXTENSION SHAFT SHALL BE FILLET WELDS, AS SHOWN.
8. ALL STEEL REQUIRED FOR EXTENSION FABRICATION SHALL BE STRUCTURAL STEEL PER ASTM A36.

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SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

FORCE MAIN VALVE

SD-38

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-38-Force Main Valve.dwg Save Date: 10/2/2026 9:09 AM Plot Date: 10/2/2026 9:09 AM BODwyer

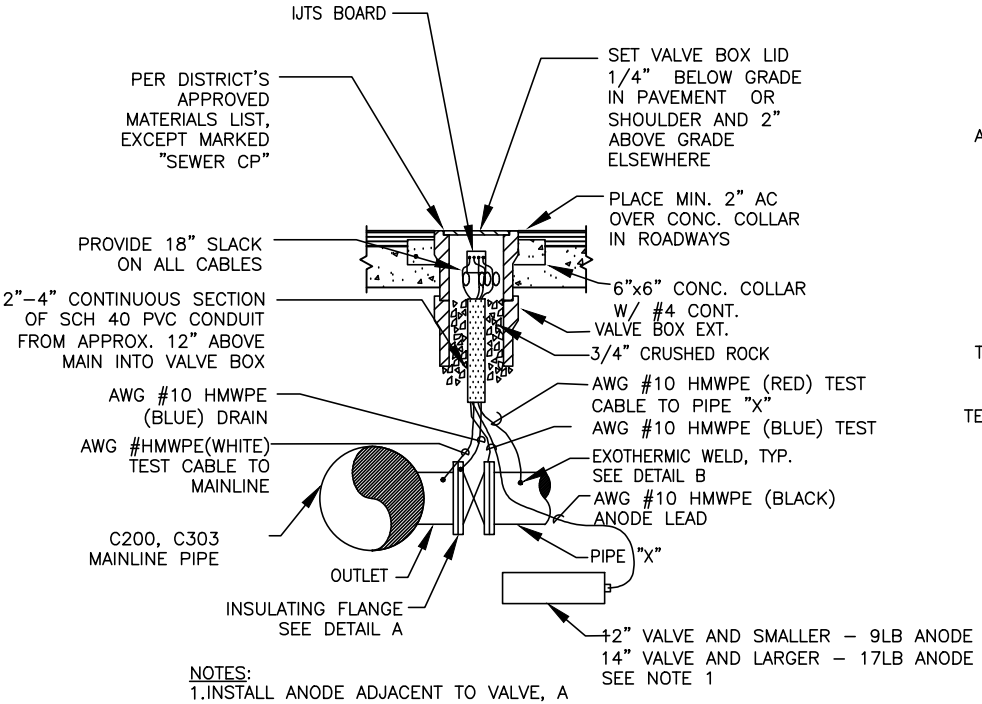
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SAUSALITO-MARIN CITY SANITARY DISTRICT
STANDARD DRAWINGS

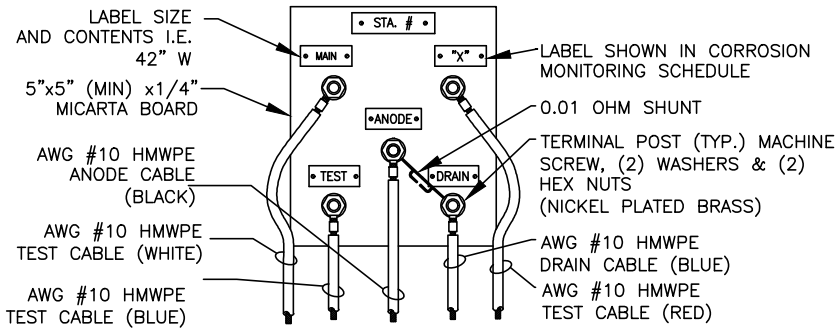
CATHODIC PROTECTION
STEEL OR DUCTILE IRON PIPE

SD-39

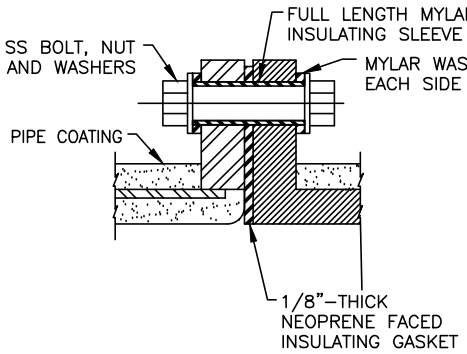


NOTES:
1. INSTALL ANODE ADJACENT TO VALVE, A MINIMUM OF 5' AWAY, AT OR BELOW
2. INVERT OF PIPELINE. PROVIDE CORROSION MONITORING SCHEDULE.

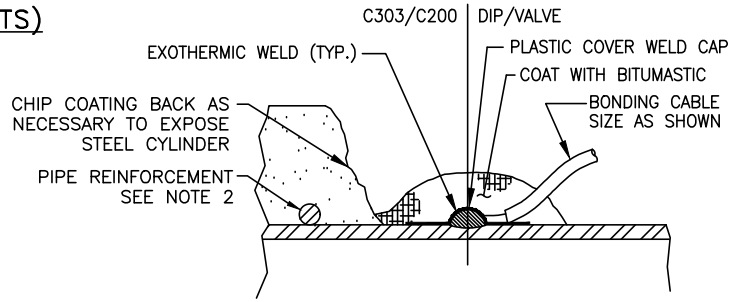
INSULATING JOINT TEST STATION (IJTS)
NTS



IJTS BOARD
NTS

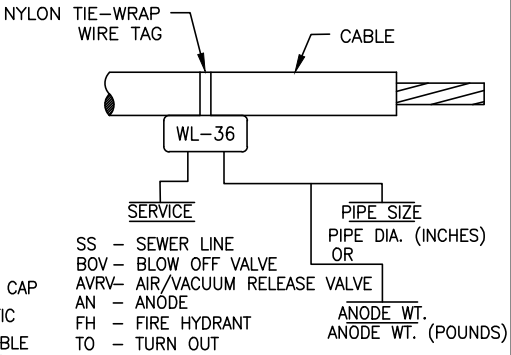


DETAIL A
INSULATING FLANGE
NTS



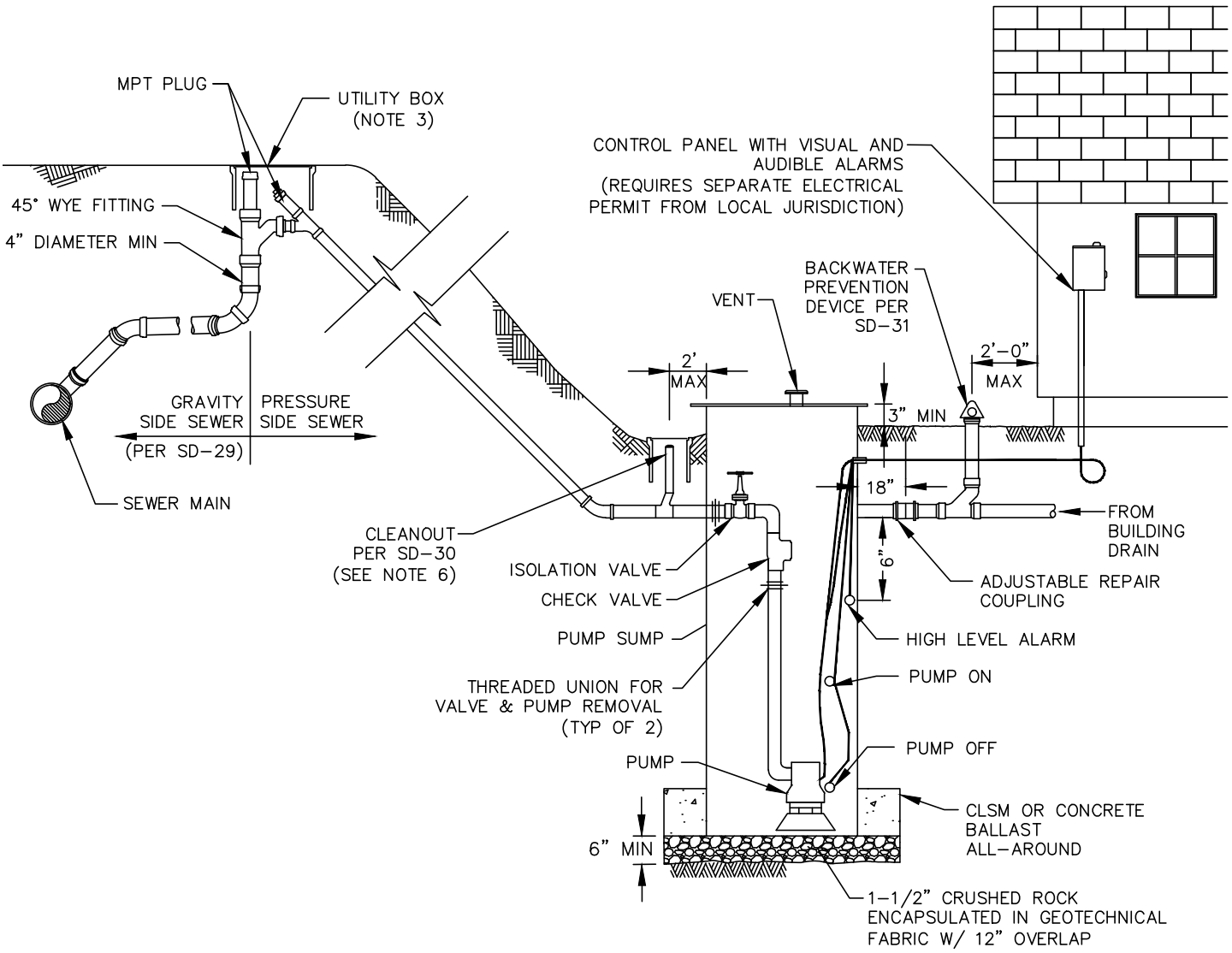
NOTES:
1. EXOTHERMIC WELDS SHALL NOT BE WELDED TO DUCTILE IRON (DI) CYLINDERS OF THICKNESS 10 GA. OR LESS WITHOUT APPROVAL OF THE ENGINEER.
2. PIPE REINFORCEMENT BARS MAY BE PUSHED APART AS NECESSARY TO INSTALL EXOTHERMIC WELD. DO NOT CUT REINFORCEMENT BARS. IF REINFORCEMENT BARS ARE CUT, TACK WELD ALL CUT ENDS TO DI CYLINDER.
3. COAT ALL EXPOSED DI WITH BITUMASTIC AFTER EXOTHERMIC WELD.
4. WHERE INSTALLING EXOTHERMIC WELD ON EPOXY COATED DI, GRIND EPOXY COATING TO EXPOSE DI, COMPLETE WELD AND APPLY EPOXY TOUCH-UP TO EXPOSED DI.
5. THIS DRAWING ILLUSTRATES MINIMUM CATHODIC PROTECTION FOR A DI CASING. CATHODIC DESIGN SHALL BE DONE BY A
6. CORROSION ENGINEER. CURB SHALL BE STAMPED "CP-FM" PER CONSTRUCTION SPECIFICATIONS SECTION 317.2.

DETAIL B
EXOTHERMIC WELD
NTS



NOTE: THE LETTERS AND THE NUMBERS SHALL BE MIN. 3/16-INCH IN SIZE.

CABLE ID TAG
NTS



SECTION
(N.T.S.)

NOTES:

1. REFER TO THE DISTRICT'S APPROVED MATERIALS LIST FOR PRE-APPROVED PUMP PACKAGES. PUMP INSTALLATION SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
2. PRESSURE PIPING AND FITTINGS SHALL BE SCH 80 PVC WITH SOLVENT WELDED JOINTS AND SDR-11 HDPE TESTED HYDROSTATICALLY FOR A MINIMUM 10 MINUTES AT 50 PSI. THREADED CONNECTIONS SHALL BE PROVIDED AS REQUIRED FOR CONNECTIONS OF VALVES, PUMPS, AND UNIONS.
3. IN NON-PAVED AREAS THAT ARE NOT SUBJECT TO VEHICLE LOADS, UTILITY BOX SHALL BE CHRISTY B16 WITH PRECAST CONCRETE COVER. IN PAVED AREAS OR AREAS SUBJECT TO VEHICLE LOADS, UTILITY BOX SHALL BE CHRISTY B1324 WITH STEEL COVER. LIDS SHALL BE MARKED "SEWER".
4. ISOLATION VALVE(S) AND CHECK VALVE(S) SHALL BE INSTALLED IN A PRECAST CONCRETE VALVE BOX EXTERIOR TO EJECTION TANK AND MADE ACCESSIBLE FOR MAINTENANCE PURPOSES. COVERS SHALL BE IN ACCORDANCE WITH THE DISTRICTS STANDARD SPECIFICATIONS.
5. CONTRACTOR SHALL LOCATE SUMP PUMPS AND CONFIRM NO STORM DRAINS PIPES ARE CONNECTED.
6. A THREAD PVC CAP SHALL BE USED IN THE PRESSURE SEWER PIPE SYSTEM.

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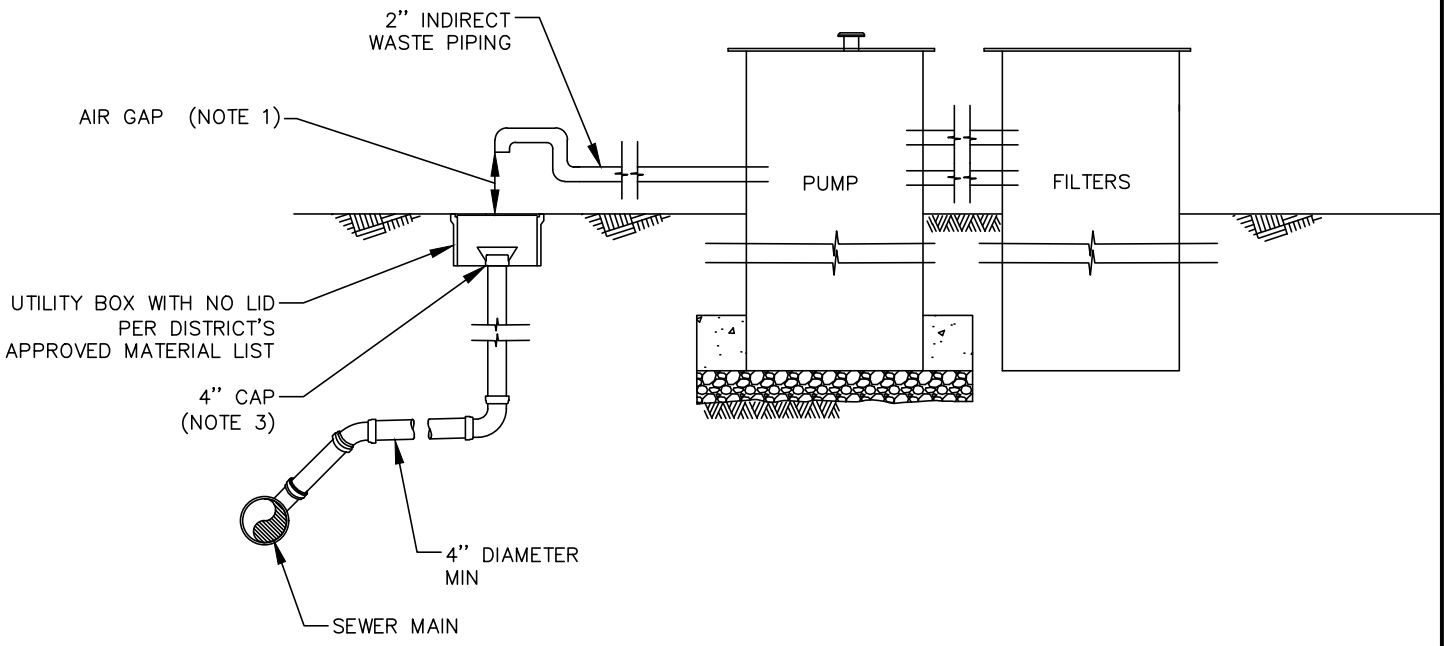
No.	BY	DATE	REVISION

SAUSALITO-MARIN CITY SANITARY DISTRICT STANDARD DRAWINGS

RESIDENTIAL LOT PUMPING SYSTEM

SD-40

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-40-Residential Lot Pumping System.dwg Save Date: 10/2/2026 9:09 AM Plot Date: 10/2/2026 9:09 AM BODwyer



NOTES:

1. **INDIRECT WASTE PIPING SHALL DISCHARGE INTO SEWER THROUGH AN AIR GAP. AIR CAP REQUIREMENTS SHALL BE PER CALIFORNIA PLUMBING CODE.**
2. **MOST INDIRECT WASTE DISCHARGES ARE LOCATED WITHIN THE BUILDING ENVELOP AND ARE IN THE LOCAL BUILDING DEPARTMENT'S JURISDICTION. THE DISTRICT REGULATES THESE DISCHARGES WHEN THEY ARE DISCHARGED INTO A SIDE SEWER.**
3. **THE DISTRICT PREFERS A "BOWL" SHAPE FITTING TO BE USED FOR 4" CAP.**
4. **AIR GAP SHALL BE USED ONLY WHEN APPROVED BY THE DISTRICT.**

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No.	BY	DATE	REVISION

SAUSALITO-MARIN CITY SANITARY DISTRICT
STANDARD DRAWINGS

RESIDENTIAL INDIRECT WASTE PIPING DISCHARGE

SD-41

P:_Projects\9272 SMCSD Std Specs And Details\CAD\2026_SD-41-Air Gap.dwg Save Date: 10/2/2026 9:09 AM Plot Date: 10/2/2026 9:09 AM BODwyer

APPENDICES

Appendix A

Overview of Side Sewers Requirements

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SAUSALITO-MARIN CITY SANITARY DISTRICT

OVERVIEW OF SIDE SEWER REQUIREMENTS

The following is an overview intended to assist applicants and contractors in understanding the necessary steps, design requirements, and construction requirements regarding repair/replacement, new construction, connection, and/or abandonment of side sewers.

All side sewers within Sausalito-Marin City Sanitary District (District) must conform to the District's Standard Specifications and Drawings and Sanitary Code, copies of which are available from the District office. In particular, see the District's Standard Specification Section 02600, Side Sewers and Standard Drawings SD-29 through SD-37 for more information.

DEFINITIONS:

Side Sewer: The privately owned and maintained sewer which connects the plumbing system of the building to the public sewer main. The side sewer begins at and includes the connection to the public sewer main and terminates at the point of connection to the building plumbing system.

Main Sewer: A publically owned sanitary sewer pipeline which accommodates one or more side sewers. These sewers are typically six (6) inches or larger in diameter.

SECTION 1 - GENERAL

1.01 JURISDICTION

The District has jurisdiction over all property to receive sewer service within the District's boundaries. District jurisdiction includes, but is not limited to: issuing permits to repair or connect to the main sewer, specification of design, type of material, construction requirements, inspection, and testing.

1.02 OWNERSHIP AND MAINTENANCE

Each building's side sewer, including sewer ejector pump system if applicable, is owned and maintained by the owner of the building served thereby.

1.03 LIABILITY

The District and its officers and employees shall not be liable for injury or death to any person, or damage to any property, arising during or growing out of, the performance of any work described herein.

1.04 CALIFORNIA ENVIRONMENTAL QUALITY ACT REQUIREMENTS

Any person requesting a sewer connection permit must also comply with all applicable environmental guidelines, including the District's Local Guidelines adopted pursuant to the Environmental Quality Act of 1970, and must make all deposits required and pay all fees established by the District to process applications to comply with said Act.

OVERVIEW OF SIDE SEWER REQUIREMENTS

1.05 PROHIBITED WASTES

A. Except as hereinafter provided, it is unlawful for any person to discharge, or cause to be discharged, any of the following described waters or wastes into any manhole or sanitary sewer line connecting to the main sewer:

1. Drainage: Leaders from roofs and surface drains for rainwater. Surface or subsurface drains for rainwater, stormwater, seepage, industrial cooling water, or unpolluted industrial process waters.

2. Swimming pool or spa discharge water, except when in compliance with Appendix B to the District's Standard Specifications, Requirements for Draining Swimming Pools and Spas to Sanitary Sewer System.

3. Septic tank sludge.

4. Industrial waste or any solid, semisolid, or liquid substance resulting from any industrial manufacturing, commercial process, or from any garage, service station, or wash rack, without first having obtained a permit to discharge.

5. Liquid or vapor having a temperature higher than 150° F.

6. Water or waste which contains more than 100 parts per million, by weight, of fat, oil, or grease.

7. Garbage that has not been shredded so that all particles will be carried freely under the flow conditions normally prevailing in the main sewer, with no particle greater than one-half inch in any dimension.

8. Ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, paunch manure, or any other solid or viscous substance capable of causing obstruction to the flow in sewers or causing other interference with the proper operation of the sewage works.

9. Waters or wastes having a PH lower than 5.5 or higher than 9.0 or having any other corrosive property capable of causing damage or hazard to structures, equipment, and personnel of the sewage works.

10. Waters or wastes containing toxic or poisonous substance(s) in sufficient quantity to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals, or create any hazard in the receiving waters of the sewage treatment plant.

11. Waters or wastes containing suspended solids of such character or quantity that unusual attention or expense is required to handle such materials at the sewage treatment plant.

12. Noxious or malodorous gas or substance capable of creating a public nuisance.

SECTION 2 - PERMITS AND INSPECTIONS

2.01 BUILDING PERMIT (FOR NEW BUILDINGS)

A. Obtain permit from building department of jurisdiction prior to performing any work.

B. Plans Required.

1. Plans approved by the building department of jurisdiction must be furnished to the District upon making application for a sewer connection permit for new structures. Said plans must show the location of the proposed structure(s), floor plans showing plumbing fixtures, including any floor drains, and the location of the side sewer including size, slope, type of material to be used, and type of connection to public sewer. The District may require a survey by a registered land surveyor or engineer if it is necessary to determine:

   a. The invert elevation of the side sewer and/or building floor

   b. That the proposed sewer installation is within the property line or easement.

2.02 ENCROACHMENT PERMITS (AS REQUIRED)

If installation of the side sewer requires digging in a street or public right-of-way, applicant must obtain the necessary encroachment permit from the city, town, or county having jurisdiction over the street or right-of-way. Side sewer work located in a District easement or public right of way may not be done by the property owner and must be performed by a properly licensed contractor who has been registered with District.

2.03 DISTRICT PERMIT

A. A permit from the District is required for any alteration, repair, replacement, new construction, connections, or abandonment/ disconnect to side sewers that flow to the District's public sewer system. Work performed without a valid District permit will be subject to removal, reconstruction, and additional fees to the property owner. To obtain a permit from the District:

1. Complete the District's application form for the proposed side sewer work.
2. Provide a set of approved plans showing work to be performed and plumbing fixtures.
3. Provide previously obtained Building Permit Number.
4. Provide copy of encroachment permits (if applicable).

5. Determine appropriate fees to District per District's application forms. Payment of fees must be made to District by cashier's check or money order.

B. Permits are Non-Transferable: Permits are issued for a specific property giving the property's street address and Assessor's Parcel Number. Permits may not be transferred to another property without written approval of the District Board of Directors.

C. Time Limit on Permits: The sewer permit becomes void and the fees paid are forfeited under the following conditions:

1. Work is not commenced within one year from date of issue; or

2. After partial completion, work is discontinued for a period of one year. Work may not begin/resume until a new, valid sewer connection permit is obtained. The new sewer connection permit will be issued upon application and payment of applicable fees.

2.04 ARRANGE FOR DISTRICT INSPECTIONS

A. Minimum 48-hour advance notification required for all District inspections.

B. The cameras used for inspections shall be equipped with footage counters.

C. Prior to District arriving on-site for inspection, Contractor shall have backfill materials present and the pipe having completed or currently under pressure test. If when the District arrives these conditions are not met, the Contractor will have a grace period of 15 minutes. If the grace period expires before these conditions are met, then the inspection will be considered a failure. It will be the responsibility of the Contractor to reschedule and pay associated rescheduling fee.

D. It is the responsibility of the sewer contractor to arrange for any additional and necessary District inspections as the work progresses.

E. When the side sewer work is completed, a District inspector will provide a final inspection upon 48-hour notification by the sewer contractor.

F. Work performed without inspection will be required to be exposed and tested in the presence of the District Inspector at the property owner or Contractor's expense.

OVERVIEW OF SIDE SEWER REQUIREMENTS

2.05 COMPLIANCE WITH REGULATIONS

A. A copy of all required permits must be kept at the job site when the side sewer is being constructed.

SECTION 3 - DESIGN REQUIREMENTS:

3.01 PIPE SIZE

A. Per District Standard Specification Section 02600 SIDE SEWERS, the inside diameter of side sewers shall meet the following requirements:

1. The pipe must conform to the size requirements for horizontal drainage based on the Equivalent Dwelling Unit (EDU) as set forth by the Marin County Assessor's office records, or fixture unit loading as set out in the Uniform Plumbing Code. Minimum pipe inside diameter shall be as follows:

Number of EDUs	And/Or	Number of Fixture Units	Min Inside Diameter
Less than 3	and	Less than 150	4 inch
Greater than or equal to 3	or	Greater than or equal to 150	6 inch

a. In no event will a side sewer be permitted to connect to a sewer of lesser inside diameter on the downstream side.

b. When more than one building sewer is allowed to be connected to a single side sewer, the side sewer from the point of intersection of one or more building sewers to the main sewer shall be calculated and submitted to the District for the proper size, and the approval shall be at the District's discretion.

2. Min. pipe diameter is 2" for drains serving a single outdoor kitchen sink.

3.02 PIPE MATERIAL

A. Pipe materials shall be per the Side Sewer Piping Schedule in the District's Approved Materials List, see attachment.

B. All side sewer pipe material between structures shall be of the same type and material, unless otherwise permitted by the District.

3.03 PIPE ALIGNMENT

A. Side sewers must be laid by the shortest route from the main sewer connection to the building plumbing outlet.

OVERVIEW OF SIDE SEWER REQUIREMENTS

3.04 SLOPE

A. Per District Standard Specification Section 02600 SIDE SEWERS, slopes of side sewers shall conform to the following:

1. The minimum slope of side sewers shall be as follows:

Pipe Nominal Size (Inches)	Minimum Slope (Percent)
4	1.5
6 or larger	0.7

2. Max slope of any portion of a side sewer shall not be greater than 150 percent.

3.05 COVER

A. Per District Standard Specification Section 02600 SIDE SEWERS, cover requirements for side sewers shall conform to the following:

1. Minimum cover between the top of side sewer piping and finished grade shall be as follows:

Location	Min Cover (feet)
Traffic Areas	3
Non Traffic Areas	1.5

a. In non-paved areas that are not subject to vehicle loads, District approval will be required for any side sewer that cannot meet this minimum cover requirement. Special pipe materials, pipeline protection, and/or special backfill materials may be required.

b. If the side sewer has less than three (3) feet of cover within the street right-of-way, Ductile Iron Pipe (DIP) shall be used in accordance with Section 15061, **DUCTILE IRON PIPE (DIP)**

3.06 BACKWATER PROTECTION DEVICES

Per District Standard Specification Section 02600 SIDE SEWERS, the following are requirements for backwater protection devices (BPDs) on side sewers:

1. A new BPD will be required for any and all repairs or alterations to existing side sewers that do not have an existing and properly functioning BPD in place.

2. A BPD is required at every location where sanitary sewer piping exits a building. Multiple BPDs may be required for some buildings. If multiple pipes that exit a building are within five feet of each other, only one BPD may be required.

3. BPDs shall be located within two (2) feet of the building foundation.

4. Elevation Requirements: BPDs shall be installed at an elevation that protects the property from damage and at least 6 inches below the lowest fixture unit in the building.

    a. The Property Owner or Contractor is responsible to confirm that the backwater prevention device is at the proper elevation.

    b. If any subsequent modification of the property results in the BPD being at an improper elevation, the Property Owner or Contractor shall adjust the BPD to the proper elevation at their cost.

5. See attached District Standard Drawings for Type 1 and Type 2 BPDs. Type 1 BPDs will typically be required.

    a. Type 2 Backwater Prevention Devices shall only be used in areas with potential for flooding, where a Type 1 backflow cannot be installed, where extendable backwater valves are required, or where required by the District.

3.07 CLEANOUTS:

A. Per District Standard Specification Section 02600 SIDE SEWERS, the following are requirements for cleanouts on side sewers:

1. Cleanouts shall be installed at the following locations on side sewers:

    a. When there are more than one building and the side sewers run from one building to the other, cleanouts shall be installed where the side sewer enters each building, and a cleanout and/or BPD shall be installed where the side sewer exits each building.

    b. Within two (2) feet of the building foundation.

    c. At or near the property line or public right of way line.

    d. At intervals not to exceed ninety (90) feet of laid pipe length. If two-way (Tee) cleanouts are being installed at both ends, the length shall be one hundred and eighty (180) feet.

    e. At any single bend, or any combination of bends that are greater than forty-five degrees (45°).

f. At intervals along the side sewer system where the cumulative total of deflection from the point of connection to the main sewer or from another cleanout equals or exceeds ninety degrees (90°)

g. At locations where there is a pipe material change, a cleanout shall be installed with secured plug to prevent from overflow.

2. The cleanout(s) nearest the building foundation shall be provided with a BPD.

3. Property line cleanouts shall be a two-way, wye, or a "Tee" as specified below,

a. PVC 900: Two-way

b. HDPE: Wye (facing sewer main)

c. Sch 80: Wye (facing sewer main)

d. CIP/DIP: "East Bay Code" Two-way

e. Blow off: Tee

f. BPD: Tee

Contractor is advised to discuss with property owner, and the District encourages the use of those per District's Approved Material list.

4. All risers on property line cleanouts shall be installed vertically. If there is a utility conflict preventing property line cleanouts being installed vertically, a one-way cleanout shall be installed with a bend making the rise vertical, allowing clearance for the cleanout.

3.08 BACKWATER CHECK VALVES

A. Per District Standard Specification Section 02600 SIDE SEWERS, the following are requirements for backwater check valves:

1. Extendable backwater check valves shall be installed on a side sewer if the difference in elevation between the lowest fixture unit in the building and the backwater prevention device is less than six (6) inches.

2. Installation requirements for extendable backwater check valves shall be determined by District or its appointed Representative for the given field conditions.

3. Extendable backwater check valves shall be per the District's Approved Materials List.

3.09 CONNECTIONS TO SEWER MAINS

A. Connections of side sewers to sewer mains shall be per District Standard Specification Section 02600 SIDE SEWERS and the District's Approved Materials List, as follows:

Sewer Main Pipe Material	Connection Type
VCP, PVC, DIP, CIP, or ACP	New Wye Fitting[1,2]
HDPE	Electrofusion Saddle , or Sidewall (Saddle) fusion fitting[3]
Ex Pipe Lined w/ CIPP	Tap Connection[4]

1. The Contractor shall cut and remove a portion of the existing main as required. Install a new wye fitting, spools of pipe, and adjustable repair couplings for connection the existing main (perform a pipeline spot repair with a new wye fitting).

   a. If the new wye fitting is within 12 inches of an existing joint on the main line, the installation and replacement of the main shall extend beyond the joint (i.e. the joint shall be cut and removed). The new pipe material shall match the existing main, unless otherwise noted.

2. Tap connections (in lieu of a new wye fitting) may be used for connections to existing sewer mains with an inside diameter of 10 inches or larger. Tap connections shall be per the District's Approved Materials List.

3. Electrofusion saddles, or/and Sidewall (Saddle) fusion fittings shall be per the District's Approved Materials List.

4. Remove host pipe and connect tap connections to existing CIPP liner. Tap connection shall be per District's Approved Materials List.

3.10 PIPE BURSTING OF SIDE SEWERS

A. Pipe bursting rehabilitation of side sewers with a minimum of three (3) feet of cover within street right of ways may be performed with District approval.

1. The Contractor shall perform pre-CCTV of the side sewer prior to ordering materials in accordance with Section 02345, PIPE BURSTING and Section

02300, CLEANING AND INSPECTION OF SATNITARY SEWER MAINS. The District may reject the use of pipe bursting method for rehabilitation of side sewers based on the pre-installation CCTV.

2. Pipe bursting of side sewers shall be performed in accordance with Section 02345, PIPE BURSTING.

3. The Contractor shall provide air gaps between existing utilities, repair surface upheaval, and repair sags in accordance with Section 02345, PIPE BURSTING, and the Standard Drawings.

B. The Contractor shall allow a minimum of 6 hours for new HDPE pipes to "relax" prior to final inspection.

3.11 CURED-IN-PLACE REHABILITATION OF SIDE SEWERS:

A. CIPP rehabilitation of side sewers may be performed only upon prior approval by the District and if a special condition exists. Per District Standard Specification Section 02600 SIDE SEWERS, CIPP rehabilitation of side sewers shall conform to the following:

1. CIPP products for side sewer rehabilitation shall be per the District's Approved Materials list.

2. The Contractor or subcontractor installing the CIPP shall be certified by the lining manufacturer. Submit experience and Certification to the District for review.

3. Perform pre-CCTV of the side sewer prior to ordering materials in accordance with District Standard Specification Section 02315, CURED-IN-PLACE PIPE (CIPP) and Section 02300, CLEANING AND INSPECTION OF SATNITARY SEWER MAINS. The District may reject the use of CIPP method for rehabilitation of side sewers based on the pre-installation CCTV.

4. The Applicant or Contractor shall be required to repair or replace the side sewer connection to the mainline as part of the construction work/permit (No hammer tap connections shall be allowed). If the connection to the main is in suitable condition, as determined by the District, then connection rehabilitation may be performed by trenchless methods, as specified in District Standard Specification Section 02315, CURED-IN-PLACE PIPE (CIPP) and per the District's Approved Materials List.

3.12 OLD SIDE SEWERS

Per District Standard Specification Section 02600 SIDE SEWERS, a new structure is not permitted to connect to an old side sewer unless the old side sewer is tested and inspected in the presence for a District Inspector and found to meet all current District Requirements. Inspection shall comply with District Ordinance 66.

OVERVIEW OF SIDE SEWER REQUIREMENTS

3.13 ABANDONING SIDE SEWERS

A. When abandoning side sewers connected to the main sewer, including side sewers from structures that are demolished, the connection to the main must be dug out, cut away, and plugged with a solid piece of pipe of the same size and material. Plugging off must be done in the presence of a District Inspector.

B. Abandonment of side sewer piping shall be in accordance with Section 02050, DEMOLITION, ABANDONMENT AND REMOVAL. The side sewer to be abandoned shall be either completely removed, or abandoned in place and completely filled with controlled low strength material (CLSM) or low density cellular concrete (LDCC), per Section 02200, EARTHWORK. Provide ventilation during abandonment to allow air to escape from side sewers.

3.14 INDIVIDUAL LOT PUMPING SYSTEMS:

A. Sumps shall be installed outside the perimeter of the building envelope.

B. Where gravity service is not feasible, special application may be made to the District to allow installation of a sewer ejector pump system in accordance with District Standard Specification Section 13100, INDIVIDUAL LOT PUMPING SYSTEMS and per the attached Standard Drawing SD-40. The District must approve the design of the system, and the District reserves the right to prohibit the installation of an individual lot pumping system.

C. When the installation of an individual lot pumping system is approved by the District, the installation of the pumping system, electrical work, and the sump shall meet the codes and regulation of the building department of jurisdiction issuing the building permit and shall be inspected by the said department (Electrical only).

D. See attached District's Approved Materials List for approved packaged pump stations.

3.15 INTERCEPTORS

As required in District Standard Specification Section 02600 SIDE SEWERS, for commercial side sewers, grease, oil, and/or sand interceptors must be installed where required by the District or the Central Marin Sanitation Agency (CMSA) for proper handling of liquid wastes grease in excessive amounts, flammable wastes, sand, or other substances capable of causing Public nuisance, damage or hazards to structures, equipment, and personnel.

3.16 EXISTING SEPTIC TANKS

A. Septic tanks are under the jurisdiction of Marin County Environmental Health Services. Marin County Environmental Health Services must be notified when a septic tank is to be abandoned or encountered during installation of a side sewer.

B. The District's requirements are, per District Standard Specification Section 02600, SIDE SEWERS:

1. All building plumbing outlets must connect to the side sewer and completely bypass the septic tank.

2. The septic tank must be abandoned following the Uniform Plumbing Code and the regulations of the Marin County Environmental Health Services.

SECTION 4 - CONSTRUCTION

4.01 EXISTING SIDE SEWER LOCATIONS

A. Per District Standard Specification Section 02600, Side Sewers, where an existing side sewer or its connection to the main is to be replaced or rehabilitated, it is the responsibility of the property owner or their contractor to locate and uncover the existing side sewer to serve the property.

1. When the lateral stub or wye cannot be located, even though the District's records indicate such a connection exists, the side sewer must be connected to the main sewer at a location designated by the District at the expense of the property owner.

2. The District does not guarantee the presence or location of lateral stubs or wyes.

4.02 NEW SIDE SEWER LOCATIONS

A. Perform the following per District Standard Specification Section 02600 SIDE SEWERS:

1. Prior to installation of side sewers in subdivisions, the lot corner nearest the side sewer and the lateral sewer terminus shall both be staked and flagged in the field.

2. Where curbs, gutters and/or sidewalks exist or are to be a part of an improvement, the location of each lateral sewer shall be permanently marked by imprinting an "S" (2" size) or by chiseling an "S" (4" size) in the concrete surface vertically above the lateral sewer pipe. The "S" shall be

marked on the curb, gutter or on the sidewalk. It shall be the Contractor's responsibility for providing the marking and for its accuracy.

4.03 BYPASS PUMPING

When performing work on side sewers, the Contractor shall bypass wastewater around the work area in accordance with the requirements of District Standard Specification Section 02145, SEWAGE FLOW CONTROL AND BYPASSING, or shall arrange with the Property Owner to temporarily shut down the side sewer. The Contractor shall ensure that no wastewater is discharged from the side sewer to the excavation.

4.04 TRENCHING

A. Trenching and backfill shall be per District Standard Specification Section 02200, EARTHWORK and the Typical Trench Section in the Standard Details.

B. Per District Standard Specification Section 02600 SIDE SEWERS, the District may reserve the right to require compaction tests for trench backfill by a soils engineer. The cost of compaction test must be paid by the Contractor or property Owner.

4.05 PIPELINE INSTALLATION

A. Side sewers shall be installed per District Standard Specification Section 15050, GENERAL PIPING:

1. Sewer pipelines shall be laid upgrade from the point of connection to the existing sewer main with the bell end at the upgrade end of each pipe length.

2. Layout of deflections and/or curves shall conform to the requirements specified in the applicable section of the District's Standard Specifications for the particular pipe material being used.

3. Per District Standard Specification Section 02600 SIDE SEWERS, the side sewer shall be installed using an industrial-standard laser grade control system to confirm that the pipe is installed to the proper grade for the following:

   a. Wherever available slope is less than two percent (2%)

   b. When length of the side sewer is greater than one hundred (100) feet

4. Where it becomes necessary to modify the design pipe alignment to resolve conflicts with unforeseen obstructions or other causes, the

Contractor shall propose a revised alignment to the District or the District's Representative for consideration. Such revision may be made by the deflection of joints, by the use of fittings or by forced bending of the pipe if permitted, however, in no case shall the deflection in the pipe or at any joint exceed the maximum deflection recommended by the pipe manufacturer.

5. The Contractor shall take all necessary precautions to prevent excavated or other foreign material from getting into the pipe during the laying operations. At all times when laying operations are not in progress and at the close of the day's work, the openings of all pipe and specials, whether in the trench or in storage, shall be protected with suitable bulkheads to prevent unauthorized access by persons, animals, water, or any undesirable substance. If debris is observed downstream of work, it is the responsibility of the Contractor to clean and CCTV the main lines.

6. The Contractor shall prevent the pipe from floating during and after its installation.

B. Per District Standard Specification Section 02600, SIDE SEWERS, electronically detectable warning tape shall be installed above all side sewer piping installed by open trench method.

4.06 REPAIRS TO EXISTING SIDE SEWERS

A. Repairs to side sewers shall be as shown in the attached District Standard Details, and per District Standard Specification Section 15050 GENERAL PIPING.

1. The replacement pipe shall be squarely cut approximately one-half (1/2) inch shorter than the missing section, providing no larger than a one quarter (1/4) inch gap between pipes on each side.

2. When repair of a damaged section of pipe is required within eighteen (18) inches of a pipe joint, the replacement section shall extend to and include the joint.

3. Where repair couplings are permitted, couplings shall be per the District's approved materials list.

4. The District Inspector may require replacement of broken, damaged or improper pipe or fittings discovered during sewer repair or replacement work.

4.07 LEAKAGE TESTING GRAVITY SIDE SEWERS

A. Perform leakage testing in accordance with District Standard Specification Section 02735, SANITARY SEWER SYSTEM TESTING.

1. Air test at a minimum of 5 psi for a minimum period of fifteen (15) minutes. If the pressure remains constant during the test period, the line has passed. If the pressure drops during the test time, the line has failed the test.

    a. Hydrostatic testing of gravity pipelines may be performed in lieu of air testing if approved by the District. Fill segment with water to an elevation ten (10) feet above the top of pipe at the upstream end of the test section, or ten (10) feet above the existing groundwater elevation, whichever is greater. If the water level is maintained for a minimum of fifteen (15) minutes, the line has passed.

4.08 CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION:

A. Perform cleaning and television inspection in accordance with District's Standard Specification Section 02300, CLEANING AND INSPECTION OF SANITARY SEWER MAINS.

1. Pre-installation CCTV inspection will be required for side sewers to be rehabilitated by pipe bursting or CIPP method. Submit videos to the District for review.

2. Post installation inspection will be required for all side sewer installations and repairs.

4.09 EROSION CONTROL

A. Provide erosion control per District Standard Specification Section 02270, EROSION CONTROL.

1. Erosion control measures shall be in accordance with the requirements of Marin County Stormwater Pollution Prevention Program (MCSTOPPP), the San Francisco Bay Region Regional Water Quality Control Board (RWQCB), and the State Water Resources Control Board (SWRCB).

2. The District may require the installation of trench dams per the Standard Details.

4.10 SURFACE RESTORATION

A. The Contractor shall restore the area affected by its side sewer installation operations in kind and accordance with the requirements of any encroachment permits (if applicable), District Standard Specification Section 02050, DEMOLITION, and Section 02900, PROTECTION OF TREES AND RESTORATION OF LANDSCAPING.

OVERVIEW OF SIDE SEWER REQUIREMENTS

4.11 SPECIAL CONDITIONS

When encountering special conditions which are not covered by District Standard Specifications and/or Code, a District Inspector and/or the District Engineer will direct the Contractor or property owner in the required procedures.

Appendix B

Side Sewer
District Approved Materials

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SIDE SEWER
PIPING SCHEDULE

Side sewer piping shall be the following, unless otherwise approved, specified, or directed by the District:

Gravity Side Sewers			
Installation Method and Conditions	**Pipe Material**	**Joint type**	**Spec Section**
Open Trench. Typical, unless otherwise required below	PVC C900/C905, DR 18 or thicker, Or High Density Polyethylene, DR17	Bell and Spigot, Or Butt-Fusion Welded, de-beaded	Section 15064, **POLYVINYL CHLORIDE (PVC) PIPE**, Or Section 15066, **HIGH DENSITY POLYETHYLENE (HDPE) PIPE**
Open Trench.<3 ft cover in ROW w/o pipe protection, or at utility crossings	C-900 DR18	Bell and Spigot	Section 15064, **POLYVINYL CHLORIDE (PVC) PIPE,** Install Concrete Cap, Use #3 rebar, 8" O.C.
Open Trench. <3 ft cover in ROW w/o pipe protection, or at utility crossings	Ductile Iron Pipe, Min Class 53	Push-On	Section 15061, **DUCTILE IRON PIPE (DIP)**
Pipe Bursting, Reaming, and/or HDD (min 3 ft cover in ROW)	High Density Polyethylene	Butt-Fusion Welded, de-beaded	Section 15066, **HIGH DENISTY POLYETHYLENE (HDPE) PIPE**
Exposed Piping	Ductile Iron Pipe, or Cast Iron Pipe, Or, UV Rated HDPE, DR17	Push-on/bell & Spigot, or stainless steel shear banded coupling* Or, Butt-Fusion Welded, de-beaded	Section 15061, **DUCTILE IRON PIPE** **Cast Iron Pipe** per ASTM A74, Or Section 15066, **HIGH DENSITY POLYETHYLENE (HDPE) PIPE**

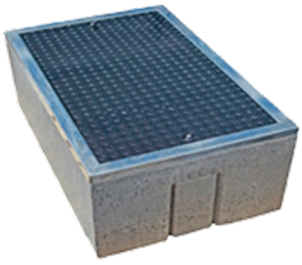
*Exposed SS shear band is acceptable, and shall be approved by the District in the rare case where burial is not possible, i.e. in laterals suspended on the side of or under bridges.

Pressure Side Sewers (Discharge from Individual Lot Pump Stations)			
Installation Method and Conditions	**Pipe Material**	**Joint type**	**Spec Section**
Open Trench. Typical	PVC Schedule 80, Or High Density Polyethylene, DR11	Solvent Welded, Threaded as required, Or Butt-Fusion Welded, de-beaded	Section 15064, **POLYVINYL CHLORIDE (PVC) PIPE** Section 15066, **HIGH DENSITY POLYETHYLENE (HDPE) PIPE**
Pipe Bursting, Reaming, and/or HDD (min 3 ft cover in ROW)	High Density Polyethylene, DR11	Butt-Fusion Welded, de-beaded	Section 15066, **HIGH DENISTY POLYETHYLENE (HDPE) PIPE**

UTILITY BOXES

All lids shall be **marked/labeled "Sewer"** as available, unless otherwise noted.

LOCATION	ITEM DESCRIPTION	PRODUCT
Traffic Areas (including all paved areas and driveways)	Cleanout Boxes	Christy B16 (Only used if it is not for H20 load rated) Christy B1017 or G05 w/Cast Iron Lid
	Backwater Prevention Devices (Type 2)	Christy V12 Box w/V12-71W Grate
	Backwater Check Valves	Christy B1017 w/Cast Iron Lid
	Box at end of pressure side sewer (for private pump stations)	Christy B1324 w/Steel Cover
Non-Traffic Areas	Cleanout Boxes	Christy B09 Box, Old Castle F8 w/ Precast Concrete Lid
	Backwater Prevention Devices (Type 2)	Christy V09 Box (Christy B09 box w/ V09-71C Grated Cast Iron Lid)
	Box at end of pressure side sewer (for private pump stations)	Christy B16
	Backwater Check Valves *Required to get written approval from District Engineer	Christy B09 Box, w/Precast Concrete Lid



Christy B1017





Christy V12 Box w/ V12-71W Grate



Christy B09



Christy V09



Old Castle F8, Christy G05, or Equal

GEOTEXTTILE FABRIC

Geotextile fabric for laying and wrapping/separating backfill materials shall be manufactured by, or approved equal:

1. Mirafi, 140N
2. US Fabrics, US 135NW
3. Carthdage Mills, FX-45HS

ADJUSTABLE REPAIR COUPLINGS

Use for connecting Ductile Iron pipelines, Cast Iron Side Sewers pipelines, and dissimilar pipe materials. Banded rubber couplings shall have four (4) clamps and metal shear bands.

All hardware shall be Type 316 Stainless Steel, including shear bands.

Adjustable repair couplings shall be manufactured by, or approved equal:

1. Fernco, 5000 Series RC Coupling, w/ all type 316 SS hardware
2. Mission Rubber Company, Adjustable Repair Coupling



Fernco, 5000 Series RC Couplings



Mission Rubber Co, Adjustable Repair Coupling

The following are not allowed:



Mission® Band Seal



Joints® Calder Coupling



Anaco – Husky Couplings



Fernco, Proflex Coupling



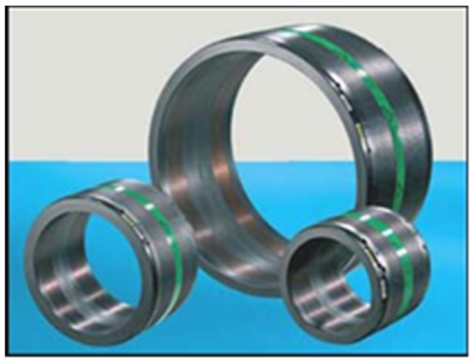
Mission Clay Band-Seal (Type 1 or 2)

HDPE COUPLINGS

Use for field closure of HDPE pipe, as required.

Electrofusion couplings, manufactured by, or approved equal:

1. Ipex USA LLC, Friatec Couplings
2. Central Plastics



Friatec - Electrofusion Coupling

Backwater Prevention Devices (BPDs)

Required at every location where sanitary sewer piping exits a building/home to prevent sewage from entering homes and businesses and reroute the spill outside the building.

BPD Type	MANUFACTURER	PRODUCT NAME
Type 1 or "Mushroom" Type	Genplex	Kelly Backwater Device (No-Hub & IPS)
	DDF	Sewer Relief Device (SRD)
Type 2	Stephens Corp	Sewer Popper™ Model S62-304

Type 1



Mushroom Type



SRD

Type 2



Sewer Popper™ OPD

BACKWATER CHECK VALVES

Backwater check valves shall be extendable type. Manufactured of PVC

Manufactured by the following, or approved equal

1. Rector Seal, Clean Check Backwater Valve
2. Mainline Backflow Products, Adapt-A-Valve Inspector chamber w/ Test-Eze Gate Feature



PVC Extendable Backwater Check Valve

*Required to get written approval from District Engineer to install Check Valves

TAP CONNECTIONS TO EXISTING SEWER MAINS

All connections to new mains shall be with new wye fittings matching the main pipe material, or electrofusion saddles for new HDPE mains.

Tap connections will only be allowed for connection to existing mains 10-inch and larger and will require District approval. However, all new connections to existing mains with an existing CIPP liner shall be with a tap connection (new wye fittings will not be allowed on existing CIPP).

Tap connections shall be **"Wye type"** where is feasible.

EX MAIN PIPE MATERIAL	MAINLINE TAP
ACP	Cascade Waterworks MNFR Co, CSWRY Stainless Steel Sewer Saddle –Wye
HDPE	Electrofusion saddles: ≤12" main wye type, >12" main may be tee type, manufactured by, or equal: • Central Plastics • Industrial Pipe Fittings, LLC – Plasson Or, Sidewall (Saddle) Fusion fittings. Manufactured by, or equal: Faction Fusion
Ex Pipe Lined w/ CIPP	Remove host pipe at connection and install directly to CIPP. • Inserta Tee (For large diameter sewer pipes ≥12'' Only) • Cascade Waterworks MNFR Co, CSWRY Stainless Steel Sewer Saddle – Tee • QwikSeal (For large diameter sewer pipes ≥10'')
VCP, PVC, DIP, Cast Iron	Connection material shall match the main materials Or, QwikSeal (For large diameter sewer pipes ≥10'')



Cascade CSWRY Tee



Cascade CSWRY Wye



Inserta Tee



QwikSeal



HDPE – IPF Plasson

SIDE SEWER FITTINGS

Side sewer fitting material shall match side sewer pipe material (either lower or upper lateral), unless otherwise directed or allowed by the District.

Property line cleanouts shall be a two-way, wye or a “Tee” as specified below:

- PVC C900: Two-way
- HDPE: “Wye” (facing sewer main)
- Sch 80: “Wye” (facing sewer main)
- CIP/DIP: “East Bay” Two-way
- Blowoff: Tee
- BPD: Tee

SIDE SEWER MATERIAL	SIDE SEWER FITTINGS
PVC C900 DR-18	PVC C900, min DR-18 thickness, bell and spigot. Tee, Wye, or 45º fitting,. White color where feasible. Manufactured by, or equal: • Specified Fittings, C900 Gasketed • Multi Fittings, Sewer Brute
HDPE	HDPE, SDR 17 min thickness. • Butt fusion Tee, Wye, 11.25º, 22.5º or 45º fitting. Fuse directly to side sewer, or use couplings as required. Manufactured by: Performance Pipe, Agru America, or equal. • Electrofusion tees. Manufactured by Central Plastics, Harrington Corp, or equal. • Electrofusion taps (for cleanout risers). Manufactured by Central Plastics Harrington Corp, or equal. • Sidewall (Saddle) fusion fittings. Manufactured by: Faction Fusion, or equal.
SCH 80 PVC	Schedule 80 PVC. Tee, Wye, or 45º fitting, fittings. Solvent welded, threaded, or flanged joints.
CIP, or DIP	Push-on

PVC FITTINGS AND HDPE FITTINGS



Butt Fusion Tee



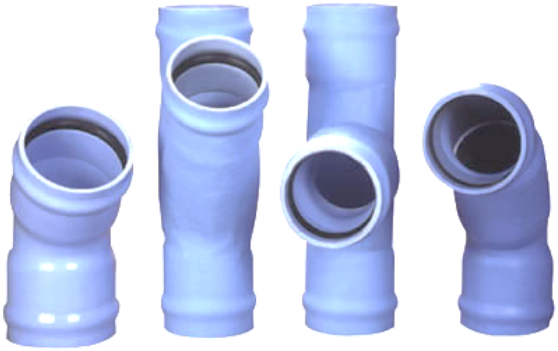
Butt Fusion Wye



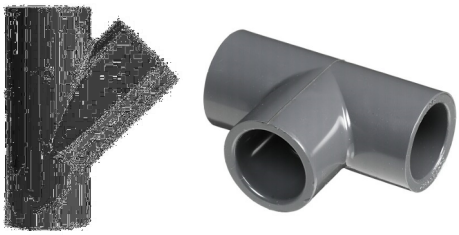
Electrofusion Tee



Electrofusion Tap



PVC C900 fittings



Schedule 80 PVC fittings

Cured-in-Place Pipe (CIPP) Products

Chemical Grout

For sealing side sewer connection to mains and/or pipe connections to manholes. Manufacturer shall by, or approved Equal

- Avanti, AV-100

CIPP Main to Side Sewer Seals

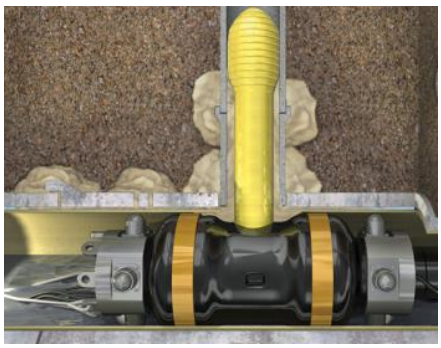
For repairing side sewer connection to mains 8-inch or larger where main is in suitable condition, as Determined by the District. Manufactured by, or approved equal:

- Pro Pipe Professional Pipe Services, Top Hat Lateral Seals

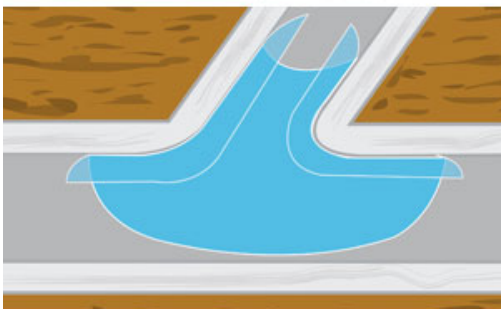
Main to Side Sewer CIPP Connection Liners

For repairing side sewer connection to mains 8-inch or larger where the main is in suitable condition, as Determined by the District. Manufactured by, or approved equal:

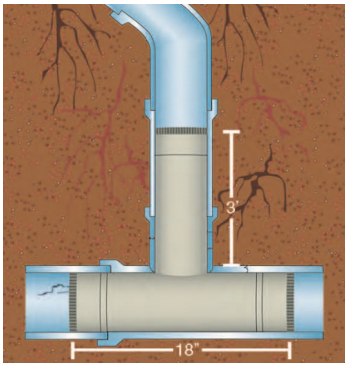
- LMK Technologies, T-Liner/Shorty



Avanti, AV-100



Top Hat

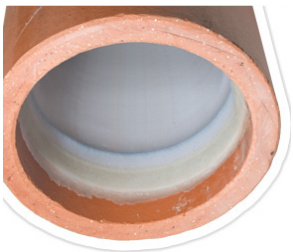


T-Liner/Shorty

CIPP Point Repairs

Use only where approved by the District. Manufacture by, or approved equal:

- LMK Technologies, Mainline Sectional Repair



LMK Mainline Sectional Repair

CIPP for Side Sewers

Use only where approved by the District. Installer must be certified by the manufacturer. CIPP Manufacturer shall be, or approved equal:

- Perma-Liner Industries, LLC
- MAXLINER LLC

DUCTILE IRON PIPE (DIP) PRODUCTS

AWWA C150 and AWWA C151, Class 53 wall thickness

Ductile Iron Pipe

Manufactured in the USA, by one of the following, or approved equal:

1. U.S. Pipe and Foundry Co.
2. American
3. McWane Ductile

Ductile Iron Fittings

Manufactured in the USA, by one of the following, or approved equal:

1. Tyler Union
2. Mueller Company
3. American

Protective Lining

Interior surfaces of all ductile iron pipe and fittings shall be lined with one of the following:

1. Protecto 401 Ceramic Epoxy,
2. Tnemec 431 Perma-Shield, or approved equal.

The dry film thickness shall be no less than 40 mils.

Protective Coating

Buried DIP: asphaltic coating with polyethylene encasement (polywrap)
Exposed DIP: Coat per Standard Spec Section 09800, Protective Coatings
Exposed DIP in Wet Wells, one of the following:

1. Tnemec 141, at min dry film thickness of 16 mils
2. US Pipe Ceramawrap, at min Dry film thickness 20 mils

Flange Gaskets

EPDM, suitable for use with wastewater service.

Grooved Couplings and Adapters

Rigid type, manufactured by, Victaulic, or approved equal.

INDIVIDUAL LOT PACKAGED PUMP SYSTEMS

Material Type(s): Pre-Approved Pump Systems, Pipe

Description:

VENDOR	SYSTEM
E-One	D-Series, W-Series, I-Series and G-Series
Liberty	2448- Series, Pro370 Series, Pro380 Series
Aqua Pro Pump Systems	E-Series, EDP Series, ESP-Series, SG-Series, DG-Series

Note: Complete packages are required for Pre-Approved Pump Systems. This includes a pump, alarm panel, isolation and check valves, sump and sump extensions (as required). Individual parts of Pump System are <u>not</u> pre-approved by the District. Models include but are not limited to the ones below, contact the District for special approval of all others.



E-One Model D-H071



Liberty 2448 Series



E-One® Model Gator



Liberty® Pro370 Series
(2” discharge system, required Access Driver)



Liberty® Pro380 Series
(2” discharge system, required Access Driver)



Aqua Pro SG-1182-2

*Required to get written approval from District Engineer to install Check Valves

MISCELLANEOUS APPROVED MATERIALS

MATERIAL	MANUFACTURER	PRODUCT
Epoxy Adhesive Anchors	Sika	FI System with Sikadur® Injection Gel Epoxy
	Hilti	HIT HY150 Adhesive Anchors
	BASF	Concresive® 1420 Gel Epoxy Adhesive
	BASF	Concresive® Paste LPL
Expanding Type Anchors	ITW	Red Head®, Trubolt Wedge Anchor
	Hilti	Kwik-Bolt 3 Expansion Anchor
Glass Capsule Polyester Resin Adhesive Anchors	Hilti	HVU Adhesive Capsule
Solvent Cements (for Sch 80 PVC)	Weld-On	700 Series, PVC Solvent Cement
	Oatey	Hercules, PVC Solvent Cement

Miscellaneous Approved Materials



Trubolt, Wedge Anchor



HVU Adhesive Capsule



HIT HY150 Adhesive Anchor



Oatey, PVC Cement



Weld-On, PVC Cement

Appendix C

Requirements for Draining Swimming Pools or Spas to the Sanitary Sewer System

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Sausalito-Marin City Sanitary District (SMCSD)
Requirements for Draining Swimming Pools and Spas
to the Sanitary Sewer System

SMCSD will allow swimming pools, spas, or swimming pool/spa filter backwash to be drained into to the sanitary sewer system provided that the property owner adheres to the following requirements:

Notification:
Notification must be provided to SMCSD a minimum of 48 hours prior to draining swimming pools, spas, or swimming pool/spa filter backwash into the sanitary sewer system.

Air Gap:
The drained and/or pumped water must pass through an air gap tank prior to discharge into the sewer to prevent overflows. See Standard Drawing SD-41.

Side Sewer Cleanout:
Discharge must be into a sanitary sewer cleanout located on the property's side sewer. If the property's side sewer does not have an existing cleanout, then the installation of a new side sewer cleanout may be required.

Max Flowrate:
The flowrate of the discharge into the sanitary sewer shall not exceed 50 gallons per minute at any time.

Weather:
Draining must occur during dry weather. The discharge of swimming pools or spas into the sanitary sewer system during rain events will not be allowed.

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